APPENDIX A:
Baseline Study Report October 2008

UNION STATION
WASHINGTON, DC
INTERMODAL TRANSPORTATION CENTER

DCFA No. POKA-2006-T-0029-JJ — Task Order 17

OCTOBER 2008

union station intermodal transportation center

BASELINE STUDY REPORT

d.
District Department of Transportation

Technical Report #1 - Baseline Studies Report

Prepared for:
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1 – INTRODUCTION

Union Station and the Union Station Tracks opened in 1908 as a replacement for train service which had previous used the area that is now the National Mall. Designed by Daniel Burnham of Burnham and Root in Chicago, the station saw increasing traffic through the 1950's, followed by a decline in ridership through the 1980's. In 1981, the Redevelopment Act created the Union Station Redevelopment Corporation, which was charged with developing the station into the multi-use facility it is today, serving local, regional, and inter-state travelers as well as shoppers and citizens of DC. In particular, the Redevelopment Act sought "restoration and operation of a portion of the historic Union Station building as a rail passenger station, together with holding facilities for charter, transit, and intercity buses in the Union Station Complex.

Today, Union Station is a major hub of transportation services in Washington DC, serving over 32 million people a year for travel, shopping, entertainment, and tourism. Union Station's role and function as a hub is projected to increase. There are growth plans for all of the major travel modes that serve the station, and there are plans for expansion of commercial, retail, and residential land uses at and near the station. In addressing both existing needs and future demands, the ***Union Station Intermodal Transportation Center Feasibility Study*** seeks to:

- Identify existing internal and external deficiencies and opportunities for improvement, including issues related to regional emergency evacuation;
- Identify and quantify future growth plans for all travel modes and uses at the Station;
- Develop an integrated and feasible plan of recommendations for both the existing facility as well as construction of a potential new Intermodal Transportation Center (ITC) on the adjacent air rights over existing rail tracks.
- The ITC would be constructed at the Akridge Development known as Burnham Place. One of the key goals of this integrated plan is to identify how the Akridge Development undeveloped air-rights contiguous and to the north of Union Station could be utilized to improve the functioning of Union Station as a Regional Intermodal Transportation Center.

A key aspect of the study is a comprehensive analysis of Union Station and its functions as a whole. This includes assessments of existing operations and needs, as well as a review of current plans by the various users of the facility. Within the context of an overall assessment, some of the specific items being reviewed and addressed by the study include examining the feasibility of:

- Constructing a new rail passenger concourse for commuter rail operations;
- Improved emergency evacuation of both Union Station and existing nearby neighborhoods;
- Improvements to the existing Amtrak passenger concourse;
- Expanded parking accommodations for tour and commuter buses;
- Integrating inter-city bus lines (i.e. Greyhound, Peter Pan, etc.) into the new ITC;
- Integrating new streetcar services;
- Developing a pedestrian connection between Union Station and H Street (and enhancing pedestrian connections on 1st street); and
- Developing a new vehicular connection between Massachusetts Avenue and H Street

The study is being developed with the participation of local community groups and other stakeholders. The study also includes a review of environmental impacts of the proposed development to the level of detail necessary to determine feasibility, and to identify environmental studies that would be needed for various recommended improvements.

Federal and local government, as well as community stakeholders, are supporting the development of the USITC via two distinct advisory groups formulated for the study: 1) the Technical Advisory Committee and 2) the Citizen's Advisory Committee.

This report, the first of several being developed for the study, describes existing uses, operations, and conditions for the various travel modes at Union Station. It provides a baseline of information to assist in informing stakeholders and a context for developing and analyzing recommendations. Follow-on reports will describe the study's recommendations based on forecasted demand for Union Station Services and will include, as appropriate, project details such as estimated costs, implementation strategiestimelines, feasibility considerations, and the identification of necessary environmental and permitting requirements.

1.1 STUDY AREA

The project focuses on Union Station, located in downtown District of Columbia. The station itself is located north of Columbus Circle on Massachusetts Avenue and 1st Street NE, about one half mile north-northeast of the United States Capitol. The project limits extend from Massachusetts Avenue on the south, 3rd Street NE on the east, M Street NE on the north, and North Capitol Street on the west. The entire study area is located within the boundaries of Ward 6, Advisory Neighborhood Commission (ANC) 6C, and "neighborhood cluster" 25. Neighborhood cluster 25 includes the Union Station Neighborhood, as well as the NoMa (North of Massachusetts Avenue area), Stanton Park and Kingman Park neighborhoods. In addition to these areas surrounding Union Station, the interior is being studied, to include all public areas, as well as the rail concourse behind the station itself. **Figure 1-1** highlights the key features in the immediate vicinity of Union Station, including existing transportation facilities, proposed developments, and proposed transportation improvements.

1.2 STUDY CONTEXT

With its dual roles as Washington's major and historic transportation hub, and its continued growth as an activity and destination center, Union Station has been the direct or indirect subject of numerous studies. These studies include:

- *Columbus Plaza Redesign* - Efforts to redesign Columbus Plaza have been ongoing, with the intent of improving the aesthetic and functional qualities of the plaza.
- *Union Station Bike Station* - A multipurpose Bicycle Transit Center is being constructed at the southwest corner of Union Station.
- *District of Columbia Transit Improvements Alternative Analysis* This study investigates short, interme-

diate and long term solutions for new transit options that protect the residential and economic vitality throughout the District, with Union Station being an anchor for several options..

- *Capitol Hill Transportation Study* - This study focuses on improving safety, easing traffic congestion, and overall improvements to the transportation in the area with a focus on improving the major arterials.
- *Tour Bus Management Initiative* - Tour buses serve a large demand in DC, but they also create issues with parking, aesthetics, congestion and pollution. Citing examples from other cities, the study recommends ways that tour bus activity can be improved in the District.
- *H Street NE Corridor Transportation Study* - This study recommends several transportation improvements along H street, including better pedestrian and bicycling amenites, as well as a proposed streetcar.

Union Station is also a key feature of city-wide transportation planning efforts including the District's Strategic Transportation Plan as well its bicycle and pedestrian plans.

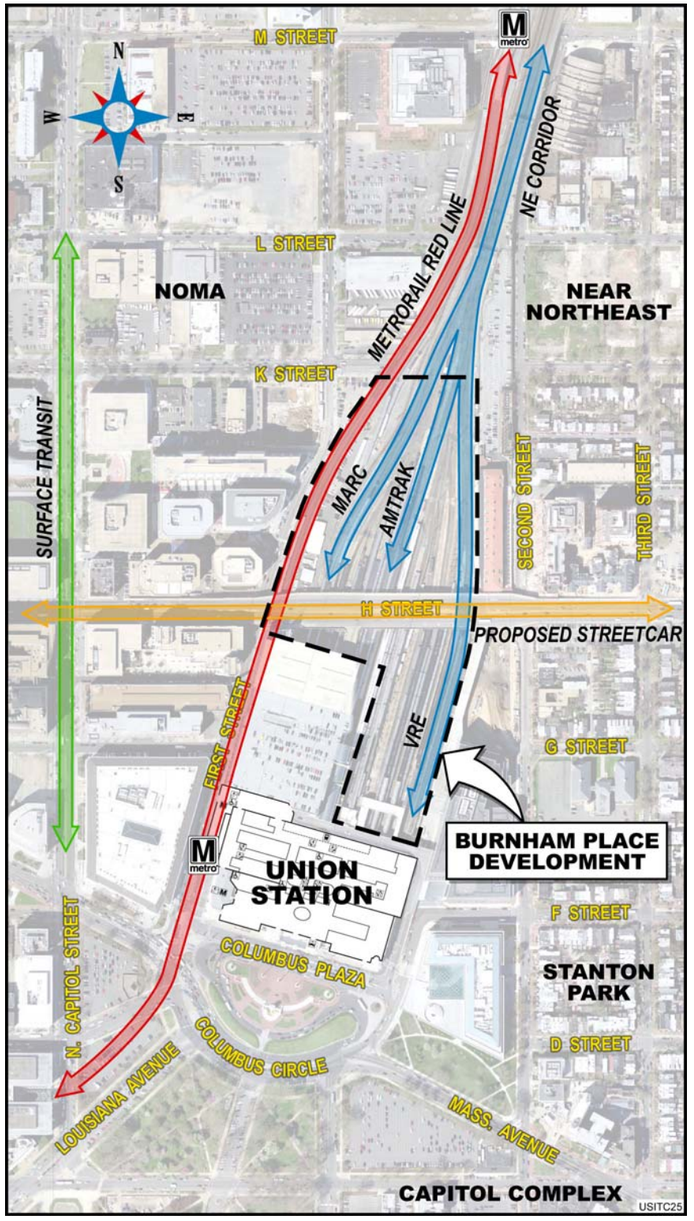


Figure 1-1. Study Area Overview

2 – EXISTING CONDITIONS

Hub: a place that is a center of activity or interest (MSN Encarta Dictionary); the central or main part of something where there is most activity (Cambridge International Dictionary of English)

Union Station is a major hub of transportation services in Washington DC, serving over 32 million people a year for travel, shopping, entertainment, and tourism. As importantly, it serves users with a variety of modes. It is the busiest station in the Metrorail system, it serves nine major City bus routes as well as the Downtown Circulator bus, it serves intercity rail, commuter rail, tour buses, and is a major pedestrian activity center. Union Station also serves a wide variety of trip types, ranging from commuter traffic to tourism. **Table 2-1** (mode table) shows the number of travel modes and trip types that are accommodated at Union Station and how they relate, truly highlighting the station's role as a key transportation and activity hub for both Washington and the region as a whole.

Key features related to transportation include:

- The station is located near major District arterial roadways including North Capitol Street, Massachusetts Avenue, and H Street.
- Walking is a key form of travel in and around Union Station, both in terms of transferring from other modes (such as commuter rail to Metrorail) as well as going to trip destinations such as work, shopping, and nearby residences.
- Located at the southern terminus of the Metropolitan Branch bicycle trail, bicycle travel is also a feature of travel at the station.
- The Union Station Metrorail station was one of the first stations on the system, opening on the same day as the very first section of Metrorail in March of 1976. The station is the most utilized in the entire Metrorail system, serving over 67,000 passengers per day.
- In terms of bus service, the area in and around the station serves nine separate Metrobus routes as well as the Georgetown-Union Station route of the Downtown Circulator. Union Station also serves a large population of tour buses that bring tourists to visit, shop and eat.
- Six commuter bus lines serve Union Station, providing service from both Maryland and Virginia.

Table 2-1. Transportation Modes Served at Union Station

	COMMUTE (WORK/SCHOOL)	LEISURE/ SHOPPING	GOODS MOVEMENT	WORK (DELIVERY, SERVICE, ETC.)	RECREATION	TOURIST	INTERCITY TRAVEL
Single-Occupant Car	●	●		●		●	●
Multi-Occupant Car	●	●		●		●	●
Taxi		●		●		●	
Metrobus	●	●		●		●	
Downtown Circulator		●		●		●	
Intercity Bus							●
Tour Bus					●	●	●
Sightseeing Vehicle					●	●	
Commuter Bus	●						
Metrorail	●	●		●		●	
Light Rail (Future)	●	●		●	●	●	
Intercity Passenger Rail						●	●
Commuter Rail	●						
Local Delivery Truck			●				
Walking	●	●		●	●	●	
Bicycling	●	●	●		●	●	

- Union Station serves approximately 200 trains per day, with the majority of service provided between 8:00 a.m. and 8:00 p.m. Approximately 60 of these trips are Amtrak trips, with the rest comprised of commuter rail trips (Amtrak has approximately 50 arrivals and 50 departures per day).
- Union Station serves three Maryland Rail Commuter (MARC) lines and two Virginia Railway Express (VRE) lines. The majority of commuter rail passengers commute in from Maryland and Virginia, although some passengers leave from the District to work in other locations such as Baltimore.
- Greyhound intercity bus service is provided at the bus station located just north of Union Station, serving approximately 3500 passengers a day with service that runs 24 hours a day.

Union Station is also the focus of substantial land use activity that generates "destination" traffic (trips that start or end in and near the station). The station and immediately surrounding areas include substantial amounts of residential, office, shopping, tourist, and leisure land uses, and there is anticipated to be ongoing growth with respect to these land uses. Union Station currently includes approximately 125 stores covering 213,000 square feet of retail space with an occupancy rate of over 96 percent and annual sales exceeding $130 million. In addition, there are over 30,000 jobs within a half-mile radius of Union Station. (Source: Jones Lang LaSalle "Center at a Glance", http://www.unionstationdc.com/uploadedFiles/About_Union_Station/UnionStation_050413.pdf, 2006 data).

NEIGHBORHOODS AND COMMUNITY OVERVIEW

Four distinct neighborhoods border the Union Station complex of Union Station and the Union Station Tracks. These include:

- NoMA (North of Massachusetts Avenue): A relatively new neighborhood situated between Massachusetts Avenue to the south and New York Avenue to the north, the North of Market neighborhood is a redevelopment area that is focused on the New York Avenue Red Line Metro Station. Over 20 million square feet of development is planned for the next 15 years, including 8000 residential units, 12,000 hotel rooms, 750,000 square feet of retail, and 10 million square feet of commercial office space.
- Near Northeast: In the study area, the Near Northeast neighborhood is a mix of light industrial and some residential zoning. Development is generally one to two stories with townhomes and row-houses providing the bulk of the housing stock.
- Stanton Park: The Stanton Park neighborhood is located due east of Union Station. In the study area, Stanton park is comprised primarily of row-houses, although there is some commercial office space as the neighborhood moves closer to Capitol Hill.

- Capitol Hill: Capitol Hill houses the Capitol Complex, with hundreds of thousands of staff arriving daily. A large portion of these staff arrive at Union station via Metro, VRE, MARC or Amtrak.

Developments in these neighborhoods, particularly in NoMA, have affected how Union Station functions, and will dictate how it must adapt to respond to changing neighborhoods around it. Developments immediately to the east of Union Station, resulted in the development of a direct connection to the east near Gate L, for example. Previously, pedestrians destined for those developments exited through the Columbus Plaza and 1st Street exits.

2.2 TRAFFIC

As with the District as a whole, the roadway system adjacent to Union Station is a basic grid system with a limited number of major diagonal avenues. Most of the roadways in the study area are classified as collector roads. These roads serve the function of collecting traffic from smaller roads and land uses and feeding higher classification roadways. The higher class roadways in the study area include North Capitol Street (principal arterial), H Street (principal arterial), Louisiana Avenue (principal arterial), Massachusetts Avenue (principal arterial west of North Capitol Street and minor arterial east of North Capitol Street), and E Street (minor arterial). Current daily traffic volumes on roadways classified as arterial and above and near the study area are shown below:

- North Capitol Street: 21,000 vehicles per day
- H Street: 27,000 vehicles per day
- Massachusetts Avenue: 23,000 vehicles per day
- Louisiana Avenue: 8,000 vehicles per day
- E Street: 11,000 vehicles per day
- Interstate 395: 48,000 vehicles per day
- Constitution Avenue: 21,000 vehicles per day.

2.2.1 Existing Street Network

To support more detailed analysis of traffic operations, vehicular turning movement counts were conducted for this study at 26 intersections within the study area. The traffic counts were conducted at each location for a consecutive 30-minute period between 7:00 and 9:00 a.m. and between 4:00 and 6:00 p.m. (coinciding with the morning and evening peaks). Data collection was conducted between March 11th 2008 and March 28th 2008 on Tuesdays, Wednesdays, or Thursdays. Counts are taken on the mid-week days because traffic on these days represents typical weekday traffic (pre- and post-weekend traffic spikes are avoided). Within the study area, traffic flows exhibit directional peaking: i.e., inbound traffic is heavier in the morning peak and outbound traffic is heavier in the evening peak.

Figure 2-1 shows levels of service (LOS) at key intersections in the study area. LOS is a standard traffic engineering method of grading roadway operations. LOS methodologies use a grading scale from A to F, with A representing excellent traffic flow with minimal delays, E representing operations at or near capacity, and F representing failure in traffic operations and very high levels of delay. In general, LOS D or better are considered desirable. The discussion below summarizes traffic volumes and operations during the morning and afternoon peak periods.

Morning Peak

During the morning peak hours, H Street, Massachusetts Avenue/Columbus Circle, and North Capitol Street carry the heaviest traffic through the study area with peak hour volumes in excess of 1000 vehicles per hour. Traffic flow is heaviest in the southbound direction along North Capitol Street and in the westbound direction along H Street and Massachusetts Avenue/Columbus Circle.

The LOS results show that intersections along the high volume corridors generally operate at LOS C, D or E. Along these corridors, the intersection LOS, in most cases, is due to the high traffic demand on the through movements. Conversely, in the non-peak direction, approaches operate at LOS A, B or C. Additionally, intersections on the study area streets that are predominantly residential also operate at LOS A, B or C, except at locations where they intersect with higher volume corridors.

Afternoon Peak

As experienced during the morning peak, H Street, Massachusetts Avenue/Columbus Circle, and North Capitol Street carry the heaviest traffic through the study area in the afternoon peak, with peak hour volumes in excess of 1000 vehicles per hour along the major corridors. The heavier travel direction is the reverse of what is experienced in the morning peak period. Traffic flow is heaviest in the northbound direction along North Capitol Street and in the eastbound direction along H Street and Massachusetts Avenue/Columbus Circle.

The operational analysis for afternoon peak conditions shows that intersections along the high volume corridors generally operate at LOS B, C, D or E and slightly better than the morning peak conditions. The improvements in LOS are primarily due to overall lower traffic volume demand. For example, at H and North Capitol Streets, LOS improves from an E in the morning to a D in the evening due to a nearly 10% reduction in overall traffic volume, and a more equal distribution of traffic on all approaches. At North Capitol and K Streets, the overall intersection traffic demand reduces by approximately 13% with a 21% reduction on the critical approaches (southbound approach during the AM peak, northbound during the PM peak). In general, intersections on the more residential streets in the study area operate at LOS A, B or C, except at locations where they intersect with higher volume corridors.

2.2.2 Circulation

A large number of travel modes are accommodated by the current circulation plans and patterns in and near Union Station, with varying levels of success. The schematic in **Figure 2-2** illustrates some of the external circulation patterns at Union Station. As described in the previous section and shown in the LOS summaries in Figure 2-1, traffic operations within the Columbus Circle area in front of Union Station are generally adequate. Current circulation issues, therefore, relate more to the sometimes confusing and indirect travel patterns than to high levels of peak period traffic congestion.

Vehicular access to Columbus Plaza is gained via Columbus Circle on the east side of Union Station. The most common path for egress necessitates completing the loop of Columbus Plaza, exiting at the east end, and then joining westbound traffic on Columbus Circle to Massachusetts Avenue. Before exiting, a connection is available that allows for a complete loop around the plaza. A bi-directional circulation road surrounds the west, north and east sides of Union Station, and provides access to the parking garage north of the station and to 1st Street NE west of the station. The circulation road can be accessed on the east where Columbus Plaza splits off of Columbus Circle; on the west it is accessed from Columbus Plaza near the southwest corner of Union Station; on the north access is provided directly from the parking garage. Columbus Circle continues past the point where Columbus Plaza and the circulation road spur off, and leads directly into eastbound F Street, NE.

As discussed, buses may access the parking garage from the circulation road, usually via Columbus Circle on the east. Buses, however, may also enter the garage by using the access road on the west side of the station. Alternatively, they may enter the garage from the north via eastbound H Street, NE. When leaving the garage, buses, can exit to the north via eastbound H Street or by way of the circulator road (west), connecting to southbound 1st Street, NE. Passenger cars may access the parking garage using the same routes as buses, though they use a separate entrance to the north that allows for access and egress from both directions of H Street.

Taxi cabs circulate Union Station by entering Columbus Plaza in their designated lane, make drop-offs then proceed towards the rear of the station via the circulation road to queue on the east side of the station to make pick-ups.

Directly in front of Union Station, three lanes are available for use by various travel modes. The lane closest to the station is reserved for taxis, the middle lane is for passenger pick-up and drop-off by the general public, and the lane furthest from the station is used by buses and for traffic going through and bypassing the passenger pick-up area. While this outside lane is used for buses, parking, standing, or idling by any vehicles, including buses, is not allowed in this lane.

2.2.3 Parking

Parking is an integral feature related to travel for the many modes of travel at Union Station. Associated with parking are also short-term waiting areas for taxis and layover locations for buses. Combining all of these, the parking at Union Station encompasses longer-term parking for those taking trains out of the District, mid-term parking for those who come in and use Union Station as their starting point for travel within the District (including those who take sightseeing tours from Union Station) or for business in the area, shorter-term parking for those visiting the shops, restaurants, and movie theaters in Union Station, and immediate-term holdover parking for taxis, buses, and for deliveries.

The predominant facility for parking at Union Station is the parking garage located directly north of the station, though street parking is available nearby. The garage is open to the public, though Union Station patrons may have their parking validated for a reduced fare. Street parking is a mixture of metered and permit parking. The garage at Union Station is a five level structure with the four upper floors designated for pas-

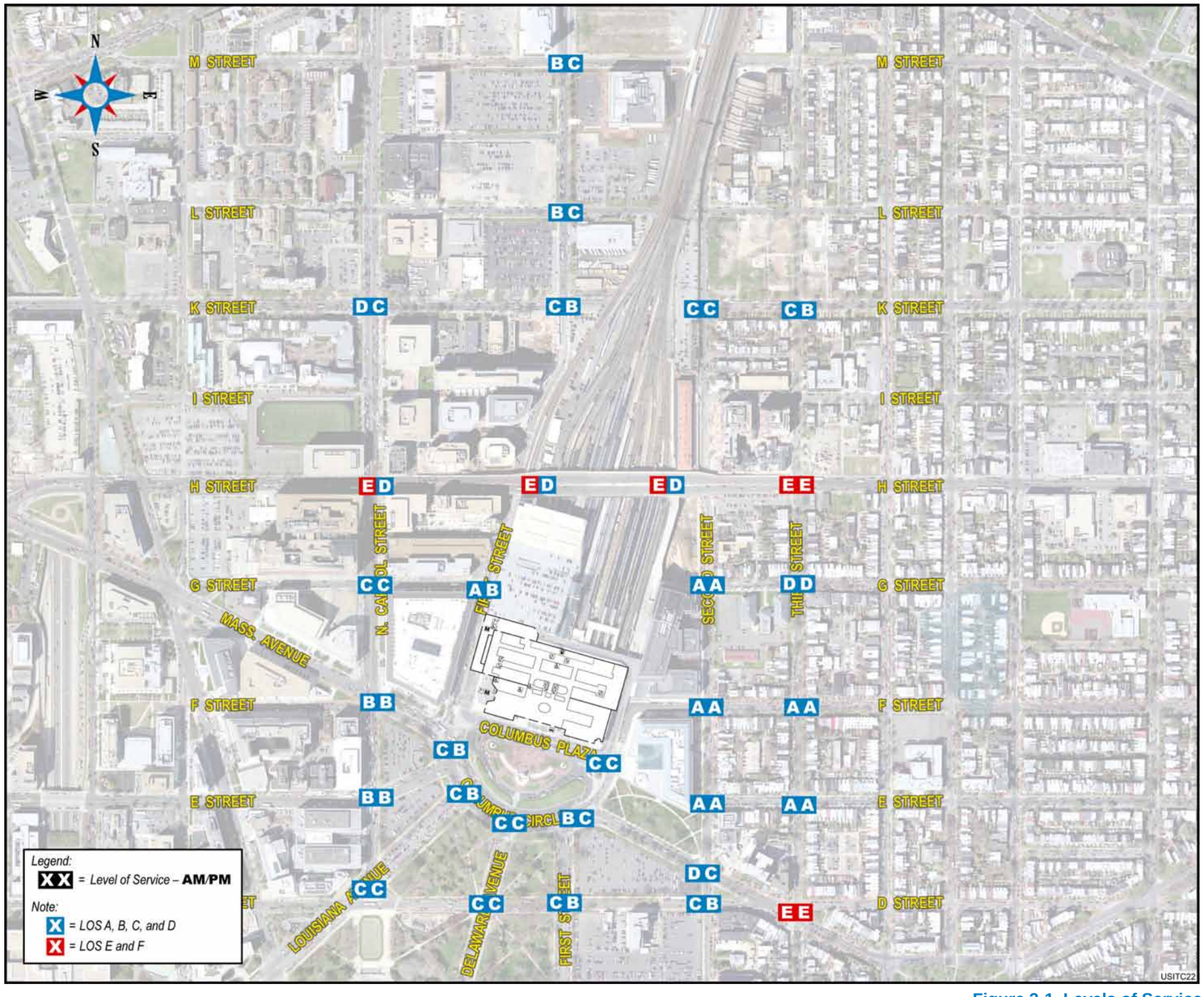


Figure 2-1. Levels of Service

senger vehicles and the lowest floor reserved for buses. The total capacity is 2,194 parking spaces, 90 of which are bus spaces, however, only 55 of the bus spaces are actually used.

Parking data provided by the Union Station Redevelopment Corporation (USRC) shows that the Union Station parking garage experiences an overall average occupancy rate of 77% (leaving 515 spaces available) during a typical week. Union Station experiences its highest parking volume on Wednesdays with an average occupancy rate of about 83% (372 available spaces). Conversely, Union Station experiences its lowest parking volume on Mondays with an average occupancy rate of about 66% (755 available spaces). Passenger car parking does not show any significant seasonal trends, and overall, the parking garage is accessed about 49,600 times per month, or about 1,600 times per day. Bus parking on the other hand, exhibits a dramatic increase during the spring tourist season. Detailed tables on parking space utilization and ticket counts for the parking garages are included in the Appendix A, Tables A-through A-4.

The pricing rates for the structure begin at $6 for the first hour and up to $19 for 24 hours. Validation is available for patrons who utilize the services inside Union Station, allowing for reduced rates up to the first three hours. Parking rates for tour buses are $20 between 7AM and 7PM, and $10 between 7PM and 7AM. Buses have in-and-out privileges throughout the time periods.

On-street parking is available near Union Station, with metered parking available as close as Columbus Plaza or 1st Street directly adjacent to the station. Metered parking is available on many of the streets in the study area, most with 2 hour limits. Unmetered parking is available, predominantly on the residential streets such as 2nd and 3rd Streets. The unmetered parking also has a two-hour limit, unless a Zone 6 resident parking permit is provided. In total, on-street parking, which is illustrated in **Figure 2-3**, provides about 440 metered parking spaces, and about 570 non-metered parking spaces within the study limits. The non-metered spaces include approximately 330 resident permit spaces, and 240 other spaces which encompass loading zones, school zones where parking may be restricted on school days, and other zones where parking is not permitted during busy traffic periods. Additionally, just south of the study limits, nearly 350 street parking spaces are available to special permit holders.

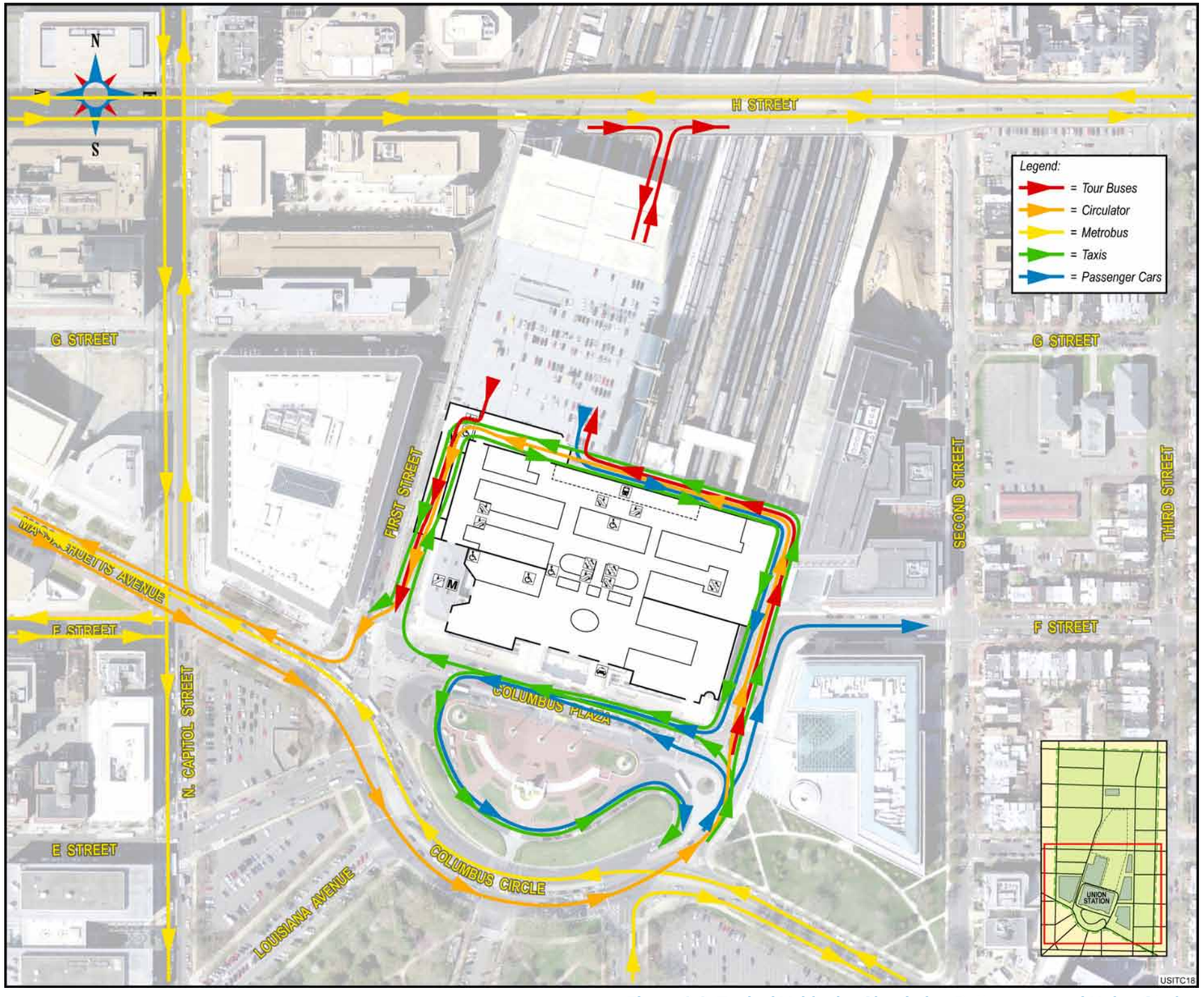


Figure 2-2. Typical Vehicular Circulation Patterns around Union Station

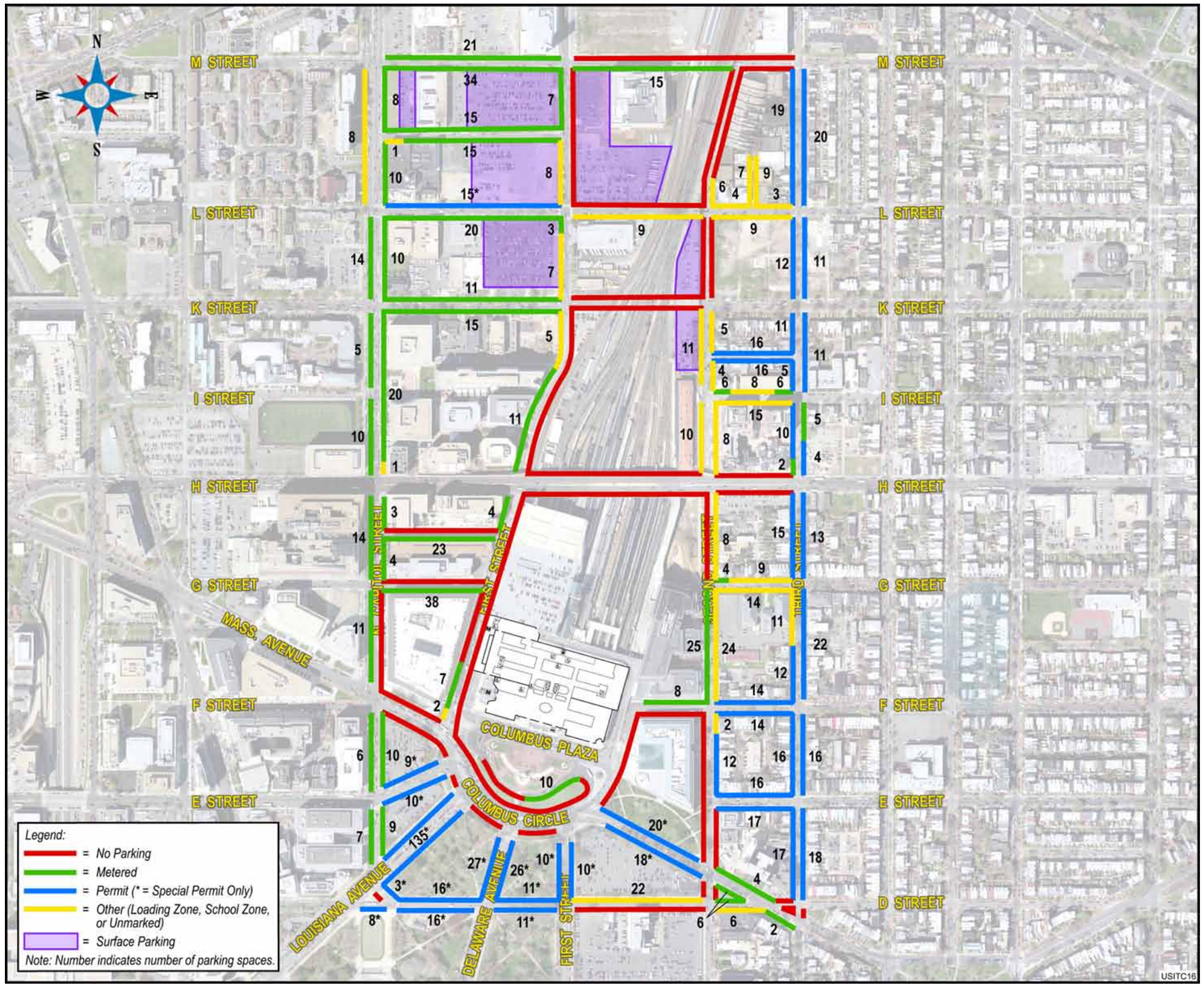


Figure 2-3. On Street Parking in the Vicinity of Union Station

2.3 PEDESTRIAN AND BICYCLE ACTIVITY

2.3.1 External Pedestrian Movements

Pedestrian flows in and around Union Station include trips that consist of shifting from one mode of travel to another (i.e., commuter rail to Metrorail), as well as trips that are ending or starting in the study area. Some of the existing issues related to pedestrian travel in Union Station come from the mixing of these two types of trips. An example of this is the concentrated and highly directional pedestrian flows in the peak period going from commuter rail to the Metrorail station mixing with those who are milling around, such as shoppers or those waiting for Amtrak trains or tours. Additional detail on pedestrian flows is included in this section.

In general, the morning peak periods exhibit pedestrian flow moving away from Union Station in nearly all directions, with the trend reversed in the evening rush period. Delaware Avenue and the western portion of 1st Street NE are the two most heavily used pedestrian routes, while Massachusetts Avenue (in both directions) and E Street NE also carry significant pedestrian volumes in the morning. Delaware Avenue and the other streets south of Union Station are heavily traveled paths in the afternoon, returning people to the station from the Capitol Hill area. Two locations where patterns are opposite to the morning-outbound/evening-inbound trend are the sidewalks along the Thurgood Marshall Federal Judiciary Building north of Massachusetts Avenue and F Street NE. In the morning, both of these paths carry people from the residential areas east of the station to the various transportation options at Union Station, or beyond to the employment areas west of the station; later in the evening the trends reverse, though the paths along the Thurgood Marshall building remain significantly heavy throughout the day. **Figure 2-4** shows pedestrian counts that highlight the heavy pedestrian flows on 1st Street, NE, going both directions on Massachusetts Avenue, and to/from E Street.

Pedestrian conflicts with traffic occur in two major areas in the vicinity of the station. At the stations' southeast corner, pedestrian traffic travelling to the SEC and other new developments to east conflicts with traffic travelling up the east ramp to the Union Station garage.

On the station's west side, traffic exiting the station on to narrow 1st street often conflicts with vehicular travelers as workers travel from Union Station to office buildings in NoMA. This street sees the highest daily volume of pedestrian flow.

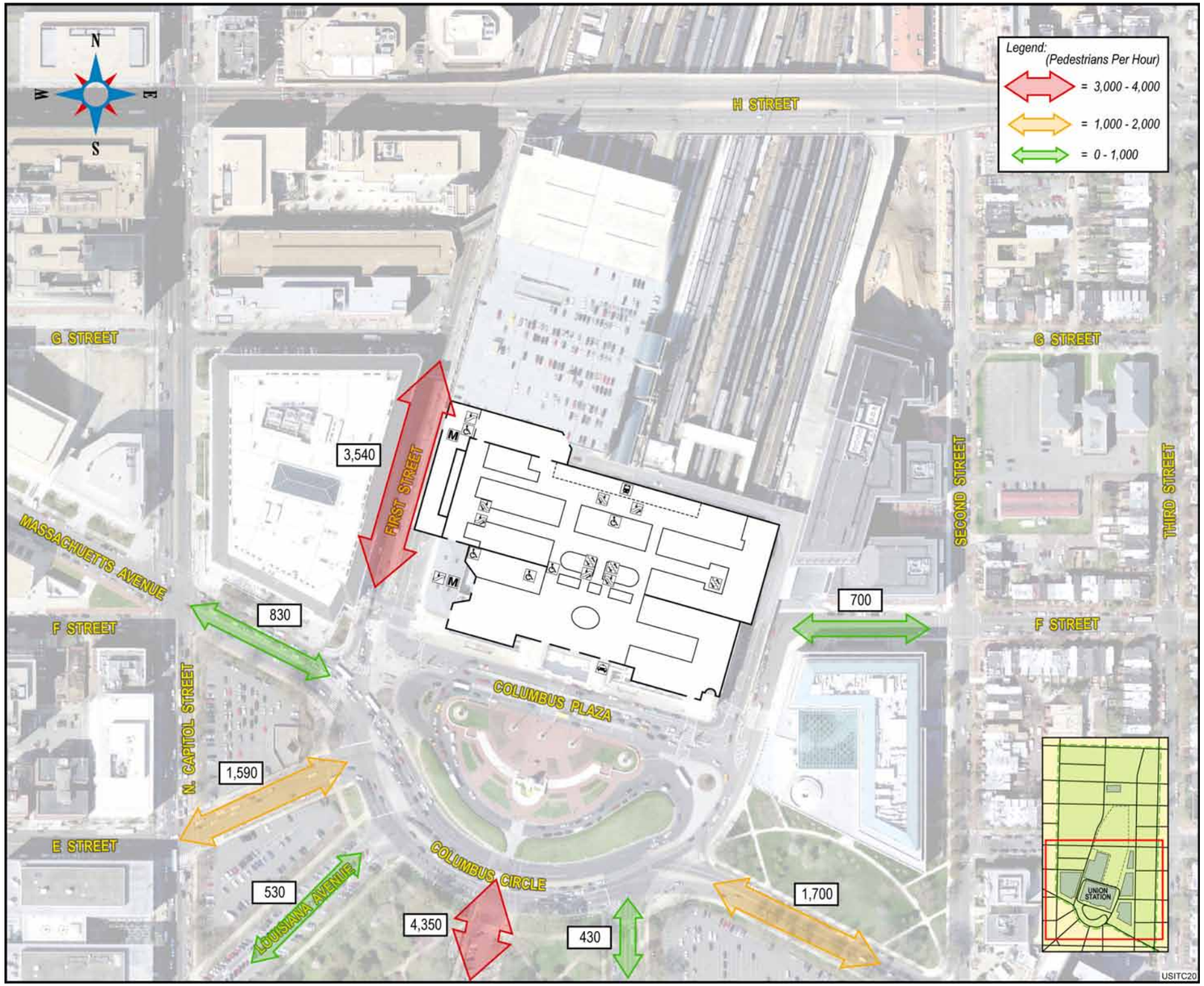


Figure 2-4. One Hour Pedestrian Volumes on Roads Adjacent to Union Station

While the main stream of pedestrian traffic exiting Union Station exits through the main entrance, this traffic is diffused by Columbus Plaza, creating more manageable pedestrian and vehicle interaction. This interaction is expected to be improved with the proposed renovation of Columbus Plaza, described in Section 1.

2.3.2 Internal Pedestrian Movements

Inside Union Station, pedestrian movements may appear somewhat random at first glance, but distinct patterns can be discerned upon closer examination. A significant portion of pedestrian traffic within Union Station occurs in waves or platoons. These platoons originate when and where people alight from public transportation. The largest groups are the most orderly, predominantly commuters originating from the commuter trains and the Metrorail. Smaller platoons of people coming from tour buses also move through the station, albeit with patterns that are much more sporadic than commuters. These platoons may range in size from 20 to 50 people from a tour bus, to well over 200 from a commuter or intercity train.

The schematic diagrams in **Figure 2-5** and **Figure 2-6** illustrate some of the major flow paths and highlight some of the potential areas of pedestrian congestion.

Commuter Movements

The most predictable path for a pedestrian platoon comes from intercity or commuter trains. As people alight from the trains, they exit the rail concourse and consequently enter Union Station at the various gates on the northern edge of the station. Passengers from the MARC trains generally come from the westernmost tracks, while VRE passengers come from the easternmost, or long haul tracks of the tracks. A vast majority of the commuter rail passengers immediately exit Union Station either by foot or by Metrorail. Pedestrian egress moves in several directions, with a majority going toward 1st St, Massachusetts Avenue, or the Capitol. In the morning, when the commuter arrivals occur in fairly rapid succession, the pedestrians efficiently move through the station with little hesitation as to which path to take. While some people will deviate from the group to purchase food or use other services at Union Station, the platoon as a whole moves to exit the station as soon as possible. When a Metrorail train arrives in the morning, groups of people move to exit the station onto the street network expeditiously; either by exiting directly to 1st Street or moving

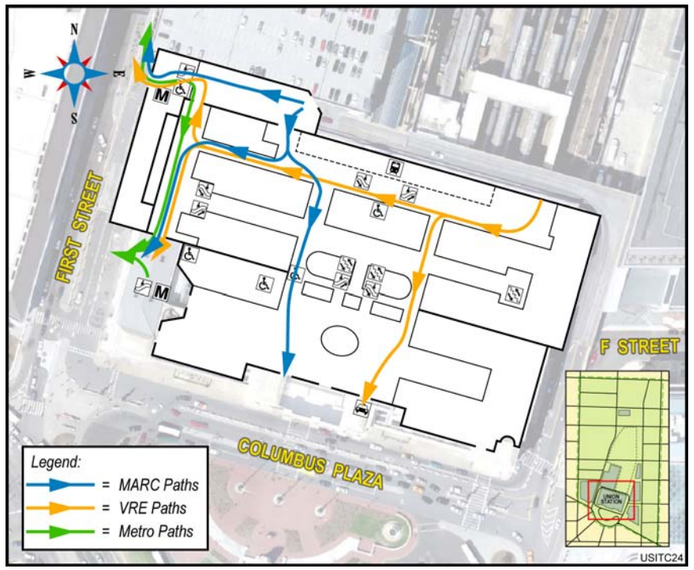


Figure 2-5. Morning Rush Period Pedestrian Platoon Paths

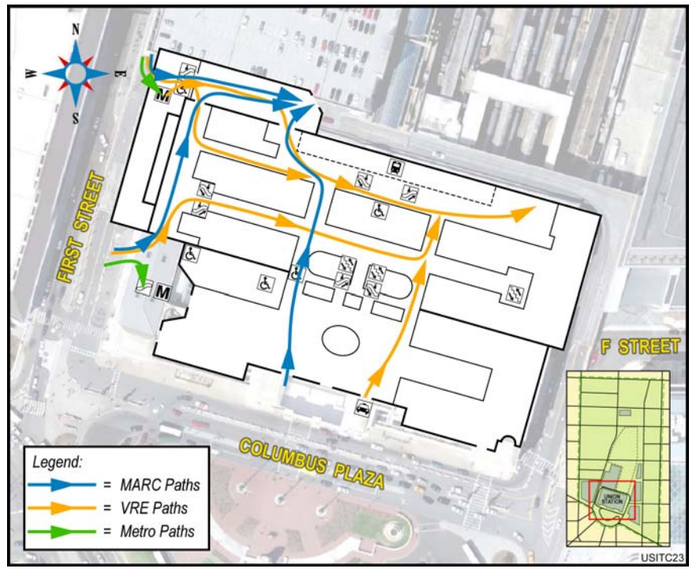


Figure 2-6. Evening Rush Period Pedestrian Platoon Paths

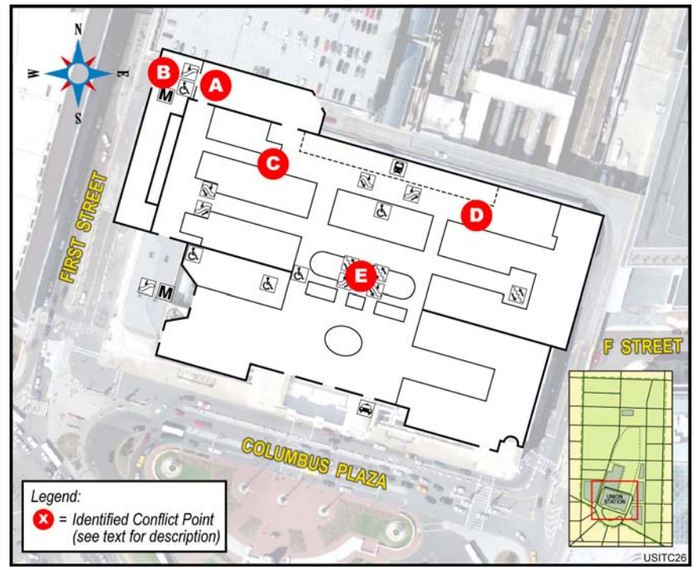


Figure 2-7. Observed Platoon Conflict Points and Bottlenecks

south through Union Station itself if leaving Metrorail via the north mezzanine, or by going directly to the streets from the south mezzanine of the Metrorail station. During the afternoon rush period, patterns are reversed with people moving from either mezzanine of the Metrorail, through Union Station, and directly toward a transfer to an commuter train. During non rush periods, the platoon of people exiting Metrorail or commuter trains is diluted with casual commuters, tourists, and mall shoppers, making the platoon effect much less pronounced.

Tour Group Movements

The tour group platoons move much less consistently than intermodal transfer groups, but their movements still follow trends, based primarily around the food court. Part of the unpredictability of tour group platoons stems from the fact that they will enter at multiple entrances to Union Station, though the mezzanine entrance from the parking garage is often a prime location. Once inside, these tour groups, often middle- to high-school aged students, will gather for instructions from chaperones, and then proceed to the food establishments on the street or lower levels. Later, the group will reconvene for head counts before returning to their tour bus, but in the meantime, smaller groups, generally less than 20, can be seen strolling around Union Station, waiting for the rendezvous time. The gathering of these student groups have been observed to occur in the main hall, in the central portion of the station near the Amtrak ticket counters, on the mezzanine overlooking the food court, and most pronounced, on the mezzanine near the exit to the parking garage. The major pedestrian flow patterns are sometimes constricted at these meeting points, though in general the meeting locations are out of the path of the heaviest intermodal transfer corridors.

Though passageways become congested with high pedestrian densities when groups of people move through the station, significant issues arise when the mass of people encounters choke points within the station. Common bottlenecks inside Union Station include escalators and stairways, merge points for groups of unloading train passengers, and passageways blocked by idle tour groups or queued passengers.

The observed pedestrian flow conflicts and choke points within Union Station throughout the day, shown in **Figure 2-7**, include:

- Location A: Masses of people, predominantly from commuter or intercity trains in the morning, form long queues at the single down escalator, heading toward Metrorail or the exit toward 1st Street.
- Location B: Masses of people, a combination of pedestrians from 1st Street and offloaded passengers from Metrorail, form long queues on the single up escalator, most heading to commuter rail platforms in the afternoon.
- Location C: Platoons of passengers arriving on concurrent MARC and VRE train arrivals merge together in a single corridor, typically seen in the morning peak.
- Location D: Passengers waiting in line to access commuter train platforms are constricted in this passageway, impeding platoon of people arriving at Union Station from VRE trains
- Location E: Typically, tour groups move en masse up or down the stairs between the mezzanine, street level, and food court level of the station, blocking movements in the opposing direction.
- Location F: (not shown in Figure 2.7, northern end of mezzanine level) Tour groups rendezvousing before or after their trip to Union Station block access between the parking garage and the mezzanine.

2.3.3 ADA Issues

On the outside of Union Station, the nearby area contains some features that may impede travel by those with disabilities. A major issue found was that of poor quality curb ramps. Many ramps were found to be narrow, not lined up properly, lacking clear indication (i.e. no detectable warnings or ‘truncated

domes'), and in some places, uneven paving on and around the ramps. Inside, narrow escalators are provided between levels of the station, though they are supplemented by elevators.

2.3.4 Bicycles

The current bicycle facilities in the vicinity of Union Station are in a transitional state, with significant changes scheduled for the very near future. The bicycle network for the study area and adjacent streets, shown in **Figure 2-8**, contains as a primary feature a portion of the Metropolitan Branch Trail, which is planned to connect Silver Spring, Maryland to downtown Washington, with spurs and connections to other bicycle facilities in the region. The trail runs along 1st Street NE, where a bicycle route which continues down Louisiana Avenue is already in place; another leg runs along 2nd Street NE, coming into the east side of Union Station.

At Union Station, there is currently bicycle parking located at the southwest corner, with storage provided for a maximum of about 50 bicycles, however, cramped conditions limit the number of bicycles that can actually be parked. Elsewhere around the station, individual bicycles are often locked to parking meters and sign posts. During field visits, the bicycle parking rack appeared to be over half full before the morning rush and after the afternoon rush periods, and nearly completely full in between. To alleviate these bicycle parking issues, plans have been made for a bicycle station at Union Station, a concept of which is shown in **Figure 2.9**, located in the same area as the current bicycle parking racks. The station will include sheltered parking for about 150 bicycles, a bicycle repair facility, bike rentals and accessories for sale. Construction is scheduled to begin with in the next few months.

During field counts of pedestrian traffic at the southwest corner of Union Station, it was observed that during peak periods, over ten bicycle riders per hour accessed the bicycle racks outside of Union Station. In general, bikes were parked in the morning and departed in the evening. Other data collected around Union Station showed as many as 20-30 bikes per hour headed towards Union Station near the eastern portion of Massachusetts Avenue and F Street NE in the morning, and up to 40 per hour moving away from Union Station on Columbus Circle/Massachusetts Avenue during the afternoon, though it was unknown if this was bicycle traffic associated with, or simply bypassing, Union Station.

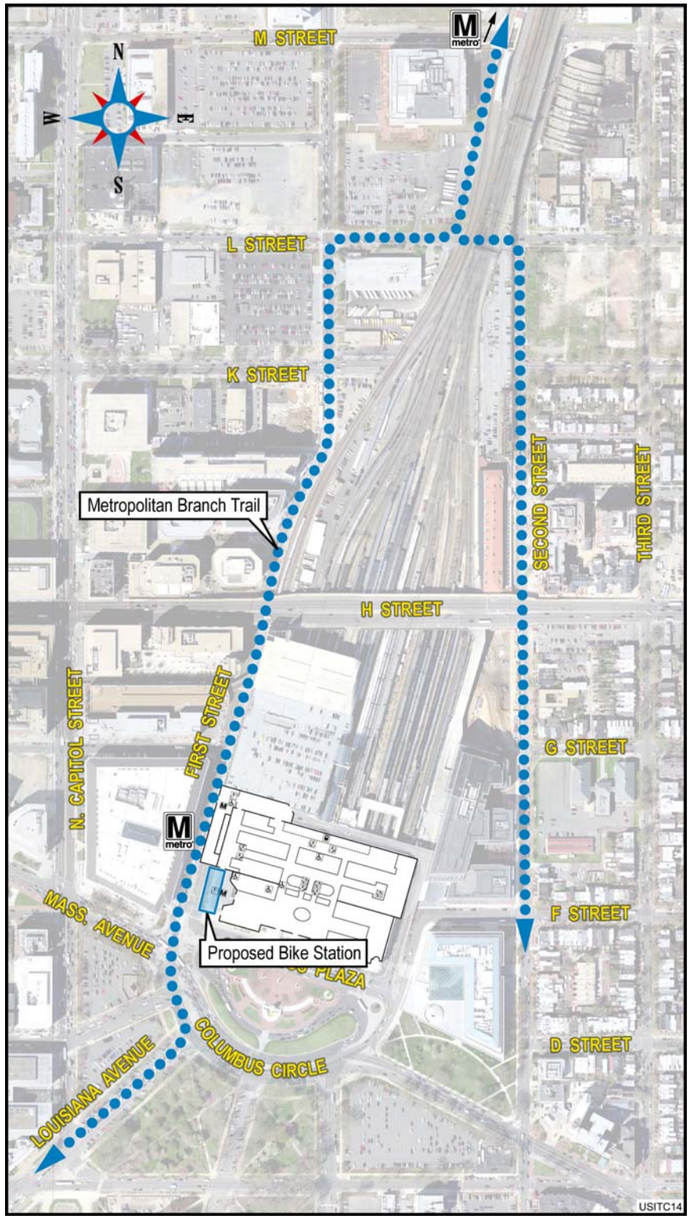


Figure 2-8. Map of Bicycle Trails in Study Area

Figure 2-9. Conceptual Design of Proposed Bicycle Facility at Union Station

2.4 TRANSPORTATION SERVICES AT UNION STATION

Transit service at Union Station includes Metrobus, Metrorail and the more recently introduced Downtown Circulator service. Transit ridership in the region continues to grow for both rail service and surface transit. These growth pressures are being felt and will continue to be felt at Union Station. Metrorail capacity constraints through the District's downtown core are focusing transit expansion more on surface transit, including expanded bus service, circulators, and light rail trolley service. This section focuses on existing transit operations while Chapter 3 includes a discussion on service expansions, such as the H Street streetcar and the K Street Transitway, that need to be considered in the planning and feasibility analysis for Union Station.

Both Metrobus and Metrorail are operated by the Washington Metropolitan Area Transit Authority, an organization that was created in 1967 to plan, develop, build, finance, and operate the region's transit system. Metrobus is the nation's fifth largest bus system, while Metrorail is the nation's second largest rail transit system. Metrorail and Metrobus serve a population of 3.5 million in a 1,500 square mile service area. Forty-two percent of those who work in the region's central core of the District (and parts of Arlington) use Metrobus and/or Metrorail to get to and from work.

2.4.1 Metrobus

2.4.1.1 Facilities

Metrobus serves Union Station directly, with a major bus stop and layover space on Columbus Plaza. Other highly utilized facilities in the study area include Columbus Circle and North Capitol Street, the latter seeing the highest Metrobus traffic in the area.

2.4.1.2 Ridership

Close to 300 miles of roadway in the District is served by the 58 major District Metrobus lines. Regionally, the system carries over 460,000 bus trips on an average weekday and, historically, about 55 percent of those trips are made within the District. The Union Station study area is served by nine separate WMATA bus routes. All of the routes operate within the District's city limits. Most of the routes operate throughout the day with increases in service during peak hours. The highest ridership in the study area occurs primarily on the busiest streets: Massachusetts Avenue, North Capitol Street and H Street. Metrobus operations are illustrated in Figure 2-2.

The four highest volume bus stops in the study area are:

- North Capitol Street & H Street
- Columbus Circle/Massachusetts Avenue & 1st Street NE
- Columbus Plaza (near the SW corner of Union Station)
- North Capitol Street & Massachusetts Avenue.

Figure 2-10 shows the ridership at the aforementioned stops, in addition to other stops with significant ridership. The information in the figure was obtained by WMATA in 2003 and is broken down by their designated peak and off peak periods. The highest ridership occurs at North Capitol and H Street, due primarily to the X2 bus route which runs along H Street and accounts for nearly two-thirds of the ridership at the N. Capitol and H Street intersection. While the X2 only runs along H Street in the study area, the majority of the buses that service both H Street and Union Station have higher ridership near the station, highlighting Union Station's current role as a transit hub. While the number of transfers from bus to other modes was not collected for this study, observations showed that at least half of bus alightings at the Columbus Plaza bus stop moved toward or came from Union Station The high bus ridership throughout the study area, including stops that are a few blocks removed from Union Station, shows that accessibility to other forms of transportation and access to employment centers are both effective at attracting people to this area. The popularity

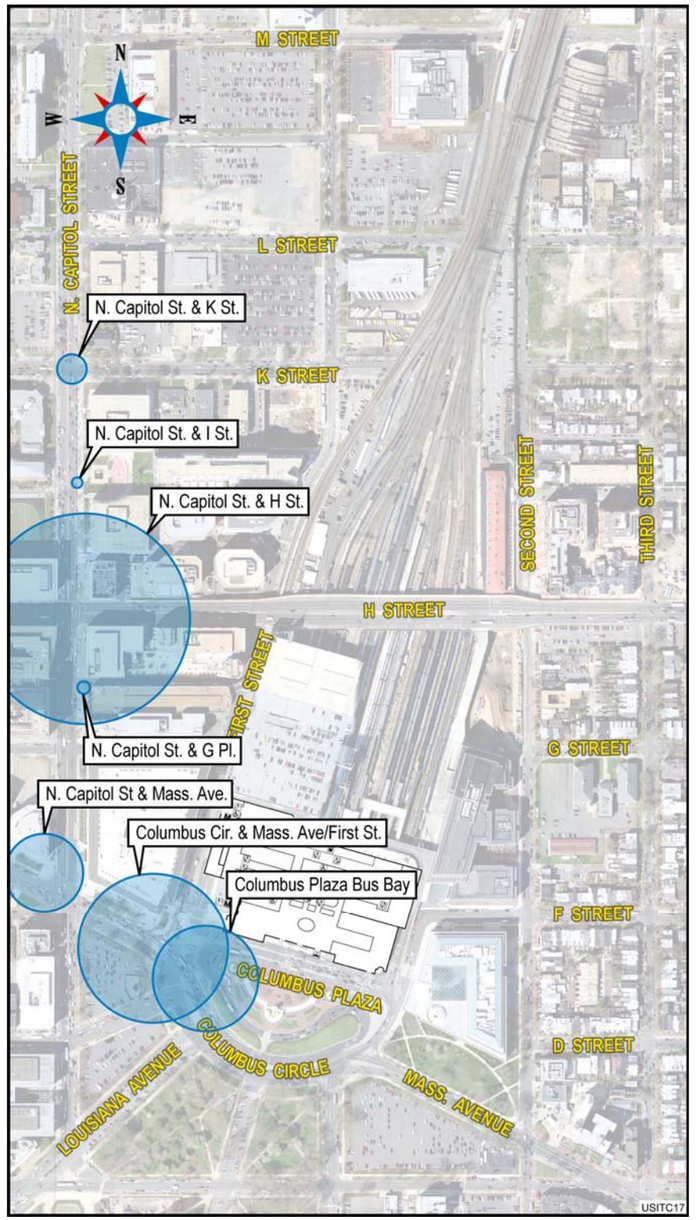


Figure 2-10. Relative Number of Boardings and Alightings at Metrobus Stops

of the Union Station study area for bus passengers is exemplified by the significant portion of the ridership on these lines occurring within the study limits. The D4 line is a particularly strong example of this, as over 40% of those who board this route do so within the study area. Details on ridership by route is included in Appendix A, Tables A-5 through A-8.

2.4.1.3 Operations

The Metrobuses near Union Station operate with frequent service throughout the day, with significant increases during peak commuting times. Bus operations ramp up during the morning period from 6 AM to 10 AM and during the evening period from 3 PM to 7 PM. The number of buses per hour scheduled to pass by the busiest stops is illustrated in Figure 2-10. The three intersections listed have comparable rates of bus traffic throughout the day, while Columbus Plaza has lighter traffic. However, it should be noted that since Columbus Plaza acts as both a terminus and origin for bus routes, the routes are only counted once there, while at other stops, the two directions are counted separately.

Since Columbus Plaza is separated from the rest of the traffic stream, buses there have an opportunity to pull over and dwell, which is the case of most of the routes that utilize this station. The westernmost portion of Columbus Plaza is reserved for MetroBuses. The westbound routes of the D4 and X8 bus and the southbound route of the D8 bus terminate at Columbus Plaza, while the accompanying eastbound and northbound routes originate there. At other times, buses dwell if they are ahead of schedule. The D4 and X8 buses have an average 4 to 5 minutes of time in between the end the westbound portion and beginning of the eastbound portion of their routes; the D8 bus has an average of about 7 minutes scheduled in between its routes. Field observations of Metrobuses in Columbus Plaza confirmed dwell times of 4 to 20 minutes, with the longer dwell times likely to be those of buses going into or out of service at Union Station.

2.4.1.4 Population

Since the service frequency of Metrobus responds to increases in demand during peak periods, a considerable number of buses are taken out of service between the morning and afternoon peaks. The morning peak operations in their current state require 591 buses of Metro's fleet, while the afternoon peak requires 571. However, during the midday, the number of buses required to run Metro's routes dips to 275, representing a gap

of over 300 buses that are taken out of or put back in to service throughout the system between peak periods.

2.4.2 DC Circulator

The Circulator bus system, like the other bus systems in the area, is designed to efficiently move people in and around the District. However, the Circulator's sole function is to move people within the core of the city. All three of the Circulator routes are downtown, one of which loops around the National Mall. The route servicing Union Station runs between the station and Georgetown. The Circulator system is relatively new, and as such, the buses are bold, modern, and very distinct from WMATA buses. Depending on the route and time of day, however, Circulator buses can cater to a similar market of DC resident transitcommuters, using the system as an extension of Metro and the Metrobus network.

2.4.2.1 Facilties

Outside of Union Station, the Circulator operates much like a Metrobus, utilizing Metrobus stops to load and unload passengers. At Union Station, however, the Circulator uses the east and west access roads to layover in the Union Station Garage, where two bays are reserved for the Circulator. While this brings Circulator service within Union Station, most passengers choose to use stops along Massachusetts Avenue to board and alight from the bus.

2.4.2.2 Ridership

The Union Station to Georgetown line is the most heavily used of the three Circulator Routes. Ridership for the line in April of 2008 was over 155,000 trips, or about 74% of all the monthly Circulator ridership. April's ridership represents a 22% increase over the same month in 2007. Ridership at specific locations was not available, though there are distinct increases in ridership at the two ends of the route. Average weekday ridership for the Union Station to Georgetown line was approximately 6,200 riders per day during the month of April.

2.4.2.3 Operations

Though the Circulator bus caters to both tourists and District residents alike, its operations near Union Station are heavily commuter in nature as a result of the fact that it serves a heavily trafficked corridor between Georgetown and Union Station. Service to Union Station runs from 7 AM to 9PM during the week, with a scheduled headway of 10 minutes throughout the day. While frequency of operation does not change, ridership on the Circulator makes a marked increase during peak periods, in particular from 7 to 8 AM and from 4 to 5 PM. **Figure 2-11** below shows the cumulative ridership by hour for the month of April, highlighting the distinct commuting peaks, as well as the significant portion of system ridership that is attributable to the Union Station to Georgetown route.

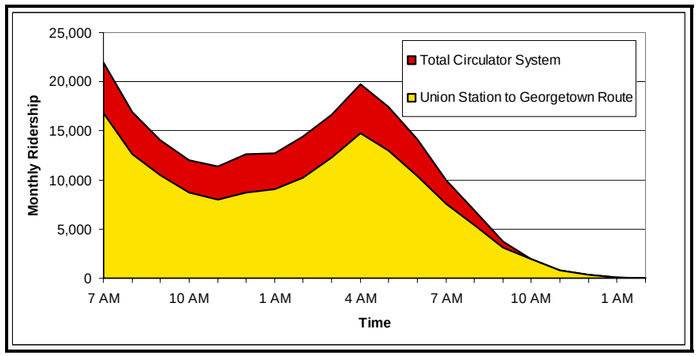


Figure 2-11. Circulator Monthly Ridership by Time of Day (April 2008)

2.4.3 Commuter Buses

Commuter buses, while represented in substantially smaller numbers than Metrobuses, also have a role in moving passengers to and from Union Station. Commuter buses are operationally different than inter-city buses such as Greyhound, although they sometimes serve the same locations, using similar vehicles. For this study, six commuter bus operations were found and analyzed that service the District. The six operations are:

- Maryland Transit Administration (MTA Maryland) commuter buses
- Potomac and Rappahannock Transportation Commission (PRTC) OmniRide
- Loudoun County (LC) commuter buses
- Martz Group commuter services
- Quick's Bus Company commuter bus service
- Shenandoah Valley commuter bus service - Valley Connector (VC)

Commuter buses cater to a market segment than local city buses or intercity buses, bringing in commuters from various suburbs surrounding the District over longer distances, with buses that are optimized for infrequent boardings and deboardings. MTA Maryland, PRTC (OmniRide) and Loudon County provide the bulk of the commuter bus service to the District. The VC commuter service, which only operates a single bus run into Washington, has the furthest route, beginning in Woodstock, Virginia, approximately 100 miles away from downtown Washington. The other Virginia based companies operate out of the Fredericksburg area (Quick's and Martz), about 50 miles outside of the District, Purcellville (LC), also about 50 miles away, and Manassas and Gainesville (PRTC).

2.4.3.1 Facilities

Union Station has no facilities dedicated exclusively to commuter bus service. MTA Maryland, the Maryland Mass Transit Administration of the Maryland Department of Transportation, operates the most commuter buses serving Union Station study area, with bus stops on N. Capitol and H streets. Loudon County Transit, the second busiest operator, serves H Street and N. Capitol Avenue, as well.

At mid-day, when commuter buses are not bringing people into or out of the city, they must be "staged," or stored before they make a return trip in the evening. The midday layover procedure varies by agency. As an example, the Loudoun County commuter buses return their entire fleet to a "home base" during the midday. Other agencies will return some buses, and have others remain in the city, staging at the various bus lots or street parking. Alternatively, others may leave the buses at a staging yard in the District, but shuttle groups of drivers back during the layover period.

2.4.3.2 Ridership

Detailed ridership of the commuter bus was not available specifically at Union Station. However, broad level estimates showed that the average commuter bus servicing Union Station is half to three-quarters full on any given day of the week. **Table 2-2** below shows the ridership for the bus routes servicing Union Station. Note that the table does NOT reflect ridership specifically at Union Station.

Table 2-2. Ridership[1] of Commuter Buses which Serve Union Station Area

	MTA MARYLAND[2]	PRTC	LC[3]
Average Daily Ridership for Route Servicing Union Station	2,153	—	1,865
Resulting Average Bus Occupancy Servicing Union Station	36	—	43

[1] Of those systems that ridership data could be obtained

[2] Average daily ridership for FY2008, up to April 2008 for 903, 922 and 950 routes obtained from phone conversation with Glen Hoge of MdTA, 5/8/08

[3] Ridership for bus routes servicing Union Station area, May '08, from http://www.loudoun.gov/Default.aspx?tabid=969

2.4.3.3 Operations

Commuter buses provide a constant stream of bus traffic into the city, predictable by time of day and uninfluenced by season. Conventional peak traffic periods see the vast majority of commuter bus volumes, while midday sees activity taper off. The majority of the commuter buses will end their trips by 9 to 10 AM for morning service into Washington. In the afternoon, the majority of them begin service around 3 PM, though there are often mid-day day departures out of the city, especially on Fridays. The number of bus runs that commuter bus agencies provide Include:

- MTA: 60 buses in the study area, 321 throughout DC
- PRTC: 2 buses in the study area, 138 throughout DC
- LC: 43 buses in the study area, 59 throughout DC
- Martz: 0 buses in the study area, 23 throughout DC
- Quick's: 2 buses in the study area, 6 throughout DC
- VC: 1 buses in the study area, 2 throughout DC

While the numbers shown above do not represent the number of actual buses, since most are used for multiple runs during any given period, they do highlight the fact that there are many buses that layover during the day, either in the city or elsewhere.

Despite Union Station's proximity to major job attractors such as Capitol Hill, only some of the commuter buses serving Washington actually pass through the study area. The MdTA and LC commuter buses both provide significant service to the station, but LC is the only agency to schedule a bus stop within the study limits for a majority of its bus routes. The other agencies have limited if any service near Union Station, and instead focus primarily on areas deeper downtown to the west such as the State Department. Of the buses that do pass within the study areas, service operates similar to any other bus route, with passenger pick up and drop offs at designated locations. Before buses begin their routes in the evening, they can often be seen idling on the 11th Street (Hopscotch) Bridge, waiting to move into position to begin their routes on schedule.

2.4.4 Metrorail

Union Station plays a large role in Metrorail's operations. While only utilized by the Red Line, Union Station maintains the distinction of being the highest volume station in the system. Even without other Metrorail lines to transfer to, much of the ridership at Union Station is still transfer traffic – specifically transfers from commuter trains. Access to neighborhoods and employers also drive the ridership at the station. Union Station's role as a transfer point and intermodal hub rely heavily on the Metrorail that runs beneath it.

2.4.4.1 Facilities

The Union Station Metro Station is located below Union Station's lower level, along the west side of the building next to 1st Street. It has three connections to Union Station:

- An outdoors entrance in the southwest corner of Union Station, with escalators from street level leading to the Metro station mezzanine level.
- An entrance from Union Station's lower level, connecting to the same mezzanine level as the entrance above.
- An entrance at the northwest corner of Union Station's main level.

As illustrated in Figure 2-7, the entrance at the northwest corner experiences heavy congestion, as it also serves as a main entrance out of Union Station for many MARC, VRE, Amtrak, and other Union Station users on their way to offices to the north and west. This entrance is very constricted, poorly marked, and heavily utilized, particularly during rush hours, by commuters transferring from Metrorail to commuter rail or vice-versa.

2.4.4.2 Ridership

During a typical weekday, the Union Station Metrorail station is the busiest station in the system. Approximately 34,000 trips on the Metrorail system originate at Union Station every day, which represents about 5% of the approximately 710,000 daily trips on the Metrorail system (as of the time survey information was collected in late spring of 2007). As can be seen in **Table 2-3**, over two-thirds of the ridership from Union Station occurs during the peak periods, with ridership slightly higher in the evening period as compared to the morning. This consistently high ridership is in contrast to most other Metrorail stations that act as primarily a morning origin (those near residential areas, such as Shady Grove) or evening origin station (those near employment centers downtown, such as Metro Center). As can be expected from consistently high boardings, the volume of alightings at Union Station is also high – the most of any station on the entire Metrorail system throughout the day.

Table 2-3. Volumes of Weekday Metrorail Trips Beginning or Ending at Union Station

	METRORAIL TRIPS ORIGINATING AT UNION STATION		METRORAIL TRIPS FINALIZING AT UNION STATION	
AM Peak (opening to 9:29 a.m.)	10,005	30%	12,395	37%
AM Offpeak (9:30 a.m. to 2:59 p.m.)	6,428	19%	7,061	21%
PM Peak (3:00 p.m. to 6:59 p.m.)	12,912	38%	11,700	35%
PM Offpeak (7:00 p.m. to 12:00 a.m.)	4,521	13%	2,407	7%
Total Peak	22,917	68%	24,095	72%
Total Offpeak	10,949	32%	9,468	28%
Total	**33,866**	**100%**	**33,563**	**100%**

Source: WMATA, 2007 Metrorail Passenger Survey

While direct hourly ridership was not obtained for the Metrorail system, it has been estimated based on peak period ridership train frequency. The estimates indicate that during the morning and peak hours, at least 3,350 and 3,850 people per hour, respectively, board a Metro train at Union Station. Likewise, at least 4,150 people alight from a Metro train in the morning peak hour, and at least 3,500 in the evening peak hour. Due to the surges that occur within these peak hours, these figures underestimate the highest peak volumes for short periods of time.

2.4.4.3 Operations

Union Station is one of several downtown stops on the Red Line, though by nature of the fixed route, has the same train frequency as all other downtown stops. From Union Station, the Red Line towards the Shady Grove terminus extends west and northwest, going through downtown Washington, neighborhoods of northwest Washington, and then out as far as Gaithersburg, Maryland; in the direction of the Glenmont, the Red Line services neighborhoods in Northeast Washington, and through Maryland to Glenmont, Maryland. During the peak periods, (roughly 7 AM to 10 AM and 4PM to 7PM) up to 25 trains in either direction arrive per hour. This is two and a half times as frequent as during regular mid-day service, which has twenty trains per hour, split evenly between the two directions. Headways in each direction through Union Station are consequently as short as two to three minutes during peak hours, six

minutes during the midday, and up to 17 minutes during weekday evening post-peak service.

2.4.5 Intercity Bus

Intercity bus service to and from the study area is provided by Greyhound and Peter Pan Bus lines, which operate from a facility north of the main Union Station Complex. Although intercity bus ridership to the Washington DC area is increasing, benefits from the increase may be limited for Union Station, due to the remote location of the bus depot. New bus services that are being developed to serve the Northeast corridor, such as MegaBus, operated by First Group, Bolt Bus operated by Greyhound, and the various coaches serving the Gallery Place Chinatown neighborhood are increasingly choosing to provide service from various curbside stops throughout the Washington DC area. Few of these curbside stops are near Union Station due to congestion on the surface streets around the station; operators instead choose locations throughout the district convenient to Metrorail or other regional transit points.

2.4.5.1 Ridership

Daily Greyhound Lines ridership at Washington DC is estimated at around 3,500 passengers.

2.4.5.2 Facilities & Operations

The Greyhound bus depot, located at 1st Street NE and L Street, is in the project area and its operations are being evaluated as an integral component of the study. Buses arrive 24 hours a day, with headways of approximately 30 minutes. Though service drops off during nighttime hours, the depot handles over 60 buses per day.

A key issue with the current configuration of facilities is the distance between Union Station facilities and the Greyhound facilities, which are separated by more than 2000 feet, or .38 miles, despite serving passengers with many of the same characteristics and needs as Amtrak passengers.

2.5 RAIL AT UNION STATION

The primary and historical transportation function of Union Station is as a rail terminal. Twenty tracks serve the station, carrying both commuter and intercity rail traffic. Seven tracks continue through the station, carrying traffic southward to Virginia and other points south. Union Station is the terminus of two of Amtraks most popular services, Acela Express and the Northeast Regional, as well as five commuter rail lines.

Rail services at Union Station use common passenger facilities along the north edge of the building that were built as part of the development activities associated with the 1981 Redevelopment Act.

2.5.1 Commuter Rail

By their nature, commuter trains, like commuter buses, operate with distinct work-based peak periods; bringing people into the District in the morning, and taking them back home in the evening.

Commuter rail service at Union Station is provided by two separate services:

- Maryland Transit Administration's Maryland Rail Commuter (MARC)
- Virginia Railway Express (VRE)

MARC trains operate on three lines, extending to Perryville, Maryland, Martinsburg, West Virginia and Baltimore, Maryland with Union Station being the terminus and only District station. VRE operates two separate lines, running from Manassas and Fredericksburg, Virginia, with service in the District at L'Enfant Plaza and Union Station.

2.5.1.1 Facilities

Commuter rail at Union station operates alongside Amtrak service. MARC trains, which serve both high and low level platforms, operate from the westernmost tracks, often interspersed with Amtrak Intercity trains.

VRE trains operate from the easternmost tracks, which are low-platform tracks to accommodate VRE's low-platform train sets. VRE shares these tracks with the 18 daily Amtrak trains that provide through service to Richmond, Virginia, the Carolinas, and Florida.

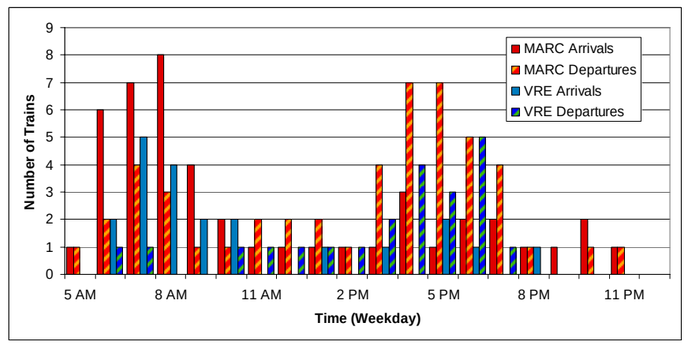
2.5.1.2 Ridership

Commuter rail operations at Union Station are some of the busiest in the county. Over 30,500 riders use the MARC system on an average weekday, while over 15,000 riders use the VRE system on an average weekday. Detailed ridership data for the commuter rail systems is shown in Appendix A, Tables A-9 and A-10.

2.5.1.3 Operations

The inbound/outbound patterns of commuter trains are similar to those of the commuter buses. **Figure 2-12** displays the frequency of service of the commuter rail operations at Union Station. The high frequency of arrivals in the morning, up to eight trains in an hour for the MARC system, coupled with the high volume of departures in the evening is dictated by a traditional work day. VRE maintains a distinct peak hour, having over 40% of the morning arrivals occurring within a single hour. Evening departures are more evenly distributed. However, the presence of trains throughout the day shows some deviation from the pure inbound/outbound daily commute. In particular, there are several morning trains which depart bound for Baltimore, another large employment attractor.

As discussed in Section 2.2.2, the arrival of the commuter trains creates a large platoon of passengers leaving the train to transfer to other modes of transportation or simply depart the station. A single train often creates a platoon of over 200 people moving through Union Station, beginning in the rear of the station where passengers exit the rail concourse, through to the Metrorail platform, or out the doors to the adjacent streets. Observations showed that essentially all the passengers depart from the commuter train within approximately five minutes, with the majority of people leaving the platforms in less than three minutes.



Source: MARC and VRE published train schedules

Figure 2-12. Commuter Train Activity at Union Station

2.5.2 Intercity Rail

Long distance rail service from Union Station is provided by Amtrak. The majority of Amtrak's trains using Union Station are part of the Northeast Corridor rail service which goes north to

Philadelphia, New York City and Boston. Schedules are focused primarily on the densely populated east coast, however, a limited number or options are available for traveling as far south as Miami, Florida, and as far west as Seattle, Washington and San Francisco, California. Additionally, some of Amtrak's operations accommodate suburban Washington region workday commuters by allowing VRE & MARC fares to be accepted on select trains with payment of a small step-up fare.

Approximately 50 trains both arrive and depart each day at Union Station with the volumes illustrated in **Figure 2-13**. Amtrak service at Union Station is more evenly distributed than the distinct morning and evening peaks of commuter rail. Between 8 AM and 8 PM, 40 trains arrive and 39 depart, which is over two-thirds of the 116 Amtrak trains using Union Station throughout a given weekday. A peak occurs between 10 to 11 AM, and again at 7 to 8 PM, with a combined 11 trains arriving or departing during each of these hours.

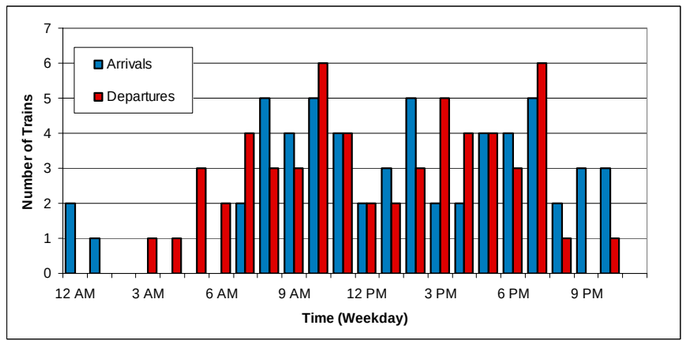


Figure 2-13. Amtrak Activity at Union Station

2.6 TOUR BUSES

Tour buses are a common sight around the District, shuttling tourists across the city to experience the history and culture of the nation's capital. The sheer volume of buses, combined with their large profile, makes them highly visible. Observations have shown that tour bus populations peak during the spring months which includes the popular Cherry Blossom Festival.

2.6.1 Facilities

A key component of the 1981 Redevelopment Act activities was the inclusion of 95 spaces for tour buses on the garage's first level. Tour buses can access this level from H Street, or the west or east access roads.

2.6.2 Ridership

A survey of bus populations was conducted on the afternoon of Thursday May 15, 2008 in order to get a "snapshot" of the number of buses in the District at any one time. Traveling around the city, buses were counted whether parked or driving, with attempts made to avoid double-counting moving buses. A number of commuter buses are included in these figures, partially due to the inability to distinguish commuter buses from smaller tour bus liveries. It was concluded, however, that even though commuter buses may have longer layover periods, and consequently different parking requirements than tour buses, the presence of commuter buses at any parking location increases the overall parking demand.

2.6.3 Operations

Although some tour buses begin and end service at Union Station (GrayLines operates a ticket booth on the bus level of the Union Station Parking Garage), most buses use Union Station as a way point allowing tourists to eat and shop at Union Station.

As shown in **Table 2-4**, the majority of tour buses are focused on the National Mall itself, as well as at locations with quick access to the Mall area. Street parking is available for buses along Maine Avenue and Water Street, as well as Ohio Drive and the Hain's Point area. These "first come-first serve" areas seem to be popular destinations for empty tour buses laying over while the passengers explore the museums and monuments downtown. These streets provide not only free parking for a certain period of time, but also relatively easy access to the major tourist destinations. Other locations which have been designated as bus layover locations are less popular. The Anacostia bus staging lot, for example, had only eleven buses, while an additional two were counted parked on an adjacent street. Most of these appeared to be commuter buses waiting for the afternoon outbound shifts. The expansive lots outside of RFK Stadium were effectively empty, only buses parked on streets adjacent to the lots were seen in this area. Likewise, no buses were seen in the parking lot of the old Convention Center in downtown, but instead a small number of buses were seen on the adjacent roads surrounding the parking lot. A survey of actual bus operators, to take place later in the study, may reveal more definitively the operations of these buses and their parking characteristics and needs.

Table 2-4. Combined Tour and Commuter Bus Populations Observed Near Downtown Washington

LOCATION	TOUR OR COMMUTER BUSES	TOURING SCHOOL BUSES
Hain's Point, Ohio Drive	83	30
Streets Adjacent to RFK Stadium Parking Lots	2	2
Anacostia Bus Parking Lot	13	0
Maine Avenue, Water Street	83	0
National Mall and Nearby Street Network	256	32
Near Old Convention Center Parking Lot	9	0
Union Station Parking Garage	55	0
Total	501	64

Source: Parsons Transportation Group field data collection May 15, 2008

3 – Planned And Proposed Transportation Components

As this report has described, Union Station serves a wide variety of travel modes and functions as a major transportation and activity hub in the District of Columbia. The success of Union Station, as evidenced by the 32 million patrons who make use of the facility every year, comes from its central location, the range of work, residential, and entertainment/shopping activities within the station and nearby, and its function as an intermodal hub that allows for transfer between the various modes that serve the station. While the current intermodal function of the station reflects some level of planning, a truly comprehensive and integrated look at how the modes interact and how those interactions could feasibly be improved is needed. This study seeks to address that need.

One of the key elements of this study is to consider the continued growth in demand for various services, current expansion needs and plans, and potential conflicts and/or constraints related to the implementation of these expansion plans. Overriding the assessment of these various plans, however, is the goal of better integrating the various modes and making the interactions between the modes as seamless and convenient as possible. To take one example: there are discussions relative to moving the existing intercity Greyhound bus station into Union Station itself. The goal of better integrating intercity bus into the intermodal mix at Union Station presents an opportunity to provide better connections for travelers, but issues relative to appropriate location and connections need to be fully identified and then addressed.

Projects planned and proposed for the Union Station study area are shown in **Figure 3-1**.

This chapter summarizes some of the current needs, plans, and potential challenges for the various modes at Union Station. It is important to note that this list will continue to be developed and updated as this study progresses.

3.1 VEHICULAR CONNECTION BETWEEN MASSACHUSETTS AVENUE AND H STREET NE

Based on annual average weekday traffic counts reported by DDOT, Massachusetts Avenue (23,000 vehicles per day) and H Street, NE (27,000 vehicles per day) are the two busiest streets in this study vicinity. The two roads intersect at a point about one half mile west of Union Station. To the east of the Massachusetts Avenue and H Street intersection, 2nd Street, NW, New Jersey Avenue and North Capitol Street provide connectivity to both roadways. Apart from these three streets, connectivity would otherwise be made via small residential streets. Based on existing physical space and other constraints, the most opportune location for a new connection would be east of Union Station, but west of 2nd Street, NE since only residential streets and neighborhoods exist further to the east. On the other hand, to the west of the station, 1st Street NE cannot be used since it is not connected at grade to H Street.

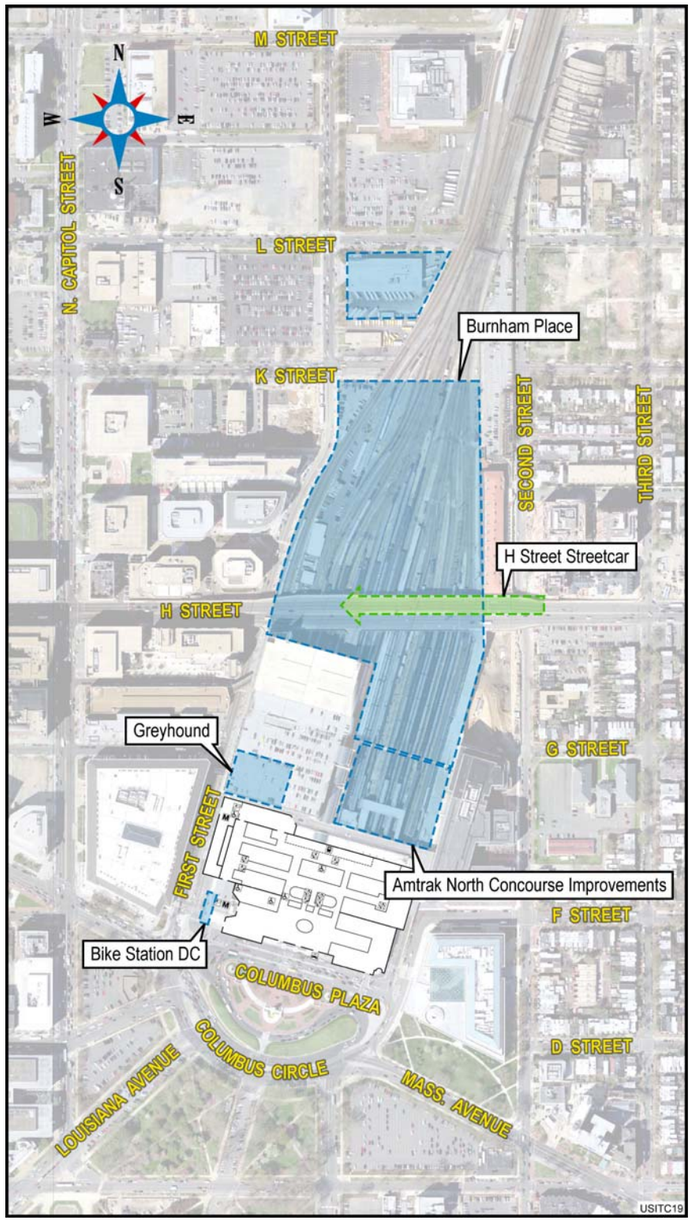


Figure 3-1. Future Development Activity near Union Station

The connection can begin with the existing northbound portion of Columbus Circle at Massachusetts Avenue and tie into H Street as another leg to the intersection of H Street and the access ramp that services the Senate Place development. This will create a more complicated intersection, but will waive the necessity of adding an additional signal on the H Street Bridge. Alternatively, the alignment can be brought closer to and parallel to the Union Station parking garage, and then brought into H Street at the same location as the driveway to the parking garage, though this will necessitate adding a traffic signal at this location.

3.2 INTEGRATION OF INTER-CITY BUS SERVICE INTO THE UNION STATION GARAGE

The Greyhound bus depot on L Street, NE utilizes 15 bus bays to cater to the 64 buses per day at the depot. Given these existing operations, an area of approximately 11,100 square feet would be required at the Union Station parking garage to accommodate these bus slips. In addition, employee parking, circulation, passenger pick-up and drop-off areas, concourses, and other outdoor station features add up to 40,000 additional square feet. Internally, areas for ticketing, passenger waiting, driver and employee accommodations, baggage etc are needed, adding another 11,000 square feet. The administrative and bus services (such as repair equipment) may add another 2,000 square feet.

While the parking garage behind Union Station may be a logical place to relocate of Greyhound services, this will require reduc-

ing or perhaps removing the tour bus parking currently available. The tour bus parking is a valuable asset to both Union Station and the District as it brings business to Union Station, and provides support to the tour bus industry which is incredibly important to Washington's businesses. A complete relocation of the tour bus parking therefore is a less than ideal option. Borrowing space from development above the rail yard behind Union Station may prove to be necessary to integrate commercial bus service. Adjusting Greyhound bus layover schedules so that fewer buses are loading or unloading at any given time may reduce the space needed closest to the station. Administrative space may be placed somewhere within Union Station, perhaps placing Greyhound ticketing alongside the current Amtrak ticket counters or using a retail store location. Alternatively, passenger car parking spaces in the parking garage could be sacrificed to create an external, but immediately adjacent facility which could also be large enough to accommodate waiting areas for passengers. Since inclusion of inter-city bus would be such a logical component of an ITC, the coordination necessary to integrate Greyhound would be worthwhile.

3.3 INTEGRATING STREETCAR SERVICE FROM H STREET

The rehabilitation of the H Street NE corridor includes plan for a streetcar running from Benning Road to 2nd Street NE along H Street. The as yet to be planned terminus could very well fit into a plan at Union Station. The current alignment calls for two sets of tracks, one on each side of H Street in the curb lanes.

One potential option for bringing the streetcar service up to Union Station would call for bringing the streetcar below grade, connecting with an existing tunnel lying below the rail yard behind Union Station. A pedestrian connection can then be made from this tunnel platform to Union Station, most likely continuing an existing tunnel that extends from the Metrorail station nearly to the tunnel below H Street If the streetcar is extended at-grade to 2nd Street, it will then have to drop in elevation to reach the existing H Street tunnel, which would require a grade of at least 3% in the approximately 650 foot horizontal distance.

Another option brings the streetcar up the H Street Bridge over the rail yard behind Union Station. This plan will necessitate integration with a deck planned above the rail yard that is part of the proposed Burnham Place development. WMATA has a vertical access easement from street level to the H Street Bridge which may be of use for accessing the streetcar terminus on the bridge. Additionally, running the streetcar on the bridge may help facilitate route extensions to the west.

3.4 OTHER MODES NEEDS

Amtrak: Amtrak projects continued growth in passenger demand, potentially requiring extensions to existing platforms. There are some physical constraints to such expansion, and alternative methods to provide expanded capacity will need to be developed and assessed.

VRE / MARC: In 2004, VRE issued a long range strategic plan that outlined their goals through 2025. Included was an option for providing run-through service at Union Station, allowing access to MARC stations for VRE trains and vice-versa. Vertical and horizontal passenger movement areas would likely need to be improved to facilitate the additional passenger volume expected as part of this service, in particular due to the need to move some MARC trains to the lower level tracks which are furthest from Metrorail. Coordination between VRE, MARC, WMATA and Union Station will be paramount to make this option feasible.

3.5 PROPOSED DEVELOPMENTS AFFECTING UNION STATION

Burnham Place is a three million square-foot development planned in the air rights above the Union Station Tracks. A key component of both the North of Market (NOMA) Neighborhood Plan and the H Street Redevelopment, Burnham place would connect Union Station, H Street, and NOMA through a complex of office space, commercial, hotel and residential place. As such, identification of key transportation issues in the corridor is critical to both Burnham Place and Union Station.

4 – SUMMARY

As described in the introduction, this Baseline Study Report, the first of several being developed for the study, describes existing uses, operations, and conditions for the various travel modes at Union Station. As such, the objective of this report was to catalog those conditions and use to inform further study of the Intermodal Transportation Center.

Key findings from this Baseline Study Report include:

1. Traffic. The streets immediately around Union Station see a high volume of traffic, and generally function at LOS D or worse. Key streets and AADTs are:

   - Massachusetts Avenue: 23,000 vehicles per day
   - H Street: 27,000 vehicles per day

2. Bus Accommodations in the Union Station Parking Garage. Intercity bus service from operators such as Greyhound and Peter Pan Lines is currently operated from a facility physically separated from Union Station. Integration of inter-city bus service into any future development at Union Station would be highly desirable by both the operators and travelers, but may be difficult to accommodate. Ample provision for tour buses exists in the current garage configuration, but may not be adequate for the addition of Greyhound Intercity Bus service.

3. Pedestrian flows into and out of Union Station. Pedestrian flows in Union Station are highly dependent on the configuration of services using the tracks. Chokepoints exist in the existing station that would need to be accommodated any additional development. Chokepoints are especially pronounced around the Metrorail Station, the busiest station in the 104 mile system. Chokepoints exist outside the station as well, especially near the southeast corner of the building, and the busy 1st street exit.

4. Grown Projections: Ridership on all modes using Union Station directly – Metrorail, MARC, VRE, and Amtrak is increasing, and is expected to grow, making existing facilities in Union Station increasingly inadequate.

   Developments in the surrounding areas of NOMA and H street will provide new traffic, transit service, and residents, and must be able to be accommodated.

Next steps for the study will include development of a set of recommendations to address growth at Union Station in both the short and longer terms.

APPENDIX – INVENTORY AND TRAVEL DEMAND TABLES

A-1. Field Collected Turning Movements

		AM PEAK PERIOD				PM PEAK PERIOD			
		L	T	R	SUM	L	T	R	SUM
N. Capitol St. and K St.	Southbound(SB)	4	1114	286	1404	14	702	168	884
	Westbound(WB)	142	494	94	730	202	360	60	622
	Northbound(NB)	50	580	108	738	2	1040	50	1092
	Eastbound(EB)	120	238	64	422	218	466	56	740
1st St. and K St., NE	SB	16	216	150	382	62	210	148	420
	WB	164	512	80	756	48	166	56	270
	NB	12	46	30	88	22	132	120	274
	EB	40	120	88	248	78	532	60	670
2nd St. and K St., NE	WB	34	724	2	760	18	230	0	248
	NB	180	4	38	222	122	0	68	190
	EB	0	156	18	174	0	778	28	806
3rd St. and K St., NE	SB	16	190	54	260	24	130	22	176
	WB	56	652	64	772	30	168	14	212
	NB	58	114	2	174	42	128	38	208
	EB	22	174	24	220	32	596	36	664
N. Capitol St. and H St.	SB	22	914	354	1290	106	600	290	996
	WB	68	1448	156	1672	80	618	142	840
	NB	34	504	110	648	0	732	140	872
	EB	152	428	76	656	114	852	56	1022
H St. and Union Station Garage NW Entrance	WB	48	1378	0	1426	8	590	0	598
	NB	8	0	4	12	210	0	96	306
	EB	0	460	56	516	0	1228	18	1246
H St. and Union Station Dock NE Entrance	WB	40	1520	0	1560	6	582	0	588
	NB	8	0	4	12	22	0	22	44
	EB	0	386	42	428	0	1312	4	1316
3rd St. and H St., NE	SB	14	88	50	152	52	130	44	226
	WB	42	1216	42	1300	18	532	16	566
	NB	98	108	36	242	46	184	48	278
	EB	26	334	24	384	114	1342	82	1538
N. Capitol St. and G St.	SB	18	794	40	852	22	612	14	648
	WB	46	36	24	106	88	94	46	228
	NB	16	582	168	766	4	898	68	970
1st St. and G St., NE	SB	0	102	96	198	0	176	130	306
	NB	0	6	2	8	0	12	4	16
	EB	78	0	44	122	56	0	52	108
2nd St. and G St., NE	SB	0	58	0	58	0	74	0	74
	WB	58	0	86	144	26	0	22	48
	NB	0	120	0	120	0	182	0	182
3rd St. and G St., NE	SB	0	98	36	134	0	136	22	158
	WB	38	88	74	202	12	26	58	96
	NB	32	108	0	140	16	152	2	170
N. Capitol St., Mass Ave. and F St.	SB	234	580	122	936	182	548	90	820
	WB	14	828	288	1130	14	364	186	564
	NB	0	410	8	418	0	624	10	634
	EB	224	348	32	604	296	502	50	848
N. Capitol St. and F St.	EB	0	410	8	418	0	624	10	634
2nd St. and F St., NE	SB	24	98	0	122	22	94	0	116
	WB	130	14	20	164	40	0	16	56
	NB	0	88	38	126	0	124	62	186
	EB	18	36	60	114	54	34	100	188
3rd St. and F St., NE	SB	16	84	28	128	48	84	22	154
	WB	22	134	38	194	6	40	14	60
	NB	14	76	18	108	8	114	32	154
	EB	30	40	18	88	36	142	12	190
N. Capitol St. and E St.	SB	16	376	218	610	36	470	136	642
	WB	40	326	4	370	78	174	14	266
	NB	24	298	34	356	12	382	12	406
	EB	128	110	24	262	196	276	52	524
2nd St. and E St., NE	SB	26	206	0	232	3	36	0	39
	WB	114	0	26	140	4	0	1	5
	NB	0	112	26	138	0	14	6	20
3rd St. and E St., NE	SB	6	58	42	106	24	66	28	118
	WB	12	106	8	126	6	26	8	40
	NB	14	78	8	100	4	112	12	128
	EB	14	20	8	42	26	98	10	134
N. Capitol St. and Louisiana Ave.	SB	2	18	360	380	0	28	498	526
	WB	0	232	24	256	2	298	8	308
	NB	0	26	2	28	0	12	0	12
	EB	406	230	0	636	318	180	0	498
Louisiana Ave. and D St., NW	SB	2	438	124	564	8	574	182	764
	WB	120	246	2	368	54	182	6	242

		AM PEAK PERIOD				PM PEAK PERIOD			
		L	T	R	SUM	L	T	R	SUM
	NB	4	498	114	616	8	532	42	582
	EB	64	122	2	188	44	130	4	178
2nd St. and Mass Ave., NE	SB	8	144	62	214	8	136	192	336
	WB	10	908	46	964	8	308	16	332
	NB	90	106	4	200	100	156	4	260
	EB	60	206	76	342	168	704	72	944
Delaware Ave. and D St., NE	SB	0	0	6	6	2	0	10	12
	WB	0	290	0	290	0	298	4	302
	NB	10	2	0	12	12	0	12	24
	EB	8	396	2	406	10	290	0	300
1st St. and D St., NE	SB	78	42	16	136	76	12	46	134
	WB	54	300	26	380	6	182	2	190
	NB	6	30	6	42	58	52	20	130
	EB	140	206	64	410	56	236	6	298
2nd St. and D St., NE	SB	10	128	112	250	6	162	68	236
	WB	26	282	4	312	12	54	0	66
	NB	72	148	16	236	40	172	46	258
	EB	46	120	142	308	62	244	98	404
3rd St. and Mass Ave., NE	SB	12	0	0	12	32	2	0	34
	WB	0	1320	36	1356	0	386	20	406
	NB	66	130	18	214	52	106	10	168
	EB	0	232	0	232	0	682	0	682
3rd St. and Mass Ave., NE	SB	16	0	38	54	20	32	42	94
	NB	38	132	22	192	2	106	16	124
	EB	12	24	0	36	12	154	0	166
D St. and Mass Ave., NE	SB	0	184	2	186	0	690	12	702
	WB	0	24	14	38	0	12	26	38
	NB	290	1078	0	1368	58	370	0	428
	EB	4	42	48	94	0	178	66	244
1st St. and M St., NE	SB	14	312	0	326	76	300	0	376
	WB	86	2	108	196	2	0	8	10
	NB	0	210	18	228	0	372	32	404
	EB	98	78	40	216	200	342	76	618
1st St. and L St., NE	SB	32	266	0	298	56	240	0	296
	WB	58	0	96	154	40	0	90	130
	NB	0	136	42	178	0	334	38	372
	EB	64	132	148	344	58	182	72	312
1st St., E St., Mass Ave. and Columbus Circle, NE	SB	86	54	28	168	148	86	78	312
	WB	234	964	0	1198	130	514	0	644
	NB	0	0	66	66	0	0	242	242
	EB	0	552	12	564	0	778	12	790
Louisiana Ave. and Columbus Circle, NE	WB	214	1336	0	1550	242	640	0	882
	NB	0	0	218	218	0	0	184	184
	EB	0	670	56	726	0	1040	66	1106
Delaware Ave. and Columbus Circle, NE	NB	0	0	16	16	0	0	8	8
	EB	0	814	12	826	0	1184	8	1192
1st St. and Columbus Circle, NE	NB	18	58	8	84	24	70	16	110
	EB	446	304	86	836	470	678	66	1214
Mass Ave. and Columbus Circle, NE	SB	36	250	16	302	48	326	14	388
	WB	2	1152	186	1340	0	580	114	694
	NB	0	0	0	0	0	4	4	8
Mass Ave. and Columbus Circle, NE	SB	0	0	234	234	0	0	126	126
	NB	416	406	360	1182	642	204	202	1048
	EB	14	0	0	14	18	0	0	18

A-2 Available Parking Spaces at Union Station Garage During Peak Parking Hour

	MON	TUE	WED	THU	FRI	AVERAGE
Month maximum occurred	Nov '07	Jan '08	Aug '07	Aug '07	Jan '08	--
Maximum available unoccupied spaces	917	771	642	642	766	748
Month minimum occurred	Dec '07	Jun '07	Mar '08	Mar '08	Dec '07	--
Minimum available unoccupied spaces	603	206	182	200	301	298
Average of available spaces over 12 months	755	493	372	386	570	515

Source: USRC data, March 2008

A-3 Available Parking Spaces at Union Station Garage During Peak Parking Hour Ticket Counts at Union Station Parking Garage over 12 Month Period

		TOTAL FOR MONTH		AVERAGE PER DAY		VEHICLES PER SPACE PER DAY	
		CAR	BUS	CAR	BUS	CAR	BUS
2007	April	50,188	2,160	1,673	72	0.80	0.80
	May	51,169	2,422	1,651	78	0.78	0.87
	June	53,437	1,715	1,781	57	0.85	0.64
	July	52,912	757	1,707	24	0.81	0.27
	August	49,374	407	1,593	13	0.76	0.15
	September	45,258	504	1,509	17	0.72	0.19
	October	50,800	697	1,639	22	0.78	0.25
	November	48,860	577	1,629	19	0.77	0.21
	December	54,534	268	1,759	9	0.84	0.10
2008	January	43,716	255	1,410	8	0.67	0.09
	February	43,899	521	1,514	18	0.72	0.20
	March	51,454	1,605	1,660	52	0.79	0.58
Total		**595,601**	**11,888**	**1,627**	**32**	**0.77**	**0.36**

Source: USRC data, March 2008

A-4 Parking Rates for the Union Station Parking Garage

FEE TYPE	HOURS						
	0-1	1-2	2-3	3-4	4-5	5-12	12-24
Regular	$6.00	$9.00	$12.00	$13.00	$15.00	$17.00	$19.00
2 hrs validation	$1.00	$1.00	$9.00	$13.00	$15.00	$17.00	$19.00
3 hrs validation	$1.00	$1.00	$1.00	$13.00	$15.00	$17.00	$19.00

A-5. Summary of Bus Routes within Study Area

RT #	ROUTE	SERVICE DIRECTION	NORTH OR EAST TERMINUS	SOUTH OR WEST TERMINUS	APPROXIMATE SERVICE TIME
80	North Capitol St. Line	N/S	Fort Totten Metro	Kennedy Center	5 AM – 2 AM NB, 4:30 Am – 1 AM SB
96	East Capitol St. – Cardozo Line	E/W	Capitol Heights Metro	McLean Gardens	5 AM – 1:30 AM
97				Union Station	6-9 AM, 3-5:30 PM only
D1	Sibley Hospital – Stadium-Armory Line	E/W	Ivy City	Glover Park	4-7 AM WB, 7-10 PM EB
D3				Sibley Hospital	7-10 AM WB, 3-6:30 PM EB
D6			Stadium-Armory Metro		4:30 AM – 1:30 AM WB, 5AM – 2:30 AM EB
D4	Ivy City – Union Station Line	E/W	Ivy City	Union Station	4AM – 1AM WB, 4:30 AM – 1:30 AM EB
D8	Hospital Center Line	N/S	Washington Hospital Center	Union Station	5:30 AM – 1:30 AM
N22	Navy Yard Shuttle Line	N/S	Union Station	Navy Yard	6 AM – 10:30 PM
X1	Benning Road Line	E/W	Minnesota Ave. Metro	Potomac Park/State Department	6-9:30 AM WB, 3:30 – 6:30 PM EB
X3				McLean Gardens	6-9:30 AM WB, 3:30 – 6:30 PM EB
X2	Benning Road – H St. Line	E/W	Minnesota Ave. Metro	Lafayette Square	4:30 AM – 2:30 AM WB, 4AM – 3 AM EB
X8	Maryland Avenue Line	E/W	Carver Terrace	Union Station	6 AM – 10 PM WB, 6 AM – 10:30 PM EB

Source: WMATA Bus Schedule as of April 2008Figure

A-6. Overall Weekday Ridership of Metrobus Routes Servicing Union Station Study Area

Bus Line	Total Line Ridership[1] (May 2008)	Study Area[2]			
		Boardings	% of ridership	Alightings	% of ridership
80	**8,449**	**1,641**	**19.4%**	**1,353**	**16.0%**
96, 97	**4,930**	**738**	**15.0%**	**988**	**20.0%**
D1, D3, D6	**6,367**	**525**	**8.2%**	**494**	**7.8%**
D4	**1,410**	**581**	**41.2%**	**479**	**34.0%**
D8	**4,704**	**804**	**17.1%**	**604**	**12.8%**
N22	**1,468**	**304**	**20.7%**	**338**	**23.0%**
X1, X3	**1,415**	**88**	**6.2%**	**116**	**8.2%**
X2	**13,846**	**1,356**	**9.8%**	**1,174**	**8.5%**
X8	**1,522**	**491**	**32.3%**	**481**	**31.6%**
TOTAL STUDY AREA LINES	44,112	6,427	14.6%	5,918	13.4%
SUBTOTAL, REGULAR DC LINES	240,860				
DAILY WMATA SYSTEM GRAND TOTAL	461,223				

1 – Metrobus Ridership by Jurisdiction and Line report for May 2008

2 – Data scaled to May 2008 ridership from detailed data collected 2000-2003

A-7. Metrobus Daily Boardings/Alightings at Busiest Bus Stops

	INTERSECTION							
	N. CAPITOL & H ST.	COLUMBUS CIRCLE/MASS AVE. & 1ST ST. NE	COLUMBUS PLAZA BUS BAY	N. CAPITOL & MASS AVE.	N. CAPITOL & K ST.	N. CAPITOL & M ST.	N. CAPITOL &G PL. NW	N. CAPITOL ST. & I ST.
3:00 AM - 5:29 AM								
Boardings	51	14	5	8	2	2	2	0
Alightings	44	43	17	26	3	5	0	1
5:30 AM - 9:29 AM								
Boardings	533	601	205	255	75	63	28	47
Alightings	618	521	596	305	129	92	133	13
9:30 AM - 2:59 PM								
Boardings	986	428	244	247	151	149	15	96
Alightings	819	544	220	278	153	152	63	28
3:00 PM - 6:59 PM								
Boardings	959	467	550	375	75	81	22	61
Alightings	542	511	247	367	74	89	48	10
7:00 PM - 2:59 AM								
Boardings	212	156	275	127	9	7	2	10
Alightings	159	72	55	68	18	25	12	3
Daily Total								
Boardings	2,540	1,665	1,279	930	311	301	68	214
Alightings	2,182	1,691	1,135	849	376	362	255	54

Source: WMATA 2003

A-8. Weekday Hourly Metrobus Volumes at Busiest Intersections

Intersection	N. Capitol St. & H St.	Mass Ave. & N. Capitol	Mass Ave. & Columbus Cir./1st St.	Columbus Plaza1
Routes Served	80, 96, D1, D3, D4, X1, X2	N22, D8, 80, D6, D4, 96, D1,D3, X1	N22, D8, D6, D4, 96	97, D4, D8, X8
3 AM - 4 AM	0	0	0	0
4 AM - 5 AM	10	8	7	2
5 AM - 6 AM	25	23	17	6
6 AM - 7 AM	42	48	35	17
7 AM - 8 AM	54	56	39	20
8 AM - 9 AM	58	59	38	23
9 AM - 10 AM	48	52	35	14
10 AM - 11 AM	39	37	29	8
11 AM - 12 NOON	40	41	31	8
12 NOON - 1 PM	36	41	33	8
1 PM - 2 PM	37	37	29	8
2 PM - 3 PM	38	38	30	9
3 PM - 4 PM	50	48	37	19
4 PM - 5 PM	63	62	44	25
5 PM - 6 PM	55	59	42	25
6 PM - 7 PM	46	49	39	15
7 PM - 8 PM	31	33	26	8
8 PM – 9 PM	24	28	24	7
9 PM - 10 PM	25	29	24	6
10 PM - 11 PM	26	27	23	6
11 PM - 12 AM	22	22	18	3
12 AM – 1 AM	17	17	13	1
1 AM - 2 AM	0	0	0	0
2 AM - 3 AM	0	0	0	0

Source: WMATA Bus schedules as of April 2008

[1]-Bus frequency at Columbus Plaza only counted once for an inbound/outbound bus combination; at other locations, each direction a bus passes is counted distinctly

A-9. Number of Commuter Bus Runs Servicing Union Station Area and DC

	MTA	PRTC	LC	Martz	Quick's	VC
3 AM - 4 AM	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
4 AM - 5 AM	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
5 AM - 6 AM	1 (4)	0 (3)	0 (0)	0 (0)	0 (0)	0 (0)
6 AM - 7 AM	9 (39)	0 (14)	2 (4)	0 (3)	1 (3)	1 (1)
7 AM - 8 AM	8 (51)	1 (23)	6 (9)	0 (4)	0 (0)	0 (0)
8 AM - 9 AM	10 (49)	0 (13)	10 (13)	0 (4)	0 (0)	0 (0)
9 AM - 10 AM	1 (12)	0 (6)	2 (4)	0 (0)	0 (0)	0 (0)
10 AM - 11 AM	0 (1)	0 (1)	0 (0)	0 (0)	0 (0)	0 (0)
11 AM - 12 NOON	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
12 NOON - 1 PM	1 (5)	0 (6)	0 (0)	0 (0)	0 (0)	0 (0)
1 PM - 2 PM	0 (1)	0 (3)	1 (1)	0 (0)	0 (0)	0 (0)
2 PM - 3 PM	1 (9)	0 (3)	0 (0)	0 (0)	0 (0)	0 (0)
3 PM - 4 PM	9 (45)	0 (17)	7 (9)	0 (5)	1 (2)	0 (1)
4 PM - 5 PM	10 (61)	0 (22)	10 (14)	0 (3)	0 (1)	0 (0)
5 PM - 6 PM	7 (34)	1 (19)	5 (5)	0 (3)	0 (0)	0 (0)
6 PM - 7 PM	3 (8)	0 (4)	0 (0)	0 (1)	0 (0)	0 (0)
7 PM - 8 PM	0 (2)	0 (4)	0 (0)	0 (0)	0 (0)	0 (0)
TOTAL	**60 (321)**	**2 (138)**	**43 (59)**	**0 (23)**	**2 (6)**	**1 (2)**

Source: Commuter bus published schedules

Format: Buses in study vicinity (buses within DC)

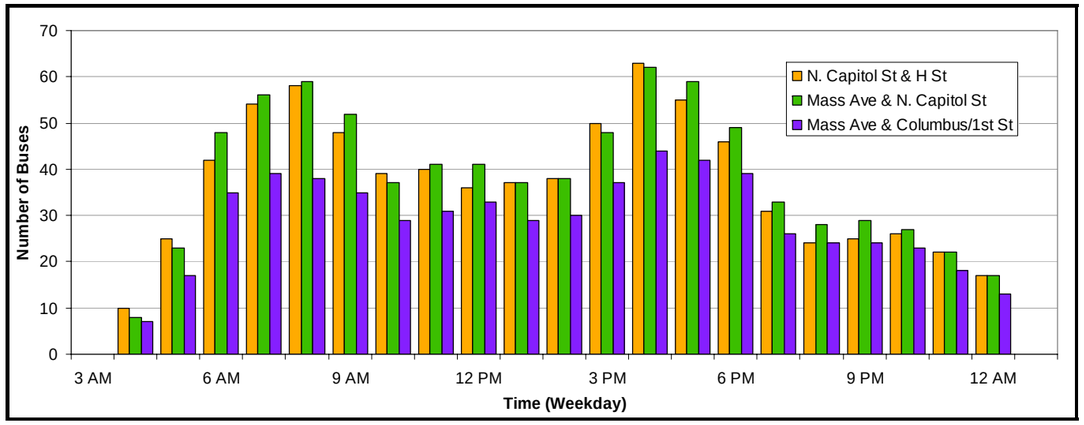
A-10. Commuter Rail Ridership at Union Station by Hour

Time Period	MARC Trains[1]		VRE Trains[2]	
	Arriving	Departing	Arriving	Departing
5 – 6 AM	615	35	0	0
6 - 7 AM	3174	78	292	1
7 - 8 AM	3606	205	642	0
8 - 9 AM	5019	176	389	0
9 - 10 AM	1149	64	156	0
10 - 11 AM	337	89	0	0
11 - 12 PM	208	120	0	0
12 - 1 PM	145	227	0	23
1 - 2 PM	117	206	0	23
2 - 3 PM	123	262	0	0
3 - 4 PM	320	1081	1	244
4 - 5 PM	458	4267	0	482
5 - 6 PM	98	4327	0	382
6 - 7 PM	164	2478	2	331
7 - 8 PM	133	586	0	0

1 – MARC Ridership provided by MARC Staff, August 2008

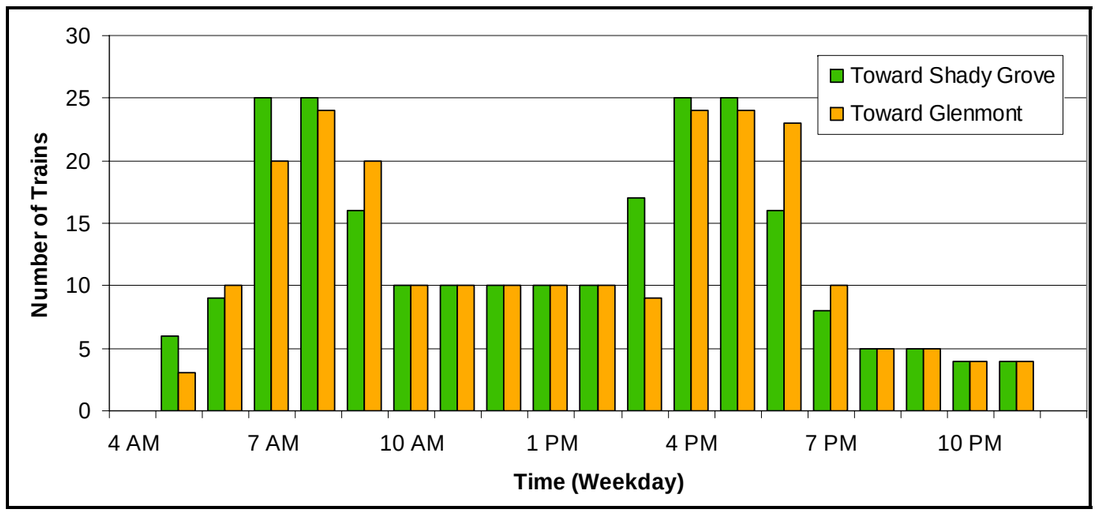
2 – VRE ridership estimated from volumes provided on VRE website, scaled by 19% rule of thumb recommended by Christine Hoeffner

A-11. Scheduled Weekday Metrobus Volumes



Source: WMATA Bus schedules

A-12. Scheduled Metrorail Volume at Union Station



Source: WMATA Metrorail schedules