MD 355/Rockville Pike Crossing Study

ALTERNATIVES RETAINED FOR DETAILED STUDY

Montgomery County Department of Transportation

September 2010

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The purpose of this document is to describe preliminary alternatives developed for this study, summarize the screening and evaluation of each alternative and its potential to meet the project purpose and need, and present the recommendations for the alternatives to be dropped from further consideration and the Alternatives Retained for Detailed Study (ARDS). The recommendations are based on stakeholder and public input that was received that this stage of the study. Based on additional study and refinements, the ARDS will be further evaluated and considered in the selection of a Preferred Alternative.

PURPOSE OF THE STUDY

The purpose of the MD 355/Rockville Pike Crossing Study is to improve the movement of the traveling public between the west and east sides of MD 355/Rockville Pike at its intersection with South Wood Road and South Drive in Bethesda, Maryland (See **Figure 1** for a map of the Study Area).

A. Purpose and Need

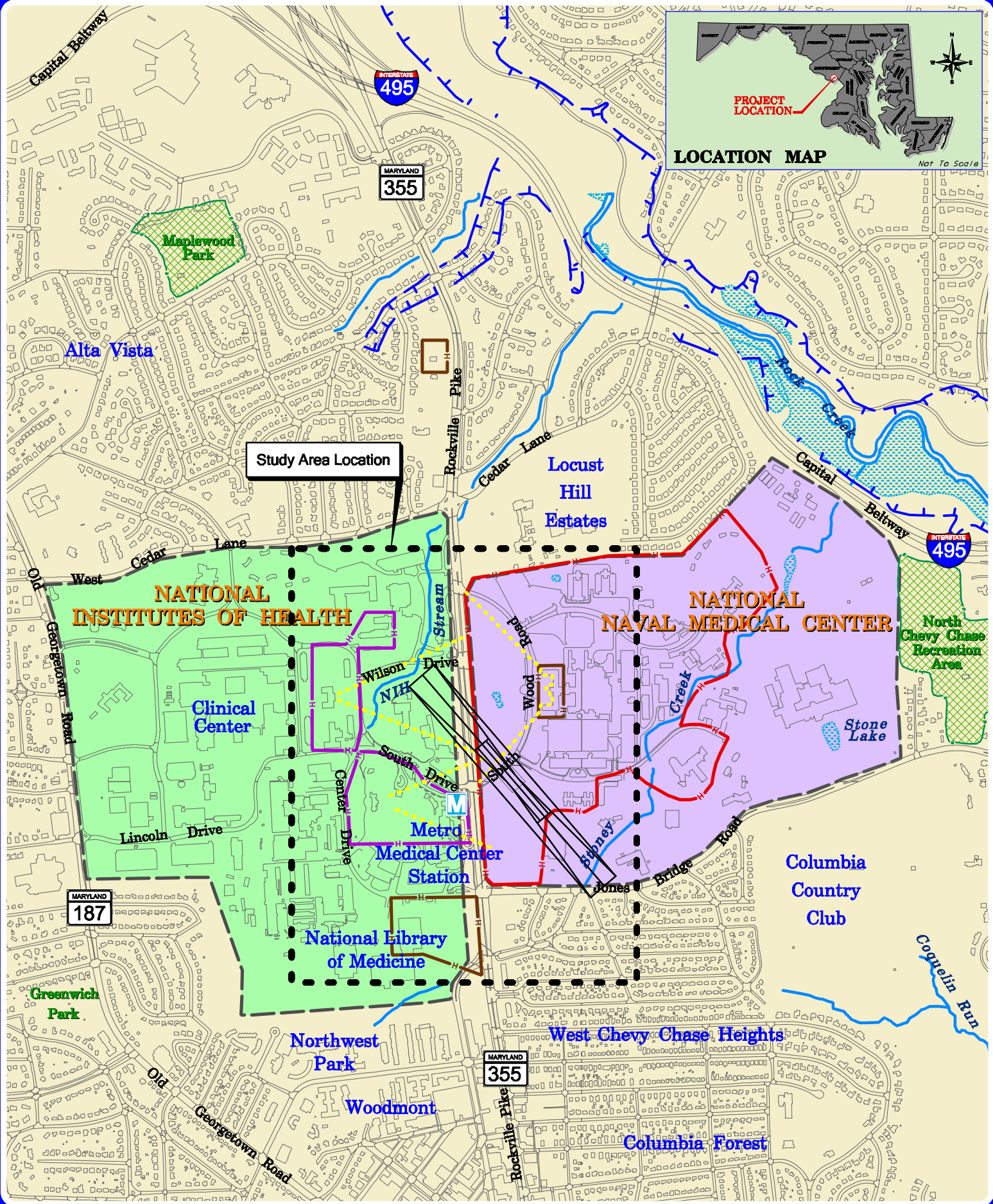
Purpose - This project is intended to: (1) enhance/improve access to mass transit facilities; and (2) improve the mobility and safety of pedestrians and bicyclists crossing MD 355/Rockville Pike and improve traffic operations at the existing intersection of South Wood Road/South Drive/MD 355.

Need - Currently transit users, pedestrians, and bicyclists wishing to cross MD 355 to get to the National Navy Medical Center (NNMC) from the Medical Center Metrorail Station or the National Institutes of Health (NIH) must compete with very high volumes of traffic traveling between South Wood Road, South Drive, and MD 355. This project is needed to improve the mobility, traffic operations, and safety for all facility users within the project area by reducing existing conflicts between pedestrians and vehicles.

B. Goals and Objectives

The MD 355/Rockville Pike Crossing Project would improve access to mass transit facilities in one of the most congested areas in the region. It would better integrate connectivity between rail, bus, car/vanpool, and pedestrian/bicycle commuters. Increasing transit usage is part of the approach to mitigate forecasted congestion levels in this area of Montgomery County associated with the Base Realignment and Closure (BRAC) action impacts. The following primary goals and objectives related to the Purpose and Need were identified for this project:

- Improve pedestrian mobility between NNMC, NIH, and Medical Center Metrorail Station facilities through improved crossing of MD 355
- Improve pedestrian safety within the project area by minimizing conflicts with vehicular traffic



Legend

- Metro Station
- Parks
- 100-Year Floodplain
- Vegetated Wetlands
- Streams and Open Waters
- Historic District Boundary
- National Register List
- National Register Eligible
- Protected Open Space and Historic Resource Viewsheds
- Airspace Restrictions

550' 0 550' 1,100'

Scale:1"= 1,100'

DRAFT: WORK IN PROGRESS
CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

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Department of Transportation

MD 355 (Rockville Pike) Crossing Study
Study Area Map

Date
September 2010

URS

Figure No.
1

- Improve traffic operations to and from NNMC and NIH/Medical Center Metrorail Station at the MD 355/South Wood Road/South Drive intersection.

The following secondary goals and objectives are not central to the Purpose and Need, but are still important considerations. These attributes will not be used as the main factors in determining which alternatives should be analyzed or carried forward, but will be used to support selection of a Preferred Alternative:

- Promote alternative modes of transportation such as rail, bus, car/vanpools, pedestrians and bicycle commuting
- Improve efficiency with which emergency and transit vehicles move between the NIH and NNMC campuses.

EXISTING CONDITIONS

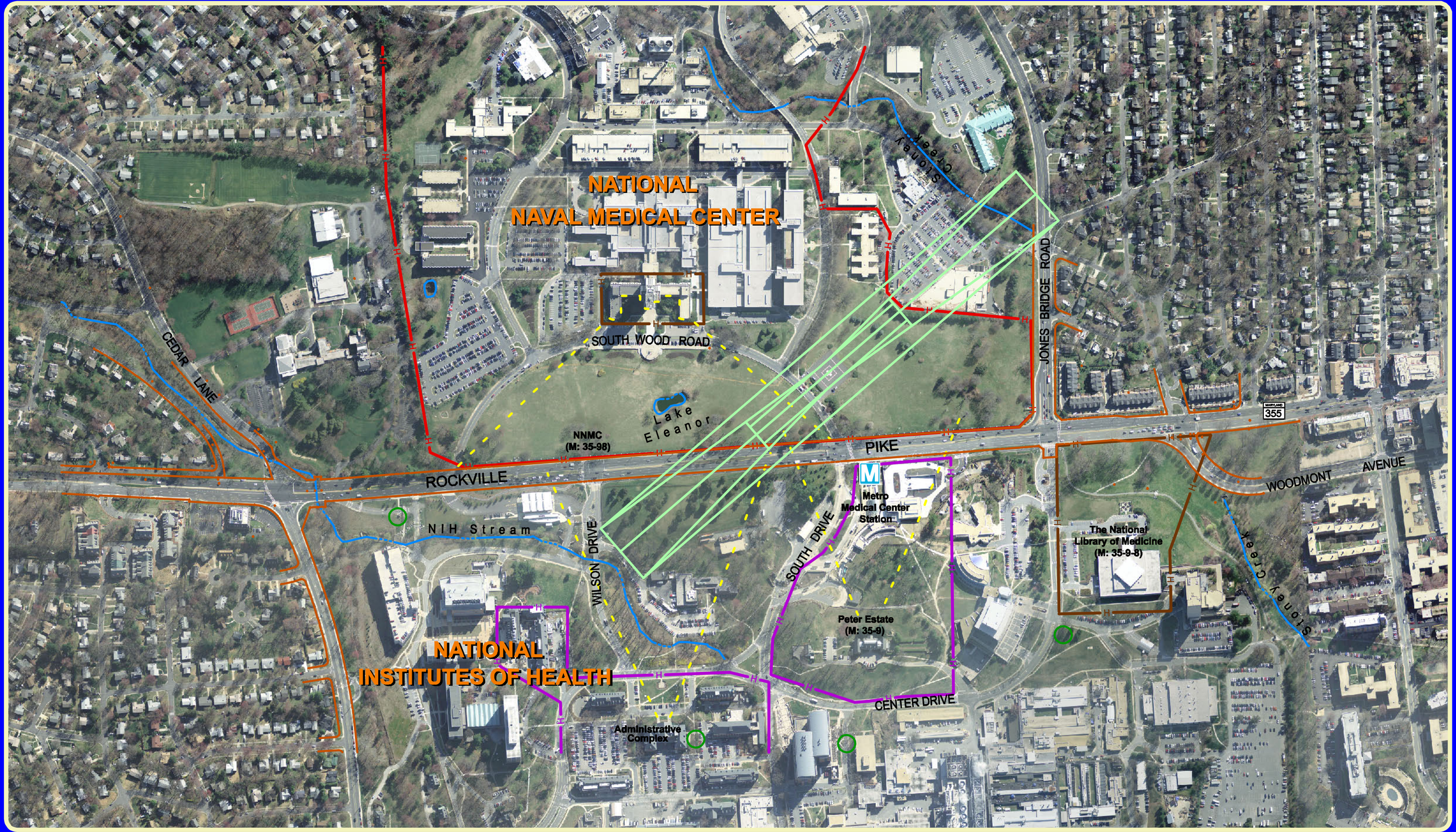
Currently, South Drive provides access to the Medical Center Metrorail Station Kiss & Ride lot, the NIH South Drive Gate, and a bus loop for Metrobuses and Ride On buses. Similarly, South Wood Road provides access to NNMC and is the only gate that allows entry 24 hours per day. More detailed background information on the existing conditions, future no-build forecasts, and traffic operational analyses are documented in the *MD 355 Purpose and Need Statement*.

In addition to traffic studies, the study team conducted an environmental overview of existing documentation and mapping. The team also initiated coordination with various resource agencies to identify natural, socio-economic, and cultural resources that exist within the MD 355 study area. **Figure 2** provides an overview of the existing natural environmental and cultural resources within the study area

A. Existing Traffic Operations

The study team used the traffic volumes developed for this study to evaluate the traffic operations at the MD 355/South Wood Road/South Drive intersection for the purpose of identifying which preliminary alternatives could potentially meet the project Purpose and Need. Traffic operations modeling programs, Synchro and SimTraffic, were used to assess the existing and future traffic operations at this intersection and the roadway network along MD 355 between Cedar Lane and Jones Bridge Road. The Synchro and SimTraffic models, once calibrated for existing conditions, were used to obtain Level-of-Service (LOS), delay, and queuing information that were used in the assessment of future No-Build conditions as well as the projected operations of each preliminary alternative.

The LOS is a qualitative measure of operational conditions within a traffic stream. LOS ranges from A to F, where a LOS A represents optimal conditions and a LOS F represents saturated or failing conditions. However, when an intersection is functioning at a LOS F it may not be possible to quantify the degree of failing operations. In this case, delay can be used as a metric that is more meaningful and easier to compare across movements and scenarios. Delay is defined as the average amount of time between when a vehicle first stops in the queue approaching an intersection and when the vehicle clears the intersection.



Legend

- Historic District Boundary
- National Register List
- National Register Eligible
- Streams / Waters of the U.S.
- County Champion Tree
- Protected Open Space and Historic Resource Viewsheds
- Metro Station
- Existing Roadway Right-of-Way
- Airspace Restrictions

0 400' 800'

SCALE: 1"=400'

DRAFT: WORK IN PROGRESS
CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

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MD 355 (Rockville Pike) Crossing Study
Environmental Features

Date
September 2010

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Figure No.
2

The highest existing volumes at the intersection of MD 355 and South Wood Road/South Drive are along southbound MD 355 in the AM peak and along northbound MD 355 in the PM peak. With the existing signal timing in place, which prioritizes the mainline, the movements on the east and west approaches experience the worst levels of service. Existing LOS and delay are summarized in **Table 1**, below.

Table 1: Existing Peak Hour LOS and Delay (seconds per vehicle) for the Intersection of MD 355/South Wood Road/South Drive

Condition	AM Peak Hour		PM Peak Hour	
	LOS	Delay	LOS	Delay
Existing	C	30.6 s/veh	F	121.7 s/veh

In addition to traffic congestion issues, there were a total of 64 reported crashes at the intersection of MD 355 and South Drive/South Wood Road, including the approaches, during the analysis period. Some key safety concerns identified include:

- Rear-end collisions were the most common type
- Six single vehicle-pedestrian related collisions were reported
- 25 percent of the crashes resulted in injury, with six of those resulting in serious injury
- 12 collisions involved transit buses.

B. Existing Natural Environmental Resources

The study area consists of two developed properties, the NIH and NNMC, and natural habitats have been replaced by urban uses and maintained trees and lawn. Existing waterways, floodplains and terrestrial areas have been evaluated in reports prepared by NIH and NNMC and are described below.

Floodplains – The 100-year floodplain of Stoney Creek is located on the NNMC facility beyond the project area. The floodplain associated with the NIH stream is also located beyond the project area.

Wetlands – Lake Eleanor is located in the lawn area of the NNMC between MD 355 and the Naval Hospital Tower (Palustrine Open-Water). No wetlands are associated with the existing stream system (Stoney Creek) which is located beyond the study area (Wetland Investigation Report, NNMC FEIS). No wetlands are present on the NIH campus and the NIH stream is located to the west of the study area (NIH Master Plan 2003 Update, March 2005).

Water Quality – The study area is located in the Lower Rock Creek Watershed. This watershed is designated a restoration area and as a result, stormwater retrofit, stream restoration and habitat improvement opportunities are being examined (NNMC 2003 Master Plan Update, March 2008).

Terrestrial Habitat – According to previous studies, no forest resources are present in the project area. Five of Montgomery County's champion trees are located on the NIH campus;

however, they are outside of the study area. Vegetation on the NNMC property along MD 355 consists of "formal plantings found around developed areas." Wooded areas are located along the eastern portion of the property beyond the study area. According to available resources, the wooded areas on the NIH campus are maintained tree lawns and do not meet the definition of forest established by Montgomery County and the Maryland Department of Natural Resources (MDNR).

Roadside trees may be located within the publicly-owned right-of-way along MD 355. Significant/specimen trees, those having a diameter of 24 inches or greater, were identified during field surveys and will be avoided if possible during the alternatives development phase. Any unavoidable impacts to trees within the publicly-owned right-of-way will require a Roadside Tree Permit from MDNR Forest Service.

Rare, Threatened, and Endangered Species – According to the US Fish and Wildlife Service (USFWS) (letter dated January 27, 2010) and the MDNR Natural Heritage Division (letter dated January 13, 2010), there are no known occurrences of Federal or State listed rare, threatened, or endangered species in the study area.

C. Existing Cultural Resources

Above-Ground Resources – Research revealed twenty (20) documented above-ground properties within a mile radius of the project area. The majority of these properties are located within the NIH or NNMC complexes.

NIH Resources – The NIH undertook a cultural resource inventory of its property and determined twenty (20) buildings are eligible for listing in the National Register of Historic Places (NRHP), either individually or as contributing resources to a historic district. Two of these buildings are located within the project area; "The Stone House," and the Caretaker's Cottage, and are known as the George Freeland Peter Estate (M: 35-9-1). In 1985, the Maryland Historical Trust determined the Peters Estate is eligible for listing in the National Register, but the documentation does not clearly define it as a Historic District. The Peter Estate consisted of the following contributing resources; the Main House (or "Stone House"), the Caretaker's Cottage, the formal garden off south axis, the rounded stone wall and fountain and the terraced walls on the hill below primary façade. The MHT documentation considers the south side of South Drive and the west side of Wisconsin Avenue as a contributing landscape resource that is included within M: 35-9-1.

NNMC Resources – The NNMC Historic District, which was listed in the NRHP in 1998 and consists of 131 acres and eighteen (18) contributing buildings. The historic district's landscape fronts Rockville Pike and is identified in the NRHP nomination form as contributing to the historic character of the property. The nomination defines the significance of the landscaped semi-circular area in front of build 1 (Bethesda Naval Hospital Tower) as "An integral part of Building 1 … its front landscape area and monumental flagpole set directly on center with the main tower." The formal landscape immediately west of Building 1 is semicircular in appearance, shaped by the formal semi-circular drive (Wood Road) that leads visitors into the site from the north and from the south." The nomination emphasizes the role the landscape plays

in defining the architectural experience of the building: "the extensive greensward surrounding the monument remains much as it appeared after its initial development. The experience, therefore, of entering a prominent and distinguished naval facility is clear and one is compelled to acknowledge and admire that which remains of its architectural character." The landscaped grounds south of Wood Drive, east of MD 355 and north of Jones Bridge Road are also considered a contributing resource in the NNMC NRHP district.

Archaeological Sites – Research identified sixteen (16) documented archaeological sites within the one-mile study area. Of these sites, eleven (11) are prehistoric and five (5) are multicomponent sites that exhibit evidence of both prehistoric and historic occupation.

While the study area has a moderate potential for containing archaeological sites, prior disturbance within the Archaeological Areas of Potential Effect (APEs) significantly reduces that potential.

DEVELOPMENT OF PRELIMINARY ALTERNATIVES

To meet the outlined goals and objectives, the study team investigated a wide array of potential concepts to understand their feasibility. These concepts ranged from pedestrian-only crossings of MD 355 to overpass and underpass concepts that could accommodate vehicles as well as pedestrians and bicyclists. Once the Purpose and Need was drafted and agreed to by the project stakeholders, the study team developed a set of preliminary alternatives from the concepts that could potentially meet the project Purpose. The preliminary alternatives that were developed were grouped into four categories of improvement type, including:

- No-Build
- Transportation System Management/Transportation Demand Management (TSM/TDM)
- Interchange Alternatives
- At-Grade Intersection Improvements with Pedestrian/Bicyclist Crossing.

For each of the proposed preliminary alternatives list below, pedestrian and bicycle access facilities designed to be in compliance with the Americans with Disability Act (ADA) would be maintained during and after construction, in configurations similar to existing conditions. Similarly, access to transit services (e.g., Metrobus, Ride On, Metrorail, Kiss & Ride, etc.) would be maintained as proposed improvements are implemented. Coordination with SHA on other MD 355 intersection improvement projects at Jones Bridge Road and Cedar Lane has been and will continue throughout the design and construction process.

A. No-Build

Alternative 1 – The No-Build Alternative is required as part of the National Environmental Policy Act (NEPA) to form a basis of comparison for the build alternatives. With the No-Build Alternative, no substantial improvements would be made in the study area beyond those improvements included in the County's Capital Improvement Plan (CIP) or Metropolitan Washington Council of Governments' (MWCOG's) Constrained Long Range Transportation

Plan (CLRP) for 2035. **Table 2**, below, provides a summary of the forecasted 2030 No-Build traffic conditions in LOS and intersection delay.

Table 2: 2030 No-Build Peak Hour Intersection LOS and Delay (seconds per vehicle)

Condition	AM Peak Hour		PM Peak Hour	
	LOS	Delay	LOS	Delay
2030 No-Build	D	36.5 s/veh	F	136.9 s/veh

As mentioned previously, the study team also investigated the operations of the roadway network along MD 355, between Cedar Lane and Jones Bridge Road. SimTraffic software was used to evaluate the operations of the corridor segment for 2030 No-Build conditions with typical NNMC gate functions, as well as with an assumed increase in NNMC gate delays. The assumed delays at the NNMC gate were evaluated in response to concerns that the operations at the gate could be relatively easy to disrupt, particularly with visitors not accustomed to security requirements. The potential delays were then evaluated for their affect on the proposed improvements to determine the overall effect on network congestion.

Based on standard gate operations data, normal processing time was assumed to be approximately eight seconds per vehicle. To assess the impact of the potential delay at the gate to the overall network the traffic team assumed 19 seconds per vehicle if a delay were to occur at the gate. The network delay data is presented below, in **Table 3**, as a percentage of overall network delay, where 2030 No-Build is the baseline (i.e., network is considered to function with a forecasted delay of 545.2 s/veh in the AM peak and 1341.3 s/veh in the PM peak). In the tables provided in this document, any percentage above zero represents increased delay; likewise, a negative value, under zero percent, shows a potential decrease in delay. As shown in **Table 3**, additional delays at the NNMC gate would increase network delay by 15 percent in the AM peak, when most traffic is entering NNMC and by two percent in the PM peak over normal No-Build operations.

Table 3: Peak Hour Network Delay for 2030 No-Build, and 2030 No-Build with Additional Delay at the NNMC Gate

Condition	AM Peak Hour Delay (Percent Change)	PM Peak Hour Delay (Percent Change)
2030 No-Build	545.2 s/veh (NA)	1341.3 s/veh (NA)
2030 No-Build With Additional NNMC Gate Delay	624.7 s/veh (15%)	1367.6 s/veh (2%)

B. Transportation System Management/Transportation Demand Management (TSM/TDM)

Alternative 2: TSM/TDM Alternative – This alternative consists of at-grade pedestrian and bicyclist facility enhancements developed to meet the project Purpose and Need while attempting to minimize costs and impacts. TDM elements include improving transit passenger amenities (e.g., enhanced bus shelters, passenger information systems, etc.), encourage NNMC to investigate opportunities to assign drivers to use other access gates, encouraging telecommuting and use of bicycles, transit-oriented development, and reduce vehicle dependency. The TSM

elements include minor capacity improvements, signal phasing or timing modifications, signal prioritization, and traffic calming measures (e.g., advanced pedestrian notification signals, synchronization of traffic signals, lighted crosswalks, flashing caution lights, pedestrian refuge median, accessible pedestrian signals, raised and/or textured pavement, improved sight distance, enlarged curb radii, etc.). Specifically, the following TSM elements are included in Alternative 2:

- Extend the southbound left turn lane (replacing exiting median with roadway surface to minimize impacts) on MD 355 approximately 425 feet to provide additional queue storage length to improve through traffic operations.
- Provide a separate pedestrian crossing signal phase that would allow pedestrians to cross at the same time as southbound left turning vehicles to remove all pedestrian/vehicular conflicts, improving pedestrian mobility and safety.
- Investigate opportunities to provide Kiss & Ride and bus pull off facilities on the east side (NNMC) of MD 355. (Note: these facilities were considered for all preliminary at-grade improvement options)
- Introduce traffic calming measures such as pedestrian median refuge, in-roadway lighted crosswalks, flashing caution lights, raised pavement, improved pedestrian signal notification and accessibility.
- Increase the curb radius from southbound MD 355 to South Drive to accommodate wider turning radii of buses.

See **Figure 3** for more details.

C. Interchange Alternatives

This category of improvements would involve grade separating MD 355 and South Wood Road/South Drive so that vehicular, pedestrian, and bicyclist traffic using South Wood Road/South Drive would no longer conflict with traffic along MD 355. The proposed relocation of the NNMC gate (an improvement that is separate from this study) was considered in the development of these alternatives.

Alternative 3: Interchange with MD 355 Under South Wood Road/South Drive – With this alternative, MD 355 would be lowered to cross beneath South Wood Road/South Drive, thereby creating a grade separation of the intersecting roadways. South Wood Road/South Drive would be carried on structure at its existing grade (with little to no change in elevation) to allow vehicles, pedestrians, and bicycles to cross over the MD 355 travel lanes. From south of the Wilson Drive intersection, MD 355 would slope down at a three percent grade under the South Wood Road/South Drive overpass then rise at a six percent grade, tying into the Jones Bridge Road approach. Vehicular access to MD 355 from South Wood Road/South Drive would be provided via an at-grade T-intersection 400 feet north of the South Wood Road/South Drive crossing. All existing turning movements (those normally occurring at South Wood Road/South Drive) would be relocated via a jug handle to a signalized intersection on the NIH campus (Note: The study team considered a roundabout in lieu of a signal at this new intersection; however, the analysis resulted in poor traffic operations and increased impacts and was therefore dropped from consideration). See **Figure 4** for more details on Alternative 3.

Alternative 2

Transportation System Management (TSM) / Transportation Demand Management (TDM)

Transportation System Management (TSM)

- Signal phasing or timing modifications, including exclusive pedestrian phase
- Priority signal control for pedestrians and transit vehicles
- Enhanced synchronization of traffic signals
- In-Roadway warning lights at crosswalks
- Flashing caution lights to warn drivers of pedestrians
- Pedestrian refuge island in median
- Accessible pedestrian signals
- Raised and / or textured pavement at crosswalks
- Improved sight distance
- Enlarged curb radii
- Extended southbound MD 355 left turn lane to South Wood Road
- Kiss and Ride Lot and / or Park and Ride Lot on the east side of MD 355

Transportation Demand Management (TDM)

- Improving transit services system-wide
  - Enhanced bus shelters
  - Enhanced passenger information system
- Encouraging telecommuting and use of bicycles
- Transit-oriented development incentives
- Optimization of land use

Improvements to South Wood Road and Gate to be Constructed by NNMC

South Drive

Kiss & Ride

Metro Medical Center Station

NIH Visitor Center

NIH Visitor Parking

Rockville Pike

South Wood Road

Planned NNMC Canopy and Guard House

Proposed Accessible Pedestrian Signal (APS)

Proposed Pedestrian Refuge Island in Median

Legend

- Metro Station
- Bus Stop
- Existing Signal
- Proposed Signal
- Stormwater Facility
- Proposed Pavement Resurface
- Proposed Full-Depth Pavement
- Proposed Underpass
- Proposed Overpass
- Proposed Sidewalk & Bikepath
- Proposed Median
- Streams / Waters of the U.S.
- Proposed Fence
- Historic District Boundary
- National Register List
- National Register Eligible
- Proposed Crosswalk

0 100' 200'

SCALE: 1"=100'

DRAFT: WORK IN PROGRESS
CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

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MD 355 (Rockville Pike) Crossing Study
~~Alternative 2A~~

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Figure No.
3

Alternative 3

Grade Separation of
MD 355 Under South
Wood Road / South Drive

At–Grade
Hiker /Biker Trail

Realign
Hiker /Biker
trail

Kiss & Ride

South Drive

Metro
Medical Center
Station

NIH
Visitor
Center

NIH
Visitor
Parking

Rockville Pike

MARYLAND
355

South Wood Road

Planned NNMC Canopy
and Guard House

Proposed Overpass
of Depressed MD 355

At–Grade
Sidewalk

Legend

- Metro Station
- Bus Stop
- Existing Signal
- Proposed Signal
- Stormwater Facility
- Proposed Pavement Resurface
- Proposed Full-Depth Pavement
- Proposed Underpass
- Proposed Overpass
- Proposed Sidewalk & Bikepath
- Proposed Median
- Streams / Waters of the U.S.
- Proposed Fence
- Historic District Boundary
- National Register List
- National Register Eligible
- Proposed Crosswalk

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

N W E S

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CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

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MD 355 (Rockville Pike) Crossing Study
Alternative 3

Date
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Figure No.
4

Alternative 4: Tight Urban Diamond Interchange – With this alternative, MD 355 would be lowered to cross beneath a reconstructed South Wood Road/South Drive connection (with the same three and six percent grades as Alternative 3) as a diamond interchange. This option would provide access to/from MD 355 while allowing movement between NIH and NNMC for vehicles, pedestrians, and bicycles separated from MD 355 through traffic. Access to/from MD 355 would be provided via right exit/merge lanes. Along with other permanent property impacts, this proposed improvement would require temporary relocation of vehicular movements to a new signalized intersection 400 feet north of the new crossing during construction. Also, this interchange design would prevent traffic heading south from NIH and NNMC from turning left onto eastbound Jones Bridge Road. As the study team was refining Alternative 4, three different scenarios were investigated; 1) single lane ramps to minimize property and cultural resource impacts; 2) double lane ramps to increase roadway capacity and operations; and 3) a pedestrian only signal phase for improved pedestrian mobility and safety. See **Figure 5** for more details.

D. At-Grade Intersection Alternatives with Pedestrian/Bicyclist Crossing Options

This category of alternatives includes improvements to intersection operations at South Wood Road/South Drive to meet the traffic operational needs identified in the study area combined with one of five pedestrian/bicyclist mobility and safety options proposed for this study to meet the transit access and pedestrian/bicycle mobility and safety needs identified in the study area. The three intersection improvements are described below, followed by the five pedestrian/bicyclist crossing options. The intersection improvements take into consideration the proposed relocation of the NNMC gate. Any of the at-grade intersection improvements could be combined with any of the five crossing options. Similarly to Alternative 2, the study team investigated opportunities to include a new Kiss & Ride and bus pull off facilities on the east side of MD 355 (NNMC property) for each at-grade alternative.

Alternative 5: Double Left Turns – Double left turn lanes are proposed from southbound MD 355 into NNMC and from NIH to northbound MD 355 to increase the available storage for these turning vehicles and improve traffic operations. The proposed southbound MD 355 double left turn lanes would require a realignment of northbound MD 355 travel lanes. Even with a grade-separated pedestrian/bicyclist crossing, at-grade pedestrian crossing facilities would still be required for those who choose not to use the proposed new crossing option. See **Figure 6** for more details.

Alternative 6: Southbound Jug Handle – All existing left turning vehicle movements (both into and out of NIH and NNMC) would be relocated to a new signalized intersection approximately 400 feet north of the South Wood Road/South Drive intersection. The existing South Wood Road/South Drive intersection would be reconfigured to accommodate through and right turning movements between NIH and NNMC and on MD 355. Similar to Alternative 5, an at-grade pedestrian/bicyclist crossing would be required for those who choose not to use the proposed new crossing option. As with Alternative 3, all turning movements would be relocated via the jug handle to a signalized intersection on the NIH campus (Note: Similar to Alternative 3, a roundabout was investigated here in lieu of a standard traffic signal, but was dropped from consideration due to impacts and poor operations). A traffic signal would still exist at the

Alternative 4

Tight Urban Diamond Interchange

MONTGOMERY COUNTY 1776 MARYLAND

MARYLAND 355

IMPACTS TO WMATA VENT

Relocate Metrobus / Ride On Bus Stop

Temporary Signal

Realign pedestrian/bicycle trail

Existing Kiss & Ride Area

South Drive

South Wood Road

Planned Final Denial Barrier

Possible Closure of Heliport Access

Proposed Canopy and Guard House

Proposed Turnstiles

Proposed Overpass

Metro Medical Center Station

NIH Visitor Center

NIH Visitor Parking

Rockville Pike

IMPACTS TO WMATA VENT

Center Drive

Jones Bridge Road

Glenbrook Parkway

Woodmont Ave

Legend

- Metro Station
- Bus Stop
- Existing Signal
- Proposed Signal
- Stormwater Facility
- Proposed Pavement Resurface
- Proposed Full-Depth Pavement
- Proposed Underpass
- Proposed Overpass
- Proposed Sidewalk & Bikepath
- Proposed Median
- Streams / Waters of the U.S.
- Proposed Fence
- Historic District Boundary
- National Register List
- National Register Eligible
- Proposed Crosswalk

0 240' 480'

SCALE: 1"=240'

DRAFT: WORK IN PROGRESS
CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

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MD 355 (Rockville Pike) Crossing Study
Alternative 4

Date
September 2010

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Figure No.
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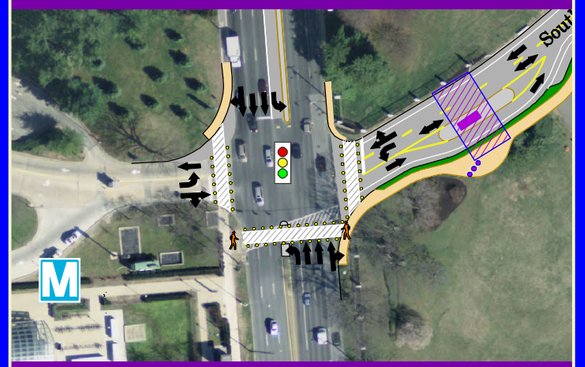
Alternative 5

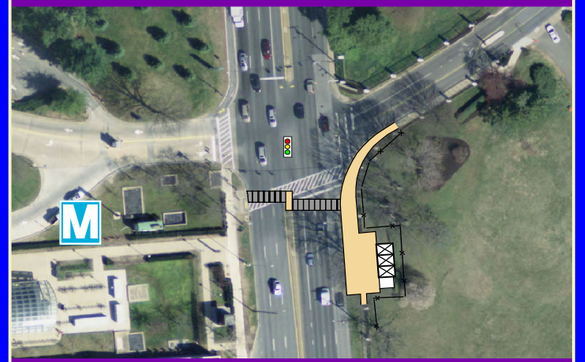
Double Left Turns with Pedestrian Crossing

TSM At-Grade Enhancements



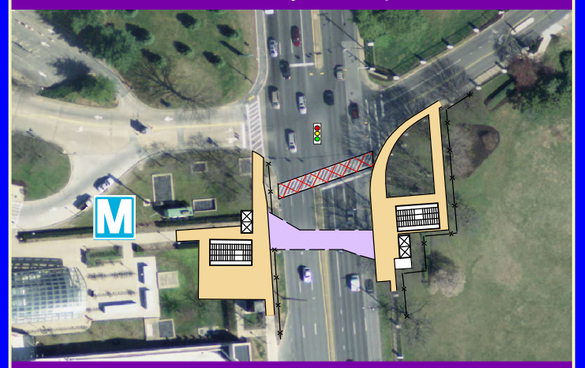
Does not reduce the pedestrian / vehicle conflict points and is not recommended for further consideration.

Deep Tunnel with Elevators

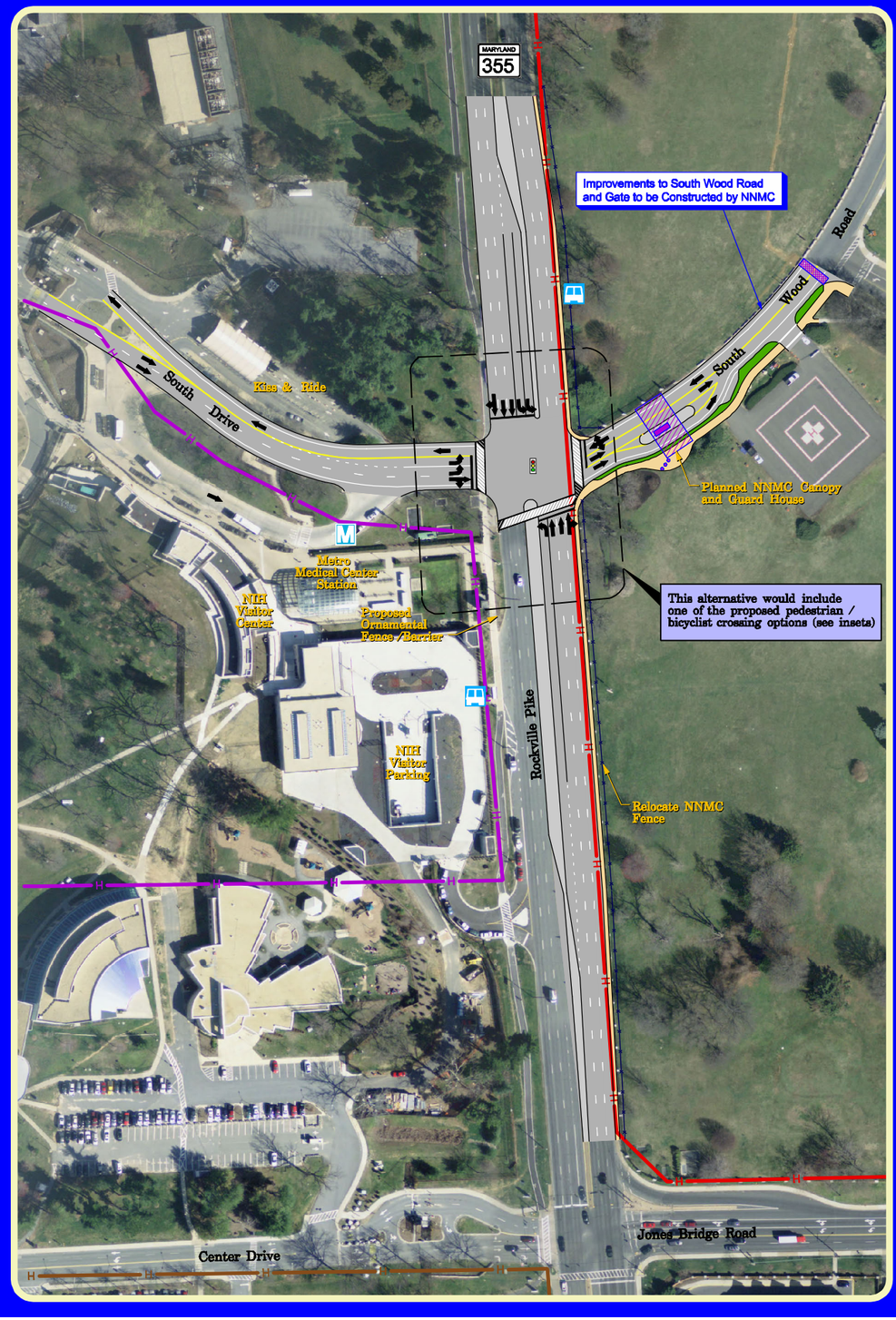


Reduces pedestrian / vehicle conflict points, but only serves Metrorail riders. As a stand alone option is not recommended for further consideration, but is being studied along with the pedestrian/bicycle underpass option.

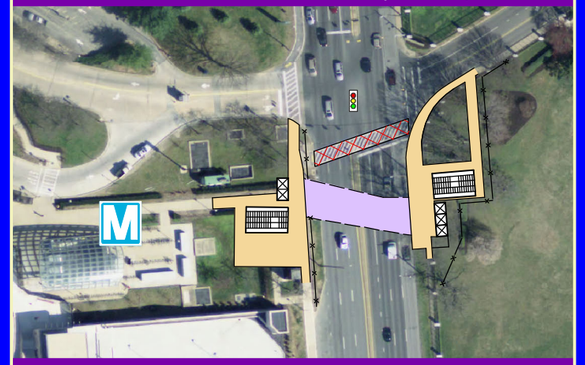
Pedestrian / Bicycle Underpass



Reduces pedestrian / vehicle conflict points and is being recommended for further study.

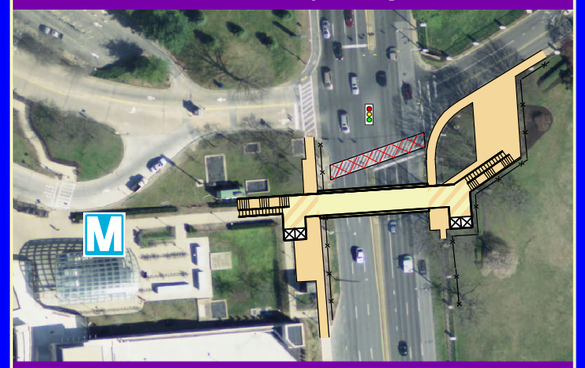


Deep Elevators and Pedestrian / Bicycle Underpass



Reduces pedestrian / vehicle conflict points and is being recommended for further study.

Pedestrian / Bicycle Bridge



Reduces pedestrian / vehicle conflict points, does not provide convenient access to pedestrians and bicyclists and is not recommended for further study.

Legend

- Metro Station
- Bus Stop
- Existing Signal
- Proposed Signal
- Temporary Pavement
- Proposed Pavement
- Proposed Underpass
- Proposed Overpass
- Proposed Median
- Proposed Sidewalk & Bikepath
- Proposed Pavement Removal
- Proposed Fence
- Proposed Crosswalk
- Historic District Boundary
- National Register List
- National Register Eligible
- Streams / Waters of the U.S.

NOT TO SCALE

DRAFT: WORK IN PROGRESS
CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

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Alternative 5

Date
September 2010

URS

Figure No.
6

intersection of MD 355/South Wood Road/South Drive. Only east-west through movements between NIH and NNMC would be permitted at this location. See **Figure 7** for more details.

Alternative 7: Northbound Jug Handle – Existing southbound left, and northbound left and right turning movements would be relocated approximately 400 feet south of the South Wood Road/South Drive intersection to tie-in with proposed jug handle lanes constructed on NNMC property adjacent to the helipad. The jug handle would provide northbound access to NIH and northbound and southbound access to NNMC. A traffic signal would still exist at the intersection of MD 355/South Wood Road/South Drive. However, no inbound traffic would be permitted to enter South Wood Road at the existing intersection. The South Wood Road security gate would be relocated to process jug handle traffic. Traffic bound for NIH would have an exclusive barrier separated lane to avoid having to stop at the NNMC gate. See **Figure 8** for more details.

E. Pedestrian/Bicyclist Crossing Options

As noted above, the following options were developed to be combined with the at-grade alternatives to satisfy all elements of the project Purpose and Need. The options were specifically intended to address pedestrian and bicyclist safety and mobility while adhering to the Americans with Disability Act (ADA) design requirements. The TSM/TDM pedestrian/bicyclist crossing option includes the portion of Alternative 2 described above that improves pedestrian mobility and safety. The other four options are based on the concepts developed as part of the Washington Metropolitan Area Transit Authority (WMATA) study completed in July 2009. See **Figures 6** through **8** for more details on all of the proposed Pedestrian/Bicyclist Crossing Options.

TSM Bicycle/Pedestrian At-Grade Crossing Option – Based on the elements investigated as part of Alternative 2 (but without geometric improvements), these at-grade pedestrian/bicyclist improvements at the existing MD 355/South Wood Road/South Drive intersection would include a separate pedestrian signal phase, advanced pedestrian notification signals, synchronization of traffic signals, lighted crosswalks, flashing caution lights, pedestrian refuge median, accessible pedestrian signals, raised and/or textured pavement.

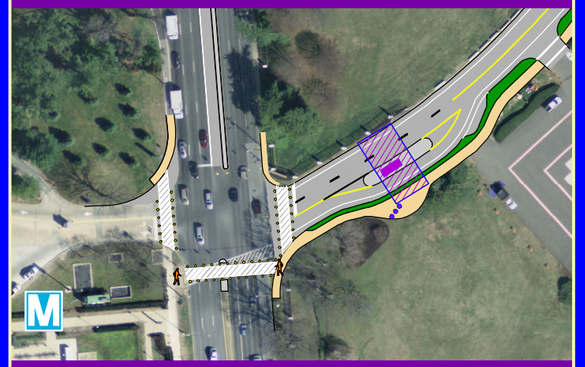
Deep Elevator Option – A series of high speed elevators would be installed to connect the east side (NNMC) of MD 355 directly to the Metrorail station, approximately 100 feet below the surface. This option would benefit Metrorail riders, but not surface pedestrians and bicyclists. As an example of the efficiency of high speed elevators, WMATA operates six high speed elevators at the Forest Glen Metrorail station, moving passengers approximately 200 feet in 20 seconds (approximately 600 feet per minute). An at-grade crossing would be maintained for those who choose not to use the deep elevators.

Shallow Pedestrian/Bicyclist Underpass Option – A pedestrian and bicyclist underpass of MD 355 would be constructed approximately 25-50 feet below the surface, requiring Metrorail riders to exit the station to access the crossing. This option would be accessible by all pedestrians and bicyclists crossing MD 355. ADA compliant ramps and/or elevators would be provided along with escalators and/or stairs to maintain accessibility. An at-grade crossing would be maintained for those who choose not to use the underpass. The average WMATA-operated escalator runs at

Alternative 6

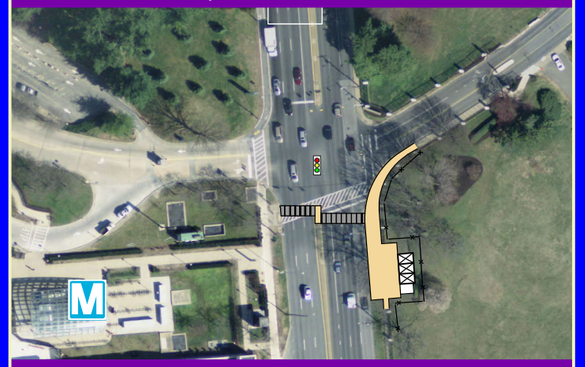
NIH Jug Handle with Pedestrian Crossing

TSM At-Grade Enhancements



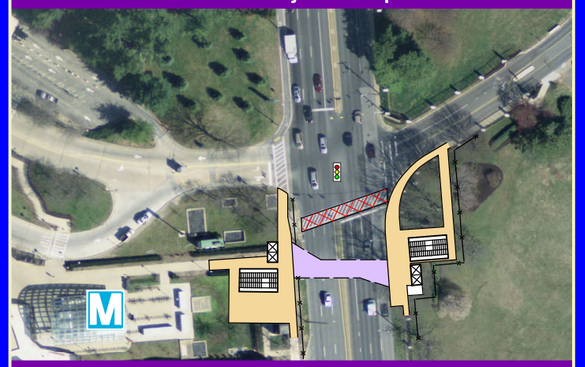
Does not reduce the pedestrian / vehicle conflict points and is not recommended for further consideration.

Deep Tunnel with Elevators

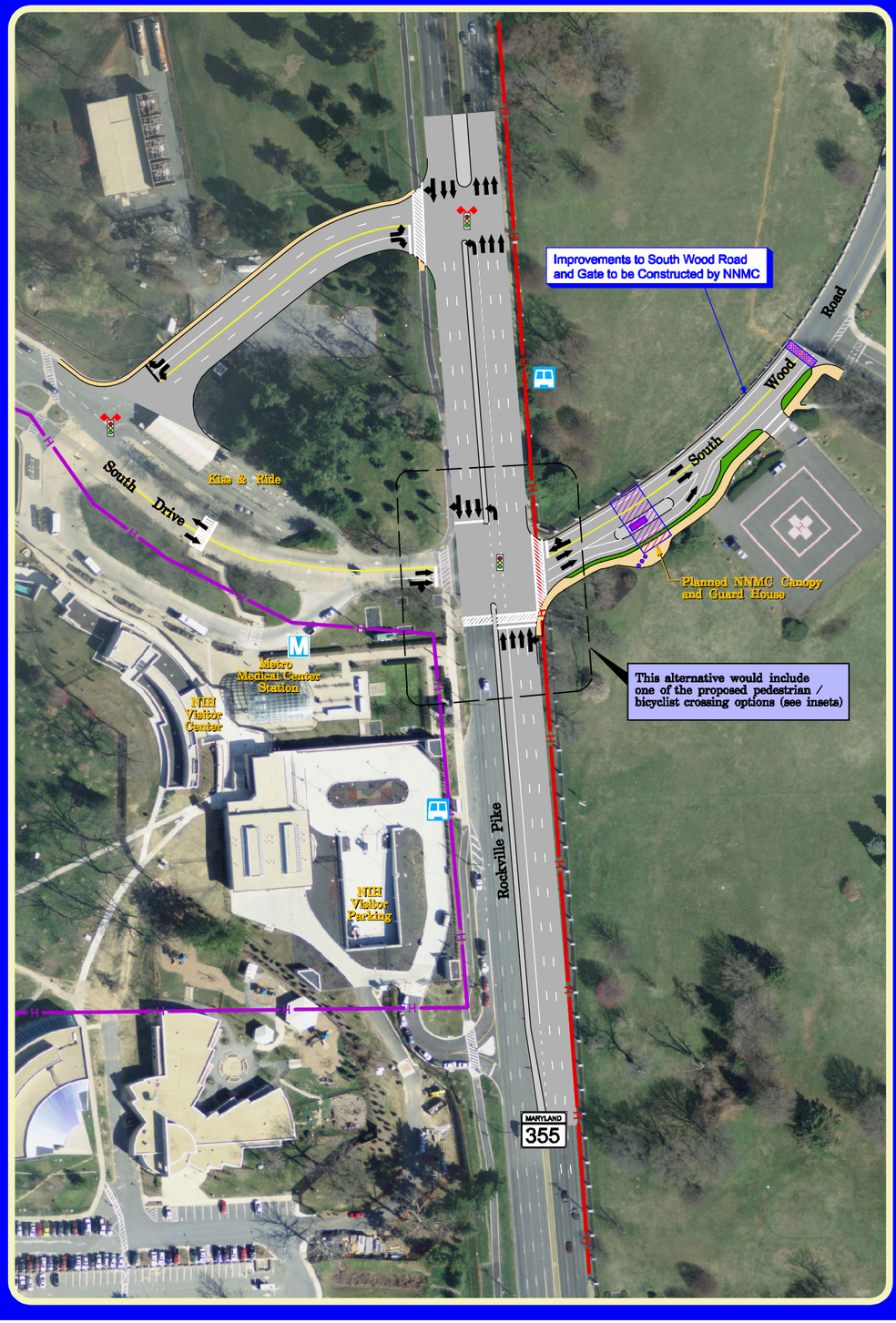


Reduces pedestrian / vehicle conflict points, but only serves Metrorail riders. As a stand alone option is not recommended for further consideration, but is being studied along with the pedestrian/bicycle underpass option.

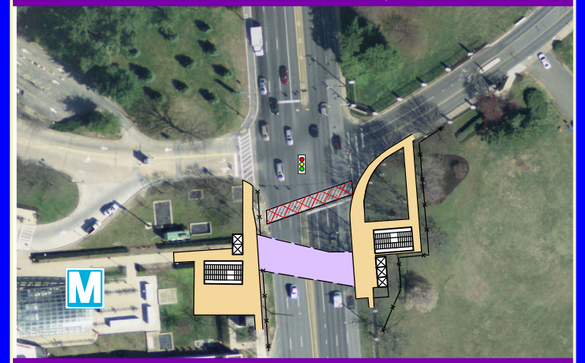
Pedestrian / Bicycle Underpass



Reduces pedestrian / vehicle conflict points and is being recommended for further study.

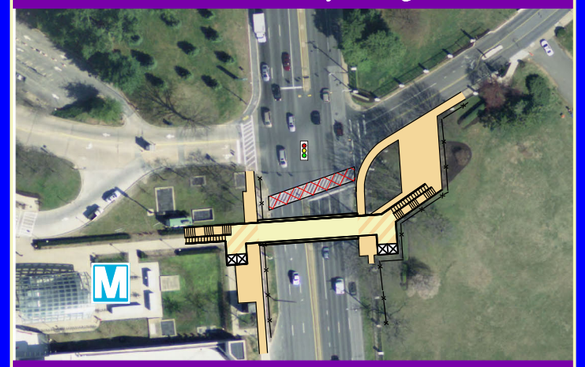


Deep Elevators and Pedestrian / Bicycle Underpass



Reduces pedestrian / vehicle conflict points and is being recommended for further study.

Pedestrian / Bicycle Bridge



Reduces pedestrian / vehicle conflict points, does not provide convenient access to pedestrians and bicyclists and is not recommended for further study.

Legend

- Metro Station
- Bus Stop
- Existing Signal
- Proposed Signal
- Temporary Pavement
- Proposed Pavement
- Proposed Underpass
- Proposed Overpass
- Proposed Median
- Proposed Sidewalk & Bikepath
- Proposed Pavement Removal
- Proposed Fence
- Proposed Crosswalk
- Historic District Boundary
- National Register List
- National Register Eligible
- Streams / Waters of the U.S.

NOT TO SCALE

DRAFT: WORK IN PROGRESS
CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

N W E S

Montgomery County
Department of Transportation

MD 355 (Rockville Pike) Crossing Study
Alternative 6

Date
September 2010

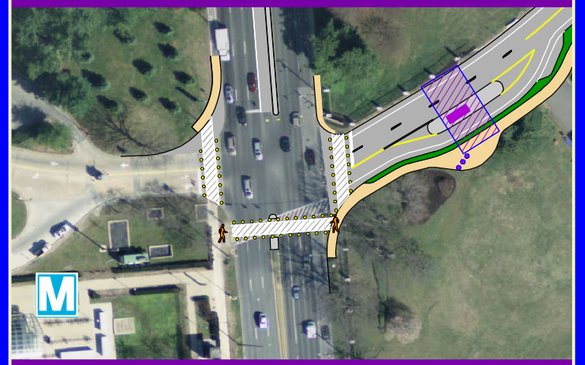
URS

Figure No.
7

Alternative 7

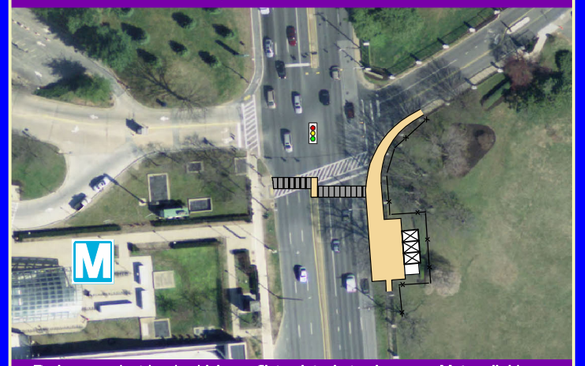
NNMC Jug Handle with Pedestrian Crossing

TSM At-Grade Enhancements



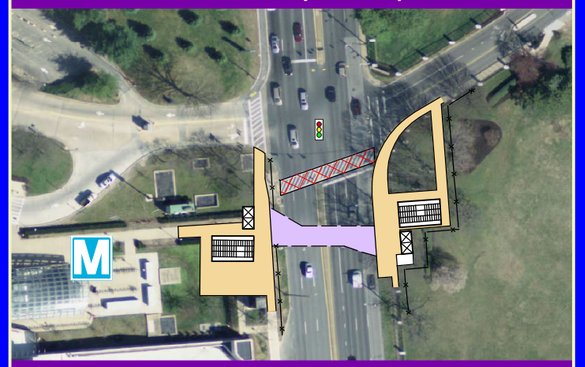
Does not reduce the pedestrian / vehicle conflict points and is not recommended for further consideration.

Deep Tunnel with Elevators

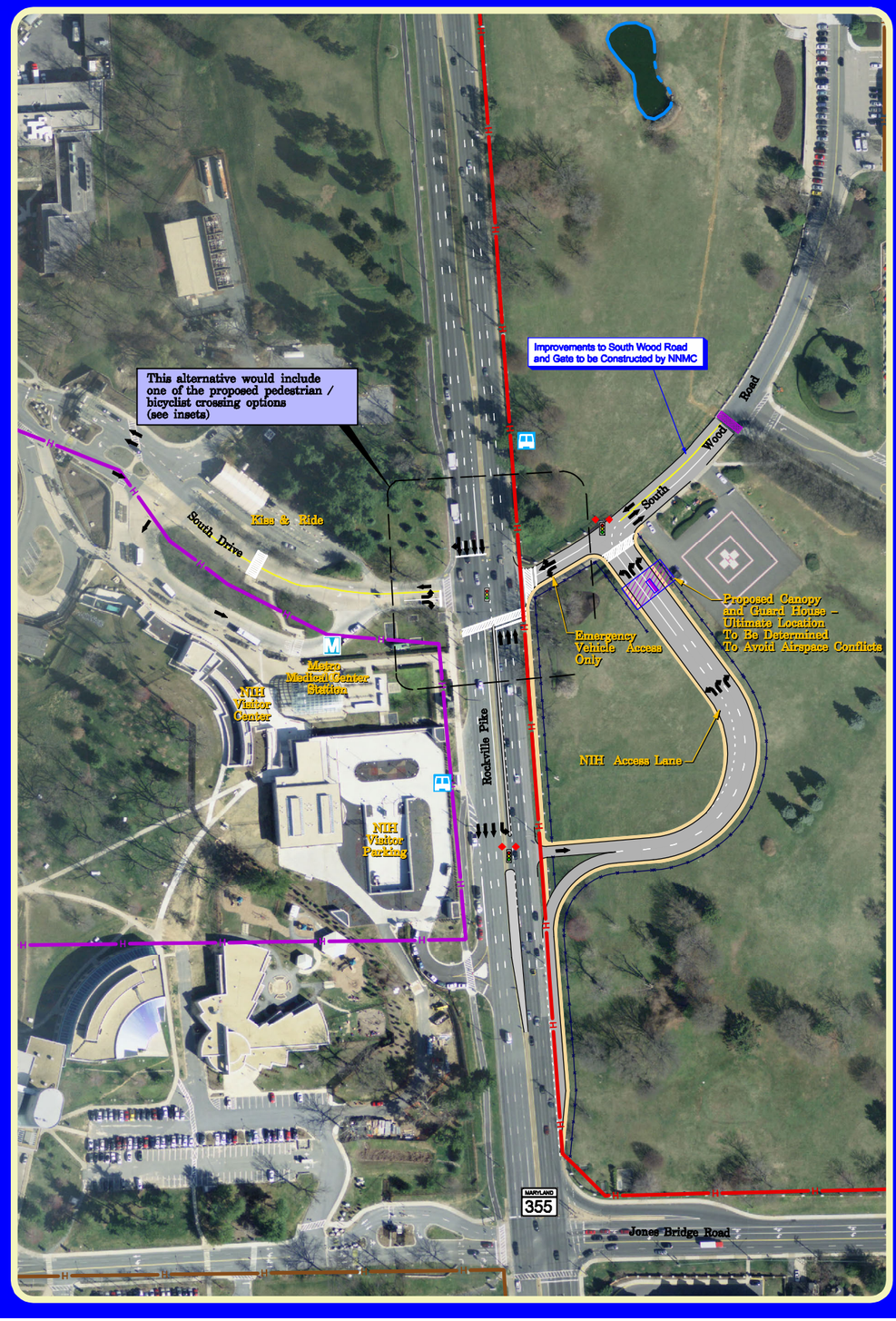


Reduces pedestrian / vehicle conflict points, but only serves Metrorail riders. As a stand alone option is not recommended for further consideration, but is being studied along with the pedestrian/bicycle underpass option.

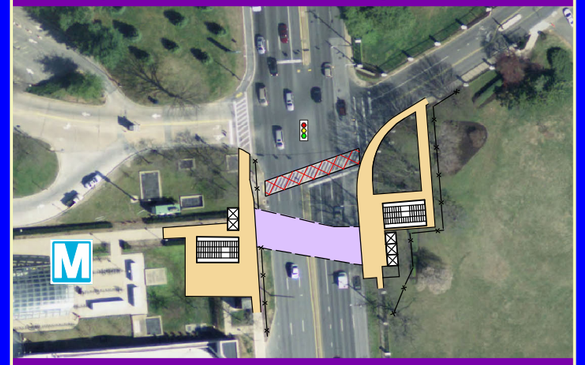
Pedestrian / Bicycle Underpass



Reduces pedestrian / vehicle conflict points and is being recommended for further study.

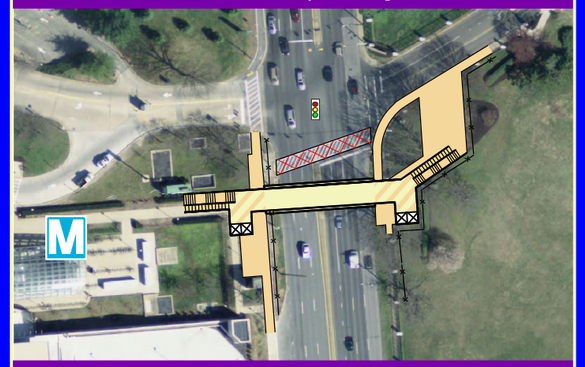


Deep Elevators and Pedestrian / Bicycle Underpass



Reduces pedestrian / vehicle conflict points and is being recommended for further study.

Pedestrian / Bicycle Bridge



Reduces pedestrian / vehicle conflict points, does not provide convenient access to pedestrians and bicyclists and is not recommended for further study.

Legend

- Metro Station
- Bus Stop
- Existing Signal
- Proposed Signal
- Temporary Pavement
- Proposed Pavement
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- Proposed Fence
- Proposed Crosswalk
- Historic District Boundary
- National Register List
- National Register Eligible
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NOT TO SCALE

DRAFT: WORK IN PROGRESS
CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

N W E S

Montgomery County
Department of Transportation

MD 355 (Rockville Pike) Crossing Study
Alternative 7

Date
September 2010

URS

Figure No.
8

approximately 85 feet per minute. An at-grade crossing would be maintained for those who choose not to use the underpass.

Deep Elevators/Shallow Pedestrian/Bicyclist Underpass Combination Option – This option would be a combination of the previous two options so that Metrorail riders and other users could access the facilities and avoid conflicts with vehicles. An at-grade crossing would be maintained for those who choose not to use the underpass or deep elevators.

Pedestrian Bridge Option – A pedestrian/bicyclist bridge would be constructed over MD 355 just south of the MD 355/South Wood Road/South Drive intersection. ADA compliant ramps and/or elevators would be provided along with escalators and/or stairs to maintain accessibility. In addition, an at-grade crossing would be maintained for those who choose not to use the overpass.

SCREENING OF PRELIMINARY ALTERNATIVES

Based on the study area needs documented in the Purpose and Need Statement and from comments received from project stakeholders, the following screening criteria and measures of effectiveness were used to determine the alternatives to be retained for detailed study (ARDS):

- Pedestrian and Bicyclist Safety and Mobility– The study team looked for opportunities to decrease the number of conflicts between pedestrian/bicyclist and motor vehicles as well as ways to improve mobility between NNMC, NIH, and the Medical Center Metro Station.
- Intersection Traffic Operations – The study team evaluated intersection LOS and travel delays for each alternative to determine how the improvements would affect intersection operations for comparison purposes.
- Network Traffic Operations – The study team evaluated network (Jones Bridge Road to Cedar Lane) delay for each alternative for comparison to No-Build and other proposed build conditions.
- Compatibility with Other Projects Proposed within the Study Area – The study team evaluated the effects on proposed SHA and NNMC projects in close proximity to the MD 355/South Wood Road/South Drive intersection.
- Impacts to Environmental and Cultural Resources – The study team identified resources and investigated impacts to natural environmental features and cultural elements for potential adverse effects.

To assess intersection and network traffic operations, simulation models were developed for the MD 355 corridor between Jones Bridge Road and Cedar Lane using Synchro/SimTraffic. This analysis tool incorporates varying travel speeds and arrival rates, various driver behaviors, specific signal timing patterns and roadway geometry (including storage lengths), and the influence that one roadway feature may have on another, such as traffic from one intersection queuing into an adjacent intersection or a merge affecting lane distributions on a freeway segment. The simulation models were developed and calibrated using the AM and PM peak hour turning movement volumes, existing lane configurations, and existing posted speeds. The existing roadway alignments and geometric conditions were incorporated into the simulation

models by using scaled aerial photographs of the study area as a background for the simulation model roadway networks. The output from Synchro, which is shown below for each preliminary alternative represents the operation of a particular intersection in isolation, that is, without considering the effects of adjacent intersections and roadway operations. The output from SimTraffic, which is also presented for each alternative, represents the operational behavior of the intersection as part of a system.

The Synchro analysis yields a Level of Service (LOS) for the intersection as well as overall intersection delay per vehicle. The LOS is a letter grade that represents the operational characteristics of an intersection, roundabout, freeway feature (merge, diverge, freeway segment, or weave), or an arterial corridor segment. The characteristics of the LOS grades are presented below.

- LOS A: Free traffic flow, low traffic volumes, minimal delays. Traffic volumes are significantly below the roadway feature's capacity.

- LOS B: Stable traffic flow, low to moderate traffic volumes, minor delays. Traffic volumes are well below the roadway feature's capacity.

- LOS C: Stable traffic flow, moderate traffic volumes, noticeable but acceptable delays. Traffic volumes are increasing, but are still well below the roadway feature's capacity.

- LOS D: Approaching unstable traffic flow, moderate to heavy traffic volumes, noticeable delays. Traffic volumes are approaching the roadway feature's capacity.

- LOS E: Unstable traffic flow, heavy traffic volumes, significant delays and vehicle backups, intersection warrants upgrade to address operations. Traffic volumes are reaching the roadway feature's capacity (the v/c ratio is approaching 1.0).

- LOS F: Unstable traffic flow, extensive delays and vehicle backups, intersection warrants upgrade to address deficiencies. Traffic volumes have exceeded the roadway feature's capacity (the v/c ratio has exceeded 1.0). LOS F conditions cannot be observed under existing conditions, but can be predicted to occur under future conditions.

The SimTraffic yields results, in terms of delay per vehicle, for each approach to the intersection. Please note, however, that the output does not necessarily represent conditions that would actually occur. For example, SimTraffic may show a delay for a particular approach that is over 1,500 seconds. While this number is not "real" in the sense that vehicles would be delayed at an intersection for 25 minutes, it does show that the delay at a particular approach will be significant. When dealing with highly congested corridors, like MD 355, it is difficult to rely on the results of the simulation models to predict "real" delay. Instead, the results are useful in understanding trends and making comparisons between different scenarios and alternatives,

PRELIMINARY ALTERNATIVES DROPPED FROM FURTHER CONSIDERATION

The study team applied the results of the technical analyses, goals and objectives, and screening criteria to all of the preliminary alternatives to assess which alternatives may not adequately meet the project Purpose and Need. It was determined that four of the seven preliminary alternatives, and three of the pedestrian/bicycle crossing options, would not adequately meet the goals and objectives and thus were recommended to be dropped from further consideration. In addition the team determined that the proposed east side (NNMC) Kiss & Ride and bus pull off facilities should be dropped from all at-grade alternatives due to concerns regarding impacts to cultural resources.

Alternative 4: Tight Urban Diamond Interchange – With this alternative, pedestrian mobility and safety remains a concern, because pedestrian crossings would not be completely separated from the vehicular traffic on the South Wood Road/South Drive ramps. The study team investigated a pedestrian only signal phase; however the traffic analysis shows that this phase change made overall network operations worse in comparison to the 2030 No-Build condition (See **Tables 4** and **5**). In addition, from an operational standpoint, queued vehicles being processed at the NNMC security gate could potentially block egress from the northbound MD 355 exit ramp during the AM peak period. The study team considered doubling the number of lanes on the ramps for added capacity, however little overall operational benefit resulted when compared to the significant impacts associated with the larger footprint. It was also determined that if the NNMC gate processing times were increased beyond what was assumed for this study, traffic would queue back along the ramps, ultimately onto mainline MD 355, blocking through lanes and worsening congestion. Moreover, the team investigated opportunities to improve pedestrian safety through signal phase modifications; however the team ultimately determined that the minor benefit to pedestrians was outweighed by the negative impacts to traffic operations and historic property.

Traffic analyses also showed a high volume of traffic turning from southbound MD 355 to access South Wood Road/South Drive and the NIH visitor parking garage in the AM peak period that would present operational and queuing issues. There were also concerns raised that the substandard distance for motorists entering southbound MD 355 from the ramp to safely weave across the three lanes to make a left turn onto eastbound Jones Bridge Road was insufficient. While the study team does not know the number of vehicles that would need to make that movement, it was noted as a potential safety issue and design flaw.

In addition to concerns regarding traffic operations and safety, the team also expressed concerns regarding the high levels of impact to properties and their associated cultural resources. Because of the extent of the improvements is so large there was a consensus among team members that Alternative 4 would be considered to have a significant adverse affect on the NNMC property, which is listed on the National Register of Historic Places.

Overall Alternative 4 does show some potential to improve traffic operations; however, the combination of concerns regarding gate operations negatively affecting the overall network,

minimal improvements to pedestrian safety, and significant impacts to cultural resources were too great for the study team to carry it forward.

Table 4: Alternative 4 Peak Hour LOS and Delay per Vehicle (in seconds)

Condition		AM Peak Hour		PM Peak Hour	
		LOS	Delay	LOS	Delay
2030 No-Build		D	36.5 s/veh	F	136.9 s/veh
Alt 4 – Single Lane Ramps NB and SB	SB Ramps	F	248.2 s/veh	E	56.0 s/veh
	NB Ramp	D	50.0 s/veh	D	36.3 s/veh
Alt 4 – Two Lane Ramps NB and SB	SB Ramps	F	117.2 s/veh	D	52.2 s/veh
	NB Ramp	C	24.6 s/veh	D	35.6 s/veh
Alt 4 – Two Lane Ramps & Pedestrian Signal Phase	SB Ramps	F	142.0 s/veh	E	70.0 s/veh
	NB Ramp	C	29.3 s/veh	D	44.9 s/veh
Alt 4 - With Additional NNMC Gate Delay	SB Ramps	F	117.2 s/veh	D	52.2 s/veh
	NB Ramp	C	24.6 s/veh	D	35.6 s/veh

Table 5: Peak Hour Network Delay for Alternative 4 Scenarios

Condition	AM Peak Hour Delay (Percent Change)	PM Peak Hour Delay (Percent Change)
2030 No Build	545.2 s/veh (NA)	1341.3 s/veh (NA)
Alt. 4 – Single Lane Ramps	908.3 s/veh (67%)	1307.2 s/veh (-3%)
Alt. 4 – Two Lane Ramps	552.8 s/veh (-4%)	1275.8 s/veh (-5%)
Alt. 4 – Two Lane Ramps with Pedestrian Signal Phase	551.8 s/veh (1%)	1556.7 s/veh (16%)
Alt. 4 – With Additional NNMC Gate Delay	902.0 s/veh (65%)	1226.0 s/veh (-9%)

Alternative 5: Double Left Turns – This alternative was dropped because it would require reconfiguration of the planned NNMC security gate that includes reversible travel lanes. The double left turn would compromise the reconfigured NNMC gate design because two receiving lanes would be required in lieu of the proposed reversible lane. This reconfiguration creates concerns regarding peak hour travel operations (See **Tables 6** and **7**).

Because the construction of the southbound double left turn lanes require widening onto NNMC property, there are concerns that the NNMC security gate processing/queuing area would be reduced by approximately 30 feet per lane (60 feet total), therefore negatively affecting operations. Conversely, the widening could require relocation of the NNMC security gate which could affect Anti-Terrorism Force Protection (ATFP) requirements. The extended left turn bay proposed as part of Alternative 2 would give a similar benefit as the double left turns (in terms of eliminating blockage of the through lanes on southbound MD 355), but with no property or cultural resource impacts. In addition, the double left turns out of NIH on South Drive appear to offer no operational benefits to NIH security gate operations based on the forecasted volume of northbound left turning traffic.

Table 6: Alternative 5 Peak Hour LOS and Delay per Vehicle (in seconds)

Condition	AM Peak Hour		PM Peak Hour	
	LOS	Delay	LOS	Delay
Alt. 5 – Geometric Improvements	C	32.8 s/veh	F	85.0 s/veh
Alt. 5 – Geometric Improvements With Additional NNMC Gate Delay	C	32.8 s/veh	F	85.0 s/veh

Table 7: Peak Hour Network Delay for Alternative 5 Scenarios

Condition	AM Peak Hour Delay (Percent Change)	PM Peak Hour Delay (Percent Change)
2030 No-Build	545.2 s/veh (NA)	1341.3 s/veh (NA)
Alt. 5 – Geometric Improvements with Pedestrian Only Signal Phase	558.1 s/veh (2%)	1406.2 s/veh (5%)
Alt. 5 – With Additional NNMC Gate Delay	608.2 s/veh (12%)	1412.4 s/veh (5%)

Alternative 6: Southbound Jug Handle – With this alternative, the proximity of the proposed signal prior to the NIH security gate could negatively affect operations (See **Tables 8** and **9**) and adding an additional signal on MD 355 in close proximity to the South Wood Road/South Drive intersection would adversely affect operations on MD 355. Bus operations could potentially be impacted due to eastbound vehicles blocking the bus bay loop. In addition, the more circuitous route combined with the signal at MD 355/South Wood Road/South Drive could lengthen the time it takes for patients to reach the NNMC emergency room. Transit vehicles would also be negatively affected by the circuitous route to access the Metrorail station.

If additional delays were to occur at the NNMC gate with the proposed Alternative 6 improvements in place, the overall network would be expected to experience approximately 126 percent higher delay during the AM peak when compared to the No-Build base condition. Unlike Alternative 3, the Alternative 6 configuration would require traffic destined for NNMC to pass through the MD 355/South Wood Road signalized intersection. With extra delays at the gate, and relatively little signal time dedicated to the through movement from South Drive, the southbound vehicles intending to enter NNMC would experience significant delays, queuing back along southbound MD 355 beyond Cedar Lane further contributing to congestion. Because of the operational and mobility issues associated with the proposed reconfiguration of movements, Alternative 6 was recommended to be dropped from consideration.

Table 8: Alternative 6 Peak Hour LOS and Delay per Vehicle (in seconds)

Condition		AM Peak Hour		PM Peak Hour	
		LOS	Delay	LOS	Delay
Alt. 6 – Geometric Improvements	Existing South Wood Road/South Drive	B	16.7 s/veh	C	28.0 s/veh
	New signal on MD 355	B	10.8 s/veh	B	14.2 s/veh
	New Signal at NIH Security Gate	A	8.3 s/veh	A	8.2 s/veh
Alt. 6 – Geometric Improvements With Additional NNMC Gate Delay	Existing South Wood Road/South Drive	B	16.7 s/veh	C	28.0 s/veh
	New signal on MD 355	B	10.8 s/veh	B	14.2 s/veh
	New Signal at NIH Security Gate	A	8.3 s/veh	A	8.2 s/veh

Table 9: Peak Hour Network Delay for Alternative 6 Scenarios

Condition	AM Peak Hour Delay (Percent Change)	PM Peak Hour Delay (Percent Change)
2030 No-Build	545.2 s/veh (NA)	1341.3 s/veh (NA)
Alt. 6 – Geometric Improvements	588.5 s/veh (8%)	1512.5 s/veh (13%)
Alt. 6 – With Additional NNMC Gate Delay	1229.7 s/veh (126%)	1575.2 s/veh (17%)

Alternative 7: Northbound Jug Handle – While there is potential for improved traffic operations and vehicle queue storage during peak travel times, negative effects result from signal coordination and impacts to NNMC gate operations and airspace restrictions (with this alternative, the NNMC security gate would have to be relocated from its current alignment on South Wood Road and a separate pedestrian only gate would be required). Likewise, the more circuitous route combined with the new signal at the jug handle intersection with MD 355 could lengthen the time it takes for patients to reach the NNMC emergency room. In addition, construction of the new access roadway would have an adverse effect on NNMC property, which is listed in the National Register of Historic Places as an historic district. Additional security measures would be required along South Wood Road to inhibit incoming vehicular traffic from the MD 355 intersection. Additionally, NIH and transit traffic must travel a circuitous route and the resulting queues may interfere with the intersection and NNMC security gate operations.

Operationally, Alternative 7 is similar to Alternative 6, but places the new intersection on MD 355 south of South Wood Road, and provides direct access to NNMC. During the AM peak hour, traffic operations would be expected to be very similar to the No-Build condition. In the PM peak hour, the new intersection to the south on MD 355 would allow vehicles to more efficiently depart NNMC and NIH onto northbound MD 355, significantly decreasing the delays experienced on those approaches. However, the addition of more NIH and NNMC vehicles to the MD 355 system reduces the ability for vehicles from other sources to enter MD 355, thereby increasing overall network delays throughout the corridor. If extra delays occurred at the NNMC gate on South Wood Road the overall network would be expected to experience 17 percent and 27 percent higher delays during the AM and PM peak, respectively, when compared to the No-Build base condition. Alternative 7 was ultimately dropped due to the overall negative impact to

the roadway network (See **Tables 10** and **11**) and a lack of safety and mobility improvements for pedestrians.

Table 10: Alternative 7 Peak Hour LOS and Delay per Vehicle (in seconds)

Condition		AM Peak Hour		PM Peak Hour	
		LOS	Delay	LOS	Delay
Alt. 7 – Geometric Improvements	Existing South Wood Road/South Drive	B	19.6 s/veh	F	82.2 s/veh
	New signal on MD 355	A	6.3 s/veh	A	5.7 s/veh
	New Signal at NNMC Gate	A	6.0 s/veh	B	13.2 s/veh
Alt. 7 – Geometric Improvements With Additional NNMC Gate Delay	Existing South Wood Road/South Drive	B	19.6 s/veh	F	82.2 s/veh
	New signal on MD 355	A	6.3 s/veh	A	5.7 s/veh
	New Signal at NNMC Gate	A	6.0 s/veh	B	13.2 s/veh

Table 11: Peak Hour Network Delay for Alternative 7 Scenarios

Condition	AM Peak Hour Delay (Percent Change)	PM Peak Hour Delay (Percent Change)
2030 No-Build	545.2 s/veh (NA)	1341.3 s/veh (NA)
Alt. 7 – Geometric Improvements	544.6 s/veh (0%)	1699.4 s/veh (27%)
Alt. 7 – With Additional NNMC Gate Delay	639.1 s/veh (17%)	1621.7 s/veh (27%)

TSM Bicycle/Pedestrian At-Grade Crossing Option (Signal Phase Enhancement and Kiss & Ride Elements Only) – During the alternatives analysis, the study team determined that proposed changes to existing geometry (i.e., extending the southbound left turn lane into South Wood Road) would not affect traffic operations but would improve vehicle queuing distances. Conversely, proposed modifications to the signal timing would increase wait times on each approach, for pedestrians as well as for vehicles (as shown in **Table 12**), and would have adverse effects on travel time delays throughout the MD 355 corridor (**Table 13**). Specifically, LOS and delay would increase significantly, further overloading the currently stressed roadway capacity. In addition, there were no safety or mobility benefits that could be directly attributed to providing a separate signal phase, therefore it was dropped from consideration for failure to meet project Purpose and Need.

As noted previously, the study team determined that the potential impacts associated with a proposed Kiss & Ride facility on the NNMC property would be too great to implement at this time and has therefore been dropped from consideration. The team did note that the Kiss & Ride may be eligible for implementation in the future, as part of another project.

Table 12: TSM Bicycle and Pedestrian Signal Phase Enhancement Peak Hour LOS and Delay per Vehicle (in seconds)

Condition	AM Peak Hour		PM Peak Hour	
	LOS	Delay	LOS	Delay
2030 No-Build	D	36.5 s/veh	F	136.9 s/veh
TSM Bicycle/Pedestrian Signal Phase Enhancement	D	70.2 s/veh	F	198.9 s/veh

Table 13: Peak Hour Network Delay for TSM Pedestrian/Bicycle Signal Phase Enhancement

Condition	AM Peak Hour Delay (Percent Change)	PM Peak Hour Delay (Percent Change)
2030 No-Build	545.2 s/veh (NA)	1341.3 s/veh (NA)
TSM Bicycle/Pedestrian Signal Phase Enhancement	557.8 s/veh (2%)	1360.7 s/veh (1%)
TSM Pedestrian/Bicycle Signal Phase Enhancement with Additional NNMC Gate Delay	589.5 s/veh (8%)	1412.3 s/veh (5%)

Pedestrian Bridge – While it would be less disruptive to construct a pedestrian bridge over MD 355 compared to an underpass or deep elevator system, the bridge would likely have an adverse effect on the historic viewsheds in the study area and create potential sight distance concerns on MD 355. Based on feedback from stakeholders, the study team noted concerns that the bridge could block the view of the traffic signals for northbound MD 355 traffic, unless the traffic signals are installed on the pedestrian bridge itself. In addition, research has shown that pedestrians are less likely to use a pedestrian bridge instead of an at-grade crossing when given the choice. Due to these concerns, the pedestrian bridge was dropped from consideration.

ALTERNATIVES RETAINED FOR DETAILED STUDY (ARDS)

The following description and attached mapping of the ARDS defines the action currently under consideration. The concept level mapping that accompanies this package includes the existing conditions study area map which represents the No-Build Alternative (Alternative 1) and three Build ARDS (Alternatives 2A, 2B, and 3). A map of each alternative described below is provided in **Figures 9** through **11**.

Alternative 1: No-Build – This alternative is being retained to provide a comparison with existing conditions and the build alternatives even though it would not address the project Purpose and Need. This alternative assumes no substantial improvements beyond those in the County's Capital Improvement Plan (CIP) or Metropolitan Washington Council of Governments (MWCOG) Constrained Long Range Transportation Plan (CLRP) for 2035. This alternative does not address impacts of BRAC on the study area.

As discussed earlier in this document and summarized in **Table 14**, below, 2030 No-Build traffic is expected to operate at LOS F during the AM peak hour, and traffic exiting South Wood Road and South Drive may have to wait through more than one signal cycle before departing. Further, the southbound left turn traffic into NNMC may occasionally queue beyond its storage lane.

Alternative 2A

Pedestrian / Bicycle Underpass and TSM / TDM Improvements

Improvements to South Wood Road and Gate to be Constructed by NNMC

South Drive

Kiss & Ride

Metro Medical Center Station

NIH Visitor Center

NIH Visitor Parking

South Wood Road

Planned NNMC Canopy and Guard House

Proposed Pedestrian Refuge Island in Median

Proposed Stair & Escalator to Underpass

Proposed Elevators to Underpass

Rockville Pike

MARYLAND 355

Legend

- Metro Station
- Bus Stop
- Existing Signal
- Proposed Roadside Tree Planting
- Stormwater Facility
- Proposed Pavement Resurface
- Proposed Full-Depth Pavement
- Proposed Underpass
- Proposed Overpass
- Proposed Sidewalk & Bikepath
- Proposed Median
- Streams / Waters of the U.S.
- Proposed Fence
- Historic District Boundary
- National Register List
- National Register Eligible
- Proposed Crosswalk

0 100' 200'

SCALE: 1"=100'

DRAFT: WORK IN PROGRESS
CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

N W E S

Montgomery County
Department of Transportation

MD 355 (Rockville Pike) Crossing Study
Alternative 2A

Date
September 2010

URS

Figure No.
9

Alternative 2B

Pedestrian/Bicycle Underpass,
Deep Elevators, and
TSM / TDM Improvements

Improvements to South Wood Road
and Gate to be Constructed by NNMC

South Drive

South Wood Road

Rockville Pike

MARYLAND 355

Metro
Medical Center
Station

NIH
Visitor
Center

NIH
Visitor
Parking

Existing NNMC Gate
to be Relocated

Planned NNMC Canopy
and Guard House

Proposed Pedestrian
Refuge Island in Median

Proposed Stair &
Escalator to Underpass

Proposed Deep
Elevators to Metrorail

Legend

- Metro Station
- Bus Stop
- Existing Signal
- Proposed Roadside Tree Planting
- Stormwater Facility
- Proposed Pavement Resurface
- Proposed Full-Depth Pavement
- Proposed Underpass
- Proposed Crosswalk
- Proposed Sidewalk & Bikepath
- Proposed Median
- Streams / Waters of the U.S.
- Proposed Fence
- Historic District Boundary
- National Register List
- National Register Eligible
- Proposed Right-of-Way

0 100' 200'

SCALE: 1"=100'

DRAFT: WORK IN PROGRESS
CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

N W E S

Montgomery County
Department of Transportation

MD 355 (Rockville Pike) Crossing Study
Alternative 2B

Date
September 2010

URS

Figure No.
10

Alternative 3

Grade Separation of
MD 355 Under South
Wood Road / South Drive

At-Grade
Hiker /Biker Trail

Relocated
Metrobus /Ride On
Bus Stop

Improvements To South Wood Road
and Gate to be Constructed by Navy

Reconfigured
Kiss & Ride Area

South Drive

South Wood Road

Planned NNMC Canopy
and Guard House

Proposed Overpass
of Depressed MD 355

Sidewalk At Existing Grade

Metro
Medical Center
Station

NIH
Visitor
Center

NIH
Visitor
Parking

Rockville Pike

Jones Bridge Road

Legend

- Metro Station
- Bus Stop
- Existing Signal
- Proposed Signal
- Stormwater Facility
- Proposed Pavement Resurface
- Proposed Full-Depth Pavement
- Proposed Crosswalk
- Proposed Overpass
- Proposed Sidewalk & Bikepath
- Proposed Median
- Streams / Waters of the U.S.
- Proposed Fence
- Historic District Boundary
- National Register List
- National Register Eligible
- Proposed Right-of-Way

0 130' 260'

SCALE: 1"=130'

DRAFT: WORK IN PROGRESS
CONCEPTUAL LEVEL GRAPHIC
ADDITIONAL ENGINEERING REQUIRED

N W E S

Montgomery County
Department of Transportation

MD 355 (Rockville Pike) Crossing Study
Alternative 3

Date
September 2010

URS

Figure No.
11

In the PM peak hour the MD 355 corridor would be congested. Traffic flow on northbound MD 355 would encounter a bottleneck north of Cedar Lane, which would cause queues at intersections throughout the network. These queues would result in a condition in which traffic approaching the South Wood Road/South Drive intersection on northbound MD 355 would frequently have to stop while their signal was green due to the back of queue from Wilson Drive extending all the way to South Drive. Southbound MD 355 would be expected to operate more smoothly with the exception of a queue in the southbound left turn lane to Jones Bridge Road which would be expected to frequently extend back through South Drive. Queues on South Wood Road and South Drive are predicted to be extensive. Extra delays occurring at the NNMC gate would be expected to increase overall network delays by approximately 15 percent during the AM peak (when entering volumes are highest) and two percent during the PM peak as shown in **Table 15**, below.

Table 14: 2030 No-Build Peak Hour Intersection LOS and Delay (seconds per vehicle)

Condition	AM Peak Hour		PM Peak Hour	
	LOS	Delay	LOS	Delay
2030 No-Build	D	36.5 s/veh	F	136.9 s/veh

Table 15: Peak Hour Network Delay for 2030 No-Build & 2030 No-Build with Additional Delay at the NNMC Gate

Condition	AM Peak Hour (Percent Change)	PM Peak Hour (Percent Change)
2030 No-Build	545.2 s/veh (NA)	1341.3 s/veh (NA)
2030 No-Build With Additional NNMC Gate Delay	624.7 s/veh (15%)	1367.6 s/veh (2%)

Alternative 2A: Pedestrian/Bicycle Underpass with At-Grade TSM Improvements – this alternative consists of combining the safety enhancement of the grade-separated pedestrian and bicycle underpass with certain elements of Alternative 2 TSM improvements (e.g., lower cost geometric improvements, traffic calming measures, and transit station improvements) and would more adequately meet the goals and objectives of the project than would Alternative 2 alone. The grade separated pedestrian/bicycle underpass would reduce conflicts with vehicles, while potentially improving traffic operations. In addition the proposed at-grade geometric roadway improvements would also enhance traffic operations through improved vehicle mobility. **Tables 16** and **17** illustrate the traffic analyses conducted for this alternative. Physical changes to the area under consideration for this alternative include:

- Extension of the southbound MD 355 left turn lane for vehicles turning left onto South Wood Road to improve queuing
- Expansion of the existing curb radius at the northeast corner of South Drive/MD 355 to improve geometrics (particularly for buses)
- Constructing a pedestrian and bicycle underpass approximately 30 feet below MD 355 to provide a fully separated crossing for pedestrians and bicyclists. Access to the underpass will be provided via elevators, escalators, and stairs.

Alternative 2B: Pedestrian/Bicycle Underpass and Deep Elevators with At-Grade TSM Improvements – This alternative incorporates the features of the shallow tunnel with deep elevators option with the TSM elements of Alternative 2. The proposed deep elevators on the east side of MD 355 would provide direct access, 118 feet below grade, to the Metrorail station. The deep elevators will give employees and visitors to NNMC direct access from the Metrorail station platform to the South Wood Road entrance without having to cross MD 355 at grade. In addition, non-Metrorail users would benefit from the safety provided by the shallow underpass crossing of MD 355 (similar to Alternative 2A). Meanwhile, the at-grade TSM roadway geometric improvements would enhance vehicle mobility. See **Tables 16** and **17** for traffic analysis summary.

For both Alternatives 2A and 2B, removing the majority of the pedestrians and bicycles from the at-grade crossing of MD 355 at South Wood Road and South Drive would reduce pedestrian/vehicle conflicts and would also be expected to allow more of the traffic exiting NIH and NNMC to proceed during each signal cycle, which would be a traffic operations improvement when compared to the No-Build condition, particularly in the PM peak hour when more vehicles are exiting NNMC and NIH.

Removal of queue overflow conflicts (where vehicles extend beyond the turn lane into the through lane) for the southbound left turn lane during the AM peak would be expected to allow slightly more efficient operations on southbound MD 355 through the MD 355/South Wood Road/South Drive intersection. More efficient operation at this location means that more vehicles would be arriving at Jones Bridge Road than would under the 2030 No-Build condition, which would put slightly more pressure on that intersection. Similarly, more efficient departures from South Wood Road and South Drive would put more traffic on MD 355, particularly during the PM peak hour where space would already be limited by congestion. This condition would lead to fewer vehicles traveling northbound on MD 355 would pass through the intersection. The net result of the improvements at MD 355/South Wood Road/South Drive would be expected to be a slightly increased overall network delay during both peak hours (less than four percent).

As shown in **Table 17**, if extra delays occurred at the NNMC gate on South Wood Road the overall network would be expected to experience approximately 8 percent higher delays during the AM peak when compared to the No-Build base condition. The extra delays anticipated under Alternative 2 would be less than those expected under the 2030 No-Build condition due to the additional southbound left turn storage length for vehicles entering NNMC.

Table 16: Alternative 2A & 2B Peak Hour LOS and Delay per Vehicle (in seconds)

Condition	AM Peak Hour		PM Peak Hour	
	LOS	Delay	LOS	Delay
Alternatives 2A & 2B with Decreased Number of At-Grade Pedestrian Crossings	D	35.4 s/veh	F	136.5 s/veh

Table 17: Peak Hour Network Delay for Alternatives 2A and 2B Scenarios

Condition	AM Peak Hour Delay (Percent Change)	PM Peak Hour Delay (Percent Change)
Alts. 2A & 2B with Decreased At-Grade Pedestrian Crossing	549.6 s/veh (1%)	1381.6 s/veh (3%)
Alts. 2A & 2B – With Additional NNMC Gate Delay	589.5 s/veh (8%)	1412.3 s/veh (5%)

Alternative 3: Grade Separation of MD 355 under South Wood Road/South Drive – This alternative involves lowering MD 355 to cross under South Wood Road and South Drive. South Wood Road and South Drive would be reconstructed to provide through movements only (without a signal) for vehicles, pedestrians and bicycles at its existing grade. Vehicle access to MD 355 would be provided via a relocated at-grade intersection 400 feet north of the South Wood Road/South Drive crossing. An exit/entrance "jug handle" would be located between the new intersection and the north side of the NIH "Kiss and Ride," connecting to South Drive. Traffic operations are expected to improve under Alterative 3. Even with an operational breakdown at the NNMC gate, Alternative 3 is expected to operate acceptably as demonstrated in **Tables 18** and **19**.

While the overall corridor shows an anticipated increase in delays of 11 percent in the AM peak hour and 10 percent in the PM peak hour when compared to the No-Build condition, during the AM peak hour the relocated intersection is expected to operate much more efficiently than the existing intersection would. However, as movements out of NNMC and NIH improve, more traffic would be able to flow through the network, which would put an additional burden on other intersections in the corridor, resulting in an overall increase in corridor-wide delays.

As shown in **Table 19**, if extra delays occurred at the NNMC gate on South Wood Road the overall network would be expected to experience approximately 13 percent higher delays during the AM peak when compared to the No-Build base condition. The extra delays anticipated would be expected to be five percent higher than the Alternative 3 base condition due to the extra storage provided for vehicles approaching the NNMC gate.

Table 18: Alternative 3 Peak Hour LOS and Delay per Vehicle (in seconds)

Condition		AM Peak Hour		PM Peak Hour	
		LOS	Delay	LOS	Delay
Alternative 3	On MD 355	C	20.4 s/veh	C	25.1 s/veh
	On South Drive	B	15.9 s/veh	B	17.4 s/veh

Table 19: Peak Hour Network Delay for Alternative 3 Scenarios

Condition	AM Peak Hour (Percent Change)	PM Peak Hour (Percent Change)
2030 No-Build	545.2 s/veh (NA)	1341.3 s/veh (NA)
Alt. 3 – Geometric Improvements	605.1 s/veh (11%)	1473.0 s/veh (10%)
Alt. 3 – Geometric Improvements With Additional NNMC Gate Delay	616.4 s/veh (13%)	1472.7 s/veh (10%)