Envisioning a 21st Century Flight-Connected City

CC2DCA

Crystal City to Ronald Reagan
Washington National Airport
Pedestrian Connection
Feasibility Study

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NOTE FROM THE BID

Implementing bold visions requires strong leadership, thoughtful collaboration, and persistence. The Crystal City Business Improvement District's "Crystal City to DCA Feasibility Study" is the first step towards a vision for a new pedestrian connection between Virginia's largest downtown district and its busiest airport.

With more than 23 million annual passengers and 9,000 workers, Ronald Reagan Washington National Airport is a powerful economic development engine for the area, providing convenient, reliable air travel to business and tourist destinations around the country. The airport's presence plays an important role in the success of Crystal City's hotel district—the largest in the region outside of downtown DC with 5,800 rooms—and in its attractiveness to corporations and associations with significant travel needs.

The Crystal City Business Improvement District (BID) sees an opportunity to further leverage the airport's proximity to Crystal City by bringing it a few steps closer. A new pedestrian connection would enable travelers to avoid potential road congestion or long waits on Metro with an enjoyable, 5-minute walk.

More than simply offering a shorter walk, the connection positions the neighborhood for future investments, both public and private. The connection would dramatically strengthen the airport as an economic development catalyst for Crystal City and offer a key amenity for tenants. It would also harness the multitude of transportation assets in Crystal City, seamlessly link them together into a multimodal hub, and position the neighborhood to attract additional rail service operations such as Amtrak, regional commuter rail, and even a future high-speed rail station.

The Crystal City to DCA Feasibility Study (CC2DCA) is a key first step towards delivering on this exciting vision for the future of Crystal City—but much work remains. The Crystal City BID looks forward to continuing the conversation with key stakeholders and agency partners. Next steps include further exploring the benefits, addressing concerns, and working collaboratively towards the shared goal of creating a strong regional economy for businesses, residents, and tourists. We welcome you to join the Crystal City BID on this journey.

—***Robert H. Mandle***
CC2DCA Project Manager, Chief Operating Officer, Crystal City Business Improvement District

EXECUTIVE SUMMARY

VISION

To directly link Crystal City with DCA via a context-sensitive pedestrian connection that strengthens Crystal City's office and hotel community, and offers new opportunities to link thousands of residents and visitors to an intermodal hub that includes the airport, Metrorail, commuter rail, regional rail, and recreational trails.

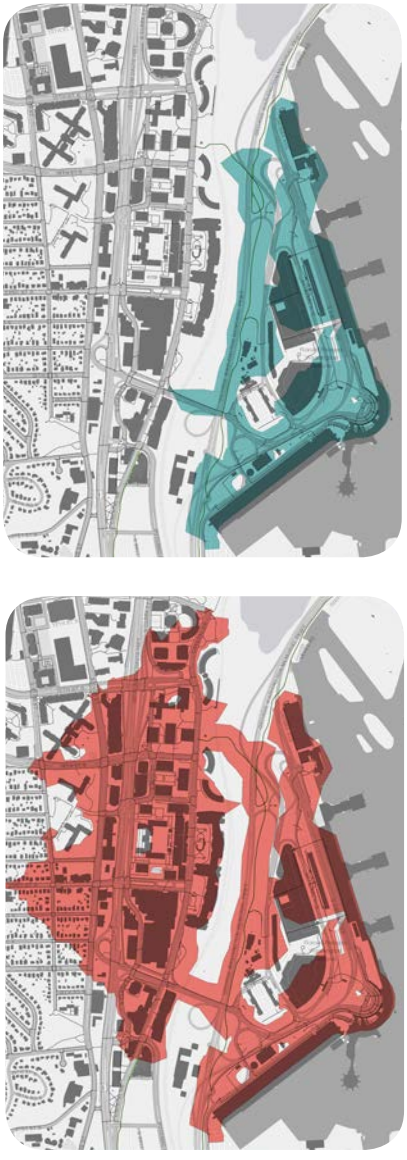


Figure 1 *Comparison of Existing Walkshed versus Alignment A Walkshed.*

The Crystal City Business Improvement District (BID) initiated the Crystal City to Ronald Reagan Washington National Airport Pedestrian Connection Feasibility Study (CC2DCA) in August 2017 with a working group that included Arlington County, JBG SMITH, National Park Service (NPS), Metropolitan Washington Airports Authority (MWAA), Washington Metropolitan Area Transit Authority (WMATA), National Capital Planning Commission (NCPC), Virginia Railway Express (VRE), Amtrak, CSX Transportation (CSXT), and others. In addition to hosting three working group sessions, the Crystal City BID conducted one-on-one meetings with members of the working group, as well as two public meetings. The purpose of the study was to identify feasible options to create a direct and walkable link between Ronald Reagan Washington National Airport (DCA) and Crystal City as recommended in the Crystal City Sector Plan.

Crystal City and DCA are separated by the George Washington Memorial Parkway (Parkway) and CSXT corridors. Existing walking routes between Crystal City and DCA are difficult to find, indirect, and take pedestrians over 35 minutes to walk between destinations (**Figure 1**). A new pedestrian connection would strengthen Arlington's long-term economic sustainability, help Crystal City attract additional rail service operations like Amtrak and Maryland Area Regional Commuter (MARC), and cement the airport as an "aerotropolis" connecting an estimated 10,000 airport passengers to Crystal City per month. Throughout the 4-month-long planning process, the study investigated the potential for a connection that:

- Generates economic development
- Creates a direct and enjoyable experience
- Provides multimodal access and connectivity to the region
- Celebrates and preserves recreational, cultural, and historic resources
- Aligns or integrates with existing and planned infrastructure projects
- Develops a practical and implementable solution

The project team developed two potential alignments between Crystal City and DCA, and selected the most feasible alignment between 2011 Crystal Drive and the airport's Parking Garage C for a bridge or tunnel option. Based on a high-level feasibility analysis, both bridge and tunnel options were deemed feasible and range from $16 million to $26 million in construction costs for a bridge and $28 million to $38 million for a tunnel. The bridge option affords potential connections to VRE's relocated station and the Mount Vernon Trail, as well as an opportunity to celebrate the history of NPS's Parkway from a unique vantage point; however, it has associated challenges by crossing above the Parkway, a cultural and natural resource on the National Register of Historic Places. The tunnel option preserves the Parkway; however, it crosses below an active railroad corridor, and doesn't allow for a direct connection to VRE's relocated station and the Mount Vernon Trail.

This study is the first step among many, and highlights considerations for a new connection like ownership, access and usage, design typologies, order of magnitude construction and maintenance costs, approvals and permitting, and funding strategies. It also includes potential improvements that can be accomplished in the near term to enhance current walking connections through wayfinding, pedestrian crossings, and widened "pinch points." Specific next steps, roles, and timelines will be determined with continued coordination of Arlington County, stakeholders, and potential funding partners and review agencies.

INTRODUCTION

DISCOVER | SYNTHESIZE | PLAN

OPPORTUNITY

Connected, safe, and enjoyable access is key to a thriving urban environment. Reducing once burdensome trips between destinations, whether through transit or walkability, can create and promote long-term economic sustainability. Crystal City's location allows it to connect with, interconnect with, and serve as host to a dynamic range of transportation options. The Crystal City to DCA pedestrian connection embodies this mission, offering the potential to create a vibrant urban environment unlike any other in the United States.

Many cities across the country are actively pursuing, through significant investment, the idea of an airport-city, or "aerotropolis." Crystal City, however, has one strategic advantage that other cities do not: its location, so close to DCA, already positions it on the cusp of becoming an aerotropolis. Few, if any, airports in the country have the existing proximity to an urbanized business district area that DCA has. As shown in **Table 1**, DCA sits at number seven on the list of airports closest to their downtowns—but that report measures the distance from DCA to Washington, DC. If you instead measure the distance from DCA to Crystal City, DCA would be nearly three times closer to its "downtown" than the top airport. None of the airports listed have the type or scale of office and retail space accessible within a 15- to 20-minute walk that Crystal City offers. Crystal City has an enormous opportunity to create something unique.

Developing a pedestrian connection between Crystal City and DCA solves three primary challenges that prevent Crystal City from fully capitalizing on its proximity to the airport:

1. The current walking connections between Crystal City and DCA are cumbersome, are not ADA compliant, and are long
2. Existing vehicular routes between Crystal City and DCA are approaching or are at capacity and are indirect
3. Existing transportation amenities serving thousands of passengers per day are not interconnected

Airport Distance to Downtown

City (Airport Code)	Distance to Downtown (Mi.)	Drive Time (Min.)
TORONTO ON (YTZ)	2.5	31 (incl. ferry), 10 after ferry
BOSTON MA (BOS)	3.5	10
SAN DIEGO CA (SAN)	3.6	11
SAN JOSE CA (SJC)	3.9	8
LAS VEGAS NV (LAS)	4	11
MIAMI FL (MIA)	5	9
WASHINGTON DC (DCA)	5.1	13
BIRMINGHAM AL (BHM)	5.4	11
VANCOUVER BC (YVR)	5.7	17
DALLAS TX (DAL)	6.4	19

Table 1 *Distance to their respective downtowns for airports (Zara Matheson, Martin Prosperity Institute)*

View of connection corridor and airport from Crystal City.

PROCESS

The project team established a three-step approach to developing and understanding the connection:

1. **DISCOVER** focused on collecting background information from stakeholders and the public, and gathering all available data sets, including development and transit usage. The DISCOVER phase aimed to create a platform to evaluate the connection.

2. **SYNTHESIZE** analyzed background information and available data to understand the potential constraints and opportunities for the connection. This process included developing and studying a series of alignments and options above and below grade. The SYNTHESIZE phase resulted in a most feasible alignment and set of potential options for the connection.

3. **PLAN** offers a vision of how the CC2DCA project could move forward. The PLAN phase focuses less on the design of the recommended connection and instead paints a roadmap for how the project would be implemented, including a proposed timeline, necessary approvals, and potential funding sources. It also identifies short-term improvements to existing conditions to address existing safety and accessibility issues for pedestrians and cyclists in the study area.

The Crystal City BID oversaw the study and convened a working group to aid the project through all three phases. The working group included:

- AMTRAK
- Arlington County Department of Environmental Services
- Arlington Economic Development
- Arlington Convention and Visitor Services (ACVS)
- CSX Transportation (CSXT)
- Crystal City Civic Association (CCCA)
- JBG SMITH
- Metropolitan Washington Airports Authority (MWAA)
- National Park Service (NPS)
- National Capital Planning Commission (NCPC)
- Office of Congressman Don Beyer
- Virginia Department of Rail and Public Transportation (DRPT)
- Virginia Railway Express (VRE)
- Washington Metropolitan Area Transit Authority (WMATA)

In addition to the working group, the project team held two public meetings: one on September 5, 2017, during the DISCOVER phase, and another at the conclusion of the PLAN phase on November 15, 2017.

PREVIOUS/PLANNED PROJECTS

The value of the CC2DCA project lies in its ability to provide connections across the region. With a focus on connectivity, several reports, projects, and studies were reviewed early in the preparation of the study to determine how their recommendations could affect the CC2DCA project, including:

- Crystal City Sector Plan
- NPS National Capital Region Paved Trail Study
- Atlantic Gateway
- Southeast High-Speed Rail Project
- Long Bridge Project
- Project Journey
- JBG SMITH/Metro Second Entrance Development
- VRE Crystal City Station Improvements

In addition to the recommendations from these plans, projects, and reports, the VRE System Plan 2040 and MARC Growth and Investment Plan 2050 both propose several operational changes to meet regional travel needs during the next 25 years. VRE's potential strategies include operating VRE trains during midday and evening hours; operating on Saturdays and Sundays; and offering high-frequency and bi-directional service during peak times for trips between Alexandria and the District. MARC proposes extending service to L'Enfant Station and Northern Virginia.

Crystal City Sector Plan

The Crystal City Sector Plan is a community-focused visionary document that lays out a path for Crystal City to become a lively urban environment. The document identifies seven key goals for the revitalization of Crystal City:

1. Create a high-quality public realm that strengthens the sense of place
2. Provide a mix of uses balancing office, residential, retail, cultural, and civic uses among several defined neighborhood centers
3. Relate architectural and urban design to the human scale
4. Enhance multimodal access and connectivity
5. Incorporate sustainable and green building principles into all urban and architectural design
6. Preserve the integrity of the single-family neighborhood to the west
7. Ensure Crystal City's long-term economic sustainability

NPS National Capital Region Paved Trail Study

The NPS Paved Trail Study identifies the general condition of the Mount Vernon Trail and related George Washington Memorial Parkway trail network. For the portion of the trail near Crystal City, the Study identifies short- and mid-term improvements to the consistency and markings along the Mount Vernon Trail. The report also identifies the need to connect the trail directly to the 26th Street Bridge.

Figure 2 *Long Bridge Corridor Project study area.*

Atlantic Gateway

The Atlantic Gateway project is a multimodal project in the I-95 corridor between the District and Fredericksburg, VA, led by the Virginia Department of Transportation (VDOT) and the Virginia Department of Rail and Public Transportation (DRPT). The project focuses on adding capacity to a 6-mile segment of the corridor just south of the Long Bridge project, stretching from the south bank of the Potomac River to Alexandria, to address freight train congestion. Upgrades include adding track to all segments of the corridor, bringing the number of tracks to four. The upgrade supports the Southeast High-Speed Rail Project.

Southeast High Speed Rail Project

Amtrak has plans to bring high-speed rail service to the I-95 corridor from Washington, DC, to Raleigh, NC. The rail infrastructure is planned to ultimately extend to Atlanta, GA. The project would improve safety, mobility, and connectivity for rail passenger and freight traffic between the two cities. It would also relieve traffic congestion along the I-95 and I-85 corridors.

Long Bridge Project

The Long Bridge crosses the Potomac River, stretching from Crystal City to downtown Washington, DC (**Figure 2**). The two-track bridge currently carries freight (CSXT), passenger rail (Amtrak), and commuter rail (VRE) service. The District Department of Transportation (DDOT) and the Federal Railroad Administration (FRA) are conducting a study to expand the capacity of the bridge to support anticipated growth in passenger and freight rail service along the corridor. Another benefit of increased capacity across the river includes additional regional commuter rail service as recommended in VRE's System Plan and MARC's Growth and Investment Plan.

The Plan specifically identifies the connection between DCA and Crystal City as a critical improvement for Crystal City's transformation into a more inviting, lively, and walkable community.

Project Journey

In the summer of 2017, the Metropolitan Washington Airports Authority (MWAA) launched Project Journey, a comprehensive campaign surrounding the planned $1 billion, multi-year capital improvement project that will transform the passenger experience at DCA. Improvements include construction of two new security checkpoints to replace the "per-gate" security that is currently in operation, a new enclosed terminal to replace the Gate 35X bus shuttles, and future roadway and parking configuration modifications (**Figures 3 and 4**).

Figure 3 *New security terminals are highlighted in yellow in the above image. (MWAA)*

JBG SMITH/Metro Second Entrance Development

With trips to and from the station projected to increase, it is anticipated that the Crystal City Metrorail Station will reach its capacity to serve Metrorail passengers. To accommodate future planned growth in Crystal City, Arlington County is working with WMATA and JBG SMITH to design and build a second station entrance along Crystal Drive, just north of 18th Street. The new entrance will help passenger flows between Metrorail and VRE, as well as between Metrorail and Metroway.

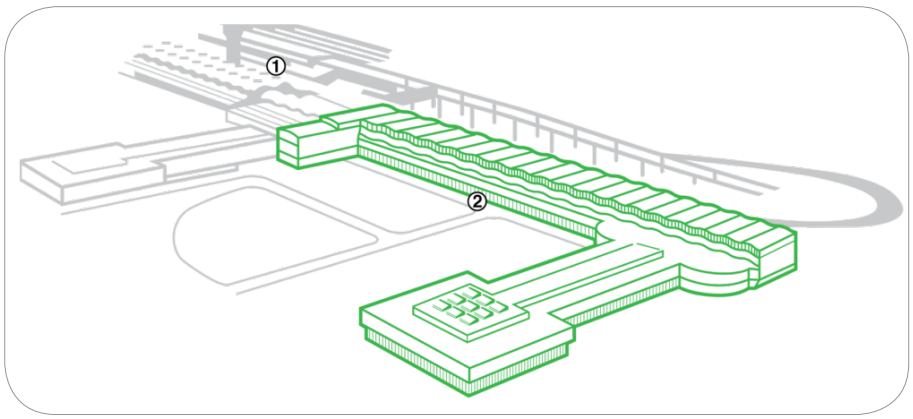


Figure 4 *Terminal Expansion over the existing 35x Gate. (MWAA)*

VRE Crystal City Station Improvements

VRE has plans to expand the capacity of its Crystal City station to accommodate future service increases and high-speed rail service planned under the Southeast High-Speed Rail Project. The current station platform serves a single track. The improvements for the Crystal City VRE station include a longer island platform that will serve two tracks. VRE is moving forward with a relocated station (**Figure 5**) and is entering 30% design.

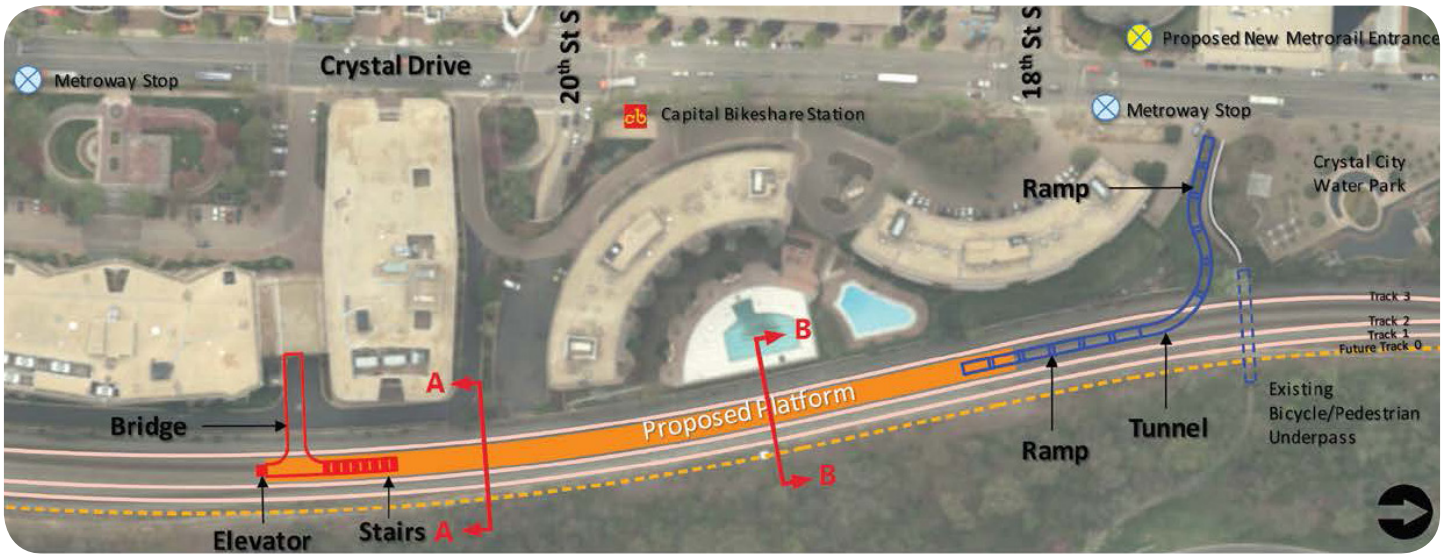


Figure 5 *The VRE Option 2 platform relocation site. (VRE)*

PHASE I
DISCOVER

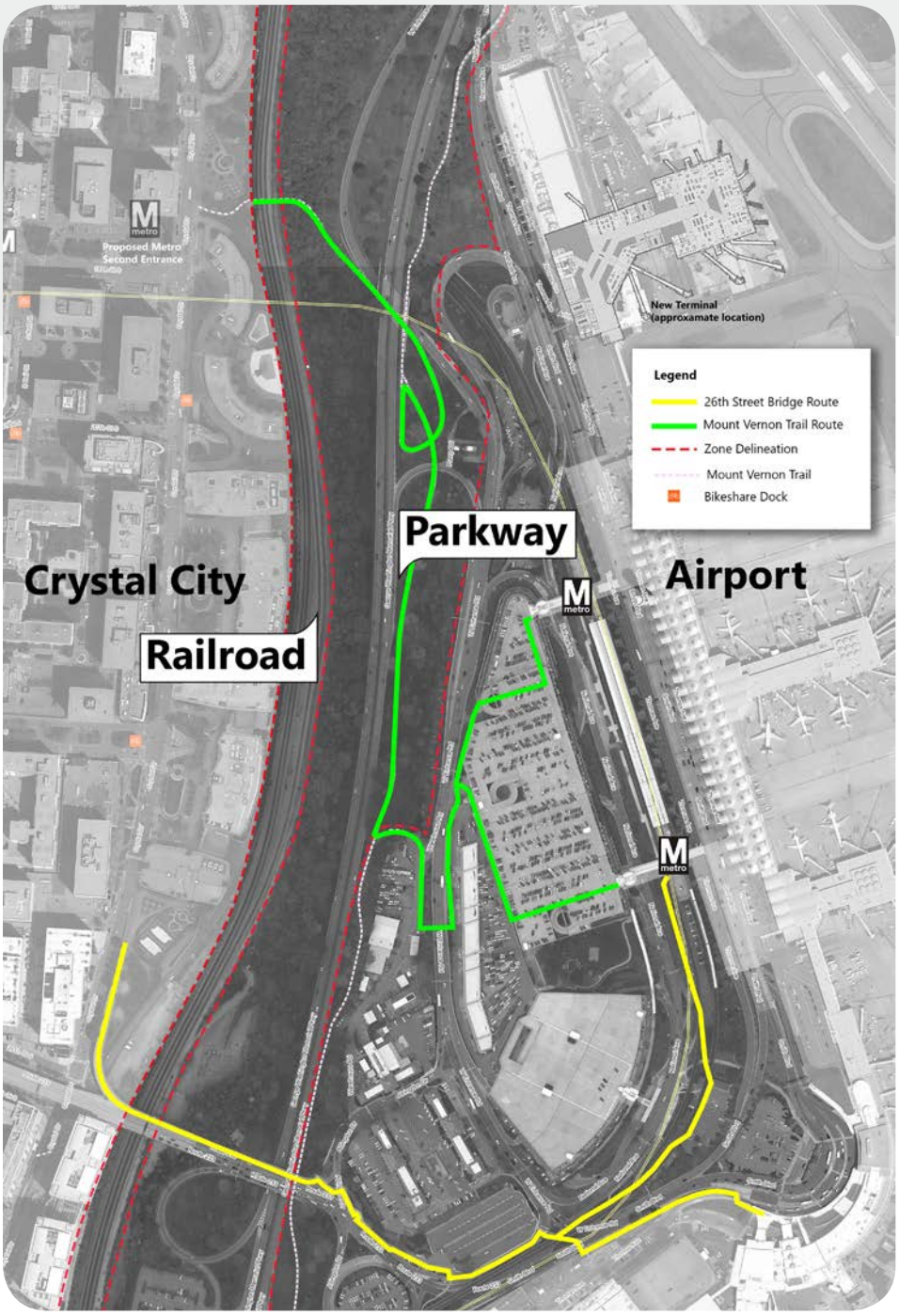


Figure 6 *Zone and existing walking route map.*

The DISCOVER phase focused on gathering all available information that could affect the location or design of the connection, or any challenges or opportunities associated with the connection. Gathering this information helped the project team understand the conditions, the potential for the connection, and where opportunities could be leveraged.

CONTEXT, BACKGROUND, & SETUP

Study Area

Crystal City and DCA are bisected north-south by both the George Washington Memorial Parkway (the Parkway) and CSXT corridors. These corridors naturally divide the site into four distinct zones: the Crystal City Zone, the Railroad Zone, the Parkway Zone, and the DCA Zone, shown in **Figure 6**. Ownership follows the zone map closely, as MWAA owns the DCA property, NPS owns the Parkway, and CSXT owns the railroad corridor. In Crystal City, JBG SMITH owns the bulk of the land alongside the railroad corridor.

A series of one-on-one meetings were held with the members of the working group to better understand each stakeholder's perspective on specific opportunities and challenges associated with a new connection.

Headway/Wait Time, Travel Time, and Cost by Mode

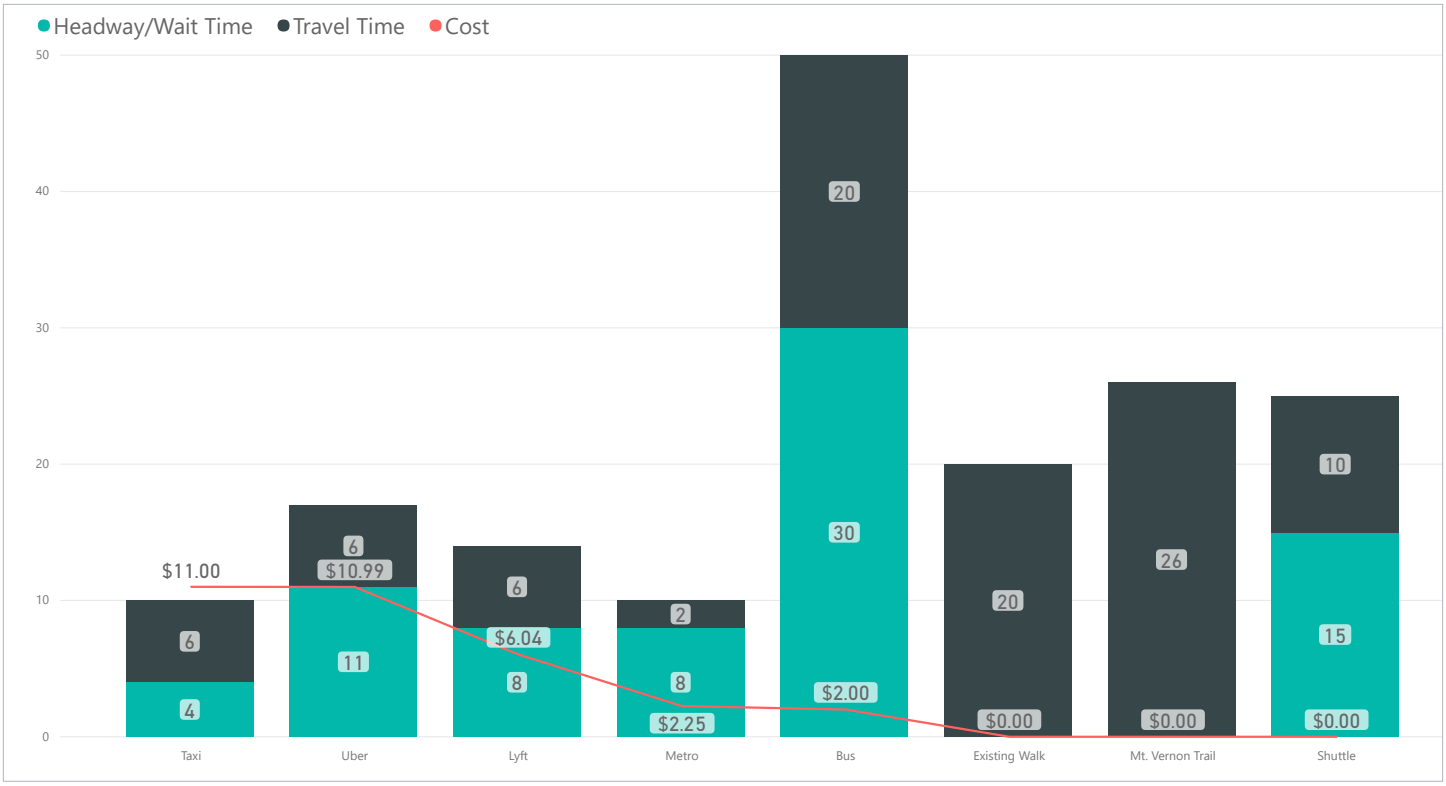


Figure 7 *Wait times and costs for travel between Crystal city and DCA. (Data based on current timetables)*

Crystal City Zone: This majority of the railway frontage in Crystal City is owned by JBG SMITH. In this zone, the preference is for the connection to land centrally in Crystal City, close to Metrorail, Metroway, and VRE's Crystal City Station relocation entering 30% design. Pedestrian access to the new connection should be prioritized because curb space is limited along Crystal Drive. The new connection may also open a new market for Crystal City to serve as a portal to DCA.

Railroad Zone: CSXT owns the railroad corridor through Crystal City. The corridor currently carries more than 75 freight and passenger trains a day, which is expected to more than double by 2040. When considering a connection, bridges are more common over similar high-volume railroad corridors, while tunnels are riskier because they pose a greater threat to railroad operations. Therefore, CSXT is more amenable to a bridge connection. The new connection should connect seamlessly to VRE's platform, adding value to passenger rail customers.

Parkway Zone: The Parkway, owned by NPS, is a cultural resource on the National Register of Historic Places because of its association with George Washington and its distinctive characteristics. NPS values preserving the Parkway's driving experience and the unique views along its length (that is, the viewshed), and is concerned about any potential impacts to cultural and natural resources. In addition, the Mount Vernon Trail provides important connectivity throughout the regional bike network, and there is a desire to explore enhancements to the trail into Crystal City and to the 26th Street Bridge.

Airport Zone: MWAA owns the Airport Zone. The airport currently experiences significant roadway congestion due to cut-through traffic, and pedestrians jaywalk across the access road from the Parkway to DCA because this is the most direct route. While the community has requested an at-grade crossing, it is not recommended due to conflicts with traffic flows exiting the parkway. From MWAA's perspective, any modifications to airport property cannot disrupt the operation of the airport or any planned roadway and parking improvements currently under environmental review; however, MWAA expressed a desire to explore improvements to the 26th Street Bridge for pedestrians while maintaining existing levels of vehicular service.

Existing Modes

There are currently eight ways to travel between Crystal City and DCA, as shown in **Figure 6**. All the connections are more than 15 minutes long, or cost money. Of the existing connections, Metrorail is the fastest mode between Crystal City and DCA, outside of the more expensive taxi and Transportation Network Companies (TNC) options. To develop a baseline understanding of how far from the airport one can travel in 15 minutes, a series of walkshed maps were generated. The walksheds were developed from the Arlington County GIS Walking Network data set. Statistics used in **Figure 7** were estimated at the time of writing. Taxi, TNC, and Metrobus were excluded from the walkshed analysis. Taxi and TNC have trip-specific destinations, and are significantly more expensive than all the other options. Hotel shuttles only operate between the airport and specific hotels. The Metrobus 10N route operates too infrequently to be a dependable solution for weekday travelers.

All walksheds start from the new security points at Terminal B and Terminal C, and continue into Crystal City.

When studied for the existing baseline 15-minute walkshed, travelers along the Mount Vernon Trail and 26th Street Bridge can just reach the edge of Crystal City, as shown in **Figure 8.** On the other hand, the existing baseline 15-minute Metrorail walkshed, shown in **Figure 9**, has a one-block radius in Crystal City. The existing walking routes follow the Mount Vernon Trail and the 26th Street Bridge. For the first walking connection via the Mount Vernon Trail, pedestrians can exit DCA through the parking garage, navigate around and under the airport access road, and take the Mount Vernon Trail to the Crystal City Connector to connect into Crystal City. This walk is not Americans With Disabilities Act (ADA) compliant because of the steep slope of the path under CSXT into Crystal City, and has several pinch points where conflicts occur between infrequent pedestrian users and more-frequent cyclist users along the trail. The connection into Crystal City is proximate to both Metrorail and Metroway stations; however, on the airport side, no signage indicates that such a trip is possible. The second walking connection, along the 26th Street Bridge, is similar in length, is not ADA compliant because of the steep slope of the on-ramp from Crystal Drive to the 26th Street Bridge, and has a similar lack of wayfinding signage. On the airport side, the walk connects you through a maze of intersections, ad-hoc sidewalks, and high-speed road crossings. Connecting most directly to Terminal A, the experience could be disorienting for passengers unfamiliar with the area.

Figure 8 *The existing baseline 15-minute walkshed does not allow users to reach downtown Crystal City.*

Figure 10 *Residents and stakeholders participated early on to determine possible locations of a crossing, both above or below grade.*

Figure 9 *The existing baseline 15-minute Metro walkshed reaches 5 minutes into Crystal City, as 10 minutes are used to travel between stations via Metro.*

WHY 15 MINUTES?

A 15-minute walk is an average distance a pedestrian is willing to walk before opting for a different mode of transportation. For airport travelers with luggage, distance is an important factor in deciding on a mode of travel.

WHAT ARE THE OPTIONS FOR A NEW CONNECTION?

At the public kick-off in September 2017, the project team presented on the potential to build a new pedestrian connection between Crystal City and DCA. Following the presentation, participants were asked to provide feedback on the objectives of the CC2DCA project and identify potential alignments for the connection. More than 60 people attended the meeting, and more than 900 people viewed the presentation online. Public feedback included:

- Make hotels and businesses in Crystal City walking distance for DCA arrivals
- Enhance connections to Mount Vernon Trail, Metro, and VRE
- Create convenient and safe access for all users of all abilities
- Incorporate wayfinding for residents and visitors alike
- Study topography to inform bridge versus tunnel options

The public identified several alignments (**Figure 10**) between Crystal City and DCA, including other potential short-term improvements like a bridge spur from the Mount Vernon Trail to the airport.

WHO WOULD USE THE CONNECTION?

A new pedestrian connection has the potential to draw users from a variety of existing travel modes, and can likely induce trips both to and from the airport. Estimating the usage of such a connection is difficult, as many of the existing modes of travel either do not track origin-destination data or only measure in one direction. Induced trips could be derived from planned Crystal City growth, business meetings and other events in Crystal City, unlocking new access to the Airport Metro, or connecting to a longer-distance trip within the region via Metroway, VRE, or other future modes of travel like Amtrak or MARC train service. The development of a user-friendly and convenient connection will only enhance the

project's ability to induce trips, as it creates a new gateway to the airport from Crystal City. The 2015 Washington-Baltimore Regional Air Passenger Survey Geographic Findings Report was used to calculate a rough order of magnitude usage figure for the connection. The report depicts how airport passengers arrived at the airport by mode. Based on the Air Traffic Statistics from MWAA, the number of arrivals and departures from DCA in 2015 were nearly split 50/50. The percent, annualized, and monthly columns in **Table 2** indicates an approximate usage by mode, adjusted for actual yearly figures.

Of the arrival modes listed, the connection has the potential to capture most of its users from taxi, TNC, Metrorail, commuter rail (VRE), and localized hotel shuttles. A conservative mode-shift estimate of 1 percent of all the modes above was used to determine how many passengers would use the connection to arrive at the airport. Some modes, like Metro, likely have a higher capture rate, while others, like TNC, may have a capture rate lower than 1 percent. A conservative estimate of double the arrivals was used to calculate the total estimated usage since the arrivals and departures were nearly split 50/50. Since some modes, like "private automobile," likely are not evenly split for arrival and departure, the estimate is conservative. The estimate in **Table 2** of 5,198 for arrivals was then doubled to 10,396 to account for departures, or about 10,000 total users a month.

Arrival Mode of Access

	%	Annualized	Monthly	1% Capture
Private Car	28%	2,951,326	245,944	
Taxi	25%	2,554,864	212,905	2,129
Rental	10%	1,045,218	87,102	
TNC	14%	1,435,502	119,625	1,196
Metro	12%	1,207,922	100,660	1,007
Rail	0%	11,327	944	9
Aiport Bus/ Shuttle/Limo	3%	334,676	27,890	279
Hotel Shuttle	6%	617,863	51,489	515
Metrobus	1%	75,173	6,264	63
Other	1%	133,870	11,156	
Totals		**10,367,743**	**863,979**	**5,198** (10,396 Arrival + Departure)

Table 2 *Approximate usage by mode for airport arrivals.*

PHASE II
SYNTHESIZE

After researching the study area and meeting with the working group and the public, the project team began to develop a set of evaluation criteria to compare the alignments and options. The criteria capture a complex list of requirements, from maintenance and operational considerations to how the alignment made users feel. The resulting evaluation criteria are:

- **Implementation,** which focuses on the "buildability" of the connection
- **Connectivity**, which measures how well the connection ties into existing and future infrastructure, and to what infrastructure it ties
- **Enjoyment,** which measures the qualitative aspects for the users of the bridge
- **Cost**, which considers overall cost as well as cost-effectiveness

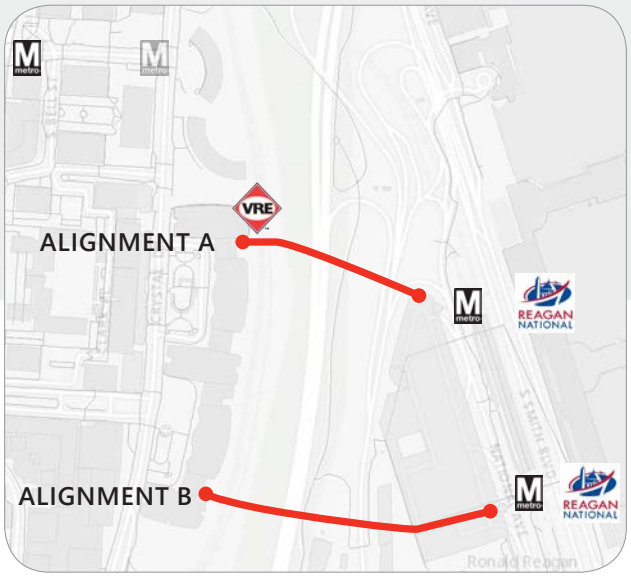


Figure 11 *Alignment locations.*

EVALUATION CRITERIA

Implementation

As the most technical evaluation criterion, the implementation metric looks at the relative complexity of the planning, permitting, land acquisition, construction, and design for the CC2DCA connection. The purpose of the implementation metric is to evaluate the relative complexities of the various potential alignments and options. Connections with less complicated permitting and construction processes are rated as more favorable than those that are more complex.

Connectivity

Connectivity is at the core of the CC2DCA project's purpose. Connectivity measures not only the physical connections that an option may have, but also the proximity of the connection to nearby amenities. Options with a higher number of connections are rated as more favorable than those with fewer. Possible connection points include the airport, transit, recreational opportunities, and other nearby destinations.

Enjoyment

The experience of using the connection speaks directly to how often it is used as a connection. Two walking routes to the airport exist today; however, those routes are longer than a 15-minute walk and are not commonly used for airport access. Connections that clearly show you where you are and where you are going are naturally used more than cumbersome or hidden connections. For a connection to be favorable and utilized, it must be well understood and known to the largest number of travelers possible.

Cost

For the project to be implemented and provide enjoyment and connectivity to its users, the cost must be considered. Cost considerations include capital costs, engineering fees, build-out, compliance/permitting, land acquisition/exchange costs, environmental mitigation, and operation and maintenance. Options with fewer major cost elements are rated as more favorable than those with more. This metric also includes cost-effectiveness, which assesses which option best meets all the other metrics in the least expensive way. At this stage, architectural finishes on the structure and landings are excluded from the cost, as each alignment option requires specific considerations around architecture, design, and finishes.

ALIGNMENTS

Overview

Two alignments (**Figure 11**) were developed by gathering input from the working group and the public, and assessing logical landing points. To determine the most appropriate alignments, the project team first determined where a connection could best physically connect, and which alignment locations best facilitated the evaluation criteria.

At the airport, several factors coalesced around two potential landing points for the connection. The existing Metro-terminal walkways serving the Ronald Reagan Washington National Airport Metrorail Station and Parking Garages B and C were identified as ideal landings. These landings are also close to new airport security gates, slated to open in fiscal year (FY) 2021. In Crystal City, the project team identified two landing locations "as the crow flies" west from the existing Metro-terminal walkways. Both landings in Crystal City are owned by JBG SMITH.

Alignment A: Starting in Crystal City, Alignment A begins at 2011 Crystal Drive and crosses above or below the railroad corridor, the Parkway, Mount Vernon Trail, and the Airport Access Road. At the airport, it travels through the northern tip of Parking Garage C for 30 feet before landing at the Metrorail Station and the Metro-terminal walkway. Alignment A is approximately 900 feet long, and links to VRE's relocated Crystal City station entering 30% design.

Alignment B: Alignment B starts at 2451 Crystal Drive and traverses the railroad corridor, the Parkway, Mount Vernon Trail, and the Airport Access Road before entering the airport. At the airport, it crosses airport and rental car service facilities. It also includes a 350-foot walk through the airport's Parking Garage B before landing at the Metro-terminal walkway. Alignment B is approximately 1,400 feet long.

WALKSHED ANALYSIS

The two alignments were analyzed based on "how far from the airport can you get in 15 minutes?" to compare the reach of each alignment. Walksheds were generated from DCA, including the time it takes to get from the Metro-terminal walkway across the new connection and into Crystal City, as shown in **Figure 12**. Though the question is phrased as a measure of what in Crystal City can be reached in 15 minutes, the inverse is equally important. The airport and its nearly 10,000 employees—including maintenance and operation technicians, pilots, flight attendants, and a host of other airport-related workers—now have access to everything within the walkshed. The opportunity for this connection benefits airport employees and passengers as well as Crystal City businesses, residents, and retail establishments.

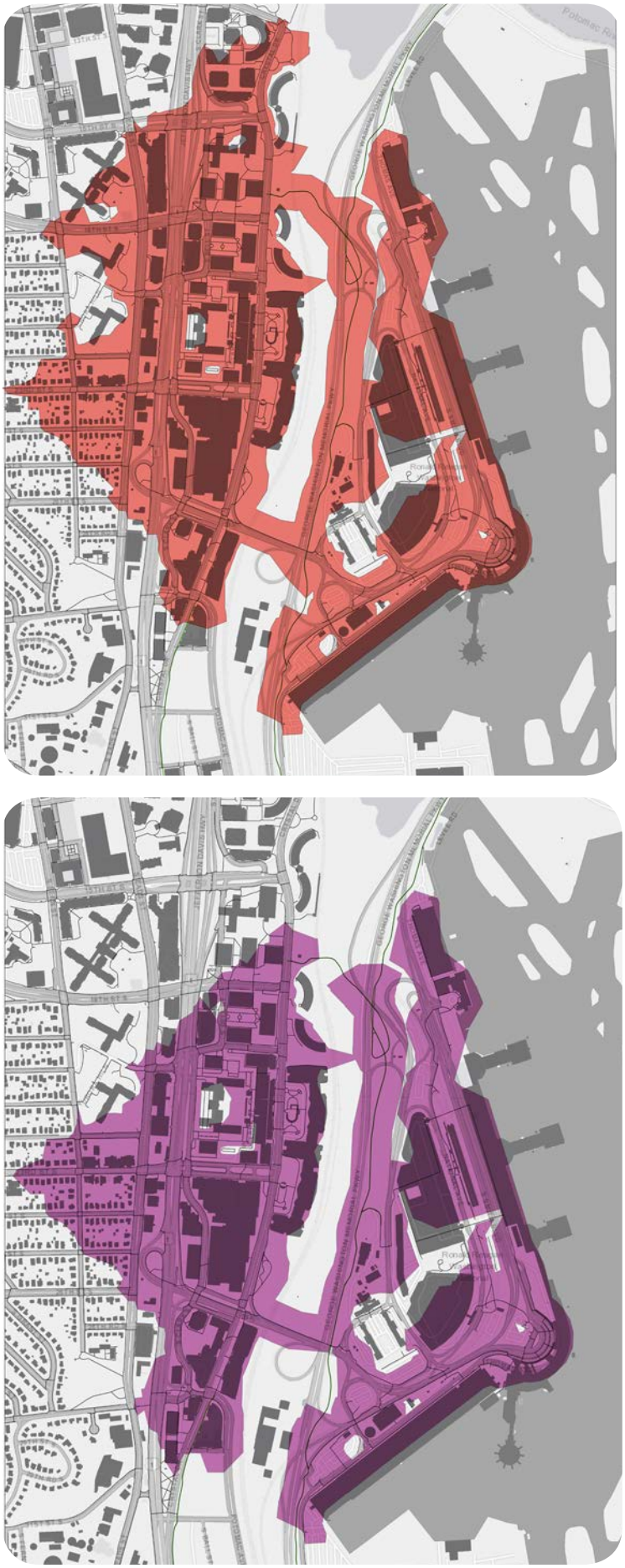


Figure 12 *Alignment A and Alignment B walksheds represent the additional area that can be reached within 15-minutes compared to baseline walksheds.*

Alignment A captures a significant portion of Crystal City in its 15-minute walkshed. Starting at the Metro-terminal walkway, the walk to the edge of Crystal City is approximately a 3-minute walk. The connection spans about 900 feet—roughly the width of the National Mall in Washington, DC. The walkshed for Alignment A captures an area of approximately 200 acres. Using market information provided by JBG SMITH, the Option A walkshed captures over 10.5 million square feet of office space, 3,600 hotel rooms, and 5,600 residential units (**Figure 13**). The hotels captured by Alignment A provide over 179,000 square feet of meeting space across 113 individual meeting rooms. Using Census data and LODES Jobs numbers, it is estimated that nearly 17,000 jobs would be within a 15-minute walk of the airport.

Alignment B is 500 feet longer than Alignment A, traversing about 1,400 feet in approximately 5 minutes of walking. Capturing a walkshed area of 137 acres, less of Crystal City is reachable with Alignment B, which is reflected in the market figures. Alignment B captures 7.5 million square feet of office space, 2,700 hotel rooms, and 3,300 residential units. More than 123,000 square feet of meeting space are spread across 107 individual meeting rooms at area hotels. According to Census data, 12,600 jobs are encompassed within the Alignment B walkshed. Though not dramatic, especially when compared to the existing walksheds, there is nearly a 2.5-million-square-foot difference in office space between the two walksheds. Illustrated in the walkshed graphic, Alignment B captures some additional land to the south; however, those properties are not as densely populated as the area captured by Alignment A.

RECOMMENDED ALIGNMENT

Before developing more detailed options for Alignment A and Alignment B, both alignments were vetted with the working group and considered against the evaluation criteria for fatal flaws. Alignment A didn't face any fatal flaws when considered against the evaluation criteria; however, Alignment B faced significant constraints.

Implementation

Alignment A has the potential to land seamlessly at the airport. Alignment B conflicts with existing airport rental car service facilities as well as MWAA's long-term roadway and parking improvements project currently under environmental review. Both alignments require complex compliance/permitting and environmental review associated with Arlington County, CSXT, NPS, and MWAA authority.

Connectivity

Alignment A has a greater number of transit options and destinations when compared to the walkshed for Alignment B. In addition, Alignment A has the potential to directly connect to VRE's relocated station entering 30% design, while Alignment B is located 1,000 feet to the south.

Enjoyment

Alignment A includes a 3-minute walk, while Alignment B is 2 minutes longer. When considering legibility, Alignment A has the potential to be highly visible, while Alignment B requires an indirect walk through Parking Garage B before entering or exiting the airport.

Cost

Alignment B is 500 feet longer than Alignment A, adding more costs to

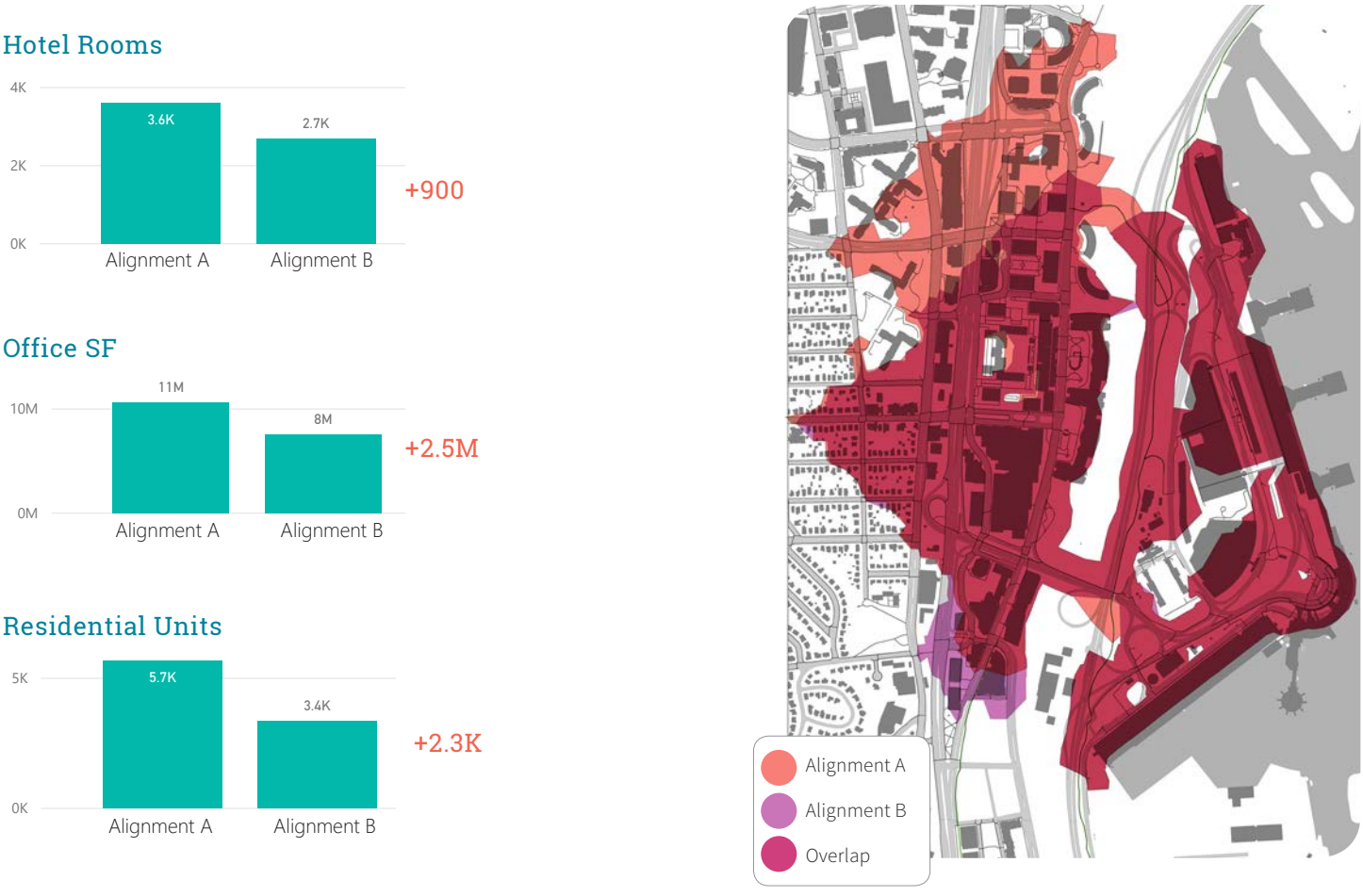


Figure 13 *Comparison of hotel rooms, office space, residential units, and walkshed reach between the two alignments.* ***Includes both graphics.***

Option A Bridge

Figure 14 *Potential cross-sections for Alignment A—Bridge.*

construction, operations, and maintenance. Alignment B is also near the existing 26th Street Bridge, greatly diminishing the cost-effectiveness of the connection.

Conclusion

The project team and working group eliminated Alignment B because it didn't meet the project's objectives or evaluation criteria. Alignment A is shorter, has fewer impediments, is highly visible, and is direct, offering the best possible mix of benefits for the connection. At approximately 900 feet, the connection is a short walk that connects the heart of downtown Crystal City to DCA, creating the most seamless "aerotropolis" experience. It provides greater access to more residents, workers, and passengers. And, most importantly, it is the only alignment that would connect the airport directly to the VRE platform.

OPTIONEERING

The development of options for Alignment A included an exploration of how the connection ties into its surroundings and landings in Crystal City and at DCA. How does the connection cross the railroad corridor and Parkway? What is the typology of the connection? Would this connection be a bridge, or a tunnel, or something in between? Options for Alignment A included an above-ground bridge connection, an underground tunnel connection, and a combination structure. Each option was considered in more detail against the evaluation criteria.

Alignment A – Bridge

A bridge option was developed because it is the most direct connection between Crystal City and the airport. This option (**Figures 14 and 15**) departs the Metro-terminal walkway through the parking garage and connects seamlessly, without any elevators or escalators, over the Parkway and railroad corridor to JBG SMITH's property in Crystal City. At the landing in Crystal City, elevators or escalators carry travelers down one story to street level. Along the route, connections to both the VRE platform and Mount Vernon Trail are possible.

Implementation

The bridge option crosses the railroad corridor and Parkway, triggering a range of constructability challenges. CSXT is generally amenable to pedestrian bridge crossings in the region with 24 feet of vertical clearance; however, NPS is concerned about any introduction of infrastructure within the boundaries of the Parkway that impact cultural and natural resources. Viewsheds, massing, visual bulk, height, overhead lines, lighting, and overall architecture would need to be coordinated closely with NPS and NCPC. Long, clear spans of more than 120 feet over the railroad corridor and the Parkway would require complex engineering, land acquisition, permitting, and construction staging. Crane placement and allowable lifting radii could be a significant challenge when lifting bridge segments, particularly around the railroad corridor as well as in confined areas like the Parkway. In addition, landings at the JBG SMITH property and DCA would require retrofits; however, reconfiguration would be minimal compared to a tunnel.

Connectivity

The above-ground connection lends itself to creating easy links to local amenities as well as destinations in the region and beyond. Potentially connecting to both the Mount Vernon Trail and VRE platform maximizes the project's usage potential, and provides a draw for residential access and a highly visible landmark for visitors. While the bridge option could accommodate cyclists, its primary function is to serve travelers on foot and with luggage.

Enjoyment

The bridge provides an opportunity to create both a visible and obvious connection between Crystal City and DCA, with opportunities for placemaking. Though detailed design is not part of this study, a bridge option lends itself to an opportunity to celebrate the presence of the Parkway while serving as a powerful new gateway to the airport and

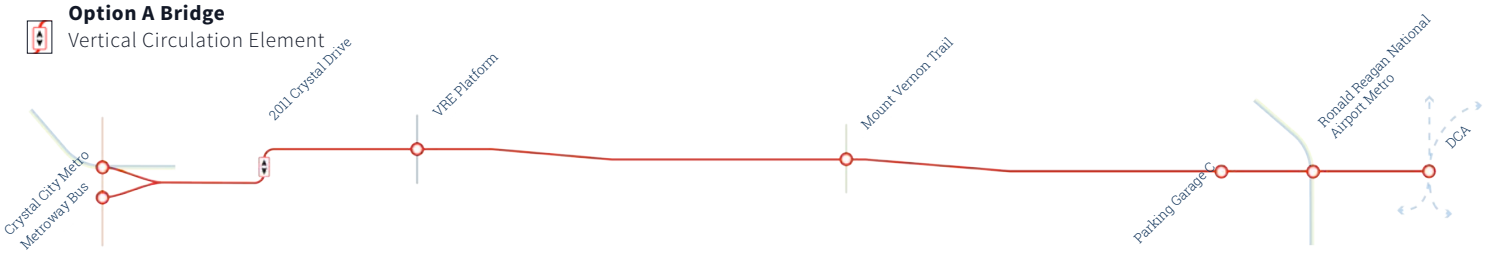


Figure 15 *Multimodal connections diagram for Option A - Bridge.*

Figure 16 *Potential cross-section for Alignment A—Tunnel.*

into Arlington. The opportunity to enjoy the Parkway from a slower, perched perspective will allow for dramatic views of planes taking off, with Washington, DC, in the distance and opportunities to explore the history of the Parkway. The required elevation of the bridge creates a seamless and easy transition between the two landings.

Cost

A bridge could cost between $16 and $26 million to build; costs are highly dependent on the type of bridge typology and could be upwards of $35 million for a state-of-the-art design. Maintenance may vary depending on type of structure—a covered open-air bridge may cost $20,000 per year to maintain, while a covered climate-controlled bridge may cost $70,000 per year. The cost-effectiveness of a bridge is high due to its potential to attract users through increased connectivity and enjoyment.

Alignment A – Tunnel

A tunnel option was explored to minimize the potential of altering the viewshed along the Parkway. This option (**Figures 16 and 17**) departs the Metro-terminal walkway descending five stories, via elevators or escalators, within or adjacent to the airport's Parking Garage C. The underground walkway continues under the Parkway and railroad corridor, where it climbs three stories to street level on JBG SMITH's property. Near the Crystal City landing, the VRE platform is accessible, although indirectly.

Implementation

Because the railroad corridor is one of the most significant and heavily travelled freight corridors in the United States, CSXT is less likely to support an underground option without significant coordination, approvals, and track monitoring to ensure continued service without interruptions. For that reason, the project team developed a tunnel option with a minimum depth of 20 feet from top of tunnel to surface to help ensure adequate ground enforcement under the railroad corridor and under the Parkway.

Similar to the bridge option, the tunnel option would require complex engineering, permitting, land acquisition, permitting, and construction. A tunnel between the two landings could be completed using jacked-in-place construction, or the New Austrian Tunneling Method (NATM). Jacked-in-place with ground improvements is a common method for comparable underground tunnels. Construction requires a 20-foot-wide construction shaft every 400 feet along the length of the tunnel, or at any location in which the tunnel turns horizontally or vertically. This would require large construction shafts on NPS property at two locations. Each of these locations would require a significant staging area for cranes to lift tunnel sections into place. The NATM technique is another possibility; however, the viability of NATM relies heavily on soil type and is more expensive compared to the jacked-in-place method. The benefit of NATM is that it allows for continuous tunnel construction, minimizing construction overlaps with NPS property.

In either tunneling scenario, landings would require significant retrofits compared to a bridge due to the required depth of a tunnel compared to the elevation of the bridge landings.

Connectivity

Unlike the bridge option, a tunnel option does not connect to the Mount Vernon Trail, and unless CSXT and VRE determine that a direct underground connection is feasible, the tunnel itself would not connect directly to the VRE platform. This option only prioritizes the landings at Crystal City and DCA, limiting the potential to attract users.

Enjoyment

The underground landings in both Crystal City and at DCA will likely be challenging for travelers to find and navigate. Elevators and escalators between three and five stories deep, located at both landings, further complicate the legibility of the connection. Aside from well-placed and -designed wayfinding, travelers

Figure 17 *Multimodal connections diagram for Option A - Tunnel.*

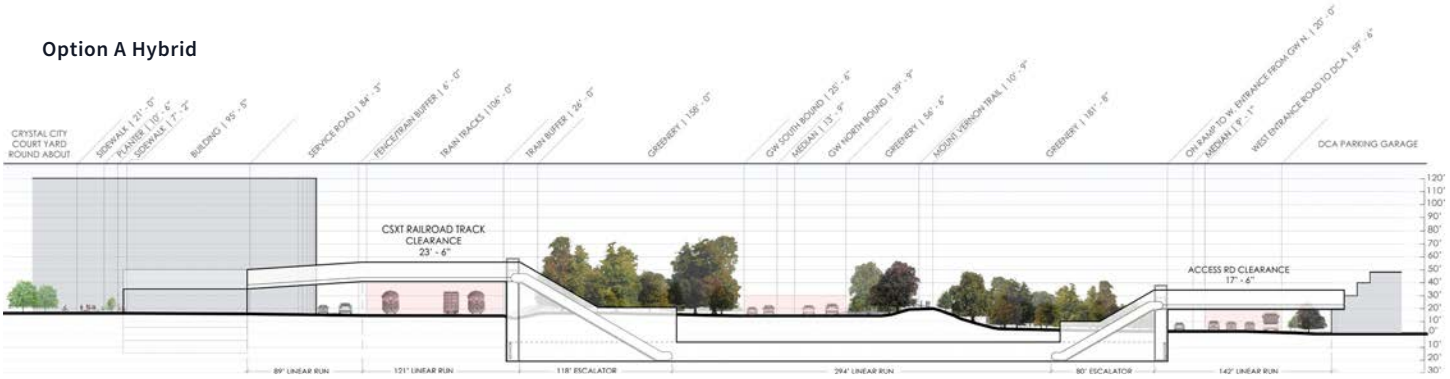


Figure 18 *Potential cross-section for Alignment A—Hybrid.*

may not utilize the tunnel as frequently compared to a bridge option. In addition to generally making the connection longer, a tunnel would feel less safe than a bridge, particularly if it is underutilized. As part of the study, residents in Crystal City raised safety and security concerns associated with tunnels.

Cost

Depending on the construction technique and build-out, a tunnel is estimated to cost between $28 and $38 million to complete. Like the bridge option, tunneling costs are variable and could be upwards of $45 million depending on the engineering needed to ensure that the railroad corridor and Parkway will not be disrupted and that the build-out meets the objectives of the CC2DCA project. Maintenance may also vary, but initial calculations estimate $120,000 per year. In addition, because the length of the tunnel exceeds 800 feet, National Fire Protection Association (NFPA) requirements will be needed to meet ventilation and egress requirements. For example, the tunnel will require an exit located less than 400 feet from any point. NFPA requirements could cause the cost to rise as the planning and permitting processes become more complicated.

Alignment A – Hybrid

The hybrid option attempts to address some of the concerns associated with building a bridge above the Parkway or building a tunnel below the railroad corridor. This option (**Figures 18 and 19**) departs the Metro-terminal walkway through Parking Garage C. After crossing the airport access road, this option descends five stories to a tunnel under the Parkway, and climbs back up five stories to a bridge over the railroad corridor to JBG SMITH's property. At the landing in Crystal City, elevators or escalators carry travelers down to street level. Along the route, the VRE platform is accessible.

Implementation

The complexity of constructing a bridge and tunnel, and connecting them, bring all the challenges of a bridge and tunnel into a single option. The bridge portion still requires significant coordination, land acquisition, and construction staging in proximity to the railroad corridor, and the tunnel portion still requires an analysis to determine the most appropriate construction technique and corresponding challenges. While the tunnel portion limits overhead alterations of the Parkway, it requires elevators or escalators on NPS property to travel below the Parkway. Elevators or escalators needed to transition from a bridge to a tunnel will likely alter the Parkway both during construction and permanently.

Connectivity

While the hybrid option connects to the VRE platform, it does not have the potential to connect to the Mount Vernon Trail. In addition, this option faces some of the usage challenges associated with the tunnel option due to its lack of visibility as an airport landmark.

Enjoyment

The experience along a hybrid route may be disorienting to travelers, as there are three significant changes in elevation through elevators or escalators along the connection, and the full connection between Crystal City and DCA is never fully visible from a single vantage point. From the Metro-terminal walkway, other than via wayfinding signage, a traveler could never know that the connection continues onto Crystal City. Similarly, in Crystal City, the connection visually terminates at the Parkway.

Cost

At a minimum, the hybrid option is estimated to cost between $28 and $38 million. The cost primarily resides in the tunnel portion of the project—though the tunnel would likely not require NFPA ventilation and egress requirements due to its shorter length, combining a bridge and tunnel structure with elevators and escalators will add to the complexity of engineering and construction.

Figure 19 *Multimodal connections diagram for Option A- Hybrid.*

SYNTHESIZE
Connection Typologies

A variety of shapes, sizes, and amenities could be incorporated into a connection between Crystal City and DCA. The project team studied the various physical connection typologies for the crossing itself. Each typology has benefits and challenges regarding implementation, connectivity, enjoyment, and cost.

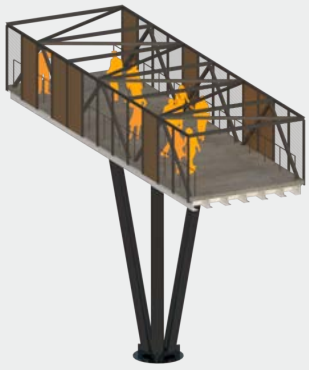
Ultimately, the connection could draw inspiration from multiple typologies to address the specific conditions in each of the four project zones. For instance, over the railroad corridor, it is required that the connection protect the railroad from thrown objects, necessitating mesh or perforated side walls. Over the Parkway, the connection would need to be light and airy with abutments set back from the Parkway to ensure that the crossing does not impact cultural and natural resources. There is also an opportunity to use materials that respond to the natural landscape of the Parkway. For tunnel options, the construction technique will need to avoid disruptions to the railroad corridor or Parkway. The project team and working group made no specific determination on which typology is best; rather, a range of typologies was identified for exploration during future planning and design stages. At this stage, there is no recommended typology, and NPS has raised concerns about the potential impacts of all bridge typologies.

UNCOVERED, BASIC

- Generally inexpensive
- Thick profile
- Open to the elements

Mount Vernon Trail Overpass near Roosevelt Island. (Google Maps)

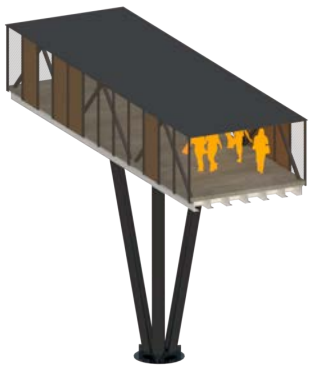
UNCOVERED, TRUSS



- Generally inexpensive
- Thin profile
- Open to the elements
- Lighter, longer span possible

Anacostia Riverwalk Trail Bridge. (DDOT)

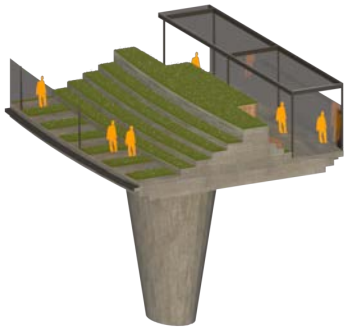
COVERED, OPEN AIR

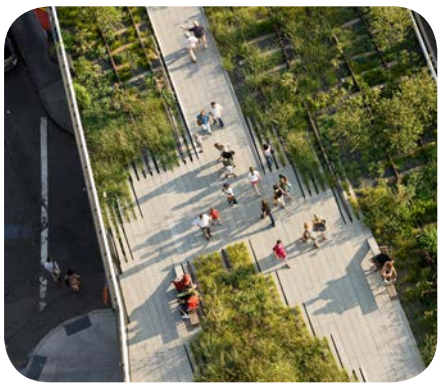


Silver Line Metro Pedestrian Bridges. (WMATA)

- Costlier than uncovered
- Roof adds visual "bulk"
- Partially open to the elements
- Lighter, longer spans possible

PARTIALLY COVERED, "HIGH LINE"





The High Line, New York City. (Iwan Baan © 2009)

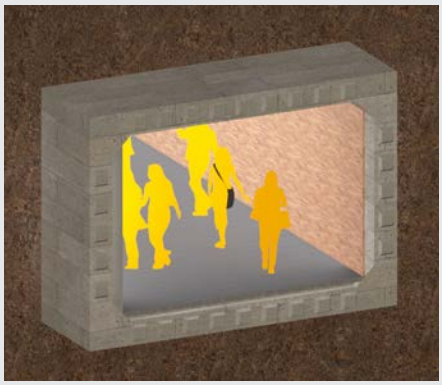
- Costlier, with more maintenance if landscaped
- Placemaking qualities
- Partially open to the elements
- Thicker profile

COVERED, CLIMATE CONTROLLED

Conceptual conditioned bridges at LAX. (SOM)

- Costlier, with more maintenance
- Thicker profile
- Conditioned, protected from elements
- Heavier, shorter spans and complex construction

JACKED-IN-PLACE



- Common construction technique
- Requires 20-foot-wide construction shafts every 400 feet
- Large staging and construction areas
- Turns require additional shafts

CUT AND COVER

- Least expensive tunneling method
- Variability in shape
- Significantly disrupts surface
- Not applicable for connection

NATM

- Likely most expensive tunneling method
- More variability in shape and size
- Doesn't require large staging and construction areas
- Application relies heavily on soil condition

SYNTHESIZE
The Future Connection

The three options selected to be studied for Alignment A each bring their own benefits and challenges. All options require complex engineering, permitting, land acquisition, and construction. After review of the evaluation findings, the working group recommended that the hybrid option be removed from consideration, and that continuous bridge and tunnel options remain on the table for future planning and design.

The challenges of the hybrid option outweigh the benefits. The hybrid option likely has the most complex planning and permitting when compared to the continuous bridge or continuous tunnel options.

Parallel infrastructure, like connecting VRE via a bridge and the airport via a tunnel, would be difficult to implement and create unnecessary redundancies that would be confusing for users and generate challenges in connectivity. Last, the hybrid option is the least direct, requiring multiple five-story climbs. For these reasons, the hybrid option was eliminated. As the CC2DCA project moves forward, the following should be considered for continuous bridge and tunnel options.

CONNECTION AS BRIDGE

The continuous bridge option directs passengers from the Metro-terminal walkway all the way into Crystal City without any grade changes, and requires only a one-story descent to get to Crystal Drive. It allows for the greatest number of direct multimodal connections including the Mount Vernon Trail and VRE. VRE's relocated station entering 30% design is likely moving forward with an aboveground connection to its platform via a bridge from Crystal City, making the continuous bridge option a seamless connection. This connection is direct, obvious, and easily understood by regular travelers and visitors alike. This option also has challenges, including its crossing over the Parkway, requiring extensive coordination with NPS and NCPC. It will also likely alter the Parkway to a greater degree compared to a tunnel option. Additionally, the design of a bridge across the Parkway would need to have a light and airy massing, produce as little light pollution as possible, and pass a series of architectural and design reviews before construction.

CONNECTION AS TUNNEL

The continuous tunnel option crosses under the Parkway to maintain the Parkway's viewshed as it is today. From NPS's perspective, this option is more favorable from a preservation standpoint. The tunnel also crosses under the railroad corridor, requiring additional CSXT approvals, and constant monitoring both during and after construction. Any potential disruptions to freight service due to underground settling issues makes the tunnel option less favorable from CSXT's perspective. Direct connections to the VRE platform and the Mount Vernon Trail are unlikely because this option requires a 20-foot-deep tunnel (from the top of the tunnel to the surface) to ensure that dynamic and static loads from the railroad and Parkway are distributed. At either end, the tunnel would require elevators or escalators to bring travelers out of the tunnel, which would range from three stories in Crystal City to five stories at DCA. These end connections would require significant modification to the parking structures at DCA and in the JBG SMITH building.

CRYSTAL CITY

WITHIN A 15-MINUTE WALK

10.5

MILLION SF OFFICE

5,700

RESIDENTIAL UNITS

3,600

HOTEL ROOMS

113

MEETING SPACES

DCA

WITHIN A 15-MINUTE WALK

20

MILLION PASSENGERS

10,000

EMPLOYEES

85

DESTINATIONS

COST-EFFECTIVENESS ANALYSIS

Cost for both the bridge and tunnel options may have varying impacts on end usage. Because the bridge has the potential of being highly visible, costs could increase to accommodate design features. The tunnel option, on the other hand, has a defined envelope, and may require more engineering to create acceptable geotechnical conditions and meet NFPA requirements. Though some bridge typologies could potentially cost more than the basic tunnel, those options provide more benefits and features, increasing their overall cost-effectiveness. For a tunnel to approach the design quality of some of the bridge typologies, the cost would need to increase dramatically.

ILLUSTRATIVE RENDERINGS

Connecting Metrorail, Metroway, VRE, the Mount Vernon Trail, and DCA, the CC2DCA project has the potential to create a multimodal hub that links the area to local, regional, and national destinations. Linking this many transportation modes and various destinations is truly unique in the region and the nation.
The project team created a series of illustrative renderings to demonstrate the experience that bridge and tunnel options could provide to users. A High Line typology was selected for the bridge option to demonstrate the maximum potential the connection could offer as a dynamic destination for residents and visitors alike. This typology provides a light and airy approach to respect viewsheds as it crosses the Parkway, while allowing for more substantial structure on either side of the Parkway to support plantings and seating as a way to celebrate the relationship with the Parkway. For the tunnel option, both jacked-in-place and NATM typologies would offer an opportunity to build out the connection with wayfinding, moving walkways, or public art.

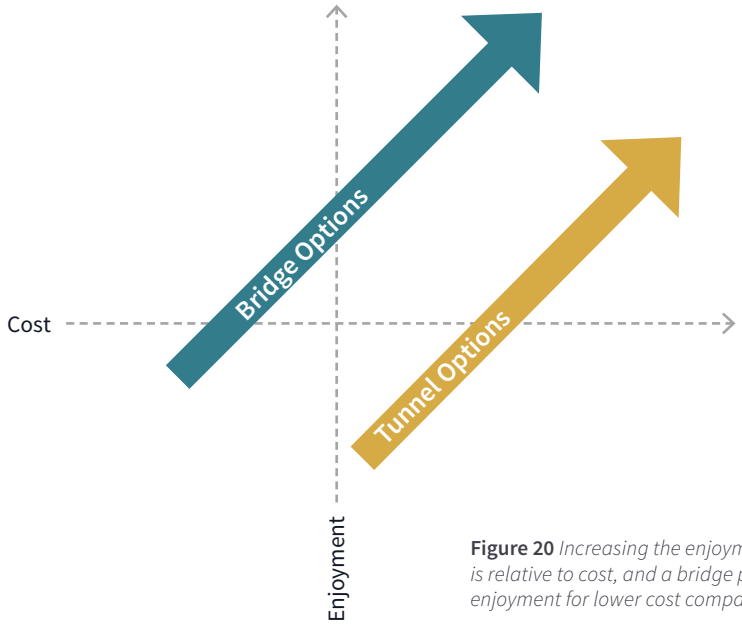


Figure 20 *Increasing the enjoyment of a connection is relative to cost, and a bridge provides greater enjoyment for lower cost compared to tunnel options.*

Birds'-eye view of Bridge landing in Crystal City: Interconnected, the HUB created connects public and private entities to a myriad of commercial, transit, and retail functions.

From the edge of the parking structure at the airport, Crystal City, VRE, Metro, Metroway, and the Mount Vernon Trail are all within a 5-minute walk.

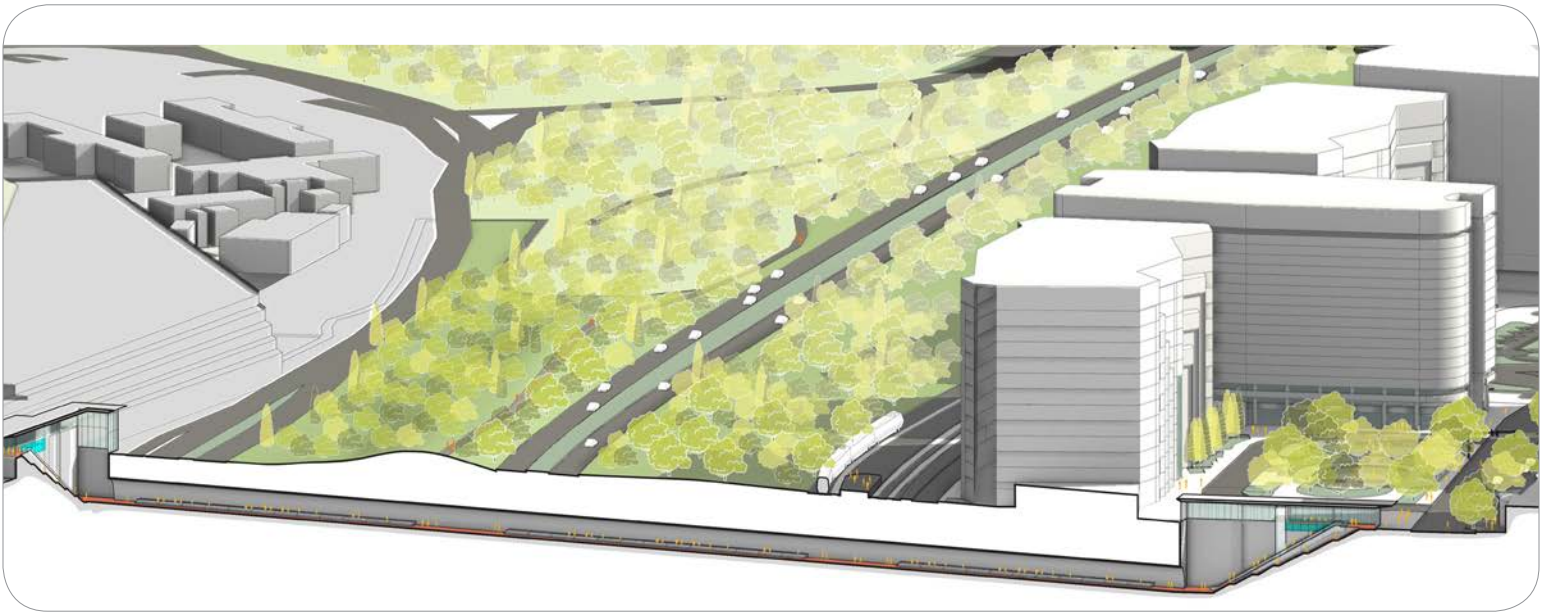
Rendering from Crystal Drive: The Landing in Crystal City operates as a landing or starting off point for trips using VRE, the Mount Vernon Trail, the airport, and Metro.

Parkway View: From the Parkway, the bridge narrows to "kiss" across the parkway, allowing the least visible impact possible.

View from Bridge Mid-Span: The Perch above the Parkway allows views of the historic Parkway, views of planes taking off, and vistas of downtown Washington, DC.

In this overview, the bridge gently curves across the Parkway and rail lines.

Tunnel Rendering: The underground passageway and vertical circulation could carry a similar character as the airport.



Tunnel Section Rendering: Overview of the tunnel connection.

PHASE III
PLAN

After evaluating options and selecting a bridge and tunnel connection for further consideration for the CC2DCA project, the project team developed a set of implementation steps and identified potential funding sources. Implementation steps range from near-term improvements that can happen tomorrow to environmental review considerations. Moving forward, stakeholders should continue to convene with the priority of refining long-term and near-term solutions and shaping a funding strategy.

Figure 21 *Baggage claim wayfinding does not include walking directions.*

Figure 22 *Signage for the Mt. Vernon Trail in the Parking Garage Basement.*

SHORT-TERM IMPROVEMENTS

Since the connection would take several years to implement, the project team investigated short-term improvements that could help increase the legibility and use of existing routes between Crystal City and DCA. The following short-term improvements enhance connectivity along existing routes with minimal impact, such as improved wayfinding and pedestrian signals. This effort could serve to gauge the success of less intensive interventions before the CC2DCA project is built.

Incorporate improved wayfinding and pedestrian lighting between Crystal City and DCA

It is recommended that the Mount Vernon Trail and 26th Street Bridge be highlighted at the airport baggage claim (**Figure 21**) and other travel information boards, as well as throughout Parking Garages B and C (**Figure 22**). Additionally, the routes themselves should include more signage, possibly including the distance to reach both Crystal City and DCA. Like road signs, pedestrian wayfinding allows for pedestrians to understand their route and more easily predict arrival time.

If possible, dedicated walkways, crosswalks, and surface treatments within Parking Garages B and C could help passengers navigate to the Mount Vernon Trail. Better lighting is also recommended, particularly in the underpasses connecting to the Mount Vernon Trail.

Add consistent sidewalks and pedestrian signals along 26th Street to DCA.

Along the 26th Street Bridge toward the airport, several sidewalk locations have narrow widths or are inconsistently paved (**Figures 23 and 24**). Creating a consistent, continuous sidewalk tells pedestrians that the pathway is an official route, and alerts drivers that pedestrians can be expected. Wide sidewalks allow for pedestrians with luggage to travel the path safely, and allows for two pedestrians to pass without hesitation or walking into the street. Arlington County is in a concept design phase for improvements to the 26th Street Bridge; it is recommended that MWAA work to improve the sidewalks on their property in advance of their roadway and parking improvement project.

Several intersections along the 26th Street Bridge toward the airport are inconsistently or incorrectly signalized to allow pedestrians to predict and understand vehicular movements. Dedicated pedestrian signals at all crosswalks are recommended at the intersection of the 26th Street Bridge and Abingdon Drive. Predictable intersections and adequate crossing time are critical to safety and usability, and should be integrated into the planned improvements.

Connect Mount Vernon Trail to the 26th Street Bridge

In addition to a continuous and wider sidewalk, there is the possibility to connect the Mount Vernon Trail to the abutment of the 26th Street Bridge, as highlighted in the NPS Paved Trail Study. A connection at this point allows Mount Vernon Trail riders from the south to access the airport property (**Figure 25**). A connection here could be easily constructed, as the grades slowly drop off to meet the trail. Further investigation is needed to see if this connection could be ADA compliant. As the on-ramp from Crystal Drive to the 26th Street bridge is not ADA compliant, this connection is limited in its ability to equitably connect the trail to Crystal City.

Create ADA compliance on existing walking routes

The existing ramp from the CSXT underpass to Crystal Drive is too steep for ADA accessibility. The relocated VRE Crystal City Station access will potentially be parallel to this pathway and could provide an opportunity to provide ADA access to both the VRE platform and Mount Vernon Trail CSXT underpass. At the 26th Street Bridge, Arlington County should consider ADA accessibility in their 26th Street Bridge improvement project.

Figure 23 *Asphalt sidewalk along Aviation Circle, leading to the 26th Street Bridge Connection from Terminal A.*

Figure 24 *26th Street Bridge intersection lacks legible pedestrian crossing signals.*

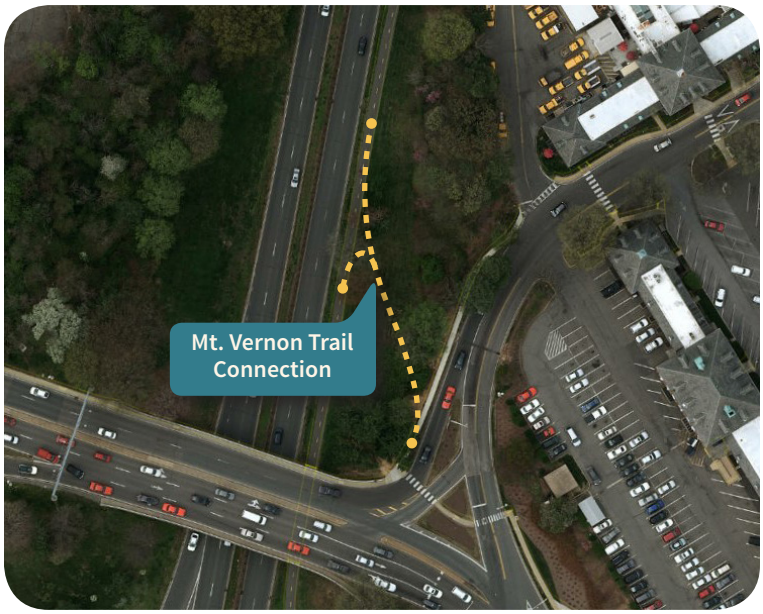


Figure 25 *Potential Mount Vernon Trail connection from 26th Street Bridge.*

Figure 26 *Narrow section of Mount Vernon Trail under the Parkway.*

Figure 27 *Potential airport spur location.*

Widen Parkway underpass along Mount Vernon Trail

The existing underpass of the Parkway serves as a vehicular access road to the airport as well as a route for pedestrians and cyclists along the Mount Vernon Trail. It is currently a bottleneck for pedestrians and cyclists. At approximately 4.5 feet wide, the sidewalk in the underpass does not allow for two bikes or a bike and a pedestrian to pass simultaneously (**Figure 26**). Through some cursory investigations of the underpass, it was determined that the vehicular lanes cannot be reduced as they are already at a minimum width. As a result, a secondary passageway could be created adjacent to the existing trail to increase capacity for pedestrians and cyclists. The expanded connection should include lighting and other visibility mechanisms like mirrors for users to see around any sharp corners.

Bridge spur from Mount Vernon Trail overpass to Parking Garage C near the Metro-terminal walkway

The Mount Vernon Trail overpass could be directly connected to the northern tip of Parking Garage C and the Metrorail Station at the airport (**Figure 27**)**.** The airport bridge spur has the potential to reduce incidents of jaywalking across the access road from the Parkway to DCA. In the walkshed analysis shown in **Figure 28**, the reach of the airport bridge spur walkshed into Crystal City is comparable to the Metro walkshed. As a result, the time savings provided by the bridge spur is marginal.

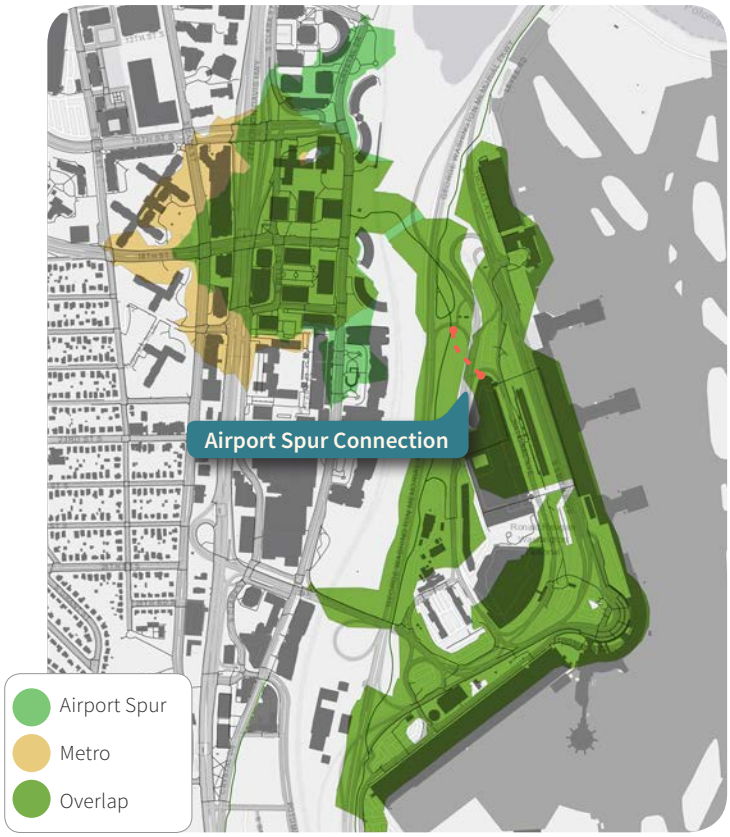


Figure 28 *Airport Spur walkshed compared to the Metro Walkshed.*

A PATH FORWARD

The CC2DCA action plan will serve as a roadmap so that stakeholders can take steps toward implementing the grand vision of a direct link between Crystal City and DCA. Because the CC2DCA project spans four distinct areas of ownership, the project will need to comply with the regulations and approvals associated with each owner. At the same time, the project will require a coordinated approach that leverages collective interests.

TIMELINE AND APPROVALS

It is important to note that bridge versus tunnel options may require different levels of approval and timeline considerations (**Figure 29**). The following recommended actions will help create the foundation for the project:

1. **Steering Committee Development:** Establish a CC2DCA project steering committee with land owners and oversight agencies who will guide the project through construction. Develop a project understanding agreement with the entities that control the alignment's right-of-way to acknowledge the objectives of the project and the recommended Alignment A.
2. **Arlington County Coordination:** Work with Arlington County staff to define appropriate levels of funding for a FY2019 to FY2028 Capital Improvement Plan (CIP) update to initiate planning, design, and environmental review for Alignment A. Obtain Arlington County Board approval to add the CC2DCA project to the CIP to help implement the Crystal City Sector Plan.
3. **Short-Term Improvements:** Work with the CC2DCA steering committee to prioritize and advance short-term improvements such as improved wayfinding and pedestrian signals. The steering committee can also help advance Arlington County's 26th Street Bridge concepts.
4. **VRE Design Coordination:** Convene design sessions with VRE and JBG SMITH to refine VRE's relocated platform entering 30% design to ensure that a connection to VRE's platform from Crystal City is accessible and visible, and that it can help serve as a springboard in streamlining portions of the CC2DCA project. The CC2DCA project should follow VRE on whichever direction the platform access chooses since the platform improvements project will likely be completed before the CC2DCA pedestrian connection. There is also an opportunity to initiate recommended short-term improvements between Crystal City and DCA, and along the Mount Vernon Trail, to help pave the way for the project.

PLANNING PHASE

During the planning phase, the following supplemental tasks are recommended prior to design and environmental review:

- **Transportation Analysis:** Conduct a multimodal circulation and access analysis to determine the challenges and opportunities associated with adding a new airport connection in Crystal City, including the potential to reduce congestion. Engage local jurisdictions and railroad entities in a discussion about the potential for future Amtrak or MARC service in Crystal City.
- **Geotechnical and Soil Analysis:** Investigate subterranean soil conditions to determine structural constraints for bridge and tunnel options. A Phase I Environmental Site Assessment is also recommended to identify any potential environmental contamination issues.
- **Draft Purpose and Need:** Early on in the process, a draft purpose and need statement should be developed with the steering committee to help guide a range of reasonable alternatives to be evaluated in the environmental review process.
- **Concept Development:** Develop design principles, narrow down the range of typologies, and prepare schematic designs for the landings in Crystal City and at the airport. The Commission of Fine Arts (CFA) could help facilitate the concept development process with stakeholders like NPS and NCPC early in the concept development.

Members of the steering committee should work with local and federal stakeholders to determine the lead federal agency, project sponsor, and appropriate level of environmental review. MWAA's Airport Master Plan and Layout Plan (ALP) will need to be revised to show the footprint of the new connection on airport property. The Federal Aviation Administration (FAA) will review the revised ALP and determine the environmental review process required on airport property. The project will likely require an Environmental Assessment (EA) or Environmental Impact Statement (EIS), which would need to be completed by the project sponsor in coordination with NPS and prepared in accordance with:

- The National Environmental Policy Act of 1969 (NEPA)
- Regulations of the Council on Environmental Quality (40 CFR 1500-1508)
- NPS Director's Order #12: Conservation Planning, Environmental Impact Analysis, and Decision-Making
- The NPS NEPA Handbook

As concepts are refined, stakeholders should start to solidify a funding approach that leverages multimodal infrastructure investments and transit-oriented development in Crystal City. The project should be submitted to Metropolitan Washington Council of Governments (MWCOG's) Financially Constrained Long-Range Plan (CLRP), and considered for the Northern Virginia Transportation Authority's (NVTA's) Long Range Transportation Plan or Six Year Program.

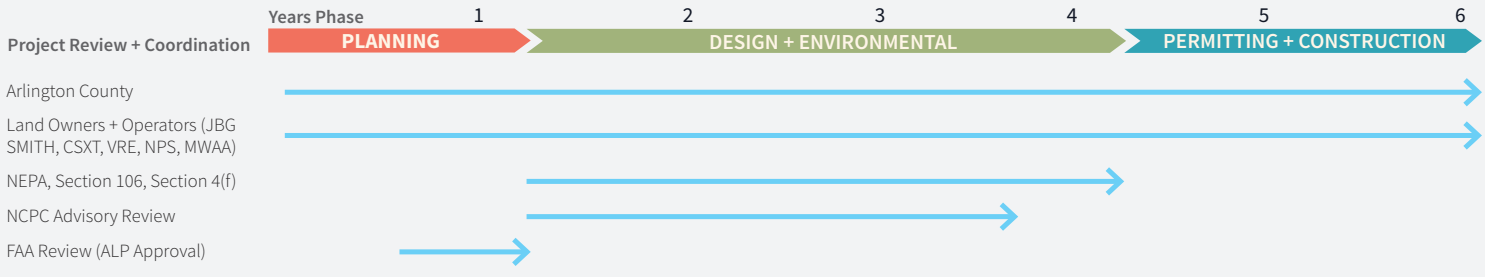


Figure 29 *High-level potential schedule for project implementation.*

During this phase, land transfers, easements, and use and lease agreements should also be identified. JBG SMITH and MWAA will need to be engaged early in the process to determine use and lease agreements for the landings in Crystal City and at the airport. Above- or below-ground easements will need to be considered for CSXT and NPS, and NPS may require a land transfer depending on the connection.

Design and Environmental Phase

The NEPA process will consider the effects of the CC2DCA project on the natural, built, and human environment, and determine mitigation. The project will also be subject to an assessment of adverse effects under Section 106 of the National Historic Preservation Act of 1966 (NHPA). Section 106 requires that Federal agencies, including the State Historic Preservation Office (SHPO), consider the effects of projects on historic properties like the Parkway. Any project that has the potential to impact federal lands or that requires a federal action (that is, the issuance of special use permit, land exchange, or right-of-way permit) must comply with NEPA and NHPA to evaluate the impact associated with the action and to avoid or minimize the impact or impacts to the greatest extent possible. The project may also involve Section 4(f) of the U.S. Department of Transportation Act of 1966, which requires that transportation projects with Federal involvement avoid the use of park and recreation land. As part of Section 4(f), it will need to be demonstrated that all possible planning is used to minimize harm to the Parkway by the CC2DCA connection. Any use of NPS administered lands will require the execution of an equal value land exchange with the NPS for permanent land acquisition as required by law under 54 USC 102901. This would include the air rights over the Parkway as well as subsurface rights, if tunneling under the Parkway and related facilities located on parkland.

The following is a summary of procedures and guidelines to be considered during preliminary and final design:

- **CSXT Public Project Policy Manual, 2017:** Because the project will cross the CSXT railroad corridor, a preliminary engineering agreement will need to be developed identifying the scope of work and payment to CSXT for use of their right-of-way. Plans for the project will need to be approved by CSXT, and a construction agreement will be developed.
- **VRE Station Design Guidelines, 2002:** VRE's design guidelines identify standards for commuter rail station projects. Because the CC2DCA project plans on connecting to the relocated VRE station, the project should follow VRE's recommendations for platform access, as necessary.
- **WMATA Adjacent Construction Project Manual, 2015:** WMATA's manual offers guidance for construction adjacent to existing WMATA property or facilities. The airport landing may need to be coordinated with WMATA's Office of Joint Development and Adjacent Construction (JDAC) depending on the final configuration.
- **MWAA Design Manual, 2014**: The project will need to follow procedures and construction requirements contained in MWAA's manual and its supporting volumes. DCA Vol. 1 identifies signing guidelines specific to DCA, and DCA Vol. 2 identifies tenant design standards. The airport landing will be subject to ongoing MWAA review in the context of future airport development.

NCPC will have advisory review authority for concept, preliminary, and final design, per the National Capital Planning Act of 1952. The relationship of the project to the Parkway and other major infrastructure projects like VRE's relocated station will be assessed. NCPC will also evaluate the relationship of the project to the skyline of the airport when viewed from the Monumental Core or from the Parkway, as defined in the NCPC/MWAA MOU of 1988.

Permitting and Construction Phase

The environmental review process will identify any remaining permitting and mitigation steps for the project. Depending on the exact details of proposed augmentations to existing property accommodating the landing in Crystal City, an amendment to Site Plan 167 may be warranted, which would require approval from the Arlington County Board. The particular entities to be involved in the formal review of entitling such a proposal would be determined based upon the specific scope and extent of changes proposed to the site plan at that time, and may involve the County's Planning Commission, Transportation Commission, and, if needed, other relevant commissions and/or committees. As owners of the underlying right-of-way, CSXT, NPS, and MWAA will likely require final design and construction approval as well.

Maintenance Considerations

Maintenance should be considered early in the design phase. The project team generated order-of-magnitude maintenance cost considerations to show the difference between bridge and tunnel options during a 30-year period (**Table 3**). Cost considerations do not consider the replacement of mechanical or electrical systems, but provide a high-level overview of potential maintenance for daily, weekly, and annual needs. In addition to ownership, maintenance agreements will need to be determined in future stages of the project.

	Bridge Maintenance	Tunnel Maintenance
	A 900-foot covered open-air bridge may cost $20,000 per year to maintain, while a covered climate controlled bridge may cost $70,000 per year.	A 900-foot tunnel is estimated to cost approximately $120,000 per year, and will need to account for NFPA requirements.
Daily	• Cleaning	• Cleaning within tunnel • Security patrol • Monitoring of the equipment room *(home to the mechanical, electrical, lighting, fire and life safety, security, and sign systems)* • On-call electrical and mechanical specialist
Weekly	• Ice preparation and snow removal *(for uncovered structure during winter months)*	• Check of the drainage inlets and pipes
Annual	*General* • Biannual bridge inspection by National Bridge Inspection Standards (NBIS)-certified inspector	*General* • Verification of the tunnel evacuation plan in case of emergency
	Annual mechanical and electrical engineer inspection and service • Heating and cooling system • Fire system	*Annual mechanical and electrical engineer inspection and service* • Heating and cooling system • Fire system • Elevator system • Ventilation system, specifically tunnel ventilation requirements as outlined in NFPA 130 for tunnel fans to run in an emergency • 24-hour lighting system • Communication system
	Direct costs • Electric bill for lighting • Landscape maintenance *(for the High Line typology)* • Air conditioning and heating bill *(for covered climate-controlled structure)*	*Direct costs* • Electric bill for lighting • Air conditioning and heating bill
	Maintenance to structure • Annual water flush of all decks, drains, bearings, joints, pier caps, abutment seats, and concrete rails • Structural repairs, such as crack repairs • Painting and coating, as needed • Window washing *(for covered climate controlled structure)* • Bird and pest control *(for uncovered structure with roof)*	*Maintenance to structure* • Annual water flush of all walls, walking surfaces, and joints • Structural repairs, such as crack repairs • Tunnel washing • Painting and coating, as needed

Table 3 *Comparison of bridge and tunnel maintenance considerations.*

Funding Toolkit

With millions of square feet of mixed-use development planned and major infrastructure projects underway in Crystal City and at the airport, there is a unique opportunity to fund the new connection as part of a larger whole. A toolkit of funding sources will be necessary due to the complexity of the connection. **Table 4** summarizes potential funding sources and opportunities.

This toolkit approach could benefit planning objectives a variety of local and federal stakeholders. Stakeholders should consider pursuing funding together for mutually beneficial enhancements.

The Potential Resource	The Potential Opportunity
Federal	• FHWA's Congestion Mitigation and Air Quality (CMAQ) Program for projects linked to vehicular trip reduction • FHWA's Transportation Alternatives Program (TAP) for pedestrian and bike improvements • FHWA's Federal Lands Access Program (FLAP) to improve access to recreational amenities • FTA's Enhanced Mobility Section 5310 for accessible connections to transit • U.S. DOT's RRIF loan for intermodal railroad facilities
State	• SMART SCALE funds for pedestrian and bike projects or rail and transit projects
Regional	• NVTA's TransAction funds to reduce regional congestion • NVTC's Commuter Choice program to fund multimodal projects
Arlington County	• NVTA's 30% funds for local transportation projects • Tax Increment Financing or other revenue sources to support implementation of the sector plan
Crystal City BID	• Private contributions for operations and programming
In-Kind Services	• JBG Smith could design and construct the landing in Crystal City • VRE could provide the access needed to incorporate the project into their relocated station • MWAA could build the connection while they advance their billion-dollar project at the airport
Airlines	• Carriers at DCA could provide funding support as a benefit to their employees (this would require Use and Lease Agreement approval)
Advertisements	• Maintenance revenue could be generated through advertising

Table 4 *Potential funding sources and opportunities.*

Conclusion

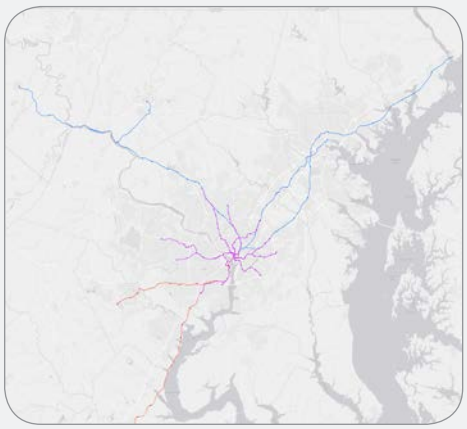
A direct pedestrian connection from Crystal City to DCA is feasible, and would bring tremendous value to the neighborhood for residents, businesses, and visitors to the region. It provides accommodations for a multimodal hub in Crystal City, which has the potential to expand its reach over time through commuter and regional railroad operations—directly connecting the airport and its 10,000 employees and 20 million passengers a year to Crystal City and beyond. It also brings 3,600 hotel rooms, 10.5 million square feet of office space, and 5,700 residential within a 15-minute walk of the airport.

Future challenges still need to be addressed, including building above or below an active railroad corridor and navigating the federal approvals process, like NEPA, associated with the Parkway and airport. In addition, the connection could cost $38 million to construct and more than $100,000 to maintain each year, with no dedicated funding sources to date. A funding toolkit will need to be solidified that leverages concurrent multimodal infrastructure investments and transit-oriented development in Crystal City. Funding strategies could range from federal, state, and regional grant or loan programs to local tax increment financing. Maintenance and operations costs will also need to be determined.

Specific next steps, roles, and timelines will be determined in 2018 through continued coordination of Arlington County, stakeholders, and potential funding partners and review agencies. The foundation for the project will be laid by establishing a CC2DCA steering committee to guide the project through implementation, updating Arlington County's CIP to including planning and design tasks for the project, advancing short-term improvements to existing walking routes, and coordinating with VRE on their relocated station and future multimodal hub.

By exploring forward-thinking opportunities to implement the project, stakeholders will lay the groundwork for Crystal City to become a true "aerotropolis" unlike any other in the United States, connecting and interconnecting local, regional, and national communities and businesses. Implementing bold visions requires strong leadership, thoughtful collaboration, and persistence. We've taken the first step towards a vision for a new pedestrian connection between Virginia's largest downtown district and its busiest airport—are you ready to help take the next step?

Local



Regional

National

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