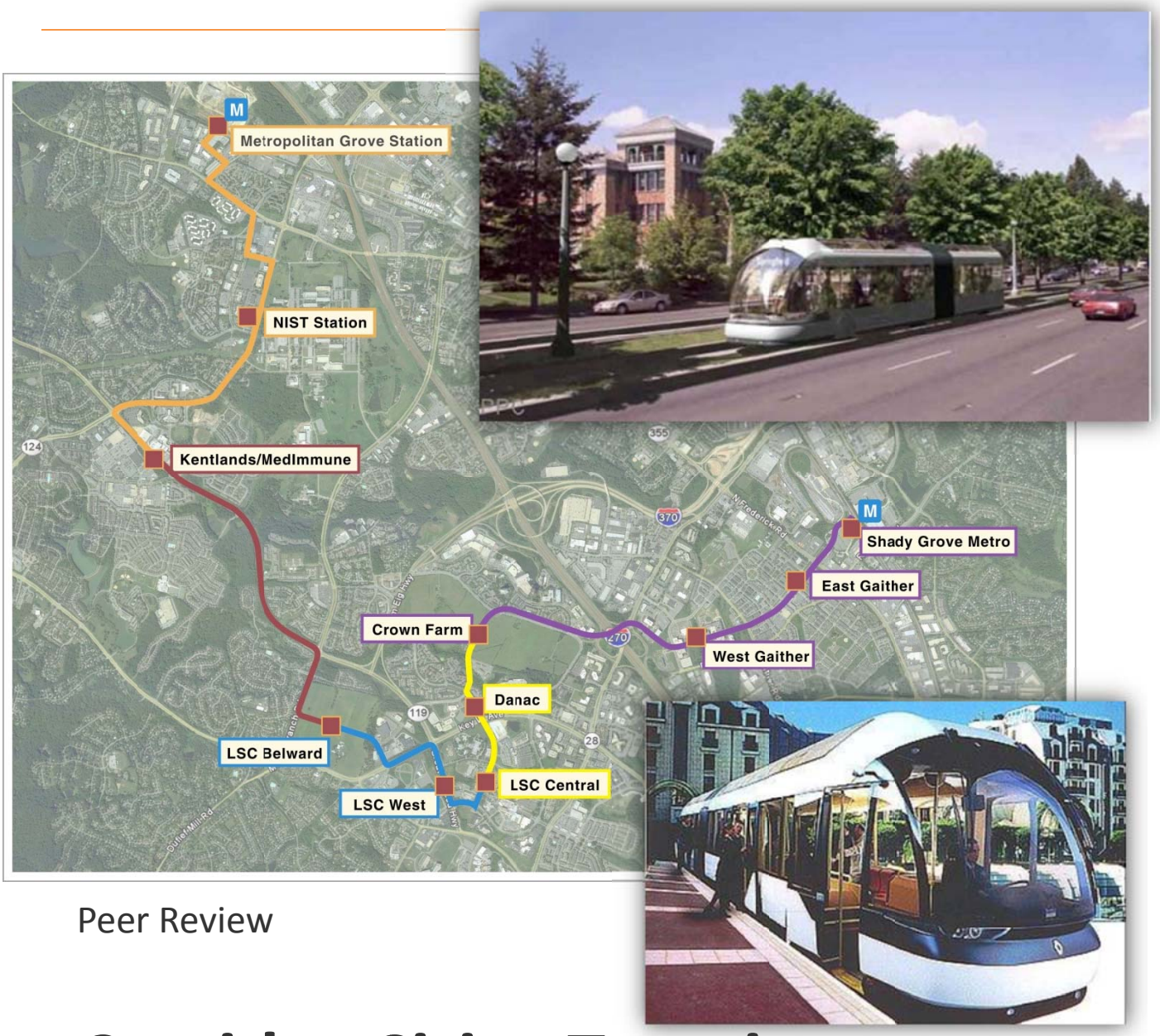

Peer Review

Corridor Cities Transitway, Phase 1

Montgomery County, Maryland

April 24, 2012

THIS IS AN INTERNAL DRAFT

FOR DISCUSSION PURPOSES ONLY

Peer Review

Corridor Cities Transitway, Phase 1

Montgomery County, Maryland

Prepared For:
Property Owners Along Phase I of the Corridor Cities Transitway

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Project No. 11751

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Introduction

The proposed Corridor Cities Transitway (CCT) through northwestern Montgomery County will connect existing and growing employment and research centers, as well as existing and new mixed-use walkable communities. As a major transportation asset in Montgomery County, the project not only supports more sustainable lifestyles with less reliance on driving, but is considered by many to be the lynchpin to the County's ability to stay economically competitive, attracting both employers and labor talent. A consortium of business, institutional and academic interests within Montgomery County commissioned this study to provide "a practical, compelling and affordable alternative" to a portion of the current CCT New Starts project being developed by the Maryland Transit Administration (MTA). The goal is to develop a more cost effective alternative for CCT Phase 1 using the following criteria:

- Eliminates or defers some of the high cost improvements with minimal reduction in either system performance or the quality of service
- Can be built sooner and become operational earlier than the current $494M MTA proposed project.
- Would result in greater economic benefits to Montgomery County than would a delayed start and later operation.

The MTA provided the study team project planning information and all available data. This study has been designed to develop the system definition, program, schedule, and a preliminary cost estimate for expedited construction of the 9 mile Phase 1 section of the CCT as described in the Great Seneca Science Corridor Master Plan. The segment will operate between the Shady Grove Metro Station and the Metropolitan Grove MARC Station. Figure 1 outlines the proposed CCT route as developed for this report

The study team attempted to maintain the MTA Alignment to the maximum extent possible. The following summarizes where the alignments differ and the triggers needed to implement additional investment:

- Shady Grove Metro Station – final station development should occur as part of development activities in the vicinity of the existing station.
- Crown Farm Station to LSC West Temporary Station – This alignment should be converted when congestion along the alignment is such that additional roadway capacity is needed. Additionally, if MTA develops a grade separated alignment in this area, the alignment should be modified to support the grade separation.
- LSC West to LSC Belward – This alignment should be modified when the PSTA site is redeveloped by Montgomery County.

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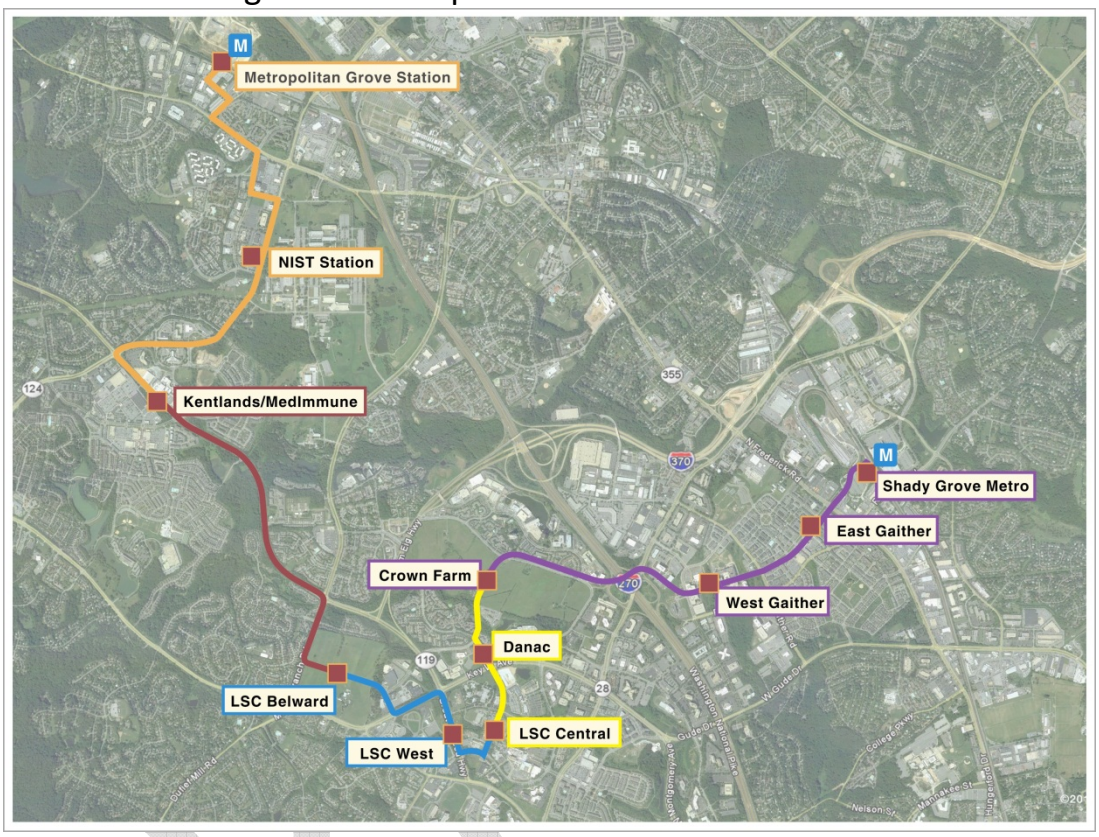
- Kentland/MedImmune – This alignment should be changed when the utilities are relocated along MD 124, and when CCT is extended west of Metropolitan Grove Station.

Figure 1 Proposed Phase 1 CCT Route



As the study's priority mission is the identification of early start cost effective solutions without compromising either the performance or the quality of Phase 1 of the CCT, this analysis generally retained the current alignment, assuming station location and routing decisions were made consistent with project development criteria established early in the MTA process. As the team evaluated alternatives to grade separation scenarios proposed by the MTA Master Plan, modifications were identified and considered within the evaluation. This study also assumes the Governor's Locally Preferred Alternative (LPA) vehicle mode was the Bus Rapid Transit (BRT) mode proposed by the MTA. However, this study assumes a mode which is neither a bus (BRT) nor a light rail vehicle (LRT), but rather a new hybrid vehicle called a Rapid Transit Vehicle (RTV). The RTV, a baseline assumption for the CCT, is an exceptionally high performance state of the art system and includes the following design features listed below and in the graphics that follow:

1. Dual lane, and fully dedicated rights of way, preferably in the medians, wherever possible;

2. High-quality, state-of-the-art vehicles on rubber tires with the potential for side guide wheels and multiple wide, side opening doors;

3. Transit Stations with both pre-boarding fare collection systems and platform to vehicle level boarding, which when combined with multiple wide, side opening doors, facilitates fast and easy entry and exit; and,

4. Real-time dispatching and operations management providing passengers real-time station arrival and departure information.

During the course of this study neither the alignment nor mode choice was definite. These decisions are expected during the second quarter of 2012 when Governor O'Malley announces the state's Locally Preferred Alternative (LPA) for the purposes of advancing to the next phase of the FTA process. The MTA's process is prescribed by the guidance for all Small Starts and New Starts projects. It should be noted that the MTA plan allows for and still considers LRT and BRT modes. The outcome of this study is described as an "Early Starts" solution, a term not recognized by the Federal Transit Administration. The "Early Starts" alignment refers to a phasing of the ultimate MTA Alignment, which is supported by the funders of this study.

This study further assumes that the Master Plan alignment changes currently being examined by the MTA serving Crown Farm, the Life Sciences Center, and Gaithersburg will be adopted as part of the Governor's Locally Preferred Alternative (LPA).

The study evaluation includes an independent cost estimate for the high-end RTV system in comparison to the current MTA proposal. The study examines and recommends system and design alternatives to reduce initial construction costs for the study segment, without compromising the quality of this precedent-setting first phase of the CCT service. Finally, the study identifies how this initial, expedited segment of the CCT can be best coordinated with ongoing planning for the full CCT; the ongoing planning for a county-wide RTV system: and integration with Metro Rail, Metro Bus, and Montgomery County's Ride-On bus operations. The work is designed to address and inform the mission

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of the County Executive's Rapid Transit Task Force to ensure a full integration among the County's various transit services and operators.

For purposes of this report, we will refer to the current alignment proposed by MTA as the "MTA Alignment," and our modified version of this alignment as the "Early Starts Alignment."

ALIGNMENT

To simplify understanding of the various places and issues present, the CCT study corridor between Shady Grove Metro and Metropolitan Grove was evaluated as five distinct segments. Each of these segments is discussed separately and then summarized in a concluding report section.

Segment 1: Shady Grove Metro Station to Crown Farm Station

Stations are proposed at Shady Grove Metro, East Gaither, West Gaither, and Crown Farm. The difference between the MTA Alignment and an Early Starts Alignment include:

- A new station is proposed at the Shady Grove Metro Station adjacent to the existing bus bays.
- Between the Shady Grove Metro and MD 355 (a distance of 0.25 miles) the CCT vehicle will operate in mixed traffic.
- Once the vehicle moves into the median on King Farm Boulevard, the alignment in this segment is consistent with the MTA alignment.
- Several alignments were studied between the end of the King Farm Boulevard Median and Crown Farm. The critical issue is the crossing of I-270 and Shady Grove Road. The project team considered alignments that used portions of Shady Grove Road to traverse from the east side of I-270 to the west side of I-270. While these alignment alternatives would have significantly reduced the cost in this area, we did not feel that it was worth the additional travel time savings and travel time reliability impacts. Accordingly, we recommend maintaining the alignment that carries the CCT over I-270 and Shady Grove Road, consistent with current MTA plans.

The proposed Segment 1 alignment is shown in Figure 2.

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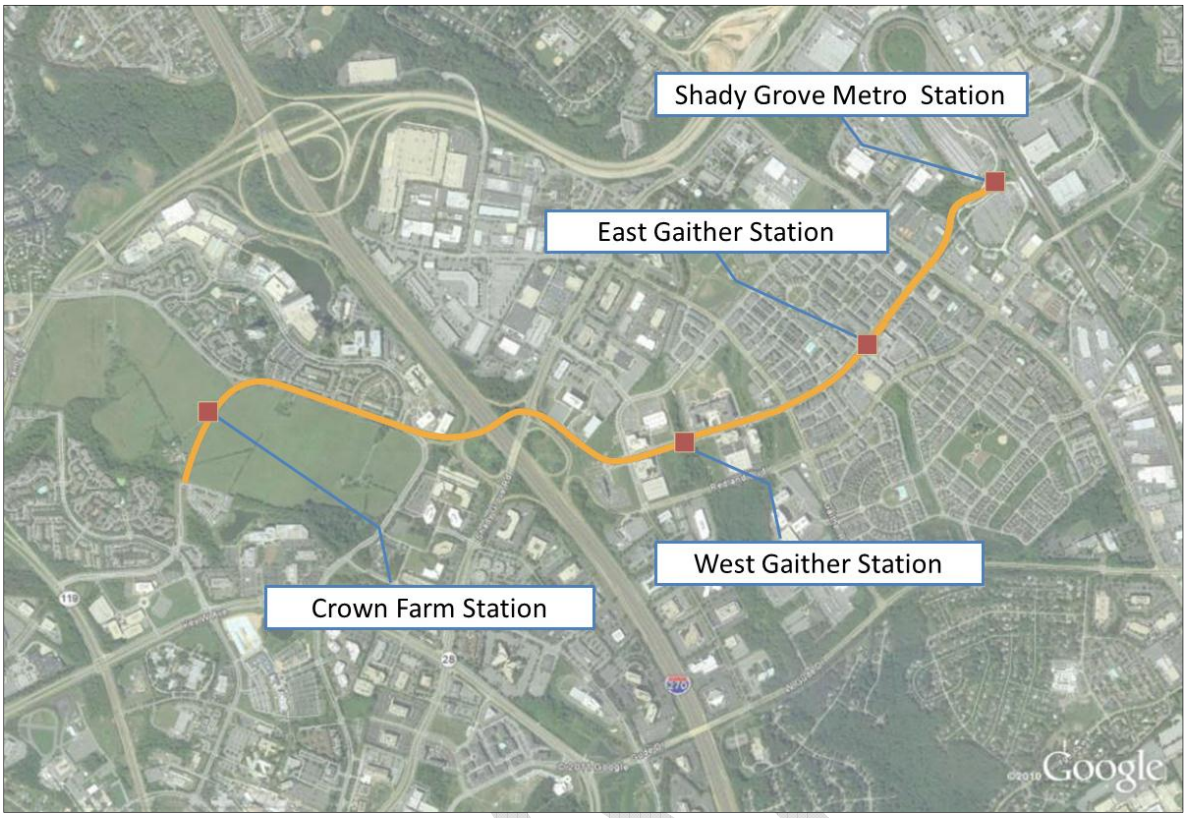
Figure 2 Proposed Segment 1 Alignment



Segment 2: Crown Farm Station to the Life Sciences Center

Stations are proposed at DANAC, LSC Central, and LSC West. All of these stations will require paired stations (for NB and SB directions) in the interim condition. The differences between the MTA Alignment and an Early Starts Alignment include:

- The alignment will use dedicated lanes throughout the Life Sciences Center. Either a parking or travel lane will be converted to a dedicated transit lane. While the details will depend on options evaluated during the final design process, the idea would be to delineate the pavement in some way so that it is distinguished from a normal travel lane. For example, some cities have distinguished the area with contrasting pavement color or texture, while others have physically separated transit traffic from general purpose traffic with a barrier treatment, such as bollards or curb. The streets affected by this change include Decoverly Drive, Diamondback Drive, Broschart Road, and Medical Center Drive. The typical section shown in Figure 12 below will apply to these streets. A transition from the Crown Farm typical section to the LSC Central typical section will need to be developed in the next phase of the project.
- Grade separations currently proposed to cross MD 28 (Key West Avenue) should be eliminated in an Early Starts project due to the relatively insignificant reduction in travel time compared to

the high cost of such crossings. These crossings should continue to be studied and considered for implementation at the appropriate time in the future.

- The Early Starts alignment does not pass through the PSTA site as it does in the MTA alignment. However, if this site were to be redeveloped near the time of the implementation of the Early Starts project, this alignment should change to traverse this site. An alternative alignment would use the existing travel lanes on MD 119 and MD 28. This portion of MD 119 has relatively low traffic volumes. Signal priority is recommended at the signal at MD 119 and MD 28 to maintain optimal performance. MCDOT and MSHA are developing criteria for consideration of signal priority at intersections, and recommendations to utilize any form of TSP should be consistent with the policy and criteria when development is complete.
- A temporary LSC West Station will be constructed near the intersection of MD 119 and Medical Center Drive until a permanent station is constructed with the PSTA development. This station will provide access to the Universities at Shady Grove and to properties south of Darnestown Road.
- The Great Seneca Science Corridor (GSSC) Master Plan provides that LSC South (including the Universities at Shady Grove) will be served by the CCT alignment and stations in LSC Central and LSC West, within a 10-15 minute walking distance. During preliminary engineering for the CCT, we recommend a review of the pedestrian, shuttle, and bicycle access between the LSC Central and LSC West CCT stations and LSC South and other areas close to the alignment.
- DANAC, LSC Central and LSC West will be temporary stations.
- Lost parking in LSC Central and LSC West will be managed by the developers and property owners of adjacent parcels who will construct structured parking on-site as these properties are redeveloped.

The proposed Segment 2 alignment and runningway example within LSC Central are shown in Figures 3 & 4.

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Figure 3 Proposed Segment 2 Alignment

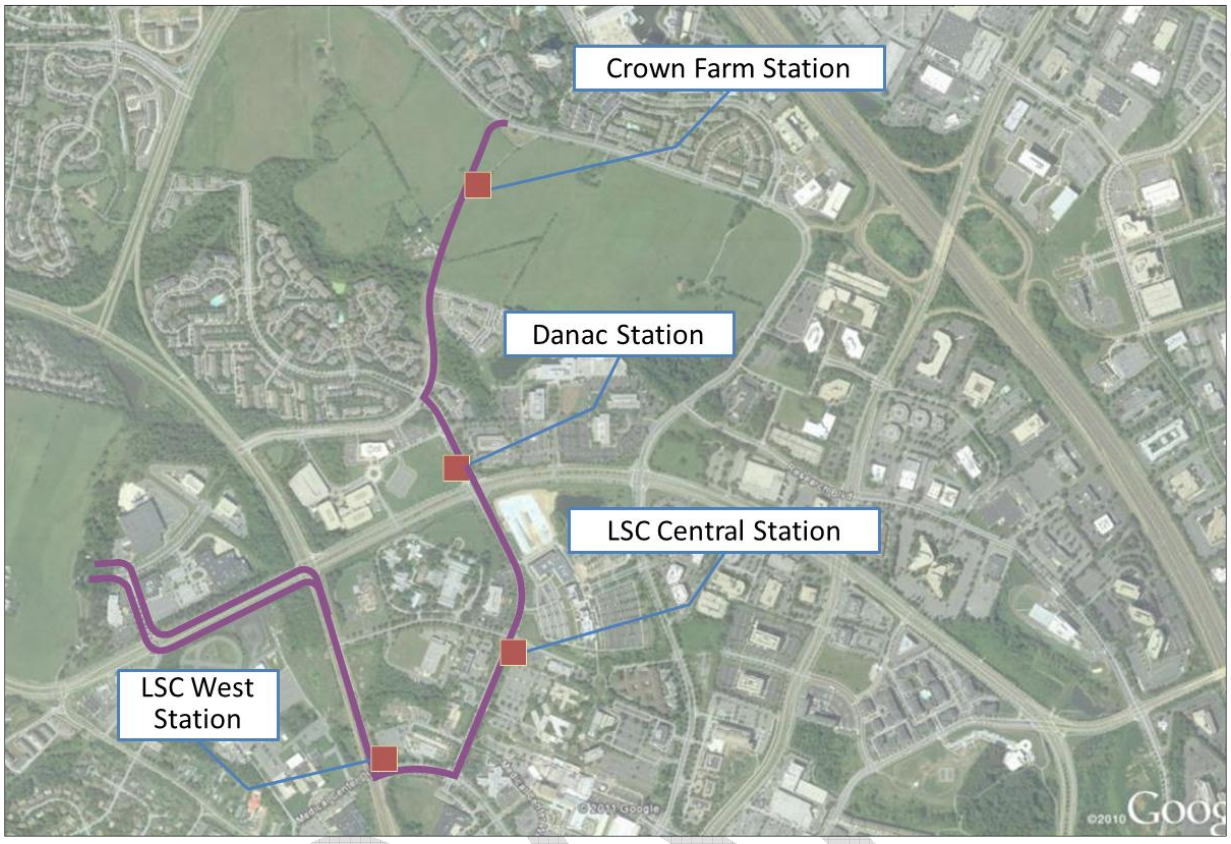
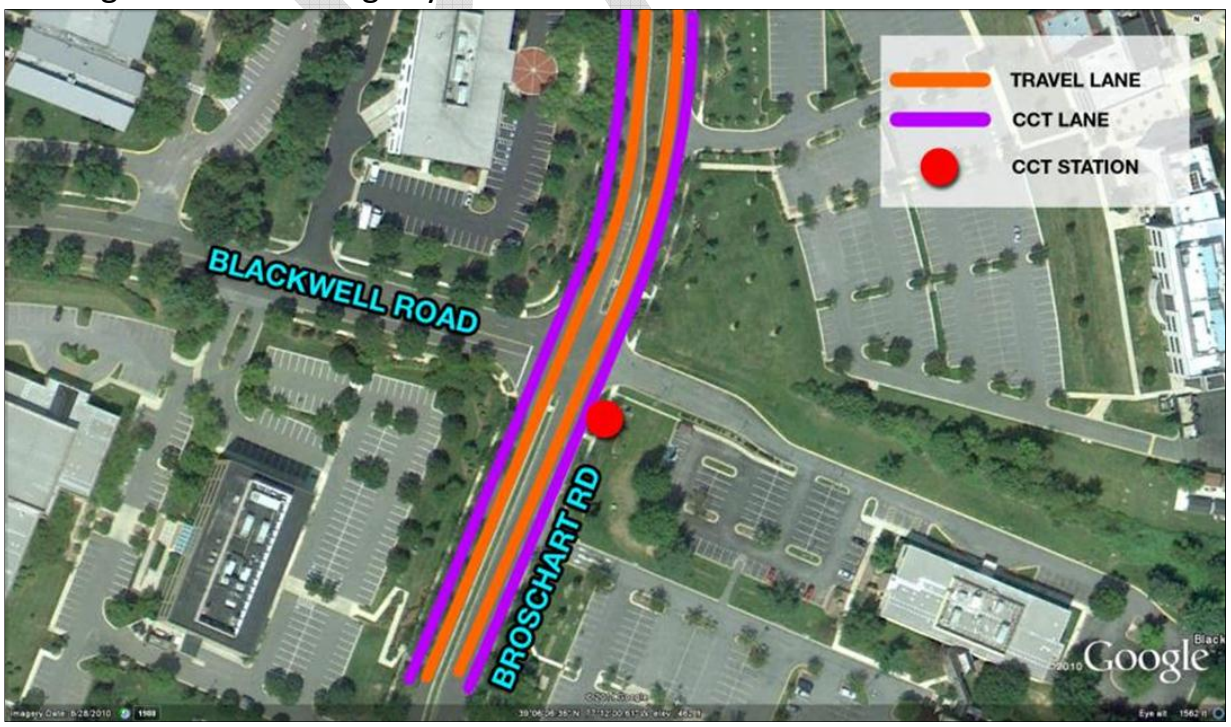


Figure 4 Runningway within LSC Central



Segment 3: LSC Central to LSC Belward

A Station is proposed on the LSC Belward Campus. Once the Early Starts alignment turns from Johns Hopkins Road to Belward Campus Drive, the modified alignment would be on the MTA Master Plan alignment. The differences between the MTA Alignment and an Early Starts Alignment include:

- Leaving LSC West Station, the Early Starts Alignment utilizes the MD 119 median between Medical Center Drive and MD 28 for the alignment of the CCT. Figure 11 below shows the typical section that would apply to this section of the alignment. The next phase of study could also consider this section operating in mixed traffic until the PSTA site is redeveloped and the ultimate CCT alignment through the PSTA site is constructed. The timing of this development and the regional traffic growth will help to guide the decision for the treatment in this area.
- As the alignment moves from the Belward Campus to Muddy Branch Road, shift the guideway into the median on Muddy Branch Road. The proposal addresses the following factors:
    - Responds to a policy of The Montgomery County's Transit Task Force that indicates preference for median running BRT to the extent possible and feasible. At a minimum, this concept should be studied for feasibility by MTA.
    - Improves access and minimizes right-of-way costs relative to costs associated with the MTA alignment.
    - Operates through the Muddy Branch Road and MD 119 intersection by turning from the median on Muddy Branch Road to the south side of MD 119. Signal operations should be reviewed to maximize concurrent movement efficiencies at the intersection.
    - Allows right-in/right-out for residential streets at all times.

The proposed Segment 3 alignment is shown in Figure 5.

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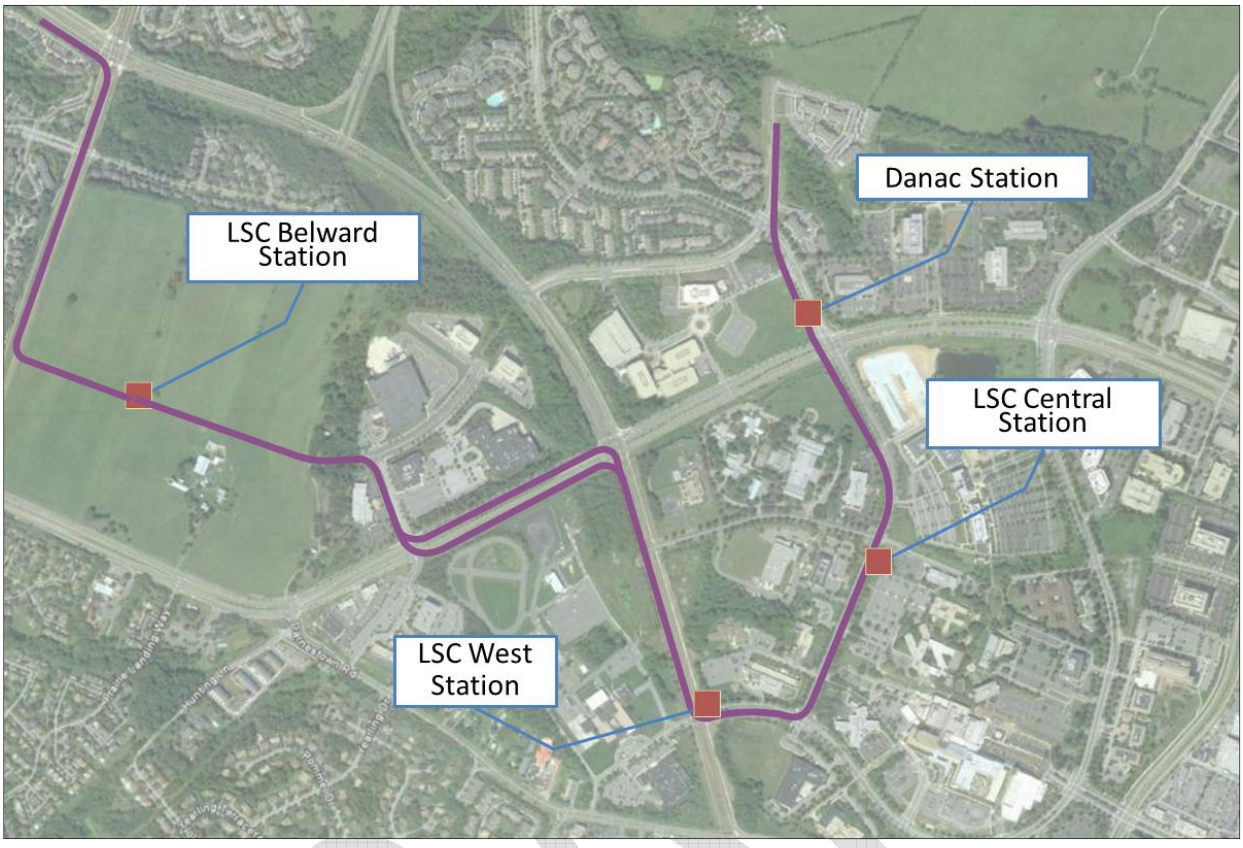
Figure 5 Proposed Segment 3 Alignment



Segment 4: LSC Belward to Kentlands/Medimmune Site

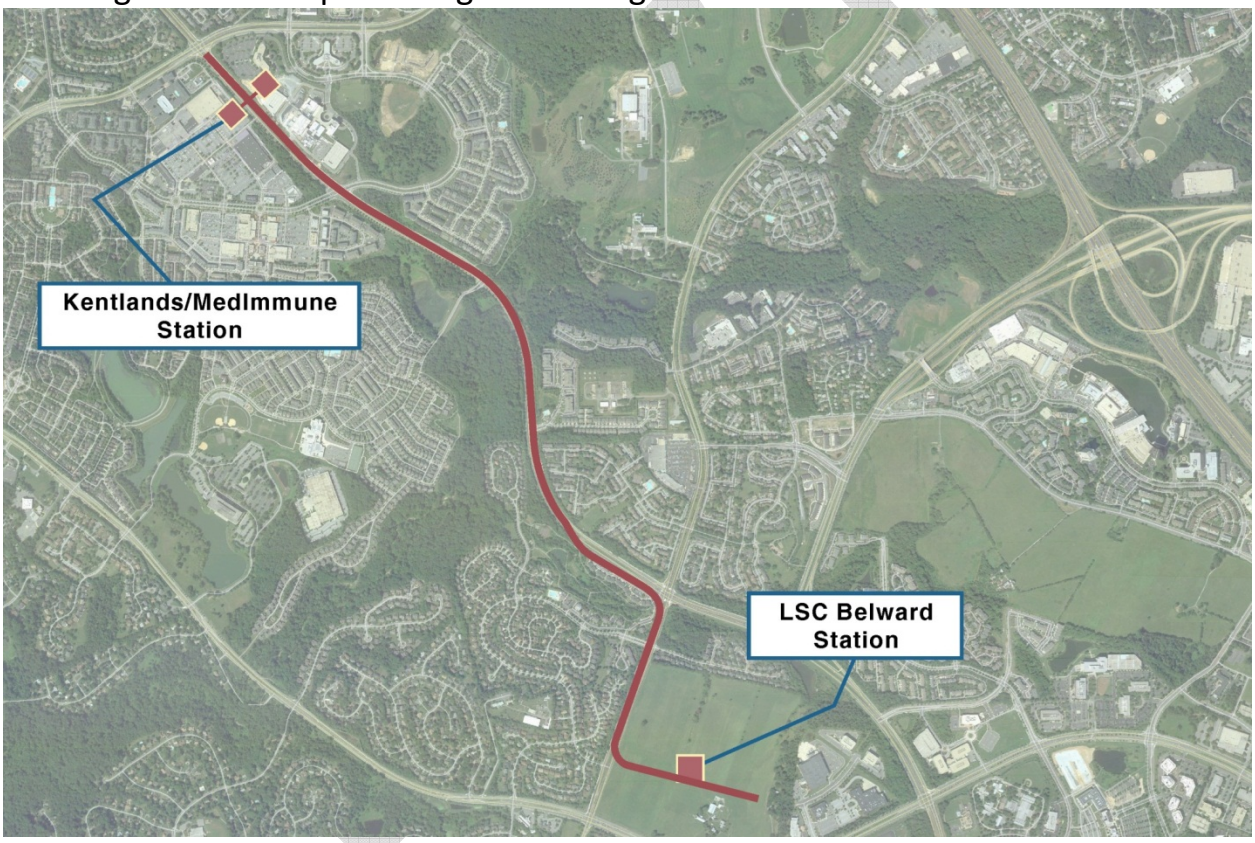
A Station is proposed in the vicinity of the Kentlands/MedImmune site. The differences between the MTA Alignment and an Early Starts Alignment include:

- The Early Starts Alignment transitions from Muddy Branch Road to MD 119 at the intersection and stays on the south side of MD 119 between Muddy Branch Road to the intersection of MD 119 and High Gables Drive. This intersection will need to be signalized and a signal phase is needed for the CCT to make this transition. At this point the CCT transitions to median running in the existing median of MD 119. This eliminates the need to add new structures over Muddy Branch, and over Kentlands Boulevard.
- At the intersection of MD 119 and Kentlands Boulevard, the Early Starts Alignment shifts to the north side of the MD 119. This alignment eliminates a structure carrying the CCT over MD 119 as the alignment moves to MD 124.
- A station can be constructed at the same elevation of the MedImmune and Kentlands site, approximately 20 feet higher than MD 119. Both of these sites would be connected with an at-grade pedestrian and bicycle bridge. Station access will be provided from both the MedImmune side and the Kentlands side. Right-of-way will be required from both sides, but the total amount

of right-of-way for this station is roughly similar to the right-of-way required from the MTA alignment. Additionally, this alignment connects both sides of MD 119 and would likely increase ridership. This would allow greater connectivity between the two sites and likely increase ridership, since two large destinations (one employment based and one mixed use) would be better served. Nearly all of the MedImmune site and most of the redevelopment area of the Kentlands site would be within ¼ mile of this station. The cost of this bridge is included in the cost estimate. Additional parking and bike sharing facilities should be included to accommodate a greater catchment area.

The proposed Segment 4 alignment is shown in Figure 6.

Figure 6 Proposed Segment 4 Alignment



Segment 5: Kentlands/MedImmune to Metropolitan Grove MARC Station

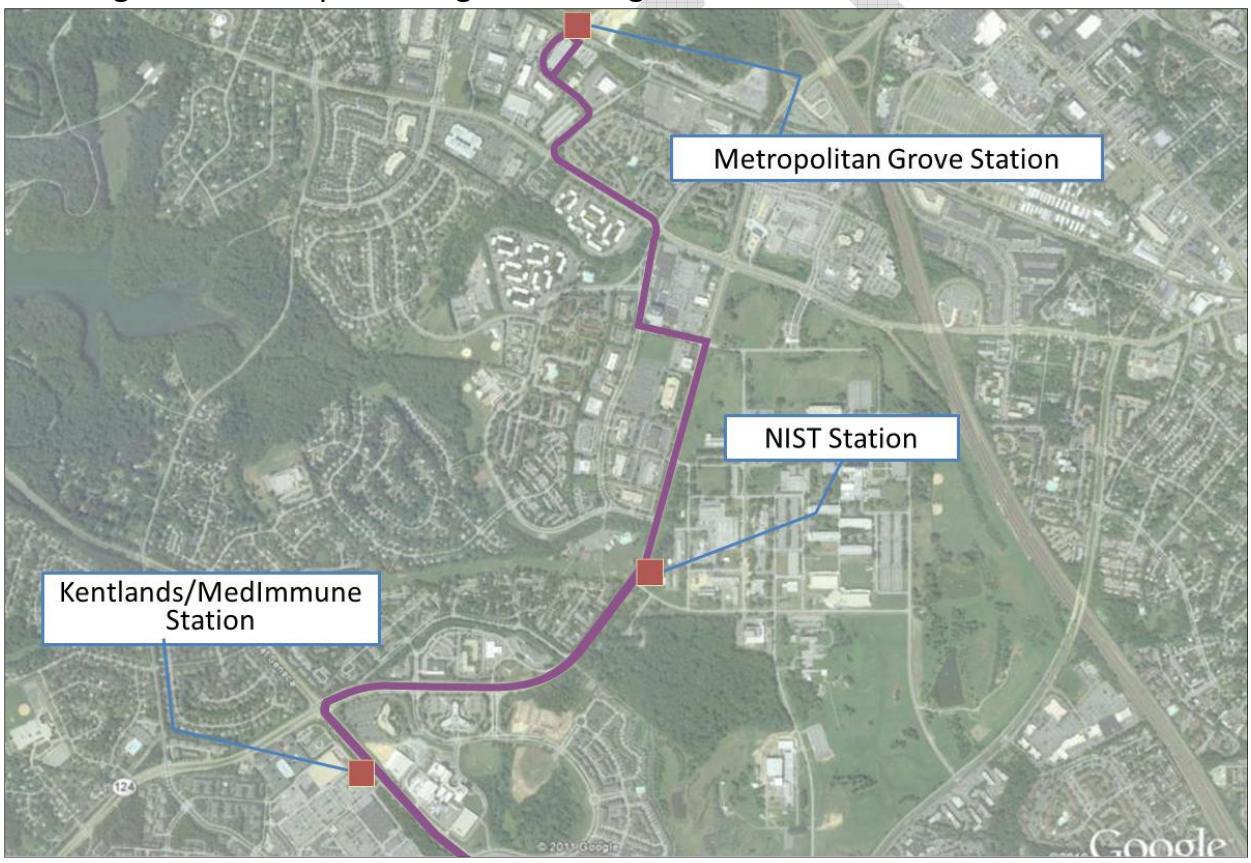
Stations are proposed at NIST and Metropolitan Grove Station. There are significant differences between the MTA alignment and an Early Starts Alignment as follows:

- From the MedImmune/Kentlands Station the alignment stays on the north side of MD 119 and the east side of MD 124 to the intersection of MD 124 and Orchard Ridge Drive. At this point the alignment shifts into mixed traffic.

- To avoid the congested intersection of MD 124 and MD 117, route the CCT around the Quince Orchard Shopping Center by using Bank Street or Quince Orchard Boulevard and First Field Road to MD 117.
- The CCT will complete its alignment by traversing on MD 117 one intersection to the west the Metropolitan Grove MARC Train Station, then to Metropolitan Grove Road, Metropolitan Court and the MTA Parking Lot. The existing bus bays will be used temporarily until the Master Plan alignment and the remainder of the CCT are built,
- Pedestrian/bicycle connections will be made to NIST Station.

The proposed Segment 5 alignment is shown in Figure 7.

Figure 7 Proposed Segment 5 Alignment



Operational Characteristics

INTERSECTION TREATMENTS

Rapid Transit Vehicle intersection treatments can be defined as any kind of physical or traffic operations improvement designed to either give RTV's an advantage over other roadway users (primarily automobiles), or to avoid the negative impacts of other roadway users. Priority treatments

apply traffic engineering tools to give transit vehicles priority over other road users. In most cases, the transit service operator is not the roadway owner, so applying any of these tools requires cooperation between the transit agency and the roadway owner. The challenge for the transit agency is demonstrating that the benefit to itself (potential cost savings) and to its passengers (travel time savings) outweighs potential impacts to other roadway users (e.g., increased delay for motorists). Some types of treatments may also generate side benefits (e.g., curb extensions create additional sidewalk area and reduce street crossing distances for pedestrians). RTV priority treatments are supportive of local policies that encourage greater alternative mode use and are justified on that basis. Key intersection treatments recommended along the CCT corridor include:

- Transit Signal Priority
- Queue Jump/Bypass Lanes
- Signalization
- Right-In, Right Out Intersections
- Traffic Signal Modifications

These are similar intersection treatments planned within MTA's design.

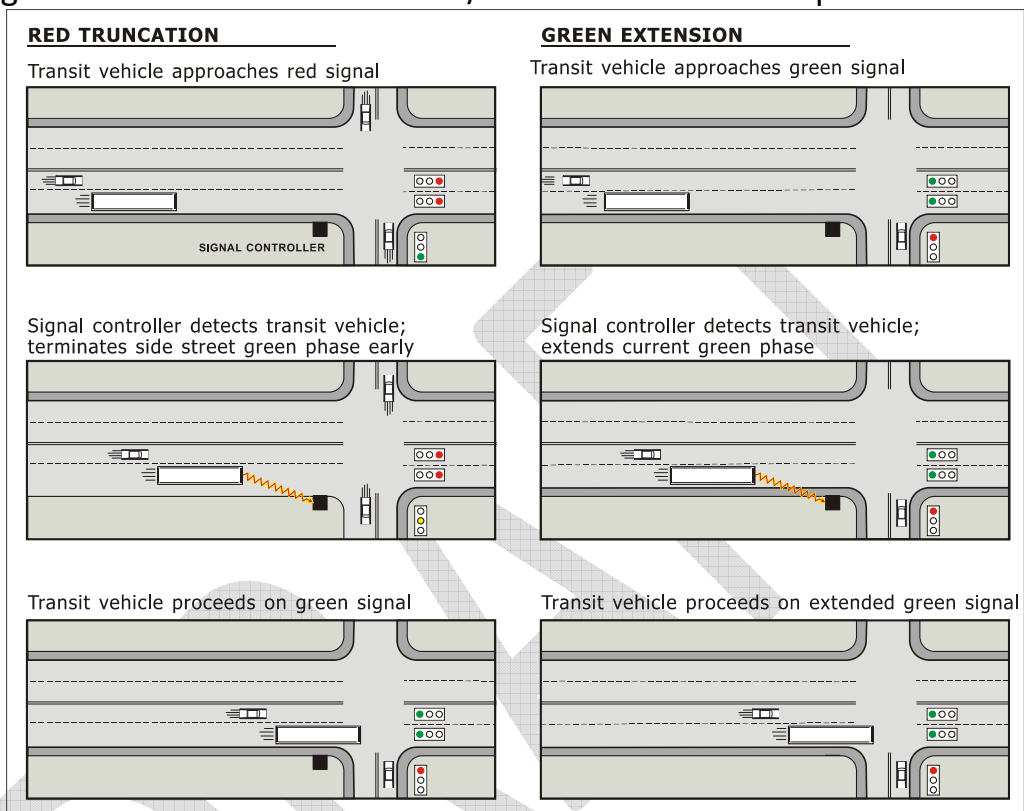
Transit Signal Priority

Active Transit Signal Priority (TSP) is used at traffic signals to detect the arrival of a transit vehicle and either hold the signal green a few seconds longer to allow the vehicle to pass through the intersection without delay, or return the green to the street a few seconds early to minimize RTV delay. Priority can be granted on a conditional basis (e.g., only to late-running vehicles). On average, RTVs can expect 5-6 seconds of average delay savings per intersection, or 0.3 – 0.5 minutes per mile saved depending on traffic signal spacing[1]. Effective use and implementation of TSP is experienced at intersections operating within capacity. At intersections that are over-capacity, additional transit preferential treatments should be considered in conjunction with TSP. TSP strategies such as frequency of granting a TSP request, amount of time that will be modified during a TSP call, time of day restrictions and schedule adherence/lateness will also impact operations. Details can be modified to balance traffic and transit operational needs. For this evaluation, it is assumed that TSP will be installed at every traffic signal along the proposed route. It is recommended that detailed TSP strategies should be developed during final design.

[1] Danaher, A., H. Levinson, and S. Zimmerman. TCRP Report 118: Bus Rapid Transit Practitioner's Guide. Transportation Research Board of the National Academies, Washington, D.C., 2007.

It should be noted that the traffic signal system within Montgomery County is a centralized signal system. This is a unique signal system within Maryland and the region. A supplemental analysis should be conducted to determine the appropriate technology and system interface to effectively manage TSP.

Figure 8 TSP Green Extension/Red Truncation Concept



SOURCE: *Transit Capacity and Quality of Service Manual* (9)
EXHIBIT 4-35 TSP Green Extension/Red Truncation Concept

Queue Jump Lanes

Queue jump lanes are typically short stretches of exclusive transit lanes allowing transit vehicles to move past a queue of cars at a traffic signal. Queue jump lanes typically include transit signal priority to gives transit vehicles a green light in advance of general traffic so they can re-enter traffic.

Discussions with Maryland SHA have commenced as part of a TIGER I project implementing queue jump lanes and signals along US 1 in Prince George's County. Project outcomes will include a preferred practice, analysis, and design of queue jump lanes.

Signalization and Right-In/Right-Out Intersections

To provide priority to RTV's and avoid conflicts between RTV's and standard automobiles, a majority of intersections along the CCT route will require signalization. There are a number of intersections where

it is recommended for the intersection to be converted to right-in/right-out access driveways in lieu of signalization. One of the main criteria for restricting access for driveways was the availability of secondary access points. It was not recommended to restrict movements for locations with a single access point or demand.

Traffic Signal Modifications

Modifications to the existing signal timing will be required at each intersection through which the CCT travels. As part of this study, a preliminary operations review was conducted at many of the key corridor intersections to determine feasibility and relative impacts. It is recommended that a more detailed operations analysis be conducted in the future to effectively assess operational impacts and necessary mitigations. The operations review conducted for this study are based on turning movement counts from a range of years (the oldest being from 2005) and sources (i.e., Maryland State Highway Administration and local traffic impact studies). Due to the short timeframe, the project scope (a planning study as opposed to a detailed operational analysis), and the budget of this project, turning movement counts at key intersections were not performed. Likewise, no base turning movement volumes were adjusted to account for traffic growth that may or may not have occurred since the date of the counts. Despite these factors and because this study's focus is short-term implementation, a preliminary assessment of operations was conducted to gain an understanding of potential capacity constraints and availability, signal timing issues and opportunities, and resultant impacts when modifications such as queue jump lanes are inserted at intersections.

TRANSITWAY DESIGN

Generally speaking, intersections and the congestion they can cause are the major contributors to transit delay. The need for transitway exclusivity—ranging from various guideway options to grade separation—is primarily driven by intersection operations, though other factors and constraints play a role as well. As described above, the capacity analysis determined where exclusive transitways would be desirable as well as where travel lanes could be converted to exclusive transitways or where roadway capacity needs to be maintained. Additionally, the capacity analysis identified sections where the RTV could operate in mixed traffic with minimal consequences.

The proposed CCT alignment will run through a variety of existing roadway cross-sections as well as undeveloped greenfields. Each configuration offers different opportunities to provide efficient transit operations, potentially without fully exclusive runningway. Typical cross-sections were developed to illustrate the runningway design in standard circumstances.

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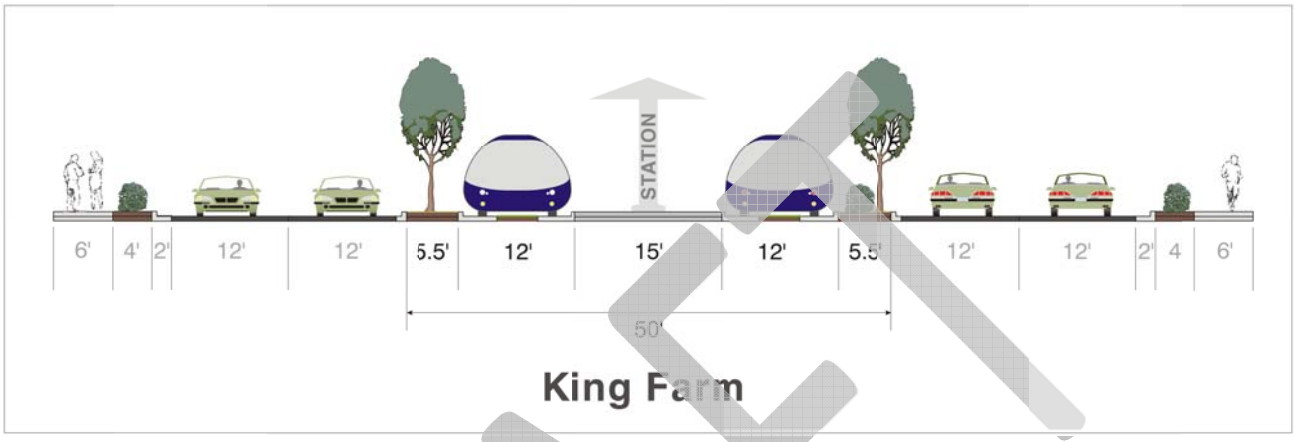
Median Runningway

Several area roadways have wide existing medians that can be utilized for RTV runningway without acquiring right-of-way for an exclusive transitway. Where the medians are sufficiently wide, the runningway can be constructed with minimal impact to the roadway. King Farm Boulevard was designed with a 50-foot median to accommodate future use as a transit way, as shown in Figure 9.

Figure 9 King Farm Cross Section



Where the RTV vehicle is routed through undeveloped land, a new roadway can be designed around a 40-foot median transitway, shown in Figure 10. Where an existing median is narrower than 40 feet or a median needs to be created or expanded, a 30-foot transitway can be applied, as shown in Figure 11. Widening a median often requires acquiring additional right-of-way and/or narrowing or converting travel lanes.

Figure 10 Crown Farm and LSC Belward Section

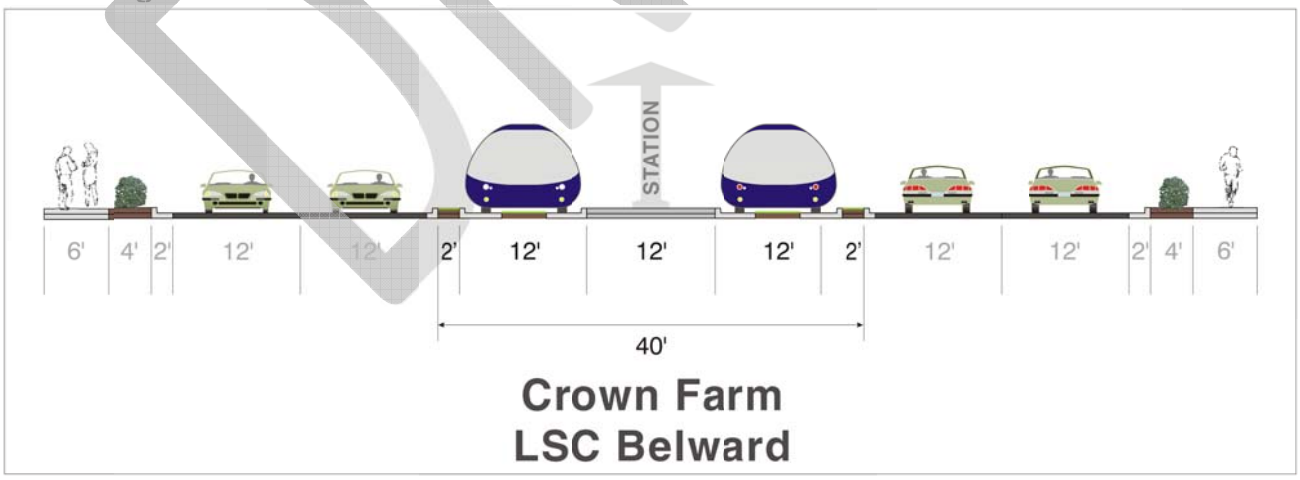


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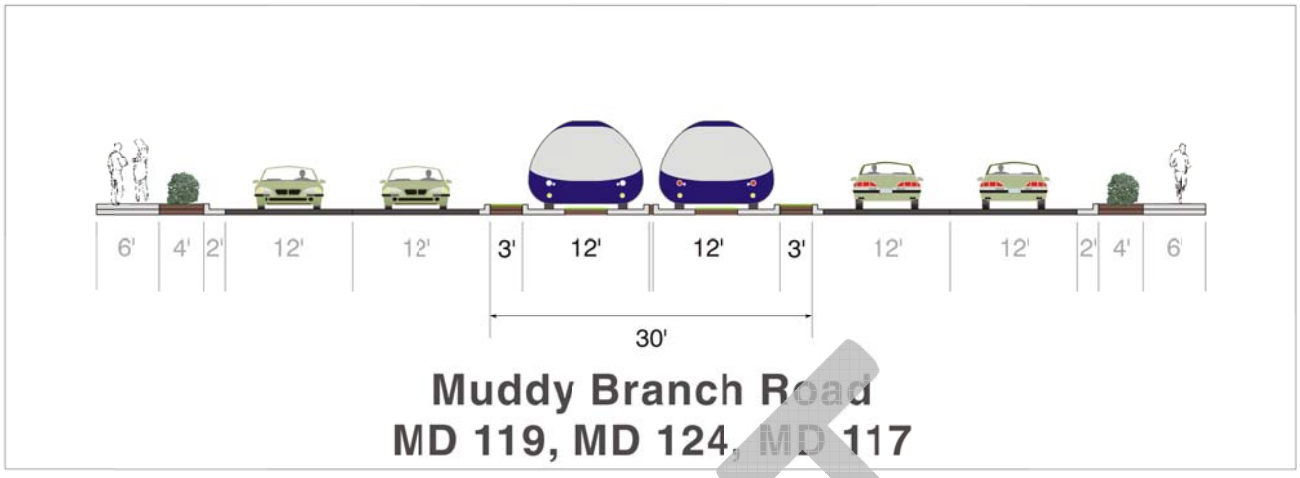
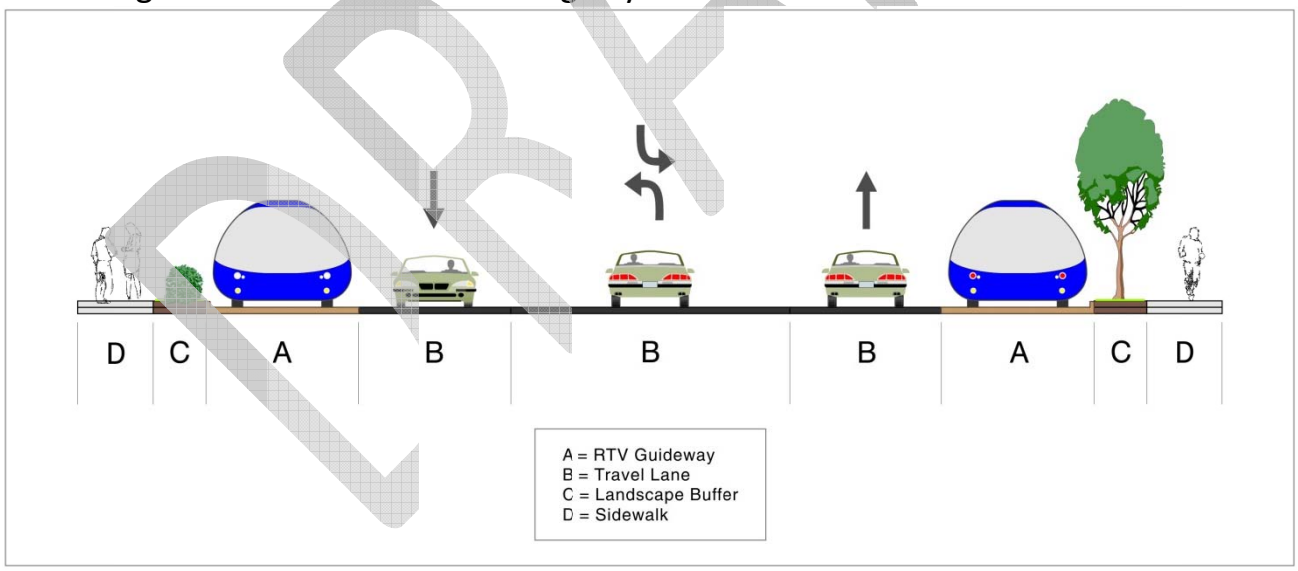
Figure 11 Muddy Branch Road Section



Curb-Lane Runningway

Vehicle lanes can be converted to exclusive RTV lanes on roadways with excess capacity to efficiently use the existing right-of-way and preserve left-turn access to driveways. These transit-only lanes can be designated with colored asphalt overlay and require minimal roadway work, making this configuration highly cost-effective. Figure 12 illustrates this configuration on a 5-lane roadway.

Figure 12 Curb-Lane Runningway Section



Semi-Exclusive Runningway

Sections of the CCT alignment will operate on open land that will not be a component of a future roadway or in locations where the transitway will operate in the shoulder of a roadway. These segments can be designed as a semi-exclusive transitway, separate from roadways except at crossings. This section applies in segments between King Farm Station and Crown Farm Station, and just past the Kentlands/MedImmune Station. Figure 13 illustrates this configuration.

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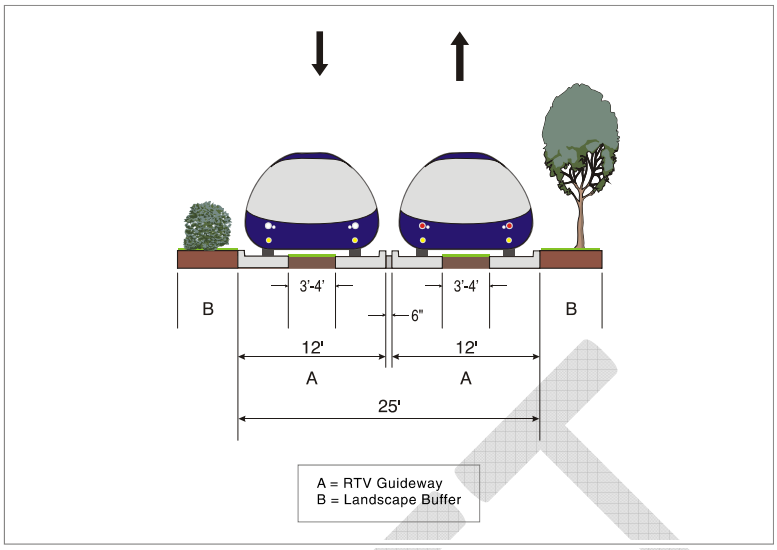
Figure 13 Semi-Exclusive Runningway Section



Exclusive Bus Lanes versus Guided Busways

Transitways typically involve exclusive transit lanes or guided transitways. Exclusive transit lanes are appropriate in cities where a relatively high number of transit vehicles are scheduled. They remove conflicts with mixed traffic and on-street parking but are typically wider than guided transitways. Exclusive transit lanes have been implemented in many major cities, such as Madison Avenue in New York City and 5th and 6th Avenue in Portland, Oregon.

Guided transitways are another form of segregated right-of-way. Guided transitways have curbs along the side of the guideway and the buses have another set of wheels that run along the curbs for lateral guidance. Guided transitways allow the bus operators more control so they can navigate more easily through a narrow right-of-way.[2] Curb guided transitways also allow for smoother rides and higher speeds in a narrower right-of-way (http://citytransport.info/FrameOBahn.htm). While guided transitways require more construction, they do require less right-of-way than an exclusive transit lane. Despite these advantages, curb guided transitways do present disadvantages. Guided transitways do not allow buses to overtake or pass in guided sections and breakdowns can cause delays to following buses. Guided transitways also require a "funnel" section for intersections and crosswalks where the guideway is typically removed temporarily. For purposes of this report, we assumed there could be a mix of exclusive transit lanes and guided transitways. For example, the RTVs could use a precision docking system as is currently used in Cleveland's Health to guide the vehicles into and out of stations.

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[2] Danaher, A., P. Ryus, E. Ellis, M. Walker, and K. Hunter-Zaworski. TCRP Report 100: Transit Capacity and Quality of Service Manual, 2nd Edition. Transportation Research Board of the National Academies, Washington, D.C., 2003.

Mixed Traffic

For short segments where there is little congestion, a dedicated runningway is neither necessary nor substantially beneficial. For example, a transit vehicle can travel freely on a section of roadway that is well under capacity between two signals, particularly if intersection treatments have been installed for the RTV to avoid undue delay at the signals themselves. In these cases, the CCT route is recommended to operate in mixed traffic. Segments where this is recommended for the Early Starts Alignment include on MD 119 through the Life Sciences center and between the Kentlands/MedImmune Station and the Metropolitan Grove MARC Station.

Stations

Station costs were estimated by identifying the type of station at each stop and comparing it to similar station costs. Stations along the CCT fell into one of three station types: enhanced stops, community stations, and transit centers. These station types embody the following characteristics based on the American Public Transit Association (APTA) recommended practices for BRT(RTV) stations and stops:

Enhanced Stops

- These stops may include amenities such as a small shelter, passenger information, seating, lighting and branding elements. Typically, these stops are smaller in size and scale than community stations.
- Pedestrian and Bicycle facilities and connections.
- Enhanced stops may moderately distinguish the RTV service from traditional bus service.
- Generally, enhanced stops are recommended in the following situations:
    - When there is a limited budget.
    - When quick deployment is a priority.
    - When travel demand is expected to be low.
    - When space limitations preclude installation of stations.

Community Stations

- Community stations are substantial facilities that can include many of the following attributes: shelter, level boarding, opportunity for advance fare collection, a unique name, a distinctive look and feel, passenger information, lighting and security, seating and other features typically associated with rapid or rail transit stations.
- Community stations convey more permanence and can provide more substantial passenger amenities than enhanced stops.
- Community stations have a higher capacity than enhanced stops and are easy for passengers to identify and locate in a street environment .
- These stations can serve as gateways for the community and encourage TOD.

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- Pedestrian and Bicycle facilities and connections.
- Recommended for most of the RTV applications, especially:
  - When high demand is expected.
  - When passenger experience is a high priority.
  - When it is desired to protect passengers from weather conditions.
  - When transit-oriented development is desired or proposed.

Transit Center

- Transit centers offer transfer opportunities to another high capacity transit line or service, generally without leaving the physical boundaries of the station.
- Pedestrian and Bicycle facilities and connections.
- Transit centers also may function as an end-of-line facility.

Each of these station types were compared with stations from other BRTs to determine which cost estimates were most appropriate. Table 1 below provides the comparable station options used for cost estimates.

Table 1 Comparable Station Cost Estimates

Bus Rapid Transit Example	Station Type	Characteristics	Year	Cost Estimates (in millions $)
Charlotte Blue Line Extension	Enhanced Stop	At-grade station-simple, running in median of Tryon Boulevard	2011	$0.8 to $0.9
	Community Station/Transit Center	At-grade Center Station (complex) or split platform stations		$1.8 to $2.0
St. Petersburg Central Avenue BRT	Community Station/Transit Center	Includes contingency and excludes escalation cost, At-grade station along one side of the street (20' to 30' shelters)	2007	$1.8 to $2.0
Montgomery County BRT Study	Enhanced Stop	Average costs of 367 stations, includes contingency and excludes escalation costs, At-grade station	2010	$0.289
I-270 Multi-Modal Corridor Study	Community Station	At-grade Station (2-180' long; 12' wide split side platforms)	2011	$1.458
	Transit Center	Aerial station (180' long, 28' center platform)		$18.472

Table 2 shows a summary of the potential station types at each stop along the CCT line and the associated costs based on comparable stations cost estimates.

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Table 2 Potential CCT Station Types and Construction Costs

Station	Type	Primary Access	Place-making function	Location	Cost Range* ($ million)	Temporary or Permanent Station
Shady Grove	Transit Center	All but heavy on bus transfers and park-and-ride users		Existing	Minimal costs related to signage, additional bus bays, vending machines, etc.	Temporary
East Gaither	Transit Center	Walk-up, kiss-and-ride, potential transfer to County BRT	High; Community focal point/gateway	At-grade; center station	$1.8 to $2	Permanent
West Gaither	Community Station	Walk-up, kiss-and-ride	High; Community focal point/gateway	At-grade; center station	$1.8 to $2	Permanent
Crown Farm	Community Station	All, potential park-and-ride	High; Community focal point/gateway (Crown Farm Developers and Johns Hopkins)	At-grade; center station	$1.8 to $2	Permanent
DANAC	Community Station	Kiss-and-ride and low walk-up	Medium	At-grade; Side station	$0.5 to $0.8	Temporary
LSC Central	Community Station	Walk-up and kiss-and ride	High	At-grade; Side station	$1.5 to $1.8	Temporary
LSC West	Community Station	Walk-up and kiss-and ride; potential transfer to County BRT line	High	At-grade; Center	$1.8 to $2	Temporary
LSC Belward	Transit Center	Walk-up, bicycle, kiss-and-ride, and potential park-and-ride	High (Campus focal point- Johns Hopkins University)	At-grade; center platform	$1.8 to $2	Permanent
Kentlands	Community Station	Walk-up, kiss-and-ride, and transfer to County BRT line	High	Higher elevation than adjacent properties; center platform	$12 to $15	Permanent
NIST	Community Station	Walk-up, kiss-and-ride, and transfer to County BRT line	High	At-grade; center platform	$1.8 to $2	Temporary
First Fields	Enhanced Stop	Walk-up and Bus Transfer	Low	At-grade, Side Station	$0.1 to $0.5	Temporary
Metropolitan Grove Station	Transit Center	All but heavy on bus transfers and park-and-ride users		Existing	Minimal costs related to signage, additional bus bays, vending machines, etc.	Temporary

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BIKE SHARING FACILITIES

It is anticipated that privately operated bike sharing facilities will be provided at each CCT station and at appropriate locations within ¼ mile and ½ mile radius of each station to expand the CCT ridership catchment areas.

TRAVEL TIMES

Travel times for the MTA and Early Starts Alignments were calculated utilizing assumptions on average travel speeds, segment distances, segment characteristics, intersection delays, and station dwell times. The intersection delays took into consideration opportunities for transit preferential treatments such as transit signal priority and queue jumps. As can be seen in Table 3, the travel time for the Early Starts Alignment is approximately 15-percent higher than the MTA Alignment for a round-trip. The primary differences between the travel times are a result of grade separation at key locations, particularly in the segment between Kentlands and Metropolitan Grove.

Table 3 CCT Travel Times

Segment	Station to Station	MTA Alignment	Early Starts Alignment
1	Shady Grove to Crown Farm	9.1	9.1
2	Crown Farm to LSC Central Station	4.0	4.4
3	LSC Central Station to LSC Belward Station	4.4	5.6
4	LSC Belward Station to Kentlands	6.5	6.5
5	Kentlands To Metropolitan Grove	7.3	9.3
Shady Grove to Metropolitan Grove (min)		**31.2**	**34.9**
5	Metropolitan Grove to Kentlands	7.3	9.6
4	Kentlands to LSC Belward Station	6.2	6.5
3	LSC Belward Station to LSC Central Station	4.0	5.7
2	LSC Central Station to Crown Farm	4.1	4.5
1	Crown Farm to Shady Grove	9.2	9.2
Metropolitan Grove to Shady Grove (mins)		**30.8**	**35.5**
CCT Round Trip Travel Time (mins)		***62.1***	***70.4***

COST ESTIMATES

The project team prepared cost estimates consistent with and using information provided to us by the MTA CCT team. The MTA estimate uses cost categories and a methodology based on Federal Transit Administration standard practices. The “”Sections” identified below are consistent with FTAs cost estimating procedures and are meant to identify the major cost categories that make a large transit capital project. We maintained most of the cost information for our estimate, and focused on changes in the running way and signalization. The cost categories include:

1. Section 10 – Guideway: This includes items such as guideway (in various runningway scenarios including portions that may use precision docking systems into and out of stations), structures, track (not applicable for this project) and signalization. The primary difference between the

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Early Start Alignment cost and the MTA cost is related to the elimination of several structures along the alignment.

2. Section 20 – Stations, Stops, Terminals and Intermodal. The primary difference between the Early Starts cost and the MTA cost is the construction of temporary stops at some locations. Section 30 - Support Facilities: Yards, Shops, Admin. Bldgs. We assumed the same cost as MTA for the construction of a maintenance yard.
3. Section 40 – Site Work. The Early Starts Alignment cost is significantly different than the MTA cost because park-n-ride facilities were not included in the initial construction.
4. Section 50 – Systems. We assumed Early Starts cost to be the same cost as MTA for the Systems costs.
5. Section 60 - Right-of-Way. We assumed the right-of-way costs to be less because the right-of-way needs are significantly less for the Early Starts Alignment. For example, no right-of-way will be needed in the Life Sciences Center and between MedImmune and Metropolitan Grove Station because the RTV will be running in mixed traffic in existing right-of-way.
6. Section 70 – Vehicles. The vehicle costs are significantly less than the MTA cost because we are recommending purchase of the RTV vehicles only at this time and not the additional costs for the feeder bus system proposed by MTA. We do recognize that these additional busses are important and will be needed at a later date.
7. Section 80 – Professional Services. These costs are developed by calculating percentages of Sections 10 through 70, and therefore the Early Starts Cost is lower than the MTA costs for this section.
8. Section 90 – Unallocated Contingency. Similar to Section 80, this category is developed by calculating percentages of Sections 10 through 70 and therefore the Early Starts Cost is lower than the MTA costs for this section.

In addition to comparing the costs to the MTA costs, a third party contractor reviewed independently reviewed the costs. All costs below are based on 2011 costs, and are subject to change in future cost estimates. The only difference below is in the cost of the Guideway. A summary of the KAI costs compared to the Contractor Cost is shown in Table 4 below.

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Table 4 CCT Cost Summary

Description	Contractor Cost	KAI Cost	Recommended Cost (+/- 10%)
10 - Guideway	$75,000,000	$45,000,000	$60,000,000
10 - Signals	$14,000,000	$14,000,000	$14,000,000
20 - Stations	$26,500,000	$ 26,500,000	$26,500,000
30 - Maintenance Facilities	$16,000,000	$16,000,000	$16,000,000
40 - Sitework	$28,000,000	$28,000,000	$28,000,000
50 - Systems	$19,000,000	$19,000,000	$19,000,000
60 - Right-of-Way	$3,500,000	$3,500,000	$3,500,000
70 - Vehicles	$15,000,000	$15,000,000	$15,000,000
80- Professional Services	$46,000,000	$46,000,000	$46,000,000
90 - Unallocated Contingencies	$7,000,000	$7,000,000	$7,000,000
Total	**$250,000,000**	**$220,000,000**	**$235,000,000**

Recommendation

As stated in the introduction of this study, the goal of the project was for this study to provide "a practical, compelling and affordable alternative" to the currently planned MTA alignment. The primary purpose was to test whether costs could be saved that would allow the MTA, in partnership with Montgomery County, to construct the first phase of the CCT (from Shady Grove Metro to Metropolitan Grove Metro Station) sooner than expected because of the lower cost. This study confirms that a cost effective RTV alternative does exist that accomplishes the exceptionally high quality and high performance transportation goals of the CCT at a reduced cost and without any material increases in travel time. Accordingly, we recommend MTA move forward with the Early Starts Alignment for Phase 1 after the Locally Preferred Alternative is announced by the Governor. The Early Starts Alignment also allows the County and the property owners/developers to move forward with their plans for development along the corridor.

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