

CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

a Supporting Document of the Crystal City Sector Plan



Prepared for:
Arlington County Division of Transportation

MULTIMODAL



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A SUPPORTING DOCUMENT OF THE CRYSTAL CITY SECTOR PLAN

FEBRUARY 2010

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TABLE OF CONTENTS

1.0: INTRODUCTION	1	Vehicular Traffic Volumes and Analysis	21
Context	1	Forecast Demand and Planned Capacity of Transit	24
Purpose	1	Metrorail	24
Study Area	1	Virginia Railway Express	25
Overview	2	Amtrak Passenger Rail Service	26
Transportation Modes	2		
Study Process	3	4.0: TRANSITWAY EVALUATION	27
Regional Partners/Agencies	3	Transitway Context	27
Study Milestones	3	Alignment Evaluation	28
Goals	4	Policy Assumptions	28
General Transportation Goals	4	Alignments	28
Study Planning Principles, Goals, and Objectives	4	Evaluation Criteria	30
		Evaluation Measures and Results	30
2.0: EXISTING CONDITIONS	5	5.0: TRANSPORTATION RECOMMENDATIONS	39
General Issues	5	Transportation Network	39
Street Network	5	Interconnected Streets	39
Transit	10	Complete Streets	39
Metrorail	10	Pedestrian and Bicycle Accommodation	41
Virginia Railway Express	11	Pedestrian and Bicycle Network	42
Bus Services	12	Transit Network	45
Pedestrians and Bicycles	14	Automobile Network	47
		Corridor Recommendations	52
		Phased Transportation Improvements	63
3.0: MODELING, FORECASTS, AND ANALYSIS	16	Transitway Service	64
Model Process and Methodology	16	Parking	73
Transportation Network	16	Transportation Demand Management	75
Person Trip Generation	17		
Internal Trips	18	6.0: CONCLUSIONS	78
Mode Split	19		
Vehicular Trip Assignment	21		



1.0: INTRODUCTION

This multimodal transportation study was undertaken as part of the Crystal City Planning process. The report is a supporting document of the Crystal City Sector Plan. The transportation planning process for this study was undertaken in concert with the land use planning and urban design process under guidance from the Crystal City Planning Task Force and Arlington County staff. The document presents an evaluation of the existing and future multimodal transportation network along with recommendations for the future transportation network and phasing of improvements.

Functioning as more of an extension of the central business district of the Washington, D.C. region than an individual district unto itself, Crystal City benefits from its location along major transportation arteries and proximity to major employers in both the District and Arlington. The area already has an impressive transportation network that includes sidewalks, bikeways, rail and rubber-tire transit services, and a relatively interconnected street network.

As a result of decisions made by the Federal Base Realignment and Closure (BRAC) Committee, a number of major office tenants within Crystal City will consolidate or relocate to other areas within and outside of Crystal City and the county. These displacements will provide the opportunity for Crystal City to evolve. The BRAC's decisions will have a temporary negative impact on the office market in Crystal City; however, over the long term, they will provide the opportunity and physical space for the land use mix in Crystal City to diversify and achieve a better balance between commercial and residential development.

Ultimately, this better balance will translate into a place where more people live, work, and play. Over time, modifications to the transportation system serving Crystal City will benefit area residents, employees, visitors, and those who travel through the area. Crystal City will be an area that is easily accessed by those outside of the immediate area; and an area that offers residents choices in the way they travel.

PURPOSE

The impending relocation and closure of a number of government offices in Crystal City offers a tremendous opportunity to reinvent the area. The redevelopment of Crystal City will introduce new residences, retailers, and offices to an already dense part of Arlington. To support future growth and ensure transportation choice in the area, strategic transportation improvements will be needed over time. This study discusses the evolution of the Crystal City transportation system in concert with the 2030 and 2050 development horizons.

This multimodal transportation study examines Crystal City's redevelopment in phases and proposes transportation improvements to provide for effective travel and mobility for the area's residents, workers, and visitors through the year 2050. The study provides physical and policy recommendations consistent with the goals and objectives of the county's Master Transportation Plan (MTP). Ultimately, recommendations from this plan will affect how people choose to travel within and access Crystal City.

STUDY AREA

The Crystal City multimodal transportation study area is shown in **Figure 1.1** and described as the area generally bounded by S. Eads Street on the west, the CSX railroad corridor on the east, S. Glebe Road on the south, and I-395 on the north. While the study focused on the entire study area, a number of sub areas also were evaluated in greater detail. These areas included the Jefferson Davis Highway/15th Street S. interchange vicinity, the Jefferson Davis Highway/Route 233 (Airport Access Road) vicinity, the Jefferson Davis Highway corridor, and the Crystal Drive corridor.

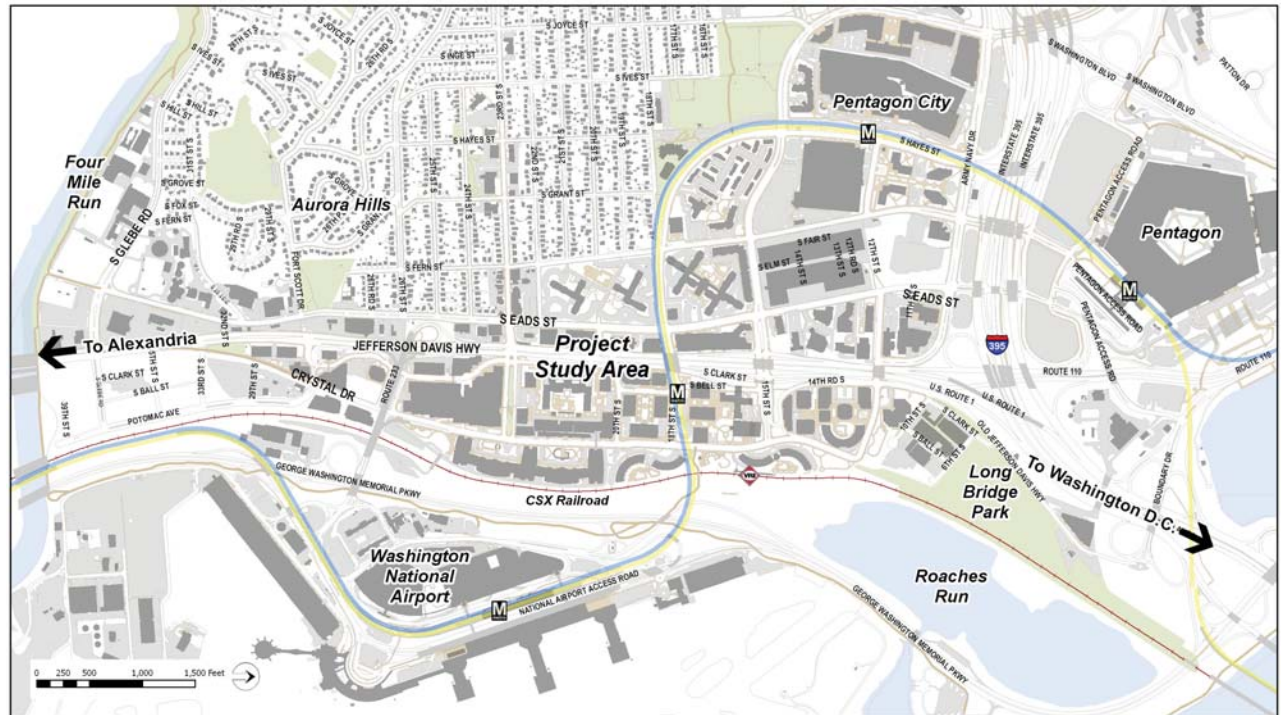


Figure 1.1: Crystal City Multimodal Transportation Study Area



OVERVIEW

The study is presented in five sections:

1. The **introduction** discusses the study area, goals, and process. This section also introduces the many modes of travel that will be highlighted in subsequent sections of the report.
2. The **existing conditions** section presents an analysis of the general transportation issues of Crystal City and discusses the existing transportation infrastructure.
3. The **modeling, forecasts, and analysis** section discusses the methodology for determining the future multimodal transportation demand generated by existing and future land use. The analysis prepared is based generally on the land use of the draft plan presented to the Task Force in March of 2007. This was termed the *Crystal City Draft Master Plan: 1.5 Alternative*. The transportation analysis finds that the transportation demand associated with the plan's density proposal can be accommodated through multimodal improvements, such as reconfiguration of streets and intersections, enhancements to pedestrian and bicycle networks, additional transit infrastructure and services, and implementation of county transportation demand management (TDM) policies and programs.
4. The **transitway evaluation** section discusses the evaluation of and recommendation for the future alignment of the Crystal City/Potomac Yard Transitway through Crystal City. Six alignment alternatives were studied by Arlington staff, a subcommittee of the Crystal City Task Force, and the consultant team.
5. The **transportation recommendations** section presents recommendations prepared based on the transportation analysis and the final sector plan, which is a revision of the Draft Master Plan: 1.5 Alternative, in close coordination with the Department of Environmental Services/Division of Transportation (DES/DOT), Arlington Economic Development (AED), and the Department of Community Planning, Housing and Development (DCPHD).

This study takes into account input from the study task force, citizens, county staff, and regional transportation partners (the Virginia Department of Transportation (VDOT), Washington Metropolitan Area Transit Authority (WMATA), the National Parks Service (NPS), the Metropolitan Washington Airports Authority (MWAA), and others). Development phasing information provided by Arlington County Economic Development (AED) demonstrates that it will take time and diligence over the course of approximately 50 years to redevelop Crystal City according to the plan's vision. During this period, existing buildings will be renovated and others torn down; new buildings will be constructed; a new mix of uses will emerge with more residential

development; and the fabric of Crystal City will become more urban and interwoven.

TRANSPORTATION MODES

This transportation study focuses on all modes of travel and balances projected increases in travel demand among all modes by proposing improvements to transit, pedestrian facilities, bikeways, and streets. The study addresses safety, operations, and modifications to the transportation network in the context of the future redevelopment of Crystal City in short- and long-term horizons. Each subsequent section of this report considers the following with regards to modes of transportation:

Pedestrians and bicyclists

- General accommodation and facility design
- Access to buildings and other attractions
- Bicycle lanes and connections to county routes and regional trails

Streets and intersections

- Design, connectivity, and operations
- Level of service/accommodation, access to parking, and loading
- Streetscape (multimodal supportive designs in context with surrounding land use)

Regional facilities

- Relationship between major transportation facilities such as National Airport and limited access highways
- Relationship to major park facilities such as Long Bridge Park and the Mount Vernon Trail

Transit

Streetcar and Bus

- Streetcar routes, stations, and facility design
- Bus access, circulation, and bus stop locations
- Interaction between current transit service and the proposed Crystal City/Potomac Yard Transitway
- Interaction between transit and proposed development

Metrorail and Virginia Railway Express (VRE)

- Station access/connectivity
- Intermodal connections
- Relationship to regional system
- Capacity

Parking

- Access, supply, operations, and facility design
- Appropriate amount of parking based on the proposed land use options and additional modes of transit



The Virginia Railway Express carries thousands of workers to Crystal City each weekday and is one of the essential components of the area's transportation system



Jefferson Davis Highway is a critical link in the major regional road network



CRYSTAL CITY Multimodal Transportation Study

STUDY PROCESS

At strategic points throughout the plan development and review process, regional partners were engaged to discuss the future of transportation in Crystal City, to express issues and priorities (for each partner), and to provide comments and feedback on plan recommendations and findings. Meetings were conducted with these agencies in April and September of 2007. The agencies and partners included in these meetings, along with a summary of primary concerns interests of each partner with regard to the Crystal City plan included the following:

- *Washington Metropolitan Area Transit Authority (WMATA):* Interaction and connectivity of other transit modes to Metro, especially connectivity of transit services to the existing 18th Street S. Metro station
- *Virginia Department of Rail and Public Transportation (VDRPT):* Regional (Arlington and beyond) coordination of transit services and overall system connectivity. Primarily focused on major transit infrastructure (service) interconnectivity—major bus routes, Metro, future transitway
- *Virginia Railway Express (VRE):* Capacity of the system and constraints as well as connectivity to Crystal City and nearby major transit services such as primary bus routes and Metro. To the degree possible, connectivity between VRE and Crystal City should be enhanced
- *Virginia Department of Transportation (VDOT):* Enhancing the operation of Jefferson Davis Highway and maintaining convenient and direct truck access to National Airport
- *Metropolitan Washington Airports Authority (MWAA):* Reducing National Airport “cut-through” (non-airport) traffic and maintaining sufficient truck and vehicle capacity to the airport from Crystal City and the George Washington Memorial Parkway
- *National Parks Service (NPS):* Maintaining and enhancing screening and landscaping for the park, strategically focusing on water quality and natural environmental health, and minimizing the visual impact of transportation modifications on the park
- *Crystal City Business Improvement District:* Providing opportunities to enhance the livability and vibrancy of Crystal City through the conversion of one-way sections of Crystal Drive to two-way. Significant concern about the impact of the transitway on Crystal Drive and its pedestrian friendliness

STUDY MILESTONES

The following is a brief summary of significant milestones in the development of the Crystal City transportation study:

- *November 2006:* Study Begins; project team includes Kimley-Horn, Nelson\Nygaard, and DMJM Harris, in partnership with Torti Gallas Partners and EDAW
- *December 2006:* Transportation planning goals and principles are developed
- *December 2006 to March 2007:* Initial analysis, concept planning, and qualitative review focusing on transportation demand management, all transportation modes, and overall multimodal connectivity
- *December 2006 to March 2007:* Four draft plan alternatives are studied and reduced to a single draft plan alternative referred to as the 1.5 Alternative
- *April 2007:* Preliminary analysis of “1.5 alternative”
- *April 2007:* Transportation coordination meeting with county staff, stakeholders, and regional partners
- *June 2007:* Study of refined draft plan concept developed by Arlington Economic Development (AED) and Torti Gallas
- *July 2007:* Detailed modeling, forecasting, analysis, and recommendations for the development of the multimodal plan for Crystal City
- *August 2007 through December 2007:* Draft report submittals and ongoing coordination and revisions to accommodate draft plan updates and modifications
- *September 2007:* Second meeting with stakeholders and regional partners
- *Spring 2008:* Additional plan revisions
- *Spring/Summer 2008:* Transitway alignment study with Kimley-Horn, DMJM Harris, and Torti Gallas and Partners, in partnership with the Crystal City Task Force Transitway Subcommittee
- *Summer 2008:* Plan revisions based on recommended transitway alignment and phasing updates.
- *Fall 2009:* Anticipated multimodal transportation study adoption/acceptance



Recent streetscape improvements along Crystal Drive



Future transitway on Crystal Drive south of 26th Street S.



GOALS

Arlington's vision of transportation is a system that provides modal choices and equal access to all users. It advocates the concentration of investment on projects that yield the greatest good not only from a transportation standpoint, but also in terms of overall quality of life. In support of the long view of transportation in the county, a number of published documents outline goals designed to help Arlington realize its vision. A list of these documents follows:

- **Arlington Master Transportation Plan (MTP)**

Goals (from the November 2007 Goals and Policies Summary)

- Provide high quality transportation services
- Move more people without more traffic
- Promote safety
- Establish equity
- Manage effectively and efficiently
- Advance environmental sustainability

- **Arlington MTP Pedestrian Element**

- **Arlington MTP Bicycle Element**

- **Arlington MTP Transportation Demand Management (TDM) Element**

- **Arterial Transportation Management (ATM)**

Goal (2004 report): Enhance the safety and efficiency of travel by motorists, transit patrons, bicyclists, and pedestrians of all abilities through a balanced approach to the design and operation of an arterial street in context with its surrounding land use



Crystal City connection to the Mt. Vernon Trail.

The following vision statement, goals, and objectives were developed by the Crystal City Task Force and adopted in November 2008 to guide the Crystal City planning process:

Crystal City Sector Plan Vision Statement

With its close proximity to the Potomac River overlooking the nation's monuments, Crystal City today offers an established office, hotel, residential, and retail mixed-use environment accessible via its extraordinary transportation network comprised of: rail and bus transit; streets and sidewalks; interior public walkways connecting to transit and, in targeted areas, lined with restaurants, local retailers, and neighborhood services; bicycle trails; regional connectors; and National Airport. In the future, as Crystal City grows along with the region it will be enhanced with improved surface transit service and a more functional and pedestrian-friendly urban street network lined with active retail and civic spaces. Crystal City's future physical character will include enhanced upper-story uses that provide a Class A office environment and expand the array of residential offerings in the neighborhood. Crystal City's "sense of place" will be strengthened by providing additional attractive and safe civic, cultural, retail, recreational, and community enhancements and defining distinct neighborhoods through high-quality architecture, open spaces, streetscape designs, and public art. Residents, visitors, and workers, alike will all benefit from Crystal City's smart growth policies, improved land use and transportation connections, and enhanced quality of life.

Crystal City Sector Plan Goals and Objectives

The Crystal City Sector Plan and this supporting multimodal transportation study are guided by seven goals, each with a set of objectives. The objectives can be found in the Crystal City Sector Plan. The goals are:

1. Create a High Quality Public Realm that Strengthens the Sense of Place
2. Provide a Mix of Uses by 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.

Goal 4: Enhance Multimodal Access and Connectivity

Objectives:

- Improve transportation and land-use connections within and beyond Crystal City through transit-oriented development.
- Enhance Crystal City's transit orientation with new and better transit services and facilities designed to meet the future needs of Crystal City, and to further encourage residents, workers, and visitors to select transit over personal vehicles.
- Enhance Crystal City's multimodal transportation infrastructure by designing transit facilities as integral architectural elements and improving overall transit, pedestrian, and bicycle access and connectivity.
- Provide high quality surface transit service that has travel times competitive with private automobiles, attracts riders, reduces automobile dependency, and limits roadway congestion.
- Enhance the urban quality of Crystal City by strengthening the urban street grid.
- Create a hierarchy of streets to facilitate automobile, transit, bike, and pedestrian use.
- Create vibrant, pedestrian oriented streets through the better use of sidewalks, streetscapes, and open space areas to improve space for pedestrians, bicyclists, parking, and transit.
- Transform Jefferson Davis Highway (Route 1) into an asset of the overall multimodal transportation network.
- Supply appropriate parking to support a vibrant mix of uses while discouraging unnecessary single occupancy vehicle use.
- Maximize the use of all parking resources through measures such as Transportation Demand Management ("TDM").
- Maintain and improve connections to the interior walkway system both vertically and horizontally as development occurs while maintaining its connectivity to Metrorail and creating linkages to transitway stations.
- Enhance the utility and safety of the bicycle network as part of the Crystal City transportation network.
- Provide better connections to National Airport and the surrounding regional transportation network.
- Provide comprehensive wayfinding for all users.



2.0: EXISTING CONDITIONS

GENERAL ISSUES

There are a number of issues that challenge all modes of transportation in Crystal City. These issues are the result of physical and operational conditions within Crystal City, and also the region. For convenience and clarity, transit, vehicular, and pedestrian and bicycle issues are summarized as follows:

Transit

Lack of modal connectivity

- VRE and Metrorail have different stations
- Limited transit connectivity between Crystal City and the airport (except Metro and hotel shuttles)

Poor transit visibility

- VRE station is not visible from Crystal Drive
- Limited visibility of Crystal City Metrorail station entrance
- Limited station amenities
- Bus stops have few shelters and benches
- Lack of bicycle storage at Metrorail station

Vehicular

Streets

- S. Clark/Bell Street alignment is disjointed and discontinuous
- S. Clark/Bell Street circulation pattern is confusing
- Crystal Drive one-way/two-way condition is confusing
- Limited on-street parking due to street configuration and lane use

Intersection configurations

- Inadequate spacing of intersections between S. Eads Street, S. Clark/Bell Street, and Jefferson Davis Highway at east/west streets requires complex signal phasing and inefficient signal timing, which leads to congestion, driver confusion, and long delays
- East/west street intersections with S. Clark/Bell Street are very wide and confusing
- Irregular intersection geometry (offset skew) at the Jefferson Davis Highway/20th Street S. intersection

Intersections fail during peak hours

- S. Clark/Bell Street/20th Street S.
- Jefferson Davis Highway/23rd Street S.
- Jefferson Davis Highway northbound off ramp/15th Street S.

Bicycle

- Connectivity
- On-street bicycle network is incomplete
- Limited bicycle connectivity to the airport (long, unclear route)

Pedestrian

Crossings

- Wide intersections are difficult to negotiate
- Jefferson Davis Highway is a barrier and is difficult to cross at signalized intersections
- Pedestrian tunnel under Jefferson Davis Highway at 23rd Street S. is inconvenient due to the need for users to descend stairs to reach the tunnel and then ascend stairs to exit the tunnel
- Operation of intersections along and adjacent to Jefferson Davis Highway contributes to long delays for pedestrians crossing the street
- S. Clark/Bell Street and Jefferson Davis Highway ramps and free-flow turn lanes decrease pedestrian safety
- Connectivity
- Large blocks contribute to long walk distances
- Limited pedestrian connectivity to the airport (long, unclear route)

STREET NETWORK

Much of Crystal City was developed prior to the completion of the Metro system and in an auto-oriented pattern. The pattern that currently exists is a super-block system, with a network of larger streets. One transportation outcome of this type of pattern is that many streets have to perform double-duty—serving local and regional trips. The limited connectivity leads to peak hour congestion at intersections where complex signal phasing and long cycle lengths are needed to accommodate demanded vehicle movements. Some intersections, unable to cope with demand, become congested with vehicles stopped for multiple signal cycles.

Although the street network is limited, streets and intersections operate relatively well during peak hours. Traffic congestion is primarily isolated to a few locations along Jefferson Davis Highway (at 20th Street S. and 23rd Street S.) and on 15th Street S. at the interchange ramps. Laneage, vehicular level-of-service, and existing weekday peak hour turning movement counts are provided in the following:

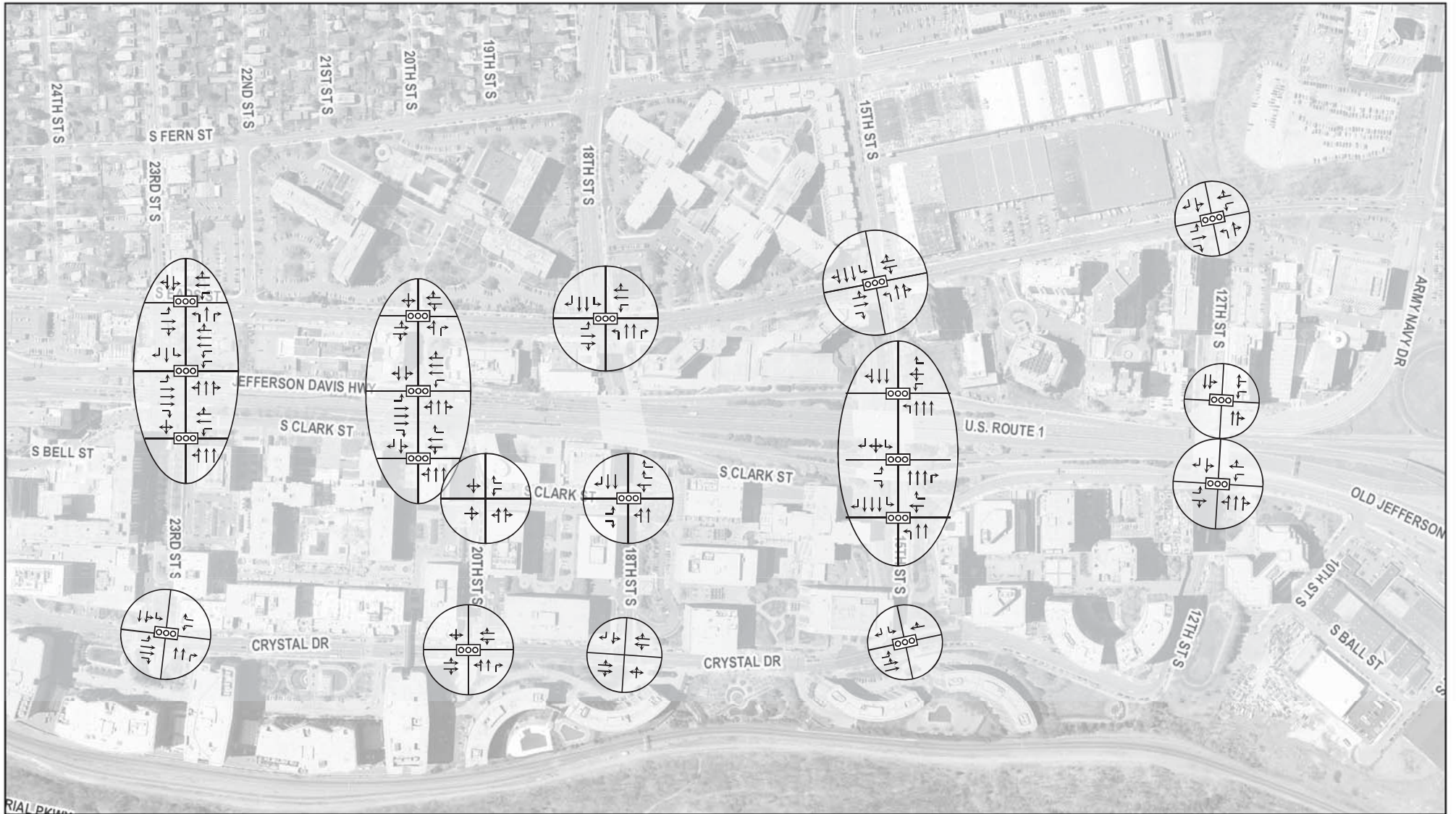
- **Laneage:** Intersection laneage and traffic control (signalized or unsignalized) is shown in **Figure 2.1 and 2.2**
- **Turning movement volumes:** A.m. and p.m. peak hour intersection turning movement volumes and vehicular levels of service are shown in **Figures 2.3 and 2.4**



Crosswalk on Crystal Drive



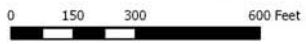
Bike lane on Crystal Drive

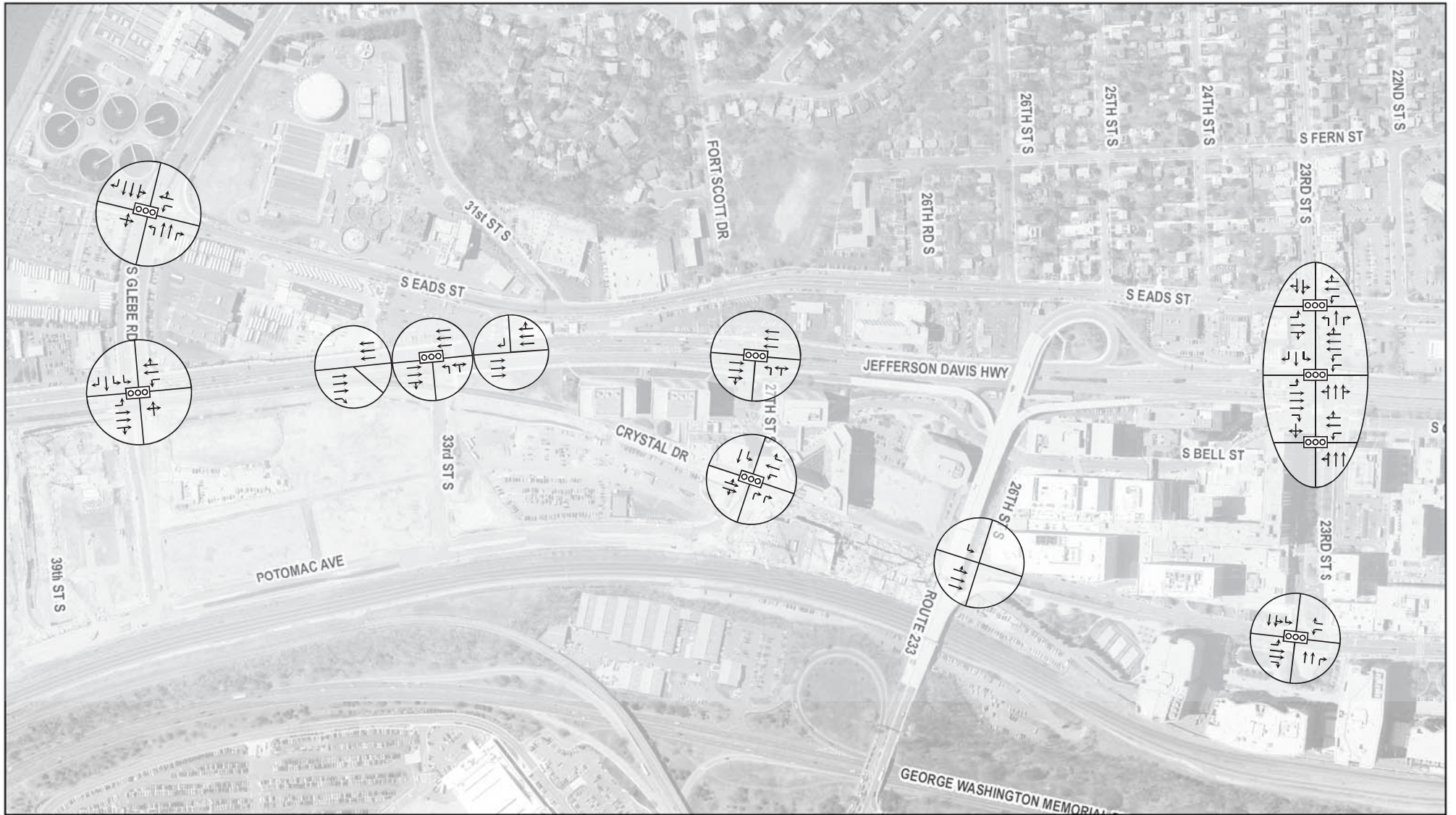


CRYSTAL CITY MULTI-MODAL TRANSPORTATION PLAN

Laneage and Traffic Controls

Figure 2.1

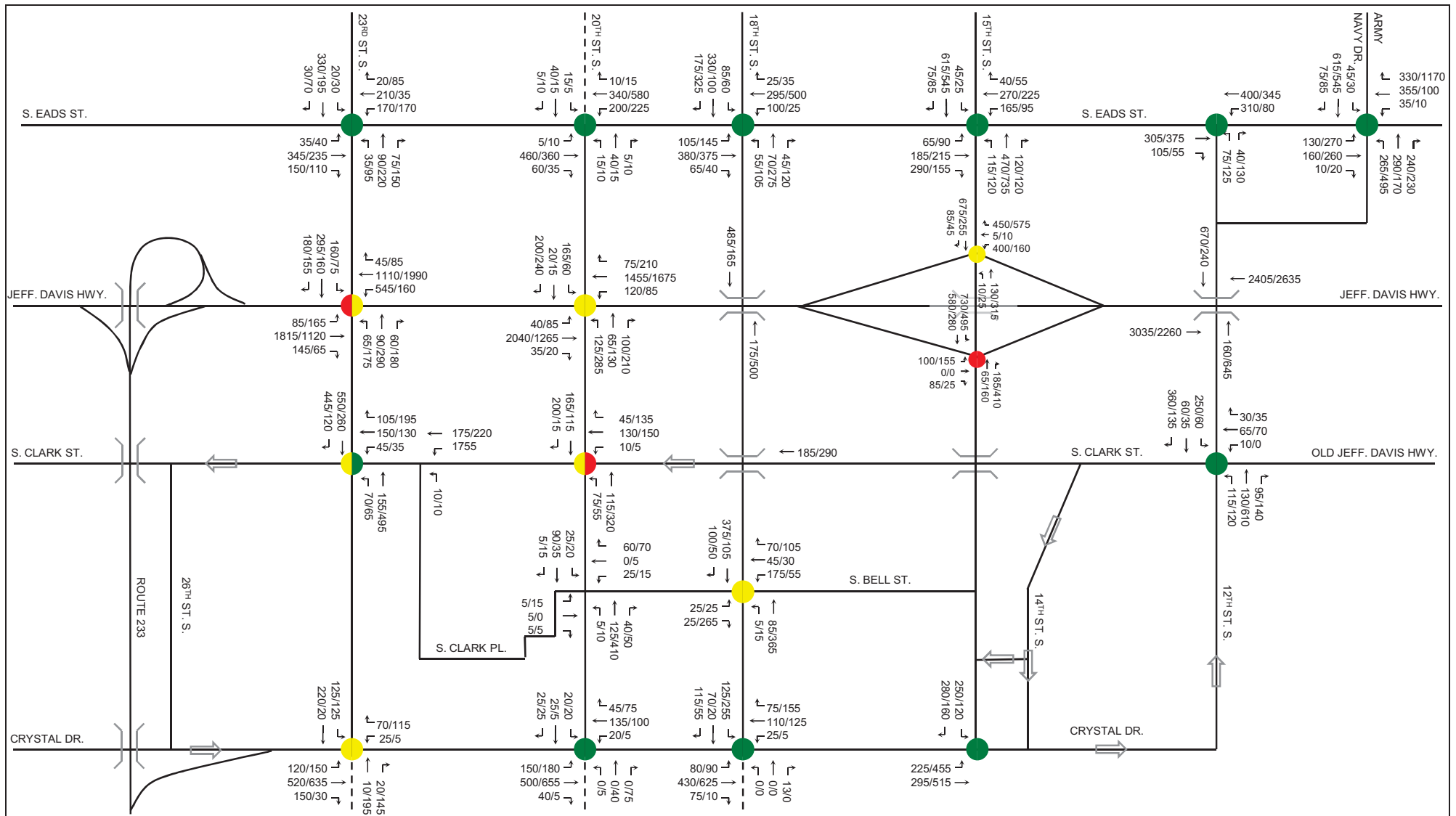




CRYSTAL CITY MULTI-MODAL TRANSPORTATION PLAN

Laneage and Traffic Controls

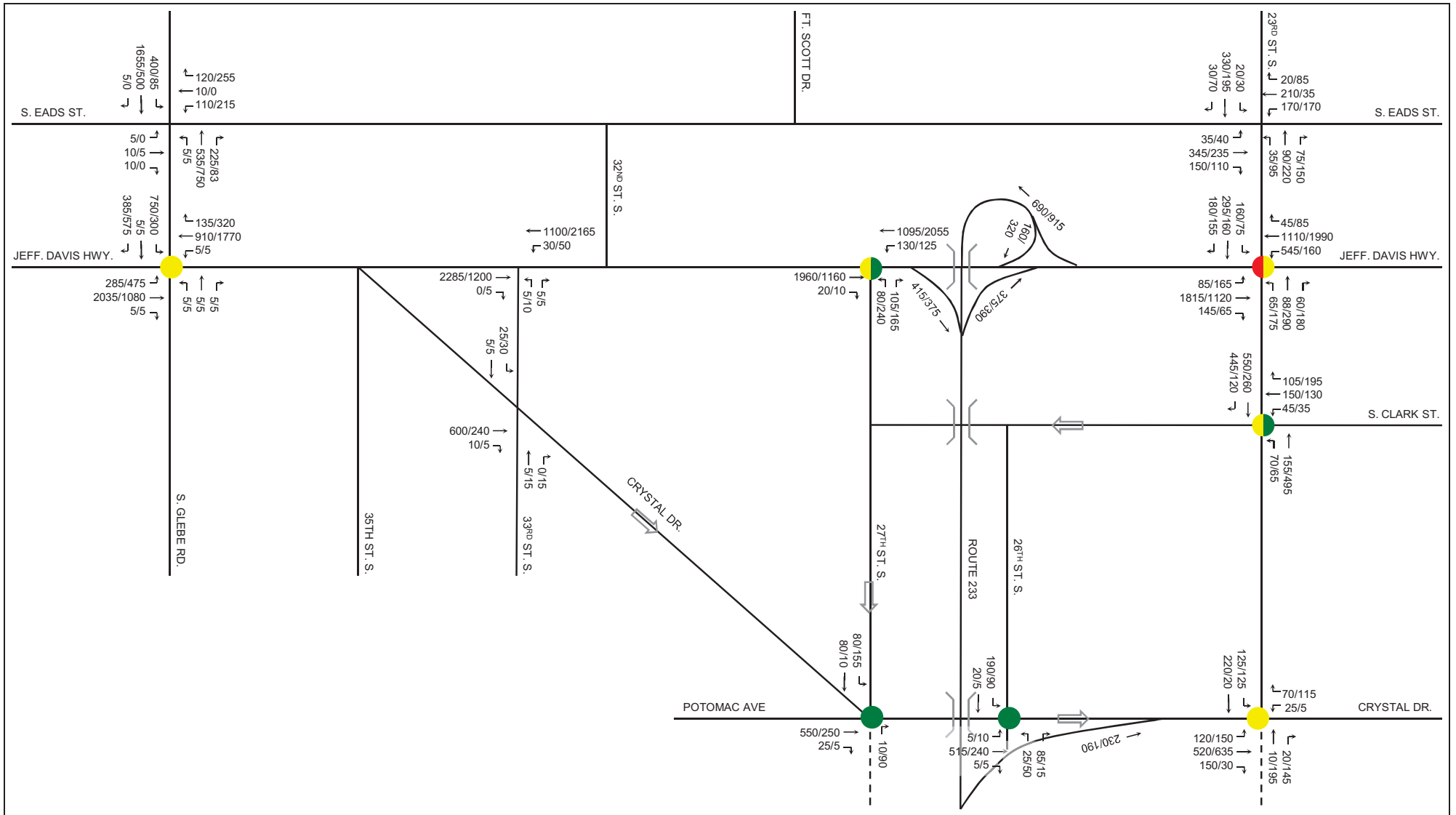
Figure 2.2



- Legend:**
- Intersection Level of Service A or B
 - Intersection Level of Service C or D
 - Intersection Level of Service E or F
 - ## Weekday AM/PM Peak Hour Traffic Volumes
 - ☰ AM Peak Hour Intersection Level of Service
 - ☷ PM Peak Hour Intersection Level of Service
 - ➡ One-way street (direction indicated by arrow)

Existing Traffic Volumes and Vehicular Levels of Service

Figure 2.3



Legend:

- Intersection Level of Service A or B
- Intersection Level of Service C or D
- Intersection Level of Service E or F

- ☐ AM Peak Hour Intersection Level of Service
- ☐ PM Peak Hour Intersection Level of Service
- ☐ One-way street (direction indicated by arrow)

Weekday AM/PM Peak Hour Traffic Volumes

Existing Traffic Volumes and Vehicular Levels of Service

Figure 2.4



TRANSIT

METRO RAIL SERVICES

Crystal City is currently served by the Yellow and Blue lines with a station located at the 18th Street S./Bell Street intersection. The Yellow and Blue lines travel from Fairfax County, Virginia, to the District and Prince George's County, Maryland. During peak hours, the combined headways of the two lines are between 3 and 6 minutes.

Existing Demand

According to 2005 passenger counts, during the time period from 7:30 a.m. to 8:30 a.m. approximately 1,900 passengers exit the Crystal City Metrorail station while 1,500 other passengers enter the station. The total number of weekday station entries is approximately 12,500. **Figure 2.5** illustrates passenger entries and exits throughout the day. Note the strong a.m. and p.m. peaking characteristics. **Table 2.1** shows weekday passenger loads during the morning peak hour (8:00 a.m. to 9:00 a.m.) for the Blue and Yellow lines near Crystal City.

Table 2.1: 2005 Northbound Peak Passenger Loads (a.m. peak hour)*

	Blue Line (58 cars)	% of Available Capacity**	Yellow Line (56 cars)	% of Available Capacity**
Pentagon City to Pentagon	74 pax/car	62%	88 pax/car	73%
Crystal City to Pentagon City	61 pax/car	51%	72 pax/car	60%
Airport to Crystal City	55 pax/car	46%	61 pax/car	51%

* All data based on the Metrorail ridership forecasts conducted in 2005-2006

** Assumes policy capacity of 120 passengers per car

pax = passengers

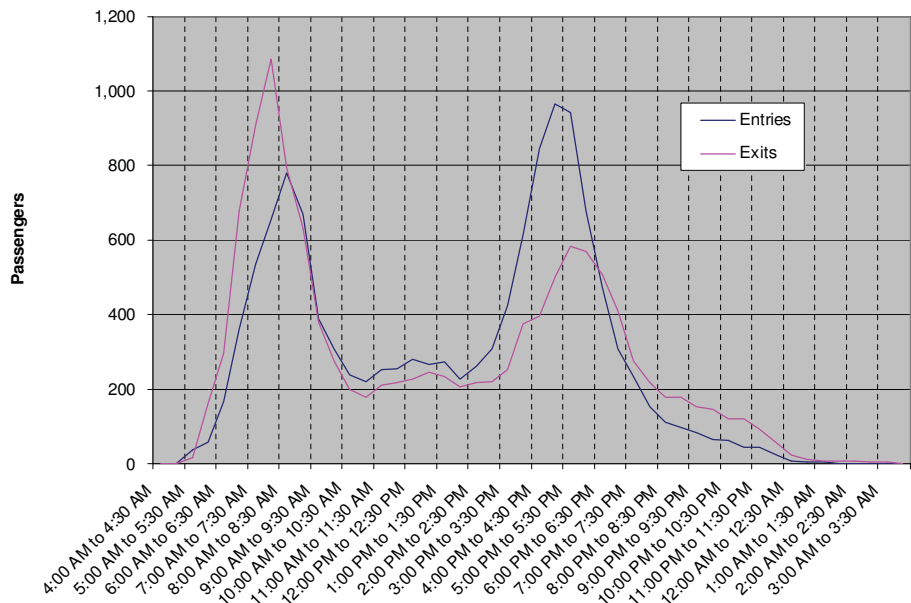


Figure 2.5: 2005 Daily Passenger Counts for the Crystal City Metrorail Station

VIRGINIA RAILWAY EXPRESS

Crystal City is served by both the Manassas and Fredericksburg Lines of the Virginia Railway Express (VRE) as shown in **Figure 2.6**. Additionally, Amtrak trains provide service at various times throughout the day to Crystal City via Alexandria or Union Station. Crystal City is VRE’s second most heavily used station; L’Enfant Plaza is the busiest. Approximately 23 percent of all VRE riders use the Crystal City station while 40 percent use L’Enfant. In fiscal year 2007 (FY07) about 3,400 trips came into and out of Crystal City on a daily basis.

Generally, service operates on non-federal holiday weekdays. The service is operated only in the peak direction—northbound in the morning and southbound in the evening. Fares for service are based on the number of zones traveled. Single fares, multiple ride passes, and monthly passes are available.

Fredericksburg Line

On the Fredericksburg line, northbound trains arrive in Crystal City approximately every 30 minutes from 6:30 a.m. to 9:00 a.m. In the afternoon, southbound trains depart from Crystal City approximately every 30 minutes from 3:40 p.m. to 7:45 p.m.

Manassas Line

On the Manassas line, northbound trains arrive in Crystal City approximately every 30 minutes from 6:00 a.m. to 9:00 a.m. In the afternoon, southbound trains depart from Crystal City approximately every 30 minutes from 4:00 p.m. to 7:00 p.m.



Crystal City VRE Station



Figure 2.6: Virginia Railway Express Service
Source: Virginia Railway Express, 2007.



BUS SERVICES

Crystal City is served by six Metrobus routes. In addition, a number of commuter bus services serve Crystal City including OmniRide from Prince William County and the Fairfax Connector.

Metrobus

Crystal City Metrobus route coverage is shown in Figure 2.7. The six routes serving Crystal City include the following:

Metrobus Route 9S (Crystal City-Potomac Yard Shuttle) focuses on travel within Crystal City, operating from the Crystal City Metrorail Station south to Potomac Yard. From Potomac Yard, the route travels north on Crystal Drive to 15th Street S. before looping back to the Metrorail station along S. Clark/Bell Street. Route 9S provides service every 6 minutes during the peak and every 12 minutes during the off-peak on weekdays. Current ridership is approximately 1,300 passengers per weekday, with 1,192 daily boardings at the Crystal City Metrorail Station*.

Metrobus Routes 23A and 23C (McLean-Crystal City Line) provides service between Tysons Corner and the Crystal City Metrorail Station via Ballston and Shirlington. They enter Crystal City along 23rd Street S. and turn north at Crystal Drive to access the Metrorail station. Route 23A provides service every 30 minutes on weekdays and Saturdays, and service every 60 minutes on Sundays. Route 23C provides one trip a day in each direction on weekdays. Current ridership is approximately 4,100 passengers per weekday, with 185 daily boardings at the Crystal City Metrorail Station*.

Metrobus route 9A (Huntington-Pentagon Line) travels between the Huntington Metrorail Station and the Pentagon via Old Town Alexandria and Jefferson Davis Highway (Route 1). This route does not provide direct service to the Crystal City Metrorail Station. Route 9A operates at 30-minute headways weekdays and Saturdays and at slightly longer headways on Sundays. Current ridership on the 9A and 9E combined is approximately 1,500 passengers per weekday*.

Metrobus route 9E (Huntington-Pentagon Line) travels between the Del Ray section of Alexandria and the Pentagon via Jefferson Davis Highway (Route 1). This route does not provide direct service to the Crystal City Metrorail Station. It operates five trips southbound in the morning peak and six trips northbound in the evening peak period, at intervals of between 5 and 30 minutes. Current ridership on the 9A and 9E combined is approximately 1,500 passengers per weekday*.

Metrobus Routes 13F and G (National Airport-Pentagon-Washington Line) operate in a loop linking National Airport, the Pentagon, and employment centers in Washington, D.C. These routes operate only on weekend mornings, providing service every 30 minutes on Saturdays and every 40 to 60 minutes on Sundays. These routes travel primarily on S. Eads Street, Jefferson Davis Highway (Route 1), and the Airport Access Road. They do not provide service to the Crystal City Metrorail Station.

Current ridership on the combined 13 lines (13A, 13B, 13F, and 13G) is approximately 800 passengers per weekday*.

Metrobus Route 16H (Columbia Heights West – Pentagon City Line) provides service between the Crystal City metro station and Columbia Heights West including stops in Pentagon City. This route operates only on weekdays during the a.m. and p.m. peak hours, providing service at intervals between 20 and 30 minutes. This route has 30 daily boardings at the Crystal City Metrorail Station*.

OmniRide

OmniRide is PRTC’s commuter bus service offering weekday service (excluding some holidays) from Dale City, Lake Ridge, and Manassas (via connection at Pentagon) to Crystal City. OmniRide has an average of 274 daily boardings in Crystal City.

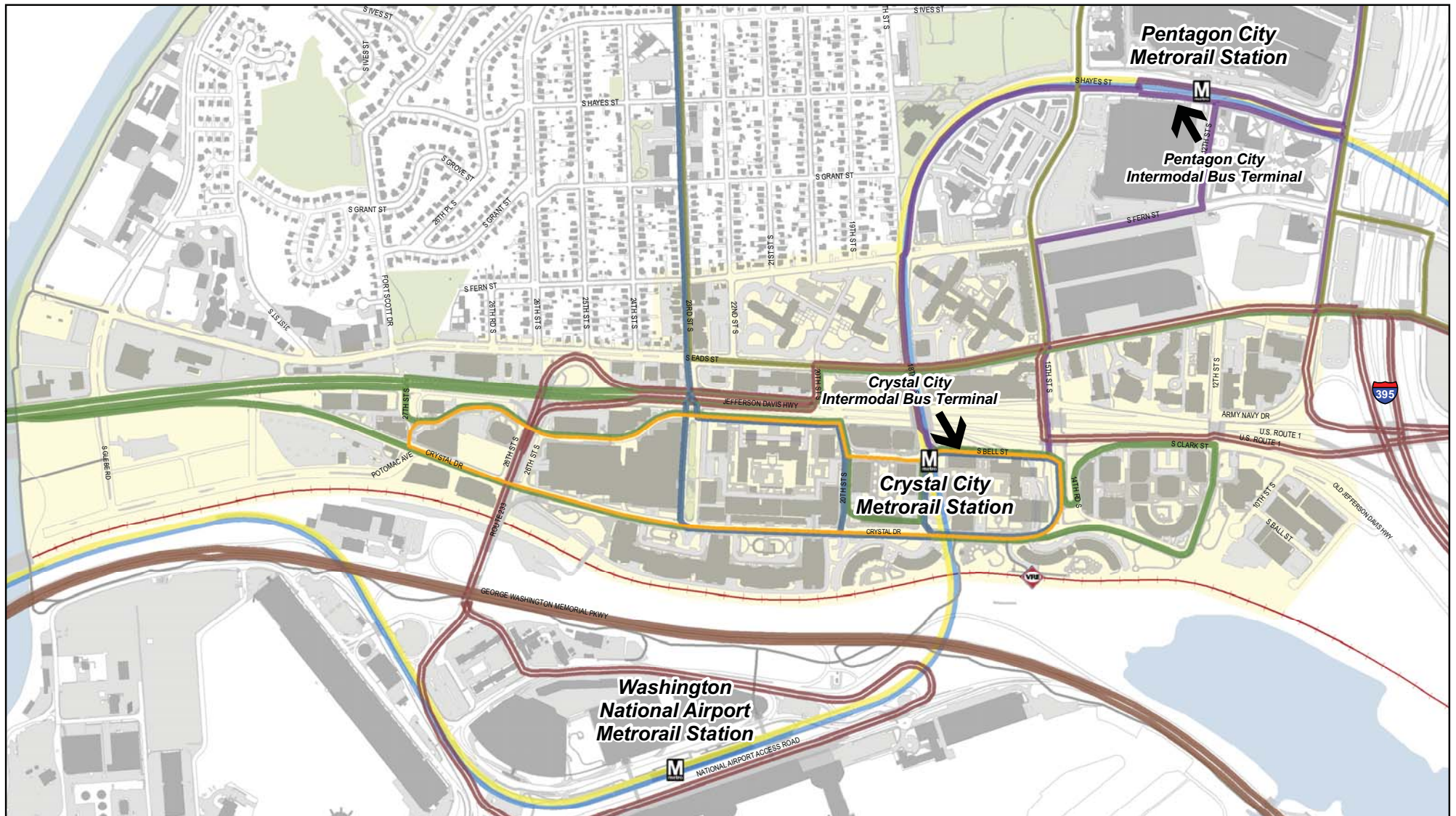
Fairfax Connector

The Fairfax Connector also serves Crystal City via the Crystal City Express (Route 597), which runs between the Reston - East Park and Ride lot at Wiehle Avenue and Crystal City and Pentagon City. This route makes a series of stops throughout Crystal and Pentagon Cities along Crystal Drive, Clark Street, S. Eads Street, 15th Street S., Fern Street, Army/Navy Drive, and 12th Street S. Morning departures from Wiehle Avenue are every 30 minutes from 5:58 a.m. to 7:28 a.m. at 30-minute intervals. Evening departures from Crystal and Pentagon Cities are from 3:30 p.m. to 5:45 p.m. at 30- to 40-minute intervals. The travel time between Reston and Pentagon City is approximately 30 to 40 minutes. The Fairfax Connector has an average of 100 daily boardings in Crystal City.



Metrobus service on Crystal Drive

* May 2008 Metrobus ridership data






0 250 500 1,000 Feet



Legend

- Metrobus Route 9S - CCPY Shuttle
- Metrobus Route 9A/E - Huntington-Pentagon Line
- Metrobus Route 10A 10E - Huntington Towers-Pentagon Line
- Metrobus Route 11Y - Mount Vernon Express
- Metrobus Route 13A 13G - National Airport-Pentagon-Washington
- Metrobus Route 16-GHKW - Columbia Heights-Pentagon City Line
- Metrobus Route 23A, C - McLean-Crystal City Line
- Metrorail
- + VRE

CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

Existing Transit Services

Figure 2.7



PEDESTRIANS AND BICYCLES

Crystal City is currently served by a network of bicycle facilities that include striped bicycle lanes, on-street routes, and off-street trails. Similarly, pedestrians are served by the existing series of sidewalks and trails. **Figure 2.8** shows existing and currently planned (consistent with the Master Transportation Plan) bicycle and pedestrian (sidewalk and trail) facilities in Crystal City that are further described below:

Underground: The Underground provides opportunities for pedestrians to travel relatively long distances within Crystal City in a comfortable and climate controlled environment. The underground also helps to extend the reach of Metrorail at 18th Street S., offering a much larger proportion of Crystal City direct and uninterrupted access to the service. The existing underground extends from 12th Street S. to between 23rd Street S. and 26th Street S.

Sidewalks: The sidewalk network in Crystal City varies in character. Along Crystal Drive, sidewalks are generous, whereas along Jefferson Davis Highway they are relatively narrow. For the most part, all streets in Crystal City have a sidewalk or comparable pedestrian accommodation. Most of the sidewalk and pedestrian spaces do not meet the standards for design outlined in the pedestrian element of the Master Transportation Plan.

Striped Bicycle Lanes: This type of facility is generally a 5-foot wide delineated area on both sides of a two-way public street, located adjacent to the curb or parking lane. In Crystal City, bicycle lanes are marked on the following streets:

- *S. Eads Street:* S. Glebe Road to 23rd Street S.
- *Potomac Avenue:* the Arlington County Line to Crystal Drive
- *Crystal Drive:* 23rd Street S. to 12th Street S.
- *18th Street S./S. Hayes Street:* S. Eads Street to Army Navy Drive

On-Street Routes: Most often located on streets having low traffic speeds, low vehicular volumes, and wide travel lanes, these facilities are not delineated on streets and rely on motorists and cyclists sharing travel lanes. In Crystal City, on-street routes are designated as the following:

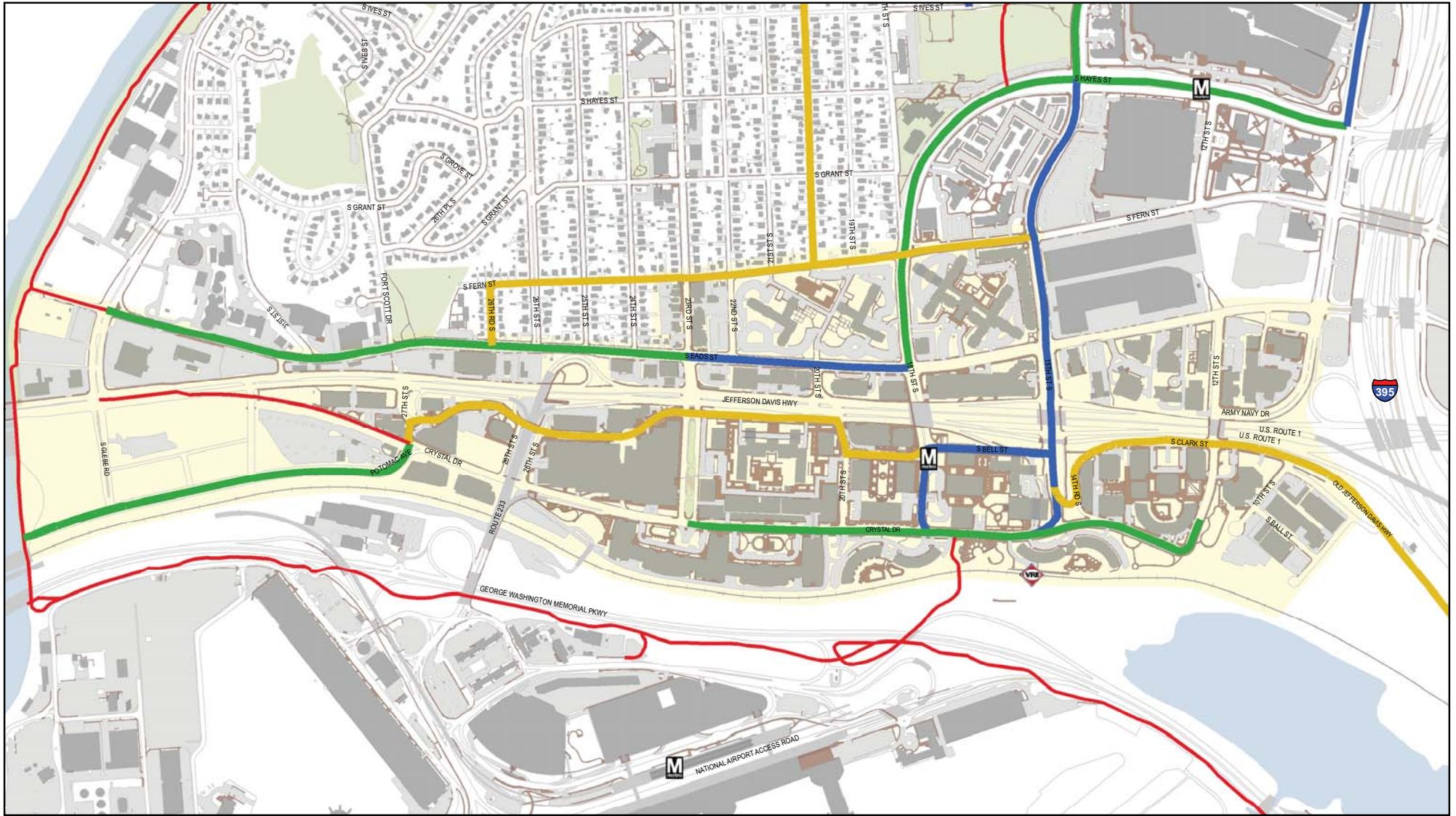
- *S. Bell Street:* 18th Street S. to 15th Street S.
- *18th Street S.:* S. Bell Street to Crystal Drive
- *S. Eads Street:* 23rd Street S. to 18th Street S.
- *S. Eads Street:* from S. Glebe Road to Four Mile Run Trail
- *15th Street S.:* S. Hayes Street to Crystal Drive

Off Street Trails: This type of facility varies in amenities provided, but generally consists of an 8- to 10-foot wide asphalt paved pathway with a continuous centerline stripe. These facilities are typically located parallel to major roadways and separated from vehicular travel lanes by 5 to 10 feet. Some of these facilities have bridges and tunnels at street and highway crossings. Crystal City is served by the following off-street trails:

- *Crystal Drive:* 35th Street to 27th Street
- *Jefferson Davis Highway:* S. Glebe Road to Crystal Drive
- Mt. Vernon Trail
- *Connector bicycle trail:* from Crystal Drive (at the Water Garden) to the Mt. Vernon Trail
- Four Mile Run Trail



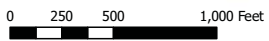
The Underground in Crystal City



CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

Existing Sidewalks and Bikeways

Figure 2.8



Legend

- Sidewalks
 - Bicycle Lane
 - Other Recommended On-Street Routes
 - Shared-Use Trail
 - On-Street Bicycle Route (signed)
- Source for bicycle facilities: 2009 Arlington County Bike Map*

3.0: MODELING, FORECASTS, AND ANALYSIS

To understand the impact of the Crystal City Sector Plan (the 1.5 Alternative is shown in **Figure 3.1**) and general regional growth, travel demand forecasts were prepared for the study area. Based on information provided by Arlington Economic Development, the horizon for the build out of the Crystal City Sector Plan is 50 or more years. The build out will occur over time and based on market forces. Based on the best information available, six build out phases were identified: phase 1, (2011 to 2015), phase 2, (2016 to 2020), phase 3 (2021 to 2030), phase 4 (2031 to 2040), phase 5 (2041 to 2050), and phase 6 (post 2050). The 2030 forecasts prepared correspond to the phase 3 redevelopment and the 2050 forecasts correspond to the phase 5 redevelopment. The modeling process employed in developing travel demand forecasts considered Crystal City’s redevelopment consistent with the sector plan and general travel demand growth attributed to regional factors.

The following sections document the model process and methodology, forecasts, and transportation analysis.

MODEL PROCESS AND METHODOLOGY

In general, the model process involved the following:

- Developing a model transportation network
- Identifying transportation analysis zones (TAZ)
- Generating person trips
- Developing mode split assumptions
- Assigning person trips to individual modes (generating transit ridership, walking trips, bicycling trips, and auto trips)
- Analyzing and adjusting assignments and forecasts

TRANSPORTATION NETWORK

The model transportation network for the Crystal City study is comprised of the network of streets, transit services, bikeways, trails, and sidewalks that currently exist and are planned and proposed.

- **Street Network:** This includes facilities of regional (major roadways) and local significance. Regional roads include facilities such as Jefferson Davis Highway, Route 233, S. Glebe Road, and I-395. The local street network includes the collection of locally significant roadways such as Crystal Drive, Old Jefferson Davis Highway, 18th Street S., 15th Street S., 23rd Street S., S. Eads Street, and other similar facilities. For the street network, intersection levels of service, delay, and overall facility size (number of lanes/configuration) were considered.

- **Transit Network:** This includes existing and envisioned transit services and facilities—Metrorail, the transitway, Metrobus, and other services and providers. For transit—services, location, connectivity, and capacity were evaluated.
- **Bicycle and Pedestrian Network:** This includes sidewalks, bikeways (on- and off-street), trails, and other pathways that connect non-vehicular modes to origins and destinations.

TRANSPORTATION ANALYSIS ZONES

Transportation analysis zones represent specific geographic areas. In transportation models, land use and socioeconomic data are aggregated based on the boundaries established for the zone structure.

The land use and socioeconomic data (population, households, and employment) included in each TAZ are used as the basis for the generation of person trips. In the Crystal City model, 16 TAZs represent the study area including zones representing the Long Bridge Park and Potomac Yard. Study TAZs are shown in **Figure 3.2**.



Figure 3.1: Crystal City Draft Master Plan: 1.5 Alternative
(Source: Torti Gallas and Partners)



Figure 3.2: Study Area Transportation Analysis Zones



PERSON TRIP GENERATION

In the model process, land use ultimately needs to be translated into trips by mode – vehicle trips, walking and bicycling trips, and transit trips. To develop trips by mode, a person trip generation exercise was conducted by using rates published by the Institute of Transportation Engineers (ITE) and by applying appropriate factors to account for the mixed-use, multimodal condition of Crystal City.

Land use was aggregated in each study TAZ for the 2007 (existing), 2030, and 2050 conditions based on information provided by Arlington Economic Development (AED) and Torti Gallas and Partners and based on the *Crystal City Draft Master Plan: 1.5 Alternative*. A summary of this information is shown in **Table 3.1**. The land use totals were adjusted based on existing building occupancy and general occupancy goals (provided by AED) for 2030 and 2050. The occupancy adjustments used in the calculation are shown in **Table 3.2**. High occupancy rates were assumed for future years in order to generate a conservatively high number of trips.

The development totals of the final Crystal City Sector Plan are lower than the development totals of the 1.5 Alternative. The results of the analysis of the 1.5 Alternative are conservative as the draft plan contained more dense development and more intense uses than the final sector plan. Based on the understanding that the final sector plan reflects a lower density, it is reasonable to assume that fewer person trips will be generated.

In addition to the development levels in the 1.5 Alternative, development from Potomac Yard is included in the development totals. The development levels are based on information available from traffic impact studies. Trips for Long Bridge Park were taken from the Long Bridge Park Multimodal Transportation Study.

Weekday a.m. and p.m. peak hour person trips generated were calculated for each TAZ based on rates and equations provided in *ITE Trip Generation Report, 7th Edition*. Trip generation equations used are shown in **Table 3.3**.

Table 3.1: Crystal City Development Totals

Type of Use	2007	2030	2050
Office	10,800 ksf	12,900 ksf	15,900 ksf
Increase		19%	47%
Residential	9,300 units	14,700 units	22,000 units
Increase		58%	137%
Hotel	4,700 rooms	4,900 rooms	5,500 rooms
Increase		4%	17%
Retail	850 ksf	1,500 ksf	1,750 ksf
Increase		76%	106%
*Total	24,700 ksf	32,900 ksf	43,310 ksf

*Totals assume an average of 1,000 square feet per dwelling unit and 757 square feet per hotel room
ksf = 1,000 square feet

Table 3.2: Occupancy Adjustments

Type of Use	2007	2030	2050
Office	81%	90%	90%
Residential	81%	95%	95%
Hotel	100%	100%	100%
Retail	100%	100%	100%

Table 3.3: Person Trip Generation Rates and Equations

Type	ITE Land Use Code	Units	AM Equation	AM % In	PM Equation	PM % In
Apartment	220	Dwelling Units	$T = 0.49(X) + 3.73$	61%	$T = 0.55(X) + 17.65$	39%
Hotel	310	Rooms	$\ln(T) = 1.24\ln(X) - 2.00$	61%	$T = 0.59(X) + 0.00$	53%
General Office	710	ksf	$\ln(T) = 0.80\ln(X) + 1.55$	88%	$T = 1.12(X) + 78.81$	17%
Specialty Retail	814	ksf	5% of p.m. trips	56%	$T = 2.40(X) + 21.48$	44%

*ksf = 1,000 square feet

INTERNAL TRIPS

In a transportation analysis, internal trips are those trips that have origins and destinations within such proximity that they do not affect the larger transportation network. In the context of Crystal City, internal trips are those trips that remain within Crystal City and are not made by Metrorail or car. In general, the propensity for trips to be “captured” internally varies based upon the conditions of the area—the pedestrian-friendliness of the urban design, the compactness of the development, the availability and convenience of non-auto travel modes, and the mixture of uses.

Analytically, Crystal City was divided into three general areas to study the potential for some trips to be captured within Crystal City. These areas are shown in **Figure 3.3**.

Using methodologies outlined by the ITE, internal capture rates were calculated within and between the three areas indicated. The development and design patterns of the Crystal City Sector Plan will increase the percentage of trips that are internally-captured by Crystal City. Those internally captured trips are assigned to walk/bike or local transit based on the proximity of zones to one another and an understanding of people’s typical willingness to walk, bicycle, and take transit to make local trips. Future improvements to the urban design and walkability are one factor influencing the assumed increase in the percent of internally captured trips that will walk or bike in 2030 and 2050. Assumptions for these assignments are shown in **Tables 3.4** and **3.5**.



Figure 3.3: Crystal City Zones for Internal Trip Evaluation

Table 3.4: Existing Internal Capture Modal Assumptions

Land Area	North	Central	South
North	100% (0%)	85% (15%)	10% (90%)
Central	85% (15%)	100% (0%)	85% (15%)
South	10% (90%)	85% (15%)	100% (0%)

Legend: % Walk or Bike (% Local Transit)

Table 3.5: 2030 and 2050 Internal Capture Modal Assumptions

Land Area	North	Central	South
North	100% (0%)	90% (10%)	15% (85%)
Central	90% (10%)	100% (0%)	90% (10%)
South	15% (85%)	90% (10%)	100% (0%)

Legend: % Walk of Bike (% Local Transit)



MODE SPLIT

Non-internal trips were divided into external transit trips and external vehicle trips. External transit trips were assumed to be primarily accommodated on Metrorail and the Virginia Railway Express (VRE), although some external transit trips will be carried by OmniRide, the Fairfax Connector, Metrobus, and other bus transit services. Based on existing Journey to Work information for Crystal City resident workers from the 2000 U.S. Census (Table 3.6), mode split data from WMATA, and mode split data maintained by Arlington County, a factor was developed for each zone to reflect the desirability of taking transit to make external trips.

Logic and experience from data suggest that the TAZs closest to the Metrorail (18th Street S. and Pentagon City) and VRE stations will have the highest rate of transit use. In the future, the combination of additional transit services, an improved urban environment, and improved pedestrian and bicycling facilities is likely to result in more people having access to and being willing to use transit. As the land use in Crystal City further diversifies and the area becomes more active during more hours of the day, transit usage in currently off-peak periods and directions is likely to increase, similar to the Rosslyn-Ballston corridor.

In the development of future forecasts, 2030 and 2050 transit use was increased compared to existing transit use. The general assumptions regarding transit share for existing, 2030, and 2050 conditions are shown in Figure 3.4 on the following page. Mode splits are summarized in Table 3.7 and 3.8 for existing and 2030 conditions, respectively.

Table 3.7: 2007 Mode Split Summary

Mode	Assumed		*AM Peak Hour Trips	*PM Peak Hour Trips
	AM %	PM %		
Non-vehicular	11%	23%	1,800	4,300
Transit	28%	27%	4,500	5,100
Auto	61%	50%	9,700	9,300
Total	100%	100%	16,000	18,700

**a.m. peak hour is a one-hour period between 7:00 a.m. and 9:00 a.m. and the p.m. peak hour is a one-hour period between 4:00 p.m. and 6:00 p.m.*

Table 3.8: 2030 Mode Split Summary

Mode	Assumed		*AM Peak Hour Trips	*PM Peak Hour Trips
	AM %	PM %		
Non-vehicular	13%	27%	3,100	8,000
Transit	38%	35%	9,000	10,300
Auto	49%	38%	11,700	11,300
Total	100%	100%	23,800	29,600

**a.m. peak hour is a one-hour period between 7:00 a.m. and 9:00 a.m. and the p.m. peak hour is a one-hour period between 4:00 p.m. and 6:00 p.m.*

Table 3.6: Journey to Work Summary*

Mode	Use
Auto (Total)	35%
Drove Alone	31%
Carpool	4%
Public Transportation (Total)	42%
Bus	1%
Subway	40%
Taxi	1%
Walk	19%
Other Mode	1%
Worked at Home	4%

Source: U.S. Census 2000, Journey to Work Summary

*Denotes Crystal City residents journey to work



Figure 3.4: External Transit Mode Split by Area



VEHICULAR TRIP ASSIGNMENT

Following the designation of internal trips and trips assigned to transit and other non-auto modes, the remaining vehicular trips were assigned to the street network for the a.m. and p.m. peak hours for 2030 and 2050. The Metropolitan Washington Council of Governments (MWCOC) Regional Travel Demand Model was used to understand regional patterns of traffic distribution relating to Crystal City.

By running the MWCOC model, regional origins and destinations for Crystal City trips were compiled and summarized for the a.m. and p.m. peak hours. Based on this summary, external distributions of trips were established for each of the locations shown in Figure 3.5. The percentage of trips assigned between Crystal City and each of these points is shown in Table 3.9. The resulting number of vehicular trips assigned between Crystal City and each external point is shown in Table 3.10.

In addition to the increase in trips that will accompany the redevelopment of Crystal City, traffic due to non-specific regional growth and change will increase the volume of traffic on primary and main corridors such as Jefferson Davis Highway, 15th Street S., S. Glebe Road, and other major area streets. Using data developed from the MWCOC model, reasonable rates of growth in traffic on major roads serving external (non Crystal City exclusive) functions were developed and applied to create 2030 and 2050 background traffic volumes. In some cases, traffic volumes were balanced across parallel roads.

Table 3.9: Traffic Distribution Between Crystal City and External Locations

Location	2007 AM Peak Hour	2007 PM Peak Hour	2030 AM Peak Hour	2030 PM Peak Hour
Jefferson Davis Highway North	33.0%	31.5%	30.5%	29.5%
Old Jefferson Davis Highway	2.0%	2.0%	2.0%	1.5%
Route 233 (Airport Access Road)	4.5%	4.5%	5.0%	5.0%
Potomac Avenue	0.0%	0.0%	3.5%	4.0%
Jefferson Davis Highway (south)	19.0%	19.0%	17.0%	17.0%
S. Glebe Road	9.5%	10.0%	8.5%	8.0%
23rd Street S.	3.5%	3.5%	1.0%	1.0%
18th Street S.	7.0%	7.0%	3.0%	3.0%
15th Street S.	8.0%	8.5%	6.5%	6.5%
12th Street S.	0.0%	0.0%	8.0%	8.5%
S. Eads Street	5.0%	5.5%	4.0%	4.0%
Army Navy Drive	7.5%	7.5%	5.0%	5.5%
All Other Streets	1.0%	1.0%	6.0%	6.5%
Total	100%	100%	100%	100%

Table 3.10: Total Vehicular Trips (Existing + New) Between Crystal City and External Locations

Location	2030 AM Peak Hour Into Crystal City	2030 AM Peak Hour Out of Crystal City	2030 PM Peak Hour Into Crystal City	2030 PM Peak Hour Out of Crystal City
Jefferson Davis Highway (north)	1,940	1,641	1,322	2,022
Old Jefferson Davis Highway	127	108	67	103
Route 233 (Airport Access Road)	318	269	224	343
Potomac Avenue	223	188	179	274
Jefferson Davis Highway (south)	1,081	915	762	1,165
S. Glebe Road	541	457	359	548
23rd Street S.	63	54	45	68
18th Street S.	191	161	134	206
15th Street S.	413	350	291	446
12th Street S.	509	431	381	583
S. Eads Street	254	215	179	274
Army Navy Drive	318	269	246	377
All Other Streets	382	323	291	445
Total	6,360	5,381	4,480	6,854

VEHICULAR TRAFFIC VOLUMES AND ANALYSIS

Using the aforementioned process, future (2030) traffic volume (weekday a.m. and p.m. peak hour turning movements) and transit ridership forecasts were developed for Crystal City. Traffic volume forecasts (turning movements) and vehicular levels-of-service for 2030 are shown in Figures 3.6 and 3.7. The vehicular levels-of-service for 2030 are based on the future street network and intersection configuration recommended in Chapter 4 of this report. The levels-of-service do not include special signal timing that would be required for operation of the Crystal City/Potomac Yard Transitway.

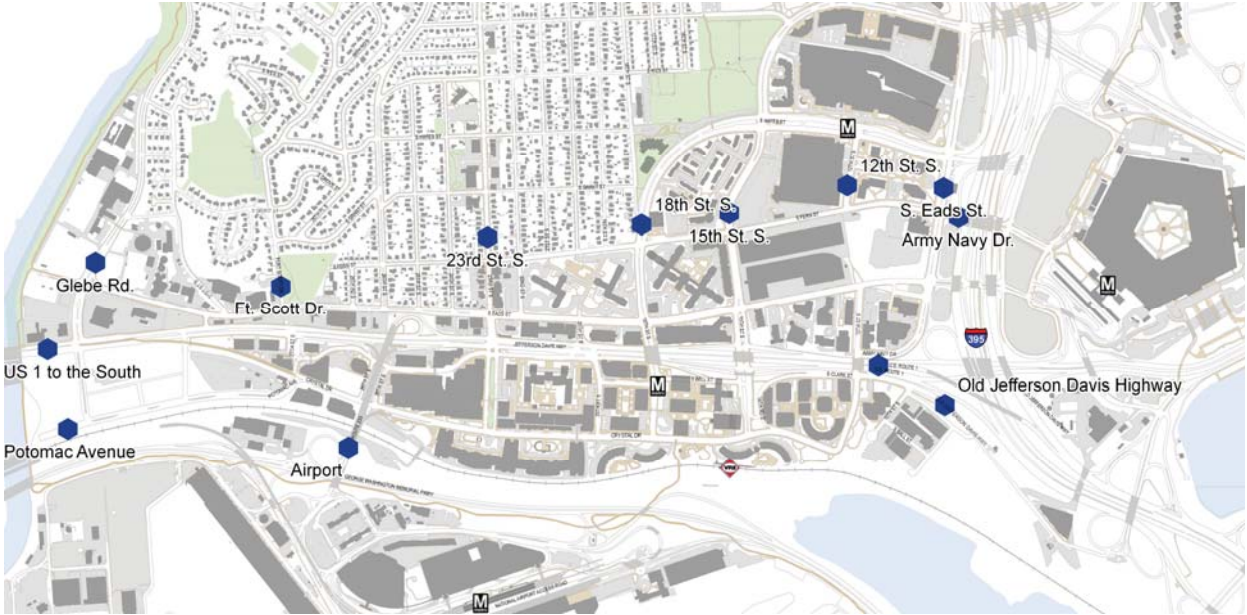
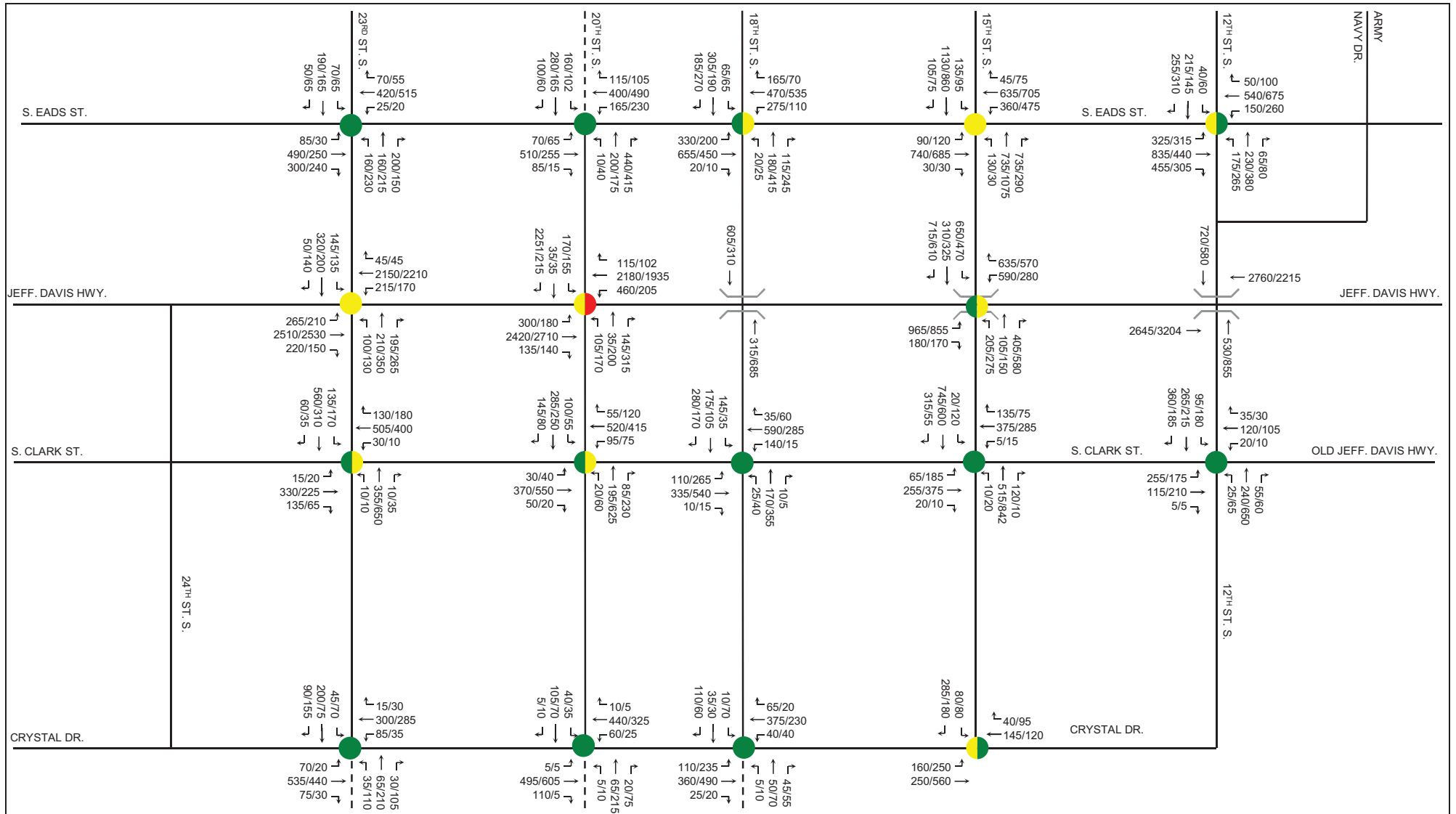
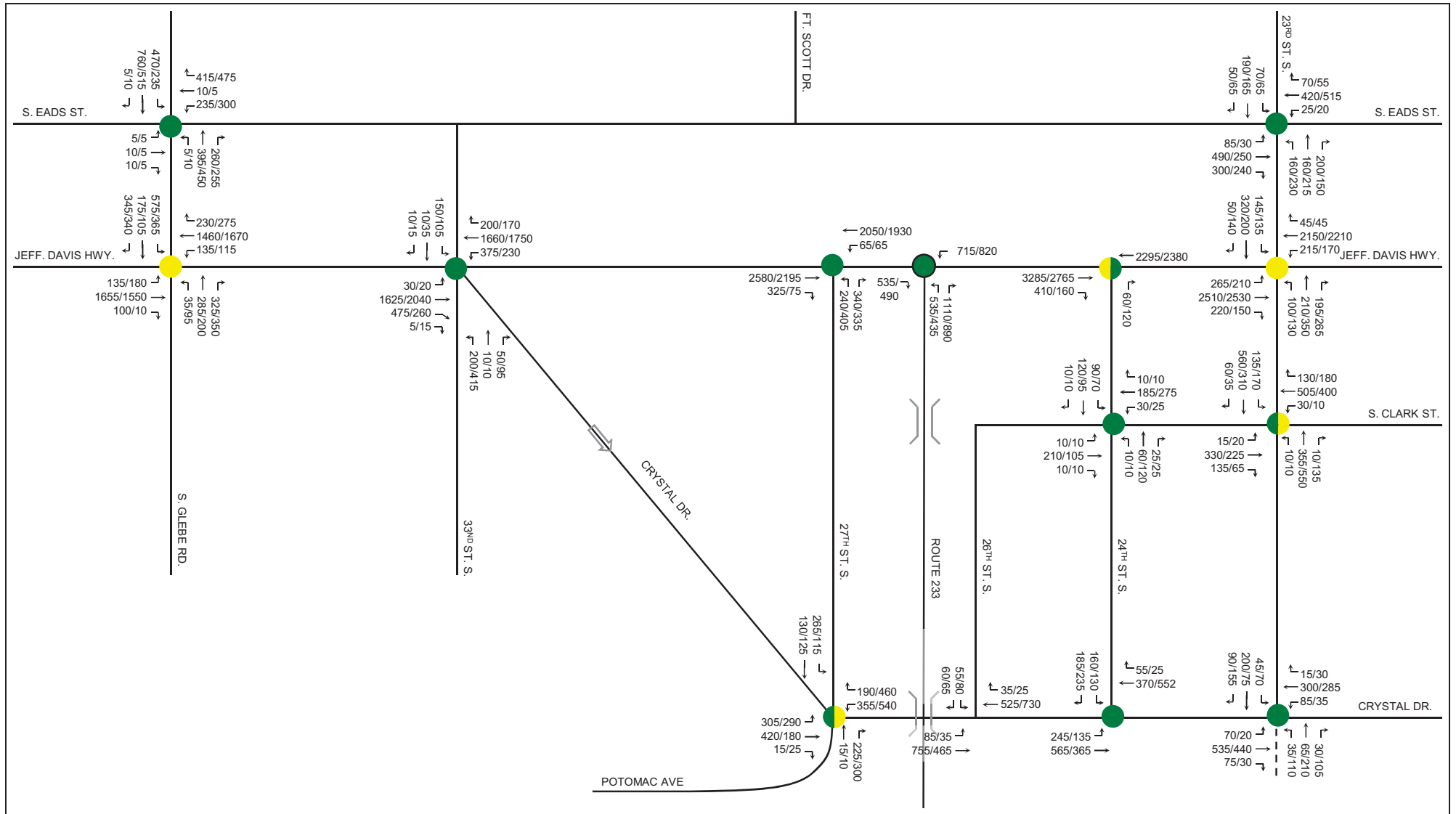


Figure 3.5: External Connection Points





Legend:

- Intersection Level of Service A or B
- Intersection Level of Service C or D
- Intersection Level of Service E or F

Weekday AM/PM Peak Hour Traffic Volumes

- AM Peak Hour Intersection Level of Service
- PM Peak Hour Intersection Level of Service
- One-way street (direction indicated by arrow)



FORECAST DEMAND AND PLANNED CAPACITY OF TRANSIT

METrorail

This section describes the existing capacity of the Crystal City Metrorail station and planned enhancements to Metrorail service on the Blue and Yellow lines that serve the station. This section reconciles the projected levels of transit demand with planned capacity improvements.

Based on information compiled from VRE and WMATA, as well as an evaluation of current facilities, station capacity enhancements are not needed to accommodate future transit demand. Metrorail train capacity to Crystal City will grow through 2020 and beyond to provide capacity for the projected demand. Depending on the rate at which the draft plan land use density is realized, demand for Metrorail service could approach or exceed capacity by 2030 or 2040. Crystal City development alone will not cause the Blue/Yellow lines or the station to reach capacity.

Projected Future Demand

Along with the recent survey of ridership, WMATA prepared near-term forecasts based on the MWCOG model adjusted to reflect detailed land use information around stations. **Table 3.11** shows the recent count information and projections for future entries at the Crystal City Metrorail station.

Table 3.11: Crystal City Metrorail Station Boardings (average weekday)

Count/ Forecast Year	Projected Station Entries	Percent Increase Over 2005 Base
2005 (count)	12,575	n/a
2010 (forecast)	14,250	13%
2020 (forecast)	16,075	28%
2030 (forecast)	16,475	31%

Source: Crystal City Metrorail Station Access Study (2002)

Line Capacity

By 2010, 50 percent of the trains on the Blue and Yellow Lines will be eight cars long. These service improvements are already funded through the WMATA capital improvement program known as Metro Matters. By 2020, WMATA expects to operate only eight-car trains on these lines (yet to be funded). **Table 3.12** shows the planned changes in the number of cars serving Crystal City during the peak hour and train capacity compared to the existing service.

The Metrorail capacity analysis assumed the proposed Blue Line split in 2010 as part of the Dulles Rail Operations Plan. Thus, in the 2010 timeframe, the peak headway for the Yellow Line is expected to be 7 minutes. The Blue line is proposed to split at Pentagon Station, with every other train traveling via Rosslyn. The remainder will travel via the 14th Street Bridge. The combined headway will be 7 minutes. Train capacity shown for 2030 assumes 100 percent eight-car trains and 7-minute operating headways on both Blue and Yellow lines. This scenario is not part of any adopted plan.

Station Capacity

The *Crystal City Station Access Study* refers to the *Core Capacity Study* finding that the Crystal City Station would not require a new entrance for the 2025 forecast timeframe, but that a new station entrance would be recommended especially with a new LRT or BRT line connecting at the station. The *Station Access* and *Core Capacity* studies were based on COG's adopted land use plan, which is different from the land use plan contained in the draft Crystal City plan. The need for a new entrance will depend on the type and intensity of land use achieved through the sector plan, particularly along Crystal Drive.

Table 3.13 shows the design capacities of the existing fare gates and escalators at the Crystal City Station.

Table 3.12: Planned Metrorail Train Capacity (peak hour, peak direction)

	Current (2005 base)	2010 (funded)	2020 (100% 8-car trains)	2030 (100% 8-car trains)
Blue Line	58 cars 6,960 pax/hour	70 cars 8,400 pax/hour	80 cars 9,600 pax/hour	80 cars 9,600 pax/hour
Yellow Line	56 cars 6,720 pax/hour	58 cars 6,960 pax/hour	72 cars 8,640 pax/hour	80 cars 9,600 pax/hour
Total	114 cars 13,680 pax/hour	128 cars 15,360 pax/hour	152 cars 18,240 pax/hour	160 cars 19,200 pax/hour

pax = passenger
Source: WMATA train assignment plans (2009)

Table 3.13: Station Capacity for Crystal City Passengers

	Number	Design Capacity	Total Capacity (peak 15 min)	2005 Counts (peak 15 min)*	Capacity Utilized
Fare Gates	6 peak direction (10 total)	35 pax/ min	3,150	650	21%
Escalators (mezzanine to street)	1 peak direction (2 total; does not include entrances via Underground)	85 pax/ min	1,275	650	51%
Escalators (platform to mezzanine)	2 exiting peak direction (3 total, each platform)	85 pax/ min	2,550	650	25%

pax = passenger
min = minute
* 2005 counts found 1,085 passengers exiting the station during the time period from 7:30 a.m. to 8:00 a.m.; passenger demand for peak 15 minutes is assumed 60% of peak ½ hour.
Source: Crystal City Metrorail Station Access Study (2002)



Observations

As land uses intensify all along the Blue and Yellow lines, demand for Metrorail service will increase and approach available capacity. Though improvements to station access and facilities are of primary importance, the aforementioned data suggest that the current assessment also should focus on Metrorail train capacity and service characteristics.

In meetings with WMATA, staff emphasized that capital and service improvement plans fully account for growth projected in the MWCOG Regional Travel Demand Model¹. WMATA projections for land use changes around stations are consistent with the regionally approved forecasts. The mix of residential and employment activity in the planned Crystal City will contribute to increased demand for transit in the non-peak hours and non-peak direction. Accordingly, the ease of trip-making in the non-peak direction will be significantly enhanced as Metrorail capacity continues to grow.

Relative growth of demand at Blue and Yellow line stations is assumed to be similar. If line capacity increases by 12 percent, the capacity to accommodate boardings from any station would increase by the same proportion. Second, the sharp peaking of travel demand to and from Crystal City will be mitigated by the growing trend toward off-peak ridership growth and by a greater increase in the number of residents as compared with an increase in the number of jobs in the study area. Third, current ridership counts indicate that there is significant unused capacity on the Blue and Yellow lines, even during peak travel periods (unused capacity for about 6,000 riders in the peak hour, northbound between Crystal City and Pentagon City).

Transit trips due to projected office and residential growth for 2020 will be accommodated by the unused existing capacity on the Blue and Yellow lines and the increased line capacity. By 2030, the stronger office market and continued strong residential growth, combined with increasingly transit-oriented land uses and travel choices are likely to consume projected Metrorail capacity. To ensure that there is adequate transit capacity, additional options for regional transit may be needed by this time. New regional transit options should be expandable to support increasing densities within Crystal City and elsewhere.

**VIRGINIA RAILWAY EXPRESS
Projected Future Demand**

VRE’s strategic plan offers the following statement about potential VRE ridership: “With proactive leadership and strong, early investment in the railroad, daily ridership as high as 40,000 trips is achievable, but the level of investment necessary over the next decade may not be financially feasible. If funding remains severely constrained, or if suburban growth in the region happens in a more scattered fashion, then VRE ridership demand might taper off between 20,000 and 25,000 daily trips.”

The VRE board recommended a middle path—a ridership goal for the year 2025 of 26,000 to 30,000 trips per day achieved by improvements to the core VRE network, additional rolling stock and locomotives, new storage and maintenance facilities, and improved parking and station access. VRE will continue to study expansion to Gainesville and Spotsylvania, and explore opportunities for partnerships, including transit oriented development. **Table 3.14** shows VRE ridership projections for the near-term period.

Table 3.14: VRE Ridership Projections by Line

	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Daily One-Way Trips							
Fredericksburg Line	7,920	8,170	8,170	8,680	9,520	10,000	10,510
Manassas Line	6,780	7,030	7,600	7,760	7,930	8,130	8,320
Total	14,700	15,200	15,770	16,440	17,450	18,130	18,830

Source: VRE Strategic Plan (2004)

System Capacity

Calculating VRE capacity is not straightforward. It is VRE’s policy to provide a seat for each passenger, if possible. The passenger carrying capacity is a system wide issue that is affected by a number of factors including:

- Parking capacity at outlying stations
- Mid-day train storage capacity
- Platform length
- Availability of equipment (locomotives and railcars)
- Master agreements with CSX and Norfolk Southern (primarily CSX)

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Multimodal Transportation Study**

Line Capacity

VRE has the ability to operate up to 32 daily trains, although only 30 operate currently. Each existing six-car train has a capacity of approximately 840 persons (140 passengers per car based on average of all cars in VRE fleet). In the future, as VRE transitions to new gallery cars, train capacity will drop to 123 persons per car, due to the interior configuration of the new cars.

In the short-term, it is VRE’s goal to run mostly six-car trains (plus existing eight-car trains). The operation of these length trains gives VRE the greatest flexibility in storing trains mid-day as well as overnight. VRE has plans to add trains in upcoming years—an increase to 34 trains per day in FY 2009 and an increase to 36 trains per day in FY 2011. **Table 3.15** shows the planned train capacity, assuming all six-car trains.

Though VRE has plans to increase service, decisions have not been made as to the type of service that will be added. In the shorter-term, service expansions are likely to include a combination of additional peak service (an earlier morning train rather than reducing headways) and mid-day service. Long-term, it is VRE’s goal to reduce headways between peak trains and/or run express trains. At this point, there are not definite plans for service changes.

As it relates to Crystal City, there is currently capacity available between Crystal City and Union Station. Currently, VRE’s fare structure is prohibitive for making this trip, when compared to Metro’s fare. Over time, as the Blue and Yellow lines become more crowded, it may be worth exploring incentives to make VRE service between Crystal City and the District more attractive.

Table 3.15: Planned VRE Train Capacity (weekday, both directions)

Element	Current (2007)	FY 2009 (funded)	FY 2011 (funded)	FY 2025 (projected)
Trains	30	34	36	40
Cars	184*	204**	216**	240***
Passenger Capacity	25,760	26,520	28,080	29,520

*Assumes four daily 8-car trains (the remainder 6 cars) with average capacity of 140 persons per car.

**Assumes all 6-car trains with average capacity of 130 persons per car.

***Assumes all 6-car trains with average capacity of 123 persons per car.

Source: VRE Strategic Plan (2004)

¹ Round 7 cooperative forecasts



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Multimodal Transportation Study

Station Capacity and Location

At a station level, capacity is most affected by platform dimensions. The Crystal City platform is 400 feet long and sized for six-car trains. Longer trains can use the station by controlling which doors open (e.g., passengers in cars off the platform have to walk to next car to exit), but that also increases the dwell time.

The addition of a second platform is not required to achieve the allowed 40 trains per day, although it would lead to more efficient train operations through the area. A third main track from Long Bridge to Slater’s Lane in Alexandria is planned, pending approval of funding.

The option of adding a second platform was investigated in 1996-98. The second platform was proposed to be located to the south of the existing platform and on the east side of the existing tracks. Both platforms would have remained in operation. The new platform was planned to connect to Crystal City and/or National Airport via the existing bike tunnel at the Water Park. The proposed location was determined to be unworkable due to a number of factors that included:

- Existing tunnel was too narrow for mixed traffic
- Above ground connection between platform and Crystal Drive was not acceptable
- Logistical difficulties in directing passengers to appropriate platforms

The location also was considered for use with MARC run-through service, which raised issues of low platform (VRE stations) vs. high platform (used by MARC) heights. Although MARC has a desire to extend service (likely the Camden Line) to Crystal City, a third track would be needed (requiring a tunnel expansion) between the District and Crystal City to accommodate this service expansion.

A second proposal identified the station being relocated farther south to the 20th/21st Street area, with a connection to the airport; however, given the challenges to connectivity to Metrorail, it does not appear that this proposal advanced beyond a concept.

AMTRAK PASSENGER RAIL SERVICE

Existing Service

According to current Amtrak timetables and the Amtrak Fact Sheet for Virginia (FY2008), Amtrak currently operates up to 12 regional trains daily between Lynchburg/Newport News/Richmond and Washington, DC. These trains pass through Crystal City on the same segment of CSX right-of-way used by VRE. Amtrak. In addition, there are several long-distance trains that use the same line, including:

- The *Cardinal* (tri-weekly New York-Washington, DC-Charlottesville-Cincinnati-Chicago)
- The *Crescent* (daily New York-Charlottesville-Atlanta-New Orleans)
- The *Palmetto* (daily New York-Richmond-Savannah)
- The *Silver Meteor* (daily New York-Richmond-Miami)
- The *Silver Star* (daily New York-Richmond-Tampa-Miami)
- The *Carolinian* (daily New York-Richmond-Charlotte)

All of these trains make station stops at King Street Station in Alexandria and at Union Station in Washington. **Table 3.16** shows annual boardings for Amtrak stations in Virginia and Washington, DC.

Table 3.16: Selected Amtrak Station Usage

Station	Annual Boardings	Daily Boardings (averaged over 365 days)
Union Station, Washington D.C.	4,489,955 (all lines)	12,301
King Street Station, Alexandria, VA	120,153	329
Lorton, VA (Autotrain to Florida)	234,839	643
Staples Mill Road Station near Richmond, VA	275,479	755
Newport News, AV	117,154	321

Source: Amtrak Fact Sheets for Virginia and District of Columbia, FY2008

Potential Crystal City Service

No ridership forecasts have been conducted as part of this study. However, given the levels of commercial activity and residential density in Crystal City, a future Crystal City Amtrak station would likely have relatively high boardings. However, a new station stop would affect service efficiency along the Amtrak lines. Service is slowed down with closely spaced stops, and the loss of ridership due to slower travel times may be greater than the increase from easier access. Future coordination with Amtrak, CSX, DRPT, and VRE is required to advance any concept that envisions Crystal City as a future Amtrak station. As with the newly initiated Amtrak Virginia service between Lynchburg and Washington, DC, the potential exists to refine connections to Amtrak through coordinated VRE service. Passengers boarding VRE trains in Crystal City would have simplified ticketing and timed transfers to Amtrak trains in Washington or Alexandria.



Looking south along the VRE platform.



Looking north along the VRE platform.

4.0: TRANSITWAY EVALUATION

This chapter presents the evaluation of and recommendation for the future alignment of the Crystal City/Potomac Yard Transitway through Crystal City. Six alignment alternatives were studied by Arlington staff, a subcommittee of the Crystal City Task Force, and the consultant team.

TRANSITWAY CONTEXT

The Crystal City/Potomac Yard Transitway is a joint project by Arlington County and the city of Alexandria with the goal of providing a high-capacity and high-quality surface transit system in the five-mile corridor between the Pentagon and Pentagon City and the Braddock Road Metrorail Station. The proposed system would connect the Proposed Columbia Pike Streetcar in Pentagon City and the Crystal city Metrorail Station, and serve the new development in Potomac Yard.

An Alternatives Analysis, which was completed in 2003, studied various high-capacity transit improvements along the corridor, including the transitway. A follow-up implementation strategy was initiated in 2005 to provide an enhanced transit service immediately in response to new housing and commercial development in the Potomac Yard area. In an initial phase Arlington has launched the 9S Metrobus service at a 6-minute peak period headway (12-minute off-peak headway) from the Crystal City Metrorail Station to the Potomac Yard redevelopment area in the County.¹

¹ The County and the City of Alexandria developed a conceptual alignment for an interim rapid bus service and the FTA has approved a categorical exclusion for a portion of that alignment between the Crystal City Metrorail station and the County boundary at Four Mile Run in Potomac Yard. The interim bus service may operate on dedicated right-of-way in Potomac Yard and Crystal City while the County develops the ultimate streetcar system.

The Crystal City Sector Plan recommends the development of a streetcar system as the preferred technology for the transitway in Arlington. A subcommittee of the Crystal City Task Force was formed to consider different alignments and stop location for a new streetcar system to serve the proposed redevelopment plan for Crystal City and Potomac Yard. The subcommittee, Arlington County staff, and the consultant team reviewed the relative advantages and disadvantages of six alignment options. Based upon this analysis, which is detailed in the subsequent section, the subcommittee and ultimately the Task Force recommended the streetcar alignment shown in **Figure 4.1**. The Task Force further recommend that stations serving the transitway should be integrated into the urban design of surrounding development and ensure multimodal access.

The study process and analysis of the six alignments along with the recommended alignment are described in detail in the following sections.

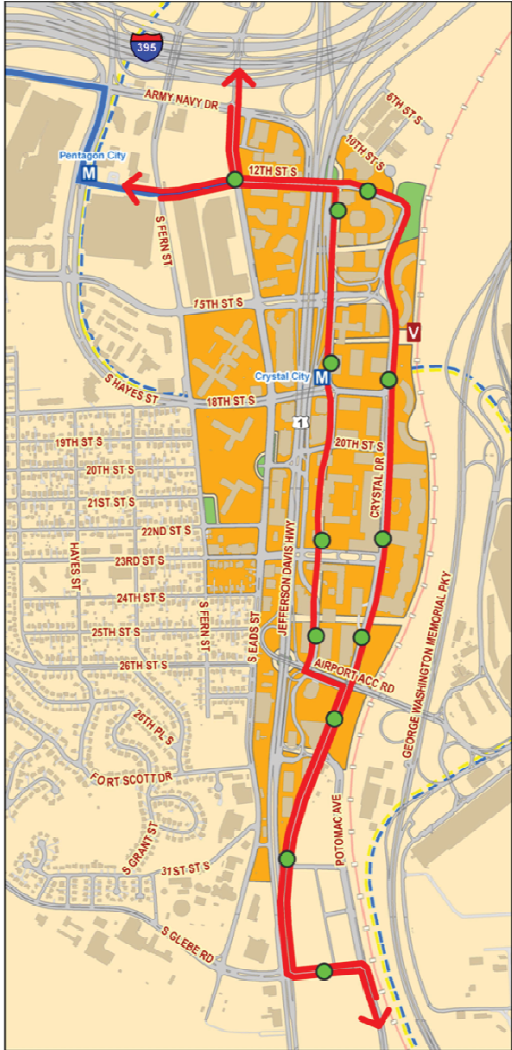


Figure 4.1: Recommended transitway alignment



ALIGNMENT EVALUATION

This section gives an overview of the evaluation process of the transitway, and presents the measures of effectiveness used to compare the alignment options.

The evaluation process relied on technical analyses as well as the input of Arlington County staff and the transitway subcommittee of the Crystal City Task Force. The subcommittee was made up of community and business representatives. In coordination with staff and the subcommittee, a framework was agreed upon which included policy assumptions to inform the analysis, alignment options to be considered, and a set of the evaluation criteria. Six alternative alignments were assessed and the results were presented to the transitway subcommittee for discussion. The subcommittee agreed upon a recommended alignment, which was adopted by the full task force. The recommended alignment will be discussed later in this section.

Policy Assumptions

The evaluation process began with the following set of assumptions, or policies, which guided the evaluation and the options to be considered:

- Assume 2030 as the year for evaluation
- Transit streets must have two-way vehicular traffic
- Maximize extent of dedicated lanes for transit
- Transit alignment must have a direct, weather-protected connection to Metrorail
- The transit alignment through Crystal City will be the principal north-south surface transit spine (no parallel service on a second spine).
- The transitway must serve the transit needs of Potomac Yard as well as Crystal City
- To the south, the alignment will use the planned transitway along Crystal Drive south of 26th Street S.
- To the north, the alignment will connect to 12th Street S. at Old Jefferson Davis Highway/S. Clark Street
- Transit technology for the transitway is to be streetcar

Alignments

Six alignment alternatives were considered. All of the alignments enter the southern boundary of Arlington County on Potomac Avenue, turn west along S. Glebe Road, and north along Crystal Drive to 26th Street S. At 26th Street S. the alignments differ. At the north end of the study area, all of the alignments travel west along 12th Street S. with a planned route turning north on S. Eads Street toward the Pentagon and a proposed route continuing to the west toward the Pentagon City Metrorail station.

Alternative 1 - Clark/Bell Alignment

This is the interim transitway route recommended as part of the Crystal City/Potomac Yard Transit Improvements Project. From Crystal Drive it turns west on 26th Street S. and then travels along S. Clark/Bell Street between 26th Street S. and 12th Street S. The Clark/Bell Alignment is shown in **Figure 4.2**.

Alternative 2 - Crystal Drive Alignment

This alignment runs along Crystal Drive between 26th Street S. and 12th Street S. It turns west onto 12th Street S. at the northern terminus of Crystal Drive. The Crystal Drive Alignment is shown in **Figure 4.3**.

Alternative 3 - Clark/Bell and Crystal Drive Couplet

This alignment creates a couplet of one-way transit streets on the major north-south streets of S. Clark/Bell Street and Crystal Drive. The two-way transit splits at the intersection of Crystal Drive and 26th Street S. and is restored at the intersection of S. Clark/Bell Street and 12th Street S. From 26th Street S., the northbound leg continues north along Crystal Drive, turning west at 12th Street S., and meeting the other leg at S. Clark/Bell Street. The southbound leg runs along S. Clark/Bell Street from 12th Street S. to 26th Street S., turning east at 26th Street S., and meeting the other leg at Crystal Drive. The Clark/Bell and Crystal Drive Couplet is shown in **Figure 4.4**.

Alternative 4 - Crystal/Bell Alignment

This alignment maintains two-way transit along a single route and runs along Crystal Drive and S. Clark/Bell Street for portions of the route. From 26th Street S. the alignment runs north along Crystal Drive to 18th Street S. It turns west along 18th Street S. from Crystal Drive to S. Clark/Bell Street and turns north along S. Clark/Bell Street. It runs north along S. Clark/Bell Street to 12th Street S. and turns west. The Crystal/Bell Alignment is shown in **Figure 4.5**.

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Alternative 5 - Crystal/Bell Alignment with Crystal Drive Loop

This alignment maintains two-way transit with the exception of a couplet loop between 23rd Street S. and 18th Street S. Two-way transit runs north along Crystal Drive from 26th Street S. and splits at the intersection of 23rd Street S. From 23rd Street S., the northbound leg continues north along Crystal Drive, turning west at 18th Street S., and meeting the other leg at S. Clark/Bell Street. The southbound leg runs along S. Clark/Bell Street from 18th Street S. to 23rd Street S., turning east at 23rd Street S., and meeting the other leg at Crystal Drive. Two-way transit runs north along S. Clark/Bell Street from 18th Street S. to 12th Street S., turning west along 12th Street S. The Crystal/Bell Alignment with Crystal Drive Loop is shown in **Figure 4.6**.

Alternative 6 - Crystal/Bell/Crystal Alignment

This alignment maintains two-way transit for the entire alignment, but runs along both Crystal Drive and S. Clark/Bell Street for portions of the route. From 26th Street S. the alignment runs north along Crystal Drive to 23rd Street S. It turns west along 23rd Street S. from Crystal Drive to S. Clark/Bell Street and turns north along S. Clark/Bell Street. It turns east along 18th Street S. from S. Clark/Bell Street to Crystal Drive and turns north along Crystal Drive. It runs north along Crystal Drive to 12th Street S. and turns west. The Crystal/Bell/Crystal Alignment is shown in **Figure 4.7**.

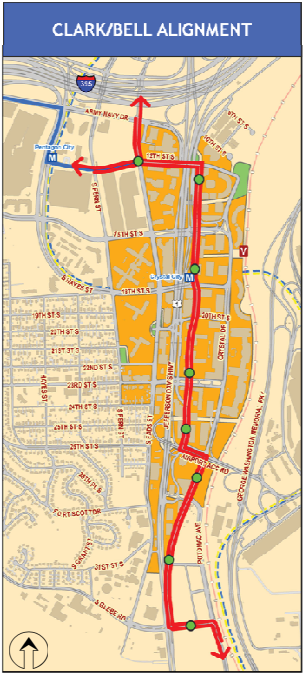


Figure 4.2: Alternative 1

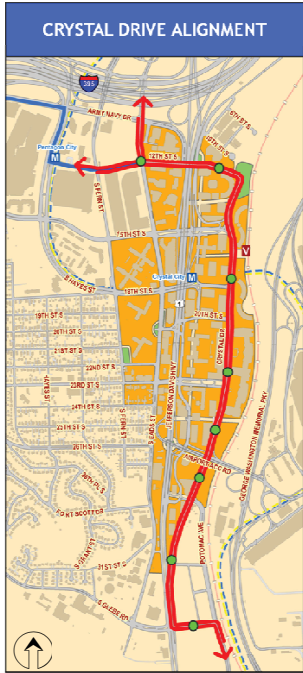


Figure 4.3: Alternative 2

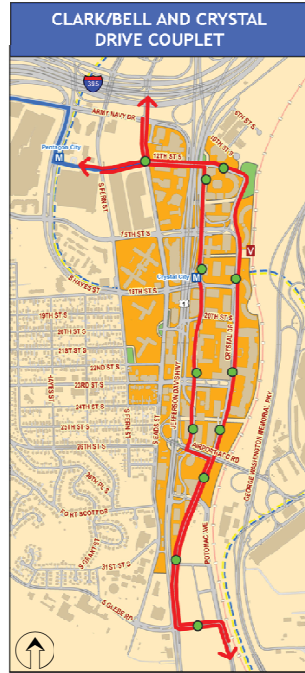


Figure 4.4: Alternative 3

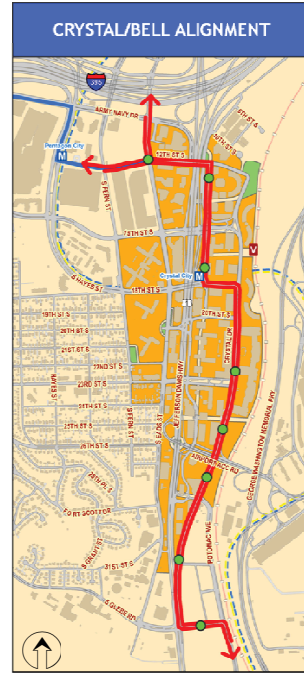


Figure 4.5: Alternative 4

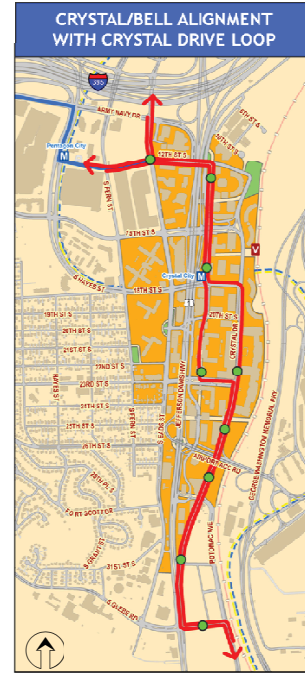


Figure 4.6: Alternative 5

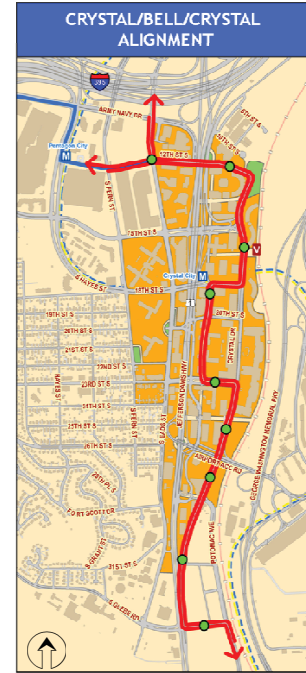


Figure 4.7: Alternative 6



Evaluation Criteria

Each of the six alternatives were assessed based on a set of evaluation criteria developed through consultation with Arlington County staff and the subcommittee of the Crystal City Task Force. The criteria were intended to provide a number of ways to assess the compatibility of each alignment option with the goals and objectives of both the Crystal City Sector Plan and the past transit planning process. A short description of each criterion is provided below:

- **Service to Planned Development:** Evaluates the extent to which each alignment option would serve residences, offices, retail establishments, hotels, and other activity centers in the build year (2030).
- **“Complete Streets” and Urban Design Considerations:** Evaluates how well each alignment option would fit into the street space envisioned for Crystal City as part of the sector plan.
- **Interface with “Future” Intermodal Center, Metrorail Station, and VRE:** Evaluates the extent to which each alignment option enables easy intermodal transfers through proximity to other modes.
- **Operational Considerations:** Evaluates the extent of impacts to auto traffic and transit operations for each alignment option.
- **Ability to Construct Transitway in the Near Term:** Evaluates how the phasing of the Crystal City Sector Plan would affect the timing of construction of each alignment option.
- **Cost:** Evaluates the capital cost of each alignment option, taking into account the effect of phasing needed for construction of a new Metrorail entrance for some options.

Evaluation Measures and Results

This section explains evaluation measures in greater detail and summarizes the results of the evaluation. A full summary of the evaluation of the six alignment options is presented in **Table 4.1** on page 35.

1. Service to Planned Development

a. Total square feet of development (2030 estimate) within 1/8 mile of station stops

Total square feet of development in 2030 was based on the 1.5 Alternative plan prepared by Torti Gallas. Using geographic information systems (GIS), existing and proposed buildings expected to be built by 2030 within 1/8 mile of station stops were identified. The gross square footage of each building was added together to determine the total square footage within 1/8 mile of station stops.

The square footage of development within 1/8 mile of proposed station stops varies within a relatively narrow range. Alternative 3 (the Clark/Bell and Crystal Drive Couplet) would cover the most area and encompass the most development. However, it also should be noted that the couplet alignment would result in less frequent service on Crystal Drive and S. Clark/Bell Street (service on each street would only be in one direction rather than two).

The proposed stop at 12th Street and Clark/Bell Streets would serve Long Bridge Park. In addition, planners are developing concepts for vehicle storage and maintenance facilities, one of which could be adjacent to Long Bridge Park. If a facility were constructed at this location, it would be logical to include a transit station adjacent to the Park.

b. Square feet of residential development (2030 estimate) within 1/8 mile of station stops

Total square feet of residential development in 2030 was based on the 1.5 Alternative plan prepared by Torti Gallas. Using GIS, existing and proposed buildings expected to be built by 2030 within 1/8 mile of station stops were identified. The gross square footage in residential development of each building was added together to determine the total square footage of residential development within 1/8 mile of station stops.

The square footage of residential development within 1/8 mile of proposed station stops varies within a relatively narrow range. Alternative 3 (the Clark/Bell and Crystal Drive Couplet) would cover the most area and encompass the most residential development. It

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should be noted that the couplet alignment would result in less frequent service on Crystal Drive and S. Clark/Bell Street (service on each street would only be in one direction rather than two).

- c. *Total commercial square feet (2030 estimate) within 1/8 mile of station stops*
Total square feet of commercial development in 2030 was based on the 1.5 Alternative plan prepared by Torti Gallas. Using GIS, existing and proposed buildings expected to be built by 2030 within 1/8 mile of station stops were identified. The gross square footage in commercial development of each building was added together to determine the total square footage of commercial development within 1/8 mile of station stops.

The square footage of commercial development within 1/8 mile of proposed station stops varies within a relatively narrow range. Alternative 3 (the Clark/Bell and Crystal Drive Couplet) would cover the most area and encompass the most commercial development. It should be noted that the couplet alignment would result in less frequent service on Crystal Drive and S. Clark/Bell Street (service on each street would only be in one direction rather than two).

- d. *Square feet of hotel development (2030 estimate) within 1/8 mile of station stops*

Total square feet of hotel development in 2030 was based on the 1.5 Alternative plan prepared by Torti Gallas. Using GIS, existing and proposed buildings expected to be built by 2030 within 1/8 mile of station stops were identified. The gross square footage in hotel development of each building was added together to determine the total square footage of hotel development within 1/8 mile of station stops.

The square footage of hotel development within 1/8 mile of proposed station stops varies significantly due to the concentration of hotels along the western side of Crystal City. Alternatives 1, 3, 4, and 5 (the Clark/Bell Alignment, the Clark/Bell and Crystal Drive Couplet, the Crystal/Bell Alignment, and the Crystal/Bell Alignment with Crystal Drive Loop) are closer to more hotel space than Alternatives 2 and 6. It should be noted that a number of hotels are located across Jefferson Davis Highway, which represents a significant barrier to pedestrians attempting to access the transitway.



e. *Number of activity nodes (2030 estimate) within 1/8 mile of station stops*
Fifteen activity nodes were identified for this analysis. The nodes within 1/8 mile of the station stops were counted for each alternative. The activity nodes included:

- Long Bridge Park
- The Metrorail and Crystal City Underground entrance at 18th Street S. and S. Clark/Bell Street
- The VRE entrance on Crystal Drive between 15th Street S. and 18th Street S.
- The shops and restaurants on Crystal Drive
- The restaurants on 23rd Street S. between Crystal Drive and S. Clark/Bell Street
- The restaurants on 23rd Street S. between S. Eads and S. Fern Streets
- Nine Crystal City Underground entrances not associated with other activity nodes

The number of activity nodes served ranged from 10 to 14. No alternative would have station stops within 1/8 mile of Long Bridge Park. Alternative 3 (the Clark/Bell and Crystal Drive Couplet) would serve the most activity nodes. However, it should be noted that Alternatives 1 and 5 (the Clark/Bell Alignment and the Crystal/Bell Alignment with Crystal Drive Loop) would serve 13 activity nodes and Alternatives 4 and 6 (the Crystal/Bell Alignment and the Crystal/Bell/Crystal Alignment) would serve 12 activity nodes.

2. "Complete Streets" and Urban Design Considerations

a. *Minimum width of widest cross-section needed for operations (width in feet)*
The widest cross-section needed represents the combined width of all modes desired for that roadway section, which may include any of the elements in the list below.

- Sidewalk (minimum 8 feet)
- Landscape strip (minimum 5 feet)
- Parking (8 feet including 1.5 foot gutter)
- Bicycle lanes (5 feet, may include 1.5 foot gutter)
- Transit lanes (width 12 feet, may include 1.5 foot gutter)
- Vehicular lanes (width generally 11 feet, turn lanes may be narrower)
- Curb and gutter
- Pedestrian refuge median (minimum 8 feet) at marked crosswalks wider than 60 feet curb to curb

The width shown in parenthesis is the dimension used for this evaluation exercise. The dimensions shown are not necessarily the recommended cross-sectional dimension.

In general, the comparison of alignment options rests on the width necessary to accommodate the desired uses on both Crystal Drive and S. Clark/Bell Street. In order to accommodate two-way transit in exclusive lanes as well as the other uses planned for the street, S. Clark/Bell Street would require 88 feet of right-of-way along its entire length, and Crystal Drive would require 122.5 feet. With the introduction of a one-way couplet, the requirements would reduce to 83 feet for S. Clark/Bell Street and 109.5 feet for Crystal Drive. Alternative 3, which includes a one-way couplet from 26th Street S. to 12th Street S., would require less right-of-way than the other alignment options, all of which involve some two-way traffic on S. Clark/Bell Street or Crystal Drive.

b. *Corridor's narrowest pinch point (width in feet)*

This is based on available information from the 1.5 Alternative plan. Minimum width was derived either from the distance between existing buildings that will remain in-place, such as those near the Crystal Drive/23rd Street S. intersection, or from the 1.5 Alternative 1.5 Alternative plan's build-to lines.

For all alignment options, the corridor's narrowest pinch point would be narrower than the minimum width necessary to accommodate all desired modes on the street. However, the length of the "pinch point" and the difference between the "pinch point" width and the minimum width needed to accommodate all desired uses vary. Alternative 3 would have the least difference (11.5 feet on Crystal Drive and 3 feet on S. Clark/Bell Street). It should be noted that the pinch point on S. Clark/Bell Street runs the length of the corridor (3,600 feet), while on Crystal Drive the pinch point of 98 feet runs for 50 feet. Crystal Drive has an additional 400-foot section that narrows to 110 feet.

c. *Number of modes (pedestrian, bike, auto, and transit) accommodated on transit streets (at pinch point)*
At a pinch point the modes that can be accommodated are indicated. Where the cross-section is not restricted (pinched), additional modes may be accommodated.

Most alignment options would be able to accommodate all planned modes at the pinch points, with some compromise (for instance, narrowed sidewalks at that point). Alternative 6 would not allow for the implementation of bike lanes on 23rd Street S., as recommended by this plan.

d. *Modes not accommodated on transit streets (at pinch point)*

At a pinch point, the mode(s) that cannot be accommodated with transit are listed. These modes may be able to be accommodated in locations where the cross-section is not restricted (pinched). In some cases, a different mode could be exchanged for the mode(s) that cannot be accommodated at pinched locations.

Most alignment options would be able to accommodate all planned modes at the pinch points, with some compromise (for instance, narrowed sidewalks at that point). Alternative 6 would not allow for the implementation of bike lanes on 23rd Street S., as recommended by this plan. Alternatives 4 and 6 would result in the loss of one auto lane on 18th Street S., and Alternatives 5 and 6 would result in the loss of one auto lane on 23rd Street S.

e. *Minimum width of pedestrian realm (width from face of building to face of curb at pinch point)*

At a pinch point, the width from building face to face of curb is given. It was assumed that this width is possible on both sides of the street. This dimension may be larger in locations where the cross-section is not restricted (pinched). In some cases, the accommodation of another mode could be exchanged for a more generous pedestrian realm.

All alignments would allow for an acceptable minimum width of the pedestrian realm. On S. Clark/Bell Street with two-way transit (Alternatives 1, 4, 5, and 6), the pedestrian realm could be 11.5 feet wide at the pinch. Alignments 2 and 4 enable a 12.5-foot-wide pedestrian realm at the pinch on Crystal Drive. Alternative 5 allows 16.5 feet for the pedestrian realm at the pinch and Alternative 6 allows 15.5 feet. Alternative 3 accommodates a slightly wider pedestrian realm, since only one lane on each street must be dedicated to transit. This alignment allows 16.5 feet of pedestrian realm on Crystal Drive at its narrowest point and 13 feet on S. Clark/Bell Street.



f. *Potential for conflict between modes (e.g., number of parking garage entrances, loading zones, or alley entrances along transit streets)*
 Parking garage entrances, loading zones, and alley entrances were identified throughout the study area. Any entrance that faces on a street where transit will run is considered to be a conflict.

The number of potential conflicts ranges from a low of 18 (Alternative 3) to a high of 22 (Alternatives 2 and 5). Alternative 1 would have 20 potential conflicts, and Alternatives 4 and 6 would have 21 potential conflicts.

g. *Available on-street parking (at pinch point)*
 At a pinch point, the number of sides of the street available for on-street parking is indicated. On-street parking may be expanded in locations where the cross-section is not restricted (pinched). In some cases, a different mode could be exchanged for parking.

For Alternatives 1, 2, and 4 it would not be possible to accommodate on-street parking at the pinch point. Alternative 3 would allow for parking on one side of Crystal Drive and one side of S. Clark/Bell Street, Alternative 5 would allow for parking on one side of Crystal Drive, and Alternative 6 would allow for parking on both sides of Crystal Drive.

3. Interface with Future Intermodal Center, Metrorail, and VRE

a. *Distance from closest station stop to existing Crystal City Metrorail Station entrance and future intermodal center entrance.*
 Using GIS, the distance from the closest station stop to the existing Crystal City Metrorail Station entrance and the future intermodal center entrance was measured. The distance was measured along the street.

The distance from the closest station stop to the existing Crystal City Metrorail Station entrance and the future intermodal center entrance ranged from 150 feet to 800 feet. Alternatives 1, 3, 4, and 5 would have station stops within 150 feet of the Metrorail Station and intermodal center entrances. Alternative 2 (the Crystal Drive alignment) would be the farthest from the Metrorail Station and intermodal center entrances, with 800 feet between the entrances and the closest station stop. However, it also should be noted that for the couplet alignments, the closest station stop is only served by transit in the southbound direction.

b. *Distance from closest station stop to potential "second" Metrorail Station entrance.*
 Using GIS, the distance from the closest station stop to the potential "second" Metrorail Station entrance was measured. It was assumed that the entrance would be incorporated into the proposed building on Crystal Drive north of the proposed park at 18th Street S. The distance was measured along the street.

The distance from the closest station stop to the potential "second" Metrorail Station entrance ranges from 50 feet to 950 feet. Alternatives 2 and 3 (the Crystal Drive alignment and the Clark/Bell and Crystal Drive couplet) would have the closest station stops, at 50 feet from the potential Metrorail Station entrance. However, it also should be noted that for the couplet alignments, the closest station stop is only served by transit in the northbound direction.

c. *Distance from closest station stop to VRE station entrance.*
 Using GIS, the distance from the closest station stop to the VRE Station entrance along Crystal Drive was measured. The distance was measured along the street.

The distance from the closest station stop to the VRE Station entrance ranged from 250 feet to 1,600 feet. Alternative 6 (the Crystal/Bell/Crystal alignment) would have the closest station stop, at 250 feet from the VRE Station entrance. However, it also should be noted that for the couplet alignments, the closest station stop is only served by transit in the northbound direction.

4. Operational Considerations

a. *Percent of alignment in exclusive right-of-way*
 This measure indicates the percent of the alignment where transit vehicles do not share their operating space with general vehicle traffic. One of the policy decisions made at the outset of this analysis was that the transitway would run in exclusive right-of-way to the greatest extent possible. The evaluation completed under Criteria 2: Complete Streets and Urban Design Considerations determined that it would be possible to run each alignment option entirely in exclusive lanes through Crystal City. Therefore, each alignment option would be 100% in exclusive lanes.

b. *Number of existing and future traffic signals affected*
 This measure indicates the number of traffic signals the transitway would encounter and where additional signal phases would be necessary for successful operations.

The number of traffic signals affected would range from a low of five (Alternative 2) to a high of nine (Alternative 3). The options which would employ couplets for a portion of the alignment (Alternative 3 and Alternative 5) or which would introduce more turns (Alternative 6) would affect more intersections and therefore more traffic signals.

c. *Number of additional signal phases at intersections*
 An additional signal phase is assumed to be required to accommodate right or left turns of the transitway at an intersection. Through movements of transit vehicles are not assumed to add a phase to traffic signals.

The number of additional signal phases required would range from zero for Alternative 2 to 10 for Alternative 5. Alternative 1 would require four additional signal phases, Alternatives 3 and 4 would require six additional signal phases, and Alternative 6 would require eight additional signal phases.

d. *Number of intersections where signal priority for transit is feasible.*
 Priority for transit vehicles is assumed to include additional signal phases that transit vehicles would activate (at turns in the transit alignment), as well as the ability to extend green time or shorten red time (at locations where the transit alignment proceeds straight through an intersection).

Desirable locations for signal priority include:

- 12th Street S. at Old Jefferson Davis Highway
- 15th Street S. at S. Clark/Bell Street; 15th Street S. at Crystal Drive
- 18th Street S. at S. Clark/Bell Street; 18th Street S. at Crystal Drive
- 23rd Street S. at Crystal Drive
- 26th Street S. at S. Clark/Bell Street; 26th Street S. at Crystal Drive

Locations where signal priority may not be possible include:

- 20th Street S. at S. Clark/Bell Street
- 23rd Street S. at S. Clark/Bell Street



For Alternative 3, it would be desirable to have transit signal priority at 10 intersections, two of which are not feasible. For Alternative 2, signal priority would be desirable at five intersections.

e. Number of turns (left or right, 90-degree)

This measure indicates the number of left or right turns the transitway makes from one end of Crystal City to the other.

The number of 90-degree turns ranged from a low of one turn (Alternative 2) to a high of five turns (Alternatives 5 and 6). Alternatives 1 and 4 would have three turns, and Alternative 3 would have four turns.

f. Length of route

This measure indicates the length of each alignment option. The measure counts the length of the north and south directions of the transitway. The length of the route for each alignment was determined using GIS. The length was measured for each direction of track that would be required from 12th Street S. to 26th Street S.

Five of the six routes would range from 10,000 to 10,500 feet in length. The shortest route would be Alternative 1 (the Clark/Bell Alignment) at 10,000 feet. The longest route would be Alternative 6 (the Crystal/Bell/Crystal Alignment) at 12,400 feet.

g. Operational flexibility (ability to accommodate multiple operating plans)

An alignment option is considered to have operational flexibility if there is a loop that is able to be negotiated within the alignment, regardless of direction.

Alternatives 3 and 5 would have operational flexibility due to the loops included in each alignment. Alternatives 1, 2, 4, and 6 would not have this type of operational flexibility.

h. Impact on intersection performance

Intersection performance was evaluated for four intersections: Crystal Drive/23rd Street S., S. Clark/Bell Street/23rd Street S., Crystal Drive/20th Street S., and S. Clark/Bell Street/20th Street S. A sketch planning-level operational evaluation was completed under future laneage and traffic volume conditions, with the transitway. To simulate the worst-case impact of the transitway on regular signal operations, a 10 second (plus clearance intervals) transit hold (all red, except transit) was implemented in each 120 second cycle where transit alignments are required to turn.

Alternatives 2 and 4 would have a lower impact on intersection performance, while Alternatives 1, 3, 5, and 6 would have a higher impact.

5. Ability to Construct Transitway in the Near-Term

a. Linear feet of track on new or realigned roadway.

The linear feet of track on new or realigned roadway was measured using GIS and 1.5 Alternative plan data provided by Torti Gallas. Based on plans, roadway will be realigned or significantly reconstructed on S. Clark/Bell Street between 15th and 18th Streets S., between 20th and 23rd Streets S., and between 23rd Street S. and "New 25th Street S." Since some alternatives involved one-way segments on multiple streets, the linear feet of track was measured both northbound and southbound.

The length of track on new or realigned roadway ranges from zero to 6,800 feet. Alternative 2 (the Crystal Drive Alignment) would not travel on any realigned roadway. Alternative 1 (the Clark/Bell Alignment) would have the most track on realigned roadway. The other alignments would have between 3,400 feet and 4,900 feet of track on realigned roadway.

b. Percent of alignment within Crystal City on new or realigned roadway.

The percent of alignment within Crystal City on new or realigned roadway was calculated using the linear feet of track on new or realigned roadway (see Measure 5a above). This number was divided by the total track length for each alternative between 12th Street S. and 26th Street S. The total track length was determined using GIS.

The percentage of the alignment on new or realigned roadway ranges from a low of zero (Alternative 2, Crystal Drive Alignment) to a high of 68 percent (Alternative 1, the Clark/Bell Alignment).

c. Development phase in which final transitway could be fully implemented.

The development phase where the final transitway could be implemented was determined using maps of the proposed alignments and information provided by Arlington County on the expected phasing of development in Crystal City. First, it was determined whether any segments of the alignment were on new or realigned roadway. If no segments of the alignment were on new or realigned roadway, it was determined that alignment could be implemented immediately. If any segments were on new or realigned roadway, these segments were then compared to the phasing plan provided by Arlington County. The phase where the final transitway could be fully implemented was the phase in which the last building necessary to complete the roadway realignment or construction was completed.

Of the six alternatives, four would not be able to be implemented until phase 4. Alternatives 1, 4, and 5 (the Clark/Bell Alignment, the Crystal/Bell Alignment, and the Crystal/Bell Alignment with Crystal Drive Loop) would not be able to be implemented until the redevelopment of Block G (the block between 15th Street S. and 18th Street S.) is completed in phase 4. Alternative 3 (the Clark/Bell and Crystal Drive Couplet) would not be able to be implemented until the redevelopment of Block Q (the block between 23rd Street S. and 26th Street S.) is completed in phase 4. Alternative 6 (the Crystal/Bell/Crystal Alignment) would not be able to be completed until the redevelopment of Block M (between 20th Street S. and 23rd Street S.) is completed in phase 2. Alternative 2 (the Crystal Drive Alignment) would be able to be implemented in phase 1, as it would not travel on any realigned roadway.



6. Capital Cost

a. Comparative capital costs (millions, 2008 dollars)

Comparative costs are based on the recent cost estimate update for the Columbia Pike streetcar project, adjusted to 2008 dollars, or \$40 million per mile of double-track alignment. Costs for single-track segments are assumed at \$22 million per mile; a 10 percent premium is included for additional maintenance of traffic and street reconstruction because of improvements on two streets.

The cost comparison includes only transit features and minor street improvements; the figures do not include street construction to achieve the 1.5 Alternative plan cross-section.

Other elements assumed in the cost figures:

- Allowance for small shop and yard
- Vehicle fleet assuming 5-minute headways
- Light utility relocations
- Minor streetscape improvements
- Simple passenger stations
- No right-of-way costs

Estimated capital costs in 2008 dollars vary in a fairly narrow band from \$38 million for Alternative 1 to \$47 million for Alternative 6. The estimated capital costs for Alternatives 2 and 3 rise from \$40 million and \$42 million, respectively, to \$60 million to \$80 million and \$62 million to \$82 million if the cost of a second Metrorail entrance is included. This cost should be included in the comparison, as one of the decisions at the outset of the analysis was that the option chosen should have a direct connection to Metrorail.

b. Comparative capital costs (millions, year of construction dollars)

This measure takes into account the likely date in which the entire transitway could be constructed given the construction phasing of other development. The 2008 estimate is escalated at 4 percent per year to the mid-year of the appropriate phase, as shown in the latest version of the development phasing plan. The values shown assume that the entire construction cost is incurred in the construction year.

Estimated capital costs in year of construction dollars vary from \$64 million (Alternative 2, assumed to be constructed in 2020) to \$118 million dollars (Alternative 5, assumed to be constructed in 2035). Alternatives 3 (\$82 million) and 6 (\$92 million) could be built in phase

2 (2025), while Alternatives 1 (\$109 million), 4 (\$115 million), and 5 (\$118 million) could not be built until phase 4 (2035).

c. Comparative capital costs with second entrance to Metrorail for Crystal Drive alignments (millions, year of construction dollars)

Construction of a second Metrorail station entrance would be required for alignment options that do not directly serve the existing entrance at 18th Street S. and S. Clark/Bell Street. This would apply to alternatives 2 and 3. An allowance of \$40 million (2008) was made for the second entrance. Year of construction streetcar costs were added to year of construction costs for the second Metrorail entrance to give a total comparative project cost.

Based on anticipated year of construction, Alternative 2 including the second Metrorail entrance was estimated to cost \$96 to \$128 million in 2020 dollars. Alternative 3 including the second Metrorail entrance was estimated to cost \$121 to \$160 million in 2025 dollars.

Evaluation Measures and Results

The Task Force Subcommittee reached a consensus of preference of Alternative 3, the Clark/Bell and Crystal Drive couplet. While all alignment options would serve the goals of the Crystal City Sector Plan and the transportation element of the plan, Alternative 3 would: provide service to the most development, enable all streets to accommodate a full range of uses with the least compromise, and provide the closest access to other transit modes. The full alignment also could be implemented in a relatively early phase, with the potential for phased implementation, which would allow the operation of a somewhat modified alignment in the near-term. The phased implementation is presented in the phased transportation elements section of this Chapter 5: Transportation Recommendations.



Table 4.1: Recommended Street Characteristics

Evaluation Criteria/ Measures of Effectiveness	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
1. Service to Planned Development						
a. Total square feet of development (2030 estimate) within 1/8 mile of station stops	29.5 million sf	27 million sf	33.7 million sf	30.4 million sf	31.9 million sf	31.6 million sf
b. Square feet of residential development (2030 estimate) within 1/8 mile of station stops	11.1 million sf	8.8 million sf	11.7 million sf	9.9 million sf	10.9 million sf	10.8 million sf
c. Total commercial (2030 estimate) square feet within 1/8 mile of station stops	13.8 million sf	15.5 million sf	17 million sf	15.6 million sf	16.1 million sf	16.2 million sf
d. Square feet of hotel development (2030 estimate) within 1/8 mile of station stops	4.8 million sf	2.5 million sf	4.8 million sf	4.8 million sf	4.8 million sf	4.4 million sf
e. Number of activity nodes (2030 estimate) within 1/8 mile of station stops	13 nodes out of 15. Two not accessible within 1/8 mile of station stops: North Tract and the Underground entrance at 20 th Street and Crystal Drive.	10 nodes out of 15. Five not accessible within 1/8 mile of station stops: North Tract, Underground entrances at Eads, north side of 15 th Street, south side of 15 th Street, restaurants at 23 rd and Eads streets.	14 nodes out of 15. One not accessible within 1/8 mile of station stops: North Tract.	12 nodes out of 15. Three not accessible within 1/8 mile of station stops: North Tract, Underground entrance at 20 th Street and Crystal Drive, restaurants at 23 rd and Eads streets.	13 nodes out of 15. Two not accessible within 1/8 mile of station stops: North Tract and the Underground entrance at 20 th Street and Crystal Drive.	12 nodes out of 15. Three not accessible within 1/8 mile of station stops: North Tract, Underground entrance at Eads Street, and the restaurants at 23 rd and Eads streets.



CRYSTAL CITY
Multimodal Transportation Study

Table 4.1 (continued): Recommended Street Characteristics

2. "Complete streets" and urban design considerations															
	Clark/ Bell	Crystal Drive	Crystal Drive	Clark/ Bell	Crystal Drive	Clark/ Bell	18th Street	Crystal Drive	Clark/ Bell	18th Street	23rd Street	Crystal Drive	Clark/ Bell	18th Street	23rd Street
a. Minimum width of widest cross section needed for operations (width in feet)	88 ft	122.5 ft	109.5 ft	83 ft	122.5 ft	88 ft	143.5 ft	109.5 ft	88 ft	134.5 ft	134.5 ft	122.5 ft	88 ft	143.5 ft	143.5 ft
b. Corridor's narrowest pinch point (width in feet)	80 ft	98 ft	98 ft	80 ft	98 ft	80 ft	110 ft	98 ft	80 ft	110 ft	110 ft	120 ft	80 ft	110 ft	110 ft
c. Number of modes (pedestrian, bike, auto, and transit) accommodated on transit streets (with pinch)	ped, 2-way transit, auto	ped, bike, 2-way transit, auto	ped, bike, 1-way transit, auto	ped, 1-way transit, auto	ped, bike, 2-way transit, auto	ped, 2-way transit, auto	ped, bike, 2-way transit, auto	ped, bike, 1-way transit, auto	ped, 2-way transit, auto	ped, bike, 1-way transit, auto	ped, bike, 1-way transit, auto	ped, bike, 2-way transit, auto	ped, 2-way transit, auto	ped, bike, 2-way transit, auto	ped, 2-way transit, auto
d. Modes not accommodated on transit streets (with pinch)	bike not planned	-	-	bike not planned	-	bike not planned	1 auto lane lost	-	bike not planned	-	1 auto lane lost	-	bike not planned	1 auto lane lost	bike, 1 auto lane lost
e. Minimum width of pedestrian realm (width from face of building to face of curb with pinch)	10.5 ft/side	10.5 ft east side	15.5 ft east side	13 ft/ side	10.5 ft east side	10.5 ft/ side	14 ft and park, 8 ft refuge	15.5 ft east side	10.5 ft/ side	14.5 ft and park, 8 ft refuge	17.5 ft/side, 8 ft refuge	13.5 ft/ side, 8 ft refuge	10.5 ft/ side	14 ft and park, 8 ft refuge	16 ft/ side, 8 ft refuge
f. Potential for conflict between modes (e.g., number of parking garage entrances, loading zones or alley entrances along transit streets)	17 conflicts	22 conflicts	18 conflicts		21 conflicts				22 conflicts				21 conflicts		
g. Available on-street parking (with pinch)	none	none	1 side	1 side	none	none	none	1 side	none	none	none	2 sides	none	none	none



Table 4.1 (continued): Recommended Street Characteristics

3. Interface with (future) multimodal center, Metrorail station, and VRE						
a. Distance from closest station stop to existing Crystal City Metrorail Station entrance and multimodal center entrance	150 ft	800 ft	150 ft	150 ft	150 ft	350 ft
b. Distance from closest station stop to VRE station entrance	1600 ft	700 ft	700 ft	1600 ft	1600 ft	250 ft
c. Distance from closest station stop to potential "second" Metrorail Station entrance	950 ft	50 ft	50 ft	950 ft	950 ft	450 ft
4. Operational considerations						
a. Percent of alignment in exclusive right-of-way	100%	100%	100%	100%	100%	100%
b. Number of existing and future traffic signals affected	6	5	9	6	8	7
c. Number of additional signal phases at intersections	4	0	6	6	10	8
d. Number of intersections where signal priority for transit is desirable	7 desirable, 2 of which are not feasible	5 desirable	10 desirable, 2 of which are not feasible	6 desirable	8 desirable, 2 of which are not feasible	8 desirable, 2 of which are not feasible
e. Number of turns (left or right, 90-degree)	3	1	4	3	4	5
f. Length of route (bi-directional) within Crystal City	10,000 ft	10,500 ft	10,100 ft	10,500 ft	10,400 ft	12,400 ft
g. Operational flexibility (ability to accommodate multiple operating plans)	No	No	Yes, loop	No	Yes, loop	No
h. Impact on intersection performance	Medium impact	Low impact	Medium impact	Low impact	High impact	Very high impact



Table 4.1 (continued): Recommended Street Characteristics

5. Ability to construct transitway in the near-term						
a. Linear feet of track on new or realigned roadway	6800 ft	0	3400 ft	3800 ft	4900 ft	2100 ft
b. Percent of alignment within Crystal City on new or realigned roadway	68%	0%	34%	37%	47%	17%
c. Land use phase in which final transitway could be fully implemented	Phase 4 – Implementation depends on redevelopment of Block G (Clark/Bell between 18 th Street and 15 th Street).	Phase 1	Phase 4 – Implementation depends on redevelopment of Block Q in order to realign Clark/Bell between the new 24 th Street and 23 rd Street.	Phase 4 –Implementation depends on redevelopment of Block G (Clark/Bell between 18 th Street and 15 th Street).	Phase 4 –Implementation depends on redevelopment of Block G (Clark/Bell between 18 th Street and 15 th Street).	Phase 2 – Implementation depends on redevelopment of Block M (Clark/Bell between 23 rd Street and 18 th Street).
6. Cost						
a. Comparative capital costs (millions, 2008 dollars) ¹	\$38	\$40 (\$60 to \$80 with second Metrorail entrance)	\$42 (\$62 to \$82 with second Metrorail entrance)	\$40	\$41	\$47
b. Comparative capital costs—streetcar only (millions, year of construction dollars) ¹	\$109 Construction in 2035	\$64 Construction in 2020	\$82 Construction in 2025	\$115 Construction in 2035	\$118 Construction in 2035	\$92 Construction in 2025
c. Comparative capital costs—with second entrance to Metrorail for Crystal Drive alignments (millions, year of construction dollars)	n/a	\$96 to \$128 Construction in 2020 With second Metrorail entrance	\$121 to \$160 Construction in 2025 With second Metrorail entrance	n/a	n/a	n/a

¹Capital costs for double-tracked segments assumed at \$40 million per mile. Capital costs for single-tracked segments assumed at \$22 million per mile (2008 dollars).



5.0: TRANSPORTATION RECOMMENDATIONS

This chapter presents multimodal transportation recommendations in support of the long-term transformation of Crystal City described by the sector plan. To accommodate the increase in density and greater diversity in land use articulated in the sector plan, this transportation study evaluated the need, location, and accommodation of pedestrians; transit services and accommodation; vehicular capacity of the street network; transportation demand management strategies and their impacts; and parking demand. Recommendations in this chapter are described in the following sections:

- **Transportation Network:** pedestrian and bicycle facilities/accommodations, general transit network, and general street and intersection recommendations
- **Corridor Recommendations:** street specific recommendations for all modes
- **Phased Transportation Improvements:** the implementation of transportation recommendations to correspond with phases of development outlined in the sector plan
- **Parking:** curb space management guidelines, parking requirements, and other programs and policies to manage parking needs
- **Transportation Demand Management:** policies, strategies, and programs consistent with county policy to encourage non-single occupant vehicle travel

Crystal City's transformation will not occur all-at-once. Its transformation will occur throughout time as a result of the redevelopment blocks and buildings and investments in transportation and other elements of the public realm. As buildings and blocks are redeveloped, the space available for transportation will change and there will be opportunities to better accommodate all modes of transportation.

The implementation of the Crystal City/Potomac Yard Transitway will also be impacted by the pace and location of redevelopment. This plan generally shows the system's alignment. In order to implement the transitway, it is likely that an initial alignment or alignments will be needed. To accommodate the transitway through different stages of implementation, the recommendations for some streets may need to be adjusted. It is recommended that the hierarchy for modal accommodation outlined in the Streets Chapter of the Arlington County Master Transportation Plan is followed.

TRANSPORTATION NETWORK

The street network is where most transportation modes interface with one another and where every element of transportation must be addressed and accommodated – pedestrians, transit, bicycles, passenger vehicles, trucks, and parking. Streets are where the public and private realms interface. They are gathering places for festivals and celebrations, they can set the tone for private investment in the community, they are the spaces that help green the city, and they connect one place to another.

Interconnected Streets

The proposed transportation network for Crystal City will divide the existing superblocks into a series of smaller blocks by introducing new east/west streets at strategic locations. The finer-grained interconnected network of streets will allow each roadway to provide fewer lanes and presents fewer obstacles to pedestrian connectivity and accommodation. The interconnected network will better manage traffic by limiting choke points and distributing traffic among many, rather than fewer, streets. Within the proposed interconnected system, there are additional intersections and locations where vehicles can turn as close to their destination as possible, minimizing travel distances and reducing the amount of time each vehicle is on the road.

Additional street connections will give pedestrians more opportunities to cross streets, minimizing their travel time and distance and encouraging walking. The additional streets will provide access even when an incident blocks another route and permit quicker emergency responses. Lastly, and as described in the county's Master Transportation Plan, additional streets will increase the valuable commodity of curbspace, which can be used for loading, passenger pick ups/drop offs, and parking.



S. Eads Street approaching 15th Street S.

Complete Streets

The street network gives physical form to urban places. It bounds the private realm (buildings and other development), while at the same time defining spaces for pedestrians, bicycles, transit, landscaping, and vehicles, both parked and moving. In the overall street system of a city or neighborhood, streets perform different functions; and all the travel modes can be accommodated differently. In the development of the future street network for Crystal City, the accommodation of pedestrians, bicycles, transit, and vehicles was considered. All streets are recommended to generally accommodate the following:

- 6-foot wide (minimum) sidewalks; most are 8- and 10-foot wide minimum (clear width for sidewalks, exclusive of 2-foot building shy zone)
- 5-foot wide minimum utility/landscape strips (8-feet on Jefferson Davis Highway)
- 5-foot wide bicycle lanes on Crystal Drive, Potomac Avenue, 12th Street S., 18th Street S., 23rd Street S.
- 10- to 11-foot wide travel lanes for general vehicles and 11- to 12-foot wide travel lanes for transit vehicles
- 7- to 8-foot wide parallel parking lanes (includes 1 1/2 feet of gutter pan) on sections of Crystal Drive, S. Clark/Bell Street, S. Eads Street, 12th Street S., 26th Street S., 15th Street S., 16th Street S., 18th Street S., 20th Street S., 23rd Street S., and 24th Street S.
- Left-turn lanes at major intersections
- Transit facilities and accommodations
- Bicycle parking
- High-visibility crosswalks
- Pedestrian count-down heads at all signalized intersections and pedestrian crossings. Signals must provide adequate time for safe pedestrian passage
- Pedestrian push buttons where the pedestrian signal phase needs to be called
- Bulb-outs that shadow on-street parking and reduce crosswalk distances at intersections
- Median pedestrian refuges at marked crosswalks wider than 60 feet, curb to curb

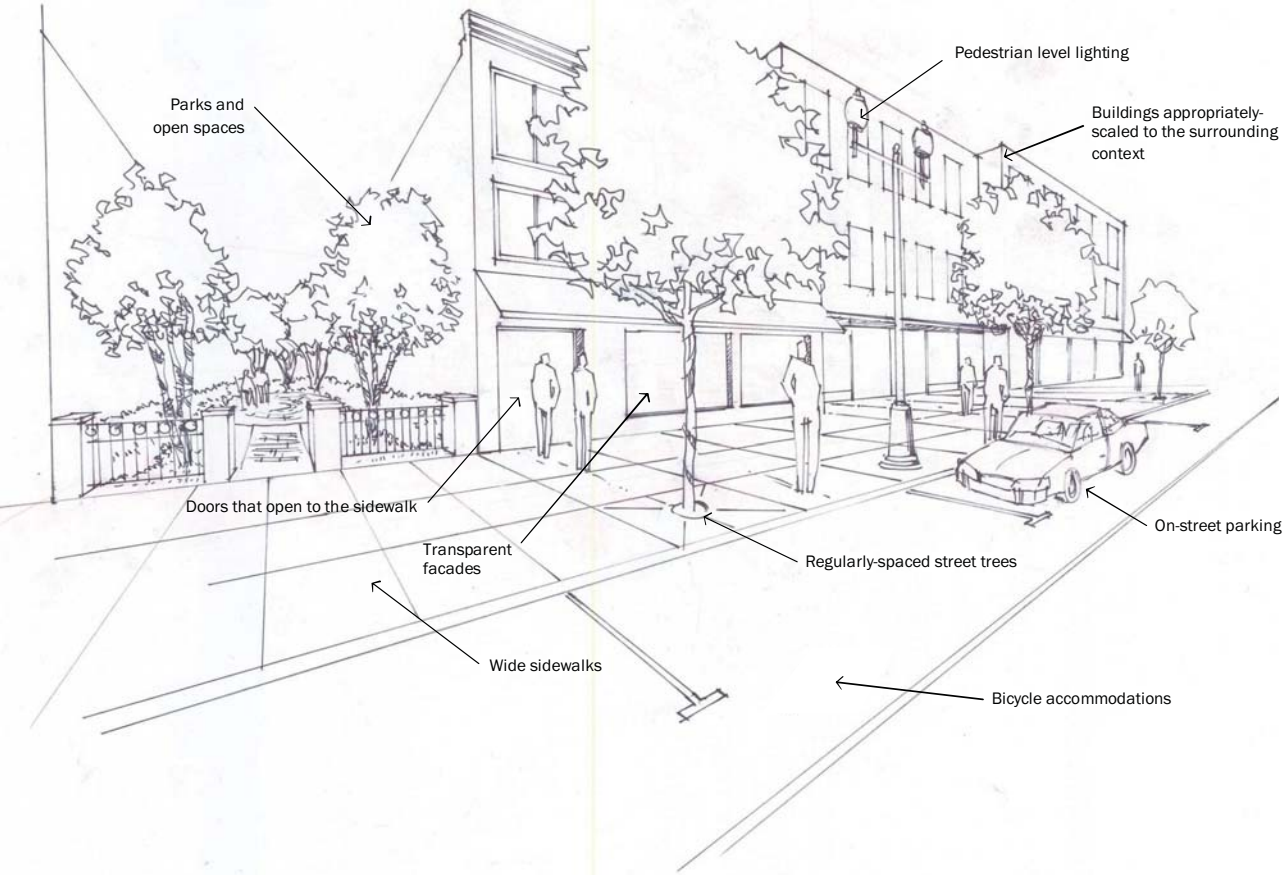


Figure 5.1 illustrates elements of a complete street.

Figure 5.1: Elements of Complete Streets

Pedestrian and Bicycle Accommodation

To provide for future growth and maintain mobility in Crystal City, providing safe and efficient pedestrian and bicycle facilities is essential. Walking and biking have innumerable benefits to personal and societal health, traffic conditions, livability, sustainability, and an area's vibrancy.

Every trip, even those made by car or transit, begins with walking. This alone necessitates design of places that accommodate pedestrians. For Crystal City, it is essential that over time, walk trips represent a greater proportion of all trips made. The pedestrian and bicycle networks should be interconnected, consistent, and safe and serve the area's residents, employees, and visitors.

Great sidewalks should be provided on both sides of every street. Crossings must be highly visible and provide adequate time for safe pedestrian passage. Generally, pedestrian accommodations should include:

- 6-foot wide (minimum) sidewalks: most are 8- and 10-foot wide minimum (exclusive of 2-foot building setback)
- 5-foot wide minimum utility/landscape strips (8-feet on Jefferson Davis Highway)
- High-visibility crosswalks
- Pedestrian count-down heads at all signalized intersections and pedestrian crossings. Signals must provide adequate time for safe pedestrian passage
- Pedestrian push buttons where the pedestrian signal phase needs to be called
- Bulb-outs where necessary to shadow on-street parking and reduce crosswalk distances at intersections
- Median pedestrian refuges on streets wider than 60 feet, curb to curb
- Pedestrian level lighting

Figure 5.2 illustrates an idealized street corner design for pedestrian accommodation at an intersection. Figure 5.3 on the following page illustrates the design configuration of physical elements within the pedestrian realm.

Bicycle Accommodation

General guidance for bicycle facilities is outlined in the following:

Bicycle Lanes are generally 5-feet in width

- May be reduced to 4 feet adjacent to the curb where there are space restrictions
- Must maintain at least 5 feet in width adjacent to on-street parking to avoid "door zone" issues

Shared lanes

- Adequately signed or marked using indicators such as "sharrows," route signage, and "Share the Road" signage

Cycle Tracks are generally 5-to 8-feet in width, but can be wider depending on anticipated use

- Must maintain 2 to 5 feet separation from parking or travel lanes
- With less separation, physical barrier such as bollards should be incorporated

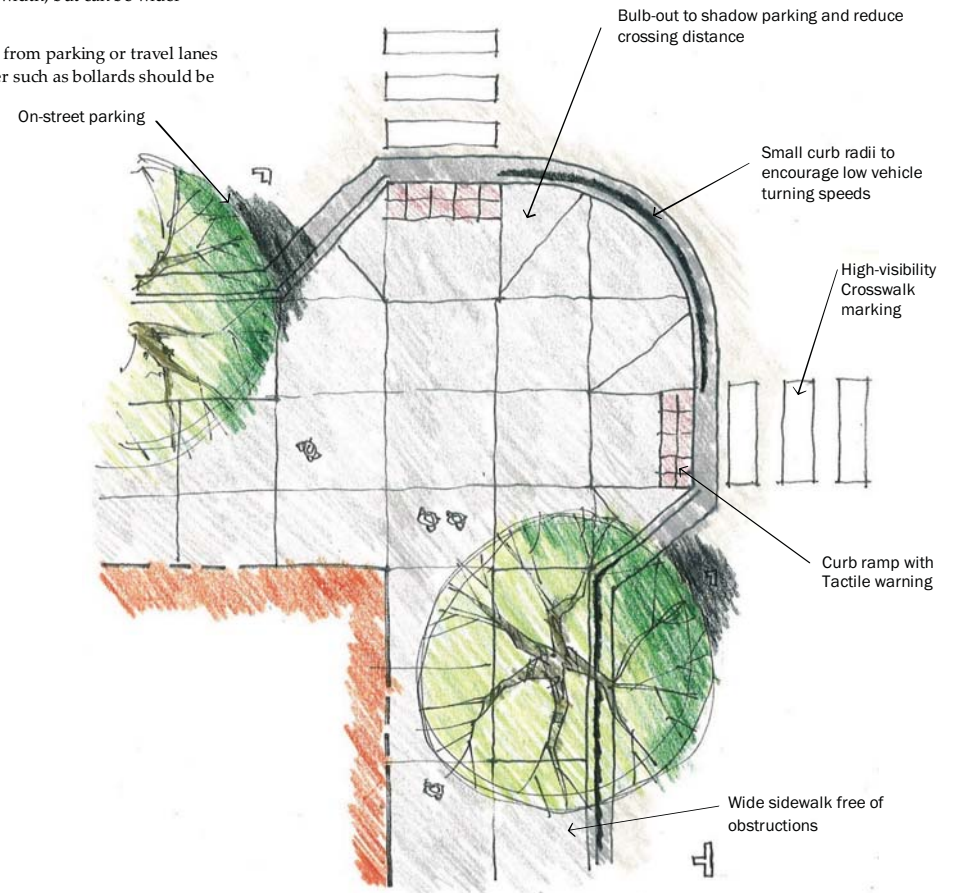


Figure 5.2: Idealized street corner design for pedestrian accommodation at an intersection

Pedestrian and Bicycle Network

Crystal City has an existing sidewalk and bikeways network. In addition, Crystal City is well-served by the regional bikeway and trails network. The Mount Vernon Trail runs west of Crystal City along the George Washington Memorial Parkway and the Four Mile Run Trail is south of Crystal City along Four Mile Run. To improve accommodations for pedestrian and bicyclists as Crystal City evolves over time, the following are recommended:

- A trail connection from Crystal Drive to the Long Bridge Park multiuse trail
- Modification of the Crystal City connection to the Mount Vernon Trail south of the Water Park to improve trail visibility, aesthetics, lighting, and width
- Direct pedestrian and bicycle connection from the Mount Vernon Trail to Terminal A of National Airport
- Direct pedestrian and bicycle connection from the Mount Vernon Trail to Terminal C of National Airport
- Parallel pedestrian and bicycle facilities along Route 233 (Airport Viaduct) from Crystal City to National Airport with a connection to the Mount Vernon Trail
- Extension of bike lanes along S. Eads Street between 15th to 23rd Streets
- Construction of Cycle Track along S. Clark/Bell between 12th to 27th Streets
- Extension of Crystal Drive Bike Lanes between 23rd to 31st Streets
- Connection of the Four Mile Run Trail to S. Glebe Road and Potomac Avenue
- Pedestrian and bicycle connection across Jefferson Davis Highway to S. Eads Street in conjunction with the reconfigured Route 233/Jefferson Davis Highway interchange
- Trail connection from the Four Mile Run Trail to Potomac Yard/Crystal City
- Continued maintenance of the pedestrian tunnel at the Jefferson Davis Highway/23rd Street S. intersection as feasible with future redevelopment and modification of Jefferson Davis Highway
- Streetscape enhancements on 18th Street S. in the vicinity of Metro and under the Jefferson Davis Highway bridge
- Streetscape enhancements on 12th Street S. in the vicinity of the Jefferson Davis Highway bridge
- Pedestrian-level wayfinding throughout Crystal City
- Bike Route Signage along most east-west streets
- Adequate bicycle parking throughout Crystal City

- Consistent with Arlington County's Master Transportation Plan, provide bicycle parking upgrades at the Crystal City Metrorail station and consider Crystal City as a candidate for a full-service bicycle station

Figure 5.4 on the following page indicates the recommended network of bicycle facilities throughout Crystal City. Wide sidewalks clear of unnecessary obstructions

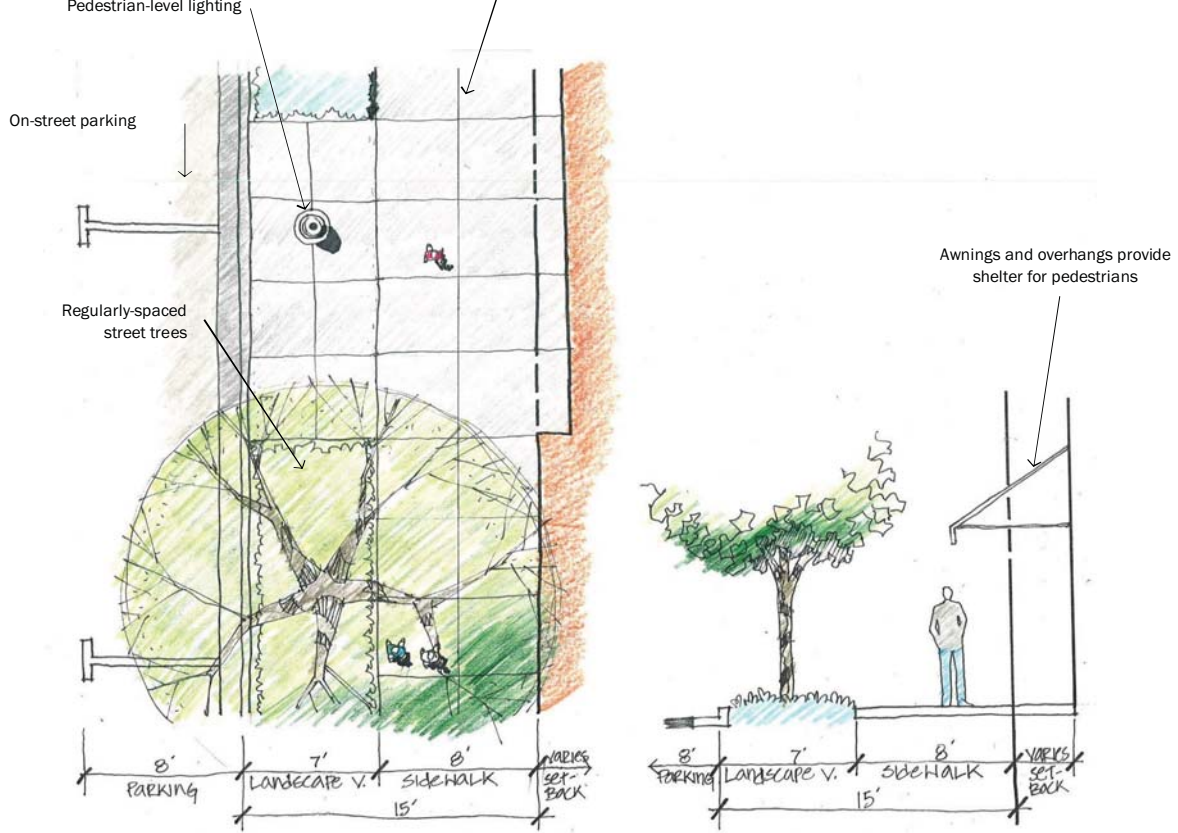


Figure 5.3: Desirable pedestrian realm configuration and support elements






0 250 500 1,000 Feet 

- Legend**
- Bicycle Lane (existing)
 - On-Street Bicycle Route (signed, existing)
 - Shared-Use Trail (existing)
 - - - Cycle Track (recommended)
 - - - Bicycle Lane (recommended)
 - - - On-Street Bicycle Route (signed, recommended)
 - - - Shared-Use Trail (recommended)

CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

Recommended Bikeway and Trail Network
Figure 5.4

In addition to Crystal City's surface pedestrian network is the extensive system of underground walkways and corridors. The existing underground is a set of retail-lined pathways and plazas that extends from 12th Street S. to 23rd Street S. between Jefferson Davis Highway and Crystal Drive. The underground provides an alternative to walking at street level, allowing pedestrians to travel from place-to-place in climate controlled conditions. Crystal City's residents have been clear in their support of this system for recreation and transportation, especially its role in extending the reach of Metro. Recognizing the value of this system, it is recommended to preserve its connectivity over-time with the understanding that the current layout may need to be modified to support the area's redevelopment.

Bicycle Sharing Program

Arlington County is developing a bike-sharing program similar to those in other locations. Worldwide, bike sharing programs are designed to encourage the use of bicycles for short trips between and within specific areas. Internationally, Amsterdam, Berlin, Brussels, London, Paris, Lyon, and other cities have already had tremendous success in operating bicycle rental systems. Paris' fleet of 10,000 bicycles generates about 45,000 trips per day—trips that may have otherwise been made by driving, walking a long distance, or riding a bus. The intent is to replace car trips with bicycle trips and increase the reach of transit by providing a reliable and convenient means to get to and from distant destinations.

Arlington County is working to have a pilot program in operation in 2010. In Arlington, bikes will be located at a combination of the existing carsharing poles and adjacent to Metrorail stations. The system would allow customers to check-out and return a bicycle by using their mobile phone to receive a random lock access and return code. Customers would pay an annual fee to subscribe to the program. The first half hour of rental would be free and a fee would be charged for further use. As the bicycle rental system is implemented, Crystal City should be included. Bicycles should be located at the 18th Street Metrorail station, near the VRE station, and at locations along Crystal Drive.



Smartbike in Washington, D.C.



Existing bike lanes on Crystal Drive



Basic bicyclists are more comfortable riding on facilities away from traffic or on facilities that separate them from the majority of traffic



Sharrow pavement marking

Transit Network

Public transit facilities and services have long been a cornerstone of the Arlington County transportation network. Arlingtonians recognize that an effective transit system is critical to meet their mobility needs, facilitate continued development, and support the high quality of life they are used to. In 2005, approximately 96 percent of Arlington’s residents and 96 percent of its jobs were located within a 1/4-mile of a local bus route or 1/2-mile of a Metrorail station. With a roadway system approaching capacity during peak travel periods (morning and evening “rush hours”), and limited opportunities to expand its roads, Arlington understands the need to invest in projects that make the most efficient use of its transportation network.

Crystal City is well-positioned in the metropolitan area with regard to transit connectivity and services. The area has easy access to VRE, Metro, and bus services and in the future will benefit from the completion of the Crystal City/Potomac Yard Transitway. The development of the transitway will extend the reach of Metro and VRE and will improve local mobility.

Arlington’s Master Transportation Plan (MTP) identifies a primary transit network (PTN) and secondary transit network (STN) throughout the County as shown in Figure 5.5. The PTN will provide high-quality, high-frequency transit service along high-density corridors. It will build on existing services such as Metrorail and the Pike Ride bus to create a network of north-south and east-west routes easily accessed by the majority of Arlington residents. The STN serves low- to moderate-density areas of Arlington with localized routes that focus on connecting people to PTN.

Within the study area, Jefferson Davis Highway is designated as a part of the PTN. As a PTN corridor, it should have “a network of transit lines that operate every 15 minutes or better for at least 18 hours a day,” according to the MTP. For this corridor, the Crystal City/Potomac Yard Transitway will augment Metrorail as a PTN service. The MTP states that “on designated PTN roadways, facilities for all travel modes will be provided; however, transit operations will receive priority because of their ability to carry high volumes of people.”

The existing transit choices within Crystal City should be maintained and enhanced whether the area redevelops or not. Transit options should include commuter-oriented services, off-peak services, and cross-county connections. The connections between transit services within Crystal City and throughout the county as well as connections to other modes of transportation should be convenient, easily understandable, and efficient. To

support future travel demand growth in Crystal City and maintain a high-level of transit service, the following additional services and enhancements to existing services are recommended:

- Development of the Crystal City/Potomac Yard (CCPY) Transitway with streetcar technology
- Deliberate connectivity between transitway stations and the pedestrian network (including the underground)
- Additional transit amenities on 18th Street S. in the vicinity of the Metro station entrance
- New station entrance to Metro in the vicinity of the Crystal Drive/18th Street S. intersection
- Development of a direct physical connection between Metro, the CCPY transitway, and VRE
- Enhancements to the existing VRE station
- Direct express bus service to the District and other high-demand destinations
- Extension of MARC service to Crystal City from Union Station
- Fixed-guideway (or dedicated shuttle) system to connect VRE, Metro, the transitway, the Airport, and internal Crystal City destinations

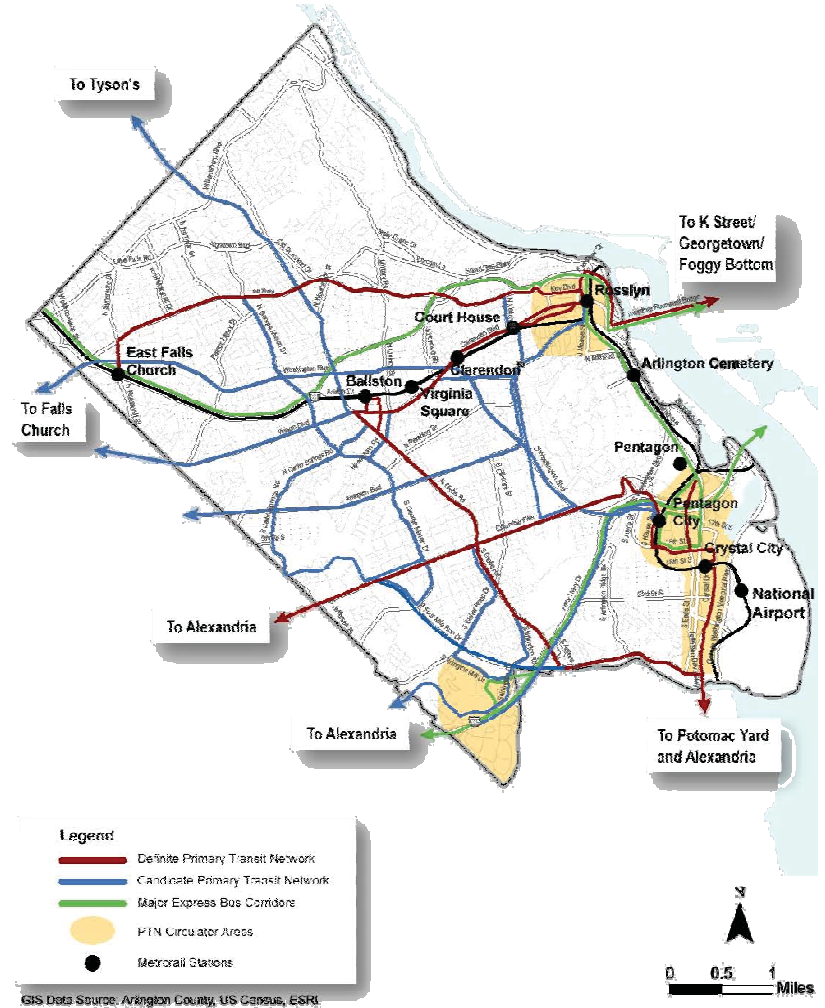


Figure 5.5: Countywide Major Transit Networks
Source Arlington County MTP, September 2007



Metrorail

Metrorail's importance in Crystal City in the future will increase as a growing regional population has access to the system. In the future, access to the station and interaction with other transit services can be improved by adding a second entrance to the Metrorail station in the vicinity of the Crystal Drive/18th Street S. intersection. Providing an additional station entrance will improve the connectivity of transit in Crystal City. As redevelopment occurs, the preservation and enhancement of existing Metrorail facilities will need to be considered. These facilities include mechanical and power distribution systems for the station as well as the primary station portal and elevator.

Intercity and Commuter Rail

The Virginia Railway Express (VRE) provides commuter rail service to Crystal City. Physical improvements can be made to enhance the user's experience on VRE within Crystal City. To anchor the station's presence on Crystal Drive and improve the experience for waiting passengers, a covered walkway should be considered to connect the existing platform and Crystal Drive. In the future, as possible, station upgrades including a high platform and enclosed station house should be considered. As ridership increases on Metro, overall transit capacity may become challenged between Crystal City and the District. To augment the capacity between these two destinations, VRE and Metro should explore an alternative fare structure to increase the attractiveness of travel by VRE between Crystal City and the District.

Future high-speed rail service between Richmond and Washington D.C. could also be an option for this corridor. When this rail service is implemented, Arlington County recommends a future train station and Multimodal center to serve both Crystal City and National Airport. This transit center could seamlessly connect passengers with both the airport and Crystal City without unnecessary connections.

Transitway

The Crystal City/Potomac Yard Transitway is a joint project by Arlington County and the City of Alexandria with the goal of providing a high-capacity and high-quality surface transit system in the five-mile corridor between the Pentagon and Pentagon City and the Braddock Road Metrorail Station. The proposed system would connect with the Columbia Pike Streetcar in Pentagon City and the Crystal City Metrorail station, and serve the new development in the Potomac Yard. In an initial phase, Arlington has launched the 95 Metrobus service from the Crystal City Metrorail station to the Potomac Yard redevelopment area in the County¹. This Sector Plan recommends the development of a streetcar system as the preferred technology for the transitway in Arlington. The stations serving the transitway should be

integrated into the urban design of surrounding development and ensure multimodal access.

¹ The interim bus service may operate on dedicated right-of-way in Potomac Yard and Crystal City while the County develops the ultimate Streetcar system.



Crystal City VRE Station



An example of a streetcar (Portland, Oregon), the recommended technology for the transitway



Bus

Bus transit will continue to be important in Crystal City and should be served appropriately through station and stop amenities as well as operational enhancements on streets and at intersections. The MTP outlines recommendations for bus service and facilities in Arlington. Among the recommendations are bus stops at the intersection of PTN routes and stops at other locations. The MTP recommends that at points where local transit intersects PTN routes, stops should be upgraded to super stops with space for two buses, attractive shelters accommodating 10 to 15 passengers, radiant heaters, lighting, real-time passenger information, security call boxes, ticket vending machines, and closed-circuit video.

Regionally, the existing private bus services that bring commuters into Crystal City should continue to be accommodated. As regional congestion grows on streets and existing transit services, the potential for express bus connections to be provided between points should be investigated. Additionally, to reduce the number of individual hotel transit services, as well as accommodate a local circulation function, the consolidation of local transit services should be considered. The MTP also recommends conducting a detailed study to evaluate the need for bus service between Crystal City and the Rosslyn-Ballston Corridor.



Transit accommodations on S. Clark/Bell Street at 18th Street S.



Multimodal Center

As there are an increasing number of transportation options available for residents, workers, and visitors of Crystal City, a facility to intentionally connect and coordinate transportation services will perform a vital function in encouraging travel choice. Within the current Crystal City Sector Plan, a multimodal transportation center is recommended to be located in the northwest quadrant of the S. Clark/Bell Street/18th Street S. intersection. This facility would be integrated with development and would directly connect to Metro and bring together local, regional, and commuter bus services, the transitway, and other publicly accessible transportation services. Understanding the larger role of the multimodal center in Crystal City, the center should accommodate facilities to serve commuting bicyclists and also provide opportunities for commuter-oriented retail and services.

Automobile Network

Although not the highest priority for Arlington, supporting vehicular travel is important in Arlington and will be important for the future of Crystal City. Within Crystal City, streets and intersections should operate at acceptable levels-of-service during most hours of the day.

The following are general guidelines that should be considered in the implementation of street modifications:

- *Travel lanes:* 10 to 11 feet wide
- *Left-turn lanes:* 10 to 11 feet wide
- *Access:* limit driveways to areas where vehicle, pedestrian, bicycle, and transit conflicts can be managed or minimized
- *Intersection spacing:* minimum of 150 feet, 300 feet is more desirable
- *Signal timing:* coordinated timings based on time-of-day and day-of-week

The Crystal City Sector Plan includes the following new streets, realignments of existing streets, and major intersection reconfigurations:

- *16th Street S.:* partial street east/west from S. Clark/Bell Street to mid-block between Crystal Drive and S. Clark/Bell Street
- *24th Street S.:* east/west between west of S. Clark/Bell Street and Crystal Drive

- *26th Street S.:* the southern terminus of the recommended transitway couplet section, connecting S. Clark/Bell Street to Crystal Drive as a two-way street on the north side of Route 233
- *S. Clark/Bell Street:* relocated between Route 233 and 12th Street S. to increase separation between Jefferson Davis Highway and S. Clark/Bell Street intersections with the numbered streets
- *20th Street S.:* realigned at Jefferson Davis Highway to improve intersection geometrics and operations
- *Jefferson Davis Highway/15th Street S. interchange:* reconstructed as a single point urban interchange, compressed diamond, or other “urban friendly” design
- *Jefferson Davis Highway/Route 233 interchange:* reconstructed as a traffic circle interchange

The recommended street network is described in **Table 5.1**. This table describes the ultimate street characteristics. To accommodate the transitway through different stages of implementation, the recommendations for some streets may need to be adjusted. **Figure 5.6** illustrates the recommended street network (by number of general use through lanes) and **Figures 5.7 and 5.8** indicate recommended intersection laneage. Recommendations for individual corridors are described in the Corridor Recommendations section.

Table 5.1: Recommended Street Characteristics

Street Name	Section	Sidewalk Width (minimum) ¹	Landscape/Utility Strip (minimum)	Bicycle Accommodation	Transit Accommodation ⁵	Parking	Number of Through Lanes	Median	Left-turn Lanes
S. Eads Street	Fort Scott Drive to 24th Street S.	Same as existing	Same as existing	Striped lane	Mixed flow ²	Both sides	2	Yes	No
	24th Street S. to 23rd Street S.	6 feet	5 feet	Striped lane	Mixed flow ²	Both sides	3 (2 NB and 1 SB)	No	Major intersections
	23rd Street S. to 15th Street S.	6 feet	5 feet	Striped lane	Mixed flow ²	Both sides	4	No	Major intersections
	15th Street S. to Army-Navy Drive	6 feet	5 feet	Route	Mixed flow ²	Both sides	4	No	Major intersections
Jefferson Davis Highway	12th Street S. to S. Glebe Road	10 feet	8 feet	None	Mixed flow ²	None	6	Yes	Intersections
S. Clark/Bell Street	27th Street S. to 26th Street S. ⁴	8 feet	6 feet	Cycle Track ⁶	Mixed flow ²	None or one side	2	No	Major intersections
	26th Street S. to 12th Street S.	8 feet	6 feet	Cycle Track ⁶ (NB)	Transitway and mixed flow ³	None or one side	2	No	Major intersections

1 – Width denotes the clear width, exclusive of the building shy zone

2 – Mixed flow: Regular (non-transitway) bus routes operate in general vehicle lanes

3 – Transitway and mixed flow: Through these sections, the transitway is continuous and exclusive of general vehicular traffic. Regular bus routes run outside of the transitway in general vehicle lanes

4 – S. Clark/Bell Street between 27th Street S. and 26th Street S. depending on development site plan. If the section is in place, Clark/Bell will be depressed under Route 233 (Airport Viaduct)

5 – Specific transit accommodation will vary based on the phasing of the recommended transitway alignment

6 – A striped bicycle lane may be used in place of a cycle track

Table 5.1: Recommended Street Characteristics (continued)

Street Name	Section	Sidewalk Width (minimum) ¹	Landscape/Utility Strip (minimum)	Bicycle Accommodation	Transit Accommodation ⁵	Parking	Number of Through Lanes	Median	Left-turn Lanes
Crystal Drive	Jefferson Davis Highway to Potomac Avenue	8 feet	6 feet	Striped lane	Transitway and mixed flow ³	One side	1 (NB)	No	Major intersections
	Potomac Avenue to 26th Street S.	8 feet	4 feet	None	Transitway and mixed flow ³	None or one side	2	Yes	Major intersections
	26th Street S. to 12th Street S.	10 feet	6 feet	Striped lane (SB)	Transitway and mixed flow ³	One side	2	Yes	Major intersections
12th Street S.	S. Fern Street to S. Eads Street	8 feet	6 feet	Route	Transitway and mixed flow ³	None	2	No	Major intersections
	S. Eads Street to Army-Navy Drive	8 feet	6 feet	Route	Transitway and mixed flow ³	None	4	No	Major intersections
	Army-Navy Drive to Old Jefferson Davis Highway	8 feet	6 feet	Route	Transitway and mixed flow ³	None	4	No	Major intersections
	Old Jefferson Davis Highway to Crystal Drive	10 feet	6 feet	Striped Lane (EB)	Transitway and mixed flow ³	One Side	2	Yes	Major intersections
15th Street S.	S. Fern Street to S. Eads Street	8 feet	6 feet	Route	Mixed flow ²	None	4	No	Major intersections
	S. Eads Street to S. Clark/Bell Street	8 feet	6 feet	Route	Mixed flow ²	None	4	Yes	Major intersections
	S. Clark/Bell Street to Crystal Drive	10 feet	6 feet	Multi-use path (in park)	Mixed flow ²	Both sides	4	Yes	Major intersections
16th Street S.	S. Clark/Bell Street to End	6 feet	5 feet	None	None	Both sides	2	No	No
18th Street S.	S. Fern Street to S. Clark/Bell Street	8 feet	6 feet	Striped lane	Mixed flow ²	None	4	No	Major intersections
	S. Clark/Bell Street to Crystal Drive	10 feet	6 feet	Striped lane	Mixed flow ²	Both sides	4	No	Major intersections
20th Street S.	S. Eads Street to S. Clark/Bell Street	8 feet	6 feet	None	Mixed flow ²	None	4	No	Major intersections
	S. Clark/Bell Street to Crystal Drive	10 feet	6 feet	None	Mixed flow ²	Both sides	4	No	Major intersections
23rd Street S.	S. Fern Street to S. Eads Street	8 feet	6 feet	Route	Mixed flow ²	None	4	No	Major intersections
	S. Eads Street to S. Clark/Bell Street	10 feet	6 feet	Shared lane	Mixed flow ²	None	4	No	Major intersections
	S. Clark/Bell Street to Crystal Drive	10 feet	6 feet	Shared lane	Mixed flow ²	One side	4	No	Major intersections
24th Street S.	End to S. Clark/Bell Street	6 feet	5 feet	None	Mixed flow ²	Both sides	2	No	No
	S. Clark/Bell Street to Crystal Drive	6 feet	5 feet	Route	Mixed flow ²	Both sides	2	No	No
26th Street S.	S. Clark/Bell Street to Crystal Drive	6 feet	6 feet	Route	Transitway and mixed flow ³	One side	2	No	No
Potomac Avenue	Jefferson Davis Highway to Crystal Drive	8 feet	5 feet	Striped Lane	Mixed flow ²	None	4	Yes	Major intersections
Route 233 (Airport Viaduct)	George Washington Parkway to Jefferson Davis Highway	10 feet	Not applicable	Parallel pathway	Mixed flow ²	None	4	Yes	Not applicable

1 – Width denotes the clear width, exclusive of the building shy zone

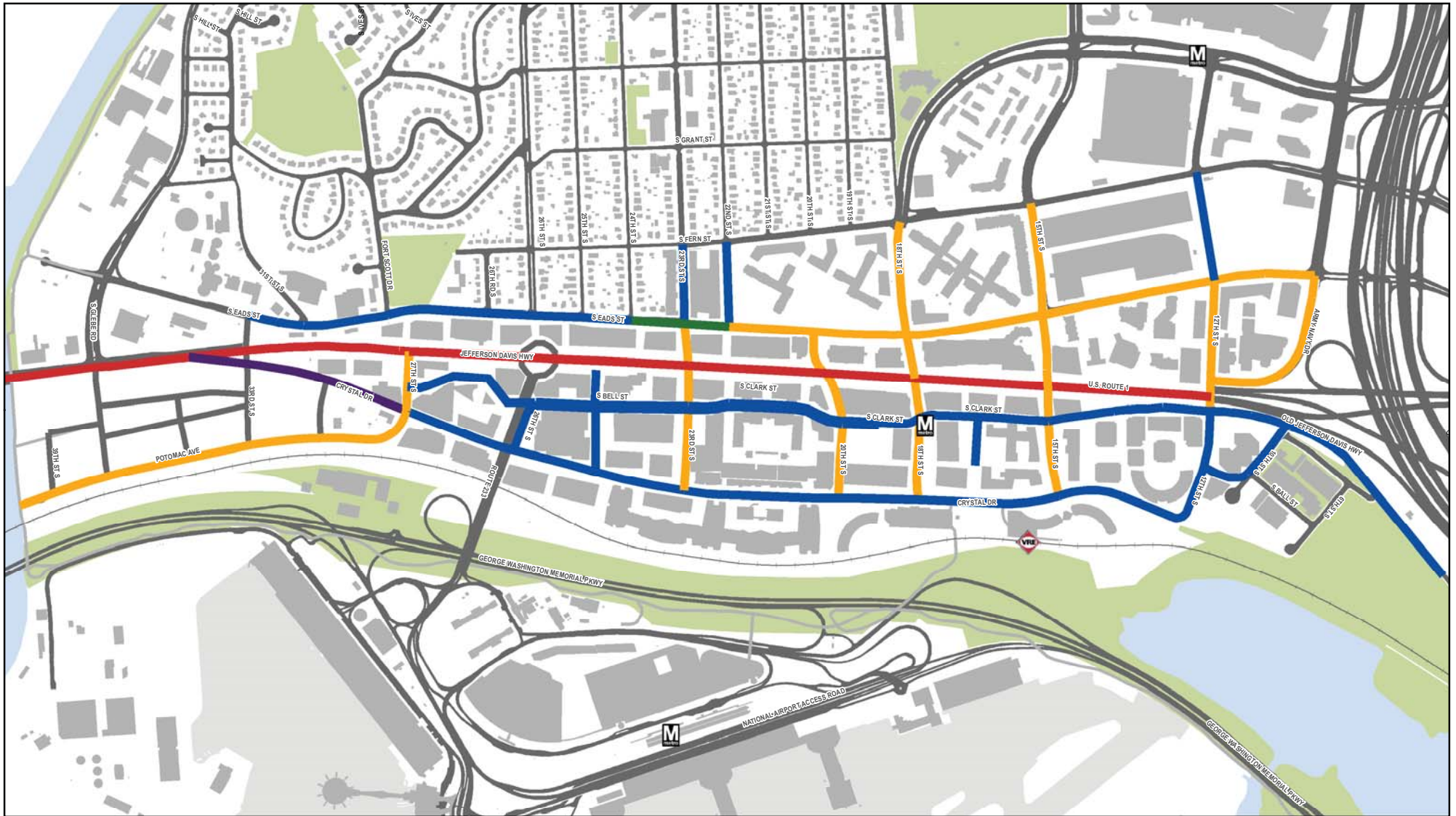
2 – Mixed flow: Regular (non-transitway) bus routes operate in general vehicle lanes

3 – Transitway and mixed flow: Through these sections, the transitway is continuous and exclusive of general vehicular traffic. Regular bus routes run outside of the transitway in general vehicle lanes

4 – S. Clark/Bell Street between 27th Street S. and 26th Street S. depending on development site plan. If the section is in place, Clark/Bell will need to be depressed under Route 233 (Airport Viaduct)

5 – Specific transit accommodation will vary based on the phasing of the recommended transitway alignment

6 – A striped bicycle lane may be used in place of a cycle track



 Kinley-Horn and Associates, Inc.
 ARLINGTON VIRGINIA
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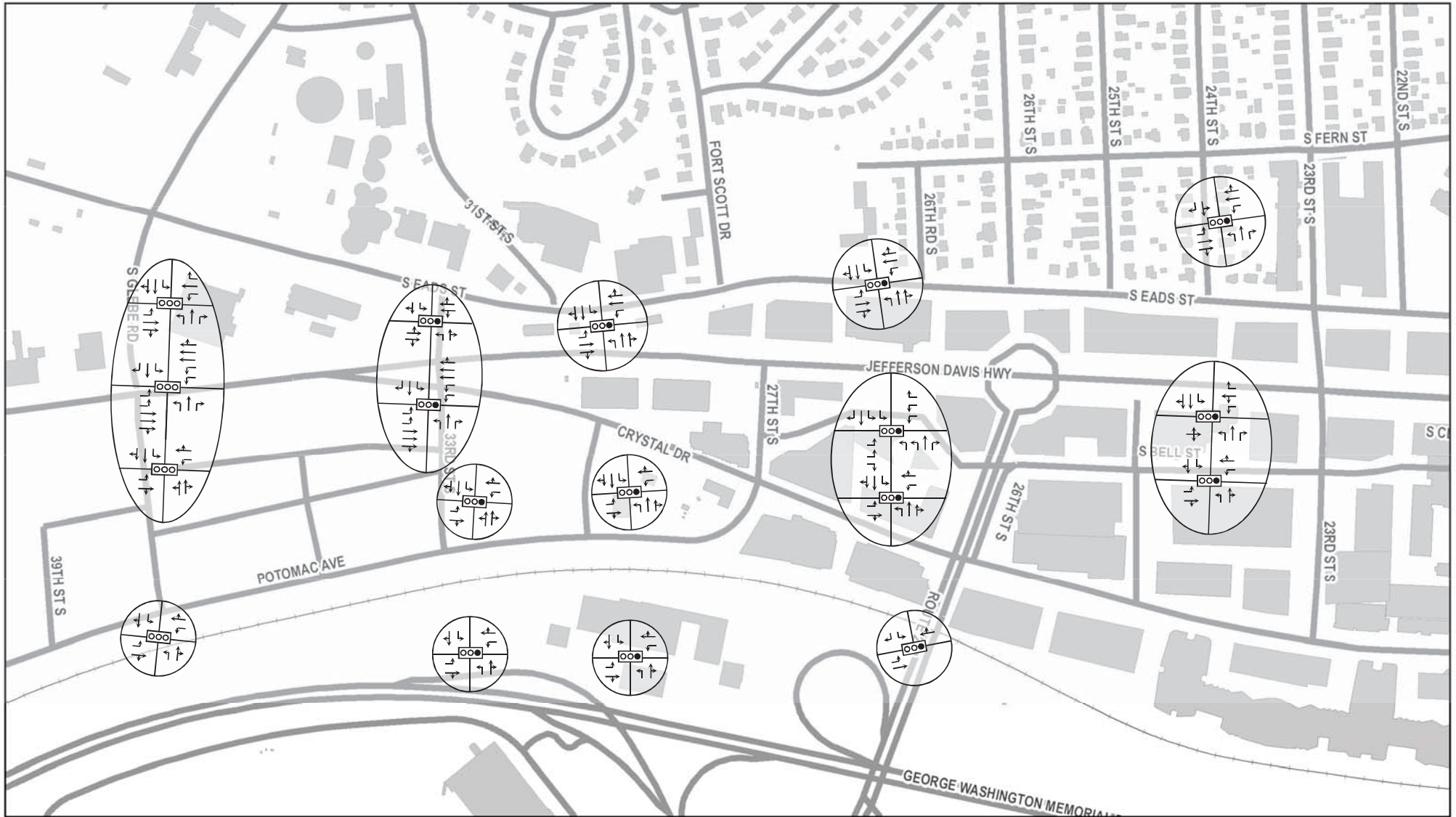
- Legend**
- 1 lane northbound
 - 4 lanes
 - 2 lanes
 - 6 lanes
 - 3 lanes

*Excludes dedicated lanes for transitway, left turn pockets, and loading zones

CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

Recommended Street Network

Figure 5.6

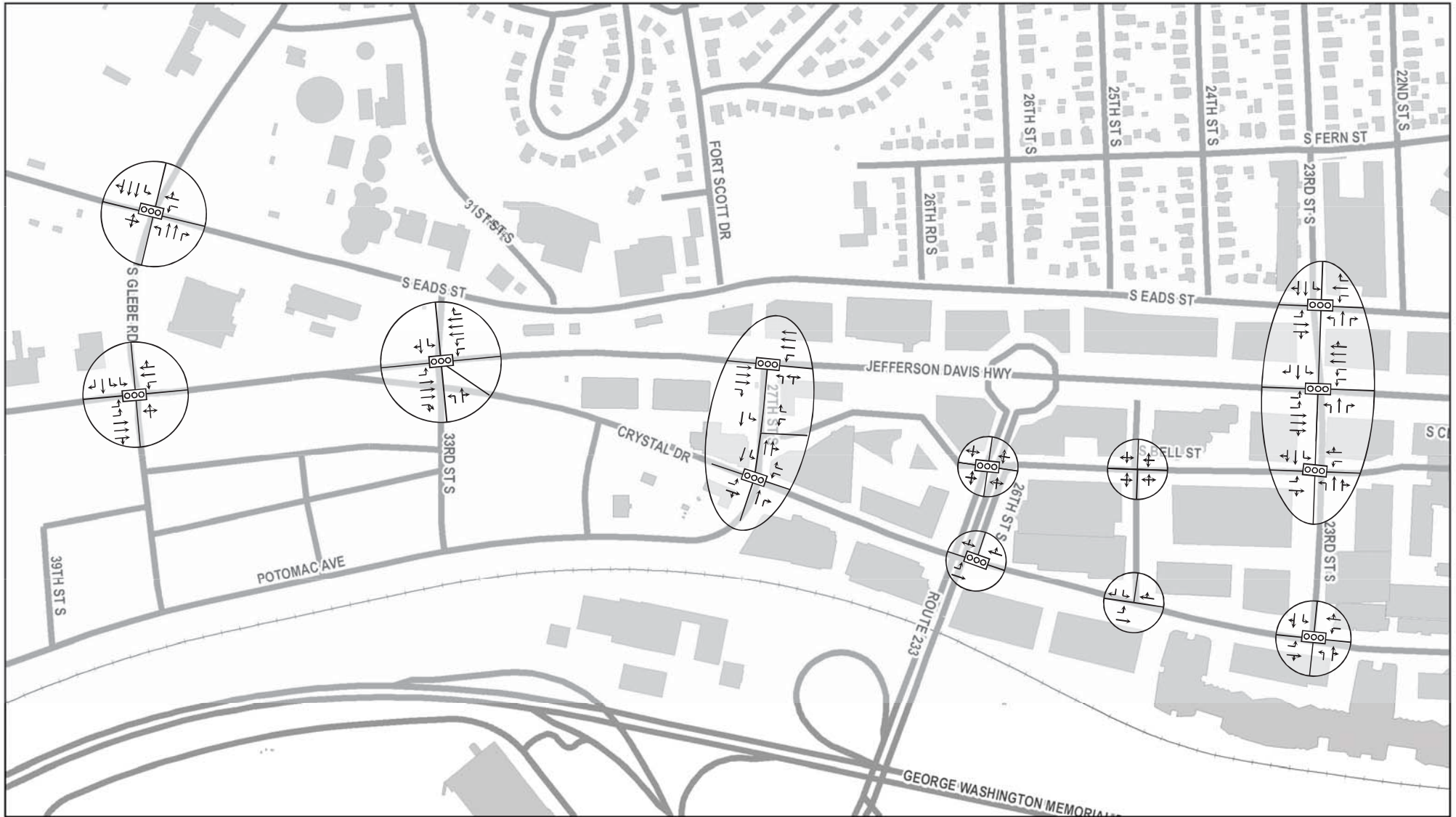


CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

Recommended Future Laneage and Traffic Control

Figure 5.7





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CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

Recommended Future Laneage and Traffic Control

Figure 5.8

CORRIDOR RECOMMENDATIONS

Jefferson Davis Highway

Jefferson Davis Highway is a barrier between the east and west sides of Crystal City. Crossing the street is a challenge for all modes. The existing conditions at Jefferson Davis Highway and 23rd Street S. are shown in **Figure 5.9**. The existing cross-section of Jefferson Davis Highway and Clark Street at the intersection with 23rd Street S. is shown in **Figure 5.10** on the following page. The recommended conversion of Jefferson Davis Highway into a tree-lined boulevard, enhancement of pedestrian crossings, and relocation of S. Clark/Bell Street further from Jefferson Davis Highway will help to reduce the barrier effect of the street. The following items are recommended for Jefferson Davis Highway:

- Maintaining the existing grade separated section of roadway from I-395 to 18th Street S.
- Conversion of the 15th Street S. interchange to a single-point configuration
- Removal of the S. Clark/Bell Street ramp from 18th Street S. to 12th Street S.
- Reconstruction of the roadway as a six-lane boulevard with a wide median and adequate pedestrian refuges at signalized intersections
- Reconstruction of the Route 233 interchange to a more “urban friendly” design such as a traffic circle
- Provision of wide sidewalks and adequate landscaped strips
- Provision of signalized crossings with adequate median refuges, high-visibility markings, and count-down pedestrian signals
- Provision of pedestrian and overhead street lighting

The recommended cross-section of Jefferson Davis Highway from 23rd Street S. to 32nd Street S. is shown in **Figure 5.11** on the following page. Clark Street is not shown in this cross-section because it has been relocated to approximately 150 feet east of Jefferson Davis Highway at 23rd Street S. and the traffic signal is no longer clustered.

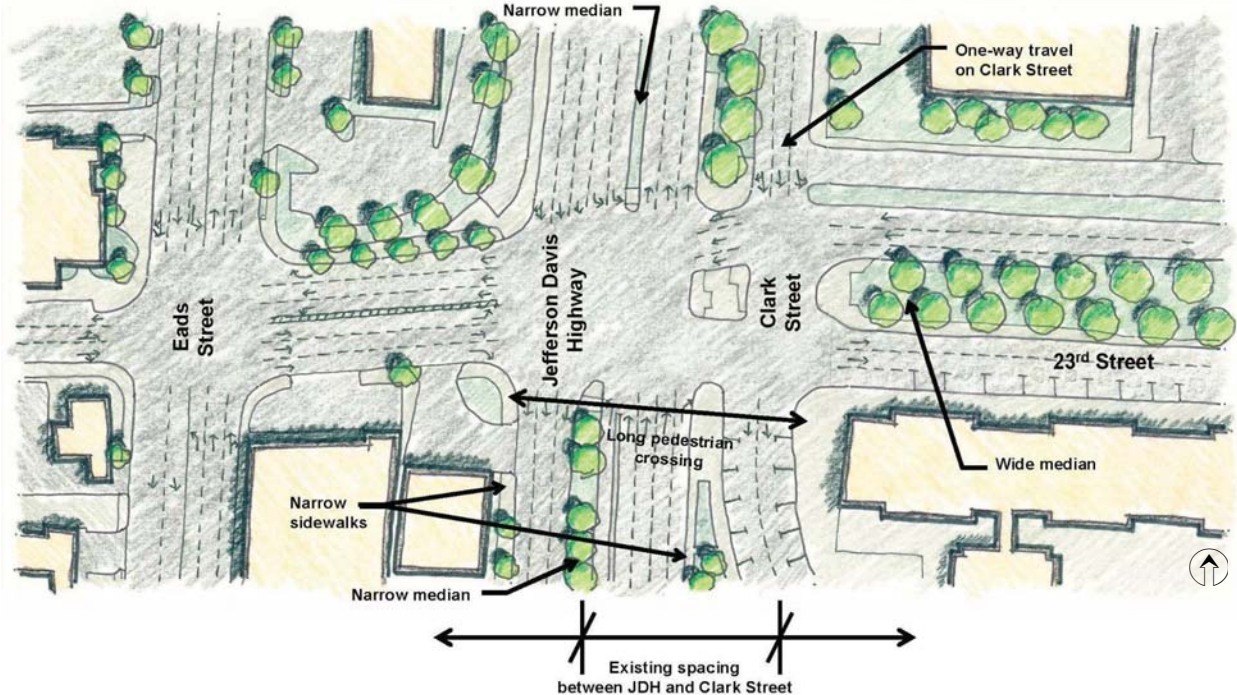


Figure 5.9: Existing Conditions at Jefferson Davis Highway and 23rd Street S.

Jefferson Davis Highway (continued)

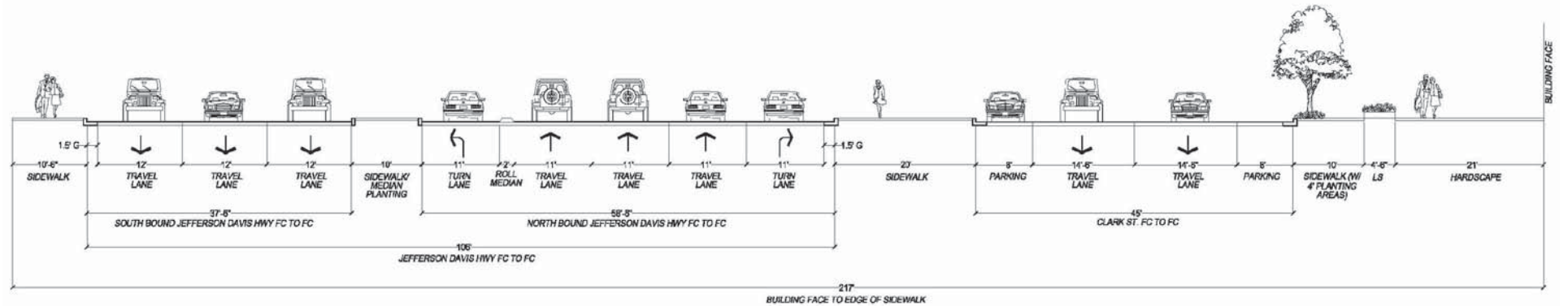


Figure 5.10: Existing cross-section of Jefferson Davis Highway and Clark Street looking north at 23rd Street S. intersection

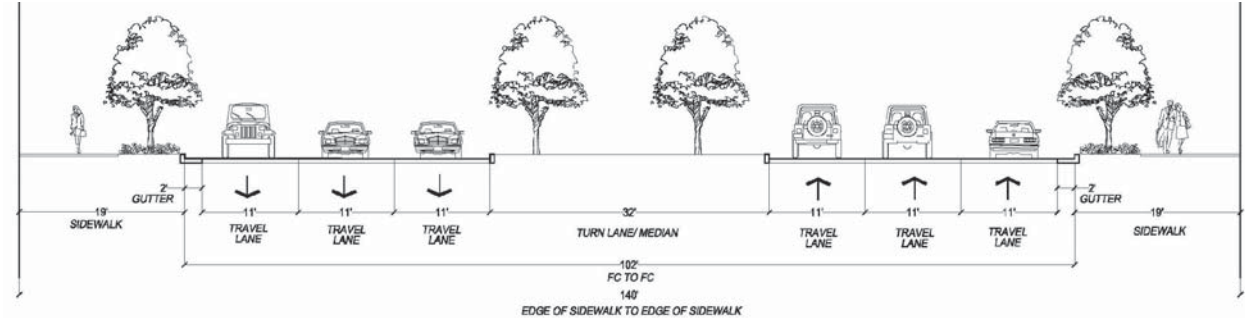


Figure 5.11: Recommended Jefferson Davis Highway cross-section looking north from 18th Street S. to 32nd Street S.
 Note: Left turn facilities are envisioned at major intersections and Clark Street is not shown in this cross-section since it is recommended to be relocated approximately 150 feet east of Jefferson Davis Highway

Jefferson Davis Highway/Route 233 Interchange

To facilitate the redevelopment of the area surrounding the Route 233/Jefferson Davis Highway interchange, it is proposed to modify the intersection's configuration to a more "urban friendly" footprint. The current proposal for the interchange would transition the configuration to a traffic circle. The modified interchange would serve as a gateway for Crystal City and National Airport and free-up land for development.

The construction of the traffic circle would require Route 233 to be reconstructed from approximately Crystal Drive to Jefferson Davis Highway to have Route 233 intersect Jefferson Davis Highway at the existing grade. Meanwhile, Jefferson Davis Highway would need to be depressed through the interchange area to maintain the vertical separation needed at Route 233 (approximately 17 feet). Ramps would be constructed along Jefferson Davis Highway to connect to Route 233 and maintain interchange functionality.

The interchange would function like a standard traffic circle, except that the major volume of traffic (on Jefferson Davis Highway) would pass beneath the traffic circle. The interchange would require pedestrian actuated signalization to enable pedestrians to access the green space at the center of the circle. Pedestrians and bicycles would navigate the circle using pedestrian actuated signals. Pedestrian movements at the traffic circle interchange are shown in **Figure 5.12**. **Figure 5.13** illustrates a Route 233 cross-section with pedestrian and bicycle accommodation.

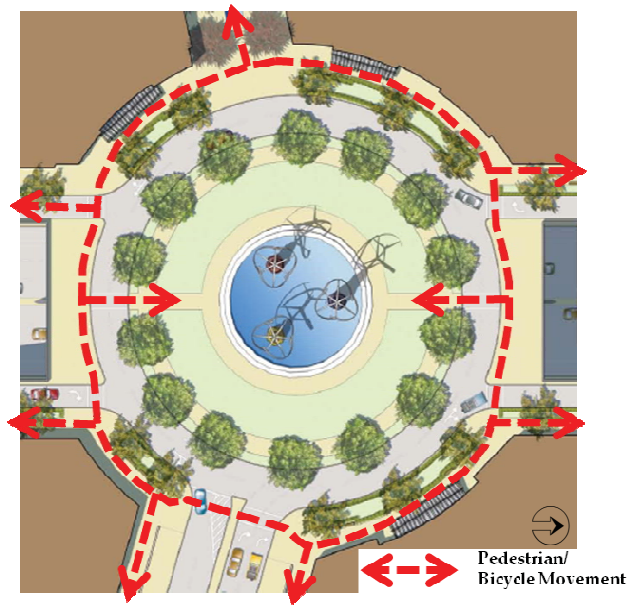


Figure 5.12: Pedestrian movements at the traffic circle interchange
Source of background graphic: Torti Gallas and Partners

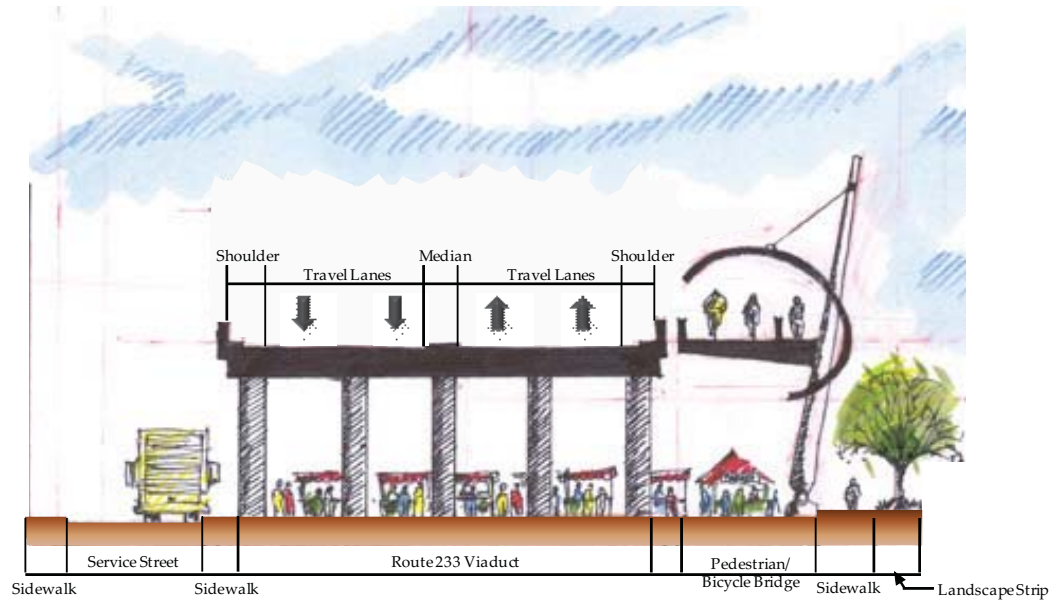


Figure 5.13: Illustrative Route 233 Cross-section with pedestrian and bicycle accommodation

Crystal Drive

It is recommended that the future Crystal Drive accommodate two-way traffic from 27th Street S. to 12th Street S. Based on projected traffic volumes, one through travel lane should be provided in each direction and left-turn lanes provided at intersections. Where possible, bicycle lanes and on-street parking should be provided in addition to wide sidewalks and adequate landscaped strips. The recommended transitway alignment runs northbound along Crystal Drive from 26th Street S. to 12th Street S. and in both directions along Crystal Drive between 27th Street S. and 26th Street S. As the recommended transitway alignment is implemented, depending on the pace of redevelopment and street reconstruction, elements will need to be adjusted to accommodate interim transitway alignments. Though shown as a circle on the sector plan, the Crystal Drive/15th Street S. intersection will function as a standard T-intersection in the future with appropriate design considerations to promote pedestrian and bicycle safety. The following items are recommended for Crystal Drive:

- Wide sidewalks and landscaped strips
- Striped bicycle lanes in the southbound direction from 12th Street S. to 27th Street S.
- Striped bicycle lanes in both directions from 27th Street S. to 33rd Street S.
- On-street parking where right-of-way constraints permit its provision
- One travel lane in each direction and left-turn lanes at major intersections
- Recommended transitway
 - In the ultimate configuration, the transitway will travel northbound on Crystal Drive from 12th Street S. to 26th Street S. and both directions from 26th Street S. to S. Glebe Road
 - In initial implementation stages, the transitway may travel in both directions of additional sections of Crystal Drive
- Pedestrian refuge islands where possible

The existing cross-section of Crystal Drive looking north near 20th Street S. is shown in **Figure 5.14**. The recommended cross-section of Crystal Drive from 12th Street S. to 23rd Street S. is shown in **Figure 5.15**. The recommended cross-section of Crystal Drive from 26th Street S. to 27th Street S. is shown in **Figure 5.16**.

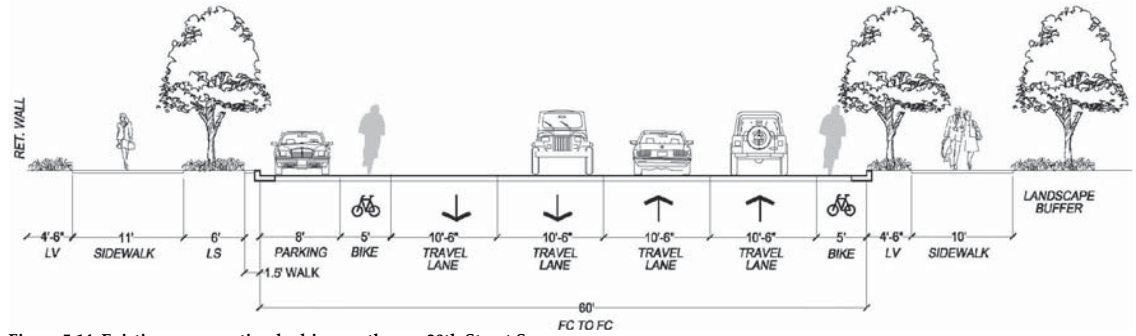


Figure 5.14: Existing cross-section looking north near 20th Street S.

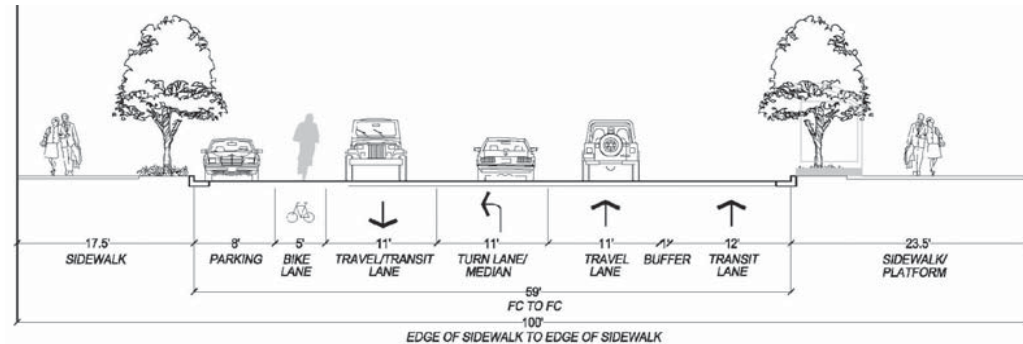


Figure 5.15: Recommended cross-section looking north with one-way transit north of 23rd Street S.

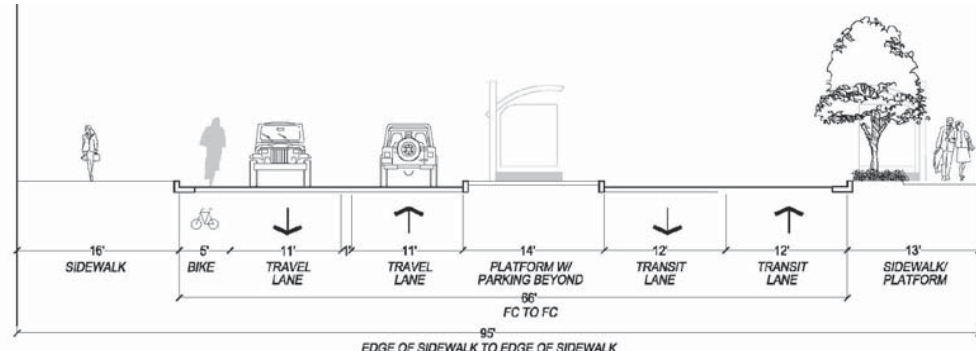


Figure 5.16: Recommended cross-section looking north with two-way transit between 26th Street S. and 27th Street S.

S. Clark/Bell Street/Bell Street

Currently, the one-way S. Clark/Bell Street corridor functions like a service street for the buildings that have frontage along it, rather than a circulation street for Crystal City. As redevelopment occurs in Crystal City, the role of the street will need to evolve to accommodate all modes. This will involve the street converting to two-way with wide sidewalks, parking, transit accommodations, and turn lanes at critical intersections. The recommended transitway alignment will run southbound along S. Clark/Bell Street from 12th Street S. to 26th Street S. As the transitway is implemented, depending on the pace of redevelopment and street reconstruction, the street will need to be adjusted to accommodate the transitway alignments. The following items are recommended for S. Clark/Bell Street:

- Wide sidewalks and landscaped strips
- A cycle track in the southbound direction from 12th Street S. to 26th Street S.
 - A striped bicycle lane may be substituted for a cycle track
 - In initial implementation stages for the transitway, striped bicycle lanes should be provided in both directions along Clark/Bell Street where a bicycle facility is not provided along a corresponding section of Crystal Drive due to two-way transit
- On-street parking where possible
- One travel lane in each direction and left-turn lanes at major intersections
- Interim transitway
- Bus and transit passenger accommodations in the vicinity of 18th Street S.

The existing cross-section of S. Clark/Bell Street looking north near 20th Street S. is shown in **Figure 5.17**. The recommended cross-section of S. Clark/Bell Street from 12th Street S. to 26th Street S. is shown in **Figure 5.18**. The alternate cross-section of S. Clark/Bell Street with a striped bicycle lane is shown in **Figure 5.19**.

The existing section of S. Clark/Bell Street between 26th Street S. and 27th Street may be reconstructed in the future based on the development plan for the block that contains the street. It may need to be depressed under the new Route 233 Viaduct to create adequate vertical clearance. The following items are recommended for S. Clark/Bell Street south of 26th Street S.:

- Wide sidewalks and landscaped strips
- Striped bicycle lanes both directions from
- On-street parking where possible
- One travel lane in each direction and left-turn lanes at major intersections

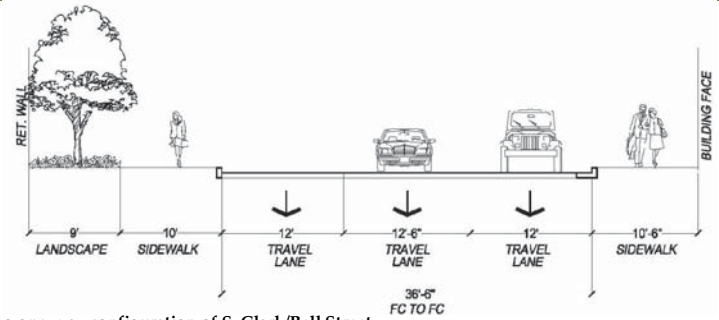


Figure 5.17: Existing one-way configuration of S. Clark/Bell Street

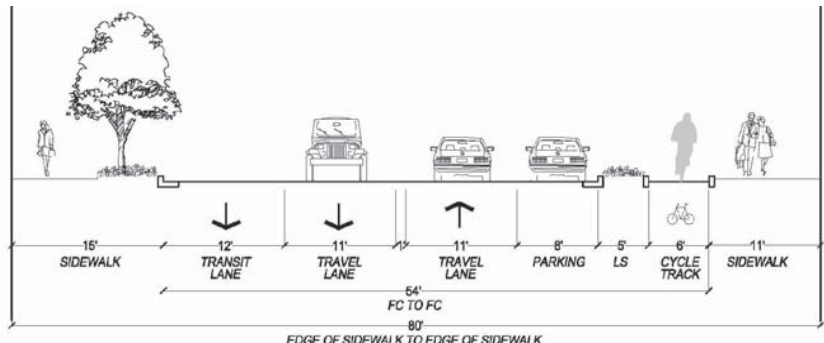


Figure 5.18: Recommended mid-block cross-section with one-way transit looking north between 12th Street S. and 26th Street S.

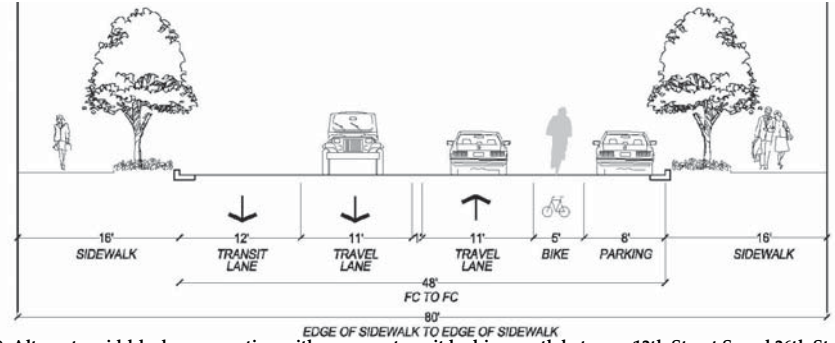


Figure 5.19: Alternate mid-block cross-section with one-way transit looking north between 12th Street S. and 26th Street S.

S. Eads Street

In the future, S. Eads Street will continue to function as an integral part of the circulation system of Crystal City—accommodating buses, automobiles, bicyclists, and pedestrians. The corridor will continue to be a boundary between Crystal City and existing residential neighborhoods. It will need to continue to accommodate all modes of transportation. The following items are recommended for S. Eads Street:

- Wide sidewalks and landscaped strips
- Striped bicycle lanes in both directions
- On-street parking where possible
- Two travel lanes in each direction and left-turn lanes at intersections from 12th Street S. to 23rd Street S.
- One travel lane in each direction and left-turn lanes at major intersections from 23rd Street S. to S. Glebe Road

The existing cross-section of S. Eads Street looking north between 20th Street S. and 23rd Street S. is shown in **Figure 5.20**. The recommended cross-section of S. Eads Street north of 23rd Street S. is shown in **Figure 5.21**.

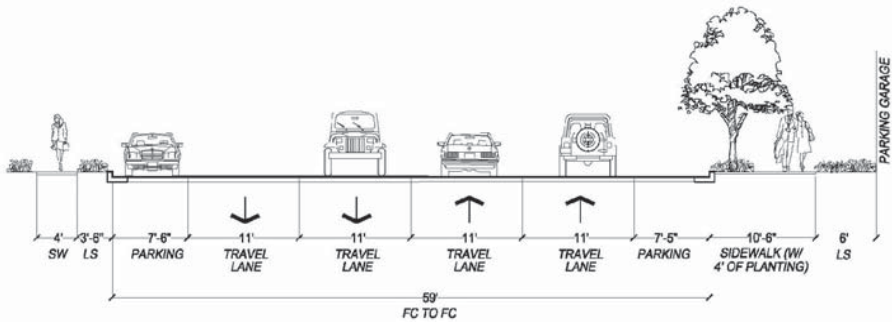


Figure 5.20: Existing cross-section of S. Eads Street between 20th Street S. and 23rd Street S.

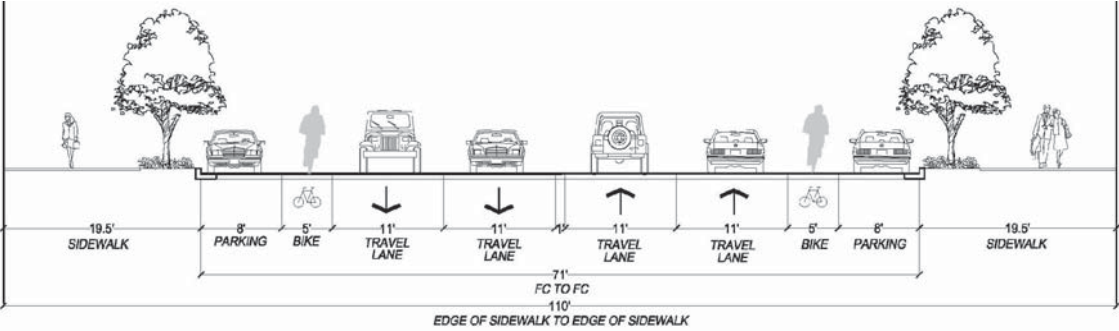


Figure 5.21: Recommended mid-block cross-section for S. Eads Street north of 23rd Street S.

12th Street S.

With redevelopment, this street will have an increased importance in Crystal City. Similar to other east/west streets, it will be a critical part of the local circulation network. The recommended transitway alignment will run westbound along 12th Street S. from Crystal Drive to S. Clark/Bell Street and in both directions along 12th Street S. west of S. Clark/Bell Street. As the transitway is implemented, depending on the pace of redevelopment and street reconstruction, elements will need to be adjusted to accommodate the transitway alignments. The following items are recommended for 12th Street S.

- Wide sidewalks and landscaped strips
- Striped bicycle lanes in the eastbound direction from Crystal Drive to S. Clark/Bell Street
- Recommended transitway
- On-street parking where right-of-way constraints permit its provision
- One travel lane in each direction east of S. Clark/Bell Street and west of S. Eads Street; two travel lanes in each direction between S. Eads Street and S. Clark/Bell Street

The existing cross-section of 12th Street S. looking west between Crystal Drive and S. Clark/Bell Street is shown in **Figure 5.22**. The recommended cross-section of 12th Street S. looking west between Crystal Drive and S. Clark/Bell Street is shown in **Figure 5.23**.

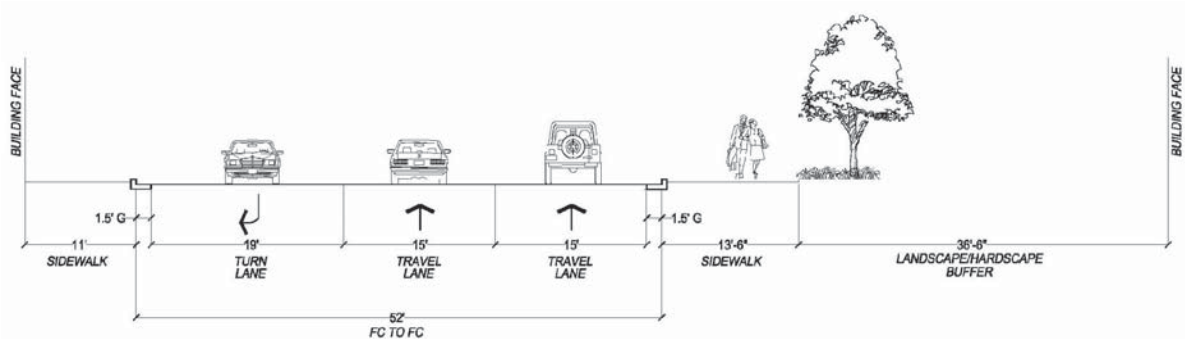


Figure 5.22: Existing cross-section of 12th Street S. looking west between Crystal Drive and S. Clark/Bell Street

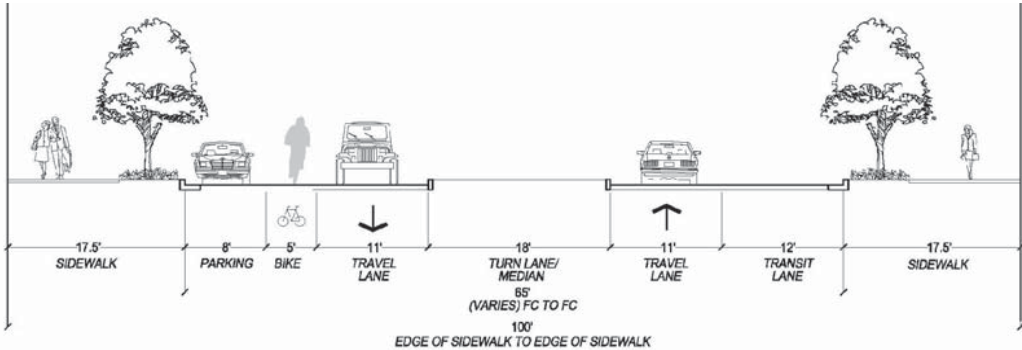


Figure 5.23: Recommended cross-section for 12th Street S. looking west between Crystal Drive and S. Clark/Bell Street

15th Street S.

15th Street S. will be an important east-west connector providing access to and from Crystal City and Jefferson Davis Highway. To accommodate future travel demand this street is proposed to have two travel lanes in each direction, left-turn lanes at intersections, and on-street parking. A median park is planned on 15th Street S. between Crystal Drive and S. Clark/Bell Street. The following items are recommended for 15th Street S.:

- Wide sidewalks and landscaped strips
- On-street parking where right-of-way constraints permit its provision

- Two travel lanes in each direction with left-turn lanes at major intersections
- A median park between Crystal Drive and S. Clark/Bell Street
- A multi-use path in the median park.

The existing cross-section of 15th Street S. looking west between Crystal Drive and S. Clark/Bell Street is shown in **Figure 5.24**. The recommended cross-section of 15th Street S. looking west between Crystal Drive and S. Clark/Bell Street is shown in **Figure 5.25**.

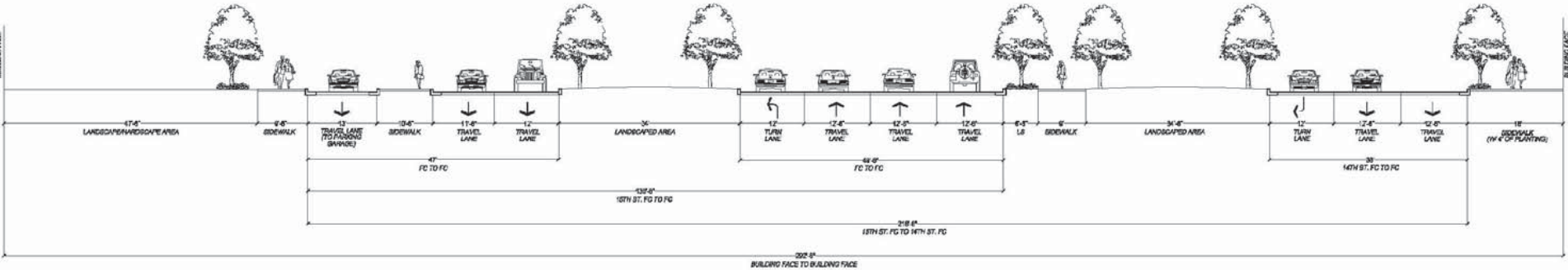


Figure 5.24: Existing cross-section looking west of 15th Street S. and 14th Street S. to the west of Jefferson Davis Highway

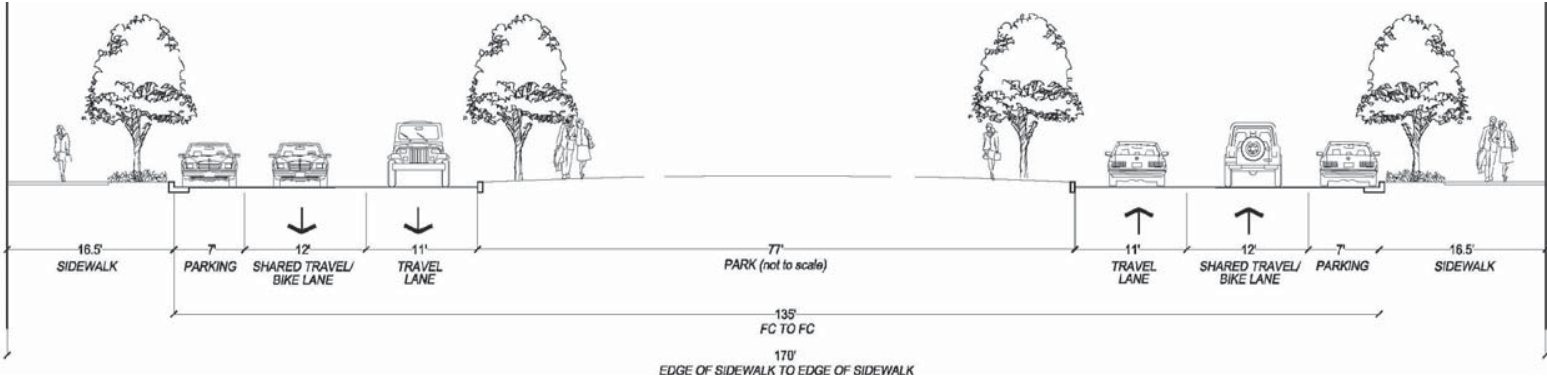


Figure 5.25: Recommended mid-block cross-section of 15th Street S. looking west between Crystal Drive and S. Clark/Bell Street

Note: 14th Street S. is not shown in this cross-section since it is recommended to be removed

18th Street S.

With the location of the Metro entrance on the northeast corner of the 18th Street S./S. Clark/Bell Street intersection, the 18th Street S. and S. Clark/Bell Street corridors will continue to be critical for bus transit in Crystal City. As the number of bus routes and transit services increase in Crystal City, strategic transit-focused improvements are recommended for 18th Street S. These improvements include bus bays and additional amenities—shelters, service information, lighting, and other street furnishings—for waiting passengers. As the recommended transitway alignment is implemented, depending on the pace of redevelopment and street reconstruction, it may run along 18th Street S. The street will need to be adjusted to accommodate initial transitway alignments. The following items are recommended for 18th Street S.:

- Wide sidewalks and landscaped strips
- Striped bicycle lanes in both directions
- Bus bays in the vicinity of the Metro station between S. Clark/Bell Street and S. Eads Street
- Two travel lanes in each direction with left-turn lanes at major intersections
 - Center eastbound travel lane may be a shared travel/transit lane with initial transit alignments

The recommended cross-section of 18th Street S. looking west between Crystal Drive and S. Clark/Bell Street is shown in **Figure 5.26**.

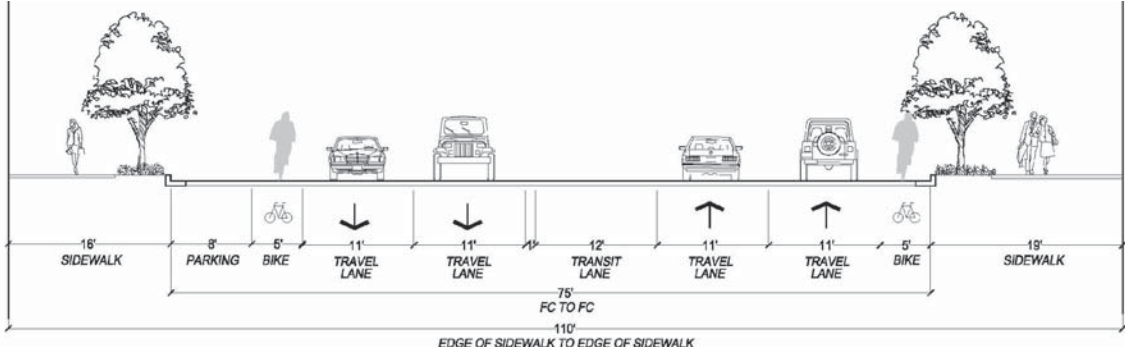


Figure 5.26: Recommended mid-block cross-section of 18th Street S. looking west between Crystal Drive and S. Clark/Bell Street

20th Street S.

20th Street S. will continue to be an essential east-west travel corridor for Crystal City. While the increased spacing between Jefferson Davis Highway and S. Clark/Bell Street will have a tremendous benefit on the operation and capacity of 20th Street S., it will still be important to provide an appropriate number of lanes to serve anticipated travel demand. The following items are recommended for 20th Street S.:

- Wide sidewalks and landscaped strips
- On-street parking where right-of-way constraints permit its provision
- Two travel lanes in each direction and left-turn lanes at intersections

The recommended cross-section of 20th Street S. looking west between Crystal Drive and S. Clark/Bell Street is shown in **Figure 5.27**.

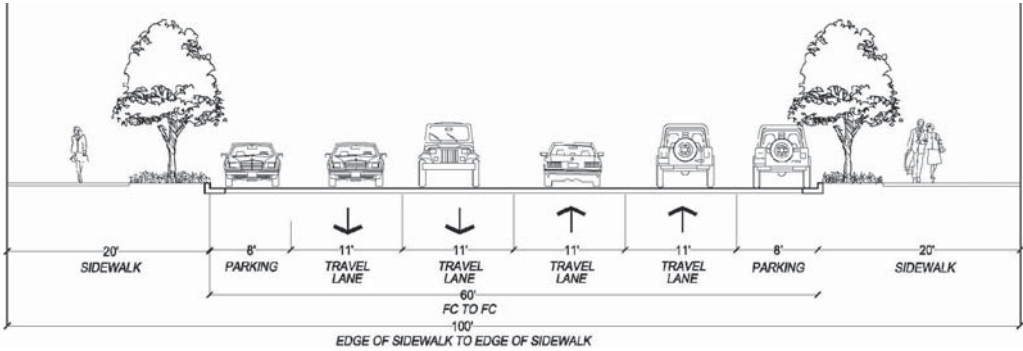


Figure 5.27: Recommended mid-block cross-section for 20th Street S. looking west between Crystal Drive and S. Clark/Bell Street

23rd Street S. South

23rd Street S. will continue to be an essential east-west travel corridor for Crystal City. While the increased spacing between Jefferson Davis Highway and S. Clark/Bell Street will have a tremendous benefit on the operation and capacity of 23rd Street S., it will still be important to provide an appropriate number of lanes to serve anticipated travel demand. As the recommended transitway alignment is implemented, depending on the pace of redevelopment and street reconstruction, it may run along 23rd Street S. The street will need to be adjusted to accommodate initial transitway alignments. The following items are recommended for 23rd Street S.:

- Wide sidewalks and landscaped strips
- On-street parking where right-of-way constraints permit its provision
- Two travel lanes in each direction and left-turn lanes at intersections
 - Outer travel lanes will be shared travel/bicycle lanes
- One eastbound travel lane transit lane with initial transit alignments

The existing cross-section of 23rd Street S. looking west between Crystal Drive and S. Clark/Bell Street is shown in **Figure 5.28**. The recommended cross-section of 23rd Street S. looking west between Crystal Drive and S. Clark/Bell Street is shown in **Figure 5.29**.

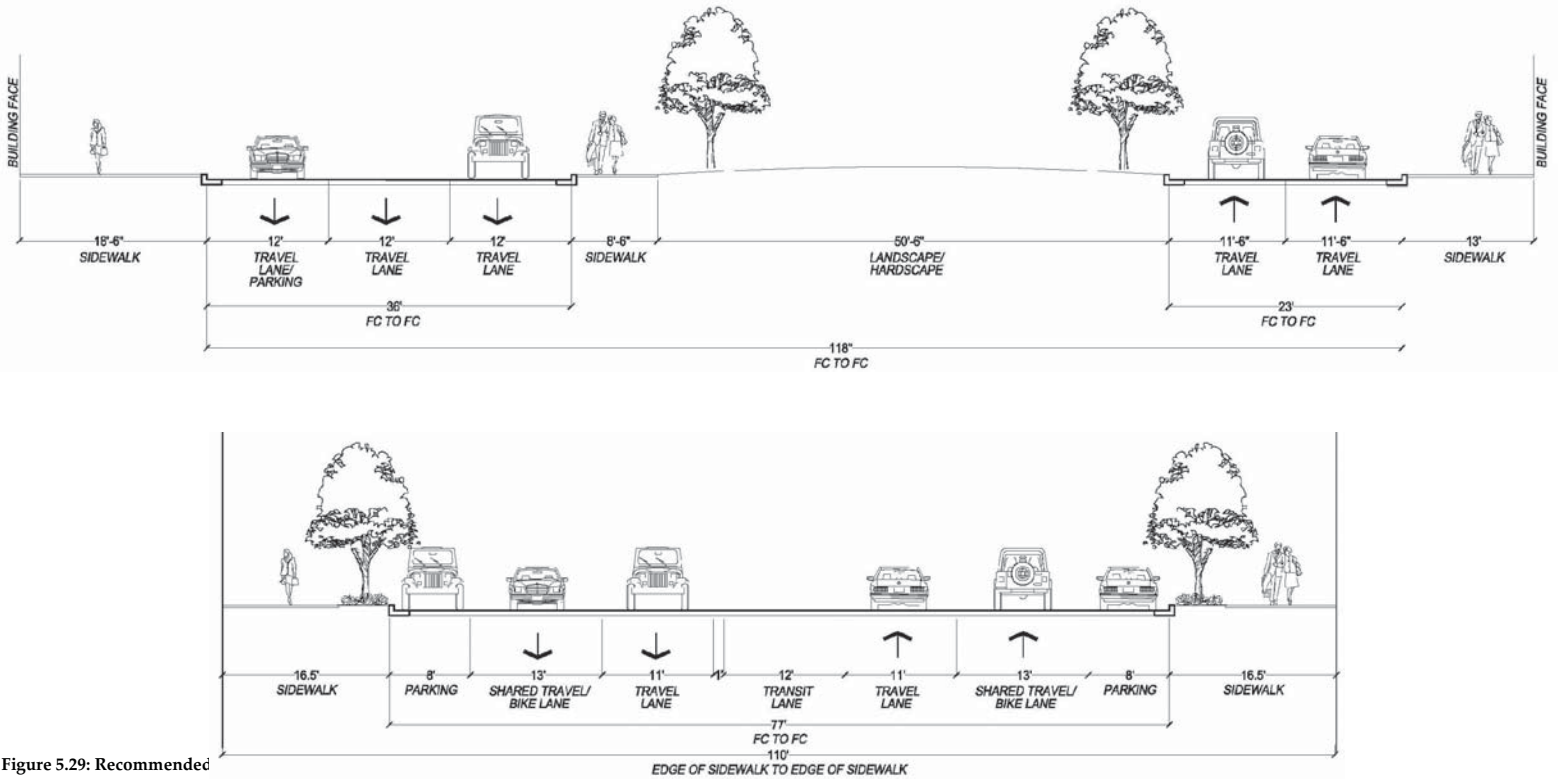


Figure 5.29: Recommended

24th Street S.

This new street will be created when the existing 23rd Street S. to 26th Street S. super block is divided as a part of the sector plan. New streets such as this will be important in improving local pedestrian and vehicular circulation. The following items are recommended for 24th Street S.:

- Wide sidewalks and landscaped strips
- On-street parking
- One travel lane in each direction
- Bike Lanes

The recommended cross-section of 24th Street S. looking west between Crystal Drive and S. Clark/Bell Street is shown in **Figure 5.30**.

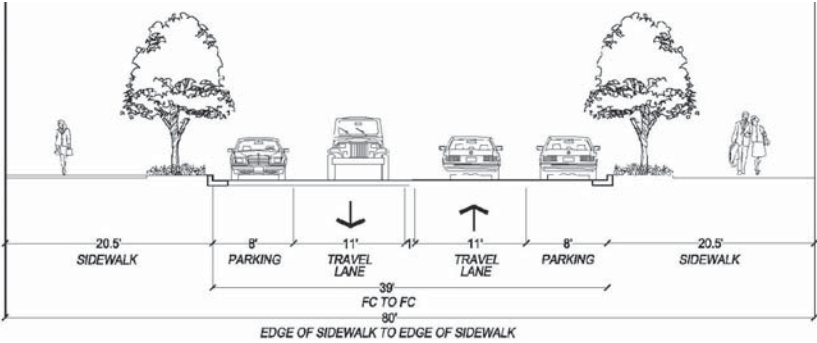


Figure 5.30: Recommended mid-block cross-section for 24th Street S. looking west between Crystal Drive and S. Clark/Bell Street

26th Street S.

With redevelopment, this street will have an increased importance in Crystal City in serving as the southern terminus of S. Clark/Bell Street. Similar to 24th Street S. and other east/west streets, it will be a critical part of the local circulation network. The recommended transitway alignment will run eastbound along 26th Street S. from S. Clark/Bell Street to Crystal Drive. As the transitway is implemented, depending on the pace of redevelopment and street reconstruction, elements will need to be adjusted to accommodate the transitway alignments. The recommended cross-section for 26th Street S. is shown. The following items are recommended for 26th Street S.:

- Wide sidewalks and landscaped strips
- Striped bicycle lane in the westbound direction
- Recommended transitway
- On-street parking
- One travel lane in each direction

The recommended cross-section of 26th Street S. looking west between Crystal Drive and S. Clark/Bell Street is shown in **Figure 5.31**.

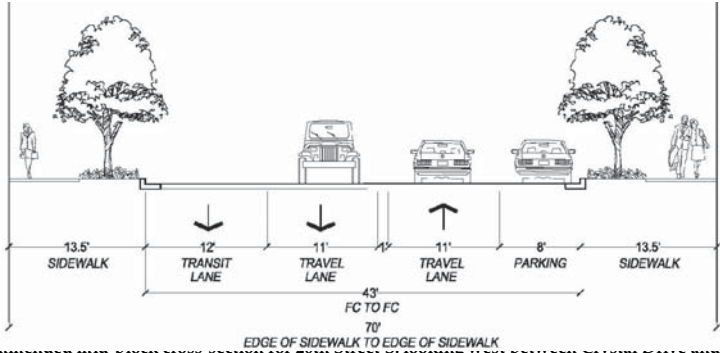


Figure 5.31: Recommended mid-block cross-section for 26th Street S. looking west between Crystal Drive and S. Clark/Bell Street

PHASED TRANSPORTATION IMPROVEMENTS

Redevelopment in Crystal City will offer the opportunity to modify the transportation system to better serve all transportation modes—pedestrians, transit, bicycles, and vehicles. Based on forecasts prepared by Arlington Economic Development (AED), over the next 50 years, buildings will be renovated, reconfigured, or demolished and replaced. Amid this change in the private realm, an improved system of streets, intersections, trails, and transit services will need to emerge in phases in support of new development conditions.

It will not be possible to implement recommended transportation network modifications in a single phase. **Figure 5.32** shows the sector plan for Crystal City with the anticipated redevelopment plan and time horizons. The phases are defined as:

- Phase 1 (2011 to 2015)
- Phase 2 (2016 to 2020)
- Phase 3 (2021 to 2030)
- Phase 4 (2031 to 2040)
- Phase 5 (2041 to 2050)

The Crystal City Sector Plan includes new streets, realignment and reconfiguration of existing streets, and major intersection reconfigurations. The phasing of street improvements is largely depending on the pace of redevelopment and the implementation of the transitway. Major street projects include:

- Jefferson Davis Highway/15th Street S. interchange
- Jefferson Davis Highway/Route 233 interchange
- S. Clark/Bell Street
- Crystal Drive
- 12th Street S.
- 16th Street S.
- 20th Street S.
- 23rd Street S.
- 24th Street S.
- 26th Street S.

This section presents a phased approach to transportation enhancements in Crystal City over an approximately 50-year period.



ARLINGTON COUNTY
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CRYSTAL CITY PLANNING PROCESS

Figure 5.32: Crystal City Potential Redevelopment Phasing

Source: Arlington Economic Development



CRYSTAL CITY
Multimodal Transportation Study

Modifications Prior to Sector Plan Redevelopment

Prior to redevelopment, a number of transportation improvements are recommended to be implemented to mitigate some existing transportation issues in Crystal City and improve conditions for all modes. Recommendations are shown in Figure 5.33 and are briefly described in the following:

Transit

- **Passenger enhancement:**
 - Install additional passenger amenities in the vicinity of the intersection of S. Clark/Bell Street and 18th Street S.
 - Install a covered walkway between the Virginia Railway Express station and Crystal Drive
- **Airport shuttle:** work with the Crystal City BID and hotel industry to support better transit shuttle service between Crystal City and the airport
- **Transitway:** complete the environmental planning and design of the alignment and necessary facilities for the transitway from Potomac Yard through Crystal City to Pentagon City and/or the Pentagon, with dedicated transit lanes for streetcar technology



Retail area along Crystal Drive.

Street Network

- **12th Street S.:** convert from one-way to two-way from S. Clark/Bell Street to Crystal Drive and modify intersections (laneage, pavement markings, and traffic control) to accommodate two-way traffic flow
- **14th Street:** remove/minimize between S. Clark/Bell Street and 15th Street S.
- **Clark/Bell ramps:** remove (demolish or block with barriers temporarily) the S. Clark/Bell Street ramps and Clark Street bridge along the east side of Jefferson Davis Highway approximately between 18th Street S. and 12th Street S.
- **Crystal Drive:** convert from one-way to two-way in the following sections:
 - 12th Street S. to 15th Street S.
 - 23rd Street S. to 26th Street S.
- **Crystal Drive:** support two-way (and modified) traffic flow by modifying traffic control, laneage, and pavement markings at the following intersections:
 - Crystal Drive/15th Street S.
 - Crystal Drive/23rd Street S.
 - Crystal Drive/26th Street S.
- **Crystal Drive/Jefferson Davis Highway intersection:** construct intersection modifications to better define vehicular turning movements, reduce vehicle turning speeds, and improve pedestrian and bicycle safety
- **Old Jefferson Davis Highway:** reconstruct the roadway north of 12th Street S.

Pedestrian and Bicycle

- **Trail connection:** construct a trail connection from the Four Mile Run Trail to Potomac Yard; study and coordinate with the National Park Service and Metropolitan Washington Airports Authority the construction of a high-quality bicycle and pedestrian trail connection between Crystal City and the airport
- **Bicycle lanes:** stripe bicycle lanes on the following streets:
 - *Old Jefferson Davis Highway:* north of 12th Street S.
 - *12th Street S.:* from S. Clark/Bell Street to Crystal Drive (tie into existing bicycle lanes on Crystal Drive)
 - *Crystal Drive:* from 23rd Street S. to 33rd Street S.
- **Bicycle sharing:** install bicycle stations every 4 blocks with approximately 20 bikes per station

- **Bicycle parking:** install bike parking shelters periodically throughout Crystal City (the Metrorail Station and two to three other locations)
- **Complete streets:** enhance amenities on the following streets to improve multimodal accommodation:
 - *12th Street S.:* Army Navy Drive to Old Jefferson Davis Highway (include striped bicycle lanes)
 - *Army Navy Drive:* Joyce Street to 12th Street S.(include striped bicycle lanes)
 - *S. Clark/Bell Street:* 12th Street S. to 18th Street S. (mid block and intersections)
 - *S. Clark/Bell Street:* Street S. to 27th Street S. (mid block and intersections)
- **Streetscape:** improve streetscape (sidewalks, landscaping, lighting, and general appearance) at the following locations:
 - Under the Route 233 Viaduct (between one-way sections of 26th Street S.)
 - On 18th Street S. approaching and under the bridge for Jefferson Davis Highway
 - On 12th Street S. approaching and under the bridge for Jefferson Davis Highway

Planning level costs (in current, 2009, dollars) were developed for elements in this phase. The order-of-magnitude cost for this phase is \$14,500,000. Costs that were prepared exclude existing structure modifications, ramp demolition, transit station modifications, new transit services, all transitway elements, operations and maintenance, underground utility relocation or betterment, right-of-way or building costs, study costs, design, and any non-transportation elements of construction. Costs should be used for general long-term planning only. More detailed studies will be needed to determine the specifics of individual projects and for programming.



Phase 1 (2011 to 2015)

Figure 5.34 illustrates recommended transportation improvements for the phase 1 redevelopment of Crystal City. Additionally, recommendations are described in the following:

Transit

- **Transitway:** construct the recommended streetcar transitway alignment from Potomac Yard through Crystal City to Pentagon City and/or the Pentagon Street S. with dedicated transit lanes for streetcar technology. As a probable initial alignment of the recommended streetcar transitway, the eastbound leg of the couplet may run along 18th Street S.
- **On-street transit facility on 18th Street S.:** provide curb bus bays on 18th Street S. between Jefferson Davis Highway and Crystal Drive either east or west of S. Clark/Bell Street
- **Metrorail station covered connection:** construct covered connection from the linear park along 18th Street S. to a portal to the Crystal City Underground to provide a sheltered path from Crystal Drive to the Metrorail station. The ability to construct a covered connection does not depend on redevelopment of land at 18th Street and Crystal Drive; however, significant improvements to the capacity of the station would depend upon the ability to redevelop this land parcel.

Street Network

- **27th Street S.:** reconstruct as a two-way street with traffic signals at Jefferson Davis Highway and Crystal Drive
- **23rd Street S.:** reconstruct between S. Eads Street and Crystal Drive consistent with the description in **Table 5.1**
- **18th Street S.:** reconstruct between S. Eads Street and Crystal Drive consistent with the description in **Table 5.1**
- **12th Street S.:** extend from Fern Street to Eads Street
- **S. Eads Street:** reconstruct between 23rd Street S. and 15th Street S. consistent with the description in **Table 5.1**
- **S. Clark/Bell Street:** reconstruct and convert to two-way between 12th Street S. to 18th Street S. consistent with the description in **Table 5.1**

Pedestrian and Bicycle

- **Trail:** construct a trail connection in the vicinity of the 10th Street S. /Crystal Drive intersection to the Long Bridge Park Esplanade
- **Trail connection:** construct a high-quality bicycle and pedestrian trail connection between Crystal City and the airport
- **Bicycle facilities:** provide bicycle facilities on the following streets concurrent with street reconstruction:
 - **23rd Street S.:** shared travel/bicycle lanes

- **18th Street S.:** striped bicycle lanes
- **S. Eads Street:** striped bicycle lanes

Phase 2 (2016 to 2020)

Figure 5.35 illustrates recommended transportation improvements for the phase 2 redevelopment of Crystal City. Additionally, recommendations are described in the following:

Transit

- **Transitway:** depending upon the pace of redevelopment and street realignment, extend the streetcar transitway southbound on S. Clark/Bell Street to 23rd Street S. where the transitway would extend to Crystal Drive
- **Metrorail station second entrance:** design and construct a new entrance to the Crystal City Metrorail Station in the vicinity of Crystal Drive and 18th Street S. The second entrance may be delayed by the pace of adjacent development
- **Intercity train:** study opportunity to provide local train service in coordination with VRE and potential service providers.

Street Network

- **S. Clark/Bell Street:** reconstruct or reconfigure and convert to two-way between 27th Street S. to 18th Street S. consistent with the description in **Table 5.1**
 - Reconstruct the street on new location between 23rd Street S. and 20th Street S.
 - Modify intersections of S. Clark/Bell Street and 23rd Street S.
- **26th Street S.:** reconstruct between Crystal Drive and S. Clark/Bell Street consistent with the description in **Table 5.1**
- **20th Street S.:** reconstruct between S. Eads Street and Crystal Drive consistent with the description in **Table 5.1**
- **10th Street S.:** extend to Crystal Drive and install appropriate measures to manage vehicle speeds and volume
- **Route 233 viaduct off-ramp to Crystal Drive:** remove ramp

Pedestrian and Bicycle

- **Bicycle facilities:** provide bicycle facilities on the following streets concurrent with street reconstruction:
 - **S. Clark/Bell Street:** cycle track in the northbound direction (or striped bicycle lane)
 - **26th Street S.:** shared travel/bicycle lane in the westbound direction

The order-of-magnitude cost (in current, 2009, dollars) for phases 1 and 2 are the following:

- Phase 1: \$23,500,000
- Phase 2: \$22,500,000

Costs that were prepared exclude existing structure modifications, ramp demolition, transit station modifications, new transit services, all transitway elements, operations and maintenance, underground utility relocation or betterment, right-of-way or building costs, study costs, design, and any non-transportation elements of construction. Costs should be used for general long-term planning only. More detailed studies will be needed to determine the specifics of individual projects and for programming.



Jefferson Davis Highway looking south toward 23rd Street S.



Phase 3 (2021 to 2030)

Figure 5.36 illustrates recommended transportation improvements for the phase 3 redevelopment of Crystal City. Additionally, recommendations are described in the following:

Transit

- **Transitway:** depending on the pace of redevelopment and street reconstruction, modify the alignment so that the eastbound leg of the recommended transitway alignment couplet will run along 23rd Street S.
- **Crystal City Circulator Transit:** study the potential to develop a transit circulator service between Metro, VRE, the transitway, and the airport
- **Metrorail station second entrance:** If not constructed in phase 2, construct the entrance in this phase

Street Network

- **24th Street S.:** construct on new location between Crystal Drive and S. Clark/Bell Street consistent with the description in **Table 5.1**

Pedestrian and Bicycle

- **Route 233 viaduct pedestrian facility – airport to Crystal Drive:** construct a pedestrian and bicycle facility parallel to (or on the structure) the Route 233 viaduct. Provide vertical circulation to the Mount Vernon Trail and Crystal Drive



Section of existing Crystal Drive with bike lanes

Phase 4 (2031 to 2040)

Figure 5.37 illustrates recommended transportation improvements for phase 4 of Crystal City. Additionally, recommendations are described in the following:

Transit

- **Transitway:** depending on the pace of redevelopment and street reconstruction, extend the streetcar transitway southbound on S. Clark/Bell Street so that the eastbound leg of the recommended transitway alignment couplet will run along 26th Street S.
- **Transit concourse:** construct a direct, weather protected pedestrian connection between Metro, VRE, and the transitway
- **VRE station upgrade:** reconstruct the VRE station to be fully enclosed with a high platform for passenger loading
- **Crystal City Circulator Transit:** continue to study the potential to develop a transit circulator service between Metro, VRE, the transitway, and the airport

Street Network

- **Jefferson Davis Highway:** reconstruct as a six-lane boulevard between S. Glebe Road and 27th Street S. and between 23rd Street S. and 12th Street S.
- **Jefferson Davis Highway/15th Street S. interchange:** reconstruct as a single-point interchange
- **S. Clark/Bell Street:** realign from 23rd Street S. to 24th Street S. and install a traffic signal at the S. Clark/Bell Street/23rd Street S. intersection
- **23rd Street S.:** reconstruct from S. Eads Street to Jefferson Davis Highway consistent with the description in **Table 5.1**
- **16th Street S.:** construct on new location from S. Clark/Bell Street to the mid-block consistent with the description in **Table 5.1**
- **15th Street S.:** reconstruct between S. Eads Street and Crystal Drive consistent with the description in **Table 5.1**

Pedestrian and Bicycle

- **Bicycle facilities:** provide bicycle facilities on the following streets concurrent with street reconstruction:
 - *S. Clark/Bell Street:* cycle track in the northbound direction (or striped bicycle lane) between 23rd Street S. and 24th Street S.
 - *15th Street S.:* shared travel/bicycle lanes

Phase 5 and Beyond (2041 to 2050 and Beyond)

Figure 5.38 illustrates recommended transportation improvements for phase 5 and beyond of Crystal City. Additionally, recommendations are described in the following:

Transit

- **MARC extension:** extend MARC service to Crystal City from Union Station

Street Network

- **Jefferson Davis Highway:** reconstruct as a six-lane boulevard between 27th Street S. and 23rd Street S.
- **Jefferson Davis Highway/Route 233 interchange:** reconstruct as a traffic circle interchange and reconstruct the Route 233 viaduct between Jefferson Davis Highway and Crystal Drive (minimum)
- **S. Clark/Bell Street:** reconstruct the street from 26th Street S. to 27th Street S. The street should be depressed with clearance for the future Route 233 (Airport Viaduct) reconstruction.
- **24th Street S.:** extend the street to the west of S. Clark/Bell Street
- **23rd Street S.:** reconstruct from S. Fern Street to S. Eads Street consistent with the description in **Table 5.1**

Pedestrian and Bicycle

- **Route 233 viaduct pedestrian facility – Crystal Drive to Jefferson Davis Highway:** construct a pedestrian and bicycle facility parallel to (or on the structure) the Route 233 viaduct
- **Connection:** provide an adequate trail connection through the reconstructed Jefferson Davis Highway/Route 233 interchange to S. Eads Street
- **Crystal City connector tunnel:** enhance existing tunnel under the CSX/VRE railroad corridor to the Mount Vernon Trail
- **Bicycle lanes:** stripe bicycle lanes on S. Clark/Bell Street concurrent with street reconstruction between 26th Street S. and 27th Street S.

The order-of-magnitude cost (in current, 2009, dollars) for phases 3, 4, and 5 are the following:

- Phase 3: \$1,000,000
- Phase 4: \$159,000,000
- Phase 5: \$165,000,000

Costs that were prepared exclude existing structure modifications, ramp demolition, transit station modifications, new transit services, all transitway elements, operations and maintenance, underground utility relocation or betterment, right-of-way or building costs, study costs, design, and any non-transportation elements of construction. Costs should be used for general long-term planning only. More detailed studies will be needed to determine the specifics of individual projects and for programming.

Transit

1. Install additional passenger amenities in the vicinity of the 18th Street/Clark/Bell Street intersection.
2. Install a covered walkway between the VRE station and Crystal Drive.
3. Support transit shuttle service between Crystal City and the airport.
4. Complete environmental planning and design of transitway

Street Network

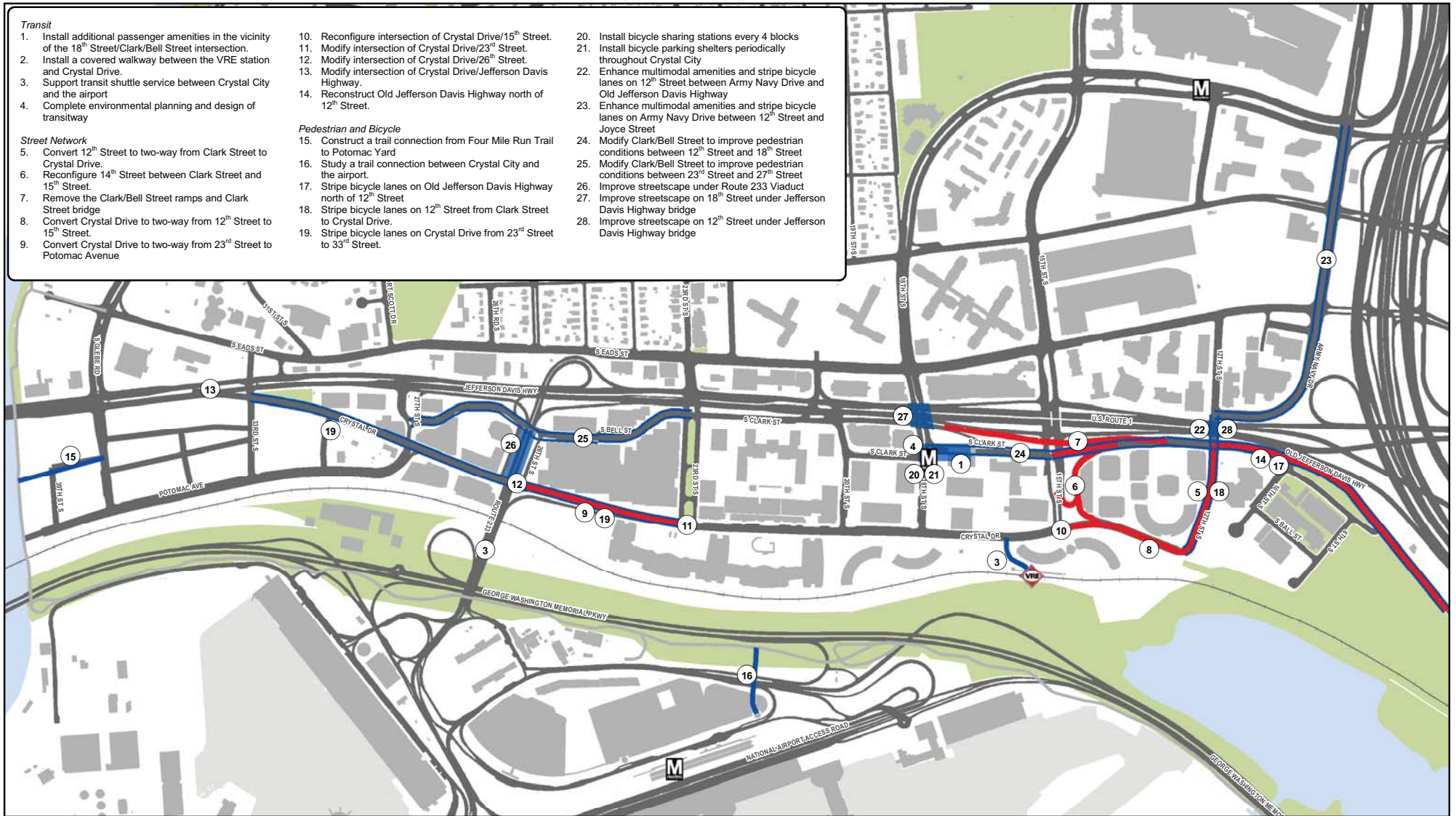
5. Convert 12th Street to two-way from Clark Street to Crystal Drive.
6. Reconfigure 14th Street between Clark Street and 15th Street.
7. Remove the Clark/Bell Street ramps and Clark Street bridge
8. Convert Crystal Drive to two-way from 12th Street to 15th Street.
9. Convert Crystal Drive to two-way from 23rd Street to Potomac Avenue

10. Reconfigure intersection of Crystal Drive/15th Street.
11. Modify intersection of Crystal Drive/23rd Street.
12. Modify intersection of Crystal Drive/26th Street.
13. Modify intersection of Crystal Drive/Jefferson Davis Highway.
14. Reconstruct Old Jefferson Davis Highway north of 12th Street.

Pedestrian and Bicycle

15. Construct a trail connection from Four Mile Run Trail to Potomac Yard
16. Study a trail connection between Crystal City and the airport.
17. Stripe bicycle lanes on Old Jefferson Davis Highway north of 12th Street
18. Stripe bicycle lanes on 12th Street from Clark Street to Crystal Drive.
19. Stripe bicycle lanes on Crystal Drive from 23rd Street to 33rd Street.

20. Install bicycle sharing stations every 4 blocks
21. Install bicycle parking shelters periodically throughout Crystal City
22. Enhance multimodal amenities and stripe bicycle lanes on 12th Street between Army Navy Drive and Old Jefferson Davis Highway
23. Enhance multimodal amenities and stripe bicycle lanes on Army Navy Drive between 12th Street and Joyce Street
24. Modify Clark/Bell Street to improve pedestrian conditions between 12th Street and 18th Street
25. Modify Clark/Bell Street to improve pedestrian conditions between 23rd Street and 27th Street
26. Improve streetscape under Route 233 Viaduct
27. Improve streetscape on 18th Street under Jefferson Davis Highway bridge
28. Improve streetscape on 12th Street under Jefferson Davis Highway bridge



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Legend

- Existing Trail
- Bicycle and Pedestrian Connections Prior to Redevelopment
- Projects Prior to Redevelopment
- Existing Streets
- Existing Buildings

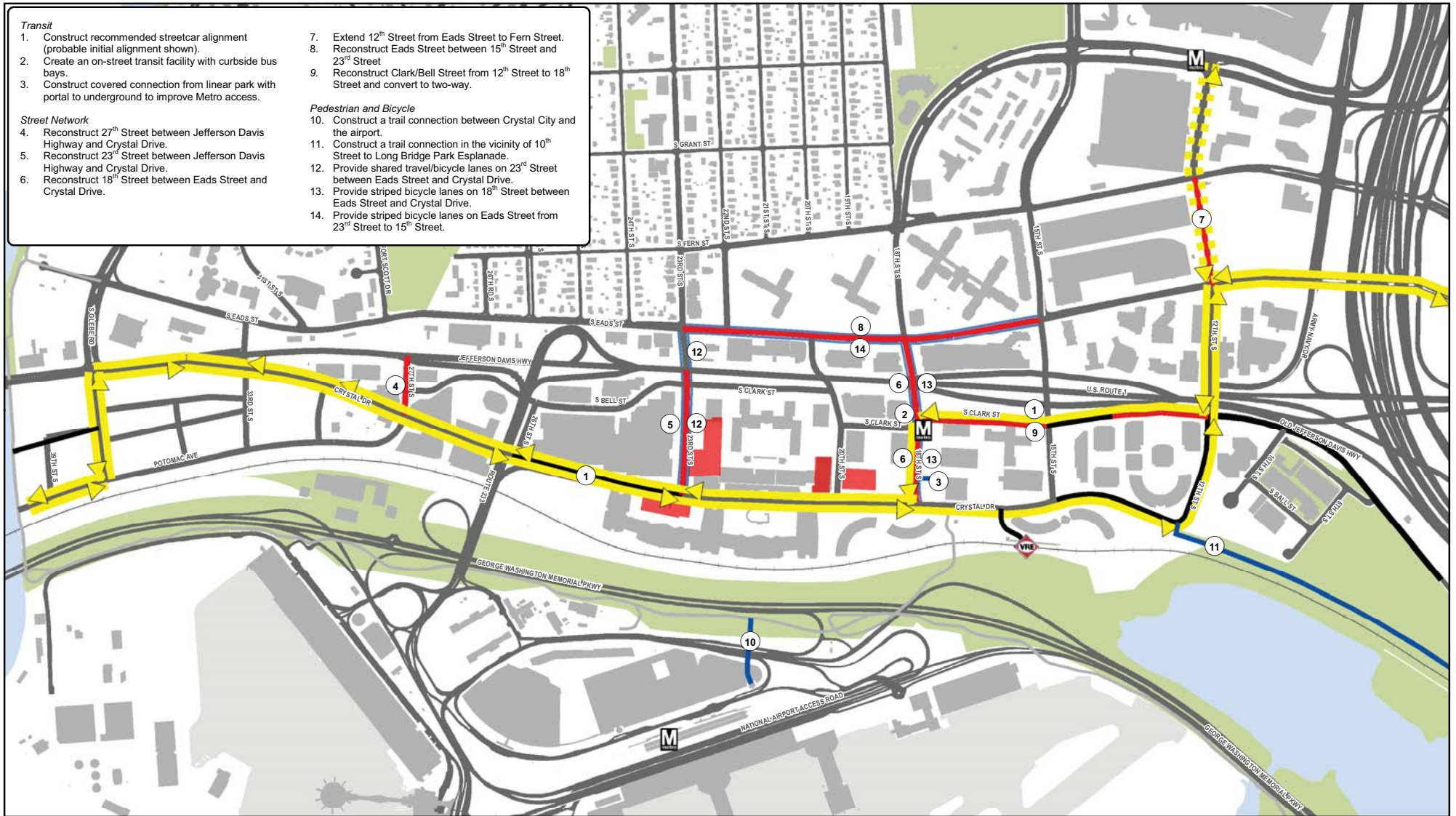
CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY
Transportation Modifications Prior to Redevelopment
Figure 5.33

- Transit**
1. Construct recommended streetcar alignment (probable initial alignment shown).
 2. Create an on-street transit facility with curbside bus bays.
 3. Construct covered connection from linear park with portal to underground to improve Metro access.

- Street Network**
4. Reconstruct 27th Street between Jefferson Davis Highway and Crystal Drive.
 5. Reconstruct 23rd Street between Jefferson Davis Highway and Crystal Drive.
 6. Reconstruct 18th Street between Eads Street and Crystal Drive.

7. Extend 12th Street from Eads Street to Fern Street.
8. Reconstruct Eads Street between 15th Street and 23rd Street.
9. Reconstruct Clark/Bell Street from 12th Street to 18th Street and convert to two-way.

- Pedestrian and Bicycle**
10. Construct a trail connection between Crystal City and the airport.
 11. Construct a trail connection in the vicinity of 10th Street to Long Bridge Park Esplanade.
 12. Provide shared travel/bicycle lanes on 23rd Street between Eads Street and Crystal Drive.
 13. Provide striped bicycle lanes on 18th Street between Eads Street and Crystal Drive.
 14. Provide striped bicycle lanes on Eads Street from 23rd Street to 15th Street.



Legend

- █ Phase 1 Projects
- █ Previous Phase Projects
- █ Existing Streets
- Existing Trail
- Previous Phase Bicycle and Pedestrian Connections
- Phase 1 Bicycle and Pedestrian Connections

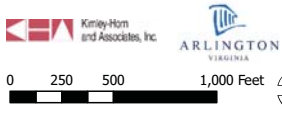
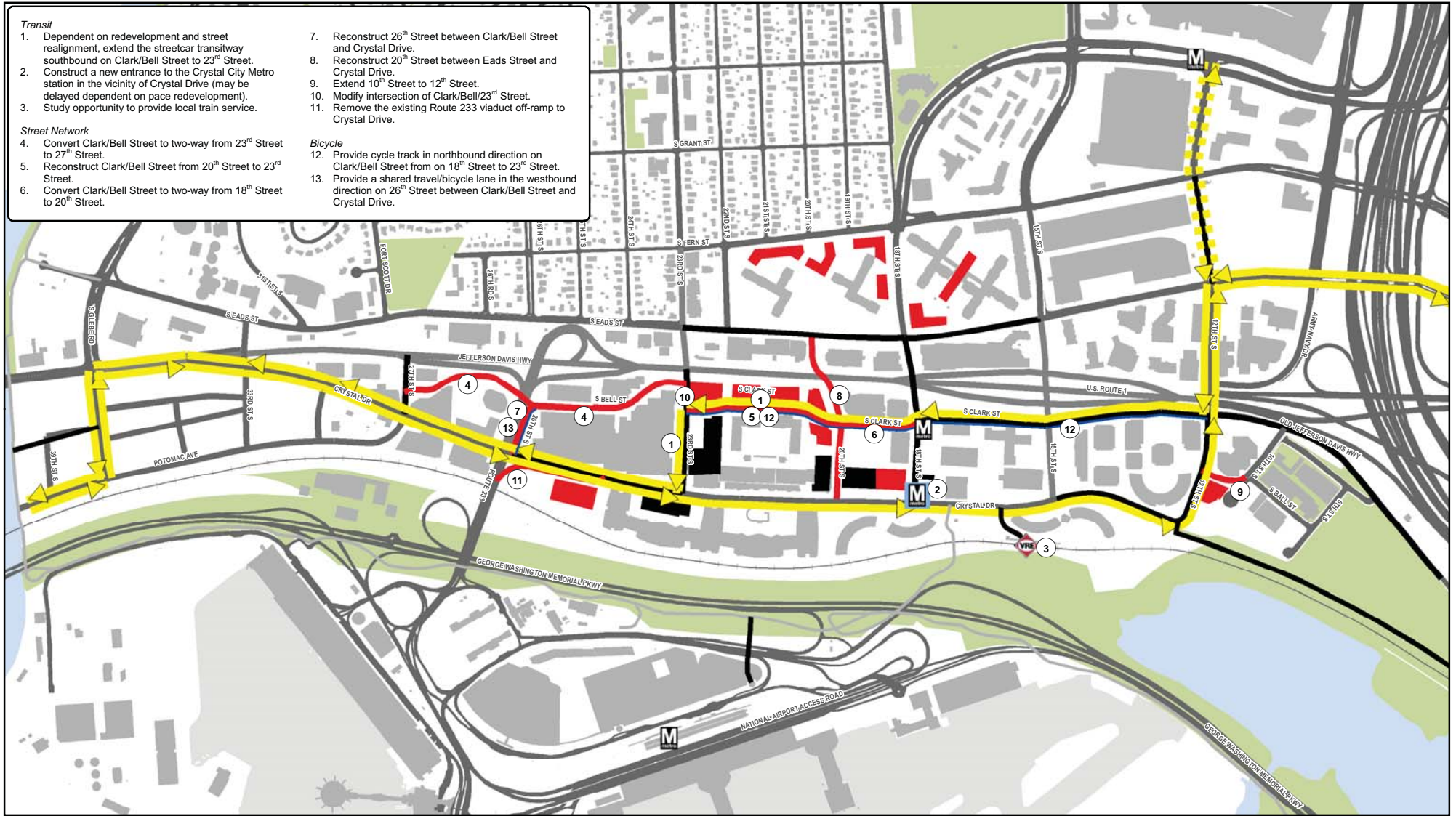
- █ Phase 1 Redevelopment
 - █ Existing Buildings
 - Planned Transitway
 - - - Proposed Transitway
- * Implementation of Phase 1 transitway is dependent on the availability of funding

CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

Phase 1 Transportation Improvements (2011 to 2015)

Figure 5.34

- Transit**
1. Dependent on redevelopment and street realignment, extend the streetcar transitway southbound on Clark/Bell Street to 23rd Street.
 2. Construct a new entrance to the Crystal City Metro station in the vicinity of Crystal Drive (may be delayed dependent on pace redevelopment).
 3. Study opportunity to provide local train service.
- Street Network**
4. Convert Clark/Bell Street to two-way from 23rd Street to 27th Street.
 5. Reconstruct Clark/Bell Street from 20th Street to 23rd Street.
 6. Convert Clark/Bell Street to two-way from 18th Street to 20th Street.
 7. Reconstruct 26th Street between Clark/Bell Street and Crystal Drive.
 8. Reconstruct 20th Street between Eads Street and Crystal Drive.
 9. Extend 10th Street to 12th Street.
 10. Modify intersection of Clark/Bell/23rd Street.
 11. Remove the existing Route 233 viaduct off-ramp to Crystal Drive.
- Bicycle**
12. Provide cycle track in northbound direction on Clark/Bell Street from on 18th Street to 23rd Street.
 13. Provide a shared travel/bicycle lane in the westbound direction on 26th Street between Clark/Bell Street and Crystal Drive.



Legend

- █ Phase 2 Projects
 - █ Previous Phase Projects
 - █ Existing Streets
 - █ Phase 2 Redevelopment
 - █ Previous Phase Redevelopment
 - █ Existing Buildings
 - Existing Trail
 - Previous Phase Bicycle and Pedestrian Connections
 - Phase 2 Bicycle and Pedestrian Connections
 - Planned Transitway
 - - - Proposed Transitway
 - M Metro Second Entrance*
- * Second Metro Entrance may not be necessary in this phase

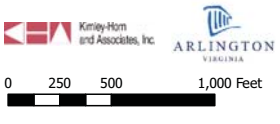
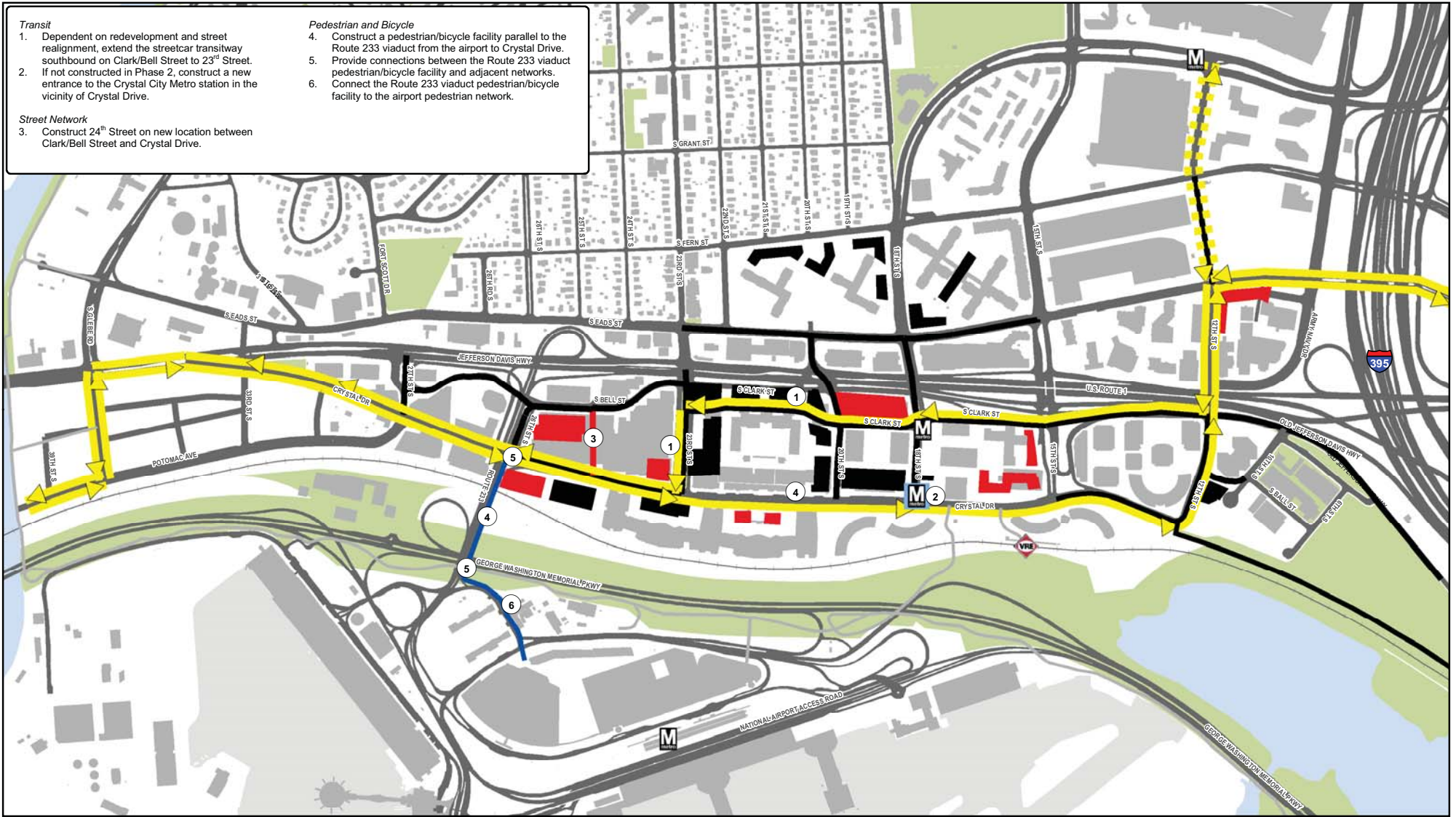
CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

Phase 2 Transportation Improvements (2016 to 2020)

Figure 5.35

- Transit**
1. Dependent on redevelopment and street realignment, extend the streetcar transitway southbound on Clark/Bell Street to 23rd Street.
 2. If not constructed in Phase 2, construct a new entrance to the Crystal City Metro station in the vicinity of Crystal Drive.
- Street Network**
3. Construct 24th Street on new location between Clark/Bell Street and Crystal Drive.

- Pedestrian and Bicycle**
4. Construct a pedestrian/bicycle facility parallel to the Route 233 viaduct from the airport to Crystal Drive.
 5. Provide connections between the Route 233 viaduct pedestrian/bicycle facility and adjacent networks.
 6. Connect the Route 233 viaduct pedestrian/bicycle facility to the airport pedestrian network.



Legend

- Phase 3 Projects
- Previous Phase Projects
- Existing Streets
- Phase 3 Redevelopment
- Previous Phase Redevelopment
- Existing Buildings
- Existing Trail
- Previous Phase Bicycle and Pedestrian Connections
- Phase 3 Bicycle and Pedestrian Connections
- Transitway
- Proposed Transitway
- M Metro Second Entrance*
* Second Metro Entrance may not be necessary in this phase

CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY
Phase 3 Transportation Improvements (2021 to 2030)

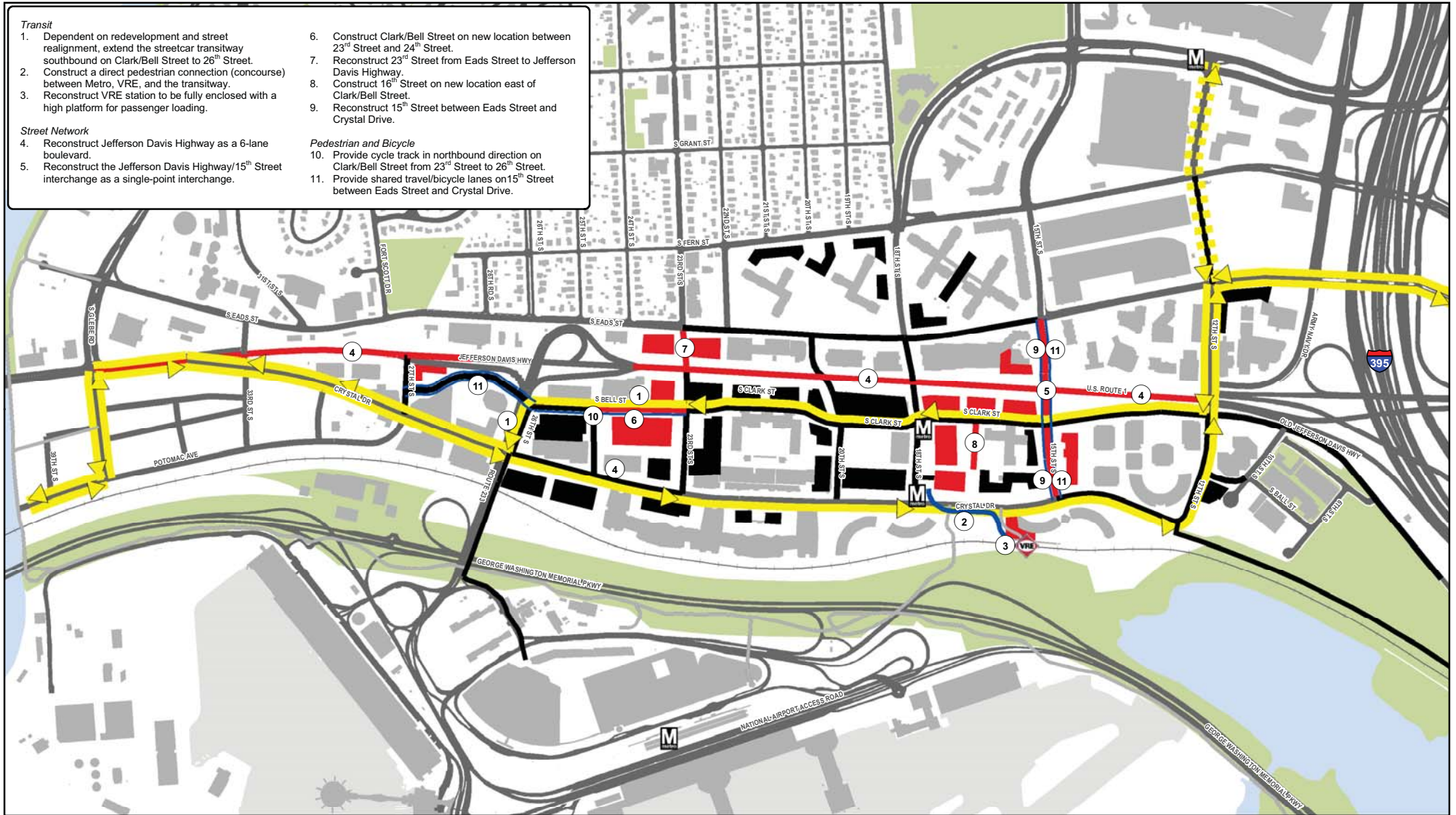
Figure 5.36

- Transit**
1. Dependent on redevelopment and street realignment, extend the streetcar transitway southbound on Clark/Bell Street to 26th Street.
 2. Construct a direct pedestrian connection (concourse) between Metro, VRE, and the transitway.
 3. Reconstruct VRE station to be fully enclosed with a high platform for passenger loading.

- Street Network**
4. Reconstruct Jefferson Davis Highway as a 6-lane boulevard.
 5. Reconstruct the Jefferson Davis Highway/15th Street interchange as a single-point interchange.

6. Construct Clark/Bell Street on new location between 23rd Street and 24th Street.
7. Reconstruct 23rd Street from Eads Street to Jefferson Davis Highway.
8. Construct 16th Street on new location east of Clark/Bell Street.
9. Reconstruct 15th Street between Eads Street and Crystal Drive.

- Pedestrian and Bicycle**
10. Provide cycle track in northbound direction on Clark/Bell Street from 23rd Street to 26th Street.
 11. Provide shared travel/bicycle lanes on 15th Street between Eads Street and Crystal Drive.



Legend

- | | | |
|-------------------------|------------------------------|---|
| Phases 4 Projects | Phase 4 Redevelopment | Existing Trail |
| Previous Phase Projects | Previous Phase Redevelopment | Previous Phase Bicycle and Pedestrian Connections |
| Existing Streets | Existing Buildings | Planned Transitway |
| | | Proposed Transitway |
| | | Phase 4 Bicycle and Pedestrian Connections |

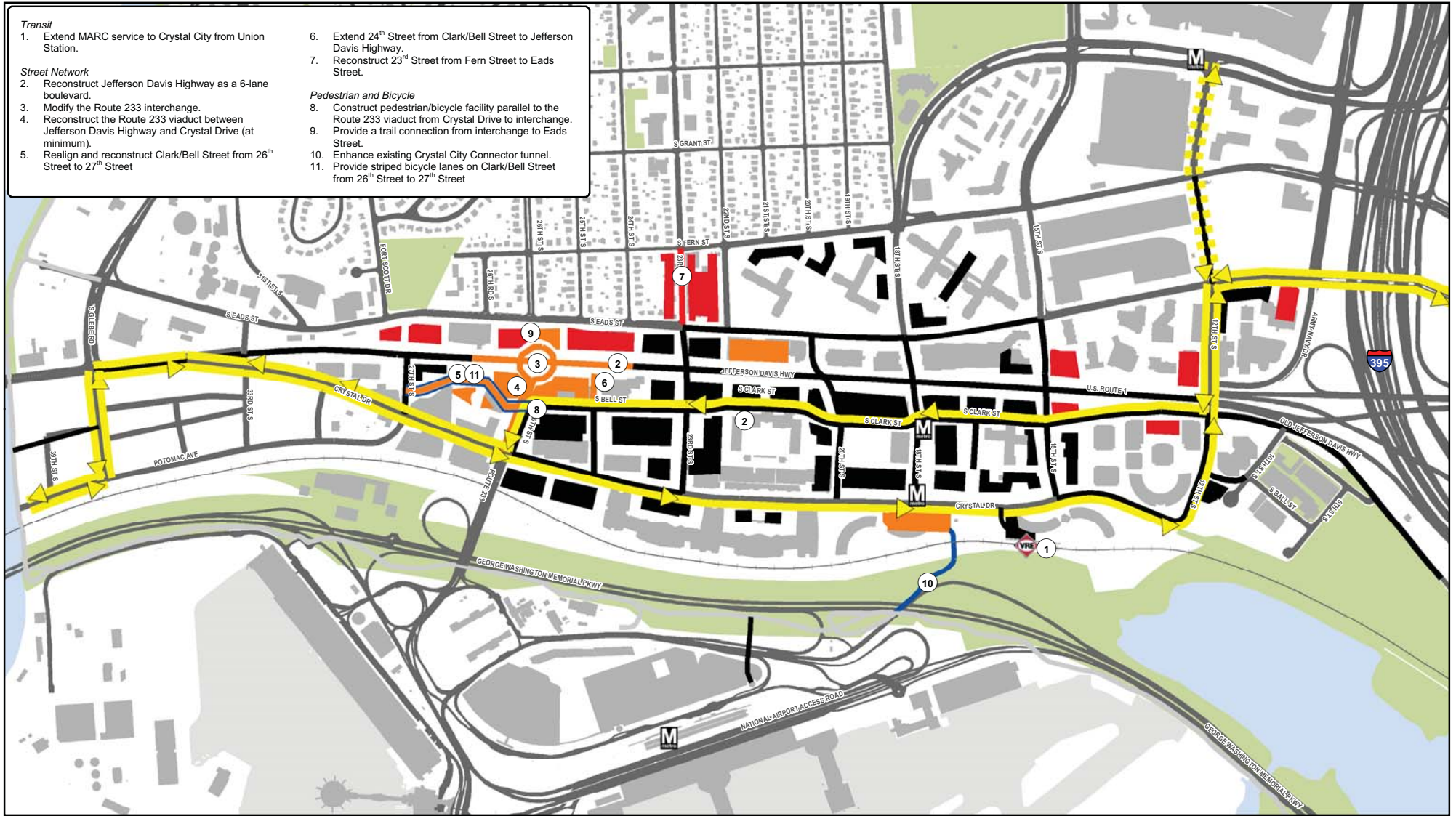


CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

Phase 4 Transportation Improvements (2031 to 2040)

Figure 5.37

- Transit**
1. Extend MARC service to Crystal City from Union Station.
- Street Network**
2. Reconstruct Jefferson Davis Highway as a 6-lane boulevard.
 3. Modify the Route 233 interchange.
 4. Reconstruct the Route 233 viaduct between Jefferson Davis Highway and Crystal Drive (at minimum).
 5. Realign and reconstruct Clark/Bell Street from 26th Street to 27th Street
- Pedestrian and Bicycle**
6. Extend 24th Street from Clark/Bell Street to Jefferson Davis Highway.
 7. Reconstruct 23rd Street from Fern Street to Eads Street.
 8. Construct pedestrian/bicycle facility parallel to the Route 233 viaduct from Crystal Drive to interchange.
 9. Provide a trail connection from interchange to Eads Street.
 10. Enhance existing Crystal City Connector tunnel.
 11. Provide striped bicycle lanes on Clark/Bell Street from 26th Street to 27th Street



- Legend**
- Phase 5 Projects
 - Projects Beyond Phase 5
 - Previous Phase Projects
 - Existing Streets
 - Phase 5 Redevelopment
 - Redevelopment Beyond Phase 5
 - Previous Phase Redevelopment
 - Existing Buildings
 - Existing Trail
 - Existing Phase Bicycle and Pedestrian Connections
 - Phase 5 and Beyond Bicycle, Pedestrian, and Transit Connections
 - Planned Transitway
 - Proposed Transitway

CRYSTAL CITY MULTIMODAL TRANSPORTATION STUDY

Phase 5 and Beyond Transportation Improvements (2041 to 2050 and Beyond)

Figure 5.38

PARKING

Parking and curb space are valuable resources in the dense urban built environment of Crystal City. Currently there is intense competition for curb space between various users and double parked vehicles are a common sight. A recent survey showed that there are over 700 metered on-street parking spaces in Crystal City, and half of these support all-day parking (12 hour meters). Additionally, there are over 20,000 off-street spaces located in about 60 garages or parking lots. Parking and curb space issues will need to be addressed for each development or redevelopment project.

While the majority of Crystal City is densely developed, some sites west of Jefferson Davis Highway have lower density development with surface lots. A study of the retail area along S. 23rd St was undertaken in 2005. The study showed that while on-street parking spaces were often congested, spaces in private lots were underutilized. Employees often competed with customers for parking spaces, further constricting the supply of convenient parking. Management of parking and curb space is essential to advance the economic competitiveness of the area.

Curb Side Uses

The optimum configuration of curb space is depending on the specific land uses and businesses served. The recommended curb side uses could vary by block. In general, the highest priority will be given to safety features like fire hydrants, curb nubs for pedestrians, and sight lines for drivers. The next priority would be for public multi-user vehicles (e.g. bus stops and taxi-stands), followed by periodic/temporary uses (e.g. car-share, shuttles and private buses, vending, loading and deliveries, and slug lines), dedicated short-term parking (e.g. paratransit drop off and short term meters), and lastly the long-term parking of vehicles (e.g. tour buses, valet parking and all-day meters). This order of priority ensures that each space maximizes its potential to support the transportation infrastructure, advance the economic well-being of the County, and serve the greatest number of users.

Time restrictions and designation of spaces may be used to optimize the use of curb space and to give priority to the appropriate users at appropriate times. In such a high-demand area, the County anticipates charging for curb space use through permits or meters.

As sites develop or redevelop, curb space uses must be re-evaluated and reconfigured appropriately. Additional parking opportunities may be created along street frontages by replacing single-space meters and delineated parking space lines with multi-space meters and parking lanes without delineated

spaces. New parking lanes or spaces may be created by restriping existing streets and narrowing overly-wide travel lanes. Remnant areas in parking lanes or garages may be dedicated for the exclusive use of small vehicles such as scooters, bicycles, and motorcycles. Street features such as curb nubs, fire hydrants and bus stops must be appropriately located to maximize available curb space length and versatility. The number and sizes of driveway curb cuts must be minimized in order to achieve longer lengths of available curb space.

With increased street-level retail and businesses, the demand for short-term on-street parking is expected to increase. Multi-space meters have recently been introduced in Crystal City and will continue to be installed on appropriate blocks in the future. If warranted, meter hours in certain parking districts (groups of blocks) may be extended into the evening, or variable pricing may be introduced during peak hours of usage.



Arlington County multi-space meter

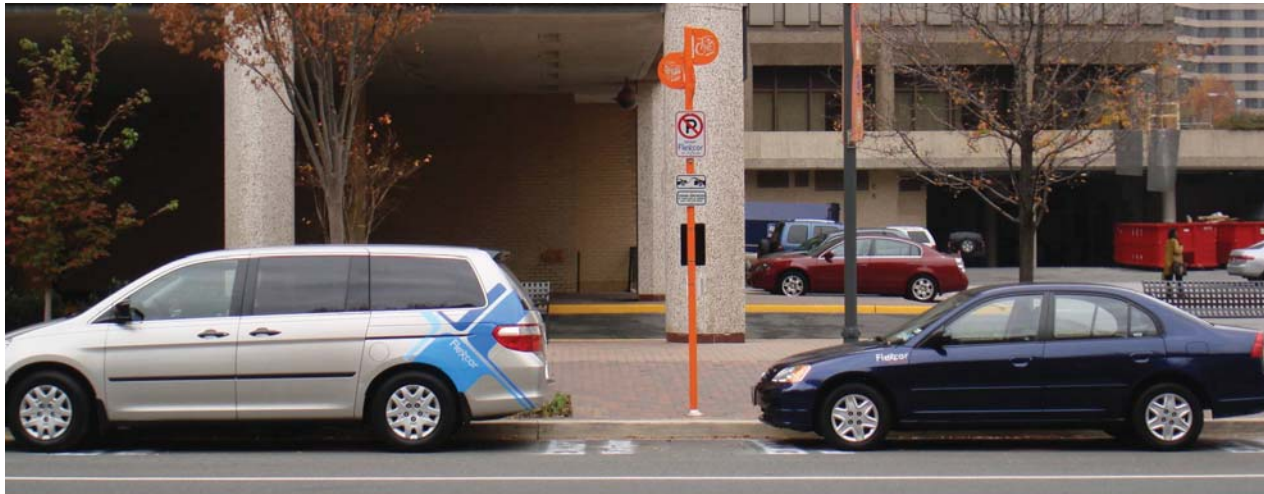
The voluntary Residential Permit Parking Program (RPPP) in the primarily residential neighborhood of Aurora Highlands supports the curb space management techniques used in the adjacent dense urban mixed-use Crystal City corridor. Aurora Highlands was the first district to petition to implement a permit district in Arlington County, the first jurisdiction in the country to set up a RPPP. Commuters to Crystal City, who had previously parked on the streets of Aurora Highlands, filed motions against the County alleging that the permit districts denied them equal protection of the laws. In 1977, the United States Supreme Court upheld the statute and ruled that Arlington County and other local governments across the nation may forbid commuter parking in residential neighborhoods. Arlington's RPPP helps to provide proximate convenient street parking for residents, and reduces the volume and impact of non-resident and non-visitor vehicles in residential neighborhoods.

Off-Street Parking

Most development in Crystal City has been approved through the County's special exception processes (site plan review and use permit) and this is anticipated to continue. Special exception projects encourage development to be evaluated and regulated on a site-specific basis. The zoning ordinance identifies a minimum parking requirement for special exception projects which differs by zoning district. In addition, the zoning ordinance allows the County Board to adjust the requirement where it finds the standards for approval have been met overall. These development processes play an important role in supporting land use and transportation policies that encourage sustainable development.

In areas such as Crystal City that are rich in travel choices, the flexibility of these processes is used to apply a more appropriate parking requirement that takes into account other factors including, but not limited to, site location, accessibility to transit, transportation demand management (TDM) measures, trends in parking demand, and management strategies of parking spaces. The recommended parking requirement for office buildings in Crystal City is between 1 space per 750 square feet (1:750) and 1 space per 1,000 square feet (1:1,000). The recommended parking requirement for residential buildings is 1.125 spaces per dwelling unit². Adjustment of parking requirements below the zoning ordinance standards will go hand-in-hand with facilitating and increasing support for other modes of travel through TDM measures and the provision of transportation infrastructure.

² Based on the 2008 Crystal City Plan Policy Directives adopted by the County Board on Dec, 13, 2008.



Carsharing parking along Crystal Drive south of 18th Street S.

Arlington County encourages sharing of existing and future off-street parking spaces to increase utilization of the transportation infrastructure. Through the special exception process, the County encourages shared parking arrangements where: parking spaces in garages built by private developers are shared with the general public; parking spaces are shared by various groups using the spaces at different/complementary times of the day or week; unused or excess parking spaces in existing or future garages are shared to satisfy the parking requirements of other proximate developments through off-site agreements; parking spaces are shared among all users of the garage (i.e. no reserved spaces).

Surface parking lots can degrade the quality of the built environment, and are a suboptimal use of highly accessible urban land. Build-to lines and building envelope standards will be established in the Crystal City Sector Plan to achieve the desirable street cross-section and character. Prohibition of surface parking lots between the curb and the building is common practice for special exception projects.

Management policies adopted by property owners and garage managers as well as employers can help to reduce the parking demand. Unbundling of parking costs from the cost of renting or owning a unit can allow drivers to consciously choose not to pay for an on-site parking space if they find other modes of travel more cost-effective and attractive. Employers may voluntarily introduce “parking cash-out” where employees are offered a cash equivalent to the parking subsidy to spend on their preferred mode of travel. Garage rates may be set to reduce or remove the subsidy to monthly pass-holders, making it more cost-effective to opt for the appropriate mode of travel on a daily basis. Through education and marketing, Arlington County can encourage the adoption of these practices in Crystal City.



Display board for an electronic parking space count system.



TRANSPORTATION DEMAND MANAGEMENT The Importance of Managing Demand

If not managed effectively, the increase in transportation demand and, more specifically, vehicular traffic, that results from projected local and regional growth will far exceed the existing and planned capacity of streets and intersections in Crystal City. Such congestion could have a negative impact upon the quality of life and business climate in Crystal City, perhaps to the point of counterbalancing the market appeal and dampening the development projections accommodated in this vision plan. Fortunately, transportation demand management (TDM) in Arlington has a proven record of success in reducing vehicular traffic, including in Crystal City. An aggressive partnership between the County and the developers and business entities in Crystal City can continue and can enhance the effectiveness of TDM to accommodate the planned growth and preserve the area's location value.

In Arlington, TDM is both a set of guiding principles underlying Arlington's development policy, and a set of services provided by Arlington County Commuter Services (ACCS) which together reduce demand for travel by single occupant vehicles (SOVs). The pedestrian-friendly, multi-modal design of Crystal City and the provision of many transportation options are intrinsic parts of the County's TDM policy which are complemented by the services of ACCS to make sure that people understand and use the available alternatives to SOV travel.

As described in this section, ACCS takes a strategic approach to the promotion of mass transit, walking, bicycling, carpooling, car sharing, and telecommuting to reduce demand for vehicular travel, lessen congestion and air pollution, and improve travel choice and accessibility. By educating and providing incentives to shift from driving alone to these alternatives, ACCS removes 38,000 vehicle trips per day from area roads, an amount equivalent to the 37,000 passenger vehicles carried on eight inbound lanes of I-66 and I-395 during the morning rush period. A significant portion of these 38,000 daily trips are being made to or within Crystal City without the traffic and parking burdens of single occupant vehicles. The concentrated implementation of TDM services in Crystal City will further improve access while minimizing congestion and parking demand.

Implementation of TDM Strategies

In December 2008, Arlington County adopted the Transportation Demand and System Management (TDSM) element of its new multi-modal Master Transportation Plan. The TDSM element lays out policies and implementing actions for TDM within the County, and it is hereby adopted by reference as a

part of this Crystal City Vision Plan 2050 Transportation Recommendations. As the TDSM element is amended in future years, those amendments will be considered to apply to the Crystal City Vision Plan as well. The TDM policies of the Master Transportation Plan most relevant to Crystal City are summarized in the following:

- **Policy 1:** Incorporate comprehensive TDM plans for all site plans and use-permit developments to minimize vehicular trips and maximize the use of other travel options.
- **Policy 2:** Incorporate TDM measures with respect to all existing public buildings and facilities, irrespective of redevelopment status. Explore strategies and incentives to achieve TDM measures in existing private buildings.
- **Policy 3:** Require regular travel surveys of new development with TDM plans and link to performance measures to enable follow-up actions. Undertake biennial evaluations of the effectiveness of the County's TDM policies and private-sector compliance with TDM commitments, and implement revisions as warranted.
- **Policy 5:** Apply TDM programs to non-work travel, as well as commuting, for resident, visitor and employee trips through informational displays, website, promotional campaigns and mailings of materials.

ACCS manages and facilitates implementation of these policies by providing TDM services in a multi-layered strategy, much of this in partnership with developers and businesses in the community.

Development Projects: As new projects, renovations, or redevelopments of properties occur, the County's TDM staff negotiates with developers during the Site Plan approval process to prepare a TDM plan appropriate for the development. ACCS provides assistance to developers and property managers to make it easier for them to effectively fulfill the requirements of their TDM plans. These TDM plans provide important benefits to the properties and their occupants while reducing traffic and parking load. Excerpts from the County's TDM policy describing typical site plan TDM conditions are summarized in the box below: "Typical TDM Conditions for Site Plans".

Employers, Hotels, and Residential Properties: ATP works with agents of individual businesses to provide a full range of TDM business services that benefit the companies as well as their tenants, guests or customers. These

CRYSTAL CITY Multimodal Transportation Study

include such services as setting up commuter benefit programs and tax-free financial incentives to use transit, personalized transportation packages, carpool formation assistance, telework assistance, lobby transportation information displays, and regular promotion of the range of transportation options available. For more information on ACCS' business services, see www.CommuterPage.com/ATP.

Individual Assistance Services: ACCS also provides information and assistance to individual commuters, residents, or visitors through its www.Commuterpage.com family of websites, online transit fare sales, bus stop information, marketing services, and individual assistance and pass sales at the Crystal City Commuter Store.

Arlington Commuter Page



Unique Opportunities for TDM in Crystal City

Crystal City today has the lowest percentage of single occupant vehicle (SOV) trips in Arlington at approximately 40 percent (40 percent SOV, 32 percent Metrorail, bus 9 percent, carpool/vanpool 8 percent, commuter rail 6 percent, bike and walk 4 percent³). In the future it will be essential to reduce the percentage of commuters driving alone even further to achieve the increased development and lower parking ratios proposed without putting unacceptable stress on the street network and parking facilities.

Experience has proven that TDM services are most effective when there is a strong partnership between ACCS and the developers, property managers and businesses in a community. These business entities have great influence over their building occupants or employees as well as frequent opportunities to communicate with them through various means. Coupled with the professional services, assistance and guidance of ATP, the TDM services jointly provided to individuals in the buildings can be immeasurably more effective than could ever be achieved through the efforts of the County or the businesses alone. The fact that much of the real estate in Crystal City is under the ownership of a relatively small number of companies can facilitate this joint working relationship and make the provision of TDM services to building occupants most efficient.



Mobile Commuter Store

³ 2008 ACCS Commercial Building Survey

Additional TDM Resources Required

The projections of new development and redevelopment in Crystal City are impressive, and will require a significant expansion of staff and resources for Arlington County Commuter Services to properly support the new growth. Projected development in this plan would be equivalent to approximately one quarter of the development currently served by ACCS, so a commensurate increase in staff and resources would be needed over time to keep up with the growth in Crystal City as development is phased in.

Protecting the Future Investment

As additional resources of all sorts are invested in Crystal City over the coming years, it will be essential that TDM services be an integral part of the development and management strategy. In Arlington, TDM is often thought of as the software that makes the hardware of the urban villages work better. A robust TDM program will help further develop the culture of Crystal City as a vibrant, transit-oriented, pedestrian friendly community. This will ensure that the neighborhood becomes more congestion free, even less auto depending, and well-positioned for the future. TDM is a small but important investment that will help fulfill the vision laid out in this plan for a highly-livable world-class urban community.

Typical TDM Conditions for Site Plans

Following are brief descriptions of applicable strategies for transportation demand management that are frequently employed in Transportation Demand Management Plans adopted through Arlington's site plan and use permit approval processes.

Program Structure, Participation, and Funding

Basic to the success of any TDM program is education and information dissemination concerning all the transportation alternatives to driving alone. Developments work with the Arlington County Commuter Services (ACCS) and its business-service agency, Arlington Transportation Partners (ATP), in promoting transportation options to persons employed within the development. ATP is prepared to provide assistance to commercial and residential properties to help their management in complying with the requirements of this TDM policy. Typical transportation-marketing strategies include transportation fairs, distribution of ridesharing marketing material to tenants and employees, and displaying information material, such as posters, and brochures in common areas, including hallways elevators, restrooms, water fountains, and building-management offices.

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The success of an employer TDM program is enhanced greatly if implemented through an Employee Transportation Coordinator (ETC) or a Property Transportation Coordinator (PTC). A PTC is an employee of the building-management team and is responsible for implementing the developer's TDM program. The PTC tailors the TDM program in response to employee-transportation-survey results. The PTC can be a part-time or full-time employee, depending upon the number of employees on-site and the complexity of the TDM program (which may be a function of the degree of impact associated with the development). PTC duties include: implementing the TDM program; conducting transportation surveys; managing a preferential parking and transit subsidy programs; and promoting group-riding to development tenant employees. ETCs function in much the same way except that they work for an individual company, which may be a tenant in a building, and coordinate transportation options for their co-workers within that company.

Site plan contributions often include a contribution to Arlington County Commuter Services, or a TMA based on a rate per square foot GFA of a given use. The terms of participation may range from 30 years to as long as the operation exists and include provisions for adjusting the contributions annually by the Consumer Price Index (CPI) to account for inflation. Recognizing that residential development generates fewer trips than commercial development, rates of contribution are less for residential development.



Arlington Commuter Store

The contribution is based on a formula, escalated by a factor for CPI, and applied by the square foot, as the most fair and equitable way to insure funding for the program.



Arlington Transportation Fair

Facilities and Improvements
On-Site Construction

Developments may be requested to dedicate on-site easements to the County and to construct associated roadway improvements adjacent to the site, such as additional travel and turn lanes.

All site-plan development is expected to provide transportation kiosks or information centers to provide information about transportation options.

Depending upon the category of development, a business center may be required to prevent incidental trips and to encourage telecommuting.

All site-plan development is expected to provide secure bicycle-storage facilities in a location convenient to office, commercial or residential development areas. Use Permit development may be required to provide secure bicycle-storage facilities as well. The facilities shall be highly visible to the intended users and should be protected from precipitation. Additional standards cover the minimum number to be provided by type (Class) and location. A written plan is required for the operation of the bicycle facilities.

Depending upon the category of development, shower facilities may be provided within the development as an amenity promoting bicycle or walking commuting by employees to the site.

Developments shall provide parking facilities designed in such a way as to ensure access by vanpools. At a minimum, 10 percent of the parking capacity shall be accessible to vans by providing a minimum vertical clearance of 86 inches from the street to the parking areas and to the garage exit onto the street. The grade of ramps, beams, pipes or other obstructions must be taken into account to allow the specified effective height.

Developments should incorporate into the design adequate short-term off-street parking space for delivery vehicles.



Lobby Transportation Kiosk



6.0: SUMMARY AND CONCLUSIONS

The Crystal City Sector Plan presents a vision for future development in Crystal City providing a policy framework and a conceptual master plan with land use and urban design recommendations. One facet of the plan is the future transportation demand that will be generated by the future development and the recommendation of a multimodal transportation network to meet the demand. This multimodal transportation study, a supporting document of the Crystal City Sector Plan, presents the assumptions and analysis that were used to formulate multimodal transportation recommendations as well as the detailed recommendations and phasing.

EXISTING CONDITIONS

Crystal City has an existing transportation network with sidewalks, bikeways, Metrorail, VRE, bus transit, and a relatively interconnected street network. Existing travel behavior in Crystal City represents one of the lowest automobile mode splits in the Washington D.C. area. Existing issues can be addressed through policy and infrastructure improvements and include:

- Lack of connectivity between transit modes
- Poor transit visibility
- Disjointed S. Clark/Bell Street
- Confusing circulation patterns on S. Clark/Bell Street and Crystal Drive
- Inadequate intersection spacing at the S. 20th Street and S. 23rd Street intersections with Eads Street, Jefferson Davis Highway, and S. Clark/Bell Street
- Intersections failing during peak hours
- Lack of bicycle connectivity
- Wide pedestrian intersection crossings
- Large blocks which create long walk distances
- Limited bicycle and pedestrian connectivity to the airport
- Lack of area wide TDM policy implementation

MODELING, FORECASTS, AND ANALYSIS

The multimodal transportation study analyzes the 2030 future density and land use mix presented in the *Crystal City Draft Master Plan: 1.5 Alternative*. This represents an overall increase in density of 33 percent. Existing Crystal City has a significantly higher proportion of office than residential square footage. In the future, residential and office space is planned to come into better balance. As a result, future travel patterns will be better balanced between trips entering and exiting Crystal City and more trips will be made within Crystal City. Higher transit mode splits due to additional transit services, density near transit, and improved access to transit, will also result in a lower percentage of car trips being made in the future.

Future vehicular trips were assigned to the street network using regional distributions determined using the MWCOG Regional Travel Demand Model. 2030 future intersection peak hour levels of service were analyzed. The analysis shaped recommendations for future intersections and street cross-sections.

Future transit trips will be served by Metrorail, the Crystal City/Potomac Yard Transitway, VRE, Metrobus, potential future local train service, and other bus services. The future capacity of the Metrorail and VRE are described in Chapter 3, while future transitway capacity is described in Chapter 4.

The Crystal City Sector Plan is less dense than the scenario analyzed in the multimodal transportation study. By distributing trips to all transportation modes, and implementing phased multimodal transportation improvements, the density in the Crystal City Sector Plan can be accommodated.

TRANSITWAY EVALUATION

The Crystal City/Potomac Yard Transitway is a joint project by Arlington County and the City of Alexandria that will provide surface transit between the Pentagon and Pentagon City and the Braddock Road Metrorail Station. Streetcar is the preferred technology for the transitway in Arlington. A subcommittee of the Crystal City Task Force was formed to consider different alignments and stop location for the system to serve the proposed redevelopment plan for Crystal City and Potomac Yard. Six alignment options were reviewed based on a set of evaluation criteria that included service to planned development, complete streets, interface with other transit systems, operations, constructability, and cost.

The Task Force Subcommittee reached a consensus of preference of Alternative 3, the Clark/Bell and Crystal Drive couplet. The evaluation showed that this alternative served the most development, would enable all streets to accommodate a full range of uses with the least compromise, and would provide the closest access to other transit modes. The full alignment also could be implemented in a relatively early phase with phased implementation. The recommended alignment is shown in **Figure 6.1**.

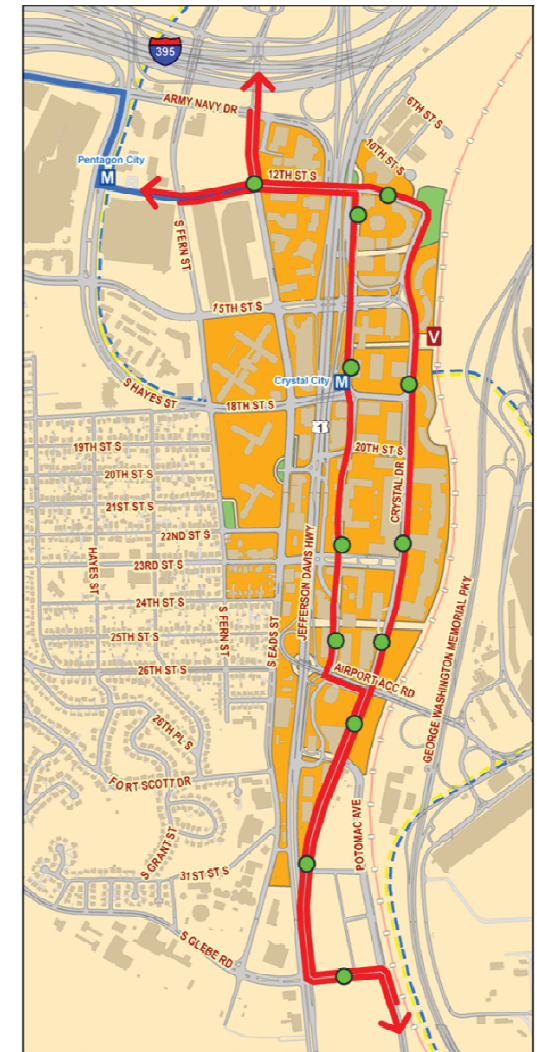


Figure 6.1: Recommended Transitway Alignment



TRANSPORTATION RECOMMENDATIONS

The transportation recommendations made by this study will create a multimodal transportation network that will meet the travel demands of Crystal City. Transportation recommendations are included for all modes of transportation and include physical improvements as well as policies. A summary of key transportation improvements by mode follows:

Pedestrians and bicyclists

- Provide high-quality facilities
- Promote connectivity throughout Crystal City and to regional facilities such as the Mount Vernon Trail, the Four Mile Run trail, and the Long Bridge Park Esplanade
- Provide connections to the airport
- Enhance crossings of Jefferson Davis Highway
- Provide pedestrian-level wayfinding
- Develop a bicycle sharing pilot program in Crystal City
- Provide adequate bicycle parking
- Preserve the underground walkway connectivity

Transit

- Develop the Crystal City/Potomac Yard (CCPY) Transitway with streetcar technology
- Promote connectivity between transit stations and the pedestrian network including
 - Additional transit amenities on 18th Street S. in the vicinity of the Metro station entrance
 - Development of a direct physical connection between Metro, the CCPY transitway, and VRE
 - Construct a new station entrance to Metro in the vicinity of the Crystal Drive/18th Street S. intersection
- Construct a multimodal transportation center in the northwest quadrant of the S. Clark/Bell Street/18th Street S. intersection
- Study intercity high-speed and commuter rail service expansion (MARC and AMTRAK) to Crystal City
- Implement dedicated shuttle service between the airport and Crystal City hotels in coordination with the Crystal City BID

Streets and intersections

- Create a network of multimodal streets that accommodate all modes of transportation
- Accommodate the appropriate mix of pedestrians, bicycles, transit, vehicular travel, and parking on all streets
- Improve local circulation by converting two-way S. Clark/Bell Street and Crystal Drive to two-way
- Reconstruct Jefferson Davis Highway as a six-lane boulevard with an improved interchange at 15th Street S. and a traffic circle interchange at Route 233 that sagely accommodate pedestrian and bicyclists
- Create new streets – 16th Street S. and 24th Street S.)

Parking

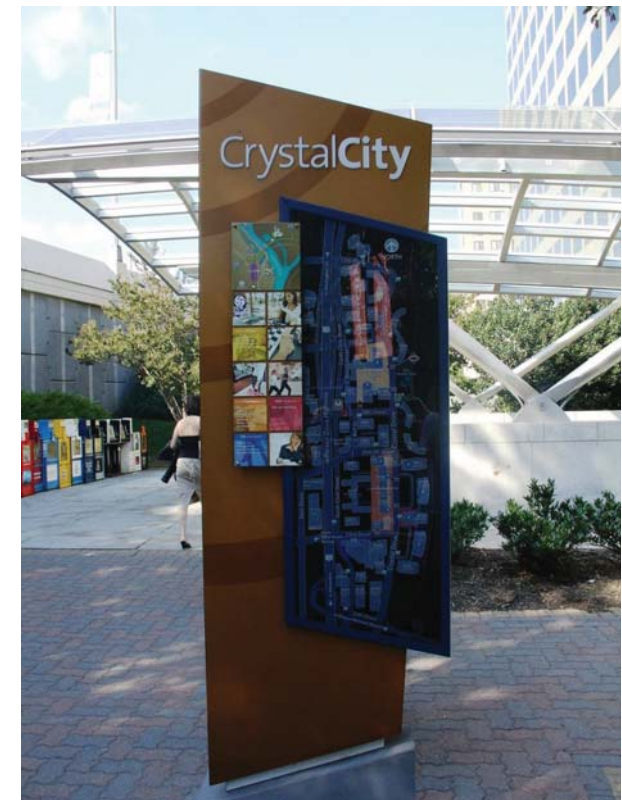
- Manage curb side uses by priority from highest to lowest:
 - Safety (emergency services/uses)
 - Multi-user vehicles
 - Periodic/temporary uses (loading, unloading)
 - Dedicated short-term parking
 - Long-term parking
- Install multi-space meters
- Utilize the Residential Permit Parking Program in residential neighborhoods
- Follow County parking requirements for development (these may be adjusted below zoning ordinance standards where TDM measures are in place and other transportation infrastructure is provided)
- Encourage shared parking and prohibit surface parking lots through the special exception process
- Use education and marketing to encourage parking managers to unbundle parking from the cost of renting or owning a unit, introduce parking cash-out, or reduce or remove monthly parking subsidies

Transportation Demand Management

- Follow the Arlington County Transportation Demand and System Management (TDSM) element of the MTP. Relevant policies from the TDSM include:
 - Incorporate comprehensive TDM plans for all site plans and use-permit developments to minimize vehicular trips and maximize the use of other travel options.
 - Incorporate TDM measures with respect to all existing public buildings and facilities, irrespective of redevelopment status. Explore strategies and incentives to achieve TDM measures in existing private buildings.
 - Require regular travel surveys of new development with TDM plans and link to performance measures to enable follow-up actions. Undertake biennial evaluations of the effectiveness of the

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- County's TDM policies and private-sector compliance with TDM commitments, and implement revisions as warranted.
- Apply TDM programs to non-work travel, as well as commuting, for resident, visitor and employee trips through informational displays, website, promotional campaigns and mailings of materials.
- Use TDM service provided by Arlington County Commuter Services such as development assistance, business services, www.commuterpage.com, and the Crystal City Commuter Store



Wayfinding at the Crystal City Metrorail station