

The District of Columbia Traffic Signal System

1971 to 2011

Transportation Operations Administration
Traffic Signals, Traffic Safety, Standards and
ITS Division
3.3.11

District of Columbia Traffic Signal System

Traffic Signal Timing in the District

The District's central traffic signal and CCTV (Closed Circuit TV) command and control system, **QuicNet**, monitors over 1500 traffic signals and devices within the District. **QuicNet** broadcasts time of day to all intersections and maintains downloadable programming data and event logging for all intersections within a central server. Programming data can be manually downloaded from the central system, or can be requested by specific key strokes on the intersection's local controller. This system is currently capable of utilizing up to nine (9) pre-programmed plans; primarily utilizing four (4) timing plans based on the AM Peak, Mid-Day, PM Peak, and Nights and Weekend traffic. The system also maintains one "240 second" cycle plan for Emergency Evacuation along regionally based published evacuation routes.

The District traffic signal system spans the majority of the City and contains multiple control zones. All traffic signals operate under coordinated timing plans i.e., stay synchronized throughout the year. With the exception of a few actuated intersections, the majority of the signals in the District operate under pre-timed control due to the highly urban environment and presence of heavy pedestrian traffic.

History

Listed below is a brief history of the Traffic Signal System within the District of Columbia and to give an insight into the current operations as well as a view of our future goals and objectives.

The District of Columbia Traffic Signal System has a rich history as the first ever Urban Traffic Control System (UTCS) in the nation. DDOT became the first agency in the nation to implement a dedicated twisted pair copper communication system to remotely evaluate, control and maintain all our traffic signals in 1971. Most jurisdictions rely on other telecommunication providers to satisfy their communication needs, however the District has maintained its twisted pair copper communication system in good condition as the communication backbone for the Traffic Signal System and ITS (Intelligent Transportation System) technologies. Also, the District was the largest jurisdiction in the nation who first implemented LEDs for traffic signal heads and Pedestrian Countdowns for all traffic signals in the District. With the advancement of new technologies, DDOT is now working on converting the communication system to Ethernet over copper technology for higher speed and bandwidth and through the upcoming ITS Master Plan effort, DDOT will also evaluate the feasibility of migrating to Fiber Optics technology to increase the capability, reliability and responsiveness of the Traffic Signal System as well as determine corridors for Adaptive Signal Control.

Challenges

Inside the central grid and outside the grid at intersections where we have major diagonal street e.g., New York Avenue, Rhode Island Avenue, Florida Avenue, Massachusetts Avenue dissecting the grid it has been challenging to provide progression due to competing users – pedestrian, buses, left-turners, right-turners and the volumes of opposing traffic on the side streets. This is quite unique. Also unlike most urban grid networks, the District does not have the abundance of one-way streets in its system. The presence of two-way streets requires bi-directional progression within the District's grid network, which makes it more challenging to prioritize one direction over the other. We tackle these challenges everyday to move the massive about of people within the district.

The District Department of Transportation (DDOT) has traditionally referred to traffic-signal optimization as the effort to improve motor-vehicular-traffic flow. However, the optimization philosophy in the District differs substantially from that of most jurisdictions as its vision of accommodating all modes of traffic focuses not only on auto-vehicular mobility but also encourages the use of mass transit, walking and biking.

Context-sensitive designs within District's urban multi-modal environment have resulted in a constant act of “balancing” when it comes to timing of traffic signals. Local buses, commuter buses, delivery trucks, over 5000 special events per year, new construction, bike routes, Metropolitan Police Department (MPD), Capitol Police, National Park Service Police all contribute to traffic issues that must be addressed daily as the optimal traffic signal patterns are developed for the roadways within the district.

Currently we are responsible for managing 14 large scale traffic signals/ITS design and construction projects with a total project value of \$29.7M. We provide traffic signal design and construction support for DDOT's Infrastructure Project Management Administration (IPMA) Capital Projects and various Development projects within the District.

Research has proven that actuated traffic signal operation will yield additional benefits during the after-hour conditions specially by reducing number of traffic stops; however a large-scale implementation of an actuated system within the District could not be proven cost-effective due to the existing constraints.

Also, due to the excellent public transportation systems in the District, vehicular traffic growth on major corridors has been modest. In addition, the District has always been very selective in providing left-turn phases and split phase operations at its traffic signals. Such operational choices over the years have led to relatively low cycle lengths in the District compared to most other jurisdictions in the Washington Metropolitan area. Low cycle lengths help to maintain wait times and queues at reasonable levels for both pedestrians and motorists. In many cases a longer cycle length would increase the bandwidth for the major movement; nonetheless, in the interest of maintaining short wait times and queues, the District has maintained short cycle lengths (100 second plan during the peak hours).

In addition, the traffic issues mentioned previously, the lay-out of the District's street system, special events all year round, construction, curb-side management, parking, mid-block friction, motorcades etc. makes the signal timing within the District very challenging.

In order to address these issues and concerns the District embarked on a traffic signal optimization project. This system-wide signal timing optimization was performed in 2004 with modifications that reflected issues at that time. A very limited amount of data was collected to optimize and update the traffic signal system. Therefore, due to significant amount of development and redevelopment activities within the District, regional growth, installation of new traffic signals, changing of travel patterns, bike lanes as well as the conflicts between different modes of travel – DDOT has decided to perform a district-wide full-blown traffic signal optimization program in 2010.

The central goal of this optimization project will be to make the current District traffic signals safer and friendlier for the pedestrians, improve bus running times & reduce bus delays, improve overall traffic flow and reduce vehicular traffic emissions. Due to the extensive amount of data collection required for this effort, this project will be implemented in phases within the next five-year period. In the future, DDOT has also planned to retime its traffic signals with a five-year cycle.

Key Projects:

City-Wide Traffic Signal Optimization

- **Project Limit:** First Phase to include 500 signalized intersections throughout the District
- **Brief Description:** The District signal optimization program will focus on reducing pedestrian and vehicular traffic delays, reducing traffic congestion and vehicular traffic emissions by the retiming traffic signals.
- **Schedule:** Request For Quotation to be advertised in January, 2011; the project is scheduled to begin in Spring, 2011.

Vehicle Detection System

- **Project Limit:** 122 locations throughout the District
- **Brief Description:** This project will install citywide vehicle detection stations to collect traffic volume, speed, and occupancy and vehicle classification data.
- **Schedule:** Notice To Proceed (NTP) provided to Fort Myer on 10/7/10; Scheduled completion date:10/7/11

Tiger Bus Priority Corridor Enhancements

- **Project Limit:** Five corridors: 16th St, Georgia Avenue, Wisconsin Avenue, TR Bridge, and the 14 St. corridors within the District of Columbia
- **Brief Description:** This project will implement transit signal priority (TSP) equipment for 93 intersections and over 125 buses within five major corridors to improve bus running times and to reduce bus delays at the traffic signals. Traffic signals will also be optimized at over 200 traffic signals leading to the downtown core to improve bus movement and UPS devices will be installed at 25 critical locations.
- **Schedule:** The project is expected to begin in April, 2011 with a completion date of June, 2015.

DDOT ITS Master Plan

- **Project Limit:** Development of ITS/Communication Master Plan
- **Brief Description:** Develop communication master plan and a RFP package for DDOT Advanced Transportation Management System (ATMS); evaluate the technologies and identify suitable corridors for the implementation of (1) traveler information system and (2) adaptive control system in the District. Review our future needs and system requirements.
- **Schedule:** Scheduled to start in Spring, 2011

Regional Evacuation Traffic Monitoring and Management

- **Project Limit:** 20 critical locations on regional evacuation routes for installation of vehicle detectors
- **Brief Description:** This is a homeland security grant for construction of 20 new vehicle detection stations in the District.
- **Schedule:** Memorandum Of Agreement (MOA) between DDOT-HSEMA has been signed in December, 2010. Construction to begin in Spring, 2011

Citywide Traffic Signal Construction

- **Project Limit:** Various signalized intersections throughout the District
- **Brief Description:** Installation of traffic signal equipment including traffic signal poles, controller cabinets, detections, signal heads, street lights etc to upgrade and modify various traffic signals within the District.
- **Schedule:** Award to be made in Spring, 2011. This will be a five-year project as more funding will be allocated in the upcoming years to include additional traffic signals in the District.

Traffic Signal System Analysis

- **Project Limit:** Citywide
- **Brief Description:** Study of intersections within the District to justify placement of new traffic signals
- **Schedule:** Work started in Nov. 2010. To be completed in Dec. 2011.

Traffic Signal Design

- **Project Limit:** Citywide
- **Brief Description:** Design of traffic signals within the District which are in need for an upgrade or modification
- **Schedule:** Design task started in January 2011. To be completed in December 2011.

Dynamic Message Signs (DMS) Design and Integration

- **Project Limit:** Nine critical locations in the District. Eleven (11) new DMS in design
- **Brief Description:** Design 11 new DMS signs at nine locations for DDOT traffic operations, incident management and emergency evacuation. New DMS signs will be controlled from the DDOT Traffic Management Center.
- **Schedule:** Design will be completed by the end of September 2011

CCTV System Upgrade

- **Project Limit:** Fifteen (15) existing camera sites in the District
- **Brief Description:** Will allow us to migrate to digital IP solution from the current analog technology.
- **Schedule:** Scheduled to be completed by the end of Dec. 2011.

Citywide Installation of permanent Traffic Count Stations

- **Project Limit:** Thirty (30) critical locations in the District
- **Brief Description:** Implement four different technologies to collect traffic data from thirty permanent count stations.
- **Schedule:** 65% of the project is currently completed with a scheduled completion by December, 2011.

Internet Protocol (IP) Communications for the District's Traffic Signal System

- **Project Limit:** Various signalized intersections within the District
- **Brief Description:** Create a standalone IP based network for District's traffic signal system. Convert the twisted pair network to IP by deploying Ethernet over copper network. First Phase will involve conversion at 400 intersections along the evacuation routes.
- **Schedule:** Construction to begin in spring, 2011

Traffic Signal Uninterrupted Power Supply

- **Project Limit:** 100 critical signal within the District
- **Brief Description:** Installation of battery back-up at 100 critical locations during the short-term power outages. The system is designed to operate a standard signalized intersection for up to six hours.
- **Schedule:** To be completed in summer, 2011.

CapTOP Data Integration, Visualization and Analysis

- **Project Limit:** Software Enhancements entire ATMS system
- **Brief Description:** Enhancement of CapTOP system which will allow us to share the DMS messages with the other regional agencies and also integrate the InRix (a type of vehicle detection system) and Vehicle Detection System (VDS) data for travel time application; Development of congestion map
- **Schedule:** Work began in January, 2011 and to be completed by December, 2011

Manage Travel for Planned Special Events in the Mall Area

- **Project Limit:** 308 intersections in downtown and 137 intersections on major arterials leading to the downtown area
- **Brief Description:** Build a traffic model in and around the downtown area
- **Schedule:** Completed in February, 2011.

Evacuation Routes

Route	From	To (Borders estimated)
MacArthur Blvd. NW	Foxhall St. NW	Western Ave.
Canal Rd. NW	Foxhall St. NW	Western Ave.
Wisconsin Ave. NW	M St. NW	Western Ave.
K St. NW	17 th St. NW	Key Bridge
Penn. Ave. NW	17 th St. NW	M St. to Key Bridge
Connecticut Ave.	17 th St. NW	Western Ave.
16 th St. NW	K St. NW	Eastern Ave.
Georgia Ave./7 th St. NW	Penn. Ave.	Eastern Ave.
Rhode Island Ave. NW	7 th St.	Eastern Ave.
New York Ave. NW	7 th St.	Eastern Ave.
H St.	Mass. Ave.	Benning to East Capitol to Southern Ave.
9 th St. NW	Penn. Ave.	I-395
14 th St. NW	Penn. Ave.	I-395
South Capitol St.	I-295	I-395
Independence Ave./Penn. Ave.	3 rd St.	Southern Ave.
Branch Ave. SE	Penn. Ave	Southern Ave.
Suitland Parkway SE	I-295	14 th St.

Table 1.

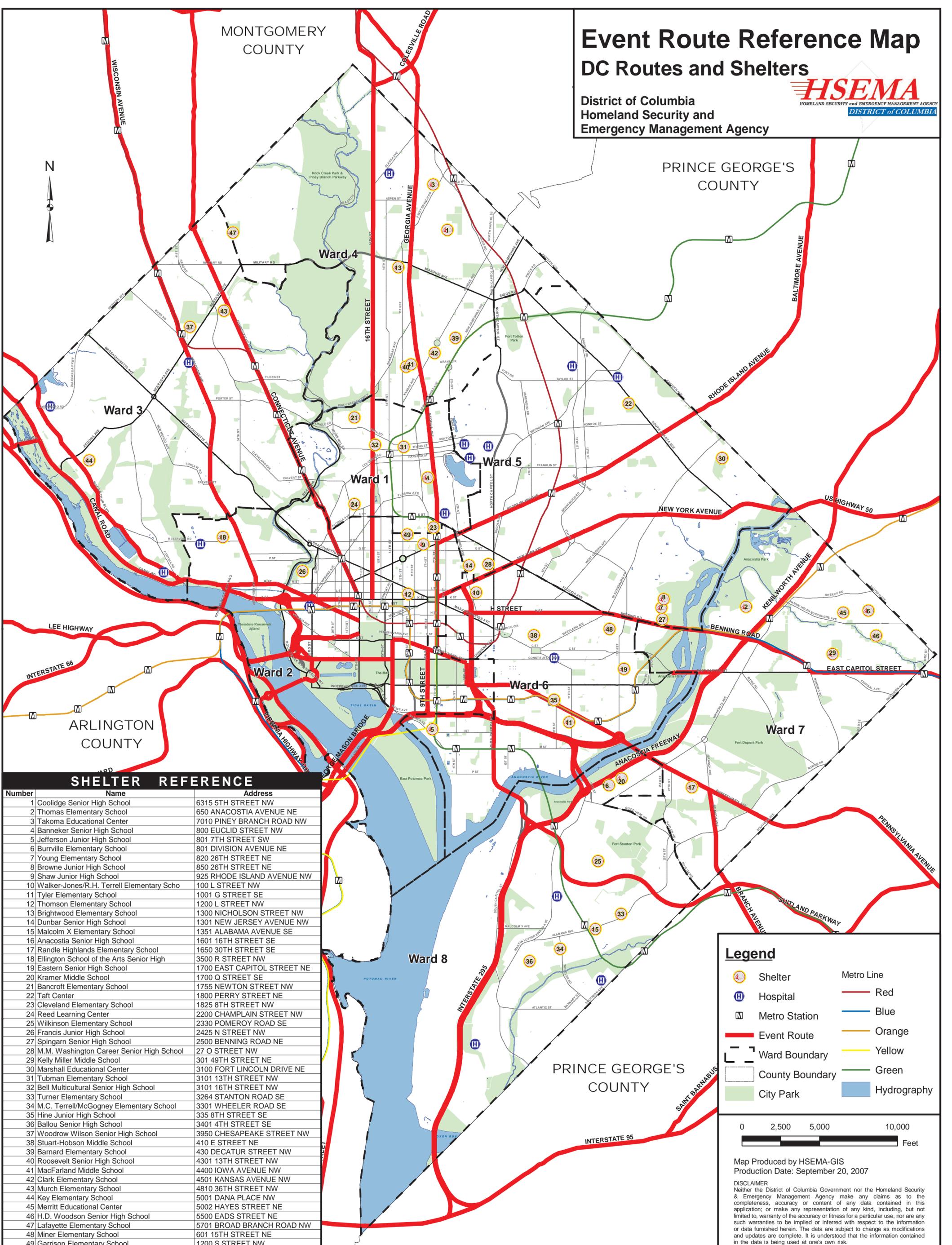
The traffic signals along the evacuation routes listed in Table 1. are timed for traffic signal progression in the inbound direction in the AM Peak Hours and in the outbound direction in the PM Peak Hours: 5:30am to 10:00am and 2:30pm to 7:00pm respectively.

Event Route Reference Map

DC Routes and Shelters



District of Columbia
Homeland Security and
Emergency Management Agency



SHELTER REFERENCE

Number	Name	Address
1	Coolidge Senior High School	6315 5TH STREET NW
2	Thomas Elementary School	650 ANACOSTIA AVENUE NE
3	Takoma Educational Center	7010 PINEY BRANCH ROAD NW
4	Banneker Senior High School	800 EUCLID STREET NW
5	Jefferson Junior High School	801 7TH STREET SW
6	Burrville Elementary School	801 DIVISION AVENUE NE
7	Young Elementary School	820 26TH STREET NE
8	Browne Junior High School	850 26TH STREET NE
9	Shaw Junior High School	925 RHODE ISLAND AVENUE NW
10	Walker-Jones/R.H. Terrell Elementary Scho	100 L STREET NW
11	Tyler Elementary School	1001 G STREET SE
12	Thomson Elementary School	1200 L STREET NW
13	Brightwood Elementary School	1300 NICHOLSON STREET NW
14	Dunbar Senior High School	1301 NEW JERSEY AVENUE NW
15	Malcolm X Elementary School	1351 ALABAMA AVENUE SE
16	Anacostia Senior High School	1601 16TH STREET SE
17	Randle Highlands Elementary School	1650 30TH STREET SE
18	Ellington School of the Arts Senior High	3500 R STREET NW
19	Eastern Senior High School	1700 EAST CAPITOL STREET NE
20	Kramer Middle School	1700 Q STREET SE
21	Bancroft Elementary School	1755 NEWTON STREET NW
22	Taft Center	1800 PERRY STREET NE
23	Cleveland Elementary School	1825 8TH STREET NW
24	Reed Learning Center	2200 CHAMPLAIN STREET NW
25	Wilkinson Elementary School	2330 POMEROY ROAD SE
26	Francis Junior High School	2425 N STREET NW
27	Spingarn Senior High School	2500 BENNING ROAD NE
28	M.M. Washington Career Senior High School	27 O STREET NW
29	Kelly Miller Middle School	301 49TH STREET NE
30	Marshall Educational Center	3100 FORT LINCOLN DRIVE NE
31	Tubman Elementary School	3101 13TH STREET NW
32	Bell Multicultural Senior High School	3101 16TH STREET NW
33	Turner Elementary School	3264 STANTON ROAD SE
34	M.C. Terrell/McGogney Elementary School	3301 WHEELER ROAD SE
35	Hine Junior High School	335 8TH STREET SE
36	Ballou Senior High School	3401 4TH STREET SE
37	Woodrow Wilson Senior High School	3950 CHESAPEAKE STREET NW
38	Stuart-Hobson Middle School	410 E STREET NE
39	Barnard Elementary School	430 DECATUR STREET NW
40	Roosevelt Senior High School	4301 13TH STREET NW
41	MacFarland Middle School	4400 IOWA AVENUE NW
42	Clark Elementary School	4501 KANSAS AVENUE NW
43	Murch Elementary School	4810 36TH STREET NW
44	Key Elementary School	5001 DANA PLACE NW
45	Merritt Educational Center	5002 HAYES STREET NE
46	H.D. Woodson Senior High School	5500 EADS STREET NE
47	Lafayette Elementary School	5701 BROAD BRANCH ROAD NW
48	Miner Elementary School	601 15TH STREET NE
49	Garrison Elementary School	1200 S STREET NW

Legend

- Shelter (Yellow circle with number)
- Hospital (Blue 'H' icon)
- Metro Station (Blue 'M' icon)
- Event Route (Red line)
- Ward Boundary (Dashed line)
- County Boundary (Dotted line)
- City Park (Green area)
- Metro Line (Red, Blue, Orange, Yellow, Green lines)
- Hydrography (Blue area)

0 2,500 5,000 10,000 Feet

Map Produced by HSEMA-GIS
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