SHADY GROVE STATION CAPACITY IMPROVEMENTS STUDY

Final Report

Shady Grove Metrorail Station
Montgomery County, Maryland
September 2015

Washington Metropolitan Area Transit Authority

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SHADY GROVE
Station Capacity Improvements Study

Washington Metropolitan Area Transit Authority
Office of Real Estate and Station Planning

September 2015

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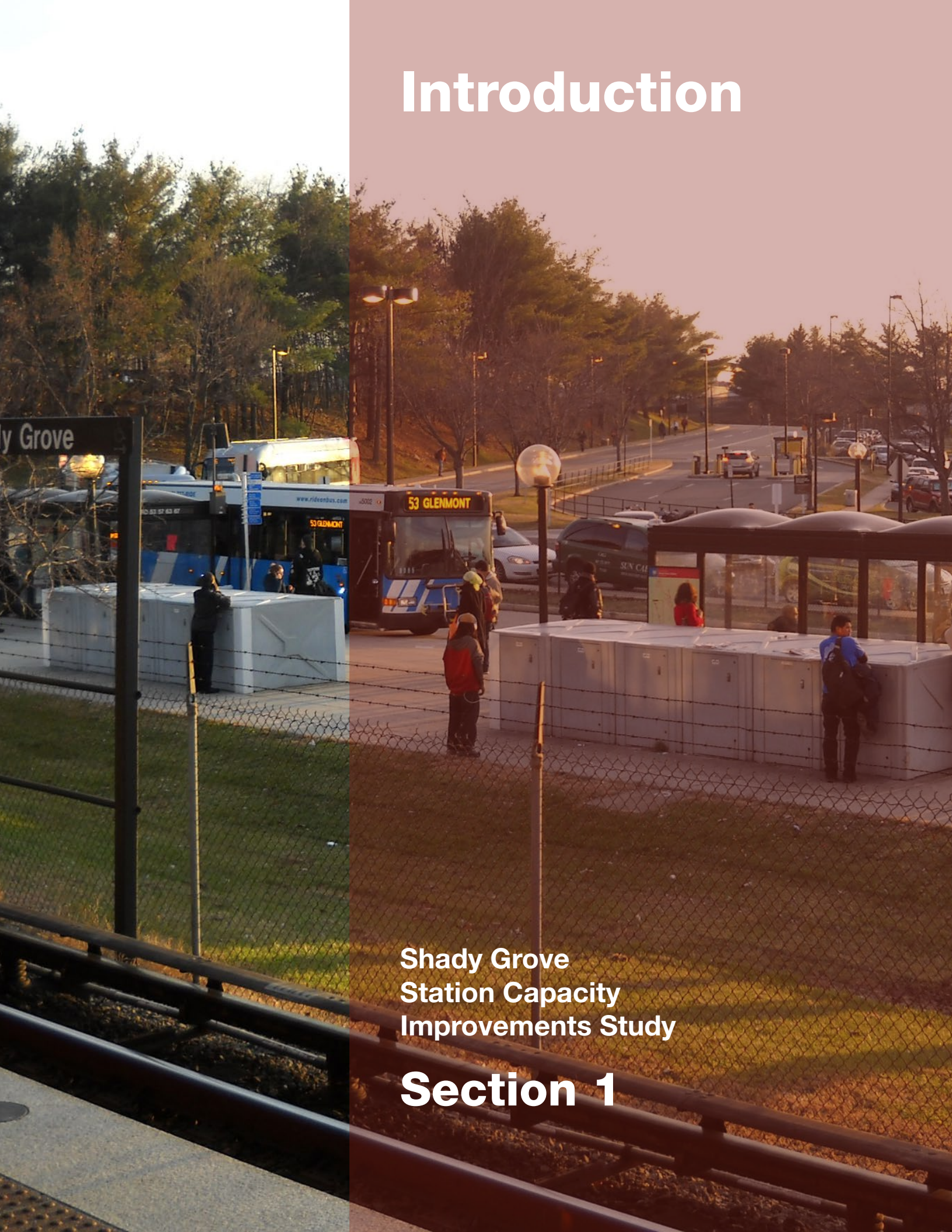

Shady Grove
Station Capacity
Improvements Study

Section 1

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1.0 INTRODUCTION

The Washington Metropolitan Area Transit Authority (Metro) has prepared the Shady Grove Station Capacity Improvements Study (station study) to assess the existing and future access and capacity needs of the Shady Grove Metrorail station. The study was conducted within the context of future transit-oriented development and the anticipated introduction of bus rapid transit (BRT) lines terminating at the station. Specifically, the station study evaluated future ridership demand at the station and facilities required to accommodate this demand, identifying both short- and long-term capital improvements to address capacity constraints.

A primary focus of the study was to examine the ways in which the station could be improved to address future transit service expansion while reducing significant current and projected constraints. This report provides the study findings and recommendations, summarizing the existing conditions in the study area, and assessing the impacts of potential improvements in the short- and long-term.

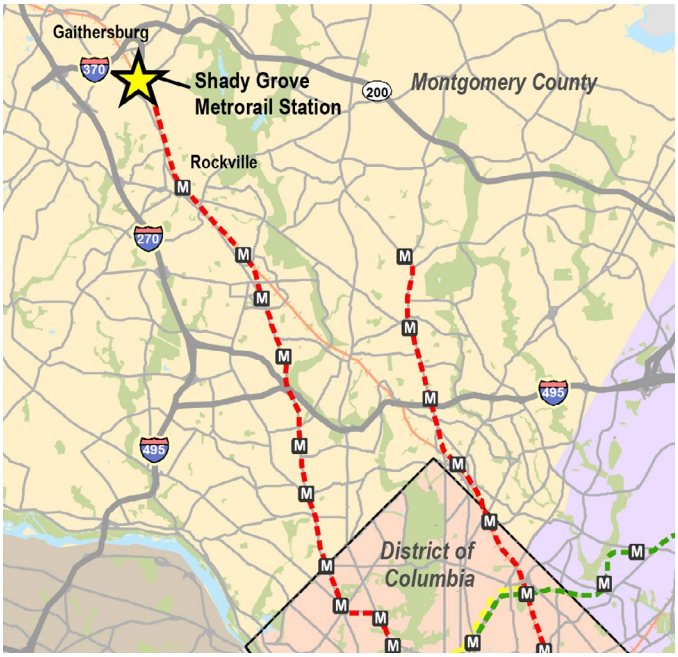
The report is organized as follows:

- **Section 1: Introduction** Provides an introduction to the station study and its purpose.
- **Section 2: Existing Conditions and Planning Context** Outlines the project study area, station area land use, and station area transportation systems.
- **Section 3: Existing and Future Ridership** Provides an overview of 2013 existing ridership and forecasted ridership in 2020 and 2030.
- **Section 4: Development of Alternatives** Presents conceptual alternatives developed for external site and internal station access.
- **Section 5: Evaluation of Internal Station Circulation** Assesses the relative advantages and disadvantages of the internal station circulation alternatives.
- **Section 6: Findings** Summarizes the findings and recommendations of the study.

1.1 Station Overview

The Shady Grove Metrorail station is located in Montgomery County, Maryland, east of Frederick Avenue/ Route 355 and north of Redland Road. The station opened in December 1984 and is the northwestern terminus of the Metrorail Red Line. The station lies adjacent to active CSX tracks that serve Maryland Area Regional Commuter (MARC) trains and Amtrak intercity trains, neither of which stop at the station, as well as freight trains. The Shady Grove Metrorail station is a major commuter station with average daily passenger boardings of more than 13,000 in May 2014. The station also handles many passenger transfers to other transit modes.

Ridership growth over the years has resulted in passenger crowding on platforms and conflicts on platforms, mezzanines, and escalators during peak periods, especially during the PM peak as passengers exit the station. Plans for the Corridor Cities Transitway (CCT), a BRT line between northern Montgomery County and the Shady Grove Metrorail station, require a new interface with the western station entrance.



Location Map

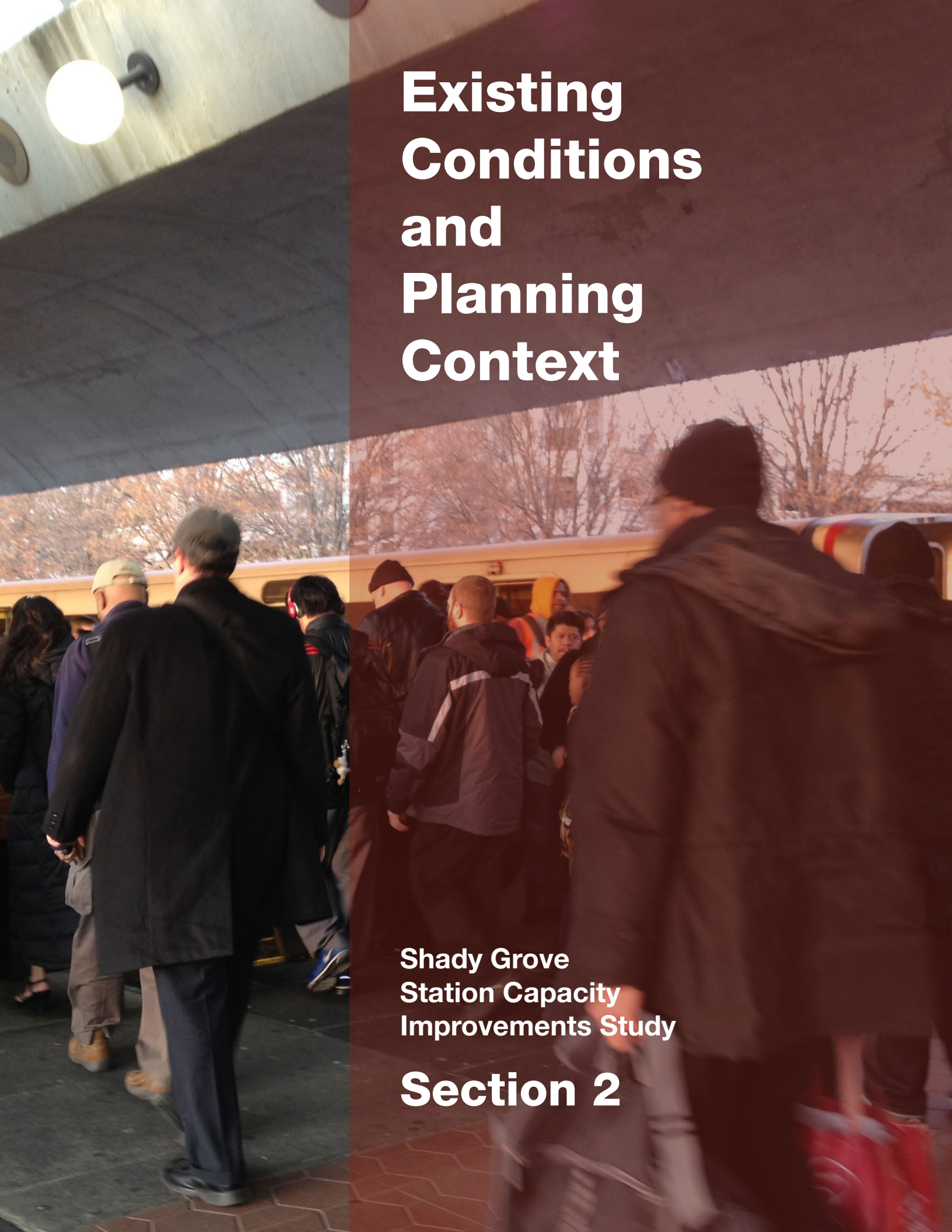
1.2 Current Study

The current study assesses short- and long-term improvements that address access and capacity constraints at the Shady Grove Metrorail station. With existing passenger congestion problems on the platforms and vertical circulation elements (VCEs), and expected ridership increases, it is imperative that measures be defined to address these capacity issues. Building off the 2011 Station Access Study and taking into consideration plans for a new interface to better connect the station with the planned CCT, the current study looks at ways to improve internal and external passenger flows at the station in terms of operation, constructibility, and cost. The station study also analyzes the ridership impact once additional future services, such as CCT, are completed.

1.3 Related Studies

Short summaries of the previous studies undertaken for this site or relevant to the study area are presented below.

- **Shady Grove Sector Plan (Maryland-National Capital Park and Planning Commission, 2006)** The Plan constitutes an amendment to the General Plan for Montgomery County, providing recommendations and guidelines for the use of publicly and privately owned land within its 2,000-acre plan area. In addition to creating a denser street grid and a varying mix of land uses, the plan also calls for an emphasis on transit use and reduction in single-occupancy vehicle trips. Specific elements include a central transit center to coordinate and encourage transit use, pedestrian and bicycle-friendly streets and intersections, connections to the CCT, and a future MARC station at the existing Shady Grove Metrorail station.
- **Metro Station Access and Capacity Study (Metro, 2008)** The Study assessed future passenger demand and available capacity across the Metrorail system. It determined that the existing vertical circulation elements (VCEs) at the Shady Grove Metrorail station would prove inadequate for the predicted increased ridership at the station in 2030. The Study recommended a suite of improvements to enhance the VCEs at the station, including new elevators, escalators and stair connections to the platform. It also recommended a new entrance at the south end of the station via a new pedestrian bridge from Redland Road.
- **Shady Grove Station Access Study (Metro, 2011)** The Study evaluated various options to improve station access and the feasibility of improvements to the existing and potential second entrance. It considered both long-distance commuters as well as those who live close to the station, and responded to the vision established in the Sector Plan. Six alternatives requiring different levels of capital investment were considered for increasing platform capacity at the station. The capacity analysis, however, did not take into account anticipated CCT ridership which would contribute further to the capacity issues at the station and reinforce the need for additional station capacity improvements.
- **Countywide Bus Rapid Transit Study (Montgomery County, 2011)** The Study identified key corridors within Montgomery County that could facilitate rapid transit service. Three corridors, the CCT, Sam Eig Highway, and Mid-County Highway, were identified as having the potential to host rapid transit and terminate at Shady Grove. However, while none of the corridors were selected to advance for a refined assessment as part of the Study, the CCT was ultimately selected a year later to be the first BRT line for Maryland and Montgomery County.
- **Transit Corridors Functional Master Plan (Montgomery County, 2013)** Adopted by the Montgomery County Board in 2013, this Plan recommends implementing a 102-mile BRT network, of which approximately 79 percent is dedicated transit lanes, comprising 10 corridors and the CCT. It also designates 24 additional Bicycle–Pedestrian Priority Areas (BPPAs) around stations and to enhance access to BRT; the area around the Shady Grove Metrorail station is one of the BPPAs identified in the Plan.
- **Rapid Transit System Project (Montgomery County, Ongoing)** The Project is studying three corridors previously identified in the Countywide Bus Rapid Transit Study for possible implementation as BRT or as a Rapid Transit System (RTS). One of the study corridors, MD-355, would link the Shady Grove Metrorail station to the RTS.



Existing Conditions and Planning Context

Shady Grove
Station Capacity
Improvements Study

Section 2

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2.0 EXISTING CONDITIONS AND PLANNING CONTEXT

2.1 Project Study Area

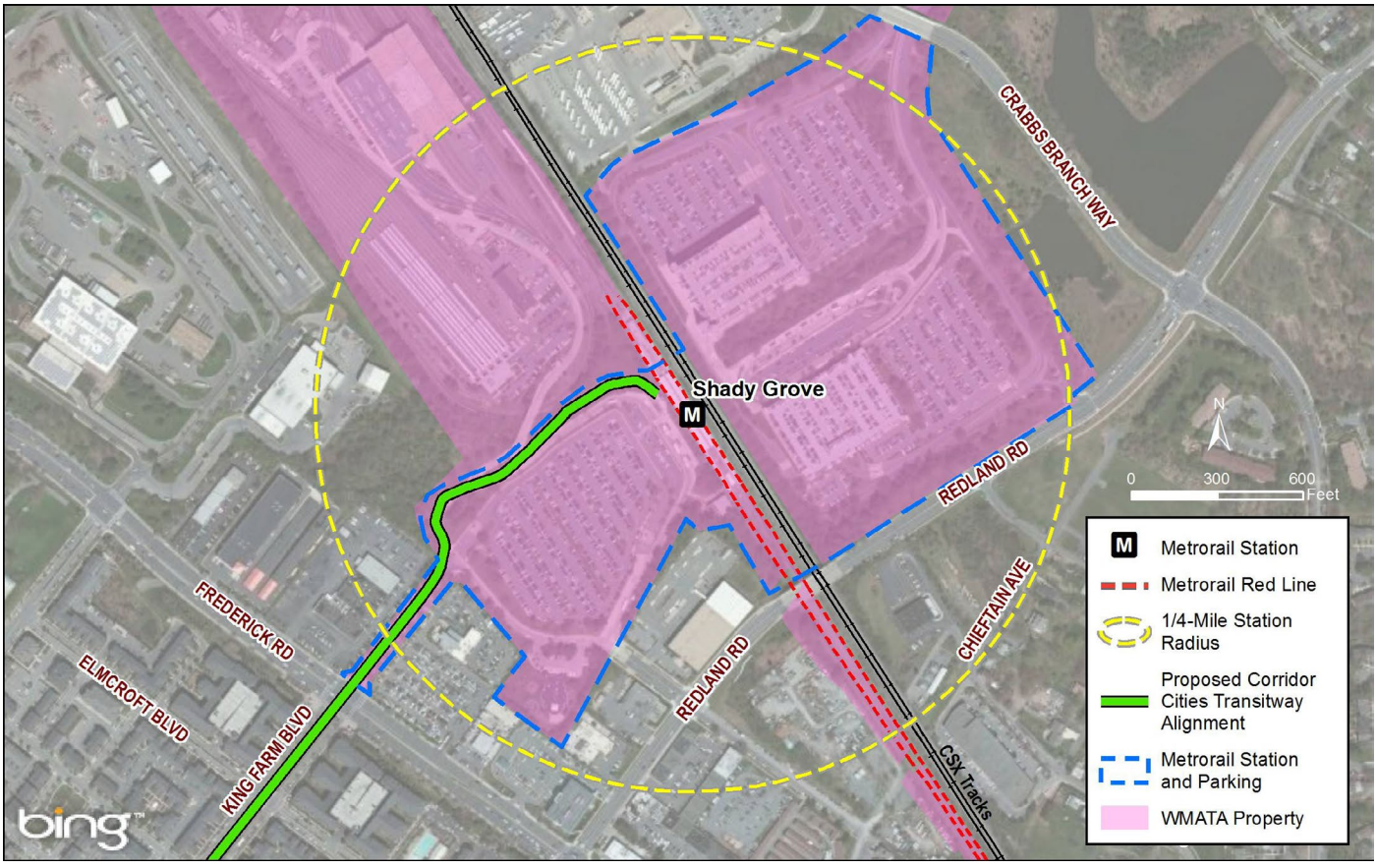
The project study area comprises the Metro property, which includes the immediate station area, parking lots and bus bays to the east and west, and access roads to the station. This area corresponds to an approximate 1/4-mile area around the Metrorail station (see **Figure 1**). The study area is roughly bounded by Shady Grove Road on the north, Crabbs Branch Way on the east, Redland Road on the south, and MD-355 or North Frederick Road on the west.

The station primarily functions as a commuter station, serving residents from as far north as Clarksburg and Damascus, and as far west as Germantown. Immediately adjacent to the station site and beyond Metro's parking facilities are a number of strip shopping centers and light industrial uses. Beyond this are the low-density residential neighborhood of Derwood to the north and east, and the higher density mix of residential and retail uses at King Farm to the southwest of the station.

According to the 2006 Montgomery County Sector Plan, the Shady Grove planning area is located at the junction of two transportation systems, the Metrorail Red Line and I-370. It is less densely developed than the other areas of the I-270 corridor despite the presence of the Shady Grove Metrorail station. Maryland's 1997 Smart Growth Act encourages development principles designed to focus investments in existing and new infrastructure, including communities that are walkable and transit accessible. The Shady Grove planning area is identified as a Certified Priority Funding Area under the Smart Growth Act.

According to the MWCOG Round 8.2 Cooperative Forecast, the area within 1/2-mile of the Shady Grove Metrorail station contained 3,207 residents and 1,305 households in 2010. The residential density for the 1/2-mile area was 2.6 dwelling units per acre. Further, in 2010, the 1/2-mile area surrounding the Metrorail station contained 2,453 jobs.

Figure 1 Project Study Area



2.2 Station Area Land Use

2.2.1 Existing Land Use

Parking and other transportation facilities form the predominant land uses immediately adjacent to the Shady Grove Metrorail station (see **Figure 2**). Residential uses beyond the ¼-mile radius include the King Farm development to the west of Frederick Road (MD 355), but pedestrian and bicycle linkages between this neighborhood and the station are limited. Some light industrial and strip retail uses exist along North Frederick Road to the west of the station area and on Crabbs Branch Way to the northeast of the station. Adjacent to the station are active CSX tracks and farther north of the station is the Shady Grove Metrorail yard. Metro owns approximately 60 acres of land in parking areas on the east and west sides of the station.

According to the 2006 Shady Grove Sector Plan, 60 percent of the land in the Sector Plan study area is occupied by residential and industrial uses. The Sector Plan study area also includes a small cluster of advanced technology and biotechnology firms along MD-355 within the City of Rockville, and the Life Sciences Center along Shady Grove Road west of I-270. The retail centers of the Grove, Redmill Center, and King Farm total approximately 338,580 square feet of retail use within a five-minute drive of the Metrorail station.

2.2.2 Proposed and Planned Land Use

The Shady Grove Sector Plan proposes 6,340 new housing units for the entire plan area and some local neighborhood retail. The Plan identifies the potential for redeveloping 195 acres of land around the Shady Grove Metrorail station to land uses that are "more appropriate for a Metrorail station." The Plan also called for taller and higher-density buildings to the west of the station, such as the King Farm development, and more modest density on the east side to ensure a more compatible transition to the Derwood community east of the station. See **Figure 3** for land use vision identified in the Plan.

To implement the vision of the Shady Grove Sector Plan, Montgomery County relocated its 92-acre County Service Park, located northeast of the Shady Grove Metrorail station. The County Service Park used to provide warehousing, distribution, and equipment maintenance facilities for various County agencies. In

Figure 2 General Layout of the Shady Grove Metrorail Station

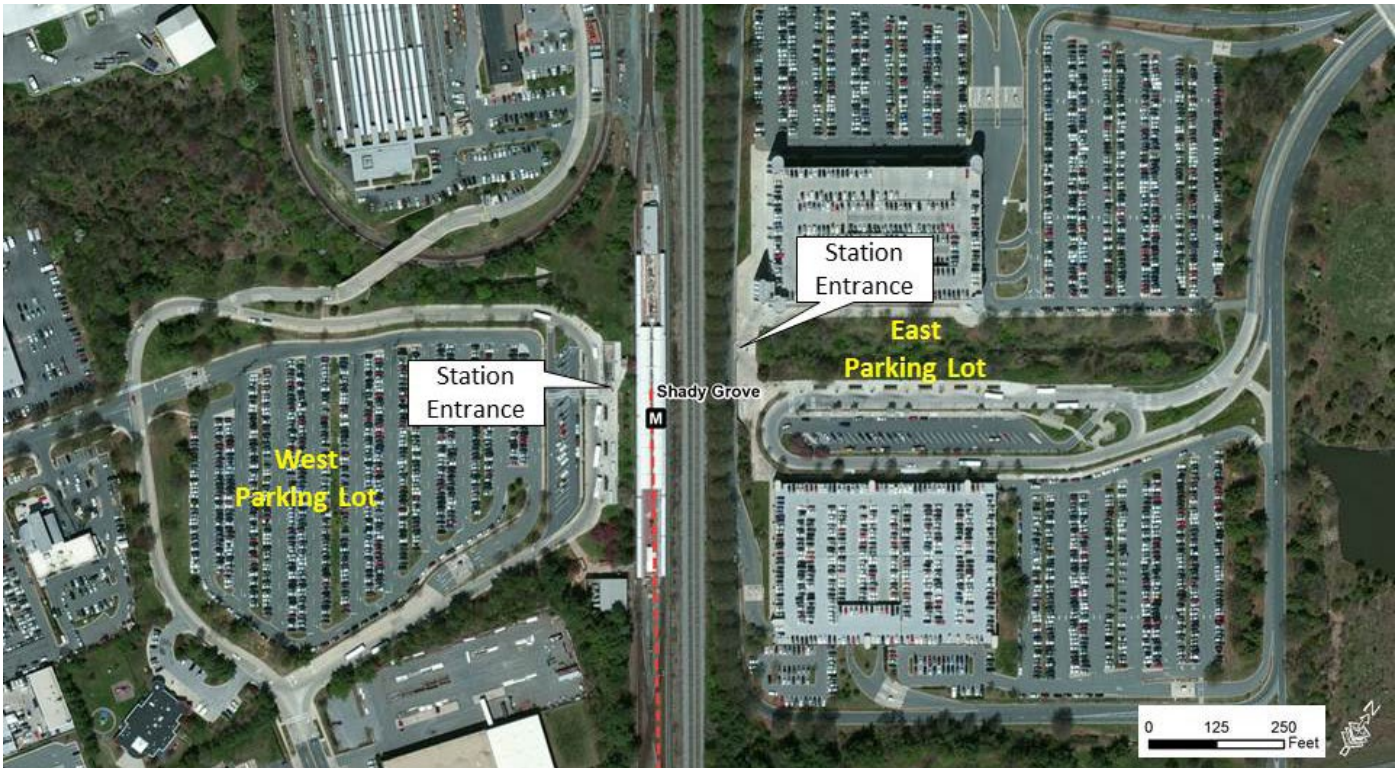
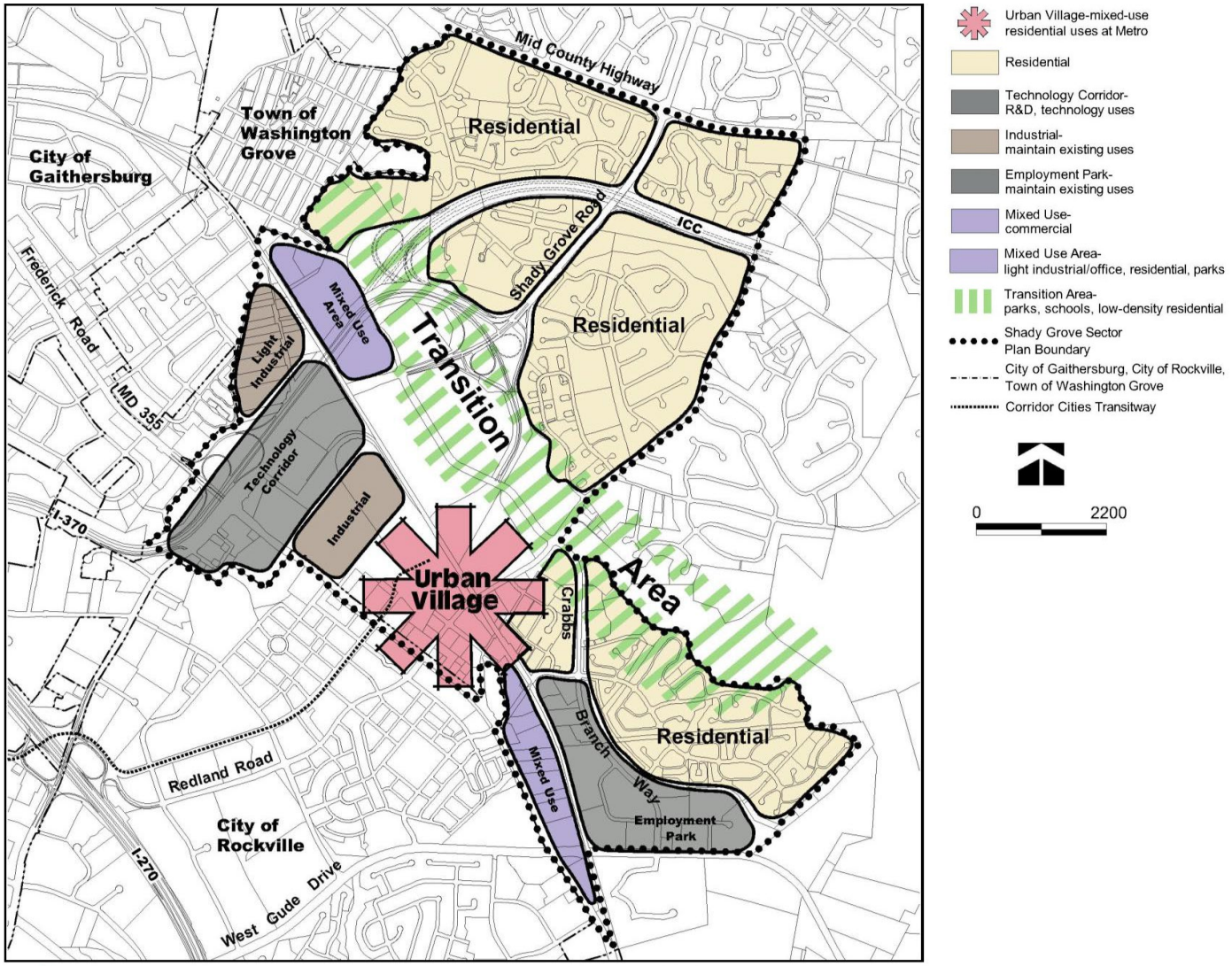


Figure 3 Land Use Vision



Source: Shady Grove Sector Plan, 2006

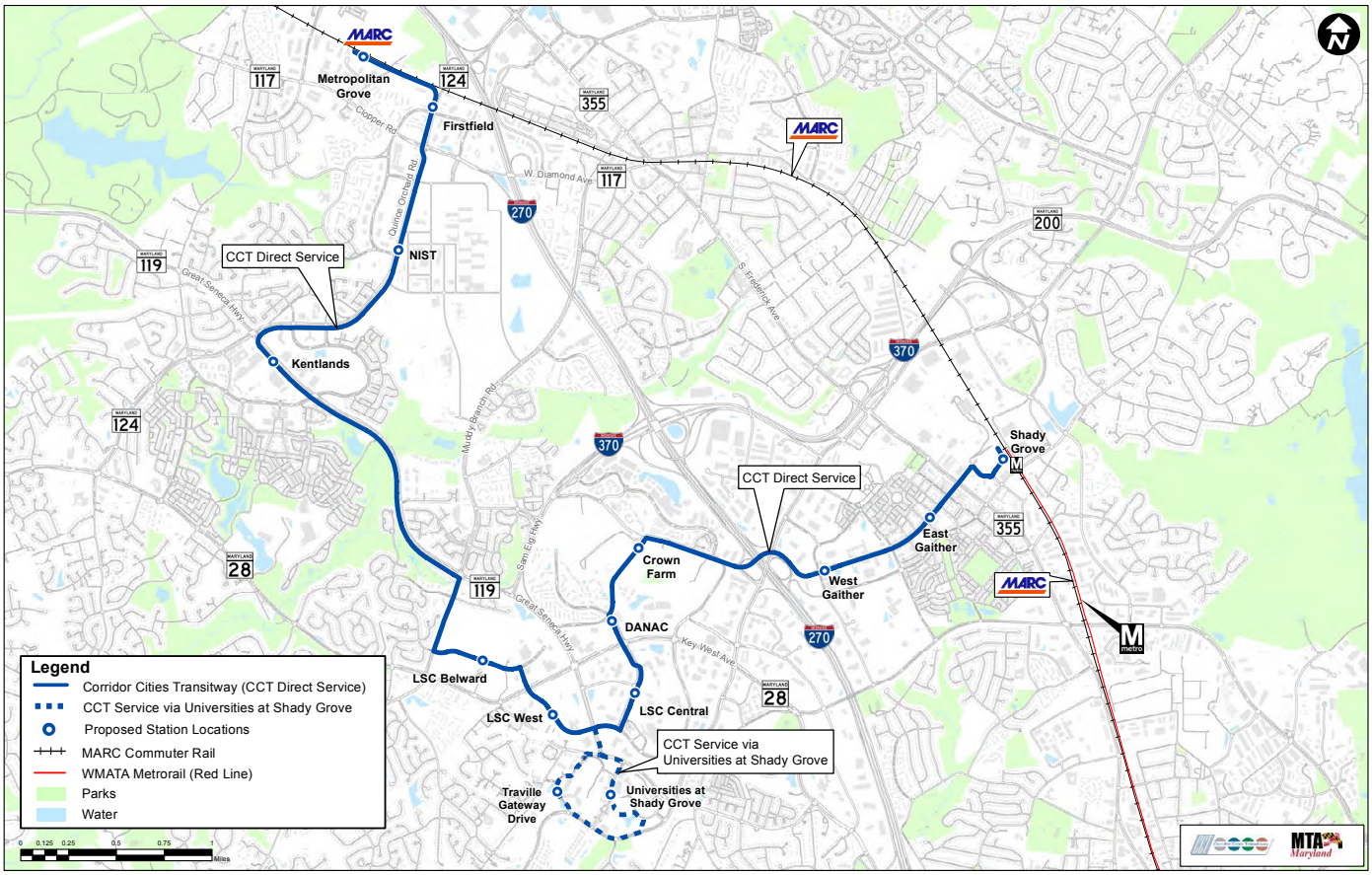
its place, the Montgomery County Board has approved the Shady Grove-Westside development by EYA of Bethesda which will include 1,521 residential dwelling units, 41,828 square feet of retail and space for a public library. In addition, the Board has approved a plan for public infrastructure that will reconstruct Crabbs Branch Way between Shady Grove Road and the Metro Access Road into an urban boulevard with on-street parking, new streetscape and shared use paths including a new sidewalk along Shady Grove Road, and new crosswalks at the intersection of Crabbs Branch Way and Shady Grove Road. The plan also proposed to construct a new sidewalk with streetscape and roadway modifications at the Shady Grove Metrorail station east side exit road.

2.3 Relevant Transportation Projects

Two transportation systems will affect and increase passenger activity within the project study area and around the station:

- **Corridor Cities Transitway (CCT)** The CCT, the proposed 15-mile bus rapid transit corridor between the Shady Grove Metrorail station and the COMSAT facility near Clarksburg, will serve a number of existing and planned activity centers in the area. The CCT will provide direct connections to the Red Line at the Shady Grove Metrorail station and the MARC Brunswick Line at the Metropolitan Grove station,

Figure 4 Corridor Cities Transitway Phase I



Source: Maryland Transit Authority

as well as link with numerous local and express bus services in the region. Phase I of the CCT will run between Shady Grove Metrorail station and the Metropolitan Grove MARC station (see **Figure 4**). Anticipated daily ridership for Phase I in 2035 is 35,900. This assumes three-minute headways in the peak hour and no changes to the underlying local Ride On bus service. The CCT will terminate on the west side of the Shady Grove Metrorail station. Several design concepts were progressed through 15% design; a single option is being developed to the 30% level of design.

- **Intercounty Connector (ICC)** The ICC is an 18-mile, eight-interchange controlled access, tolled highway. The ICC links the I-270 and I-95/US-1 corridors with 16 miles of highway in Montgomery County and two miles in Prince George's County. Interchanges provide access to MD-355 (Frederick Road), the Shady Grove Metrorail station access road, Georgia Avenue, MD-182 (Layhill Road), New Hampshire Avenue, US-29, I-95, and Virginia Manor Road. The eastern terminus of the ICC is an at-grade intersection with US-1. The last phase of the ICC became operational on November 10, 2014.

2.4 Station Area Transportation Systems

2.4.1 Existing Systems and Ridership

The Shady Grove Metrorail station serves as the northwest terminus for the Metrorail Red Line, which carries passengers south towards Bethesda and Washington, DC. Based on 2014 ridership data, over 13,000 rail boardings occur each weekday with 3,400 rail boardings in the AM peak hour. The station is well-served by parking and a number of bus services. The station has 5,745 long-term parking spaces, 76 short-term spaces, and bus facilities for four Metrobus routes, 21 Ride On routes, and four Maryland Transit Administration (MTA) routes. Private shuttles that operate during the AM and PM peak periods also access the station.

Parking spaces are housed within two parking structures on the east side of the station and in surface lots on the east and west sides. Eight bus bays serve the east side and three serve the west side. In addition, both sides include a Kiss & Ride area with a pick-up/drop-off lane for private vehicles and taxis, motorcycle spaces, shuttles, car-sharing, bike racks, and bike storage lockers (see **Figure 5**). **Table 1** outlines the station amenities on the west and east sides of the station.

Figure 5 Station Amenities at the Shady Grove Metrorail Station

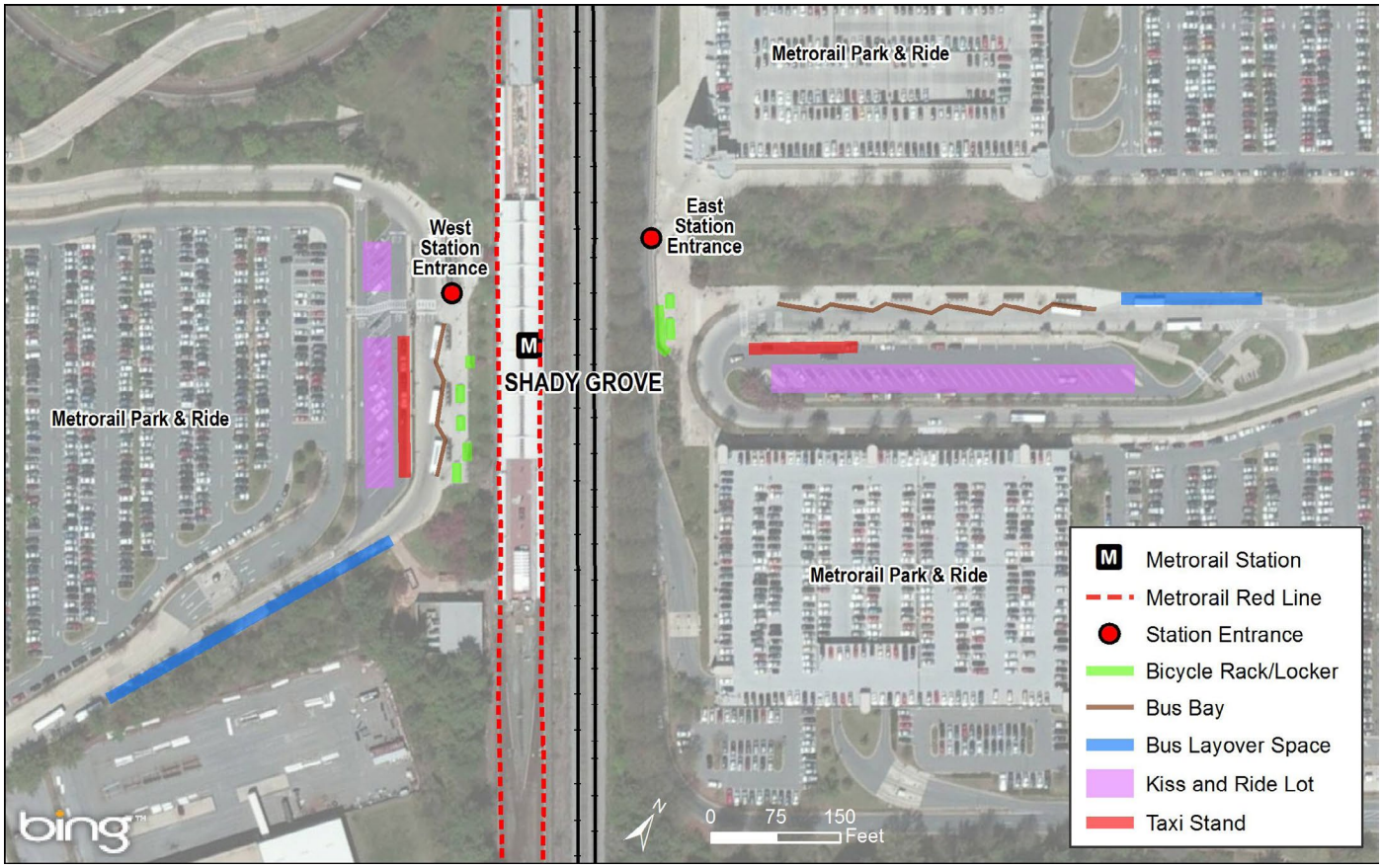
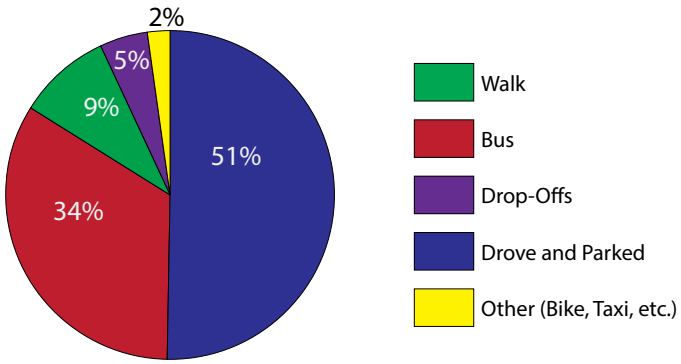


Table 1 Station Amenities on the East and West Side Lots of the Shady Grove Metrorail Station

	West Lot	East Lot	Total
Bus Bays	3	8	11
Bus Layover Spaces	1	3	4
Park & Ride Spaces	922	4,823	5,745
Kiss & Ride (Short-Term)	14	40	54
Kiss & Ride (Driver Attended Spaces)	5	4	9
Taxi-stand (curbside)	8	2	10
Bicycle Racks	30	16	46
Bicycle Lockers	35	24	59
Motorcycle Parking	11	30	41

Figure 6 shows passengers by mode of access during the morning peak hour. As a suburban station outside the Beltway (I-495), the percentages confirm commuter station characteristics of primary access by automobile and bus, and smaller percentages of pedestrians and bicyclists.

Figure 6 Passengers by Mode of Access in the AM Peak Hour (2012)



Source: WMATA

The area is well-connected to the entire region through a network of regional roadways including the I-270, I-370, the ICC, and Mid-County Highways. **Table 2** shows the study area roadway classifications, lanes, and volumes. The west side of the station is accessed from King Farm Boulevard and Redland Road and the east side of the station is accessed from Shady Grove Road via the Metro Access Road.

2.4.2 Station Site Access and Circulation

West Side

The west side of the Shady Grove Metrorail station is considered the primary local neighborhood access point to the station. **Figure 7** shows the layout of the west side in relation to the Shady Grove Metrorail station and its entrance. West side parking provides approximately 16 percent of the Park & Ride capacity for the station with 922 surface spaces. Fourteen Metrobus and Ride On bus routes use the three bus bays and one lay-over space on the west side (see **Figure 8**). In addition, shuttle buses also serve the west side of the station.

Table 2 Study Area Roadway Classifications, Lanes and Volumes

Roadway Name	Classification	Lanes	2014 Average Daily Traffic Volumes
Interstate 270	Freeway	12 lanes, divided	27,165 (ramp to Redland Road and Shady Grove Road) 213,102 (westbound, north of the Shady Grove Road interchange)
Interstate 370	Freeway	6 lanes, divided	90,132 (between I-270 and MD-355)
Intercounty Connector (ICC)	Freeway	6 lanes + median	44,132 (east of Shady Grove Road)
Mid-county Highway	Major Highway	4 lanes + median	23,692 (west of Shady Grove Road)
MD-355 (North Frederick Road)	Major Highway	6 lanes + median	45,102 (south of Redland Road)
Shady Grove Road	Major Highway	6 lanes, divided	48,772 (south of Mid-County Highway)
Crabbs Branch Way	Commercial Business District Street	4 lanes	16,742 (south of Shady Grove Road)
Redland Road	Commercial Business District Street	4 lanes + median	10,780 (between MD-355 and MD-115)
Redland Entrance Metro Access Road	Major Highway	6 lanes	Not Available
King Farm Boulevard	Commercial Business District Street (planned)	2 lanes (existing)	Not Available
Somerville Drive	Commercial Business District Street (planned)	4 lanes (existing)	Not Available

Figure 7 West Side of Shady Grove Metrorail Station

Figure 8 Bus Bays on the West Side Lot

Figure 9 Peak Hour Taxi Queue at the West Side Lot

The West Kiss & Ride facility includes 14 metered spaces, five "A" spaces for 15-minute driver-occupied waiting, four car-sharing (e.g. Zipcar) spaces, 11 motorcycle spaces, one ADA accessible space, and eight taxi stand spaces. The area also accommodates 35 bicycle lockers and 30 bicycle racks. In the PM peak, taxis wait in Kiss & Ride spaces and often queue outside the entrance to the Kiss & Ride area (see **Figure 9**).

The 2006 Shady Grove Sector Plan proposes "shared use paths, bike lanes and shared use roads" leading from Redland Road and King Farm Boulevard to the west side

station entrance. In addition to the bike racks and bike lockers (see **Figure 10**), a Capital Bikeshare station with 19 docks was installed on the west side in April 2014. Since installation through the end of 2014, a weekly average of 31 Capital Bikeshare trips began and 23 trips ended at the Shady Grove Metrorail station.

Figure 10 View of Bike Racks and Lockers

West Side Vehicular Access and Circulation

Figure 11 shows the vehicular access and circulation pattern around the west side of the station. There are two primary access points into the site, from Redland Road and from North Frederick Road. Both access points are two-way roads into and out of the site as well as into the Park & Ride area.

Somerville Drive intersects the one-way, counter-clockwise loop road which provides access for buses, taxis and Park & Ride vehicles (see **Figure 12)**. By the station entrance, the loop road splits into a dedicated bus lane and general purpose lanes for the Kiss & Ride and taxi staging areas.

Figure 11 West Side Vehicular Access and Circulation

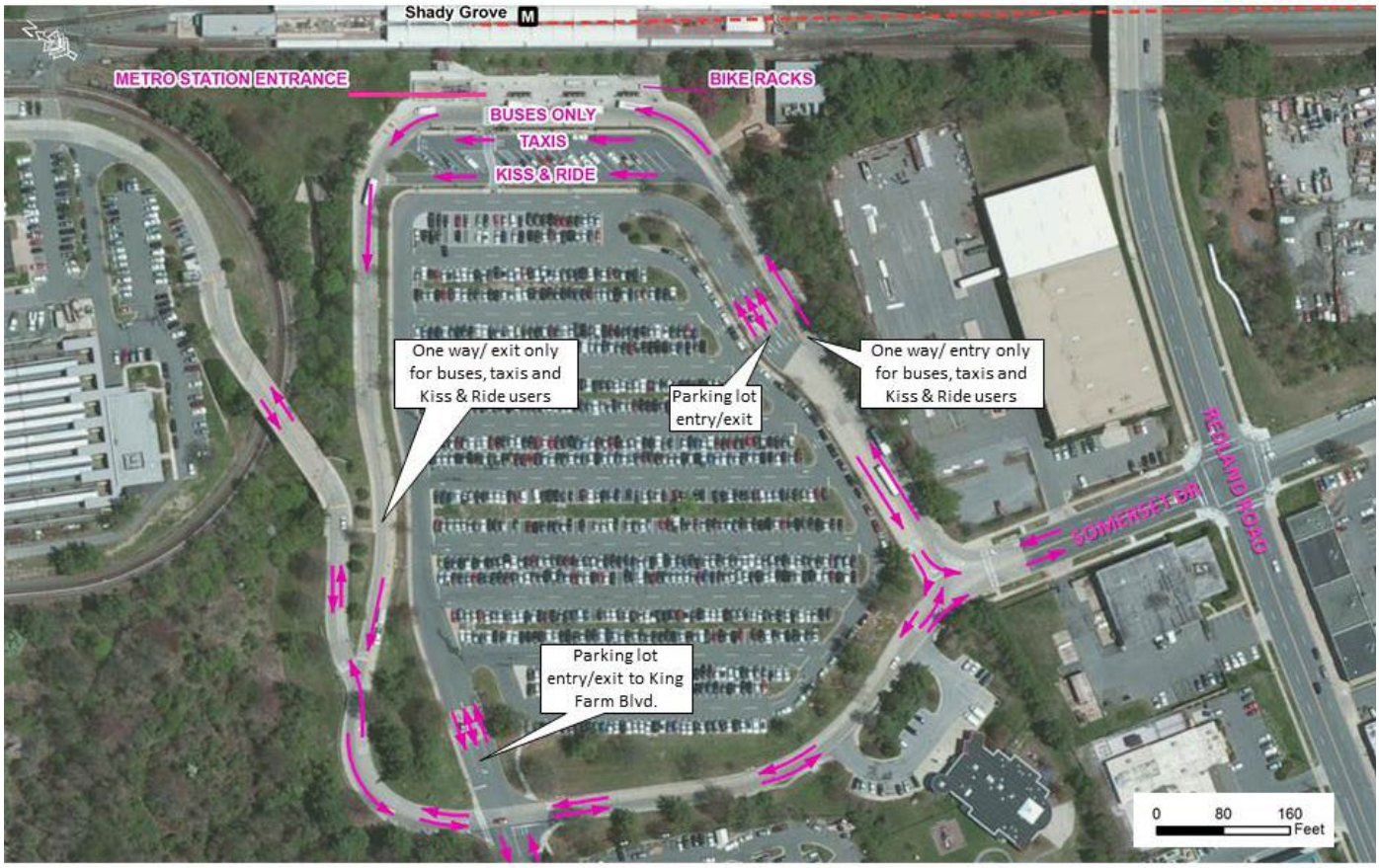


Figure 12 View (looking west) of the Loop Road and Parking Lot Entry/Exit

East Side

The east side of the Shady Grove Metrorail station provides over 80 percent of the Park & Ride capacity for the station with 4,823 parking spaces in surface lots and in parking garages. Compared to the west side, the east side lot is configured for a more regional market due to its easy access to I-370, I-270 and the ICC. **Figure 13** shows the layout of the east side in relation to the Shady Grove Metrorail station and its entrance.

Sixteen bus routes serve the east side. Metrobus routes do not use the east side bus bays. However, Ride On and MTA bus routes use the eight bus bays and three lay-over spaces on the east side (see **Figures 14** and **15**). There are 31 AM peak departures and 51 PM peak departures. In addition, shuttle buses serve the station from the east side bus bays.

The East Kiss & Ride facility includes 40 metered spaces, four "A" spaces for 15-minute driver-occupied waiting, 30 motorcycle spaces, two ADA accessible spaces, and two taxi stand spaces. The area also accommodates 24 bicycle lockers and 16 bicycle racks. In the PM peak

Figure 13 East Side of Shady Grove Metrorail Station

Figure 14 Bus Bays and Kiss and Ride Lot on the East Side

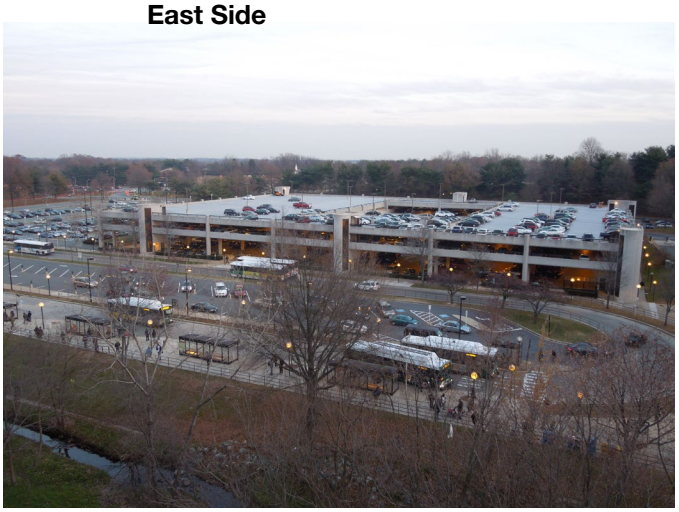


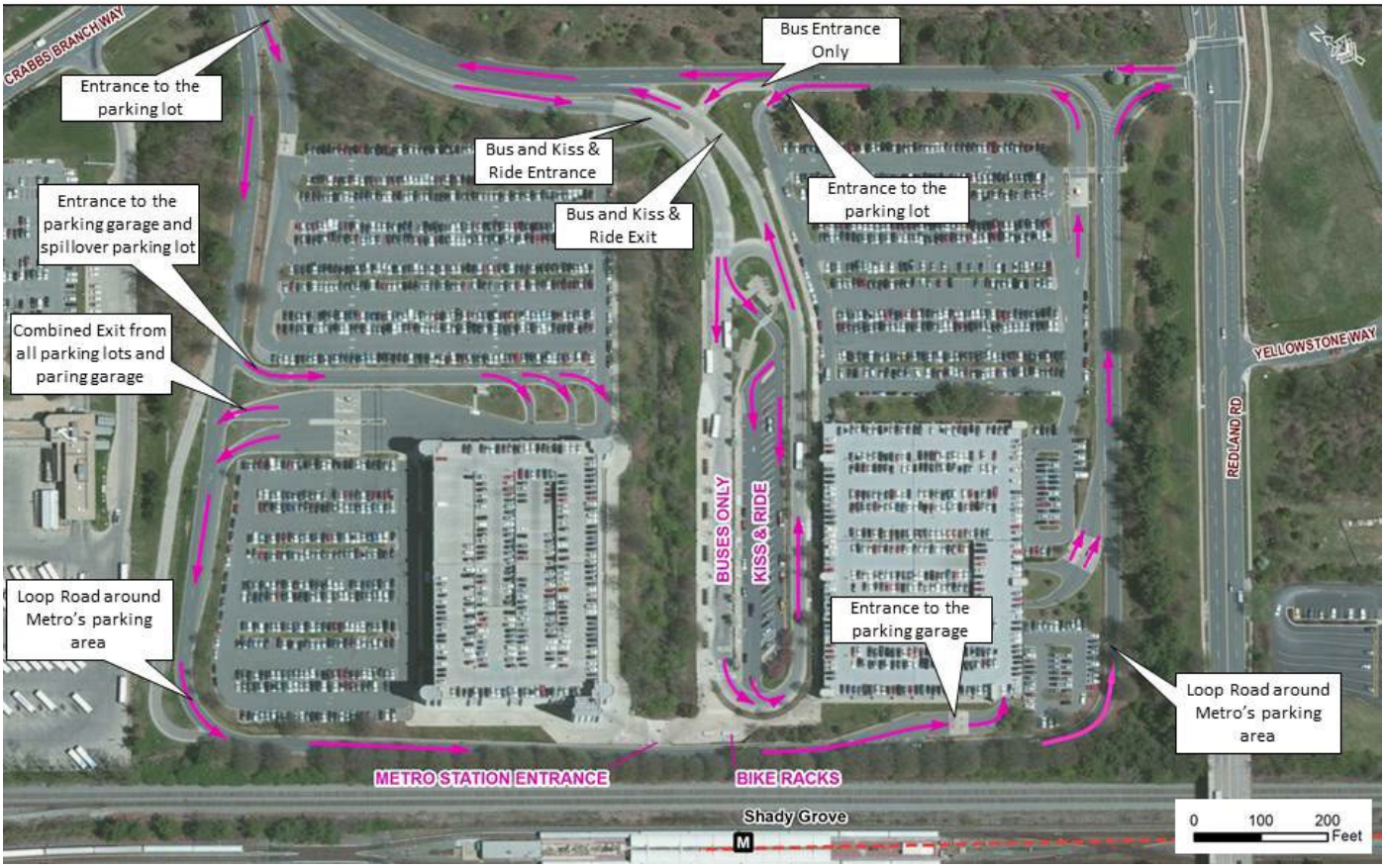
Figure 15 South Parking Garage on the East Side

congestion and circulation issues were observed in the Kiss & Ride.

In 2010, as part of a Capital Improvements Program by Montgomery County, a ten-foot wide bike trail between Shady Grove Road and Redland Road along the east side of the WMATA Access Road was approved and is now open. This trail provides access to the east side and also connects to an existing trail on Crabbs Branch Way[1]. Currently, 16 bike racks and 36 bike lockers are provided on the east side of the Shady Grove Metrorail station.

1 http://www.montgomeryplanning.org/community/shadygrove/documents/sg_access_bike_path_cip500600.pdf

Figure 16 East Side Vehicular Access and Circulation



East Side Vehicular Access and Circulation

Figure 16 shows the vehicular access and circulation pattern for the east side area roadways. There are two access roads leading to parking areas. Passengers using the north Park & Ride garage and parking lot use the Metro Access Road from Shady Grove Road. Passengers access the south Park & Ride garage and parking lot from Redland Road, as well as the loop road around the parking area. The Kiss & Ride lot can be accessed from the Metro Access Road only. However, buses can enter the bus loop from both directions.

2.4.3 Existing Station Platform and Access

The Shady Grove Metrorail station has a below-grade mezzanine at the northern end with a platform above. Access to the east and west parking areas is through a pedestrian passageway at the mezzanine level under Metro and CSX tracks. The fare gates and the station manager's kiosk are located on the mezzanine level.

Mezzanine and Platform

Inside the paid area, the below-grade mezzanine has two escalators with a single staircase and a single elevator connecting to the platform level. On the platform, the escalators and stairs are located slightly north of the middle of the platform length.

As shown in **Figure 17**, the escalators currently provide adequate capacity to passengers traveling in the non-peak direction, but are heavily congested during the peak hours in the peak direction. The situation is aggravated when trains arrive at two- to three-minute intervals during the PM peak and passengers have not cleared the platform prior to the arrival of a following train. Passengers from the earlier train are still queued to take the escalator and stairs down to the mezzanine level. Imbalance is a key issue, with the down escalator congested and the up escalator empty.

No issues or problems with congestion were observed at the fare gates and passenger volumes dissipated quickly at that point. In the free area of the mezzanine are the fare card vending machines that appear to be adequately serving the current need, and other passenger amenities such as ATMs (see **Figure 18**).

The mezzanine to platform elevator is located inside the mezzanine paid area. The elevator doors open to the north at the mezzanine level and to the south at the platform level. There is adequate queuing area both at the mezzanine and platform levels. The queuing area at the platform level is covered by the platform canopy and is free of obstructions. **Figure 19** provides a view of the platform elevator looking south.

Figure 17 Escalator and Staircase Congestion - PM Peak

Figure 18 View Toward Pedestrian Passage Beyond the Fare Gates

Way-finding signage in the free area directs passengers to the station amenities on the east and west sides of the station.

Metrorail facilities were assessed using on-site observations and as-built drawings. Vertical circulation capacity was assessed by on-site observation of

Figure 19 View of the Platform Elevator

passengers using the facilities during peak and non-peak hours. The level of congestion was observed to measure the adequacy of the space or any deficiency. Circulation elements and their respective queuing spaces were assessed on-site. The observations were compared to the guidelines in the WMATA Station Site and Access Planning Manual (2008).

West Entrance

The west entrance is approximately at the same level as the station platform. Figure 20 shows the west station entrance, which is located at the northern end of the bus bay area. The west entrance has a single down escalator, stairs, and an elevator that lead down to the pedestrian passageway. At the mezzanine level, the elevator doors open to the north into the west pedestrian passageway (see **Figure 21**).

At street level the elevator is accessed from the plaza between the entrance escalators/stairway and the Metro tracks. The elevator doors open to the south and the queuing area is partially covered by an overhang attached to the elevator. The queuing area is of adequate size and free of obstructions (see **Figure 22**).

Three bus bays with shelters, bike racks, and bike lockers are located closest to the west station entrance. To the west of the bus lane is a separate waiting area with a shelter to wait for taxis and Kiss & Ride pickup/dropoff. The Park & Ride lot is to the west of the Kiss & Ride lot. In compliance with the general design guidelines in WMATA's 2008 Station Site and Access Planning

Figure 20 West Station Entrance viewed from the Station Platform

Figure 21 Pedestrian Passageway - Looking West

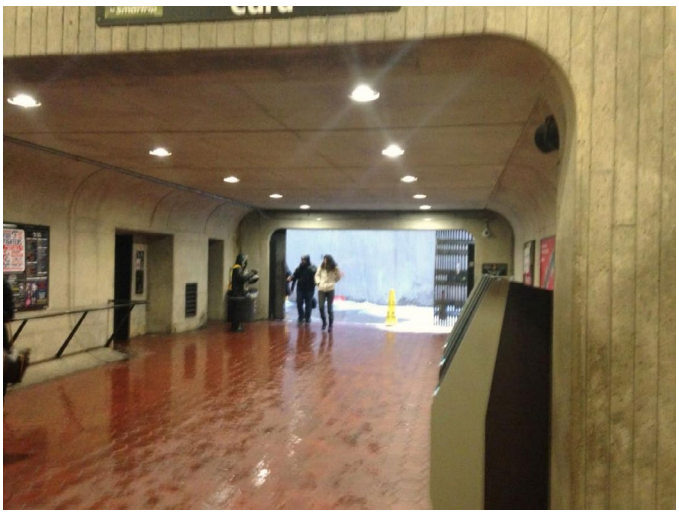


Figure 22 West Entrance Elevator

Manual, all of the station site facilities are interconnected by accessible pedestrian crosswalks. Bike access to the station is on shared station access roadways.

East Entrance

The east entrance is at the same level as the pedestrian passage (see **Figure 23**). The bicycle racks and lockers, bus bays, and both parking garages are easily accessible for pedestrians without the need to cross any traffic lanes, and are ADA compliant. A crosswalk leads to the covered taxi stand and Kiss & Ride lot across the bus lanes. However, once at the median waiting area between the bus lanes and the Kiss & Ride lot, pedestrians being picked up do not have a designated crosswalk across the Kiss & Ride lot and must cross the lane of taxis and private vehicles traveling through the Kiss & Ride lot.

Figure 23 View of the East Station Entrance

2.4.4 Bus Facilities and Operations

Public Transit

More than a third of Metrorail boardings at Shady Grove are via transfers from buses. The following public bus routes serve Shady Grove Metrorail station:

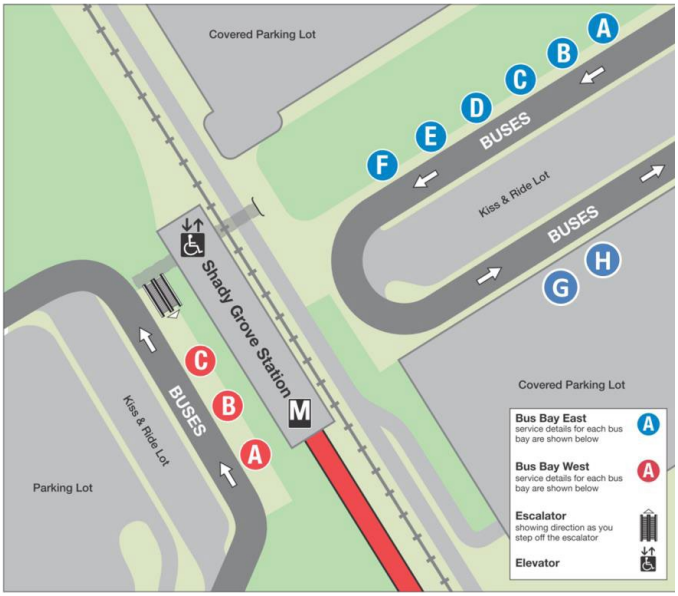
- **Metrobus –** Metrobus Q1, Q2, Q5, and Q6 routes terminate and lay over at Shady Grove.
- **Ride On –** Routes 55 and 59; Routes 43, 46 (select trips), 53, 57, 58, 61, 63, 64, 74, 76, 90, and 100 terminate and lay over at Shady Grove; weekday, peak-direction-only Routes 60, 65, 66, 67, 71, 78, and 79 terminate and lay over at Shady Grove.
- **Maryland Transit Administration (MTA) –** Routes 201, 202, 205, 991; select weekday trips on MTA Route 991 terminate and lay over at Shady Grove.

Currently, there is no Metrobus supervisor at the station. The number of departures for the morning and evening peak periods from the east and west sides are listed below:

- AM Peak Hour: 6:30 AM – 7:29 AM (60 departures: 29 West, 31 East)
- PM Peak Hour: 4:30 PM – 5:29 PM (78 departures: 27 West, 51 East)

Figure 24 shows the bus bays on each side of the Shady Grove Metrorail station; **Figure 25** shows the routes assigned to each bus bay.

Figure 24 Bus Bays on the East and West Side of the Shady Grove Metrorail Station



Private Shuttle Services

Shuttle bus service provides access between the station and residential neighborhoods, as well as employment centers. The WMATA 2011 Shuttle Services at Metro Facilities Study noted that there were 37 shuttle trips during the peak hour and shuttle trips are expected to increase by 35 percent by 2040 to about 50 shuttle trips during the peak hour. Three shuttle routes serve the King Farm development and operate from the west side of the Shady Grove station.

Figure 25 Public Bus Routes Served at the Shady Grove Metrorail Station

Bus bay information from Shady Grove Station (West)

All frequencies in this table are shown in minutes; check schedules for full details.

Bus Bay	Route	Destination	Serving	Operator	Monday to Friday			Saturday	Sunday	Fri/Sat
					AM Rush	Midday	PM Rush	Day	Day	Late Night
A	53	Glenmont	Norbeck Grove, Onley	RO	30	-	30	-	-	-
	57	Lakeforest Transit Center	Washington Grove, Emory Grove	RO	30	30	20	30	30	30
	63	Rockville	Redland Blvd, Piccard Dr	RO	30	30	30	-	-	-
	66	Traville Transit Center	Redland Blvd, Research Blvd	RO	30	-	-	-	-	-
	67	Traville Transit Center	Dufief Mill Rd, Shady Grove Rd	RO	-	-	30	-	-	-
B	46	Medical Center	Montgomery College, Rockville Pike	RO	3 trips	-	-	3 trips	30	-
	55	Germantown Transit Center	Lakeforest Transit Center, Milestone Center	RO	15-20	20	15-20	20	30	30-45
	55	Rockville	Montgomery College, Hungerford Dr	RO	15-21	21	15-21	20	30	30-46
	59	Montgomery Village	Lakeforest Transit Center	RO	20-30	20-30	15-20	30	30	30
	59	Rockville	Gude Dr, Lincoln Park	RO	15-20	30	30	30	30	30
C	Q1	Silver Spring	Rt 355, Rockville, Veirs Mill Rd, Wheaton, Georgia Ave	Metro	-	-	-	-	Evening Only	30
	Q2	Silver Spring	Rt 355, Montgomery College, Rockville, Veirs Mill Rd, Wheaton, Georgia Ave	Metro	-	-	Evening Only	Evening Only	-	-
	Q5	Wheaton	Rt 355, Rockville, Veirs Mill Rd	Metro	-	-	-	-	30	-
	Q6	Wheaton	Rt 355, Montgomery College, Rockville, Veirs Mill Rd	Metro	15-30	30	16	30	-	-

Bus bay information from Shady Grove Station (East)

All frequencies in this table are shown in minutes; check schedules for full details.

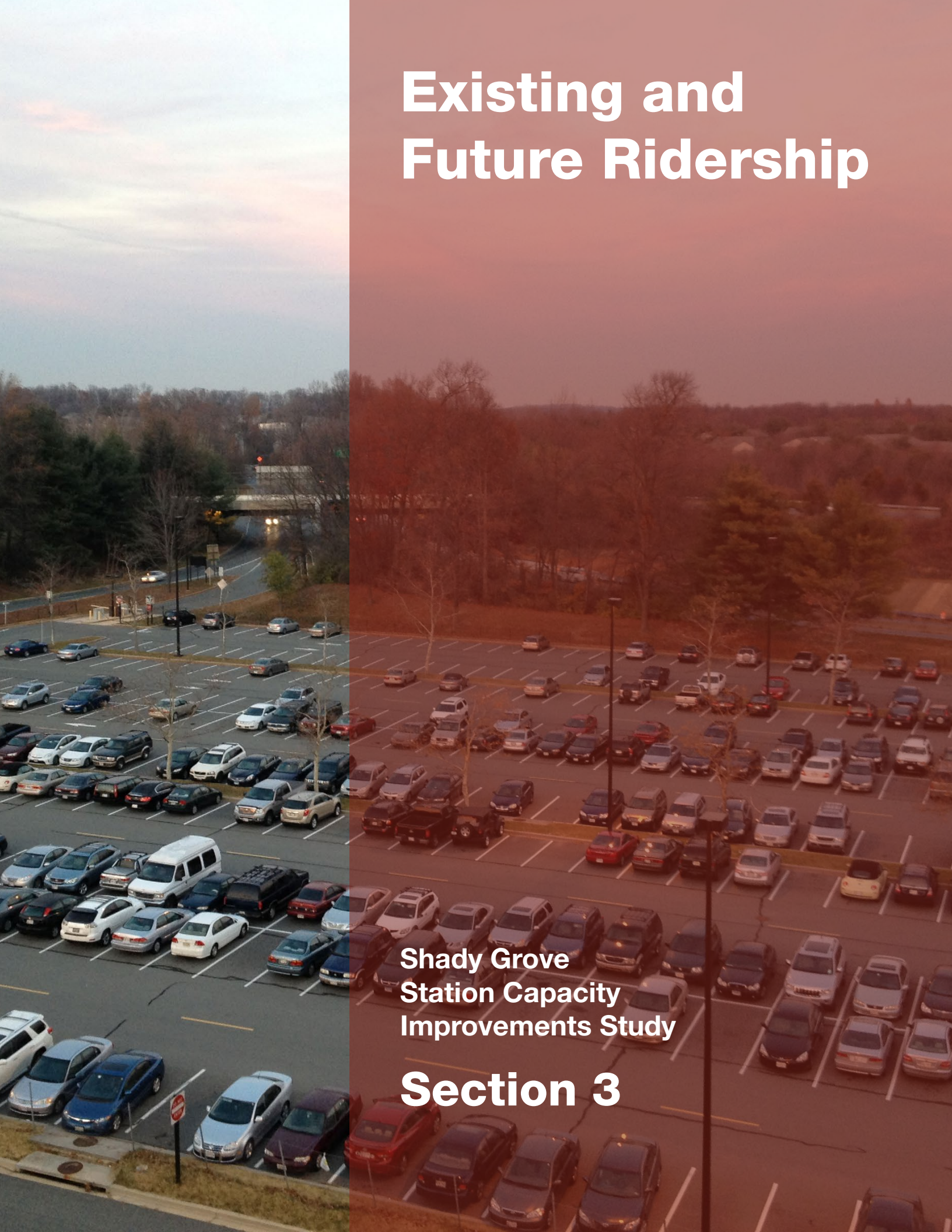
Bus Bay	Route	Destination	Serving	Operator	Monday to Friday			Saturday	Sunday	Fri/Sat
					AM Rush	Midday	PM Rush	Day	Day	Late Night
A	79	Milestone Park & Ride	Exp I-370, I-270, Middlebrook Rd	RO	-	-	30	-	-	-
	90	Milestone Park & Ride	Woodfield Rd, Damascus, Ridge Rd	RO	30	30	30	30	-	-
	205	Germantown Transit Center	NIST	MTA	3 trips	-	-	-	-	-
	205	College Park	ICC Park & Ride, Muirkirk MARC	MTA	-	-	3 trips	-	-	-
B	58	Lakeforest Transit Center	Montgomery Village	RO	30	30	25-30	30	30	-
	65	Montgomery Village	Shady Grove Rd, Mid-County Hwy	RO	-	-	30	-	-	-
C	74	Germantown Transit Center	I-370, Great Seneca Hwy	RO	30	30	30	-	-	-
	76	Poolesville	Quice Orchard HS, Darnestown, Dawsonville, Wootton Ave	RO	30	30	30	-	-	-
D	43	Traville Transit Center	Shady Grove Hospital	RO	15	20	15	30	-	-
	60	Montgomery Village	Shady Grove Rd, Centerway Rd	RO	-	-	30	-	-	-
	64	Montgomery Village	Shady Grove Rd, Goshen Rd	RO	30	30	20-30	30	30	-
E	100	Germantown Transit Center	Express I-370, I-270	RO	5-10	10-15	5-10	30	30	30
F	61	Germantown Transit Center	Montgomery Village, Lakeforest TC	RO	30	30	30	30	30	30
	71	Kingsview Park & Ride	Express I-370, I-270, Clopper Rd, Dawson Farm Rd, Steeple Rd	RO	-	-	30	-	-	-
	78	Kingsview Park & Ride	Express I-370, I-270, Clopper Rd, Great Seneca Hwy, Richter Farm Rd	RO	-	-	30	-	-	-
G	201	BWI Airport	Burtonsville Park & Ride, Dorsey MARC Station, Arundel Mills Mall	MTA	60	60	60	-	-	-
	201	Gaithersburg Park & Ride	NIST	MTA	60	60	60	-	-	-
	202	Ft Meade	Savage MARC Station	MTA	3 trips	-	-	-	-	-
	202	Metropolitan Grove	Gaithersburg Park & Ride	MTA	-	-	4 trips	-	-	-
H	991	Rock Spring Business Park	Rockledge Center	MTA	10-35	-	-	-	-	-
	991	Hagerstown	Urbana Park & Ride, Monocacy MARC	MTA	-	-	10-25	-	-	-

Bus Operator Codes

Metro Metrobus
MTA Maryland Transit Authority
RO Ride On, Montgomery County

Note: Routes current as of May 2015.

Existing and Future Ridership



Shady Grove
Station Capacity
Improvements Study

Section 3

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3.0 EXISTING AND FUTURE RIDERSHIP

Metrorail ridership at the Shady Grove station comprises passengers from the region who access the station by driving, walking, biking, taking a bus, or being dropped off.

The ridership forecast has been completed by modeling regional person trips generated by the MWCOG Version 2.3 Travel Model and the Round 8.0 Cooperative Land-Use Forecast. The transit forecasting model assumes:

- Parking constraints at the Shady Grove Metrorail station;
- 50 percent of the proposed transit-oriented development identified in the Sector Plan in place around the Metrorail station in 2020 with and without the CCT, and;
- 100 percent of the proposed transit-oriented development in place around the Metrorail station in 2030 with the CCT operating as a BRT system.

The analysis focuses on the AM Peak Hour. The transit forecasting model assumes that origin and destination data for the PM Peak Hour will be the same, but in the opposite direction of the AM Peak Hour demand.

Figure 26 shows the total ridership under four scenarios: 2030 Existing Conditions, 2020 without CCT, 2020 with CCT, and 2030 with CCT.

Figure 27 shows that passengers accessing the Shady Grove Metrorail station from the east and the west entrances is not evenly distributed. While growth is almost equal at both the east and the west entrances in 2020 without CCT (56 and 60 percent, respectively), the opening of the CCT changes the balance significantly in both 2020 and 2030. In 2020 with CCT, growth at the west entrance is 155 percent compared to 32 percent at the east. In 2030 with CCT, growth at the west entrance is 359 percent compared to only 32 percent at the east. The decrease in ridership using the east entrance can be attributed to a mode shift from cars and buses to the CCT, which transfers some of the ridership to the west entrance.

Figure 26 Total AM Peak Ridership by Scenario

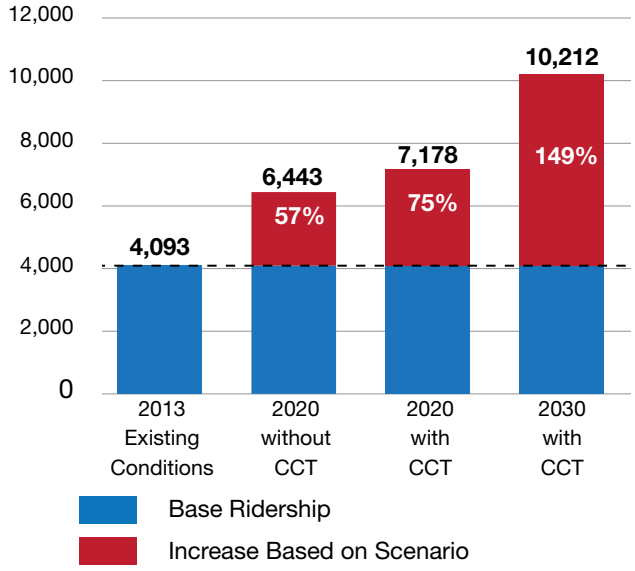
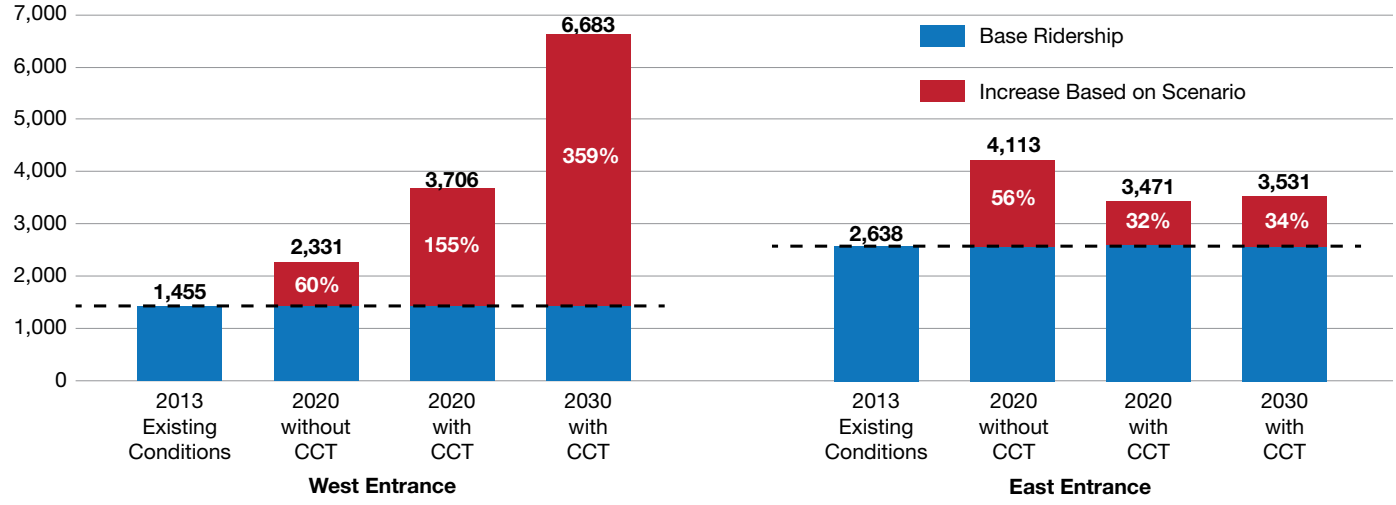


Figure 27 West and East Entrance AM Peak Ridership by Scenario



3.1 2013 Existing Conditions

In 2013, a total of 4,093 passengers used the Shady Grove Metrorail station in the AM Peak Hour. **Table 3** shows station origins and destinations of passengers by mode and direction in the AM Peak Hour. **Figure 28** displays the data from **Table 3** graphically. Ridership in 2015 is at nearly the same level as 2013 ridership.

In the AM Peak Hour in 2013, a total of 1,455 passengers entered or exited the station through the west entrance and 2,638 passengers used the east entrance. **Figures 29** and **30** summarize the connecting modes of passengers using the west and east entrances during the peak hour in 2013. In 2013, more passengers used the east entrance, which can largely be attributed to the number of passengers that drive and park at the larger parking facilities on the east side.

Table 3 Origin-Destination Matrix – AM Peak Hour

Origin	Destination					Total
	WMATA Red Line	Walk West	Bus West	Walk East	Bus East	
WMATA Red Line		84	187	57	167	495
Walk West	227					227
Bus West	503					503
Car West	454					454
Walk East	151					151
Bus East	446					446
Car East	1,817					1,817
Total	3,598	84	187	57	167	**4,093**

Figure 28 AM Peak Hour Origin-Destination by Mode

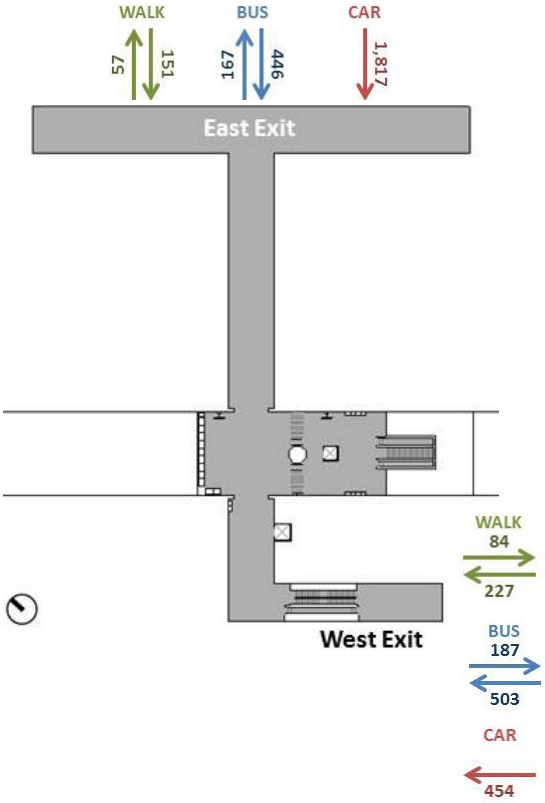


Figure 29 West Entrance-Access by Mode

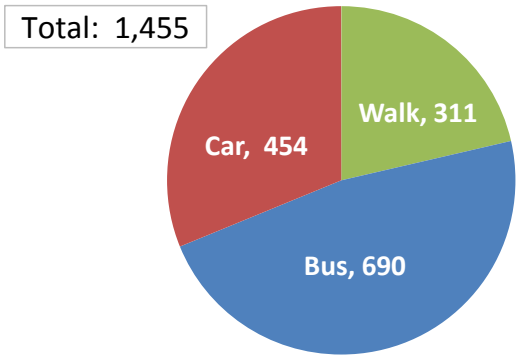
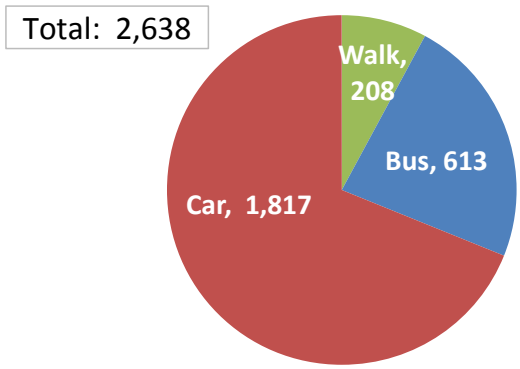


Figure 30 East Entrance-Access by Mode



3.2 2020 Without CCT

Without the CCT in operation, an estimated 6,443 passengers would use the Shady Grove Metrorail station in 2020. **Table 4** shows station origins and destinations of passengers by mode and direction in the AM Peak Hour. **Figure 31** shows the data from **Tables 4** graphically. The peak hour demand in 2020 without CCT increased by 57 percent from 2013.

Similar to 2013, more passengers enter and exit through the east entrance (4,113 passengers) than the west entrance (2,331 passengers) in the AM Peak Hour in 2020 without CCT. **Figures 32** and **33** show the access by mode from the east and west entrances in 2013 and 2020 without CCT. Both entrances show growth, most significantly in passengers walking to and from the station. This can be attributed to the new transit-oriented development near the station.

Table 4 Origin-Destination Matrix – AM Peak Hour

Origin	Destination					Total
	WMATA Red Line	Walk West	Bus West	Walk East	Bus East	
WMATA Red Line		165	171	211	152	698
Walk West	637					637
Bus West	806					806
Car West	552					552
Walk East	827					827
Bus East	715					715
Car East	2,208					2,208
Total	5,745	165	171	211	152	**6,443**

Figure 31 AM Peak Hour Origin-Destination by Mode

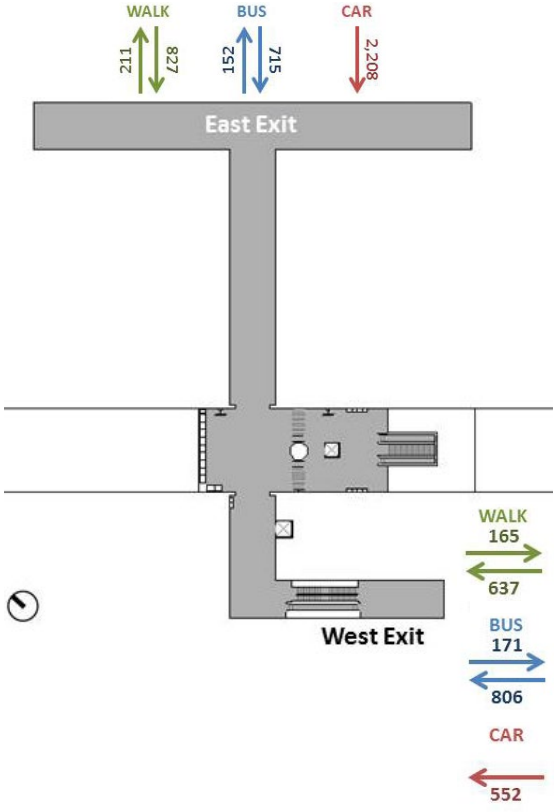


Figure 32 West Entrance-Access by Mode

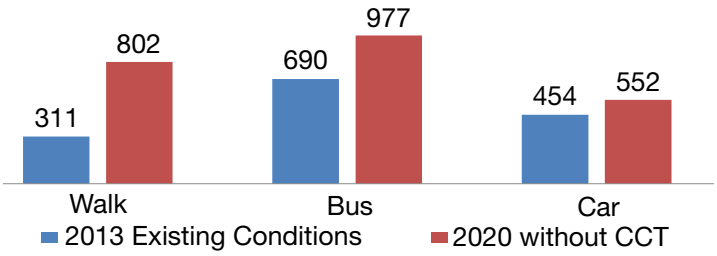
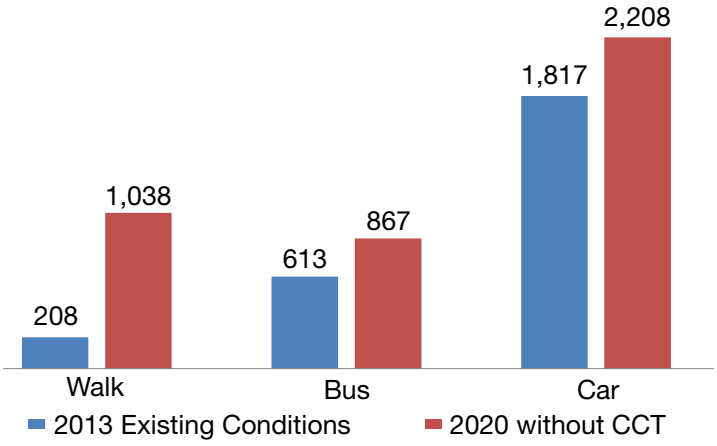


Figure 33 East Entrance-Access by Mode



3.3 2020 With CCT

With the CCT in operation, an estimated 7,178 passengers would use the Shady Grove Metrorail station in 2020. **Table 5** shows station origins and destinations of passengers by mode and direction in the AM Peak Hour. **Figure 34** shows the data from **Table 5** graphically. The total peak hour demand in 2020 with CCT would increase by 75 percent from 2013, and is 11 percent higher than the ridership scenario in 2020 without CCT.

Unlike 2013 and 2020 without CCT, more passengers enter and exit through the west entrance (3,706 passengers) than the east entrance (3,471 passengers) in the AM Peak Hour in 2020 with CCT. **Figures 35** and **36** show the access by mode from the east and west entrances for 2013, 2020 without CCT, and 2020 with CCT. Both entrances show growth compared to 2013, but total ridership at the east entrance decreases compared to 2020 without CCT. This can be attributed to a mode shift to CCT from buses and cars that would have otherwise accessed the Shady Grove Metrorail station from the east side.

Table 5 Origin-Destination Matrix – AM Peak Hour

Origin	Destination						Total
	WMATA Platform	Walk West	Bus West	CCT West	Walk East	Bus East	
WMATA Platform		165	75	594	210	67	1,112
	672						672
Bus West	586						586
Car West	451						451
CCT West	1,163						1,163
Walk East	854						854
Bus East	536						536
Car East	1,804						1,804
Total	6,067	165	75	594	210	67	**7,178**

Figure 34 AM Peak Hour Origin-Destination by Mode

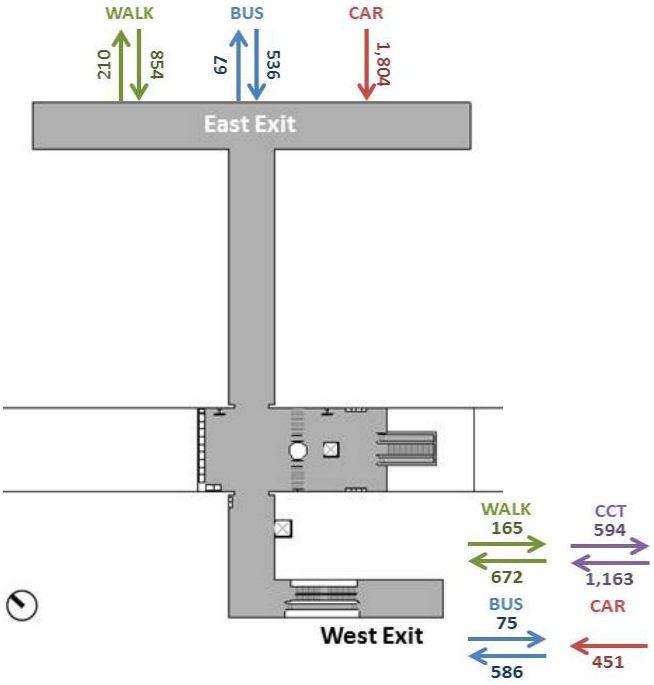


Figure 35 West Entrance-Access by Mode

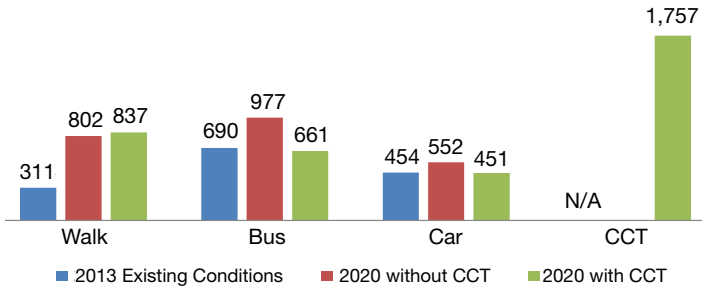
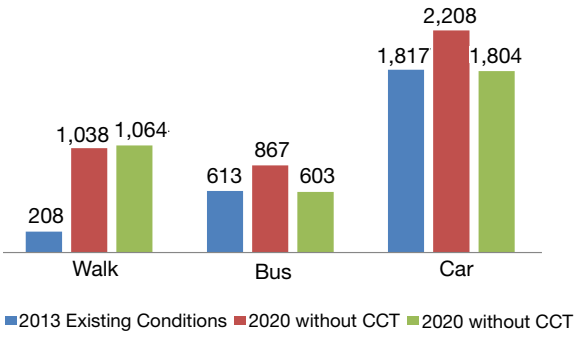


Figure 36 East Entrance-Access by Mode



3.4 2030 With CCT

With the CCT in operation, an estimated 10,212 passengers would use the Shady Grove Metrorail station in 2030. **Table 6** shows station origins and destinations of passengers by mode and direction in the AM Peak Hour in 2030. **Figure 37** shows data from **Table 6** graphically. The total peak hour demand in 2030 would increase by 150 percent from 2013.

Similar to 2020 with CCT, more passengers enter and exit through the west entrance (6,683 passengers) than the east entrance (3,531 passengers) in the AM Peak Hour in 2030 with CCT. **Figures 38** and **39** show the access by mode from the east and west entrances in 2013, 2020 with CCT, and 2030 with CCT. The ridership on the west side is significantly higher than the east side in comparison to 2020 with CCT due to the forecasted growth in CCT ridership. In addition, a mode shift away from cars and buses is forecasted, and an increase in the walk share is also anticipated.

Table 6 Origin-Destination Matrix – AM Peak Hour

Origin	Destination						Total
	WMATA Platform	Walk West	Bus West	CCT West	Walk East	Bus East	
WMATA Platform		529	148	2,156	279	75	3,186
Walk West	1,217						1,217
Bus West	340						340
Car West	401						401
CCT West	1,892						1,892
Walk East	1,241						1,241
Bus East	331						331
Car East	1,605						1,605
Total	7,026	529	148	2,156	279	75	**10,212**

Figure 37 AM Peak Hour Origin-Destination by Mode

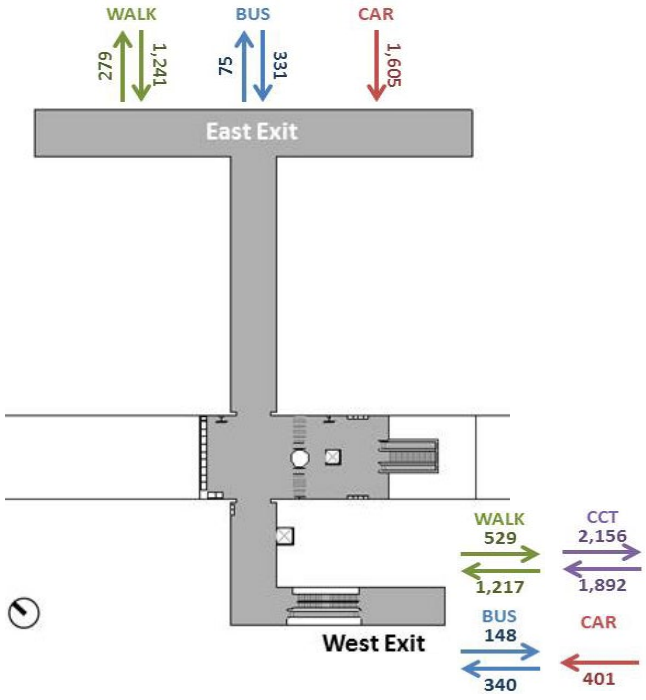


Figure 38 West Entrance-Access by Mode

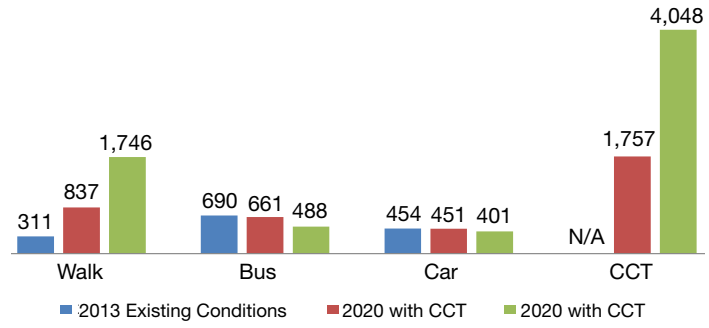
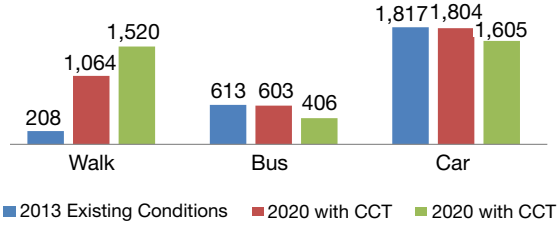


Figure 39 East Entrance-Access by Mode



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Development of Alternatives

Shady Grove
Station Capacity
Improvements Study

Section 4

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4.0 DEVELOPMENT OF ALTERNATIVES

Design alternatives were developed based on observed patterns and constraints for access and circulation within the station, and taking into account forecasted ridership growth.

4.1 External Site Access

4.1.1 Corridor Cities Transitway

The proposed CCT station at Shady Grove would be located on the west side of the existing Shady Grove Metrorail station. CCT plans assume that a new entrance will be constructed to access the Metrorail station.

The existing bus loop would be reconfigured to provide separate boarding and alighting platforms for the CCT adjacent to Metrorail station entrances. This would allow the high volume of CCT passengers to transfer easily between Metro and the CCT without having to cross vehicular traffic. WMATA and Ride On buses, which would serve fewer passengers compared to the CCT, would be placed in the second lane within the reconfigured bus loop. Taxi and Kiss & Ride services would be placed in the innermost lane, and surface parking located at the center of the loop. All the facilities would be connected with high-visibility pedestrian crosswalks and medians to provide a safe refuge for pedestrians. The CCT plan proposes to reconfigure and restripe the surface parking lot to maintain the current number of spaces.

CCT and Metro bus operations would be optimized by having all the all buses move in a one-way counter-clockwise direction. The design proposed by MTA makes provisions to have five layover spaces for the BRT vehicles.

Figure 40 shows MTA's current draft CCT alignment at the Shady Grove Metrorail station as of June 8, 2015. As the design advances, the plans will be reviewed for conformance with the 2008 *WMATA Station Site and Access Planning Manual* and *Adjacent Construction Project Manual – Revision 5*, and will be subject to further review and approval by WMATA.

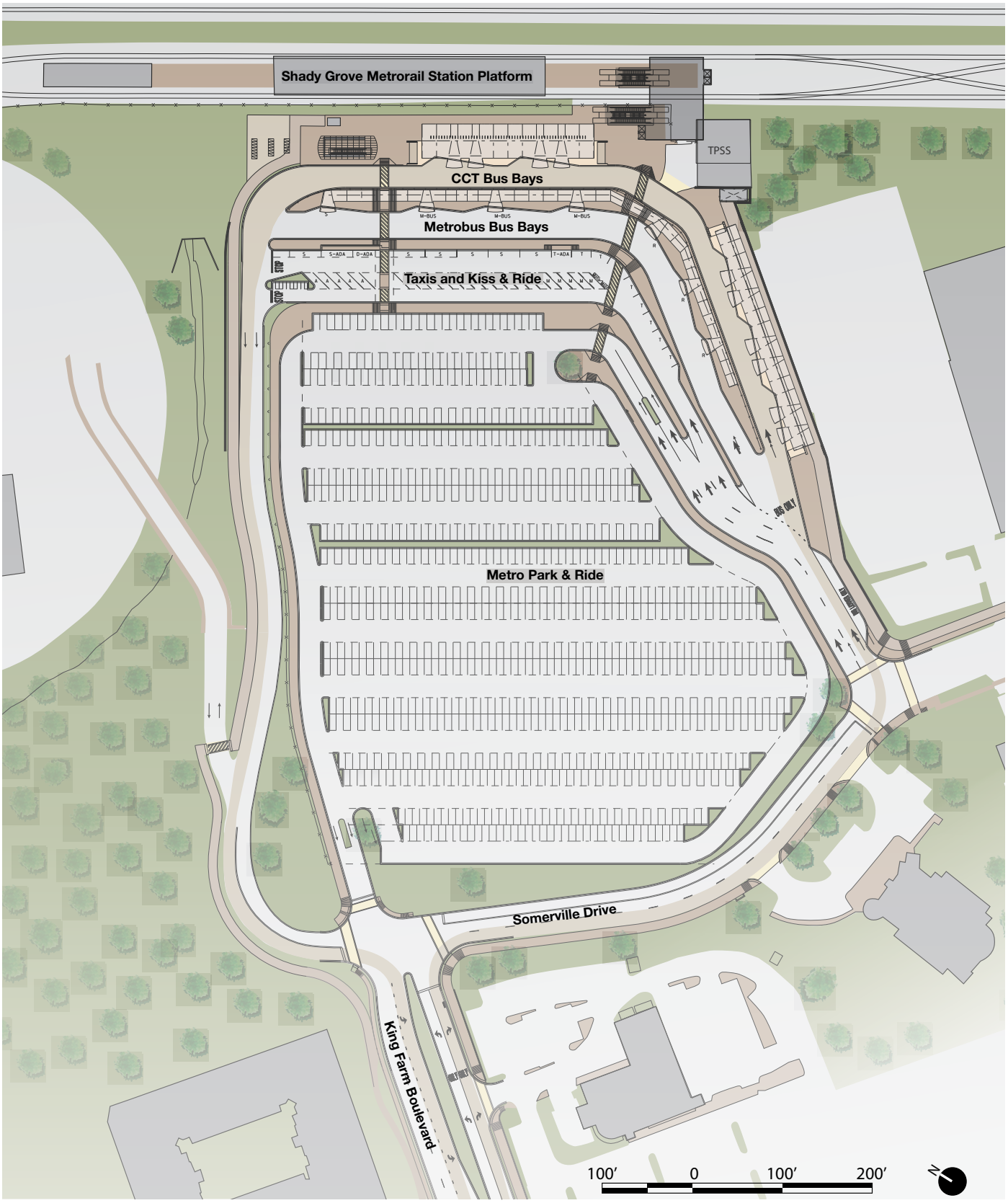
4.1.2 Event Center

Montgomery County, working with a private development team, has expressed interest in using part of the current Shady Grove west parking lot as the location for a new privately built and operated event center. The event center would consist of an approximately 7,500-seat multi-purpose arena and, to the extent that the site can accommodate it, a separate banquet and conference facility and ancillary retail uses. Locating these facilities on-site would also require that the current surface parking be relocated into a structured garage to be built on the site. WMATA, the CCT team, Montgomery County, and the private developer met for initial coordination in 2013. No detailed analysis or site planning has been advanced. The feasibility of building the event center at this location would be contingent on the compatibility of the event center within the physical and operational constraints imposed by Metro and CCT's current and proposed uses.

4.1.3 Future Bus Facility Needs

A preliminary analysis was conducted regarding Metrobus, Ride On, and MTA lines currently serving the Shady Grove Metrorail station. The analysis includes the bus routes operated by each agency, as well as the service provided to the east side and west side bus bays. Operators did not provide specific expansion plans for services at the Shady Grove Metrorail station. Future bus levels of service were estimated based on the ridership forecast and pedestrian modeling effort described in **Section 3.0**. The CCT is reflected in future service levels. The remaining Montgomery County BRT Network projects are reflected as existing bus routes that follow similar alignments as the proposed BRT routes. The new services will impact bus facility needs at the Shady Grove Metrorail station. In total, four scenarios were considered regarding the bus bay capacity at the station: current service levels, 2020 without CCT, 2020 with CCT, and 2030 with CCT.

Figure 40 Shady Grove Station Site Plan



The methodology used to estimate future bus bay needs is below:

- Determine peak hour total number of buses from current public timetables.
- Project service growth by:
  - Obtaining bus to rail and rail to bus passenger activity flow from pedestrian model activity.
  - Calculating percent change in bus to rail and rail to bus pedestrian activity for each scenario for both the east and west sides of the station. The model treats CCT as a separate service.
- Establish future facility needs by:
  - Applying the percent change in pedestrian activity for arriving (bus to rail) and departing (rail to bus) service to the current level of service (i.e., bus trips) for each route serving the east side and west side of Shady Grove Metrorail station. No new routes were assumed.
  - Calculating the number of bus bays based on a four-minute dwell time for arriving and departing buses for routes that terminate at the station, or four-minute total dwell time for routes that operate through the station. Therefore, routes that arrive at the station and then depart on a return trip have an assumed eight-minute dwell time.
  - Calculating the number of layover spaces needed based on a ten-minute average layover time applied to all routes that begin and end at the station. The calculation of layover needs does not specify whether layovers would take place within the bus bays or in a separate location.

Projected Service Growth

The level of service growth is based on the pedestrian modeling activity that was used to forecast pedestrian flows between the Metrorail platform and the bus bays. The estimate for the change in the level of bus service for each scenario is based on the percent change in bus to rail passengers and rail to bus passengers at each side of the station. The bus to rail passenger percent change was used to estimate the change in the number of buses arriving at the station, and the rail to bus passenger percent change was used to estimate the number of departing buses from the station for each scenario. The percent change in the number of buses was applied to each bus route serving each side of the station and pivots off the existing service levels described in **Section 2.3.4**.

A summary of the pedestrian flows used to estimate future bus levels of service is presented in **Table 7.** CCT was assumed to have an exclusive platform and stop areas; therefore, CCT service needs did not factor into the bus bay estimates. Bus bay requirements for the other proposed Montgomery County BRT services were estimated based on existing services along similar routes.

Future Bus Bay and Layover Needs

Future facility needs were first calculated assuming that buses do not lay over in the bus bays. A dwell time of approximately four minutes was allocated for each bus arriving to and departing from the Shady Grove Metrorail station in revenue service, meaning that each bus bay has a capacity of 15 arriving or departing buses per hour. Thus, a route that terminates at Shady Grove and begins revenue service on a return trip would be allocated eight minutes, four minutes for unloading passengers and four minutes to load passengers. For bus routes that do not terminate at Shady Grove Metrorail station, but operate through the station, four minutes are allocated to the bus, since the Shady Grove Metrorail station is a mid-route stop location for the bus route.

The findings of the bus bay and layover analysis are summarized in **Figures 41** through **44**. The appropriate growth factors were applied from **Table 7** to the existing bus bay activity to arrive at the future bus bay activity for each route. As shown in **Figure 41** and **42**, fewer bus bays are needed for local buses once the CCT starts operating; five additional bus bays are required for the CCT. This reflects the findings of the regional ridership model, which shows a shift in passengers to the CCT from local services. Additional details of the analysis are provided in **Appendix A: Shady Grove Bus Bay Analysis Technical Memorandum**.

Table 7 Projected Bus Ridership

	AM Peak				PM Peak			
	Bus to Rail		Rail to Bus		Bus to Rail		Rail to Bus	
	East Side	West Side	East Side	West Side	East Side	West Side	East Side	West Side
Passengers (non-CCT services only)								
2013	446	503	167	187	167	187	446	503
2020 (no CCT)	715	806	152	171	152	171	715	806
2020 (with CCT)	536	586	67	75	67	75	536	586
2030 (with CCT)	331	340	75	148	75	148	331	340
Change from Current								
2020 (no CCT)	60.3%	60.2%	-9.0%	-8.6%	-9.0%	-8.6%	60.3%	60.2%
2020 (with CCT)	20.2%	16.5%	-59.9%	-59.9%	-59.9%	-59.9%	20.2%	16.5%
2030 (with CCT)	-25.8%	-32.4%	-55.1%	-20.9%	-55.1%	-20.9%	-25.8%	-32.4%

Figure 41 East Side Bus Bay Analysis

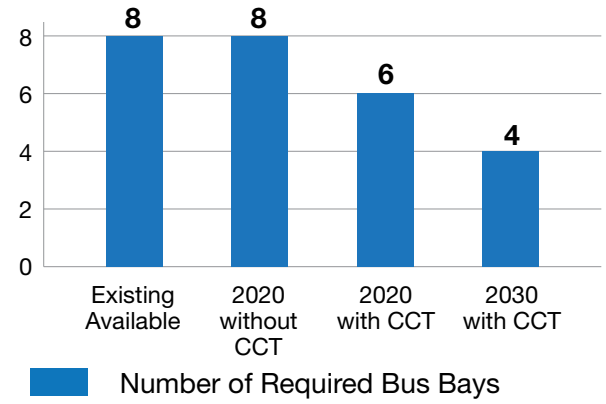


Figure 42 East Side Layover Requirements

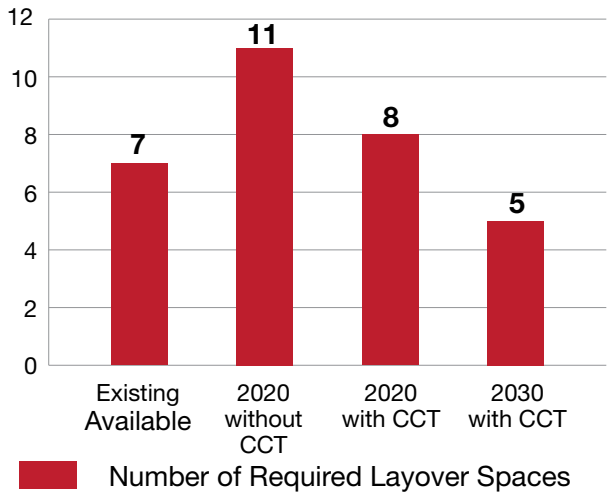


Figure 43 West Side Bus Bay Analysis

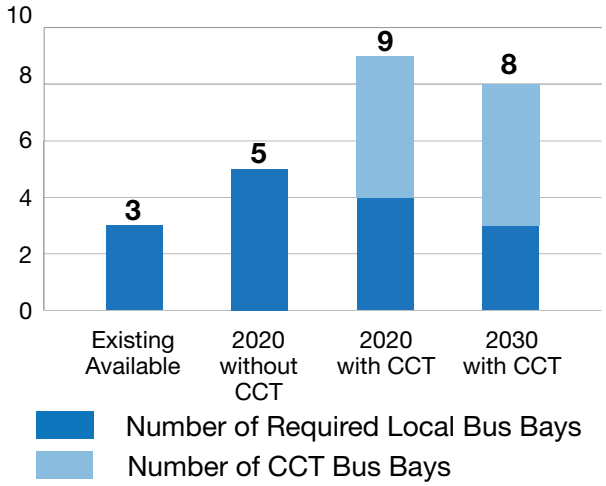
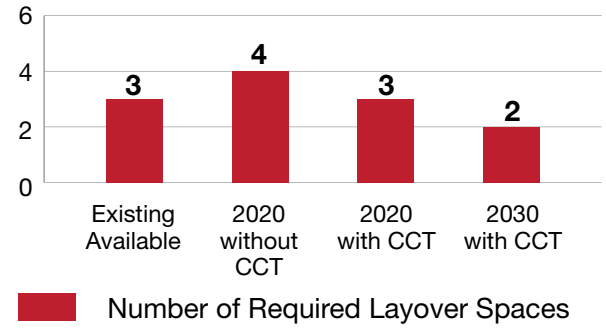


Figure 44 West Side Layover Requirements



4.2 Internal Station Access

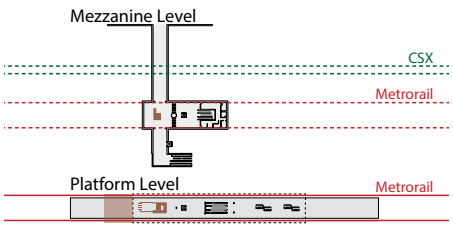
4.2.1 Preliminary Alternatives Considered

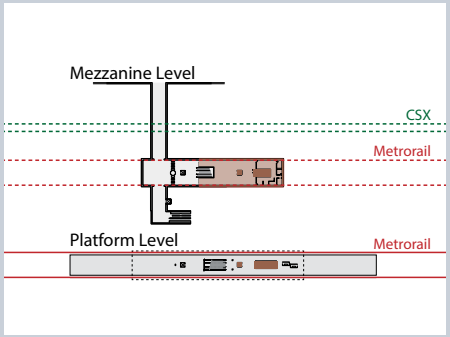
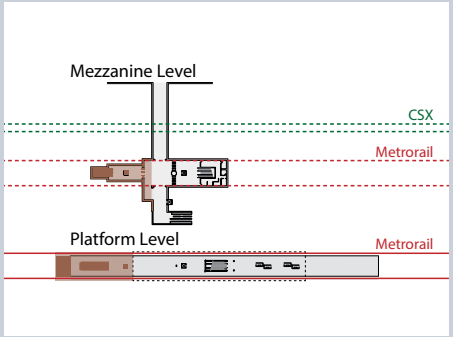
Several alternatives were developed to address capacity issues at entrances, vertical circulation elements (VCEs), mezzanine, and platforms of the Shady Grove Metrorail station. **Table 8** shows all alternatives considered and highlights those selected for further study. Based on an initial screening process, six alternatives were eliminated from further consideration.

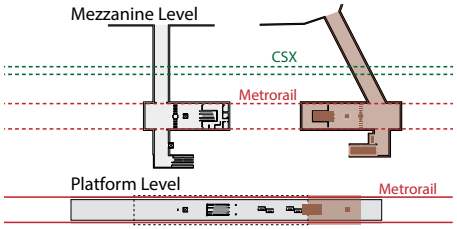
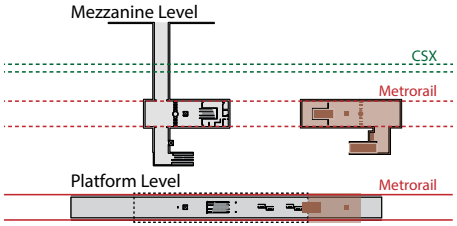
Generally, the preliminary alternatives are grouped as follows:

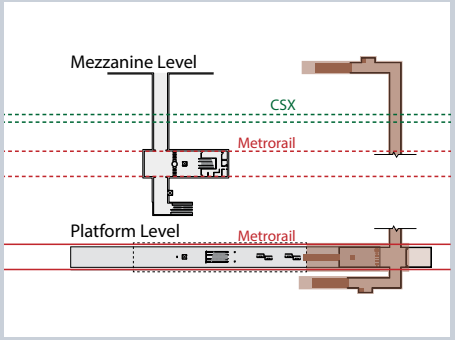
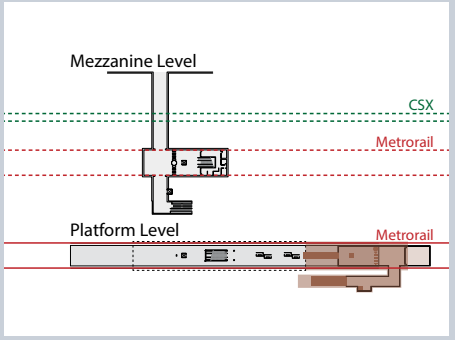
- Alternative 1: Additional Circulation at Current Entrance
- Alternative 2: New South Entrance with an Underground Mezzanine
- Alternative 3: New South Entrance with an Upper Level Mezzanine
- Alternative 4: New West Side Platform

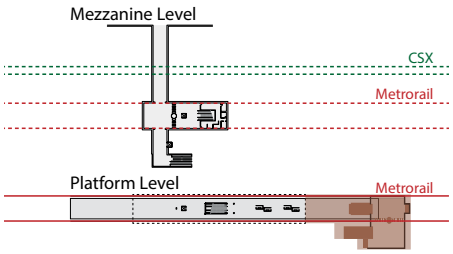
Table 8 Alternatives Considered and Selected for Further Study

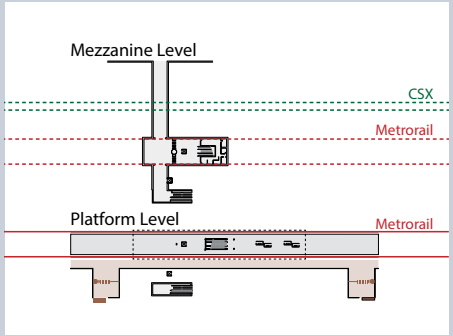
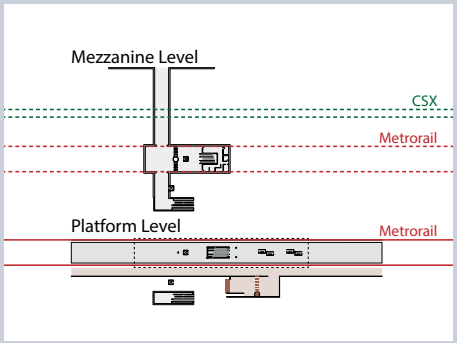
Alternative (Timeframe)	Description	Issues and Options Considered	Selected for Further Study
Alternative 1A (Short-Term) Open-Well Staircase 	Open-well staircase with quarter-turn landing; fare gates and add-fare machine at the platform level	• **Platform/Mezzanine Crowding:** Addresses platform crowding by adding second exit off platform for passengers. • **VCE Capacity:** Addresses bottleneck created at escalators by providing a second exit off the platform for passengers. • **Station Operations:** Operational issues with not having a manager's kiosk at the platform (Note: similar precedents exist at several other stations, including Judiciary Square, Takoma Park, Arlington Cemetery, and Deanwood). • **Constructibility:** Further analysis needed to determine issues with constructibility. • **Other Considerations:** – If advanced further, this alternative should consider incorporating an add-fare machine at platform level. – Also evaluated switchback staircase (four flights) in the platform cut-out leading to the platform level; eliminated due to height clearance constraints.	**Yes**

Alternative (Timeframe)	Description	Issues and Options Considered	Selected for Further Study
Alternative 1B (Short-Term) Extended Mezzanine South 	Extend underground mezzanine to the south	• **Platform/Mezzanine Crowding:** Alleviates platform crowding by adding second exit off platform for passengers. However, capacity problems are transferred to the paid area of mezzanine and fare gates. • **VCE Capacity:** Addresses bottleneck created at escalators by providing a second exit off the platform for passengers. • **Station Operations:** None. • **Constructibility:** Further analysis needed to determine issues with constructibility. • **Other Considerations:** None.	No
Alternative 1C (Short-Term) Extended Mezzanine North 	New underground mezzanine to the north (where the fare vending machines are currently located)	• **Platform/Mezzanine Crowding:** Alleviates platform crowding by adding second exit off platform for passengers. However, capacity problems are transferred to the unpaid area of mezzanine. • **VCE Capacity:** Addresses bottleneck created at escalators by providing a second exit off the platform for passengers. • **Station Operations:** None. • **Constructibility:** Moderate benefits do not justify expected high costs of construction or disruptions during construction. • **Other Considerations:** None.	No

Alternative (Timeframe)	Description	Issues and Options Considered	Selected for Further Study
Alternative 2A (Long-Term) New South Entrance with Underground Mezzanine (East and West Connections) 	New south entrance (east and west connections) and underground mezzanine	• **Platform/Mezzanine Crowding:** Addresses platform crowding by adding second exit off platform for passengers. Addresses mezzanine crowding by providing a second mezzanine. • **VCE Capacity:** New escalators distribute passengers to mezzanines on both ends of the platform. Exits to both west and east sides from both mezzanines make platform VCEs equally convenient and less congested. • **Station Operations:** None • **Constructibility:** Further analysis needed to determine issues with constructibility and permitting issues of building a tunnel under Metro and CSX tracks. • **Other Considerations:** – Requires extending the platform canopy to cover the new escalator/staircase.	**Yes**
Alternative 2B (Long-Term) New South Entrance with Underground Mezzanine (West Connection Only) 	New south entrance (west connection only) and underground mezzanine	• **Platform/Mezzanine Crowding:** Addresses platform crowding by adding second exit off platform for passengers. The second mezzanine addresses crowding, especially in future years, when passengers are trying to access the CCT on the west side of the station. • **VCE Capacity:** New escalators distribute passengers to mezzanines on both ends of the platform. Exits to west sides from both mezzanines make platform VCEs equally convenient for passengers trying to access the CCT. • **Station Operations:** None • **Constructibility:** Further analysis needed to determine issues with constructibility and permitting issues of building a tunnel under Metro tracks. • **Other Considerations:** – Requires extending the platform canopy to cover the new escalator/staircase.	**Yes**

Alternative (Timeframe)	Description	Issues and Options Considered	Selected for Further Study
Alternative 3A (Long-Term) New South Entrance with Upper Mezzanine (East and West Connections) 	New south entrance (east and west connections) and upper level mezzanine	• **Platform/Mezzanine Crowding:** Addresses platform crowding by adding second exit off platform for passengers. Addresses mezzanine crowding by providing a second mezzanine. • **VCE Capacity:** New escalators distribute passengers to mezzanines on both ends of the platform. Exits to both west and east sides from both mezzanines make platform VCEs equally convenient and less congested. • **Station Operations:** None • **Constructibility:** Clearance requirement of 23.5 feet over CSX tracks (per Federal Railroad Administration regulations) for new mezzanine and bridge to the east would add to project costs. Extensive coordination would be required for construction over CSX tracks. • **Other Considerations:** – Requires extending the platform canopy to cover the new escalator/staircase. – Height of mezzanine may result in visual impacts.	No
Alternative 3B (Long-Term) New South Entrance with Upper Mezzanine (West Connection Only) 	New south entrance (west connection only) and upper level mezzanine	• **Platform/Mezzanine Crowding:** Addresses platform crowding by adding second exit off platform for passengers. The second mezzanine addresses mezzanine crowding, especially in future years, when passengers are trying to access the CCT on the west side of the station. • **VCE Capacity:** New escalators distribute passengers to mezzanines on both ends of the platform. Exits to west sides from both mezzanines make platform VCEs equally convenient for passengers trying to access the CCT and less congested overall. • **Station Operations:** None • **Constructibility:** Further analysis needed to determine issues with constructibility and permitting issues of building over Metro tracks. Higher clearance height of new mezzanine and bridge, which matches the clearance height of Alternative 3A, would add to project costs. • **Other Considerations:** – Requires extending the platform canopy to cover the new escalator/staircase.	No

Alternative (Timeframe)	Description	Issues and Options Considered	Selected for Further Study
Alternative 3C (Long-Term) New South Entrance with Upper Mezzanine (West Connection Only) 	New south entrance (west connection only) and upper level mezzanine	• **Platform/Mezzanine Crowding:** Addresses platform crowding by adding second exit off platform for passengers. The second mezzanine addresses mezzanine crowding, especially in future years, when passengers are trying to access the CCT on the west side of the station. • **VCE Capacity:** New escalators distribute passengers to mezzanines on both ends of the platform. Exits to west sides from both mezzanines make platform VCEs equally convenient for passengers trying to access the CCT and less congested overall. • **Station Operations:** None • **Constructibility:** Further analysis needed to determine issues with constructibility and permitting issues of building over Metro tracks. • **Other Considerations:** – This alternative is a modification of Alternative 3B to reduce vertical clearance over Metro tracks to the required 16-feet 9-inches. This results in less vertical distance for users and lower project costs compared to Alternative 3B. – Requires extending the platform canopy to cover the new escalator/staircase.	**Yes**

Alternative (Timeframe)	Description	Issues and Options Considered	Selected for Further Study
Alternative 4A (Long-Term) New West Side Platform with Two Exits 	New side platform on the west, with north and south exits	• **Platform/Mezzanine Crowding:** Addresses platform crowding by adding second platform for passengers exiting to the west side. Addresses mezzanine crowding, especially in future years, when passengers are trying to access the CCT on the west side of the station, by providing a direct connection to the west side from the west platform. • **VCE Capacity:** Reduces demand and congestion at existing platform VCEs for exiting passengers by providing a second platform on west side. • **Station Operations:** To maximize utility of this atypical design, the majority of trains would need to terminate on the western track. Operational issues resulting from this operating plan were deemed insurmountable by Metro operations staff. • **Constructibility:** Easy to construct and does not require additional escalators or elevators. • **Other Considerations:** – All boardings would occur from center platform, while exits could be distributed better when using the western track. – Reduces at-grade plaza area on west side.	No
Alternative 4B (Long-Term) New West Side Platform with One Exit 	New side platform on the west, with one exit from the center	• **Platform/Mezzanine Crowding:** Addresses platform crowding by adding second platform for passengers exiting to the west side. Addresses mezzanine crowding, especially in future years, when passengers are trying to access the CCT on the west side of the station, by providing a direct connection to the west side from the west platform. • **VCE Capacity:** Reduces demand and congestion at existing platform VCEs for exiting passengers by providing a second platform on west side. • **Station Operations:** To maximize utility of this atypical design, the majority of trains would need to terminate on the western track. Operational issues resulting from this operating plan were deemed insurmountable by Metro operations staff. • **Constructibility:** Easy to construct and does not require additional escalators or elevators. • **Other Considerations:** – All boardings would occur from center platform, while exits could be distributed better when using the western track. – Reduces at-grade plaza area on west side.	No

4.2.2 Alternatives Selected for Further Study

Table 9 summarizes the key design elements of the four design alternatives that were selected for further study. These are described in further detail in following sections.

Table 9 Key Design Elements of Alternatives 1A, 2A, 2B, and 3C

Key Elements	Alternative 1A (Short-Term)	Alternative 2A (Long-Term)	Alternative 2B (Long-Term)	Alternative 3C (Long-Term)
New Mezzanine	None	Underground	Underground	Elevated
New Pedestrian Connections	None	East and West	West only	West only
New Staircase	1	2	2	2
Location of New Staircase	• Existing Mezzanine to Platform	• New Mezzanine to Platform • New Mezzanine to West Entrance	• New Mezzanine to Platform • New Mezzanine to West Entrance	• New Mezzanine to Platform • New Mezzanine to West Entrance
Number of New Escalators	None	4	4	4
Number of New Elevators	None	3	3	4
Station Manager's Kiosk	None	1	1	1
New Fare Gates	• Regular - 3	• Regular - 9 • ADA-compliant - 1	• Regular - 9 • ADA-compliant - 1	• Regular - 9 • ADA-compliant - 1
Fare Machines	None	6	6	6
Add-fare Machines	None	2	2	2
Additional Facilities	None	• Restrooms - 2 • Cleaner's Room • Electrical Cabinet • Escalator Control Room • Elevator Machine Room	• Restrooms - 2 • Cleaner's Room • Electrical Cabinet • Escalator Control Room • Elevator Machine Room	• Restrooms - 2 • Cleaner's Room • Electrical Cabinet • Escalator Control Room • Elevator Machine Room
Estimated Time to Bid and Construct	8 months	24 months	24 months	24 months

Alternative 1A (Short-Term)

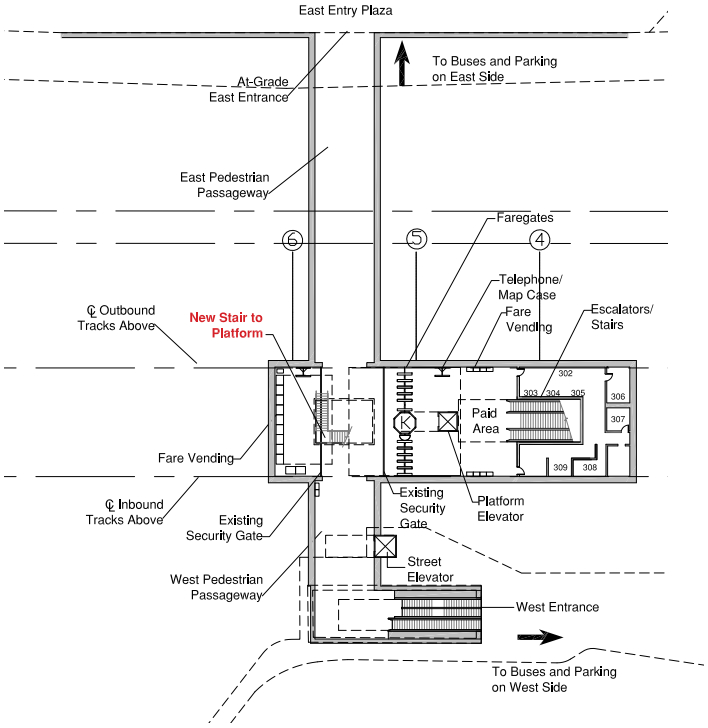
Alternative 1A (see **Figure 45**) consists of a new staircase in the open well between the platform and the mezzanine area below. This staircase will create additional egress from the platform and alleviate platform crowding.

The new staircase would be located at the north end of the platform. It would include three turns through the square opening to the unpaid area of the mezzanine below and face toward the east side parking. At the platform level, three fare gates would be added. This would be an exit-only staircase allowing people to leave the platform, but not enter from the mezzanine. An exit-only gate at the bottom of the staircase would prevent entry from the mezzanine.

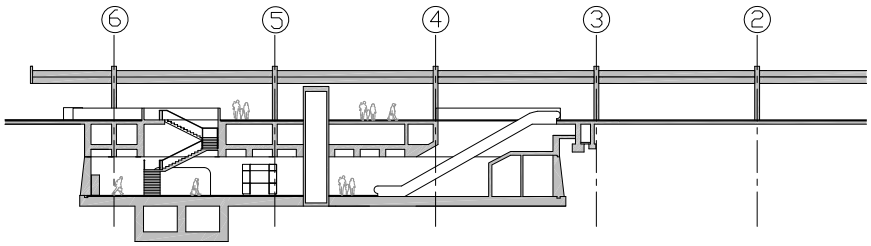
The location of the staircase in front of fare machines at the mezzanine level would restrict the queuing space to 12 feet. Although this location is the least intrusive to general movement of passengers through the mezzanine, it may add to crowding at the fare machines.

Figure 45 Alternative 1A (Short-Term)

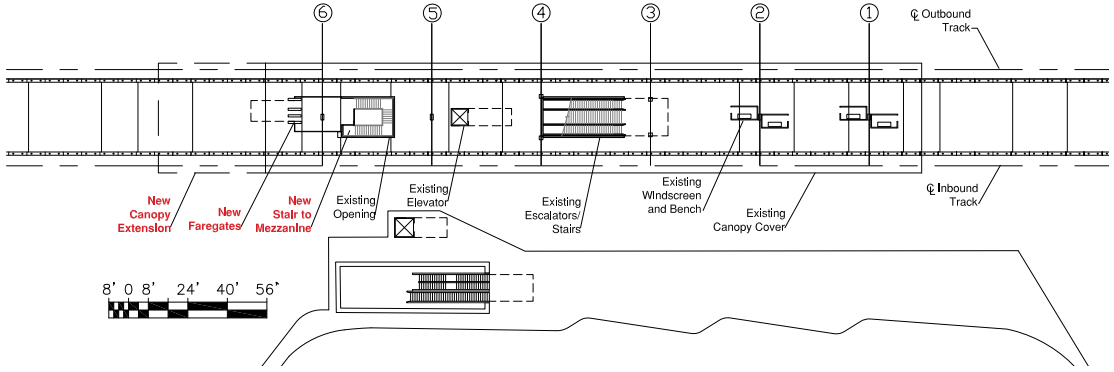
Mezzanine Level



Cross Section View



Platform View



Alternative 2A (Long-Term)

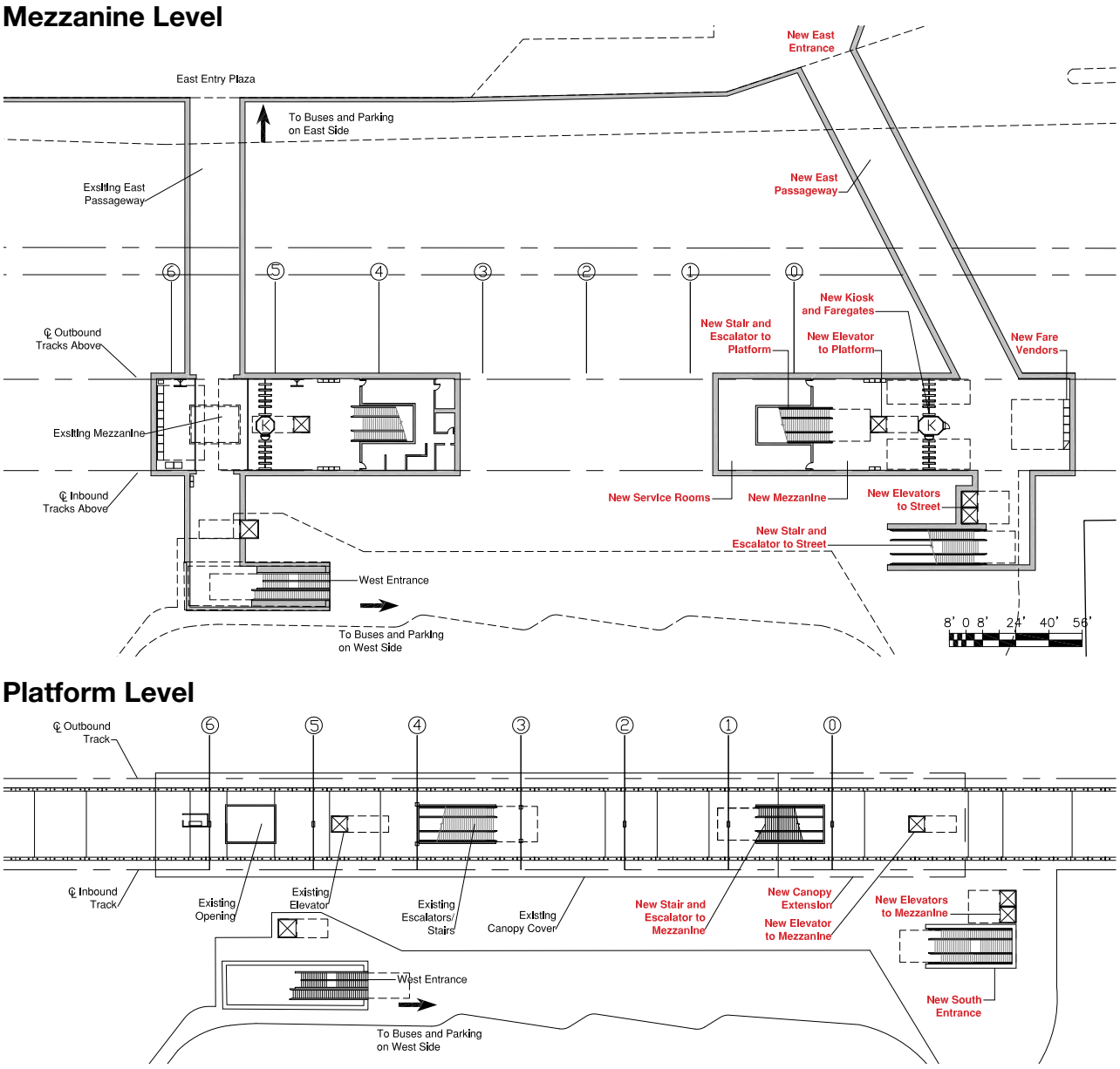
Alternative 2A (see **Figure 46**) consists of a new underground mezzanine at the south end of the station that connects to both the east and west sides of the tracks. The mezzanine would be constructed under the existing platform and Metro tracks. This mezzanine and new vertical circulation would add to the overall capacity of the station and alleviate platform and mezzanine crowding.

From the west, the new underground mezzanine would be entered by two new escalators and a staircase that would be covered with a standard Metro glass canopy. In addition, there would be two new elevators clad in glass for safety and visibility. New pavement would be required at the entrance tying into the existing bus area. From the east, a pedestrian tunnel under the CSX tracks would connect directly to the mezzanine from the parking area. Similar to the existing east entrance, the tunnel entrance would be at the same level as the mezzanine and no vertical circulation would be required. CSX approval and coordination would be required for building under active tracks.

The new mezzanine would have six fare machines, two add-fare machines, nine fare gates and one ADA-accessible gate. An elevator, two escalators, and a staircase would provide access to the platform. In this case, a single new elevator would be provided due to limited space on the platform. Behind the escalators, new service rooms including two restrooms, cleaner's room, electrical cabinet, escalator control room, and an elevator machine room would be provided.

At the platform level, a new canopy would be extended approximately 100 feet to cover the new escalators and elevators. This canopy is not designed and will need to be addressed in future studies.

Figure 46 Alternative 2A (Long-Term)



Alternative 2B (Long-Term)

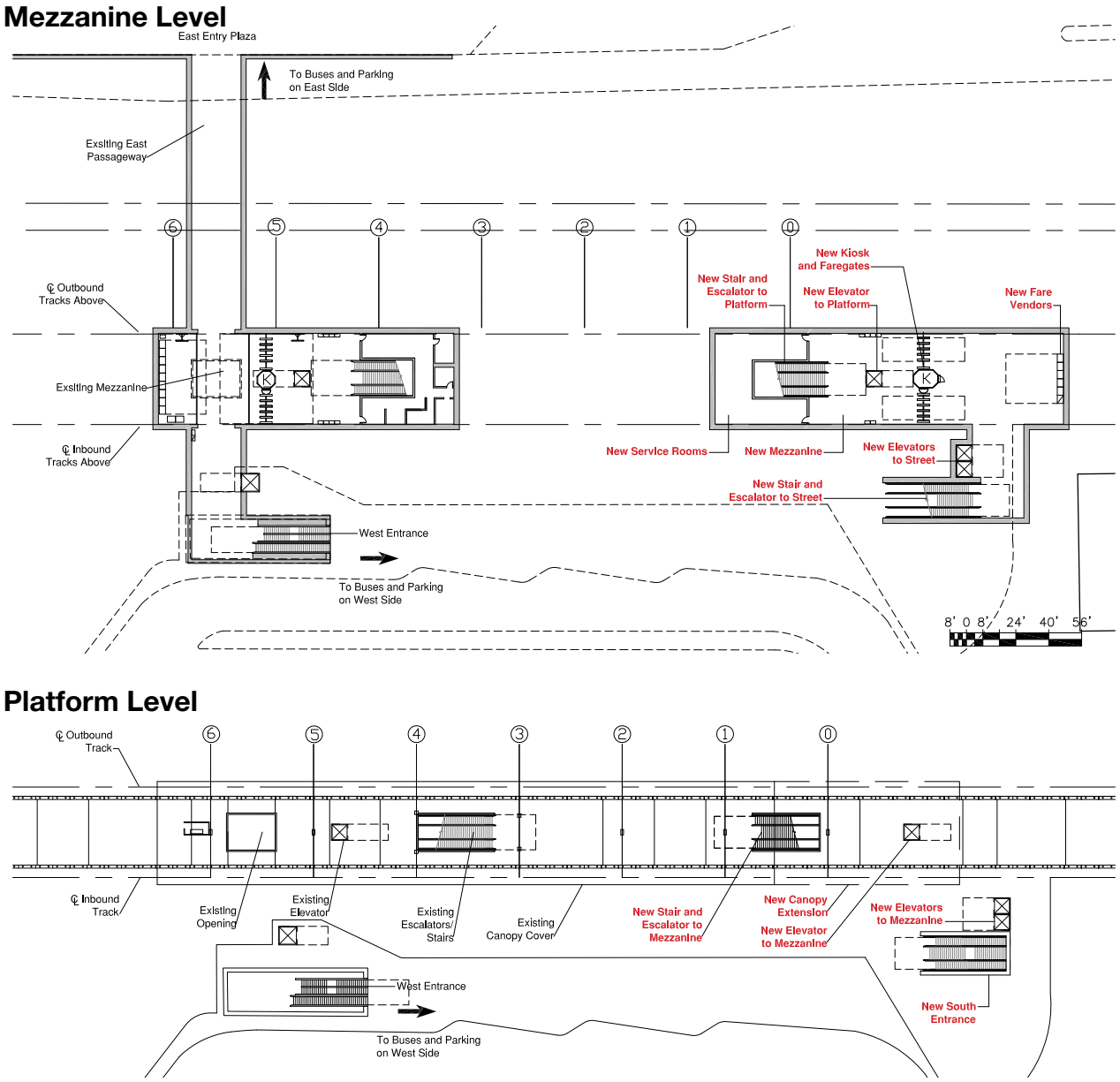
Alternative 2B (see **Figure 47**) consists of a new underground mezzanine at the south end of the station that connects to the west side parking area only. The mezzanine would be constructed under the existing platform and Metro tracks. This mezzanine and new vertical circulation would add to the overall capacity of the station and alleviate platform and mezzanine crowding.

From the west, the new underground mezzanine would be entered by two new escalators and a staircase covered with a standard Metro glass canopy. In addition, there would be two new elevators clad in glass for safety and visibility. New pavement would be required at the entrance tying into the existing bus area.

The new mezzanine would have six fare machines, two add-fare machines, nine fare gates and one ADA-accessible gate. An elevator, two escalators, and a staircase would provide access to the platform. In this case, a single new elevator would be provided due to limited space on the platform. Behind the escalators, new service rooms including two restrooms, cleaner's room, electrical cabinet, escalator control room, and an elevator machine room would be provided.

At the platform level, a new canopy would be extended approximately 100 feet to cover the new escalators and elevator. This canopy is not designed and will need to be addressed in future studies.

Figure 47 Alternative 2B (Long-Term)



Alternative 3C (Long-Term)

Alternative 3C (see **Figure 48**) consists of a new elevated mezzanine at the south end of the station that connects to the west side parking area only. The mezzanine would be constructed over the existing platform and metro tracks. This mezzanine and new vertical circulation would add to the overall capacity of the station and alleviate platform and mezzanine crowding.

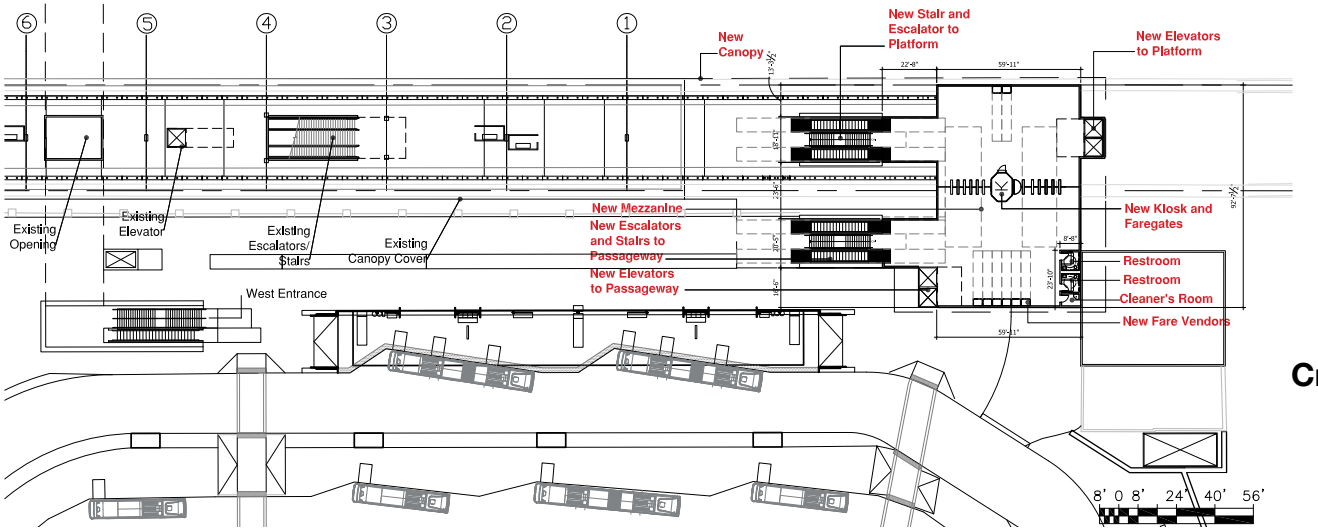
From the west, the new elevated mezzanine would be entered by two new escalators and a staircase covered with a new glass canopy. The new canopies over the stair/escalator and the mezzanine would need to be designed in future studies. In addition, there would be two new elevators clad in glass for safety and visibility. New pavement would be required at the entrance tying into the existing bus area.

The new mezzanine would have six fare machines, two add-fare machines, nine fare gates and one ADA-accessible gate. Two elevators, two escalators, and a staircase would provide access to the platform. At the mezzanine level, two new restrooms and a cleaner's room would be provided. Behind and under the entry escalators at grade level, new service rooms including an electrical cabinet, escalator control room, and an elevator machine room would be provided.

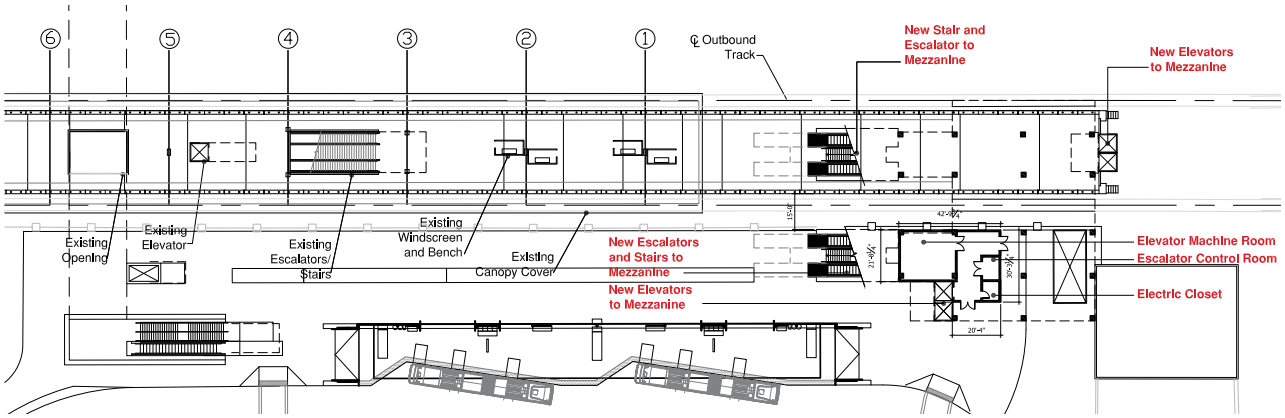
At the platform level, a new canopy would be extended approximately 50 feet to cover the new escalators. This canopy is not designed and will need to be addressed in future studies.

Figure 48 Alternative 3C (Long-Term)

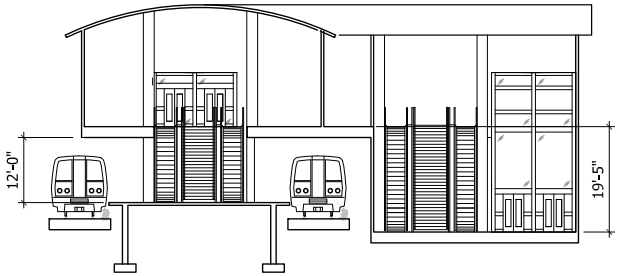
Mezzanine Level



Platform Level



Cross Section View



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Evaluation of Internal Station Circulation

Shady Grove
Station Capacity
Improvements Study

Section 5

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5.0 EVALUATION OF INTERNAL STATION CIRCULATION

In-depth analysis evaluating the pedestrian circulation within the internal station platform and mezzanine of the Shady Grove Metrorail station was conducted for each analysis time period and for each station circulation alternative.

5.1 Pedestrian Simulations

Based on the issues considered and described in **Section 4.2.1**, pedestrian simulations were conducted for the following scenarios and design alternatives:

- 2013 Existing Conditions
- No Build 2020 without CCT
- No Build 2020 with CCT
- No Build 2030 with CCT
- Build 2020 Short-Term Alternative 1A: Open-Well Staircase
- Build 2030 Alternative 2A: New South Entrance with Underground Mezzanine (east and west connections)
- Build 2030 Alternative 2B: New South Entrance with Underground Mezzanine (west connection only)*

**Note: Build 2030 Alternatives 2B and 3C are similar configurations. The major difference is that Build 2030 Alternative 2B is below grade and Build 2030 Alternative 3C is aerial. For simulation purposes, they have been treated as the same.*

Metrorail station ridership used for the simulations is described in **Section 3.0**. Assumptions for Metrorail and CCT headways, an important input into the pedestrian model, is shown in **Table 10**. Pedestrian simulations for all scenarios and design alternatives assumed the existing operational practice of trains arriving and departing from alternate sides of the platform. Detailed passenger density analysis by scenario and design alternative is shown in **Section 5.2**.

Pedestrian density level of service (LOS) ranges from A to F, with A (greater than 35 square feet per person) being the best and F (less than five square feet per person) referring to congested and unsafe conditions. The typical design target for platforms, vertical circulation elements (VCEs), and mezzanine is LOS C (15 to 25 square feet per person) for existing conditions with the guideline-recommended maximum density of LOS D (10 to 15 square feet per person).

Table 10 Assumptions for Pedestrian Simulations

Scenario and Design Alternative	Metrorail Headways	CCT Headways
2013 Existing Conditions	6 minutes	N/A
No Build 2020 without CCT	6 minutes	N/A
No Build 2020 with CCT	6 minutes	3 minutes
No Build 2030 with CCT	3 minutes	3 minutes
Build 2020 Short-Term Alternative 1A	6 minutes	3 minutes
Build 2030 Alternative 2A	3 minutes	3 minutes
Build 2030 Alternative 2B	3 minutes	3 minutes

5.1.1 Pedestrian Density Level of Service

Table 11 summarizes the findings of the detailed pedestrian simulations. It shows the percentage of all passengers on the platform or the mezzanine who experienced LOS E and F (i.e. less than 10 square feet per person) during the peak 15-minute period under each scenario and design alternative. Note that **Table 11** refers to the peak 15-minutes during the peak hour (peak of the peak). The color highlighting ranges from green for limited percentages of passengers experiencing LOS E and F to red for high percentages of passengers experiencing LOS E and F.

While crowding is currently significant in the PM Peak only, the initiation of CCT service changes the character of the Shady Grove Metrorail station from a terminus to a major transfer point accommodating passengers traveling in both directions in the AM and PM Peak; as a result, significant crowding occurs in the AM Peak as well. This is most pronounced in the No Build 2030 with CCT scenario. Crowding can be slightly alleviated in 2020 with Short-Term Alternative 1A; however, pedestrian circulation significantly improved in 2030 with Build Alternatives 2A or 2B.

Table 11 Percent LOS E and F - AM and PM Peak 15 Minutes

Time	Location	No Build				Build with CCT		
		2013 Existing	2020 without CCT	2020 with CCT	2030 with CCT	2020 Short-Term Alternative 1A	2030 Alternative 2A	2030 Alternative 2B
AM Peak	North Mezzanine	2%	6%	17%	91%	19%	2%	3%
	Platform	2%	5%	9%	28%	7%	8%	7%
	South Mezzanine	N/A	N/A	N/A	N/A	N/A	2%	1%
PM Peak	North Mezzanine	2%	8%	12%	51%	4%	36%	34%
	Platform	52%	66%	67%	50%	64%	18%	22%
	South Mezzanine	N/A	N/A	N/A	N/A	N/A	5%	1%
	Average LOS E or F	10%	14%	18%	37%	16%	10%	10%

Low Congestion  High Congestion

5.1.2 Vertical Circulation Element (VCE) Comparison

The pedestrian analysis simulation also defined queuing as when walking speed is reduced to less than the escalator flow rate of 90 people per minute. Average clearance time in minutes and seconds was used to assess vertical circulation operations. **Tables 12** and **13** summarize clearance times at the existing and proposed vertical circulation elements in the Shady Grove Metrorail station for each scenario and design alternative. The color highlighting in these tables ranges from green (for limited queuing times) to red (for queues unable to clear before the arrival of the next train).

Table 12 shows that in the AM Peak there are no queues under the existing conditions; however, in the No Build 2030 with CCT scenario, passengers are unable to clear the platform before the arrival of the next train.

In the PM Peak (see **Table 13**), vertical circulation operations from the platform to the mezzanine steadily deteriorate from 2013 to the No Build 2020 with and without CCT scenarios and fail in the No Build 2030 with CCT scenario. Vertical circulation improves somewhat in 2020 with the proposed Short-Term Alternative 1A, and significantly in 2030 with Build Alternatives 2A and 2B.

Table 12 Clearance Time at Vertical Circulation Elements - AM Peak

Location	No Build				Build with CCT		
	2013 Existing	2020 without CCT	2020 with CCT	2030 with CCT	2020 Short-Term Alternative 1A	2030 Alternative 2A	2030 Alternative 2B
Existing Platform to Mezzanine (Down)	No queue	0:32	1:26	2:25	0:50	0:43	0:49
Existing Mezzanine to Platform (Up)	No queue	No queue	2:25	Unable to Clear	2:05	No queue	No queue
Existing Entrance Mezzanine to Street (Up)	No queue	No queue	No queue	1:09	No queue	No queue	No queue
Existing Entrance Street to Mezzanine (Down)	No queue	No queue	No queue	No queue	No queue	No queue	No queue
Proposed Short-Term Stairs (Down)	N/A	N/A	N/A	N/A	No queue	N/A	N/A
Proposed Platform to Mezzanine (Down)	N/A	N/A	N/A	N/A	N/A	No queue	No queue
Proposed Mezzanine to Platform (Up)	N/A	N/A	N/A	N/A	N/A	No queue	No queue
Proposed Southwest Entrance (Up)	N/A	N/A	N/A	N/A	N/A	No queue	No queue

Note: Clearance time appears in minutes and seconds.

Low Congestion  High Congestion

Table 13 Clearance Time at Vertical Circulation Elements - PM Peak

Location	No Build				Build with CCT		
	2013 Existing	2020 without CCT	2020 with CCT	2030 with CCT	2020 Short-Term Alternative 1A	2030 Alternative 2A	2030 Alternative 2B
Existing Platform to Mezzanine (Down)	2:52	4:01	4:22	Unable to Clear	2:49	1:31	1:53
Existing Mezzanine to Platform (Up)	No queue	No queue	No queue	Unable to Clear	No queue	1:10	1:32
Existing Entrance Mezzanine to Street (Up)	No queue	No queue	No queue	No queue	1:35	No queue	No queue
Existing Entrance Street to Mezzanine (Down)	No queue	No queue	No queue	0:50	No queue	0:33	0:33
Proposed Short-Term Stairs (Down)	N/A	N/A	N/A	N/A	2:03	N/A	N/A
Proposed Platform to Mezzanine (Down)	N/A	N/A	N/A	N/A	N/A	No queue	No queue
Proposed Mezzanine to Platform (Up)	N/A	N/A	N/A	N/A	N/A	No queue	No queue
Proposed Southwest Entrance (Up)	N/A	N/A	N/A	N/A	N/A	No queue	No queue

Note: Clearance time appears in minutes and seconds.

Low Congestion  High Congestion

5.1.3 Overall Station Threshold

The point at which potentially unsafe conditions could occur is when 20 percent or more of passengers in the paid area of the station experience combined LOS E and F during the peak hour. Past experience in similar station contexts has shown that meeting or exceeding this threshold correlates to significant queues at VCEs or fare gates and unsafe or disruptive levels of congestion on platforms and within other passenger circulation areas. As shown in **Sections 5.1.1** and **5.1.2**, mean density distributions may reveal specific locations within the paid area, such as platforms or VCEs, where acute crowding may occur. These locations should be addressed independently of the overall station threshold year. Because the Shady Grove Metrorail station currently displays high levels of crowding in the evening peak, the station threshold analysis is based on the PM Peak Hour only.

Model outputs show that the percentage of Shady Grove Metrorail passengers experiencing an average LOS E or F in the PM Peak Hour was 18 percent in 2013. In the No Build 2020 scenarios, this is projected to increase to 25 percent and 26 percent without and with CCT, respectively. Passengers experiencing LOS E or F in the PM Peak Hour increases to 34 percent in the No Build 2030 with CCT scenario. As shown in **Figure 49**, the threshold value of 20 percent would be reached in 2015 for the No Build without CCT scenario. Note that the overall station threshold analysis uses Peak Hour ridership, while the pedestrian density level of service (**Section 5.1.1**) and the VCE comparison (**Section 5.1.2**) use peak 15-minute ridership.

Figure 49 Shady Grove Station Threshold Analysis

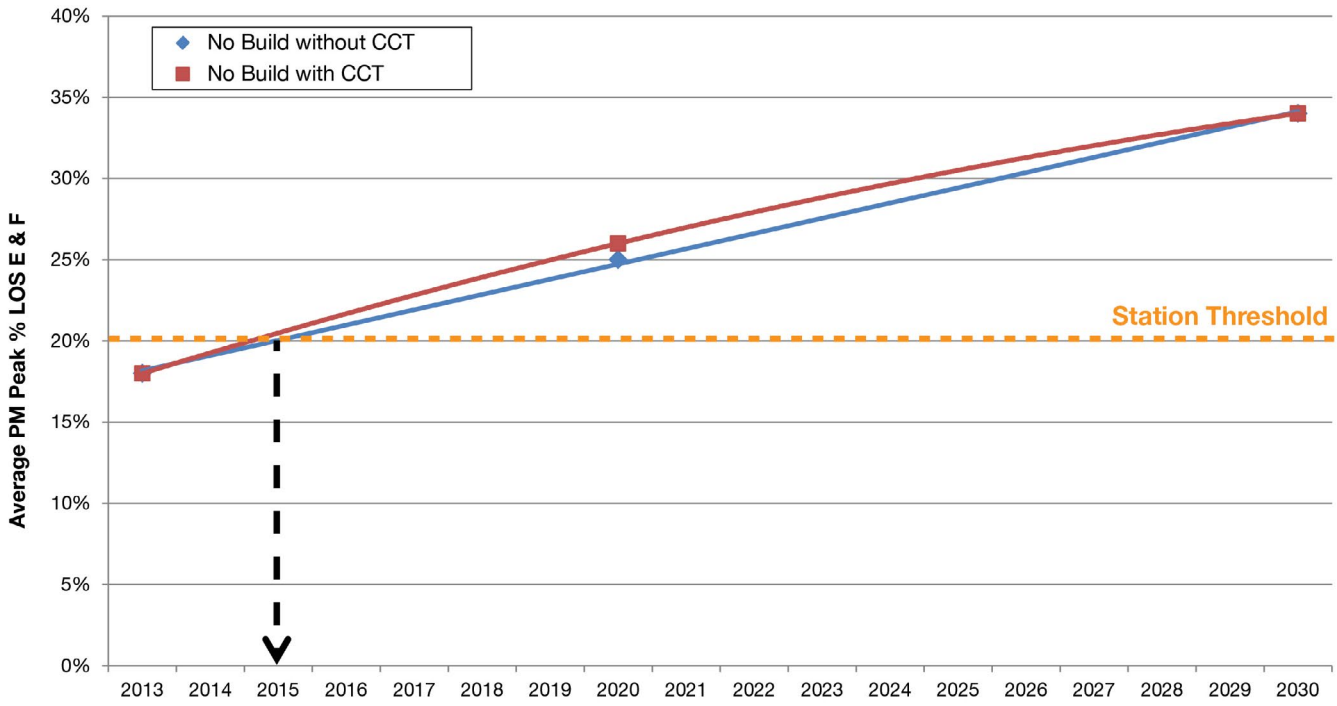


Figure 50 Density Map - 2013 Existing Conditions AM Peak 15 Minutes

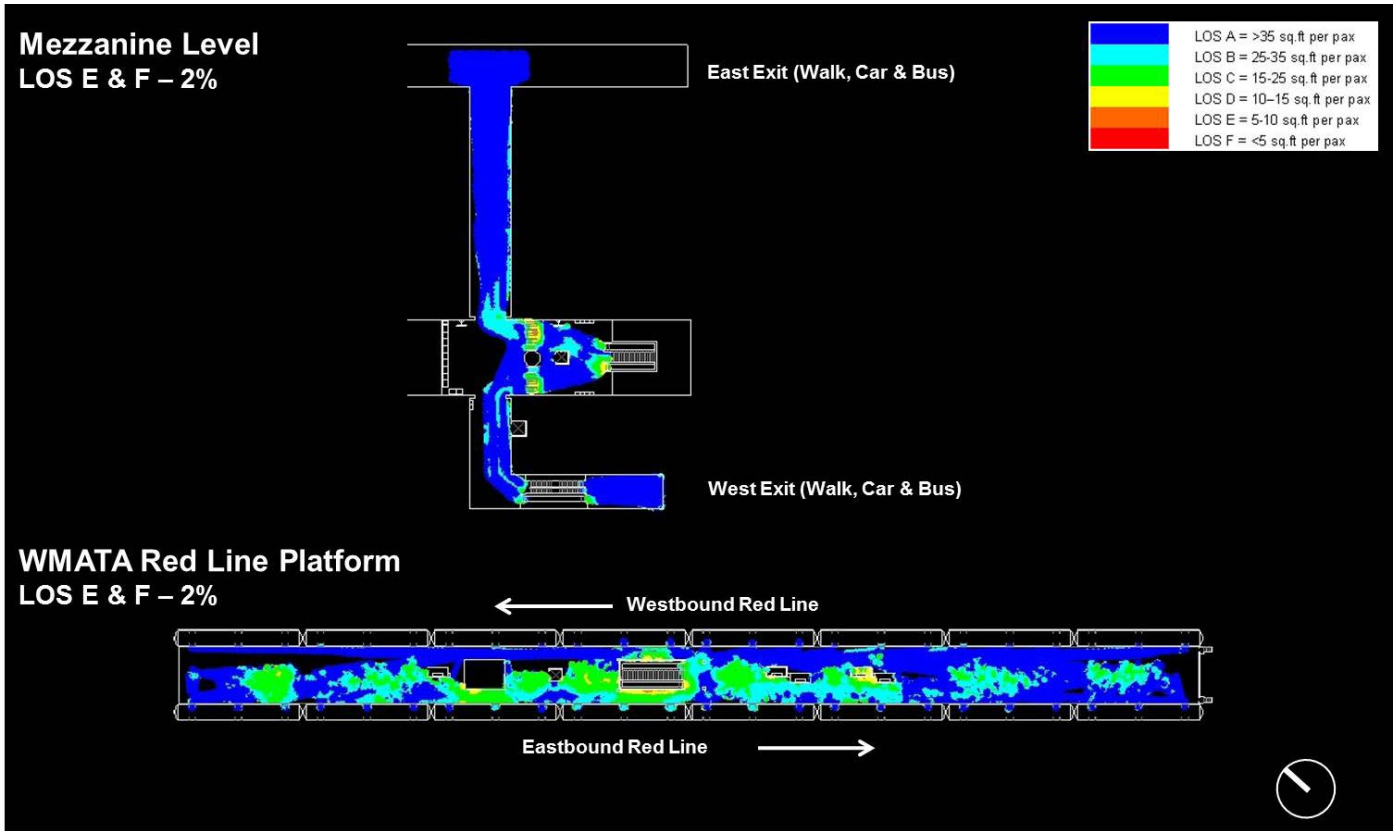
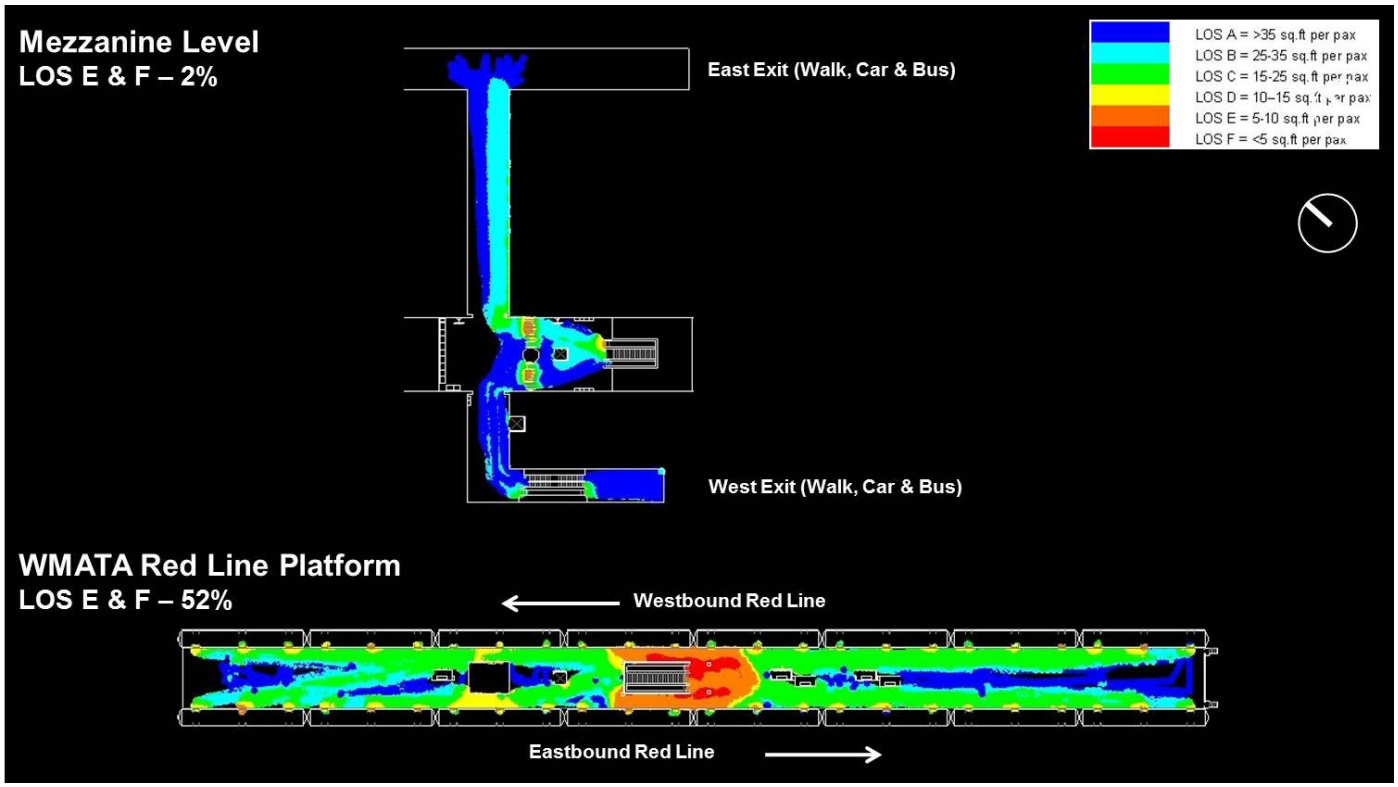


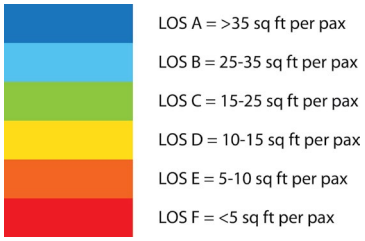
Figure 51 Density Map - 2013 Existing Conditions PM Peak 15 Minutes



5.2 Passenger Density by Scenario and Design Alternative

Passenger density maps were developed for the peak 15 minutes of the Peak Hour (i.e. peak of the peak). The peak of the peak is used to capture the worst-case scenario for congestion and identify impacts accurately; pedestrian volumes spread over an hour tend to understate the severity of crowding. Density maps display crowding by color to indicate Level of Service (LOS) as shown in **Figure 52**.

Figure 52 Pedestrian Density Level of Service



Source: Transit Capacity and Quality of Service Manual - 3rd Edition, Chapter 10 - Station Capacity, 2014.

Areas of orange and red denote LOS E and F, respectively. Note that density is calculated within the paid areas of the station only. As noted previously, the typical design target for platforms, transfer areas, and mezzanines is LOS C (green) for existing conditions, with the guideline-recommended maximum density of LOS D (yellow).

5.2.1 2013 Existing Conditions

As shown in **Figure 50**, there are currently no crowding issues in the AM Peak; only two percent of passengers in the AM Peak 15 minutes experience LOS E or F on the mezzanine or platform levels. This implies that 98 percent of all passengers have ten square feet or more space as they move through the Shady Grove Metrorail station. Further, there are no queues at any of the VCEs.

However, the PM Peak simulation, as shown in **Figure 51**, shows pedestrian crowding at the platform level with 52 percent of all passengers on the platform experiencing LOS E or F in the peak 15 minutes. Platform clearance time with the single escalator is 2 minutes and 52 seconds; this is consistent with visual observations during site visits. The escalator and stairs meter passenger flow from the platform level to the mezzanine. Mezzanine crowding near the fare gates is minimal with only two percent of all passengers experiencing LOS E or F.

Figure 53 Density Map - No Build 2020 Without CCT AM Peak 15 Minutes

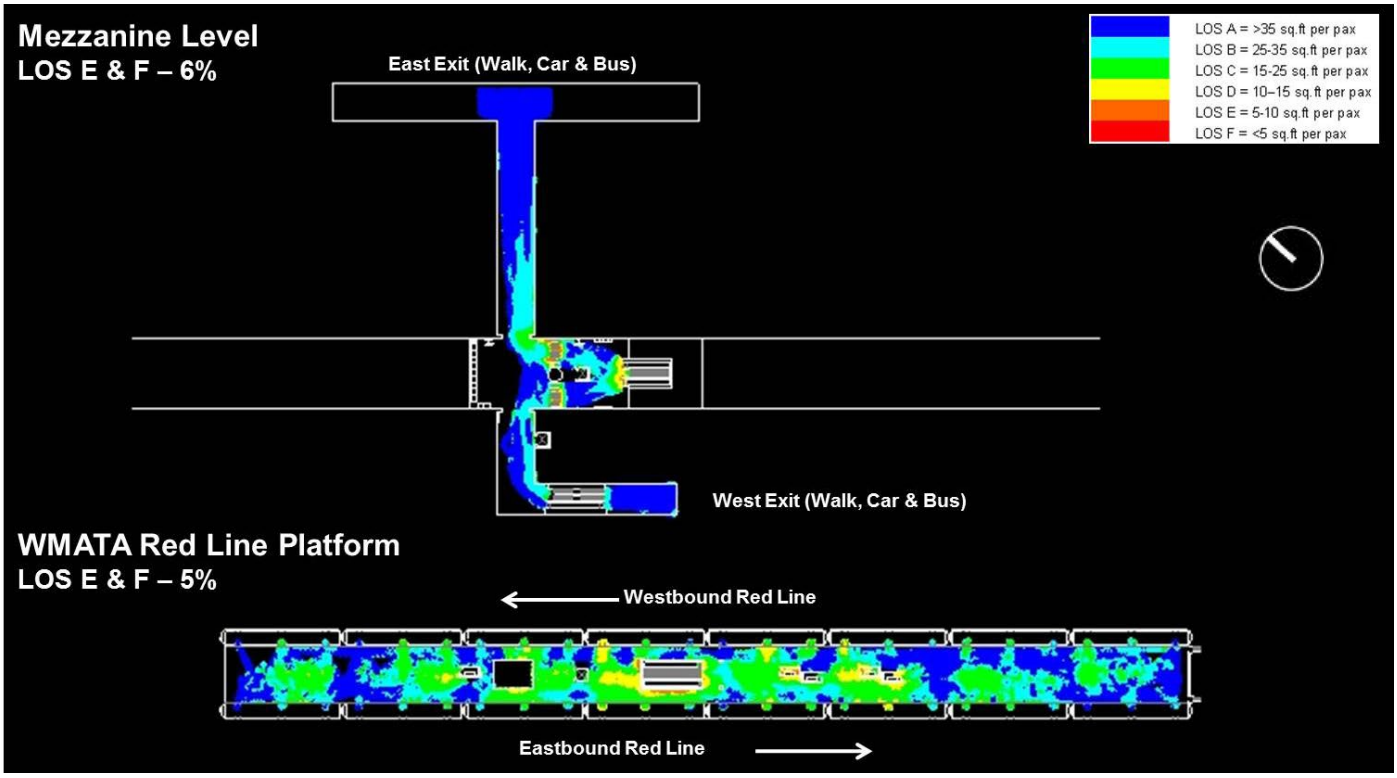
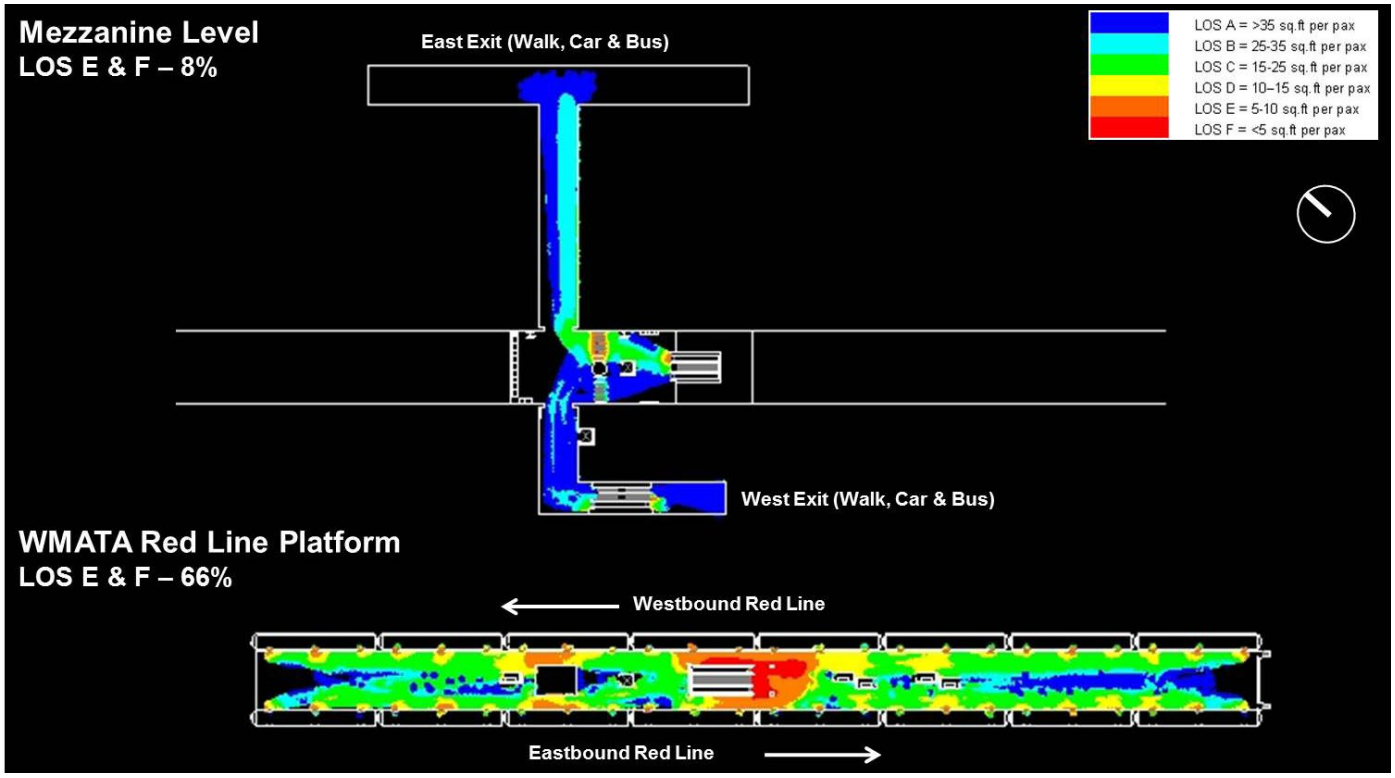


Figure 54 Density Map - No Build 2020 Without CCT PM Peak 15 Minutes



5.2.2 No Build 2020 Without CCT

Ridership forecasts for 2020 conditions without CCT show an anticipated 57 percent growth over 2013 ridership.

As shown in **Figure 53,** there are no significant crowding issues in the AM Peak; only six percent of all passengers on the mezzanine level and five percent of all passengers at platform level experience LOS E or F in the AM Peak 15 minutes. This implies that 94 percent of all passengers on the platform level and 95 percent of all passengers at platform level have 10 square feet or more space as they move through the Shady Grove Metrorail station. However, passengers experience a slight delay with a clearance time of 32 seconds on the escalator up to the platform from the mezzanine; no queues were observed in the opposite direction or on the VCE to the street level at the west entrance.

In the PM Peak, as shown in **Figure 54**, pedestrian simulations show crowding at the platform level with 66 percent of all passengers experiencing LOS E or F in the PM peak 15 minutes. While there are no queues at the other VCEs or for passengers going from the mezzanine to the platform, the clearance time for those descending from the platform to the mezzanine is now 4 minutes and 1 second; for the 2013 PM Peak, the clearance time was 2 minutes and 52 seconds. At the mezzanine level, only eight percent of all passengers experience an LOS E or F; however, this is four times higher than the two percent that experienced crowded conditions in 2013 PM Peak.

Figure 55 Density Map - No Build 2020 With CCT AM Peak 15 Minutes

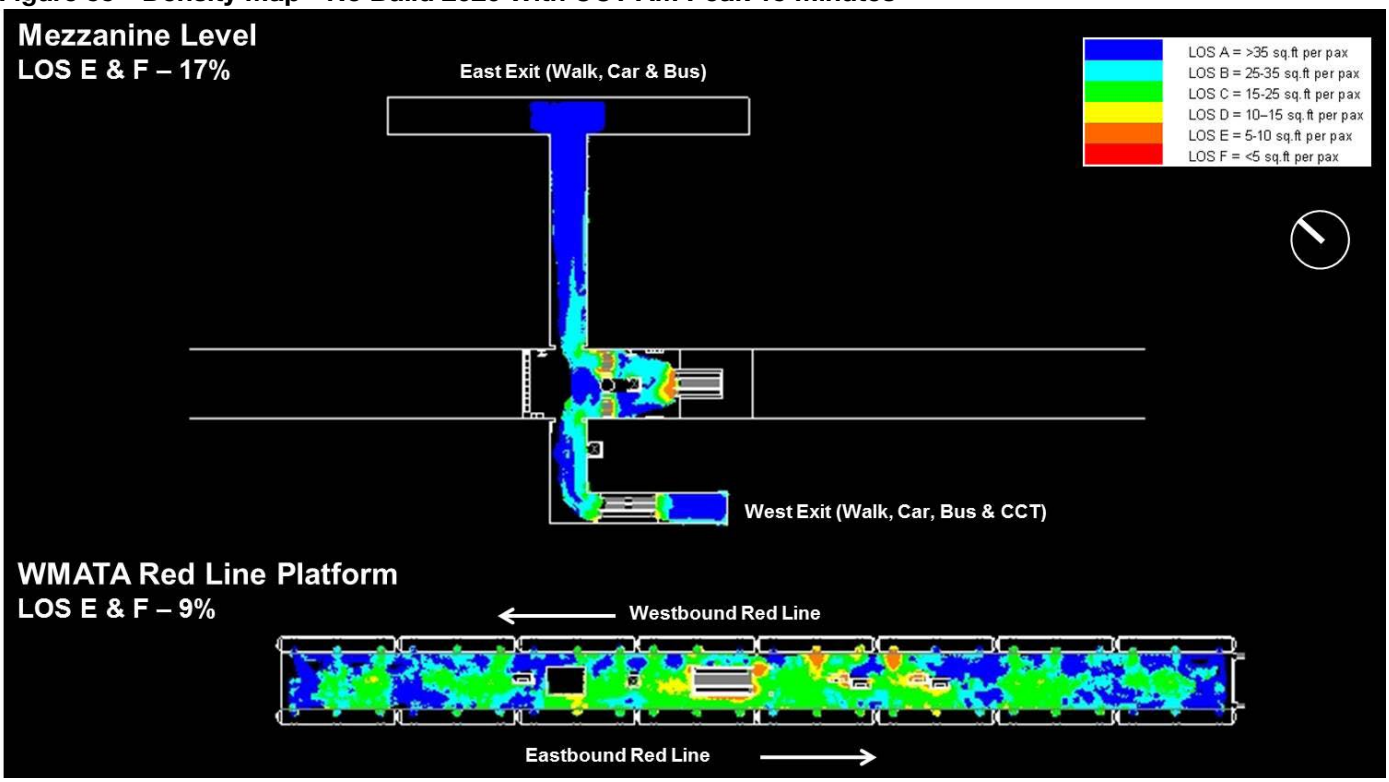
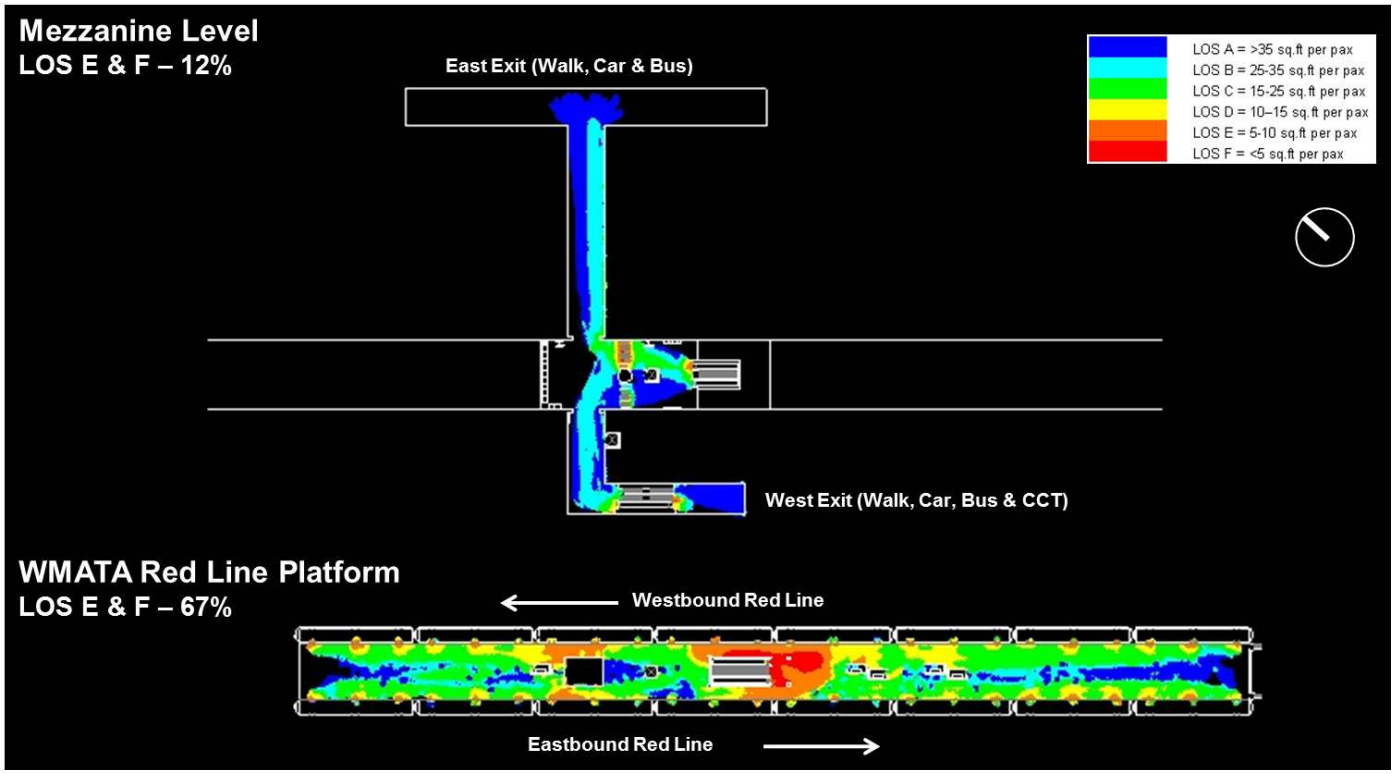


Figure 56 Density Map - No Build 2020 With CCT PM Peak 15 Minutes



5.2.3 No Build 2020 With CCT

Ridership forecasts for 2020 conditions with CCT show an anticipated 75 percent growth over 2013 ridership.

As shown in **Figure 55**, with the CCT in operation, there are some crowding issues in the AM Peak; 17 percent of all passengers on the mezzanine level and nine percent of all passengers at platform level experience LOS E or F in the AM Peak 15 minutes. There are no queues at the escalators to the street level at the west entrance. However, passengers on the escalator up to the platform experience significant delay with a clearance time of 2 minutes and 25 seconds; the corresponding clearance time for the No Build 2020 without the CCT scenario was 32 seconds. The clearance time coming down the escalator from the platform is 1 minute and 26 seconds; no queues were observed in the same direction for this VCE in the No Build 2020 without CCT scenario.

In the PM Peak, as shown in **Figure 56**, pedestrian simulations show significant crowding at the platform level with 67 percent of all passengers experiencing LOS E or F in the PM peak 15 minutes. Similar to 2013 PM Peak and PM Peak under No Build 2020 without CCT, there are no queues at the other VCEs or when passengers are going up to the platform from the mezzanine, but the clearance time for passengers to descend from the platform by escalator is now 4 minutes and 22 seconds. The clearance time was 4 minutes and 1 second in the No Build 2020 without CCT scenario and 2 minutes and 52 seconds in 2013 PM Peak. At the mezzanine level, while only 12 percent of all passengers experience LOS E or F, this is 1.5 times higher than the eight percent in the No Build 2020 without CCT scenario and six-times higher than the two percent that experienced crowded conditions in 2013 PM peak 15 minute period.

Figure 57 Density Map - No Build 2030 with CCT AM Peak 15 Minutes

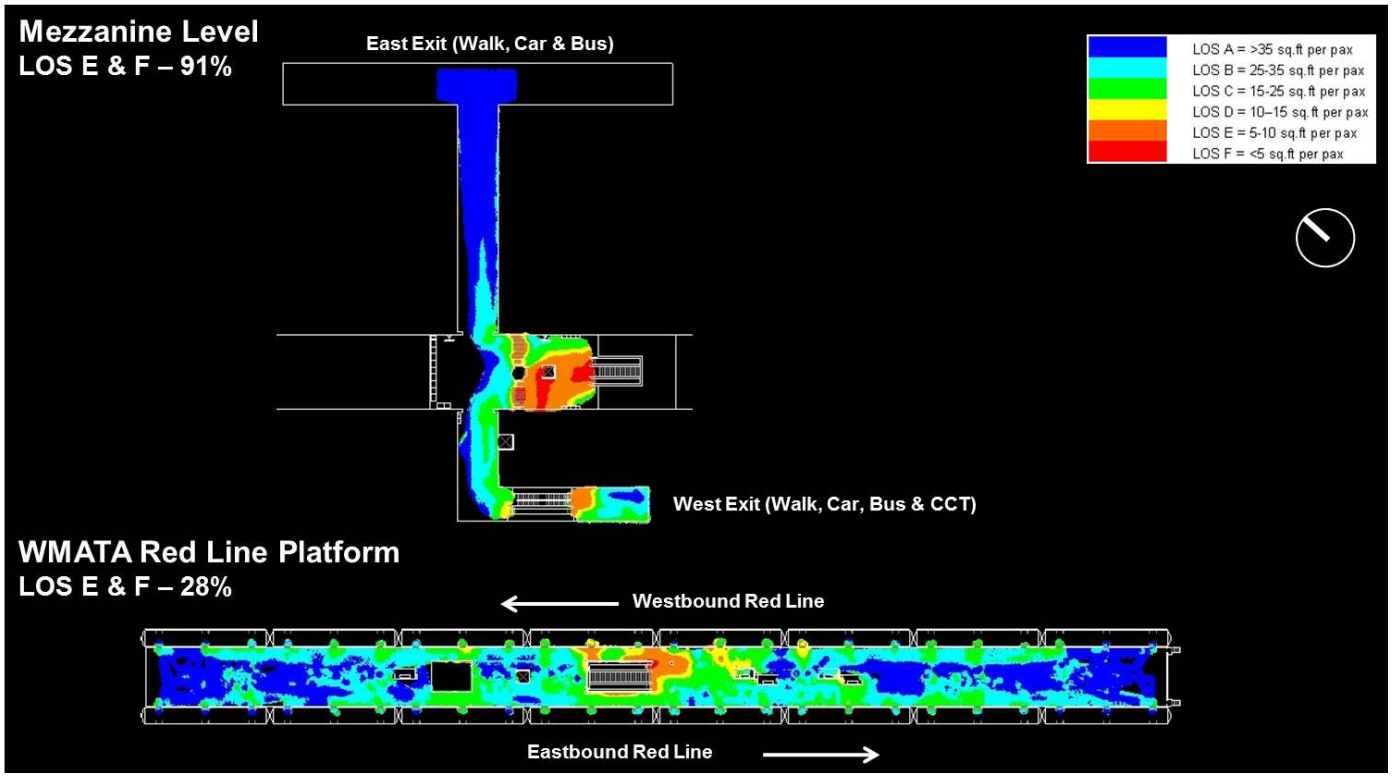
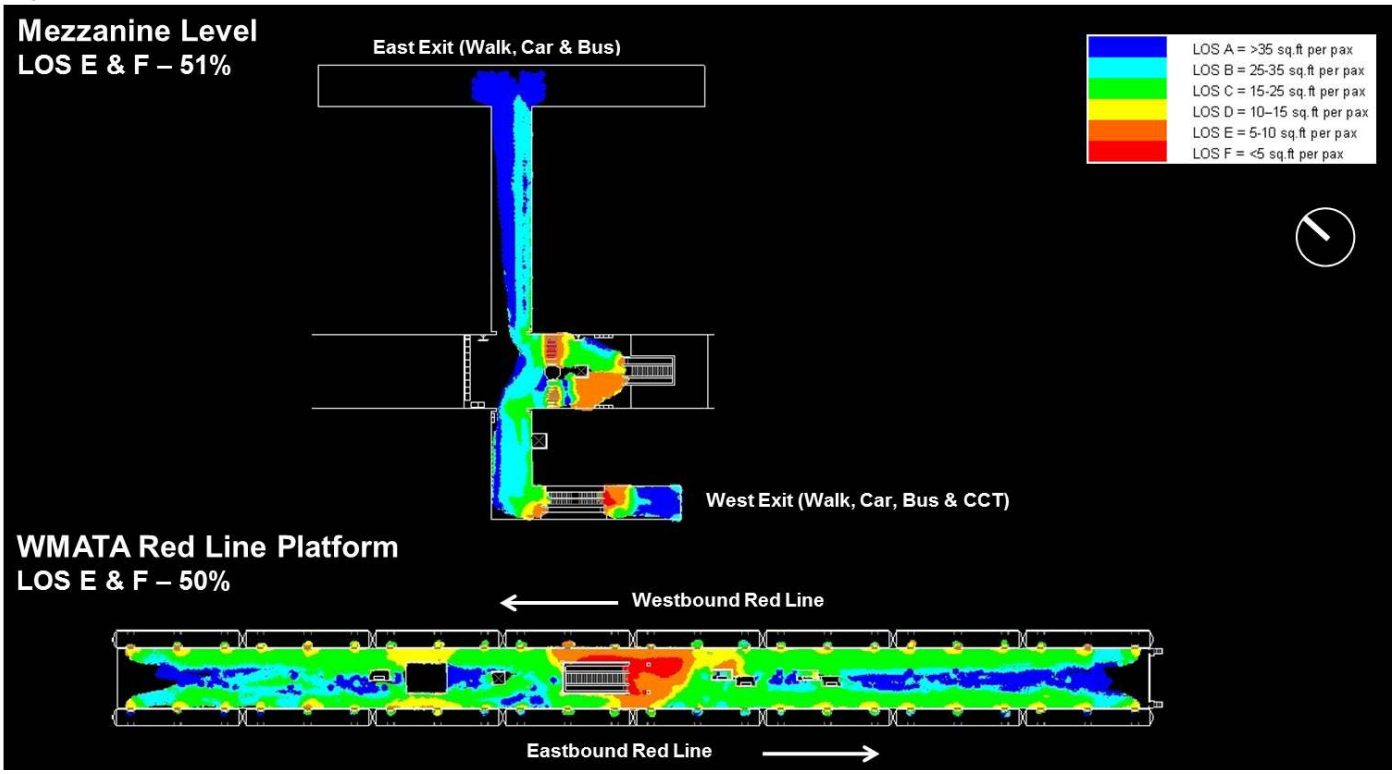


Figure 58 Density Map - No Build 2030 with CCT PM Peak 15 Minutes



5.2.4 No Build 2030 With CCT

Ridership forecasts for 2030 conditions with CCT show an anticipated 149 percent growth over 2013 ridership.

As shown in **Figure 57**, with the CCT in operation, there are extreme crowding issues in the AM Peak, especially at the mezzanine level where 91 percent of all passengers experience LOS E or F in the AM Peak 15 minutes. The platform also shows significant crowding with 28 percent of all passengers experiencing LOS E or F. Queues form at the platform level at the top of the down escalator; the clearance time of 2 minutes and 25 seconds is significantly higher than that of any other No Build scenario in the AM Peak. The most noteworthy change from other scenarios is the queue on the street level at the west entrance where passengers experience a delay with a clearance time of 1 minute and 9 seconds at the down escalator; none of the other No Build scenarios exhibited a queue at this VCE in the AM Peak.

In the PM Peak, as shown in **Figure 58**, pedestrian simulations show significantly more crowding at the mezzanine than any of the previous No Build scenarios with 51 percent of all passengers experiencing LOS E or F in the PM peak 15 minutes; in the No Build 2020 with CCT scenario, mezzanine crowding was 12 percent. However, crowding on the platform, with 50 percent of the passengers experiencing LOS E or F, is significantly lower than the 67 percent experiencing LOS E or F in the No Build 2020 with CCT scenario. This is due to Metrorail trains operating at higher frequencies (i.e. three-minute headways versus six-minute headways in 2020) and with eight-car trains, both of which help spread out the passenger load.

While the mezzanine and platform experience less crowding, the escalators in both directions between the mezzanine and platform are unable to clear prior to the arrival of the next scheduled train. There is a 50-second delay in clearing the escalator down to the mezzanine at the west entrance.

Figure 59 Density Map - Build 2020 Short-Term Alternative 1A AM Peak 15 Minutes

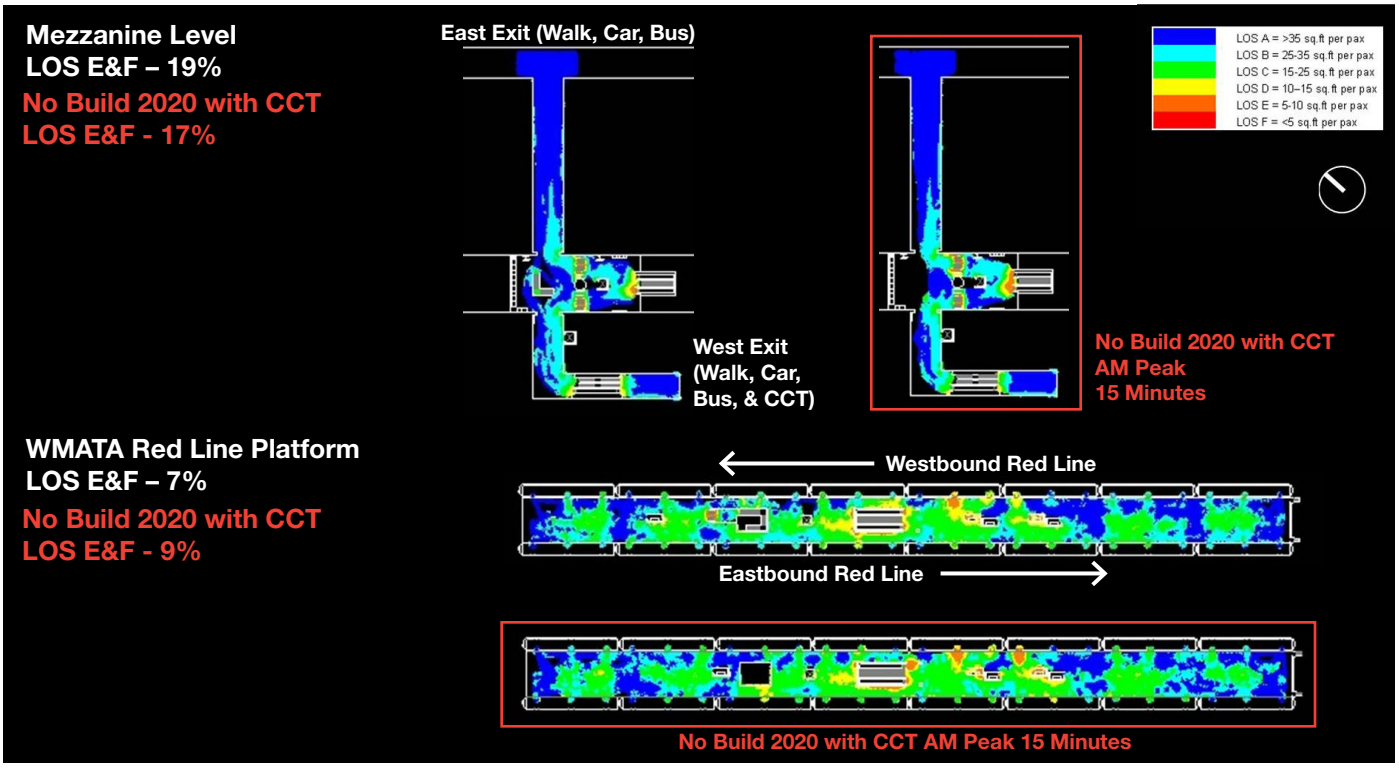
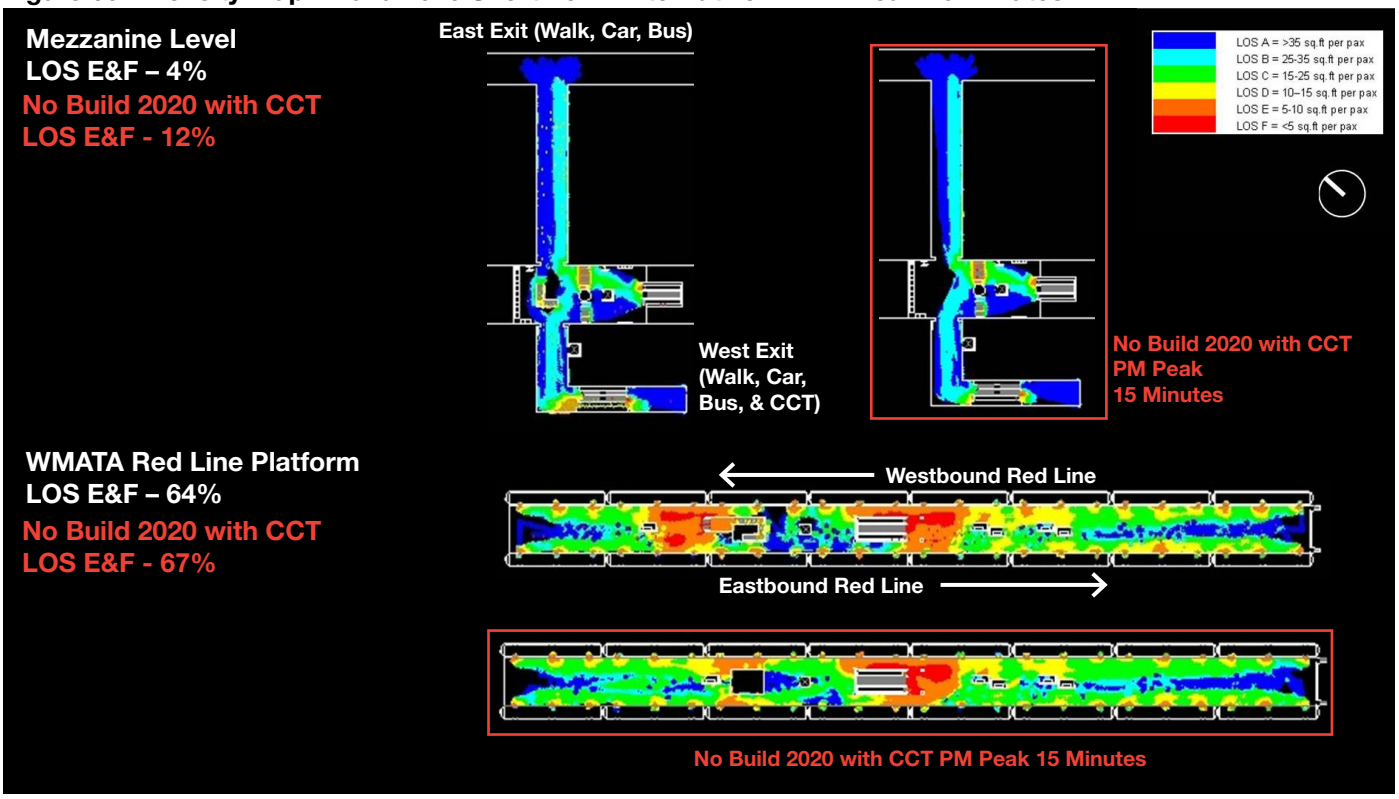


Figure 60 Density Map - Build 2020 Short-Term Alternative 1A PM Peak 15 Minutes



5.2.5 Build 2020 Short-Term Alternative 1A: Open-Well Staircase

This short-term Build alternative was simulated using the No Build 2020 with CCT ridership forecast and operational assumptions.

As shown in **Figure 59**, in the AM Peak 15 minutes, crowding on the mezzanine level increases slightly from the No Build 2020 with CCT scenario, changing from 17 percent to 19 percent. This is due to the new staircase, which reduces the area available for circulation on the mezzanine. Crowding at the platform level, however, decreases slightly with only seven percent of all passengers experiencing LOS E or F compared to the nine percent in No Build 2020 with CCT scenario.

The clearance time at the escalator up to the platform improves slightly from the 2 minutes and 25 seconds in the No Build 2020 with CCT scenario to 2 minutes and 5 seconds with the proposed short-term improvement. The more marked improvement is for the escalator down from the platform where the clearance time is 50 seconds compared to 1 minute and 26 seconds with the No Build 2020 with CCT scenario. There are no queues at the escalator to the street level at the west entrance.

In the PM Peak, as shown in **Figure 60**, pedestrian simulations continue to show significant crowding at the platform level with 64 percent of all passengers experiencing LOS E or F in the PM Peak 15 minutes. Overall this represents a minor reduction in crowding compared to the 67 percent experiencing LOS E or F in the No Build 2020 with CCT scenario. However, the delay or clearance times at the VCEs from the platform to the mezzanine decrease significantly from 4 minutes and 22 seconds to 2 minutes and 3 seconds at the escalators and 2 minutes and 49 seconds at the staircase with this improvement, which demonstrates the benefit the additional VCE has on clearing the platform. Clearance time at the escalators up to the west entrance is now 1 minute and 35 seconds compared to the previous scenario without the new staircase and without queues.

Table 14 shows the distribution of the LOS E and F percentages in the No Build 2020 with CCT and Build 2020 Short-Term Alternative 1A scenarios.

Table 14 LOS E and F on Platform in No Build 2020 with CCT and Build 2020 Short-Term Alternative 1A (PM Peak 15 Minutes)

	LOS E	LOS F	LOS E & F
No Build 2020 with CCT	26%	41%	67%
Build 2020 Short-Term Alternative 1A	36%	28%	64%

At the mezzanine level, only four percent of all passengers experience LOS E or F; this is a marked improvement over the No Build 2020 with CCT scenario where 12 percent of all passengers experienced crowding (i.e. LOS E or F) in the PM Peak.

Figure 61 Density Map - Build 2030 Alternative 2A AM Peak 15 Minutes

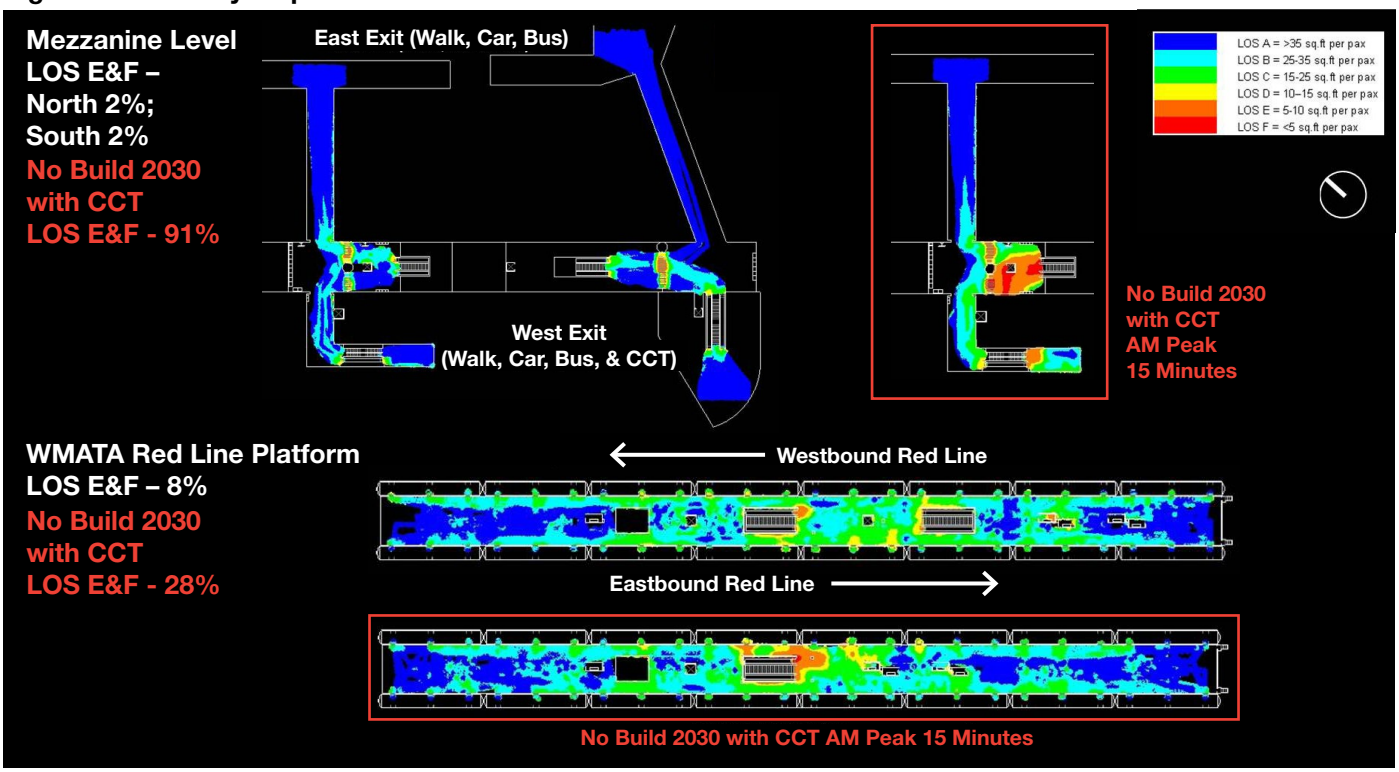
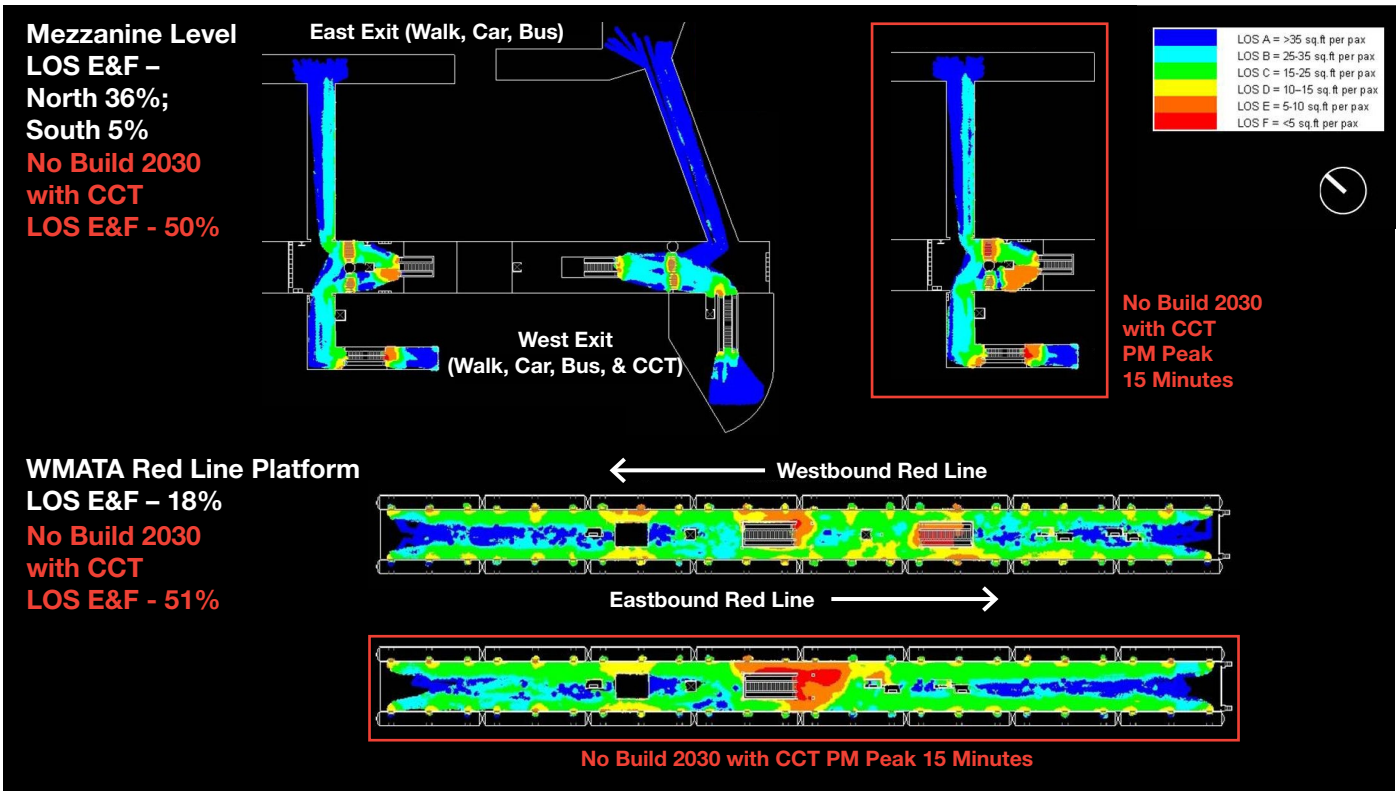


Figure 62 Density Map - Build 2030 Alternative 2A PM Peak 15 Minutes



5.2.6 Build 2030 Alternative 2A: New South Entrance with Underground Mezzanine (East and West Connections)

This Build alternative was simulated using the No Build 2030 with CCT ridership forecast and operational assumptions.

As shown in **Figure 61**, in the AM Peak 15 minutes, crowding on the mezzanine level is effectively eliminated with the provision of a new entrance. Only two percent of all passengers on the north (existing) and south mezzanines experience LOS E and F compared to the 91 percent in the No Build 2030 with CCT scenario. Crowding at the platform level decreases as well with only eight percent of all passengers experiencing LOS E or F compared to the 28 percent in the No Build 2030 with CCT scenario.

A clearance time of 43 seconds is required at the existing platform escalator coming down to the north mezzanine; there are no queues in the opposite direction or at any of the other escalators in the station.

In the PM Peak, as shown in **Figure 62** crowding at the platform level decreases significantly with 18 percent of all passengers experiencing LOS E or F compared to the 50 percent experiencing LOS E or F in the No Build 2030 with CCT scenario. **Table 15** shows the distribution of the LOS E and F percentages in both scenarios. On the mezzanine level, 36 percent of all passengers on the north mezzanine experience LOS E or F, while only five percent experience LOS E or F on the south mezzanine, compared to 51 percent in the No Build 2030 with CCT scenario. The existing escalators between the north mezzanine and the platform require clearance times of 1 minute and 10 seconds to go up to the platform and 1 minute and 31 seconds down from the platform to the mezzanine, while there are no queues or delays on the south mezzanine VCEs. It may be assumed that passengers who experience discomfort due to crowding or delays at the VCE will eventually start using the south mezzanine and VCEs, thereby improving access and realizing a further benefit of the proposed Build 2030 Alternative 2A.

Table 15 LOS E and F on Platform in No Build 2030 with CCT and Build 2030 Alternative 2A (PM Peak 15 Minutes)

	LOS E	LOS F	LOS E & F
No Build 2030 with CCT	25%	25%	50%
Build 2030 Alternative 2A	15%	3%	18%

Similarly, there is a clearance time of 33 seconds at the existing northwest entrance escalator to the north mezzanine, while there are no queues at the south entrance.

Figure 63 Density Map - Build 2030 Alternative 2B AM Peak 15 Minutes

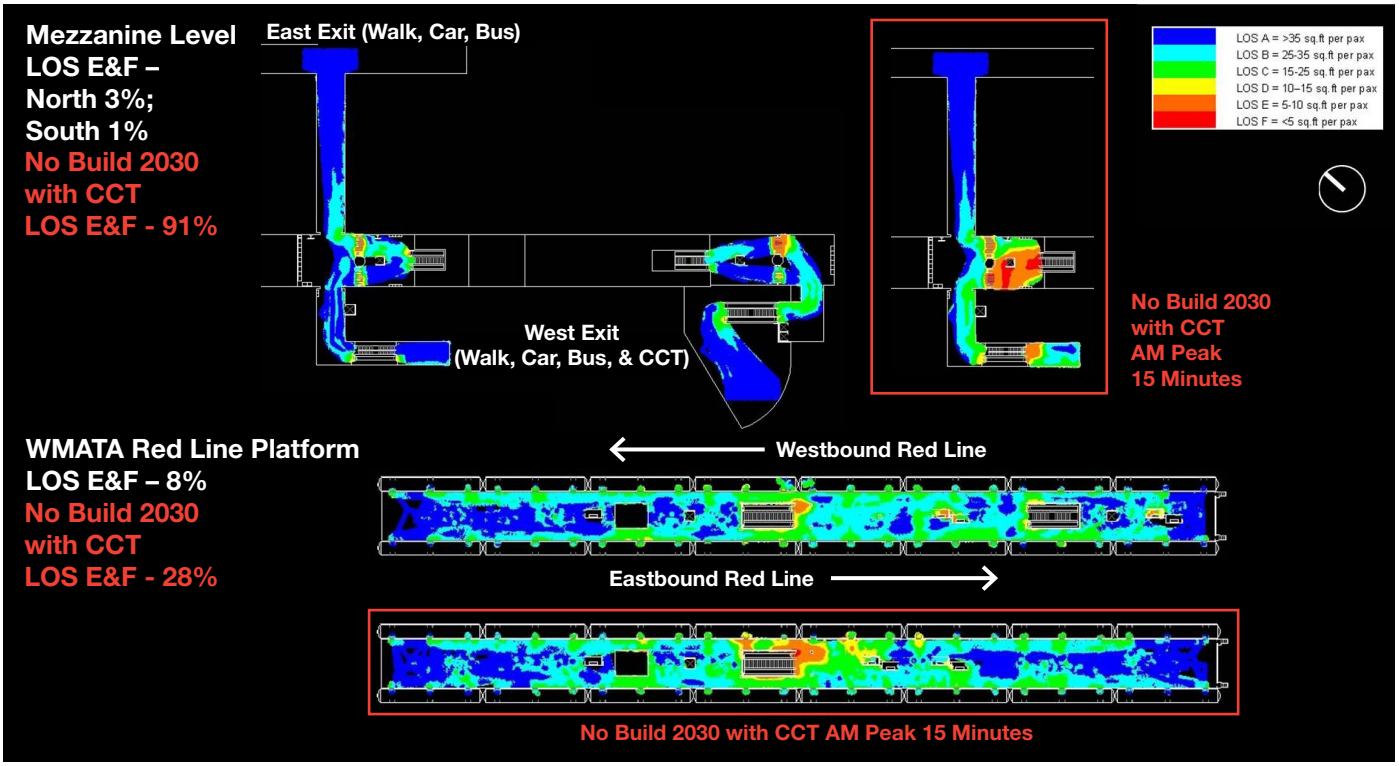
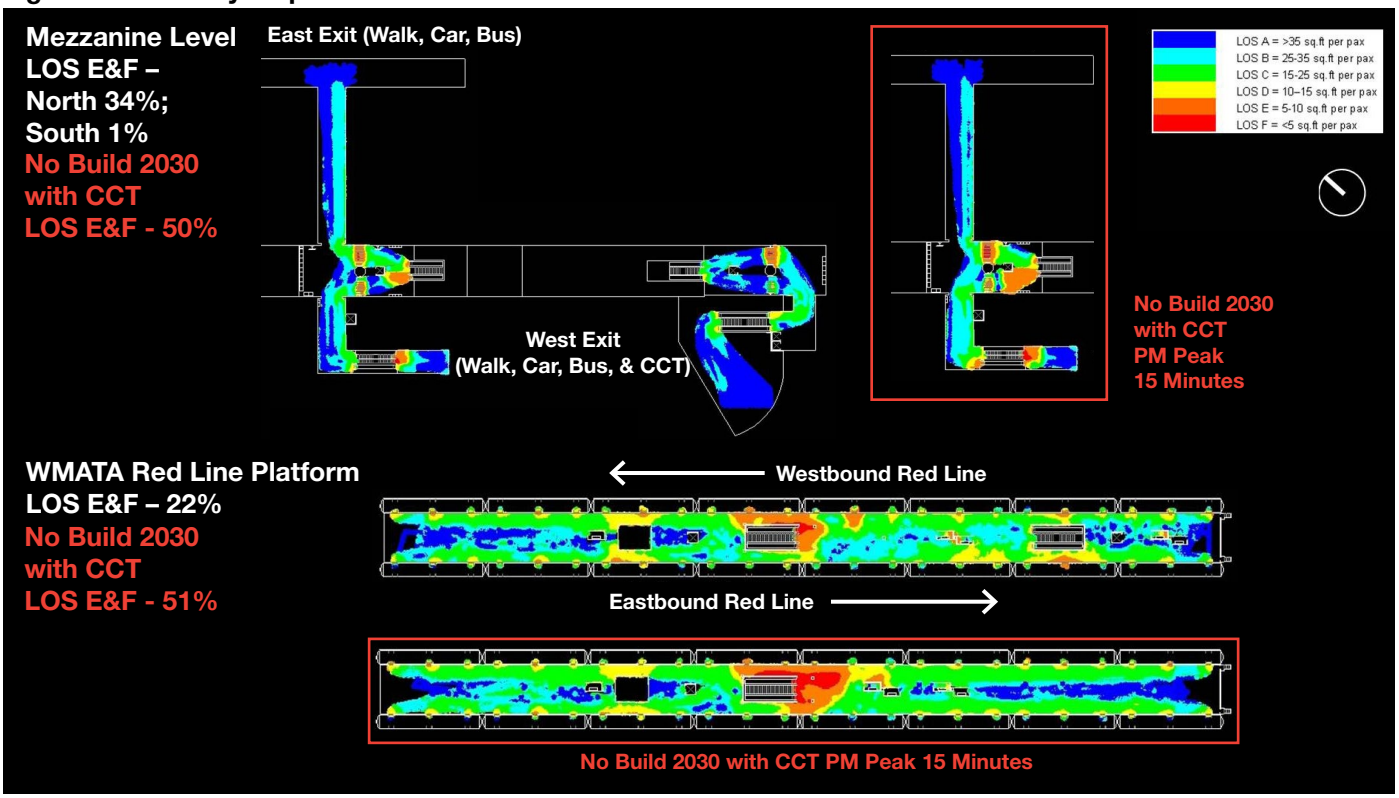


Figure 64 Density Map - Build 2030 Alternative 2B PM Peak 15 Minutes



5.2.7 Build 2030 Alternative 2B: New South Entrance with Underground Mezzanine (West Connection only)

This Build alternative was simulated using the No Build 2030 with CCT ridership forecast and operational assumptions.

While Build 2030 Alternative 2B was selected for further evaluation by the project team at the time the simulations were developed, this alternative was subsequently refined to accommodate the design of the CCT (Build 2030 Alternative 3C). Although Build 2030 Alternative 3C was not simulated, the designs of Build 2030 Alternatives 2B and 3C, as well as the pedestrian movements with both options, were considered to be similar enough to not warrant a separate simulation for Alternative 3C. Therefore, it is assumed that the pedestrian movements and Measures of Effectiveness (MOEs) for Build 2030 Alternative 3C would be comparable to the Build 2030 Alternative 2B simulation described here.

Figure 63 and **Figure 64** show passenger density on the platform and in the mezzanine and access areas for the 2030 AM and PM Peak 15 minute periods.

As shown in **Figure 63**, in the AM Peak 15 minutes, crowding on the mezzanine level is effectively eliminated with the provision of a new entrance. Only three percent of all passengers on the existing north mezzanine and one percent of all passengers on the south mezzanine experience LOS E and F compared to the 91 percent in the No Build 2030 with CCT scenario. Crowding at the platform level decreases as well with only seven percent of passengers experiencing LOS E or F compared to the 28 percent in the No Build 2030 with CCT scenario. Crowding on the mezzanines and the platform are comparable to the Build 2030 Alternative 2A scenario.

Passengers descending the existing platform escalator to the north mezzanine experience a clearance time of 49 seconds; there are no queues in the up direction. There are no queues on the south mezzanine VCEs.

In the PM Peak, as shown in **Figure 64**, crowding at the platform level decreases significantly with 22 percent of all passengers experiencing LOS E or F compared to the 50 percent experiencing LOS E or F in the No Build 2030 with CCT scenario, although this is not as great an improvement as the 18 percent in the Build 2030 Alternative 2A scenario. **Table 16** shows the distribution of the LOS E and F percentages in both scenarios. On the north mezzanine level, 34 percent of all passengers experience LOS E or F, while only one percent experience LOS E or F on the south mezzanine; both the north and south mezzanine LOSs represent a slight improvement compared to the Build 2030 Alternative 2A scenario.

Table 16 LOS E and F on Platform in Build 2030 Alternative 2A and Build 2030 Alternative 2B (PM Peak 15 Minutes)

	LOS E	LOS F	LOS E & F
Build 2030 Alternative 2A	15%	3%	18%
Build 2030 Alternative 2B	16%	6%	22%

The existing escalators in both directions between the platform and north mezzanine require clearance times of 1 minute and 32 seconds (up) and 1 minute and 53 seconds (down); there are no queues or delays on the south mezzanine VCEs. Similar to the Build 2030 Alternative 2A scenario, it may be assumed that passengers who experience discomfort due to crowding or delays at the VCE will eventually use the south mezzanine and VCEs, thereby improving platform density and clearance times, further benefits of the proposed Build 2030 Alternative 2B. Similarly, there is a clearance time of 33 seconds at the existing northwest entrance escalator down to the north mezzanine while there are no queues at the southwest entrance.

5.3 Implementation of Alternative Schemes

Considerations for constructibility and implementation of the four alternatives are below:

5.3.1 Build 2020 Short-Term Alternative 1A

Build 2020 Short-Term Alternative 1A would consist of a new stair in the open well between the platform and the passageway/mezzanine area below. This new stair would be constructed of precast concrete sections or a steel structure with concrete treads. In both cases, the stair runs would be constructed off-site and brought in on a truck and erected during non-revenue hours. A section of the precast parapet at the platform level would be removed when the stair is complete. New rails and fare gates would be installed on the platform. Finishing the stair railings and fare gate work could be completed during revenue operations by restricting access to those areas. The floor at the mezzanine level may need to be reinforced where it would span over the existing culvert.

5.3.2 Build 2030 Alternative 2A

Build 2030 Alternative 2A would consist of a new below-platform mezzanine at the south end of the station that would connect to both the east and west sides. The mezzanine would be built under the existing platform and Metrorail tracks. Slurry walls would need to be built under the tracks with beams connecting between them to support the existing platform. When the track is closed, the entry connection under the track would be constructed. Soil would be removed through either the east or west connection depending on which is built first. To accomplish this, one then the other track would be closed for several months. As this is a terminal station with adjacent track crossovers, it is anticipated that normal Metrorail operations would continue during this time. In addition, a mined tunnel would be implemented under the CSX tracks. This procedure would require CSX approval and coordination.

Once the underground structure is built, the openings to the platform would be cut and the escalators, stairs, and elevator installed. A new canopy would be built over the platform. Much of this work would need to be completed during non-revenue hours. West entry escalators, stairs, and elevators would be constructed at the same time. Pavement would be installed to connect to the existing bus bays on the west and to the parking areas on the east.

5.3.3 Build 2030 Alternative 2B

Build 2030 Alternative 2B would consist of a new below-platform mezzanine at the south end of the station that connects to the west only. The mezzanine would be built under the existing platform and Metrorail tracks. To build this new mezzanine, slurry walls need to be built under the tracks with beams connecting between them to hold up the existing platform. At the same time the west (inbound) track is closed, the entry connection under the track would be constructed. Soil would be removed through the connection to the west. To accomplish this, one track would be closed for several months, then the second track continuing with the same procedure. It is assumed that normal operating schedules would be maintained during this time.

Once the underground structure is built, the openings to the platform would be cut and the escalators, stairs, and elevator installed. A new canopy would be built over the platform. Much of this work would need to be completed during non-revenue hours. West entry escalators, stairs, and elevators would be constructed at the same time. Pavement would be installed to connect to the existing bus bays.

5.3.4 Build 2030 Alternative 3C

Build 2030 Alternative 3C would consist of a new above-platform mezzanine at the south end of the station that connects to the west side only. The mezzanine would be built over the existing platform and Metrorail tracks. To build this mezzanine, new foundations would be required on both sides of the station along the tracks. One track would be closed for several days while the foundations are implemented, and again when columns and deck above are installed. The same would be done for the other track. This would be accomplished by blocking off only one side; the platform could remain in operation. Once the structure is in place, work could proceed on the new deck above the tracks to finish the mezzanine. The stairs, escalators, and elevators could be installed on the platform in a similar method. The mezzanine to platform elevators are beyond the platform and construction would have little impact on patrons. The entry stairs, escalators, and elevators would be on the west side of the tracks and could proceed as an independent construction phase without interrupting operations. Pavement would be installed to connect to the existing bus bays.

5.4 Cost Estimates

Table 17 shows the summary of order of magnitude cost estimates for each alternative. **Appendix B: Cost Estimates** shows the details of the inputs and assumptions in developing these preliminary concept level costs.

The purpose of the cost estimate is to establish a probable budget cost of construction based on the concept stage of design. The estimates were prepared with unit cost information from recent Metro projects, as well as from conversations with members of the design team, and a visit to the site. The pricing reflects probable construction costs in the area in 2013 and uses labor rates applicable to similar projects.

The projected construction schedule indicates that Build 2020 Short-Term Alternative 1A could be bid and built in 2017, while Build 2030 Alternatives 2A, 2B, and 3C could be built by 2025, depending on funding availability. The estimates include assumed escalation between 2013 and the mid-point of each construction phase.

Table 17 Summary of Order of Magnitude Cost Estimates

	Build 2020 Short-Term Alternative 1A	Build 2030 Alternative 2A	Build 2030 Alternative 2B	Build 2030 Alternative 3C
Construction	$571,100	$19,918,400	$17,217,400	$14,645,900
Contingencies	$182,800	$6,373,900	$5,509,600	$4,159,400
Escalation	$82,300	$11,757,900	$10,163,500	$7,225,000
Design, Engineering, Management	$250,900	$11,415,100	$9,867,100	$7,809,100
Construction Support	$167,200	$7,610,100	$6,578,100	$5,206,100
Total	**$1,254,300**	**$57,075,400**	**$49,335,700**	**$39,045,500**

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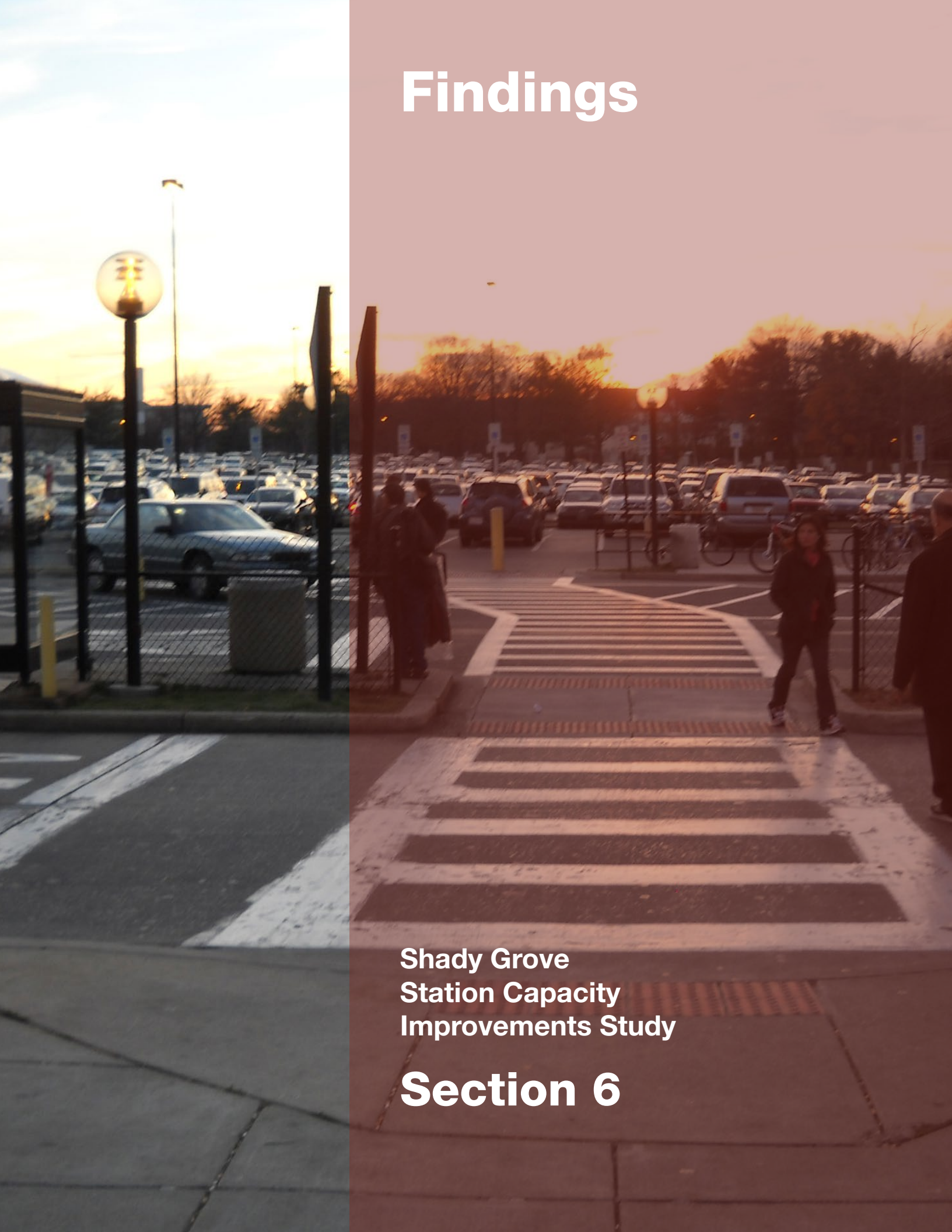
Findings



Shady Grove
Station Capacity
Improvements Study

Section 6

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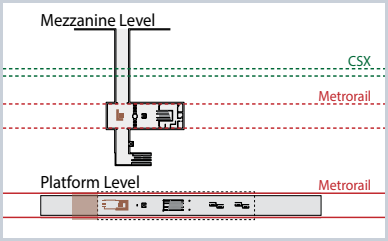
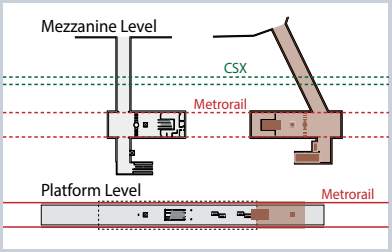
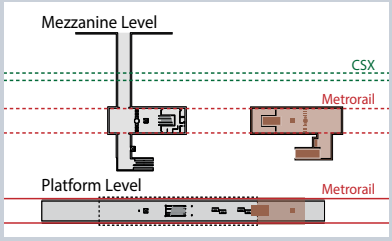
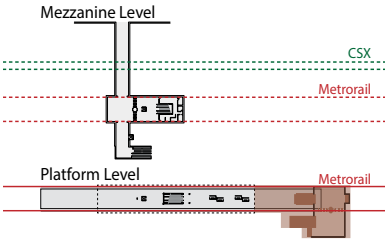
6.0 FINDINGS

6.1 External Site Access

External site access to the Shady Grove Metrorail station was evaluated for coordination with existing and future bus services to the station, as well as for CCT access to the site. Key findings related to these issues are below:

- Assuming the construction of the CCT, which includes five new bus bays at the west side of the station, there are adequate bus bays and layover spaces both on the east and west sides of the Shady Grove Metrorail station in 2020 with and without CCT, and in 2030 with the CCT.

Table 18 Alternatives Selected for Further Study

Alternative	Description
2020 Short-Term Alternative 1A 	Provides an open-well staircase with quarter turn landing, as well as fare gates and add-fare machine at the platform level as a short-term improvement.
Build 2030 Alternative 2A 	Provides a new south entrance (east and west connections) and underground mezzanine as a long-term improvement.
Build 2030 Alternative 2B 	Provides a new south entrance (west connection only) and underground mezzanine as a long-term improvement.
Build 2030 Alternative 3C 	Provides a new south entrance (west connection only), upper level passageway and mezzanine as a long-term improvement.

- The current MTA draft concept for CCT access to the Shady Grove Metrorail station (July 2015) is subject to further review and approval by WMATA.
- The feasibility of building the event center would be contingent on its working within the physical and operational constraints imposed by Metro and the CCT's current and proposed uses.

6.2 Internal Station Access

Platform crowding observed on-site during the evening peak hour, transit-oriented development planned for the Shady Grove Metrorail station area by Montgomery County, and the anticipated introduction of the CCT served as the impetus for developing alternatives for internal station access. After evaluation of numerous short- and long- term conceptual options, four design alternatives were selected for further study, as described in **Table 18**.

Build 2030 Alternative 3C emerged as the lead based on detailed analysis of the conceptual design alternatives, including pedestrian simulations, projected levels of service required to serve the projected CCT ridership, and order of magnitude cost. Key findings for each alternative are below:

- 2020 Short-Term Alternative 1A provides a short-term solution for platform crowding and significantly reduces projected 2020 crowding at the mezzanine and queuing at platform VCEs.
- Build 2030 Alternatives 2A and 2B were found to be comparable in reducing crowding, most significantly at the existing mezzanine in the AM Peak. Elements of Build 2030 Alternative 2A would be reevaluated as long-term development occurs.
- For Build 2030 Alternative 3C, pedestrian movements would be comparable to Build 2030 Alternative 2B. The primary difference is that Build 2030 Alternative 3C is above ground over the Metrorail tracks while Build 2030 Alternative 2B is under the Metrorail tracks.

The order of magnitude cost of Build 2030 Alternative 3C is $39 million, a cost that is less than the other long-term alternatives while providing similar benefits.

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Appendices

Shady Grove
Station Capacity
Improvements Study

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Appendix A:
SHADY GROVE BUS BAY ANALYSIS TECHNICAL MEMORANDUM

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AECOM
2101 Wilson Boulevard
8th Floor
Arlington, Virginia 22201
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703 340 3100 tel
703 340 3101 fax

Memorandum

To	Robin McElhenny
CC	
Subject	Future Bus Facilities Needs at Shady Grove Metrorail Station
From	Derek Crider, Stuart Geltman
Date	June 30, 2014

Metrobus and Other Bus Services

1. *Bus Bays*

A preliminary analysis was conducted regarding Metrobus, Ride-On, and Maryland Transit Administration (MTA) lines currently serving the Shady Grove Metrorail station. This analysis included service on each line as well as at the east side and west side bus bays. Operators did not provide specific expansion plans for services at the Shady Grove Metrorail station. Future bus levels of service were determined based on the ridership forecast and pedestrian modeling effort that was a part of this study. The Corridor Cities Transitway (CCT) and the Montgomery County Bus Rapid Transit (BRT) Network, transit expansion projects which are reflected in future service levels, will impact the Shady Grove Metrorail station. In total, four scenarios were considered regarding the capacity of the station's bus bays: current service levels, horizon year 2020 without CCT, horizon year 2020 with CCT, and horizon year 2030 with CCT.

The following sub-sections and steps reflect the methodology followed to determine bus bays needed:

- Section 1.1.1: Determine peak hour total number of buses from current public timetables.
- Section 1.1.2: Determine projected service growth by:
    - Obtaining bus to rail and rail to bus passenger activity flow from pedestrian model activity.
    - Calculating percent change in bus to rail and rail to bus pedestrian activity for each scenario for both the east and west side of the station (model already treats CCT as a separate service).
- Section 1.1.3: Establish future facility needs by:
    - Applying the percent change in pedestrian activity to arriving (bus to rail) and departing (rail to bus) to the current level of service for each route serving the east side and west side of Shady Grove station. No new routes were assumed.
    - Calculating the number of bus bays based on a 4 minute dwell time for buses and applied to both arriving and departing buses for routes that terminate at the station or 4 minutes dwell time for routes that operate through the station

1.1.1 Existing Service Level

The current off-street bus terminal facility at Shady Grove Metrorail station has eight bus bays on the east side of the station and three bus bays on the west side of the station. There is limited space available for bus layover and staging on each side of the station. On the east side, bus layover and staging activities occur in a variety of locations including the bus roadway adjacent to the parking garage. Bus layover spaces are located east of the bus bays and along the shoulder of the Metro Station access roadway extending Shady Grove Road and Interstate 370/Intercounty Connector. On the west side of the station, buses lay over at various locations along the loop and the station access roadway. Buses on either side of the station sometimes lay over within the bus bay.

Review of public timetables for bus service at Shady Grove Metrorail station shows that the PM peak hour (5:00 PM to 6:00 PM) has a higher number of bus movements than the AM peak hour (6:30 AM to 7:30 AM). There are 78 peak hour departures and arrivals from the station's east side bus bays. On the west side, there are 44 departures and arrivals during the PM peak hour.

1.1.2 Projected Service Growth

The level of service growth is based on the pedestrian modeling activity that was used to forecast pedestrian flows between the Metrorail platform and the bus bays. The estimate for the change in the level of bus service for each scenario is based on the percent change in bus to rail passengers and rail to bus passengers at each side of the station. The bus to rail passenger percent change was used to estimate the change in the number of buses arriving at the station and the rail to bus passenger percent change was used to estimate the number of departing buses from the station for each scenario. The percent change in the number of buses was applied to each bus route serving each side of the station and pivots off the existing service levels described in Section 1.1.1.

A summary of the pedestrian flows used to estimate future bus levels of service is presented in **Table 1**. CCT was assumed to have an exclusive platform and stop areas; therefore, CCT service needs did not factor into the bus bay estimates. Bus bay requirements for Montgomery County BRT services were not estimated because detailed service plans at Shady Grove Metrorail station have not yet been developed.

Table 1: Current and Future Pedestrian Flows

	AM Peak				PM Peak			
	Bus to Rail		Rail to Bus		Bus to Rail		Rail to Bus	
	East Side	West Side	East Side	West Side	East Side	West Side	East Side	West Side
Passengers								
2013	446	503	167	187	167	187	446	503
2020 (no CCT)	715	806	152	171	152	171	715	806
2020 (with CCT)	536	586	67	75	67	75	536	586
2030 (with CCT)	331	340	75	148	75	148	331	340
Change from current								
2020 (no CCT)	60.31%	60.24%	-8.98%	-8.56%	-8.98%	-8.56%	60.31%	60.24%
2020 (with CCT)	20.18%	16.50%	-59.88%	-59.89%	-59.88%	-59.89%	20.18%	16.50%
2030 (with CCT)	-25.78%	-32.41%	-55.09%	-20.86%	-55.09%	-20.86%	-25.78%	-32.41%

1.1.3 Future Facility Needs

Future facility needs were first calculated assuming that buses do not lay over in the bus bays. A dwell time of approximately four minutes was allocated for each bus arriving to and departing from the Shady Grove Metrorail station in revenue service meaning that each bus bay has a capacity of 15 arriving or departing buses per hour. Thus, a route that terminates at Shady Grove and begins revenue service on a return trip would be allocated eight minutes, four minutes for unloading passengers and four minutes to load passengers. For bus routes that do not terminate at Shady Grove Metrorail station, but operate through the station, four minutes is allocated to the bus since the Shady Grove Metrorail station is a mid-route stop location for the bus route. Additional layover space would then be required nearby.

Table 2 summarizes the current service level and future projected service needs. The next section covers layover facility needs.

Table 2: Future Bus Bay Needs

	Route	2013 (Existing)	2020 (without CCT)	2020 (with CCT)	2030 (with CCT)
East Side					
Total PM Peak Hour Bus Activity	Ride On 43	6	8	5	3
	Ride On 58	5	7	5	3
	Ride On 60	2	3	2	1
	Ride On 61	5	7	5	3
	Ride On 64	5	7	5	3
	Ride On 65	2	3	2	1
	Ride On 71	2	3	2	1
	Ride On 74	4	5	3	2
	Ride On 76	7	9	6	4
	Ride On 78	2	3	2	1
	Ride On 79	2	3	2	1
	Ride On 90	5	7	5	3
	Ride On 100	20	25	16	11
	MTA 201 EB	1	2	1	1
	MTA 201 WB	1	2	1	1
	MTA 202	1	2	1	1
	MTA 991	8	13	10	6
Trips per Hour		78	109	73	46
Dwell per Bus		4	4	4	4
Bus Bay Minutes		312	436	292	184
Calculated Berths		5	7	5	3
Schedule Variability Berth		1	1	1	1
Total Berth Needs		**6**	**8**	**6**	**4**
Current Berths		8	8	8	8
Additional Berths (East)		**-2**	**0**	**-2**	**-4**
West Side					
Total PM Peak	WMATA Q1/2/5/6	8	10	7	6
	Ride On 53	4	5	3	3
	Ride On 55 NB	5	8	6	3
	Ride On 55 SB	6	10	7	4

	Route	2013 (Existing)	2020 (without CCT)	2020 (with CCT)	2030 (with CCT)
	Ride On 57	6	8	4	4
	Ride On 59 NB	4	6	5	3
	Ride On 59 SB	3	5	3	2
	Ride On 63	4	5	3	3
	Ride On 66	2	2	1	2
	Ride On 67	2	3	2	1
Trips per Hour		44	62	41	31
Dwell per Bus		4	4	4	4
Bus Bay Minutes		176	248	164	124
Calculated Berths		3	4	3	2
Schedule Variability Berth		1	1	1	1
Total Berth Needs		**4**	**5**	**4**	**3**
Current Berths		3	3	3	3
Additional Berths (West)		**1**	**2**	**1**	**0**

2. *Layover Opportunities*

Given that every Metrobus route and many Ride-On and Maryland Transit Authority bus routes that now serve Shady Grove Metrorail station lay over at the station, careful consideration of layover space is important to the design of the bus facility. WMATA considers the minimum layover time allowable to be 10 percent of the running time for each route. For analysis purposes, and to be consistent with other station area studies, 10 minutes was used as an average layover time at the Shady Grove Metrorail station for all routes; this average layover was applied to all routes that begin and end at the station. **Table 3** shows calculations of layover needs whether layovers take place within the bus bays or in a separate location.

Table 3: Future Layover Needs (Positions)

	Route	2013 (Existing)	2020 (without CCT)	2020 (with CCT)	2030 (with CCT)
East Side					
Total PM Peak Hour Bus Layover Activity	Ride On 43	3	5	4	2
	Ride On 58	3	5	4	2
	Ride On 60	2	3	2	1
	Ride On 61	3	5	4	2
	Ride On 64	3	5	4	2
	Ride On 65	2	3	2	1
	Ride On 71	2	3	2	1
	Ride On 74	2	3	2	1
	Ride On 76	4	6	5	3
	Ride On 78	2	3	2	1
	Ride On 79	2	3	2	1
	Ride On 90	3	5	4	2
	Ride On 100	10	16	12	7
	MTA 991	1	2	1	1
Total per Hour		42	67	50	27
Layover Time per Bus		10	10	10	10

	Route	2013 (Existing)	2020 (without CCT)	2020 (with CCT)	2030 (with CCT)
Layover Space Minutes		420	670	500	270
Layover Positions (East)		**7**	**11**	**8**	**5**
West Side					
Total PM Peak Hour Bus Layover Activity	WMATA Q1/2/5/6	4	6	5	3
	Ride On 53	2	3	2	2
	Ride On 57	3	5	3	2
	Ride On 63	2	3	2	2
	Ride On 66	2	2	1	2
	Ride On 67	2	3	2	1
Total per Hour		15	22	15	12
Layover Time per Bus		10	10	10	10
Layover Space Minutes		150	220	150	120
Layover Positions (West)		**3**	**4**	**3**	**2**

3. *Conclusions*

Based on the analysis, the east side of the Shady Grove station would need 8 bus bays in 2020 without the CCT, which is what is currently available. The requirement under existing conditions (6 berths), as well as in 2020 with CCT (6 berths), and 2030 with CCT (4 berths), is less than the actual number of bus bays currently available (8). While 7 layover spaces are currently available, the east side would need additional layover spaces in 2020 without and with CCT of 11 and 8 total spaces, respectively. In 2030, with the CCT in operation, the need for layover spaces will reduce to 5 spaces (3 surplus spaces).

Bus bay needs were assessed for the west side of the Shady Grove station. While there are currently 3 spaces on the west side, it is crowded in the peak hour and actually needs 4 spaces. In 2020 without CCT, the west side would need 5 spaces; and 4 spaces with CCT in operation in 2020. By 2030, the current 3 bus bays would be sufficient. The bus bay needs identified here are in addition to the CCT bus bays.

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Appendix B:
ORDER OF MAGNITUDE COST ESTIMATES

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August 2014

FEASIBILITY STUDY - DRAFT
COST ESTIMATE
for
SHADY GROVE STATION
WMATA

CONTENTS

BASIS OF COST ESTIMATE

The cost estimate is based on an independent cost estimate. The purpose of this estimate is to reflect the new cost summary and sub-headings that have been used on other WMATA projects.

Cost Estimate Prepared From	Dated	Received
Drawings issued for		
Concept Design Submission	08/28/13	04/22/14

Conditions of Construction

The pricing is based on the following general conditions of construction

- A start date of June 2017 for Alernative 1A
- A start date of June 2025 for Alernative 2A, 2B & 3C
- Construction Period:
  - Alternative 1A: Construction Period of approximately 8 months
  - Alternative 2A: Construction Period of approximately 24 months
  - Alternative 2B: Construction Period of approximately 24 months
  - Alternative 3C: Construction Period of approximately 24 months
- The general contract will be awarded to one construction manager and competitively bid to qualified subcontractors
- There will not be small business set aside requirements
- The contractor will be required to use union wage rates
- A 5% phasing allowance is included. (see estimate detail)
- The general contractor/construction manager will have full access to the site during normal business hours
- Compression of schedule, premium or shift work, and restrictions on the contractor's working hours - An allowance for 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half is included with each line item (see detailed estimate)

INCLUSIONS

This project in Arlington, Virginia comprises the construction of a second entrance to the Crystal City Metro station. Three options were examined under the feasibility study.

Option A

A new mezzanine level, 4# hydraulic elevators from mezzanine level to platform, new escalator and stair entrance to street level with two new hydraulic elevators from grade to mezzanine level including reconfiguring program space at existing mechanical area

Option A.1

This is similar to Option A. The general difference is the reduction of the mezzanine level floor plate and a slight adjustment to the new escalator and stair entrance to street level.

Option C.1

A new mezzanine level, 4# hydraulic elevators from mezzanine level to platform, new escalator and stair entrance to street level on the opposite side of the street with three new hydraulic elevators from grade to mezzanine level including reconfiguring program space at existing mechanical area. In this option a new pedestrian tunnel is required to connect the mezzanine level to the new entrance on the opposite side of the road.

Bidding Process - Market Conditions

This document is based on the measurement and pricing of quantities wherever information is provided and/or reasonable assumptions for other work not covered in the drawings or specifications, as stated within this document. Unit rates have been obtained from historical records and/or discussion with contractors. The unit rates reflect current bid costs in the area. All unit rates relevant to subcontractor work include the subcontractors overhead and profit unless otherwise stated. The mark-ups cover the costs of field overhead, home office overhead and profit and range from 10% to 20% of the cost for a particular item of work.

Pricing reflects probable construction costs obtainable in the project locality on the date of this statement of probable costs. This estimate is a determination of fair market value for the construction of this project. It is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the construction work for all subcontractors and general contractors, with a minimum of 5 bidders for all items of work. Experience and research indicates that a fewer number of bidders may result in higher bids, conversely an increased number of bidders may result in more competitive bids.

Since AECOM has no control over the cost of labor, material, equipment, or over the contractor's method of determining prices, or over the competitive bidding or market conditions at the time of bid, the statement of probable construction cost is based on industry practice, professional experience and qualifications, and represents AECOM's best judgment as professional construction consultant familiar with the construction industry. However, AECOM cannot and does not guarantee that the proposals, bids, or the construction cost will not vary from opinions of probable cost prepared by them.

EXCLUSIONS

- Owner supplied and installed furniture, fixtures and equipment - except as specifically identified
- Loose furniture and equipment except as specifically identified
- Security equipment and devices except as specifically identified
- Audio visual equipment
- Hazardous material handling, disposal and abatement
- Design, testing, inspection or construction management fees
- Assessments, taxes, finance, legal and development charges
- Environmental impact mitigation
- Builder's risk, project wrap-up and other owner provided insurance program
- Land and easement acquisition
- Specialty Contractor parking requirements

CLARIFICATIONS and DEFINITIONS*

**It is anticipated that the project will be a Design & Build contract with a Construction Manager.*

Hard Construction

Design Contingency (item #22)

Design Contingency is an allowance for future design development, which alter the cost of the building as the design progresses, this percentage reduces as the design develops. It is based on a percentage of the sum of Sub-Total Construction, General Conditions and Requirements, Bond & Insurance and Building Permit.

Construction Management Fee (item #23)

Costs associated with general coordination of design reviews, meetings management, quality assurance, quality control, scheduling, financial close-out, and monitoring the project.

Escalation (item #24)

Escalation is included to allow for market/price fluctuations and is escalated to the mid-point of construction @ 3% per annum.

Soft Costs

Design and Engineering (item #25)

The costs associated with the design and engineering services to include drawings, specifications, change orders and other design documentation. (Including A&E bridge documents and CM completion of design).

Design Management (item #26)

Design support and oversight from WMATA and Arlington County to include review of all drawings, specifications and construction documents as they are developed by A/E during Schematic Design, Design Development, and Construction Documents design phases of the project, as well as meetings, town hall meetings, scheduling and overall general coordination of A/E.

Construction Support (item #27)

A general term for construction coordination and support by both WMATA and Arlington County during construction to include; project management, site inspector(s), safety, scheduling, operation & maintenance manuals, contract administration, etc.

The cost estimate is based on an independent cost estimate. The purpose of this estimate is to reflect the new cost summary and sub-headings that have been used on other WMATA projects.

OVERALL SUMMARY COMPARISON - ORDER OF MAGNITUDE COSTS

Item	Description		Alternative 1A	Alternatives* Alternative 2A	Alternative 2B	Alternative 3C	Alternative 3C rev
1	*DEMOLITION/RE-ROUTING & RE-BUILDING - ALLOW*		$3,870	$537,500	$537,500	$268,750	$403,125
2	*EARTHWORK & FOUNDATION*		$0	$1,827,231	$1,354,231	$234,243	$470,960
3	*UTLILITY IMPACTS/REROUTING*		$0	Included w/item 1	Included w/item 1	Included w/item 1	Included w/item 1
4	*ELEVATOR SHAFT AND ELEVATOR PIT*		$0	$617,695	$617,695	$446,125	$887,499
5	*TUNNEL*		not required	$657,900	not required	not required	not required
6	*MEZZANINE FLOOR CONSTRUCTION*		not required	$1,745,564	1,792,380	434,300.00	$1,653,908
7	*NEW ENTRANCE ROOF STRUCTURE*		not required	$181,998	181,998	0.00	
8	*STANDARD WMATA ELEVATORS*		not required	$980,000	$980,000	$900,000	$1,800,000
9	*STANDARD WMATA STANDARD ESCALATOR*		not required	$1,400,000	$1,400,000	$700,000	$1,400,000
10	*INTERIOR BUILD-OUT*		$418,928	$3,435,969	$3,295,574	$2,383,598	$2,557,425
11	*MECHANICAL*		not required	$2,390,000	1,790,000	$1,590,000	$107,500
12	*ELECTRICAL*		$10,750	$402,050	326,809	$594,690	$739,600
13	*COST TO REPLACE EXISTING ELEVATOR FOR NEW ELEVATOR*		not required	not required	not required	not required	not required
14	*COST TO REFURBISH EXISTING ELEVATOR*		not required	not required	not required	not required	not required
15	*ELEVATOR DOWN TIME (costs of WMATA bus-bridge)*		not required	not required	not required	not required	not required
16	*EXTERIOR WORK*		$0	$1,201,420	$1,015,875	$2,635,900	$1,316,492
17	*LABOR COSTS*		included above	included above	included above	included above	included above
18	*PHASING REQUIREMENT*		$21,677	$768,866	$664,603	$509,380	$566,825
SUB-TOTAL CONSTRUCTION			**$455,225**	**$16,146,193**	**$13,956,665**	**$10,696,986**	**$11,903,334**
Markups							
	General Conditions						
19	General conditions and project requirements	20.0%	$91,045				
19	General conditions and project requirements	18.0%		$2,906,315	$2,512,200	$1,925,458	$2,142,600
20	Bond and Insurance	3.0%	$16,388	$571,575	$494,066	$378,673	$421,378
21	Building Permit	1.5%	$8,440	$294,361	$254,444	$195,017	$178,550
PLANNED CONSTRUCTION COST			**$571,098**	**$19,918,444**	**$17,217,375**	**$13,196,134**	**$14,645,862**
Contingencies/Escalation							
	Contingencies						
22	Design Contingency	20.0%	$114,220	$3,983,689	$3,443,475	$2,639,227	$2,929,172
23	Construction Management Fee	10.0%	$68,532	$2,390,213	$2,066,085	$1,583,536	
23	Construction Management Fee	7.0%					$1,230,252
	Escalation						
24	Escalation to mid-point construction (4Q2017)	10.9%	$82,320				
24	Escalation to mid-point construction (4Q2026)	44.7%		$11,757,937	$10,163,485	$7,789,731	
24	Escalation to mid-point construction (3Q2026)	38.4%					$7,224,991
ESTIMATED CONTRACT AWARD (Hard Costs)			**$836,170**	**$38,050,283**	**$32,890,420**	**$25,208,628**	**$26,030,277**
Soft Costs							
25	*Design + Engineering*	15.0%	$125,426	$5,707,542	$4,933,563	$3,781,294	$3,904,542
26	*Design Management*	15.0%	$125,426	$5,707,542	$4,933,563	$3,781,294	$3,904,542
27	*Construction Support**	20.0%	$167,234	$7,610,057	$6,578,084	$5,041,726	$5,206,055
ESTIMATED CONTRACT AWARD (Hard & Soft Costs)			**$1,254,256**	**$57,075,424**	**$49,335,630**	**$37,812,942**	**$39,045,416**
28	**ESCORT ALLOWANCE included with Construction Support*		included above	included above	included above	included above	included above
ESTIMATED CONTRACT AWARD (Hard, Soft and Escort Costs)			**$1,254,256**	**$57,075,424**	**$49,335,630**	**$37,812,942**	**$39,045,416**

	Quantity	*Unit*	*Rate*	*Total*

Alternative 1A*

DEMOLITION/RE-ROUTING & RE-BUILDING - ALLOW				
Necessary demolition, re-routing and re-building of existing mechanical, electrical, plumbing and structural systems.				assume not required
Cut existing concrete balustrade for stair	6	LF	600.00	3,600
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	270.00	270
				$3,870
EARTHWORK & FOUNDATION				
No work anticipated				
				$0
UTLILITY IMPACTS/REROUTING				
No work anticipated				
				$0
ELEVATOR SHAFT				
No work anticipated				
				$0
MEZZANINE FLOOR CONSTRUCTION				
No work anticipated				
				$0
NEW ENTRANCE ROOF STRUCTURE				
No work anticipated				
				$0
STANDARD WMATA ELEVATORS				
No work anticipated				NIC
				$0
STANDARD WMATA STANDARD ESCALATOR				
No work anticipated				
				$0

Alternative 1A*

	Quantity	Unit	Rate	Total
INTERIOR BUILD-OUT				
Structural steel framing to stair	280	SF	100.00	28,000
Structural steel framing to landing	135	SF	80.00	10,800
Granite treads	270	LF	100.00	27,000
Granite landing	135	SF	100.00	13,500
Glass railing	160	LF	350.00	56,000
Metal guard rail under staircase	28	LF	200.00	5,600
Specialized equipment provided by WMATA				
Fare gate	4	EA	45,000.00	180,000
Fare gate collection system				assume not required
Metal guard railing	44	LF	200.00	8,800
Miscellaneous specialties/signage	1	LS	10,000.00	10,000
Provisional allowance for possible upgrade of structural support over existing Creek	1	LS	50,000.00	50,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	29,227.50	29,228
				$418,928
MECHANICAL				
No work anticipated				
				$0
ELECTRICAL				
Lighting, power, communication and security modifications	1	LS	10,000.00	10,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	750.00	750
				$10,750
COST TO REPLACE EXISTING ELEVATOR FOR NEW ELEVATOR				
Standard WMATA Elevators				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
COST TO REFURBISH EXISTING ELEVATOR				
Standard WMATA Elevators				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0

	Quantity	*Unit*	*Rate*	*Total*
Alternative 1A*				
ELEVATOR DOWN TIME (costs of WMATA bus-bridge)				
WMATA bus bridge - allowance				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
EXTERIOR WORK				
RC curved canaopy extension to match existing				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	0.00	
				$0
SUB TOTAL				**433,548**
PHASING REQUIREMENT				
It is anticipated that phasing will be required to ensure that the metro station remains operational as much as possible. A 5% phasing allowance is included	1	LS	21,677.40	21,677
SUB TOTAL Including phasing requirement				**455,225**

Alternative 2A*

	Quantity	Unit	Rate	Total
DEMOLITION/RE-ROUTING & RE-BUILDING - ALLOW				
Locate, link and expand existing utilities	1	LS	250,000.00	250,000
Cut existing platform for access	1	LS	250,000.00	250,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	37,500.00	37,500
				$537,500
EARTHWORK & FOUNDATION				
Excavate for Mezz, remove & dispose	7,200	CY	50.00	360,000
Excavate for West passage to ditto	1,800	CY	50.00	90,000
Excavate for East tunnel and ditto	2,200	CY	200.00	440,000
Dewatering	1	LS	50,000.00	50,000
Temporary Underpin canopy columns	3	EA	1,500.00	4,500
Sheet piling at Mezzanine	10,500	SF	30.00	315,000
Shoring at West Passage	1,600	SF	15.00	24,000
Compacted backfill	1,000	CY	25.00	25,000
RC structural foundation to Mezzanine	436	LF	100.00	43,600
RC structural foundation to West access	212	LF	150.00	31,800
RC structural mat slab at Mezzanine 36"	8,060	SF	35.00	282,100
RC structural slab to West passage	1,350	SF	25.00	33,750
RC slab to Tunnel--included in Item 12				
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	127,481.25	127,481
				$1,827,231
UTLILITY IMPACTS/REROUTING				
Utility impacts/rerouting			incl w/Demolition/Re-routing section	
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				
				$0
ELEVATOR SHAFT & ESCALATOR PIT				
Shaft				
Elevator pits, complete including WPM	3	EA	5,000.00	15,000
Escalator pits, complete including WPM	4	EA	10,000.00	40,000
Glass and metal elevator shafts	3,264	SF	150.00	489,600
Roof panels to shaft	200	SF	150.00	30,000

Alternative 2A*

	Quantity	Unit	Rate	Total
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	43,095.00	43,095
				$617,695
TUNNEL CONSTRUCTION				
RC structural Tunnel to East passage 28 x 12	170	LF	3,600.00	612,000
RC roof slab to Tunnel included included	-		-	
RC retaining wall to Tunnel included	-		-	
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	45,900.00	45,900
				$657,900
MEZZANINE FLOOR CONSTRUCTITON				
RC beams to suspended slab 24" x 36"	816	LF	330.00	269,280
RC suspended slab to Mezzanine 18"	8,060	SF	35.00	282,100
RC suspended slab in platform repair	5,000	SF	20.00	100,000
RC retaining wall and WPM to Mezz 30"	9,216	SF	65.00	599,040
RC retaining wall and WPM to West	4,700	SF	45.00	211,500
RC staircase to platform	420	SF	45.00	18,900
RC flat canopies over stairs and WPM	1,432	SF	30.00	42,960
Allowance for hoisting including mobilization and demobilization	1	LS	100,000.00	100,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	121,784	121,784
				$1,745,564
NEW ENTRANCE ROOF STRUCTURE				
RC suspended roof slab to West passage	1,350	SF	30.00	40,500
WPM roofing to Mezzanine overhang	2,400	SF	12.00	28,800
Allowance for hoisting including mobilization and demobilization	1	LS	100,000.00	100,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	12,697.50	12,698
				$181,998
WMATA STANDARD ELEVATORS				
Hydraulic elevator per WMATA,single door	1	EA	300,000.00	300,000
Hydraulic elevator ditto two doors	2	EA	340,000.00	680,000

	Quantity	*Unit*	*Rate*	*Total*
Alternative 2A*				
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$980,000
STANDARD WMATA STANDARD ESCALATOR				
Standard WMATA Escalators	4	EA	350,000.00	1,400,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$1,400,000
INTERIOR WORK				
CMU partitions to Service area	2,400	SF	50.00	120,000
Metal doors, frames and hardware	10	EA	1,850.00	18,500
Metal sliding gate to East passage	1	EA	45,000.00	45,000
Metal guard rails to Tunnel	340	LF	75.00	25,500
Glass stair rails and balustrades	240	LF	350.00	84,000
Granite treads to stairs	270	LF	75.00	20,250
Concrete wall form finish	15,000	SF	8.00	120,000
Quarry tile hexagonal floor	10,000	SF	16.00	160,000
Ceramic tile toilet floor	220	SF	20.00	4,400
Ceramic tile wainscot	330	SF	20.00	6,600
Vinyl floor to corridors	500	SF	10.00	5,000
Colored screed to platform	5,000	SF	6.00	30,000
Metal panel tile ceiling	7,400	SF	30.00	222,000
Misc. specialties/graphics including exg. relocation	1	LS	100,000.00	100,000
Toilet acessories	1	LS	5,000.00	5,000
Specialized equipment provided by WMATA				
Fare gate	8	EA	45,000.00	360,000
Fare gate collection system	14	EA	100,000.00	1,400,000
Kiosk including structure, electrical, and mechanical, and installation.	1	EA	350,000.00	350,000
Relocate Windscreen	6	EA	20,000.00	120,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	239,718.75	239,719
				$3,435,969
MECHANICAL				
ACU & Heating to Service area - Adapt & amend	1	LS	850,000.00	850,000
Plumbing to Toilets 4 Fixtures	1	LS	15,000.00	15,000
Connections to soil/waste/water & vent	1	LS	30,000.00	30,000
Fire protection adapt & amend	1	LS	300,000.00	300,000

	Quantity	*Unit*	*Rate*	*Total*
Alternative 2A*				
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	1,195,000.00	1,195,000
				$2,390,000
ELECTRICAL				
Lighting/power/	8,000	SF	28.00	224,000
CCTV cameras				NIC - by owner
Security and communication allowance	1	LS	150,000.00	$150,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	28,050.00	28,050
				$402,050
COST TO REPLACE EXISTING ELEVATOR FOR NEW ELEVATOR				
Standard WMATA Elevators				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
COST TO REFURBISH EXISTING ELEVATOR				
Standard WMATA Elevators				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
ELEVATOR DOWN TIME (costs of WMATA bus-bridge)				
WMATA bus bridge - allowance				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
EXTERIOR WORK				
Curved canopy extension	3,520	SF	250.00	880,000
RC column supports to canopy	50	LF	300.00	15,000
Clear & prepare site as necessary	1	LS	25,000.00	25,000
Metro track removal & replacement				NIC - by owner
RC Structural retaining wall at East entry	4,200	SF	28.00	117,600
Soil backfill	1,500	CY	20.00	30,000

	Quantity	*Unit*	*Rate*	*Total*
Alternative 2A*				
Grass, shrubs and landscaping	1	LS	50,000.00	50,000
Elevator enclosure at grade level	assume included w/Elevator shaft section			
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	83,820.00	83,820
				$1,201,420
SUB TOTAL				**15,377,327**
PHASING REQUIREMENT				
It is anticipated that phasing will be required to ensure that the metro station remains operational as much as possible. A 5% phasing allowance is included	1	LS	768,866.33	768,866
SUB TOTAL Including phasing requirement				**16,146,193**

Alternative 2B*

	Quantity	Unit	Rate	Total
DEMOLITION/RE-ROUTING & RE-BUILDING - ALLOW				
Locate, link and expand existing utilities	1	LS	250,000.00	250,000
Cut existing platform for access	1	LS	250,000.00	250,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	37,500.00	37,500
				$537,500
EARTHWORK & FOUNDATION				
Excavate for Mezz, remove & dispose	7,200	CY	50.00	360,000
Excavate for West passage to ditto	1,800	CY	50.00	90,000
Dewatering	1	LS	50,000.00	50,000
Temporary Underpin canopy columns	3	EA	1,500.00	4,500
Sheet piling at Mezzanine	10,500	SF	30.00	315,000
Shoring at West Passage	1,600	SF	15.00	24,000
Compacted backfill	1,000	CY	25.00	25,000
RC structural foundation to Mezzanine	436	LF	100.00	43,600
RC structural foundation to West access	212	LF	150.00	31,800
RC structural mat slab at Mezzanine 36"	8,060	SF	35.00	282,100
RC structural slab to West passage	1,350	SF	25.00	33,750
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	94,481.25	94,481
				$1,354,231
UTLILITY IMPACTS/REROUTING				
Utility impacts/rerouting			incl w/Demolition/Re-routing section	
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				
				$0
ELEVATOR SHAFT & ESCALATOR PIT				
Shaft				
Elevator pits, complete including WPM	3	EA	5,000.00	15,000
Escalator pits, complete including WPM	4	EA	10,000.00	40,000
Glass and metal elevator shafts	3,264	SF	150.00	489,600
Roof panels to shaft	200	SF	150.00	30,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	43,095.00	43,095
				$617,695

Alternative 2B*

	Quantity	Unit	Rate	Total
TUNNEL CONSTRUCTION				
No work anticipated				
				$0
MEZZANINE FLOOR CONSTRUCTITON				
RC beams to suspended slab 24" x 36"	816	LF	330.00	269,280
RC suspended slab to Mezzanine 18"	8,060	SF	35.00	282,100
RC suspended slab in platform repair	5,000	SF	20.00	100,000
RC retaining wall and WPM to Mezz & East wall 30"	9,886	SF	65.00	642,590
RC retaining wall and WPM to West	4,700	SF	45.00	211,500
RC staircase to platform	420	SF	45.00	18,900
RC flat canopies over stairs and WPM	1,432	SF	30.00	42,960
Allowance for hoisting including mobilization and demobilization	1	LS	100,000.00	100,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	125,050	125,050
				$1,792,380
NEW ENTRANCE ROOF STRUCTURE				
RC suspended roof slab to West passage	1,350	SF	30.00	40,500
WPM roofing to Mezzanine overhang	2,400	SF	12.00	28,800
Allowance for hoisting including mobilization and demobilization	1	LS	100,000.00	100,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	12,697.50	12,698
				$181,998
WMATA STANDARD ELEVATORS				
Hydraulic elevator per WMATA,single door	1	EA	300,000.00	300,000
Hydraulic elevator ditto two doors	2	EA	340,000.00	680,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$980,000
STANDARD WMATA STANDARD ESCALATOR				

	Quantity	*Unit*	*Rate*	*Total*
Alternative 2B*				
Standard WMATA Escalators	4	EA	350,000.00	1,400,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$1,400,000
INTERIOR WORK				
CMU partitions to Service area	2,400	SF	50.00	120,000
Metal doors, frames and hardware	10	EA	1,850.00	18,500
Glass stair rails and balustrades	240	LF	350.00	84,000
Granite treads to stairs	270	LF	75.00	20,250
Concrete wall form finish	15,000	SF	8.00	120,000
Quarry tile hexagonal floor	6,400	SF	16.00	102,400
Ceramic tile toilet floor	220	SF	20.00	4,400
Ceramic tile wainscot	330	SF	20.00	6,600
Vinyl floor to corridors	500	SF	10.00	5,000
Colored screed to platform	5,000	SF	6.00	30,000
Metal panel tile ceiling	7,400	SF	30.00	222,000
Misc. specialties/graphics including exg. relocation	1	LS	97,500.00	97,500
Toilet acessories	1	LS	5,000.00	5,000
Specialized equipment provided by WMATA				
Fare gate	8	EA	45,000.00	360,000
Fare gate collection system	14	EA	100,000.00	1,400,000
Kiosk including structure, electrical, and mechanical, and installation.	1	EA	350,000.00	350,000
Relocate Windscreen	6	EA	20,000.00	120,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	229,923.75	229,924
				$3,295,574
MECHANICAL				
ACU & Heating to Service area - Adapt & amend	1	LS	600,000.00	600,000
Plumbing to Toilets 4 Fixtures	1	LS	15,000.00	15,000
Connections to soil/waste/water & vent	1	LS	30,000.00	30,000
Fire protection adapt & amend	1	LS	250,000.00	250,000
Connections to soil/waste/water & vent				
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	895,000.00	895,000
				$1,790,000
ELECTRICAL				
Lighting/power/	7,286	SF	28.00	204,008

	Quantity	*Unit*	*Rate*	*Total*
Alternative 2B*				
CCTV cameras				NIC - by owner
Security and communication allowance	1	LS	100,000.00	100,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	22,800.60	22,801
				$326,809
COST TO REPLACE EXISTING ELEVATOR FOR NEW ELEVATOR				
Standard WMATA Elevators				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
COST TO REFURBISH EXISTING ELEVATOR				
Standard WMATA Elevators				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
ELEVATOR DOWN TIME (costs of WMATA bus-bridge)				
WMATA bus bridge - allowance				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
EXTERIOR WORK				
Curved canopy extension	3,520	SF	250.00	880,000
RC column supports to canopy	50	LF	300.00	15,000
Clear & prepare site as necessary	1	LS	25,000.00	25,000
Metro track removal & replacement				NIC - by owner
Grass, shrubs and landscaping	1	LS	25,000.00	25,000
Elevator enclosure at grade level	assume included w/Elevator shaft section			
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	70,875.00	70,875
				$1,015,875
SUB TOTAL				**13,292,062**
PHASING REQUIREMENT				

	Quantity	*Unit*	*Rate*	*Total*
Alternative 2B*				
It is anticipated that phasing will be required to ensure that the metro station remains operational as much as possible. A 5% phasing allowance is included	1	LS	664,603.09	664,603
SUB TOTAL Including phasing requirement				**13,956,665**

Alternative 3C*

	Quantity	Unit	Rate	Total
DEMOLITION/RE-ROUTING & RE-BUILDING - ALLOW				
Locate, link and expand existing utilities	1	LS	250,000.00	250,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	18,750.00	18,750
				$268,750
EARTHWORK & FOUNDATION				
Excavate for Mezz, remove & dispose	250	CY	35.00	8,750
Dewatering	1	LS	15,000.00	15,000
Sheet piling at Mezzanine	1,200	SF	30.00	36,000
Compacted backfill	250	CY	25.00	6,250
RC column bases	20	EA	350.00	7,000
RC structural mat slab at Mezzanine 36"	6,300	SF	20.00	126,000
RC staircase	420	SF	45.00	18,900
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	16,342.50	16,343
				$234,243
UTILITY IMPACTS/REROUTING				
Utility impacts/rerouting			incl w/Demolition/Re-routing section	
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				
				$0
ELEVATOR SHAFT & ESCALATOR PIT				
Shaft				
Elevator pits, complete including WPM	3	EA	5,000.00	15,000
Escalator pits, complete including WPM	4	EA	10,000.00	40,000
Glass and metal elevator shafts	2,200	SF	150.00	330,000
Roof panels to shaft	200	SF	150.00	30,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	31,125.00	31,125
				$446,125
TUNNEL CONSTRUCTION				
No work anticipated				
				$0

Alternative 3C*

	Quantity	Unit	Rate	Total
MEZZANINE FLOOR CONSTRUCTITON				
RC beams to suspended slab	800	LF	150.00	120,000
RRC suspended slab to Mezzanine	8,100	SF	20.00	162,000
Column supports	20	EA	3,600.00	72,000
Allowance for hoisting including mobilization and demobilization	1	LS	50,000.00	50,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	30,300	30,300
				$434,300
NEW ENTRANCE ROOF STRUCTURE				
No work anticipated				
				$0
WMATA STANDARD ELEVATORS				
Hydraulic elevator per WMATA	3	EA	300,000.00	900,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$900,000
STANDARD WMATA STANDARD ESCALATOR				
Standard WMATA Escalators	2	EA	350,000.00	700,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$700,000
INTERIOR WORK				
CMU partitions to Service area	2,400	SF	50.00	120,000
Partition walls at escalators	3,200	SF	12.00	38,400
Metal doors, frames and hardware	10	EA	1,850.00	18,500
Glass stair rails and balustrades	160	LF	350.00	56,000
Granite treads to stairs	400	LF	75.00	30,000
Concrete wall form finish	6,000	SF	8.00	48,000
Quarry tile hexagonal floor	14,400	SF	16.00	230,400
Ceramic tile toilet floor	220	SF	20.00	4,400
Ceramic tile wainscot	330	SF	20.00	6,600
Vinyl floor	500	SF	10.00	5,000

Alternative 3C*

	Quantity	Unit	Rate	Total
Misc. specialties/graphics including exg. relocation	1	LS	50,000.00	50,000
Toilet acessories	1	LS	5,000.00	5,000
Specialized equipment provided by WMATA				
Fare gate	7	EA	45,000.00	315,000
Fare gate collection system	9	EA	100,000.00	900,000
Kiosk including structure, electrical, and mechanical, and installation.	1	EA	350,000.00	350,000
Relocate Windscreen	2	EA	20,000.00	40,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	166,297.50	166,298
				$2,383,598

MECHANICAL				
ACU and Heating to Service area	1	LS	500,000.00	500,000
Plumbing to Toilets 4 Fixtures	1	LS	15,000.00	15,000
Connections to soil/waste/water & vent	1	LS	30,000.00	30,000
Fire protection adapt & amend	1	LS	250,000.00	250,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	795,000.00	795,000
				$1,590,000

ELECTRICAL				
Lighting/power/	14,400	SF	28.00	403,200
CCTV cameras				NIC - by owner
Security and communication allowance	1	LS	150,000.00	150,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	41,490.00	41,490
				$594,690

COST TO REPLACE EXISTING ELEVATOR FOR NEW ELEVATOR	
Standard WMATA Elevators	not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	included above
	$0

COST TO REFURBISH EXISTING ELEVATOR	
Standard WMATA Elevators	not required

	Quantity	*Unit*	*Rate*	*Total*
Alternative 3C*				
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
ELEVATOR DOWN TIME (costs of WMATA bus-bridge)				
WMATA bus bridge - allowance				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
EXTERIOR WORK				
PC curved canopy over existing platform	4,000	SF	250.00	1,000,000
Steel trusses, metal curved canopy	11,600	SF	100.00	1,160,000
RC external wall	1,600	SF	30.00	48,000
Exterior wall glass screen, 10' high	5,400	SF	40.00	216,000
Double glass entrance doors, complete	3	PR	5,000.00	15,000
Clear & prepare site as necessary	1	LS	3,000.00	3,000
Metro track removal & replacement				NIC - by owner
Grass, shrubs and landscaping	1	LS	10,000.00	10,000
Elevator enclosure at grade level	assume included w/Elevator shaft section			
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	183,900.00	183,900
				$2,635,900
SUB TOTAL				**10,187,606**
PHASING REQUIREMENT				
It is anticipated that phasing will be required to ensure that the metro station remains operational as much as possible. A 5% phasing allowance is included	1	LS	509,380.30	509,380
SUB TOTAL Including phasing requirement				**10,696,986**

Appendix C:
CORRIDOR CITIES TRANSITWAY
SHADY GROVE STATION SITE PLAN

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Corridor Cities Transitway

SHADY GROVE STATION

DRAFT: WORK IN PROGRESS

Redland Rd

Somerville Dr

TPSS

Shady Grove Metrorail Station Platform

CCT Bus Bays

Metrobus Bus Bays

Taxis and Kiss & Ride

Metro Park & Ride

STOP

STOP

King Farm Blvd

Frederick Rd

100′ 0 100′ 200′