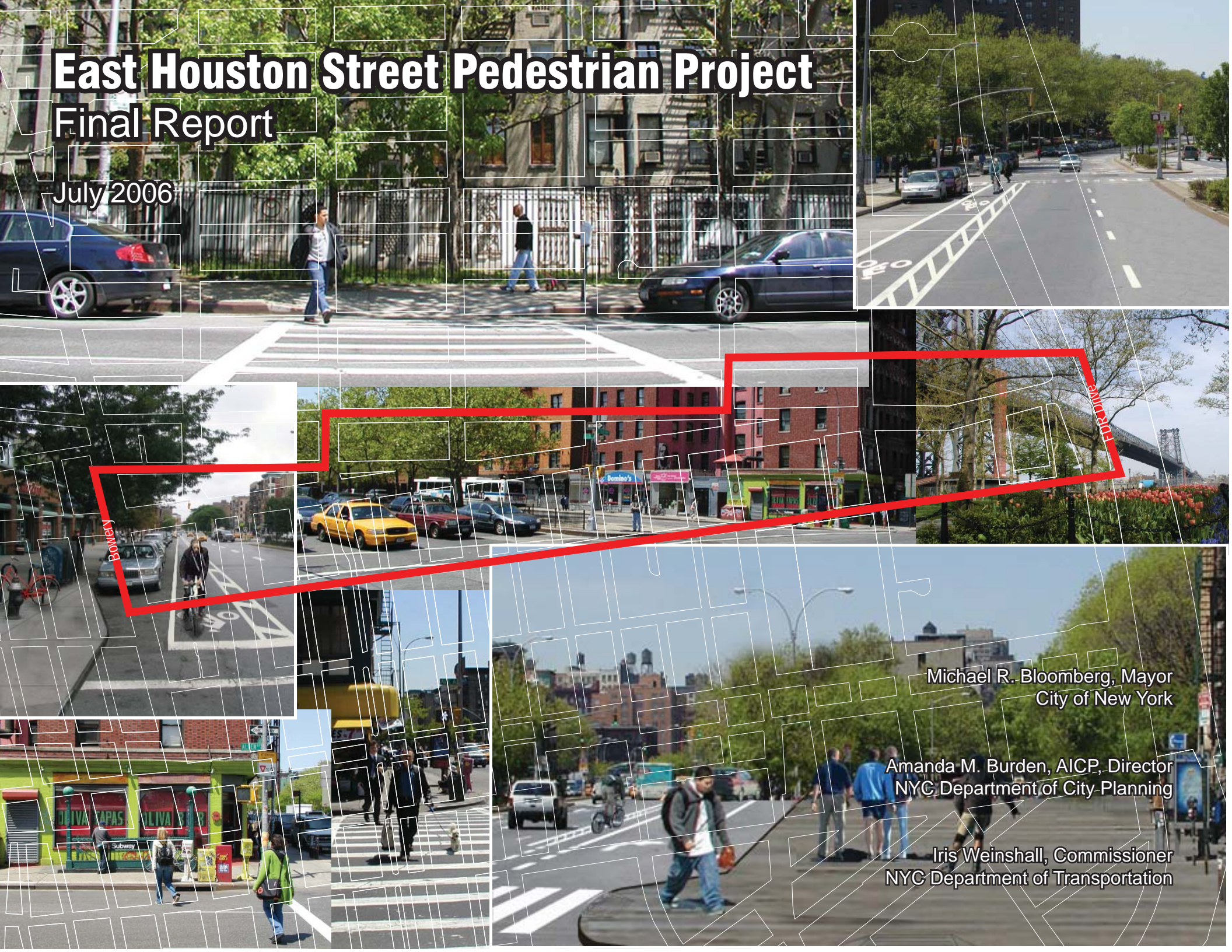


East Houston Street Pedestrian Project

Final Report

July 2006



Michael R. Bloomberg, Mayor
City of New York

Amanda M. Burden, AICP, Director
NYC Department of City Planning

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Introduction

East Houston Street is a critical corridor in Manhattan, providing east-west travel across the island, access to the subway, buses, local parks, and tourist destinations, and defining the border between the Lower East Side and East Village neighborhoods. However, the roadway's substantial width and its position at the base of the Manhattan street grid, encourage high vehicular speeds and present problems for pedestrian, cyclist and vehicular circulation, making it difficult and potentially dangerous for locals and visitors to access the area's open space resources, commercial services and transit stations.

The East Houston Street Pedestrian Project will plan, design, and implement improvements for pedestrians and cyclists along East Houston Street, improving safety and circulation at dangerous intersections, facilitating access to commercial, recreational and transportation destinations, and improving the roadway's streetscape.

This project, a joint venture by the New York City Department of City Planning and the Department of Transportation, is funded by the Enhancements program of the Transportation Equity Act for the 21st Century (TEA-21). Funding in the amount of \$1,100,000 has been awarded to prepare this plan, test and evaluate the recommendations, and implement physical and operational street improvements. An Advisory Committee, comprised of elected officials as well as representatives of government agencies, civic organizations and community boards, has been assembled to inform and consult on the project at identified milestones.

Study Area

The primary study area for this project is East Houston Street from the Bowery to the East River Park entrance abutting the Franklin Delano Roosevelt (FDR) Drive. Eight critical intersections are areas of particular focus for this study. These intersections - the Bowery, Second Avenue/Chrystie Street, First Avenue/Allen Street, Avenue A/Essex Street, Avenue B/Clinton Street, Avenue C/Pitt Street, Avenue D/Columbia Street and the FDR Drive - stand out because of their complex traffic flow and geometry and/or high number of accidents.

The secondary study area includes one block on either side of East Houston Street. While data was collected and examined for the secondary study area, the implementation of improvements is focused on the primary study area.

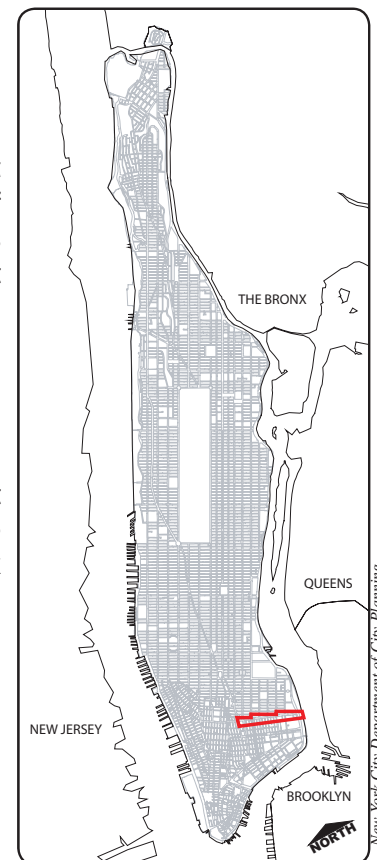


Figure 1: Study Area Locator



First Park (top); Entrance to East River Park (middle); Gustave Hartman Square (bottom).



Existing Conditions

This section inventories 2002 data on existing land use, zoning, street geometry, and signal timing in the study area. This assessment of existing conditions allowed the project team to identify issues and opportunities for improvement along the corridor. An Advisory Committee meeting held on September 25, 2002 introduced the project to the public and provided the opportunity for community input. In addition, a presentation was given to the Transportation and Public Safety committees of Community Board 3 on December 10, 2002, followed by a presentation to the full Board on February 25, 2003.

Zoning

The East Houston Street study area is primarily composed of two zoning districts. A C6-1 district is zoned on the south side of East Houston Street from the Bowery to Essex Street and on Second Avenue north of East Houston Street. This classification has a commercial Floor Area Ratio (FAR*) of 6.0, and a residential FAR of 0.87 to 3.44. The C6-1 district allows high bulk commercial uses requiring a central location, including corporate headquarters, large hotels, retail stores, and some residential development in mixed-use buildings (See Figure 3).

The north side of East Houston Street east of the Bowery (excluding Second Avenue), and the south side of East Houston Street east of Essex Street are zoned R7-2. R7 is a medium density residential district with 208 to 226 dwelling units per acre, which typically produces 14-story buildings.

The north side of East Houston Street, and First Avenue, Avenue A and Avenue C have C2-5 commercial overlays, permitting a range of local retail and service establishments, such as funeral homes and small bowling alleys, that serve a relatively large neighborhood. Avenues B and D have C1-5 commercial overlays which permit retail and personal service shops needed in residential neighborhoods. Regulations limit commercial use in these districts to one or two floors.

The western edge of the study area borders the Special Little Italy District, which was established to preserve and strengthen the historical and cultural character of the community; protect the scale of storefronts and character of the existing retail uses; preserve the vitality of street life by

reducing conflict between pedestrian and vehicular traffic; permit rehabilitation and new development consistent with the residential character and scale of the existing buildings in the area; provide amenities, such as public open space and street trees, improve the physical environment; discourage the demolition of noteworthy buildings which are significant to the character of the area; and promote the more desirable use of land in the area to preserve its value.

*FAR is the multiple of the lot area which permits the maximum development of the site.



Figure 2: Zoning

Land Use

East Houston Street is the border between the Lower East Side and East Village. The East Village, which borders the corridor to the north, is primarily composed of mixed-use residential and commercial buildings and multi-family elevator and walk-up buildings. The area boasts a kinetic nightlife with experimental music clubs, theatre and cutting edge fashion boutiques. South of the study area is the Lower East Side, which is characterized by a variety of uses, including commercial and office buildings, residential buildings, and vacant lots. A longtime destination for its bargain shopping and historic sites, the Lower East Side is now home to a burgeoning nightlife with new restaurants, nightclubs and music venues opening everyday.

Little Italy and the Bowery are at the west end of the study area. Both areas are in transition as the art and fashion worlds and nightlife of a gentrified SoHo, and newly gentrifying Lower East Side, expand into the frontier borders of the Bowery and Little Italy. The Bowery, long a major manufacturing hub, has been for decades a site for low-income and Artist in Residence (AIR) housing. Recently, new luxury residences have been erected, with many more proposed. Several new restaurants, bars and music clubs have turned what was once an underground art and music scene into an established nightlife destination. Little Italy pays homage to the neighborhood's history as a home to Italian immigrants a century ago. Its cobblestoned streets are lined with turn-of-the-century tenements, restaurants, and souvenir shops making this neighborhood an international tourist destination. Both areas feature a variety of land uses, with heavy concentrations of mixed residential and commercial buildings in Little Italy, and commercial and office buildings along the Bowery (See Figure 3).



Figure 3: Land Use

The Lower East Side Historic District, listed on the State and National Registers of Historic Places, is bordered by East Houston Street to the north, Allen Street to the west and Essex Street to the east, and East Broadway, Grand Street, Division Street, and Eldridge Street to the south. The district comprises five hundred properties, including aging tenements, utilitarian commercial buildings, historic ecclesiastical buildings and works by some of the city's most prominent architects.

New Development

There is currently a significant amount of new development within and surrounding the East Houston Street project study area, including within two Urban Renewal Areas (URA): Cooper Square and Seward Park. The New York City Department of Housing Preservation and Development (NYCHPD) has selected Chrystie Venture Partners to develop four properties within the Cooper Square Urban Renewal Area. The development proposal would bring an estimated 1,400 residents and 700 workers to the site. Construction began in Fall 2003 on the southern side of East Houston Street between Chrystie Street and the Bowery, and is planned for sites on the northern and southern sides of East First Street between Second Avenue and the Bowery. The development consists of 712 housing units (25 percent of which must be set aside for low-income households), 150,000 square feet of commercial and retail space, and 36,000 square feet of community facility space.

The action also preserved Liz Christy and Rock 'n' Rose community gardens, located on the north side of East Houston Street between the Bowery and Second Avenue. The gardens were transferred to the New York City Department of Parks and Recreation (NYCDPR) and are open to the public seven days a week. The sale of other community gardens for housing development continues to be an issue in Community District 3.



New York City Department of City Planning

Figure 4: Rendering of Buildings within Study Area

The Seward Park Urban Renewal Plan calls for the acquisition of all but six structures in an area bounded by Delancey Street to the north, Grand Street to the south, Essex Street to the west and Willet Street to the east. The structures are to be demolished and the cleared land will be redeveloped for residential, commercial, public and semi-public use, and necessary street widenings. The six structures which will not be acquired - nearby historic and religious sites and community facilities - will be rehabilitated. The New York City Economic Development Corporation (NYCEDC) currently has a Request for Proposal (RFP) for the sale and redevelopment of four city-owned parcels bounded by Delancey, Grand, Norfolk and Clinton streets.

Other new developments include the Board of Standards and Appeals (BSA) approval of a variance application for a 23-story residential building at 215 East Houston Street at Ludlow Street. The project is awaiting construction. Additionally, Cooper Union, located at Cooper Square between Third and Fourth avenues, has received City Planning Commission and City Council approval to develop two sites to consolidate their educational activities and provide new commercial space to finance their long-term educational programs.

Open Space

There are twelve open space and recreation areas in the primary study area. These include parks, community gardens, playgrounds and viewing gardens. Open spaces located in the primary study area include: Liz Christy Houston Bowery Garden, Sara D. Roosevelt Park, First Park, Allen Street Mall, Peretz Square, ABC Playground, Le Petit Versailles, Boy's Club of NY, Hartman Square, Hamilton Fish Recreation Center, Wald Playground, East River Park. The sites provide for activities such as handball, baseball, basketball, soccer, jogging, walking, cycling and swimming. Additionally, Tompkins Square Park and numerous community gardens are situated in the East Village, north of the primary study area.

**East River Park (left);
Sara D. Roosevelt Park (center-top);
Hamilton Fish Park (center-bottom);
Liz Christy Garden (right).**

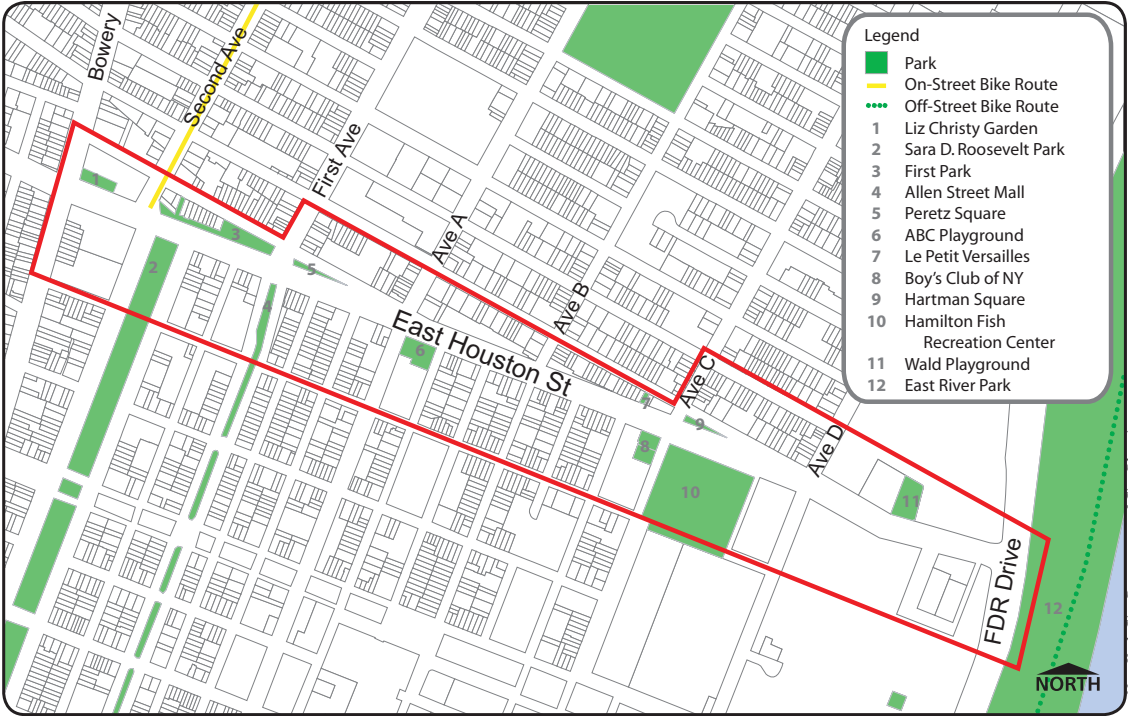


Figure 5: Open Space



Institutions

Institutions and facilities, including schools, day care facilities, and facilities for the elderly, the disabled, and the homeless, present special populations that must be accommodated in any recommended improvements. There are six such institutions and facilities in the primary study area: PS 20, PS 188, Bard High School/Early College, New Explorations in Science, Technology and Math, Barrier-Free Living and Auxiliary Services. Just outside the primary study area are PS 15, PS 63, Lower East Side Prep and the NY Society for the Deaf.

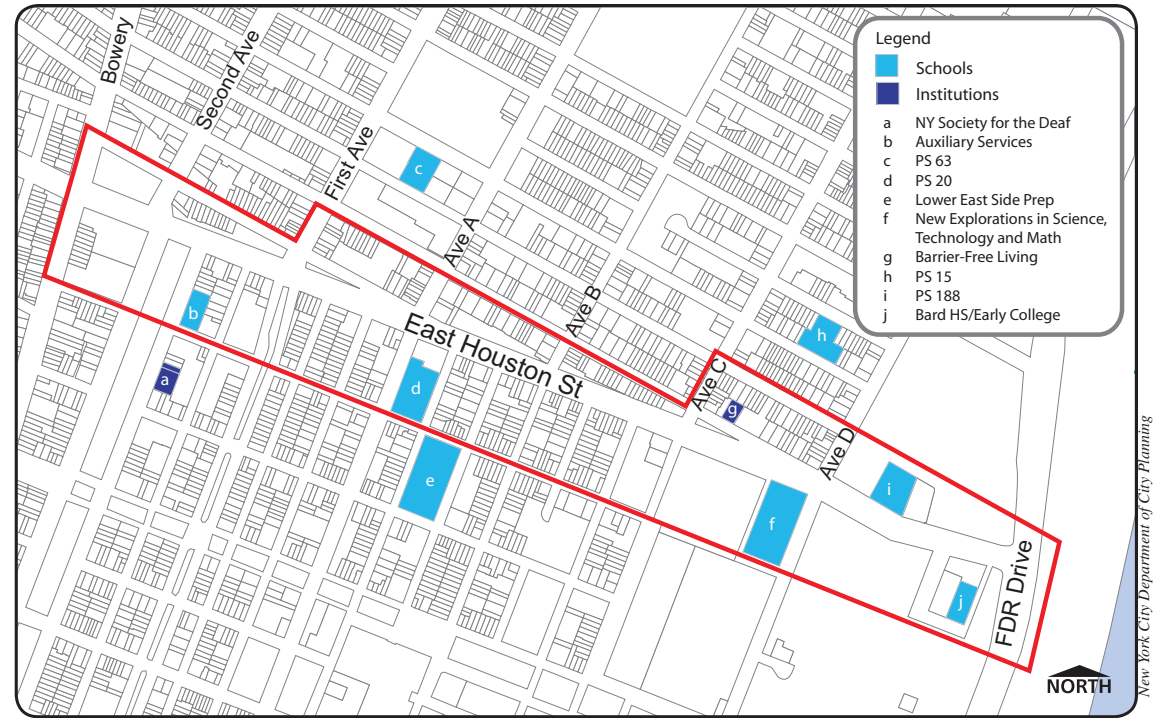


Figure 6: Institutions



N.E.S.T High School (top);
Barrier-Free Living (left);
PS 188 (right).

Public Transportation

Subway Service

The primary study area is served by the Sixth Avenue local F and V trains connecting subway riders to Brooklyn, Midtown Manhattan, and Queens. Subway entrances on East Houston Street are located at the intersections of First and Second avenues. Approximately one-third of a mile south of the study area is the Delancey/Essex station where the F, J, M, and Z trains stop, and approximately one-third of a mile west of the study area is the Broadway-Lafayette/Bleecker station, where the 6, B, D, F, and V trains stop (See Figure 6).

New York City Transit's *Subway and Bus Ridership Report* for the year 2000 states that from 1998 through 2000 the Second Avenue, Delancey/Essex, and Broadway-Lafayette/Bleecker subway stations all experienced increased usage. The Broadway-Lafayette/Bleecker station is the 29th busiest of 424 subway stations serving nearly 9 million riders in the year 2000, an increase of 11.9% from 1999. The Second Avenue station ranks

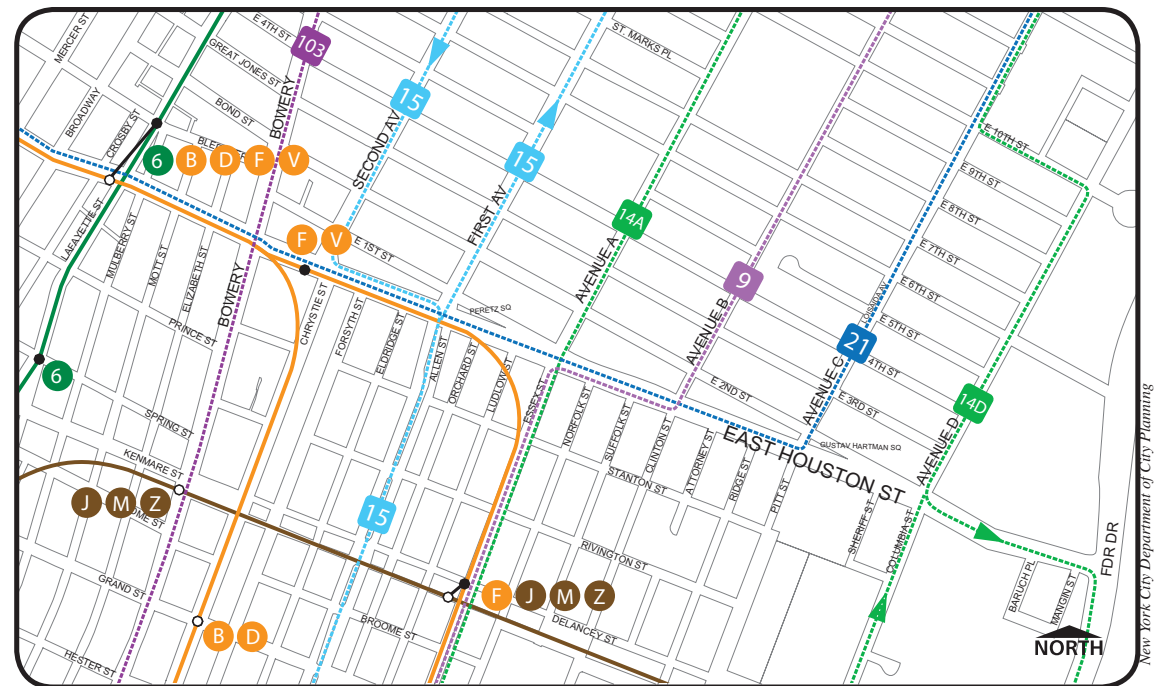


Figure 7: Public Transportation

Subway entrance at southwest corner of East Houston and Allen streets.



109th system-wide and served just over 3.6 million riders, an increase of 9.3% from 1999. The Delancey/Essex subway station ranks 90th system-wide with a little over 4 million riders, an increase of 3.6% from 1999.

Bus Service

The primary study area is served by five bus lines. The M9, M14, M15 and M103 lines provide north/south access to Manhattan along the Bowery, Second Avenue, First Avenue/Allen Street, Avenue A/Essex Street, Avenue B, and Avenue D, while the M21 line provides crosstown access along Houston Street, as well as north-south access along Avenue C.

New York City's Transit *Subway and Bus Ridership Report* for the year 2000 ranks the M15 first in annual bus ridership, serving over 19 million riders. The M14, ranked ninth, served just over 11.3 million people, and the M103 ranked 55th with approximately 4.5 million riders.

Streets

This section describes the streets in the study area, including street geometry, signalization, parking regulations, and accident data.

East Houston Street

Street Geometry

East Houston Street is the dividing line between two disjointed Manhattan street grids, creating irregular street geometry at many of the intersections in the study area. Where East Houston Street intersects with Avenue A and Avenue D, traffic triangles are created which pose challenges for pedestrians, cyclists and motorists.

East Houston Street is a major east-west corridor and through truck route carrying heavy vehicular traffic west of First Avenue and Allen Street and connecting motorists to the FDR Drive. Between the Bowery and the FDR Drive the roadbed is approximately 96 feet wide. East Houston Street has four eastbound and three westbound travel lanes

Looking north at Second Avenue.



A view west from Mangin Street.

from the Bowery to First Avenue and Allen Street, three travel lanes in each direction from First Avenue and Allen Street to Avenue C and Pitt Street, and two travel lanes in each direction east of Avenue C and Pitt Street to the FDR Drive.

At most intersections there are either standard, ladder, or high-visibility crosswalks. Left turn bays are located at its intersections with the avenues, as well as Baruch Place, Ludlow and Ridge streets. At intersections where left turn bays do not exist, a planted median approximately 14 feet wide runs through the center of the street and is maintained by the New York City Department of Parks and Recreation (NYCDPR) through the Greenstreets program.

Sidewalks range in width from 12 to 18 feet. Sidewalks at the west end of the study area are generally narrower than those at the east end.

Parking Regulations

Along East Houston Street's south curb parking is permitted except from 3:00am to 6:00am Tuesday,

Thursday and Saturday from the Bowery to Ludlow Street or; 7:30am to 8:00am except Sunday. Two hour parking is permitted from 8:00am to 7:00pm including Sunday, from Essex Street to Ridge Street; 9:00am to 10:30am Tuesday and Friday from Ridge Street to Mangin Street. In addition, between Baruch Place and Mangin Street parking is permitted except from 7:00am to 4:00pm on school days.

Parking is permitted along East Houston Street's north curb, from Avenue A to the FDR Drive, except from 9:00am to 10:30am Monday and Thursday. Standing is not permitted anytime from the Bowery to Second Avenue, and from Avenue C to Avenue D. Two hour parking is permitted from 9:00am to 7:00pm between Second Avenue and First Avenue; one hour parking is permitted from 7:00am to 9:00pm between First Avenue and Avenue A. On school days parking is permitted except from 7:00am to 4:00pm west of Baruch Drive.

Bus stops are located on the south curb of East Houston Street at the east corner of the Bowery, between Chrystie Street and Forsyth Street, the west corner of Eldridge Street, the west corner of Essex Street, the east corner of Norfolk Street, the east corner of Clinton Street, the east corner of Ridge Street, the east corner of Columbia Street, the east corner of Baruch Drive, and the west corner of Mangin Street. Bus stops are located on the north curb of East Houston Street at the west corner of Second Avenue, the east corner of First Avenue, the east corner of Avenue A, the west corner of Avenue B, and the west corner of Avenue C.

Accidents

An analysis of NYSDOT accident data for the years 1998 through 2000 indicates that the highest accident totals occurred where major through streets such as the Bowery, Second Avenue, Allen Street and Essex Street/Avenue A intersect with East Houston Street. The Bowery at East

Houston Street had 261 accidents, the highest number along the corridor. Of these accidents, 97 were reportable, meaning that the accident resulted in an injury and/or at least \$1,000 worth of damage.

Fatal accidents occurred at three locations on East Houston Street: the Bowery; Essex Street/Avenue A; and mid-block between Chrystie Street and Forsyth Street. The Bowery at East Houston Street had the most bicycle accidents with a total of eight. Essex Street/Avenue A had the highest number of pedestrian accidents, sixteen, while the Bowery had fifteen.

There have been few accidents of any kind (and only one reportable accident), and no fatalities, at the FDR Drive intersection, despite its complexity and numerous approaches. This may be due to the limited pedestrian access or the slow speed at which vehicles must navigate the intersection. There were, however, 29 total accidents at nearby Mangin Street and East Houston Street, of which sixteen were reportable, including one pedestrian accident and one bicycle accident.

Many of the intersections with a high number of accidents have irregular street geometry or non-continuous traffic flow which may contribute to the cause of accidents along the corridor. Additionally, some of these locations encourage high vehicular speeds, such as at Bowery, First Street, and Second Street. (See Appendix 1 for detailed accident data from the NYS Department of Transportation.)

A westbound cyclist approaching the Bowery.



Existing Conditions

The Bowery @ East Houston Street

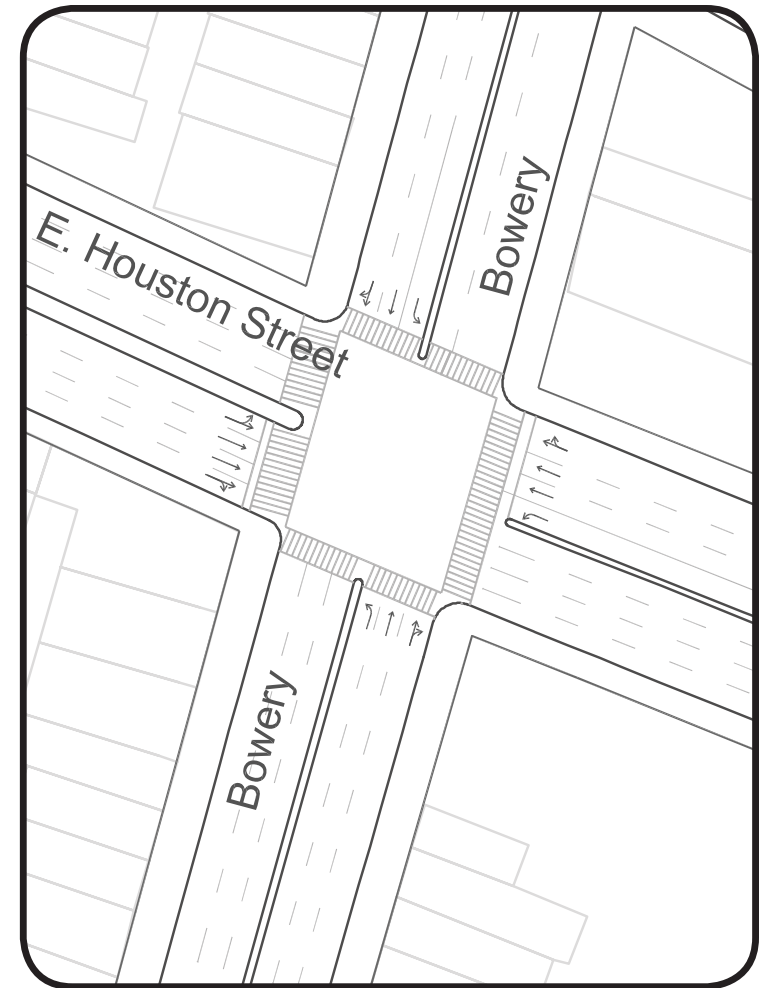
The area surrounding the Bowery is primarily comprised of commercial and office buildings, public facilities, and some mixed use commercial and residential buildings. Liz Christy Garden, a community garden maintained by the Green Guerillas, is located on the northeast corner of the intersection.

Street Geometry

The Bowery, a local truck route that carries heavy vehicular traffic, is approximately 79 feet wide with three southbound travel lanes, three northbound travel lanes and two parking lanes. There is a narrow median of about four feet running along the Bowery. Ladder crosswalks connect the corners of the four-way intersection.

Signalization

This intersection is signalized and has a 90-second signal cycle. There is a permitted and protected left turn onto East Houston Street from both northbound and southbound Bowery. Traffic has 36 seconds of green time on East Houston Street, 31 seconds on the Bowery and eight seconds for the left turn from the Bowery, with three seconds of amber and two seconds of red at each phase for both streets.



A view of westbound East Houston Street traffic and the Liz Christy Garden at the northeast corner of the intersection.

Parking Regulations

North of East Houston Street parking is not permitted from 8:00am to 6:00pm on either side of the Bowery. South of East Houston Street, a bus stop is located on the east corner of the Bowery, and south of the bus stop parking is not permitted from midnight to 3:00am Tuesday, Thursday and Saturday. Standing is not permitted from 7:00am to 7:00pm except trucks. Another bus stop is located on the west side of the Bowery, and south of the bus stop one hour parking is permitted 9:00am to 4:00pm. Standing is not permitted from 4:00pm to 7:00pm.

Accidents

There were a total of 261 accidents at this intersection, 97 of which were reportable, from the years 1998 through 2000. One of these accidents resulted in a fatality. Eight of these accidents involved a cyclist, and 15 involved a pedestrian.



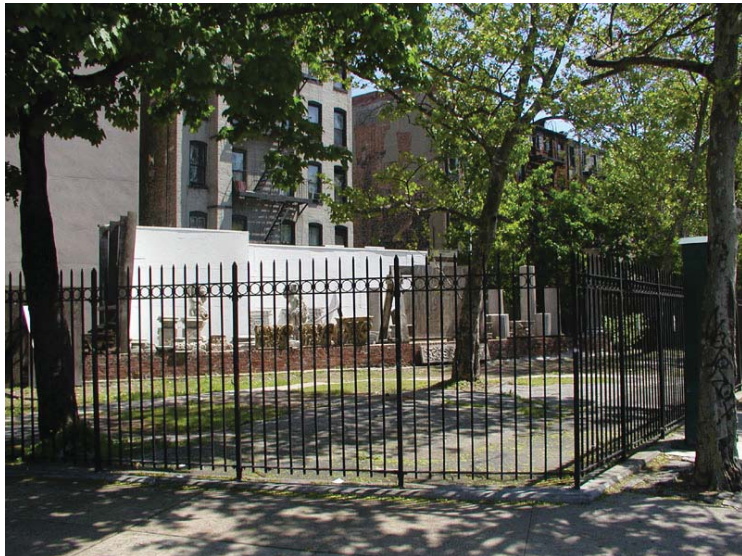
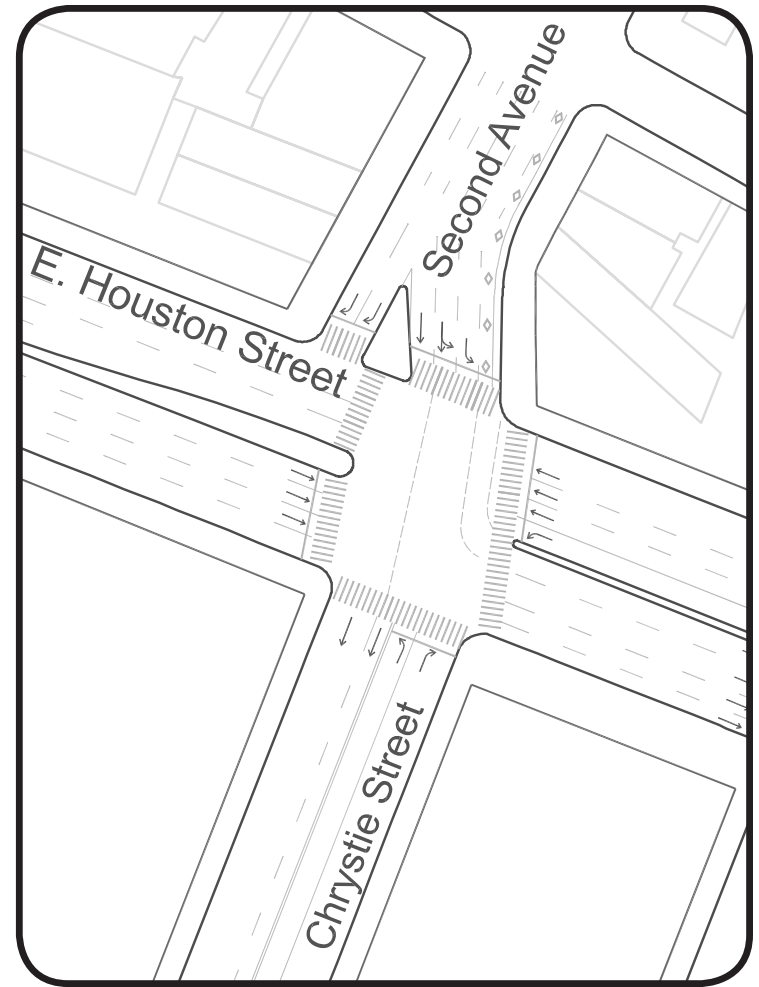
Looking north at traffic on the Bowery.

Second Avenue and Chrystie Street @ East Houston Street

The area surrounding Chrystie Street and Second Avenue is comprised of a mix of industrial and manufacturing buildings, commercial and office buildings and some mixed-use commercial and residential buildings. *Irreplaceable Artifacts*, an architectural salvage-and-sell operation, occupied the northwest corner of Houston Street at Second Avenue and Chrystie Street until a wall collapsed on July 13, 2000, leaving a vast construction site in that lot. Sara D. Roosevelt Park, a seven block-long park maintained by the Forsyth Street Garden Conservancy, begins at the southeast corner of Houston Street at Chrystie Street and continues south along Chrystie and Forsyth streets.

Street Geometry

Second Avenue, a local truck route, is a one-way southbound street north of East Houston Street. It is 60 feet wide, with five lanes of traffic and a bike lane along its eastern curb. Vehicular traffic is heavy, and as Second Avenue approaches East Houston Street it widens to accommodate a traffic triangle to channelize vehicles. Two right turn only lanes are directed west of the offset traffic triangle; the three through and left turn lanes, along with the bike lane, are directed south or east. Chrystie Street, a through truck route, is a 68-foot wide two-way street that approaches East Houston Street from the south. The street has two northbound travel lanes, two southbound travel lanes and parking lanes. Northbound vehicles on Chrystie Street must turn either right or left onto Houston Street since Second Avenue is a one-way southbound street. High visibility crosswalks connect the corners of this intersection.



The former site of Irreplaceable Artifacts (left). Sara D. Roosevelt Park at the southeast corner of the intersection (top). Southbound Second Avenue traffic seen from the northeast corner of the intersection (bottom).

Signalization

This intersection has a 90-second signal cycle. Traffic has 31 seconds of green time on East Houston Street, 19 seconds on Chrystie Street and 21 seconds on Second Avenue. The amber phase is three seconds, and the red phase is two seconds. There is a four-second interval allotted to pedestrians, known as the Leading Pedestrian Interval (LPI), during which pedestrians may cross East Houston Street before vehicles are permitted to turn east from Second Avenue.

Parking Regulations

Immediately north of East Houston Street parking is not permitted anytime on either side of Second Avenue. One parking spot is available on the east side of Second Avenue near East First Street, however parking is not permitted from 8:00am to 6:00pm Monday through Friday. Parking is permitted on the west side of Second Ave, extending north approximately 100 feet from the corner, except from 8:00am to 6:00pm Monday through Friday.

South of East Houston Street parking is permitted on the east side of Chrystie Street except from midnight to 3:00am Monday, Wednesday and Friday; on the west side parking is permitted except from midnight to 3:00am Tuesday, Thursday and Saturday.

Accidents

There were a total of 153 accidents at this intersection, 63 of which were reportable, from the years 1998 through 2000. Four of these accidents involved a cyclist, and six involved a pedestrian. A fatality occurred midblock between Chrystie and Forsyth streets, where a bus turning left from Second Avenue onto East Houston Street struck a pedestrian.



A left-turn bay for westbound East Houston Street traffic (top). A view of the west and north crossings at Second Avenue and East Houston Street (above).

Existing Conditions

Forsyth Street @ East Houston Street

In addition to the open space and recreational facilities, such as Liz Chrystie Garden and Sara D. Roosevelt Park, the intersection of East Houston Street at Forsyth Street is comprised primarily of multi-family walk-up buildings and some commercial and office buildings. Commercial activity has recently surged along East Houston Street between Forsyth and Eldridge Streets with the opening of a new Howard Johnson's Motel, and the resurrection of the landmark Sunshine Theatre.

Street Geometry

Forsyth Street is six blocks long and carries light, one-way, northbound traffic from Hester Street until it terminates at a T-intersection with East Houston Street. Traffic on Forsyth Street is permitted to turn onto both east and westbound East Houston Street. It has a 45-foot wide roadbed and parking lanes on both sides of the street. Standard crosswalks traverse Forsyth Street and East Houston Street, west of Forsyth Street. A ladder crosswalk traverses East Houston Street east of Forsyth Street.

Signalization

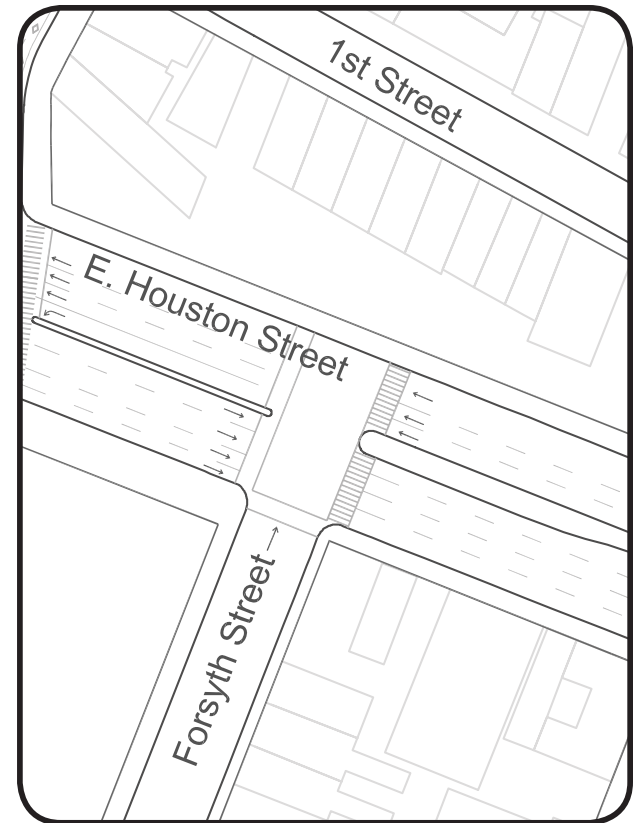
This intersection has a 90-second signal cycle. Traffic has 54 seconds of green time on East Houston Street and 26 seconds on Forsyth Street, with three seconds of amber and two seconds of red at each phase for both streets.

Parking Regulations

Parking is permitted on Forsyth Street at all times except for midnight to 3:00am Tuesday, Thursday, and Saturday along the west curb and Monday, Wednesday, and Friday along the east curb.

Accidents

There were a total of 16 accidents at this intersection, eight of which were reportable, from the years 1998 through 2000. One of these accidents involved a pedestrian.



The east crosswalk of the intersection of Forsyth Street and East Houston Street (left). Sara D. Roosevelt Park borders Forsyth Street to the west (right).



Eldridge Street @ East Houston Street

Eldridge Street is largely residential, and is comprised primarily of multi-family elevator buildings, multi-family walk-up buildings and mixed residential and commercial buildings. Like neighboring Forsyth Street, Eldridge Street at East Houston Street is enjoying a new surge of activity due to the new motel and movie theater nearby.

Street Geometry

Eldridge Street is a one-way northbound street that terminates at a T-intersection with East Houston Street. Eldridge Street carries light, local traffic, and all traffic is controlled by a stop sign and must turn right onto East Houston Street. The 25-foot wide roadbed has one moving lane and parking lanes on both sides of the street. A ladder crosswalk traverses Eldridge Street.

Signalization

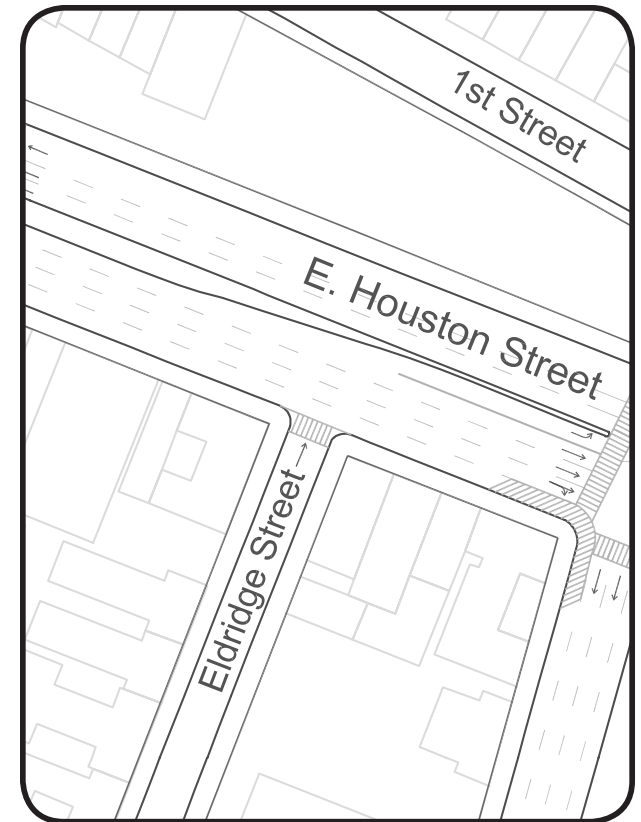
This intersection is unsignalized. A stop sign controls Eldridge Street traffic entering East Houston Street.

Parking Regulations

Parking is permitted except from 8:00am to 9:30am Tuesday and Friday on the east side of Eldridge Street, and from 8:00am to 9:30am Monday and Thursday on the west side of Eldridge Street.

Accidents

There were a total of 26 accidents at this intersection, six of which were reportable, from the years 1998 through 2000. Three of these accidents involved a cyclist.



Two views of Eldridge Street, a one-way northbound local street.

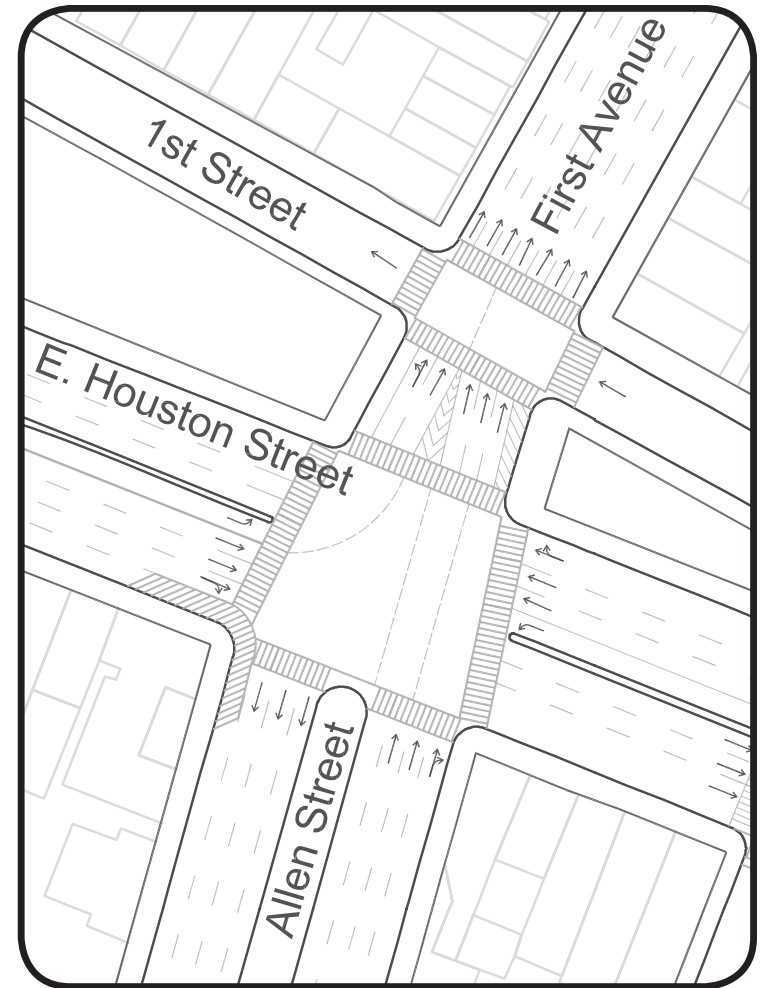
Existing Conditions

First Avenue and Allen Street @ East Houston Street (and First Avenue @ First Street)

The area around First Avenue and Allen Street at East Houston Street is composed of many mixed commercial and residential buildings, retail and office buildings and some multi-family elevator and walk-up buildings. The area is also home to a number of open space and recreational facilities, such as First Park, at the northwest corner of First Avenue at East Houston Street; Peretz Square, a pocket park located on East Houston Street between First Avenue and Avenue A; and the Allen Street Malls, a series of concrete malls that extend along Allen Street from East Houston Street to Division Street, all maintained by the New York City Department of Parks and Recreation (NYCDPR).

Street Geometry

Both First Avenue and Allen Street carry heavy vehicular traffic. First Avenue, a local truck route, is a one-way northbound street with five travel lanes and two parking lanes. Allen Street, a through truck route, is eight blocks long. A two-way street that begins at East Houston Street, it has six travel lanes, three northbound, three southbound, and two parking lanes. There is excess roadbed along the southwest corner of Allen Street at East Houston Street as a result of the discontinuous travel direction. On Houston Street, traveling east and approaching Allen Street, there is a striped neckdown reducing traffic from four to three travel lanes. Ladder crosswalks connect the corners of this intersection.



A view of the south crosswalk, subway entrance, and bus stop (left); First Park (middle); Peretz Square (right).

First Street is a one-way westbound street with one travel lane and two parking lanes. North of its intersection with First Street, First Avenue provides five northbound travel lanes and two parking lanes. Ladder crosswalks connect the corners of this intersection.

Signalization (East Houston Street @ First Avenue)

This intersection has a 90-second signal cycle. Traffic has 29 seconds of green time on First Avenue and Allen Street, 30 seconds on East Houston Street, and 12 seconds for the two protected left turn on East Houston Street and First Avenue. Each phase has three seconds of amber and two seconds of red. There is a four-second LPI for pedestrians crossing East Houston Street.

Signalization (First Avenue @ First Street)

This intersection has a 90-second signal cycle. Traffic has 50 seconds of green time on First Avenue and 30 seconds of green time on First Street, with three seconds of amber and two seconds of red for each phase for both streets.

Parking Regulations

Between East Houston Street and First Street, standing is not allowed anytime on the eastern side of First Avenue. Parking is not permitted from 8:00am to 8:30am on the western side of First Avenue. One hour parking is permitted from 8:30am to 7:00pm. On either side of First Avenue, north of First Street, parking is not permitted from 8:00am to 8:30am and one hour parking is permitted from 8:30am to 7:00pm. There is a bus stop located on the eastern side of First Avenue, north of First Street.

South of East Houston Street, two hour parking is permitted on either side of Allen Street from 9:00am to 7:00pm. In addition, on the western side of Allen Street, parking is not permitted from midnight to 3:00am Monday, Wednesday, and Friday, and there is a bus stop located just south of East Houston Street.

Accidents

There were a total of 166 accidents at this intersection, of which 49 were reportable, from the years 1998 through 2000. Seven of these accidents involved a cyclist, and five involved a pedestrian.

A pedestrian crossing East Houston Street using the west crosswalk (top); Looking north along First Avenue (bottom).



Existing Conditions

Orchard Street @ East Houston Street

Orchard Street has a heavy concentration of mixed-use commercial and residential, with some multi-family walk-up and elevator buildings. Once a Jewish wholesale enclave, it is still a thriving shopping destination for bargains as well as designer merchandise. The Lower East Side Tenement Museum, a National Trust for Historic Preservation site, is located at 97 Orchard Street, between Broome Street and Delancey Street.

Street Geometry

Orchard Street carries light traffic one-way northbound, until it terminates at a T-intersection with East Houston Street. Traffic on Orchard Street is permitted to turn onto both eastbound and westbound East Houston Street. The 24-foot wide roadbed has one moving lane and parking lanes on both sides of the street. There is a ladder crosswalk and stop line traversing Orchard Street; high visibility crosswalks traverse East Houston Street.

Signalization

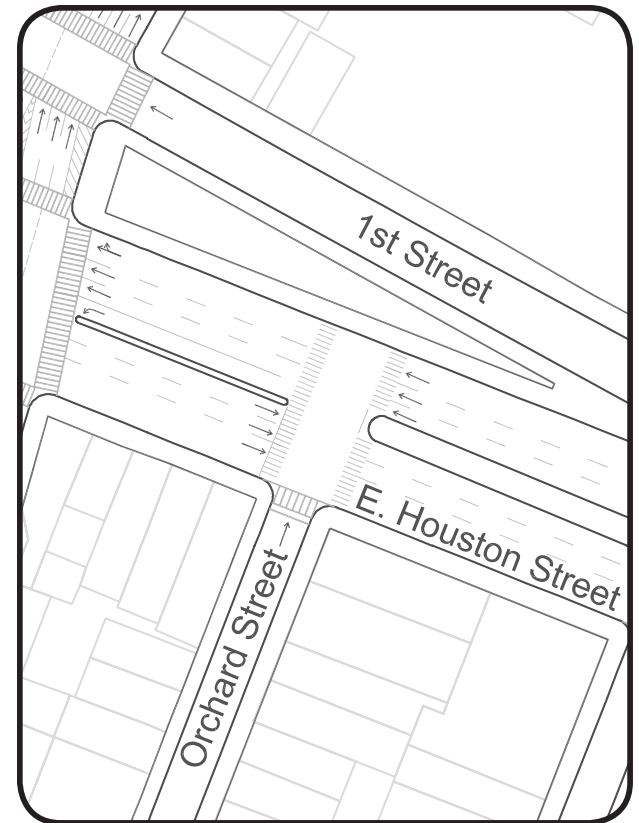
This signalized intersection has a 90-second signal cycle. Traffic has 54 seconds of green time on East Houston Street and 26 seconds on Orchard Street, with three seconds of amber and two seconds of red at each phase for both streets.

Parking Regulations

Parking is permitted on the east side of Orchard Street except from 7:00am to 7:00pm not including Sunday, and standing is permitted except from 8:00am to 6:00pm on Sunday. Two-hour Parking is permitted on the west side of Orchard Street from 9:00am to 7:00pm except Sunday. Parking is also not permitted from midnight to 3:00am Tuesday, Thursday, and Saturday.

Accidents

There were a total of 33 accidents at this intersection, 12 of which were reportable, between the years 1998 through 2000. One of these accidents involved a cyclist, and four involved a pedestrian.



A view of Orchard Street.

Ludlow Street @ East Houston Street

Ludlow Street is comprised primarily of mixed residential and commercial buildings, with some commercial and office and industrial and manufacturing buildings. Katz's Delicatessen, the oldest kosher-style New York delicatessen, founded in 1888, is located on East Houston Street at Ludlow Street.

Street Geometry

Ludlow Street carries light, one-way southbound traffic, starting at a T-intersection with East Houston Street. Traffic from both east and westbound East Houston Street is permitted to turn onto southbound Ludlow Street. The 24-foot wide roadbed has one moving lane and parking lanes on both sides of the street. There is a ladder crosswalk traversing Ludlow Street.

Signalization

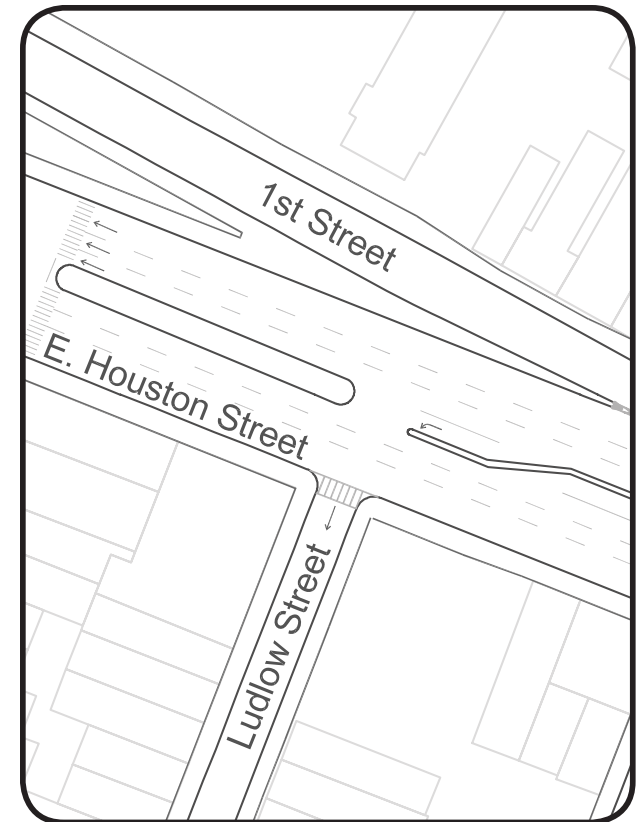
This intersection is unsignalized.

Parking Regulations

Parking is permitted on the east side of Ludlow Street except from midnight to 3:00am Tuesday, Thursday and Saturday, and one-hour parking is permitted from 9:00am to 7:00pm including Sunday. Parking is not permitted on the west side of Ludlow Street from 7:00am to 7:00pm Monday through Friday and from midnight to 3:00am Monday, Wednesday and Friday. One-hour parking is permitted from 9:00am to 7:00pm Saturday and Sunday.

Accidents

There were a total of 38 accidents at this intersection, 10 of which were reportable, from the years 1998 through 2000. One of these accidents involved a pedestrian.



Katz's Deli on the corner of Ludlow Street and East Houston Street.

Existing Conditions

Avenue A and Essex Street @ East Houston Street

The area around Essex Street at East Houston Street is comprised primarily of mixed residential and commercial buildings with some commercial and office buildings as well. ABC Playground, maintained by the Department of Parks and Recreation, is located on East Houston Street between and Essex and Norfolk streets. P.S. 20 lies adjacent to the playground on Essex Street between East Houston and Stanton streets.

Street Geometry

Essex Street and Avenue A connect north-south traffic across East Houston Street, with both streets carrying moderate traffic. Avenue A is approximately 49 feet wide and runs north of East Houston Street with one northbound travel lane, one southbound travel lane and two parking lanes. Essex Street is approximately 54 feet wide and runs south of East Houston Street with two northbound travel lanes, two southbound travel lanes and two parking lanes. East of the intersection the right lane of westbound East Houston Street branches off and turns into East First Street, creating a traffic triangle between East Houston Street and East First Street. At the corner of Avenue A and First Street there is a striped neckdown that channels vehicular traffic onto East First Street.

Signalization

This signalized intersection has a 90-second signal cycle. Traffic has 33 seconds of green time on East Houston Street, 27 seconds on Essex Street and Avenue A and 9 seconds for the protected left turn bays on East Houston Street. The amber phase is three seconds for East Houston Street, Essex Street/Avenue A and for the dual turn lanes on East Houston Street. The red phase is two seconds on East Houston Street, three seconds on Essex Street/Avenue A and two seconds for the left turn bays on East Houston Street. There is a five-second LPI for pedestrians crossing East Houston Street.



Parking Regulations

North of East Houston Street, parking is permitted on the west side of Avenue A except from 8:00am to 8:30am; one-hour parking is permitted from 8:30am to 7:00pm including Sunday. There is a bus stop on the east side of Avenue A and one-hour parking is permitted from 9:00am to 7:00pm. Parking is not permitted from 8:30am to 9:00am except Sunday.

South of East Houston Street, parking is permitted on the east side of Essex Street except from midnight to 3:00am Tuesday, Thursday and Saturday, and two hour parking is permitted 9:00am to 7:00pm including Sunday. There is a bus stop on the west side of Essex Street, just south of East Houston Street.

Accidents

There were a total 141 accidents at this intersection, 58 of which were reportable, from the years 1998 through 2000. Three of these accidents involved a cyclist, and 16 involved a pedestrian. There was one fatality at this intersection.



Opposite page: A pedestrian using the north crosswalk (left); A view of East Houston Street and East 1st Street; looking west (middle). A pedestrian crossing East 1st Street (right). This page: A view of ABC Playground (above) and Essex Street (left).

Existing Conditions

Norfolk Street @ East Houston Street

The area around Norfolk Street at East Houston Street is comprised of multi-family walk-up buildings and mixed residential and commercial buildings. Norfolk Street also borders both the ABC Playground and P.S. 20.

Street Geometry

Norfolk Street carries light, one-way northbound traffic terminating at a T-intersection at East Houston Street. Traffic on Norfolk Street is permitted to turn onto both east- and westbound East Houston Street. It has a 25-foot wide roadbed with one moving lane and parking lanes on either side of the street. There is a ladder crosswalk traversing Norfolk Street and standard crosswalks traversing East Houston Street.

Signalization

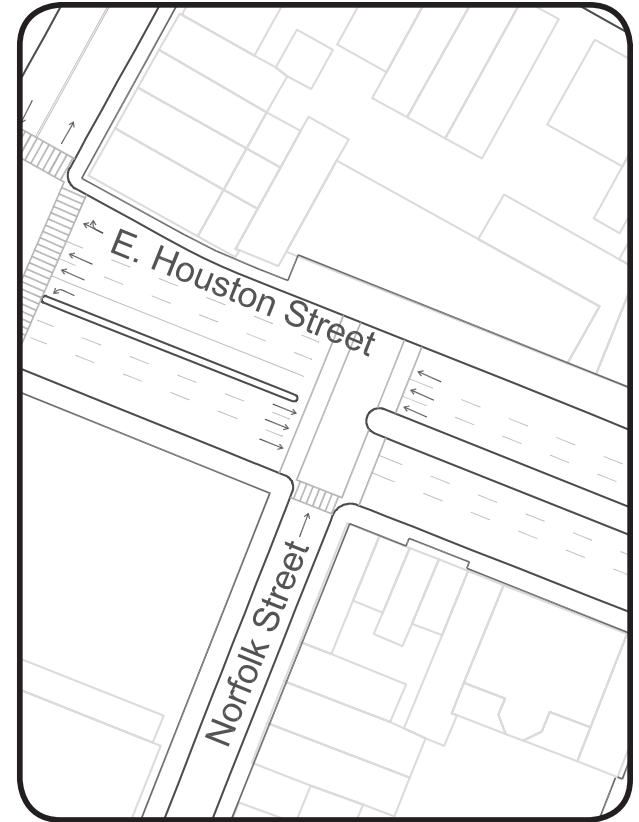
This signalized intersection has a 90-second signal cycle. Traffic has 54 seconds of green time on East Houston Street and 26 seconds on Norfolk Street, with three seconds of amber and two seconds of red at each phase for both streets.

Parking Regulations

Parking is permitted on the east side of Norfolk Street except from 9:00am to 10:30am Tuesday and Friday, and parking is not permitted anytime on the west side of Norfolk Street.

Accidents

There were a total of 19 accidents at this intersection, six of which were reportable, from the years 1998 through 2000. Two of these accidents involved a cyclist.



Norfolk Street and ABC Playground.

Suffolk Street @ East Houston Street

The area around the intersection of Suffolk Street at East Houston Street is comprised of mixed residential and commercial, multi-family walk-up and some commercial and manufacturing buildings.

Street Geometry

Suffolk Street is a one-way southbound street, carrying light traffic, starting at a T-intersection with East Houston Street. Both east- and westbound traffic on East Houston Street is permitted to turn onto Suffolk Street. It has a 25-foot wide roadbed, with one moving lane and a parking lane on the east side of the street. A high visibility crosswalk and a stop line traverse Suffolk Street.

The left turn bay on East Houston Street was initially closed off as a result of Suffolk Street being reversed from a southbound to a northbound street due to the Williamsburg Bridge reconstruction. Since the restoration of Suffolk Street to a southbound street, the left turn bay has remained closed.

Signalization

This intersection has a 90-second signal cycle. Traffic has 54 seconds of green time on East Houston Street and 26 seconds on Suffolk Street, with three seconds of amber and two seconds of red at each phase for both streets. There is no movement on Suffolk Street when cars on East Houston Street are stopped, allowing a de facto all-pedestrian phase.

Parking Regulations

Parking is permitted on the east side of Suffolk Street except from 9:00am to 10:30am Tuesday and Friday; parking is permitted on the west side of Suffolk Street except from 9:00am to 10:30am Monday and Thursday.

Accidents

There were a total of 43 accidents at this intersection, 17 of which were reportable, from the years 1998 through 2000. Four of these accidents involved a cyclist, and two involved a pedestrian.



A view of Suffolk Street (left) and the west crosswalk traversing East Houston Street (right).



Existing Conditions

Avenue B and Clinton Street @ East Houston Street

At the intersection of East Houston Street and Avenue B there are multi-family walk-up and multi-family elevator buildings as well as mixed commercial and residential and commercial and office buildings. A Gaseteria gas station is located at the northeast corner of the intersection.

Street Geometry

North of East Houston Street, Avenue B carries moderate traffic. It is approximately 33 feet wide with one northbound travel lane, one southbound travel lane and two parking lanes. South of East Houston Street, Clinton Street is a one-way, northbound street that carries moderate traffic. It is approximately 25 feet wide with one travel lane and one parking lane along its western curb. Traffic along Clinton Street has increased with the recent redirection of the street from southbound to northbound, allowing Clinton Street to function as a northbound corridor for traffic exiting the Williamsburg Bridge. Ladder crosswalks traverse Avenue B, Clinton Street and Houston Street east of Clinton Street. There is a standard crosswalk traversing East Houston Street west of Clinton Street.

Signalization

This signalized intersection has a 90-second signal cycle. Traffic has 46 seconds of green time on East Houston Street and 29 seconds on Avenue B. The amber phase is three seconds on East Houston Street and Avenue B. The red phase is two seconds on East Houston Street and Avenue B. There is a five-second LPI for pedestrians crossing East Houston Street.



A view of the north crosswalk and Gaseteria gas station at the intersection of Avenue B and East Houston Street (left). Pedestrians using the west crosswalk (right).

Parking Regulations

North of East Houston Street, parking is not permitted from 11:00am to 12:30pm Tuesday and Friday on the east side of Avenue B. Parking is not permitted from 11:00am to 12:30pm Monday and Thursday on the west side of Avenue B. In addition, there is a bus stop located midblock on the west side of Avenue B.

South of East Houston Street parking is not permitted anytime on the east side of Clinton Street, and standing is not permitted from 7:00am to 10:00am, except Sunday, on the west side of Clinton Street.

Accidents

There were a total of 70 accidents at this intersection, 26 of which were reportable, from the years of 1998 through 2000. One of these accidents involved a cyclist, and four involved a pedestrian.



A view from the northwest corner of Avenue B and East Houston Street.

Existing Conditions

Attorney Street @ East Houston Street

The area around the intersection of East Houston Street at Attorney Street is comprised primarily of multi-family walk-up and mixed commercial and residential buildings, with a number of parking facilities along Attorney Street between East Houston and Stanton Streets.

Street Geometry

Attorney Street carries light traffic one-way, northbound until terminating at a T-intersection with East Houston Street. Traffic on Attorney Street is permitted to turn onto both east- and westbound East Houston Street. It has a 25-foot roadbed, with one moving lane and parking lanes on both sides of the street. A high visibility crosswalk and a stop line traverse Attorney Street and no crosswalks traverse East Houston Street.

Signalization

This intersection is unsignalized. A stop sign controls Attorney Street traffic entering East Houston Street.

Parking Regulations

Parking is permitted on the east side of Attorney Street except from 7:00am to 6:00pm not including Sunday, and parking is permitted on the west side of Attorney Street except from 7:00am to 6:00pm Monday through Friday.

Accidents

There were a total of 17 accidents at this intersection, four of which were reportable, from the years 1998 through 2000. One of these accidents involved a pedestrian.



A view of Attorney Street.

Ridge Street @ East Houston Street

East Houston Street at Ridge Street is comprised primarily of multi-family elevator and multi-family walk-up buildings with some mixed commercial and residential buildings as well. Le Petit Versailles, a garden maintained by Greenthumb, is located northeast of the intersection.

Street Geometry

Ridge Street carries light, one-way southbound traffic, starting at a T-intersection with East Houston Street. Traffic from both east and westbound East Houston Street is permitted to turn onto southbound Ridge Street. It is approximately 25 feet wide with one travel lane and two parking lanes. A high visibility crosswalk traverses Ridge Street.

Signalization

This intersection is unsignalized.

Parking Regulations

Parking is permitted on the east side of Ridge Street except from 9:00am to 10:30am Tuesday and Friday; parking is permitted on the west side of Ridge Street except from 9:00am to 10:30am Monday and Thursday.

Accidents

There were a total of 13 accidents at this intersection, six of which were reportable, from the years 1998 through 2000. One of these accidents involved a pedestrian.



A view of Ridge Street (left) and Le Petit Versailles garden (right).

Existing Conditions

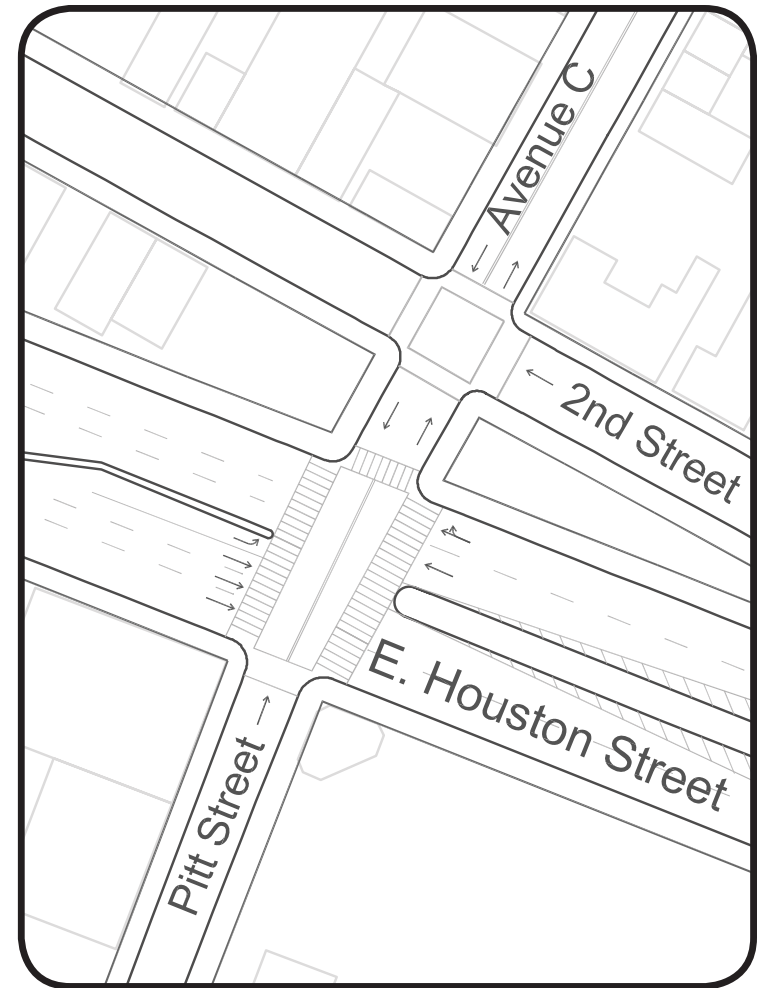
Avenue C and Pitt Street @ East Houston Street (and Avenue C @ Second Street)

The area around East Houston Street at Second Street, Avenue C and Pitt Street is one of open space and recreation. Gustav Hartman Square, a pocket park maintained by NYCDPR, occupies the triangle formed by East Houston Street, East Second Street and Avenue C. The Hamilton Fish Recreation Center, also maintained by NYCDPR, is located on Pitt Street between East Houston and Stanton streets. Barrier Free Living Inc., an institution for the disabled, is located on East Second Street west of Avenue C. A Mobil gas station occupies the northwest corner of the intersection.

Street Geometry

Avenue C is approximately 33 feet wide north of East Houston Street, carrying moderate traffic along one northbound travel lane, one southbound travel lane, and one parking lane along its west curb. The eastern lane is a fire zone. Pitt Street is a one-way street that extends south of East Houston Street and is approximately 25 feet wide with one northbound travel lane and two parking lanes. A standard crosswalk traverses Pitt Street. Ladder crosswalks traverse Avenue C and East Houston Street.

Second Street is a one-way westbound street with one travel lane and two parking lanes. Standard crosswalks connect the corners of its intersection with Avenue C, and a short block separates the intersection of Second Street and Avenue C from East Houston Street.



Left: Looking north up Avenue C. Top: Hamilton Fish Park, at the southeast corner of the intersection. Bottom: Hartman Square, at the northeast corner of the intersection.

Signalization (East Houston Street @ Avenue C)

This intersection has a 90-second signal cycle. Traffic has 46 seconds of green time on East Houston Street and 29 seconds on Avenue C. The amber phase is three seconds on East Houston Street and Avenue C. The red phase is two seconds on East Houston Street and Avenue C. There is a five-second LPI for pedestrians crossing East Houston Street.

Signalization (Avenue C @ Second Street)

This intersection has a 90-second signal cycle. Traffic has 31 seconds of green time on Avenue C and 49 seconds on East Second Street. The amber phase is two seconds on Avenue C and three seconds on East Second Street. The red phase is five seconds on Avenue C and two seconds on East Second Street.

Parking Regulations

Between East Houston Street and Second Street, standing is not permitted anytime on the east side of Avenue C. There is a driveway for the Mobil station on the west side of Avenue C. North of Second Street on the east side of Avenue C there is a no standing "fire zone". Parking is not permitted from 11:00am to 12:30pm Tuesday and Friday on the west side of Avenue C.

South of East Houston Street, parking is not permitted from 8:00am to 6:00pm except Sunday, on the east side of Pitt Street, and parking is not permitted from 9:00am to 10:30am Monday and Thursday on the west side of Pitt Street.

Accidents

There were a total of 59 accidents at this intersection, of which 24 were reportable, from the years 1998 through 2000. Three of these accidents involved a cyclist, and four involved a pedestrian.



Top: Looking south down Pitt Street. Above: Mobil gas station, at the northwest corner of the intersection.

Existing Conditions

Avenue D and Columbia Street @ East Houston Street

East Houston Street east of Avenue D, Columbia Street and Second Street is dominated by a group of multi-family elevator buildings, the Lillian Wald Houses. Mixed commercial and residential and retail and office buildings occupy the northwest corner, and a grade school, New Explorations Into Science Technology and Math, is located at the southwest corner. There is a beer distributor located near the west corner of Avenue D at Second Street.

Street Geometry

Avenue D is approximately 46 feet wide and runs north of East Houston Street carrying moderate traffic along one northbound travel lane, one southbound travel lane and one parking lane along its west curb. Columbia Street is approximately 52 feet wide and runs south of East Houston Street with one northbound travel lane, one southbound travel lane and two parking lanes. Ladder crosswalks traverse Avenue D, Columbia Street and East Houston Street west of Columbia Street. A standard crosswalk traverses East Houston Street east of Columbia Street. West of the intersection, the right lane of westbound East Houston Street branches off and turns into East Second Street, creating a traffic triangle between East Houston Street and East Second Street.



Looking east at Houston Street.

Signalization

This intersection has a 90-second signal cycle. Traffic has 46 seconds of green time on East Houston Street and 29 seconds on Columbia Street. The amber phase is three seconds on East Houston Street and Columbia Street. The red phase is two seconds on East Houston Street and Columbia Street. There is a five-second LPI for pedestrians crossing East Houston Street.

Parking Regulations

North of East Houston Street, there is a bus stop located on the east side of Avenue D, and parking is not permitted from 11:00am to 12:30pm Monday and Thursday on the west side of Avenue D. South of East Houston Street, parking is not permitted from 11:00am to 12:30pm Tuesday and Friday on the east side of Columbia Street, and parking is not permitted from 7:00am to 4:00pm on schooldays; or from 11:00am to 12:30pm Monday and Thursday on the west side of Columbia Street.

Accidents

There were a total of 79 accidents at this intersection, 43 of which were reportable, from the years 1998 through 2000. Five of these accidents involved a cyclist, and seven involved a pedestrian.



Top: Looking east, a pedestrian crossing East 2nd Street. Above: Looking west at Houston Street and East 2nd Street.

Existing Conditions

Baruch Drive @ East Houston Street

The area around East Houston Street at Baruch Drive is residential, and comprised almost entirely of multi-family elevator buildings including the Baruch Houses. P.S. 188 is on the north side of East Houston Street, across from Baruch Drive, as is Wald Playground, which is affiliated with the school.

Street Geometry

Baruch Drive carries light, one-way, southbound traffic from East Houston Street into Baruch Houses, and is approximately 34 feet wide with one travel lane and two parking lanes. Only eastbound Houston Street traffic can access Baruch Drive. A standard crosswalk traverses East Houston Street to the west of Baruch Drive, and a ladder crosswalk traverses the street to the east of Baruch Drive.

Signalization

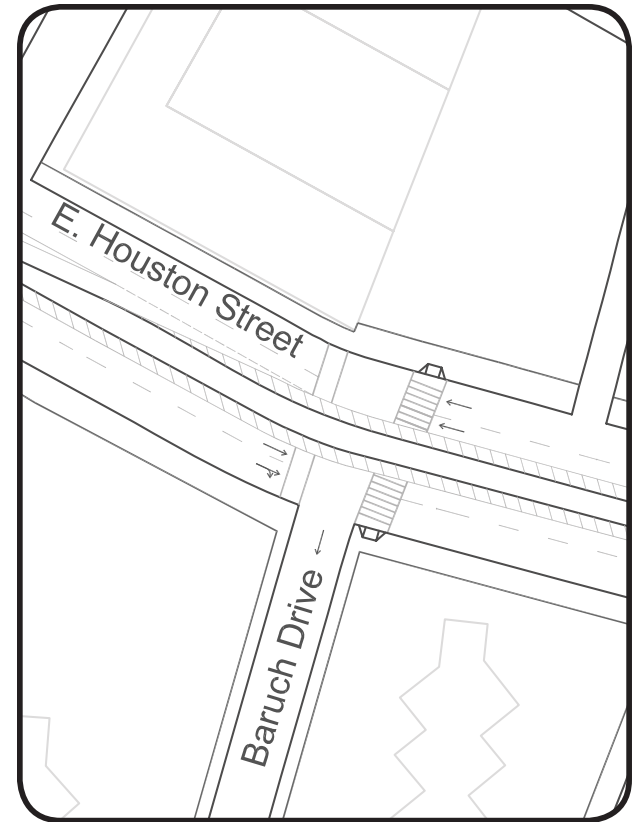
This signalized intersection has a 90-second signal cycle. Traffic has 53 seconds of green time on East Houston Street and 27 seconds on Baruch Drive, with three seconds of amber and two seconds of red at each phase for both streets. When traffic along East Houston Street is stopped there is no movement on Baruch Drive, thereby creating a de facto all-pedestrian phase.

Parking Regulation

Parking is permitted on the east side of Baruch Drive except from 11:00am to 12:30pm Tuesday and Friday, and parking is permitted on the west side of Baruch Drive except from 11:00am to 12:30pm Monday and Thursday.

Accidents

From 1998 through 2000 there were no accidents at this intersection.



Looking south, the east crosswalk at Baruch Drive and East Houston Street.

Baruch Place @ East Houston Street

The area around East Houston Street at Baruch Place is comprised primarily of multi-family elevator and walk-up buildings.

Street Geometry

Baruch Place carries light, one-way, southbound traffic from East Houston Street into Baruch Houses and is approximately 42 feet wide with one travel lane and two parking lanes. Ladder crosswalks traverse Baruch Place and East Houston Street to the east of Baruch Place. A standard crosswalk traverses East Houston Street to the west of Baruch Place.

Signalization

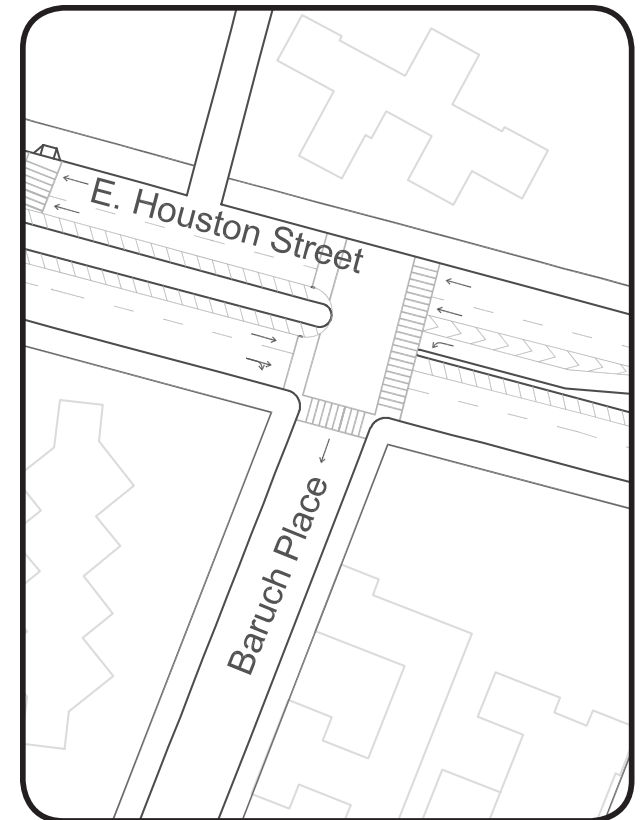
This intersection has a 90-second signal cycle. Traffic has 53 seconds of green time on East Houston Street and 27 seconds on Baruch Place, with three seconds of amber and two seconds of red at each phase for both streets. When traffic along East Houston Street is stopped there is no movement on Baruch Place, thereby creating a de facto all-pedestrian phase.

Parking Regulations

Parking is not permitted on the east side of Baruch Place from 11:00am to 12:30pm Tuesday and Friday, and parking is not permitted from 11:00am to 12:30pm Monday and Thursday on the west side of Baruch Place.

Accidents

There were a total of 45 accidents at this intersection, 19 of which were reportable, from the years 1998 through 2000. Six of these accidents involved a cyclist, and two involved a pedestrian.



Looking north, the east crosswalk at Baruch Place and East Houston Street.

Existing Conditions

Mangin Street @ East Houston Street

The area around East Houston Street at Mangin Street is mainly residential, with multi-family elevator buildings on both sides of East Houston Street. Bard High School Early College (BHSEC), a joint creation of the New York City Board of Education and Bard College, is located at the southwest corner of Mangin and Stanton Streets.

Street Geometry

Mangin Street carries light, one-way, northbound traffic from Baruch Houses to East Houston Street and is approximately 25 feet wide with one travel lane. A ladder crosswalk and stop line traverse Mangin Street. Traffic on Mangin Street may turn east or west onto East Houston Street.

Signalization

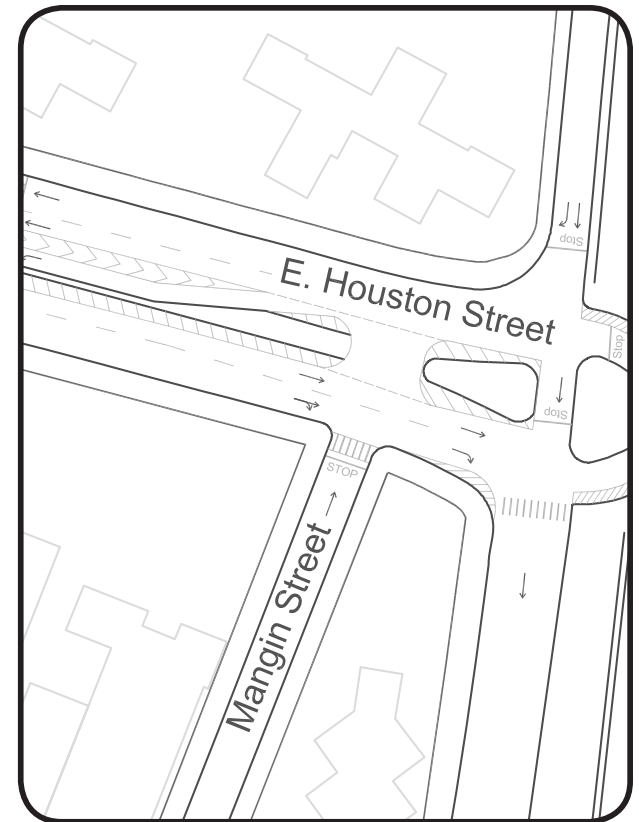
This intersection is unsignalized. A stop sign controls traffic entering East Houston Street from Mangin Street.

Parking Regulations

Parking is not permitted at anytime on Mangin Street.

Accidents

There were a total of 29 accidents at this intersection 16 of which were reportable. One of these accidents involved a cyclist, and one involved a pedestrian.



Looking west from the intersection of Mangin Street and East Houston Street.

FDR Drive @ East Houston Street

FDR Drive at East Houston Street provides vehicular access between the street system and a limited access highway. This intersection is also an access point to East River Park for pedestrians and cyclists. The park, maintained by the Department of Parks and Recreation (DPR), stretches from Montgomery Street to 14th Street, and can be accessed by the entrance located to the east of the northbound FDR Drive exit ramp.

Street Geometry

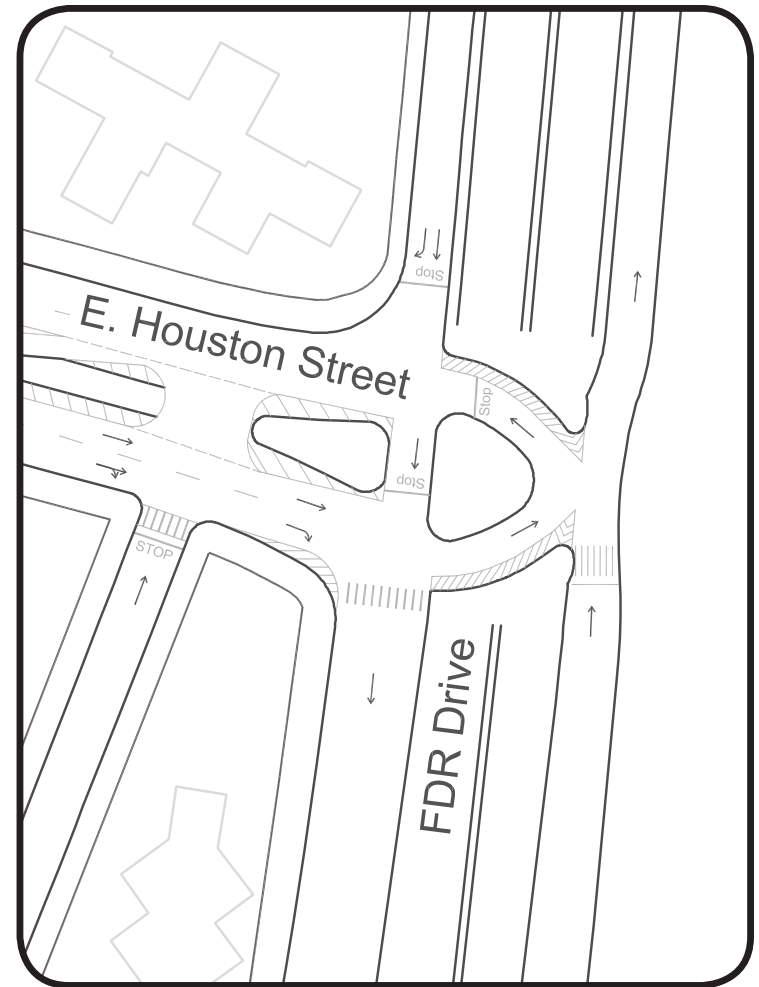
The intersection of the FDR Drive and East Houston Street is complex, with irregular geometry and multiple approaches. Traffic is heavy and the traffic semi-circle allows vehicles traveling along the northbound and southbound service roads of the FDR Drive to either access East Houston Street or the opposite service road. High visibility crosswalks traverse the roads on the southern side of the intersection. Stop signs control traffic on the northbound and southbound service roads. While striping reduces the width of the service roads into one lane of traffic, frequently they operate as two lanes of traffic as vehicles queue in the striped areas.

Signalization

This intersection is unsignalized. Stop signs control the movement of FDR Drive traffic entering and exiting East Houston Street.

Accidents

Few accidents were reported at this intersection from 1998 through 2000. Accident data from NYSDOT show that two accidents occurred at the southbound exit ramp, one occurred at the southbound entrance ramp, two occurred at the point between the southbound exit and entrance ramps, and four occurred at the intersection of the northbound exit ramp and northbound entrance ramp. Two of these accidents were reportable and both involved pedestrians.



Left to right: Pedestrians crossing the south crosswalk of the southbound FDR Drive entrance ramp; northbound FDR Drive exit ramp; southbound FDR Drive exit ramp traffic.

Issues and Opportunities

The analysis of existing pedestrian and vehicular conditions along East Houston Street identified a number of issues and opportunities for improvement. Some of these issues may be found corridor-wide; others are unique to specific focus intersections, resulting from irregular street geometry or other localized problems.

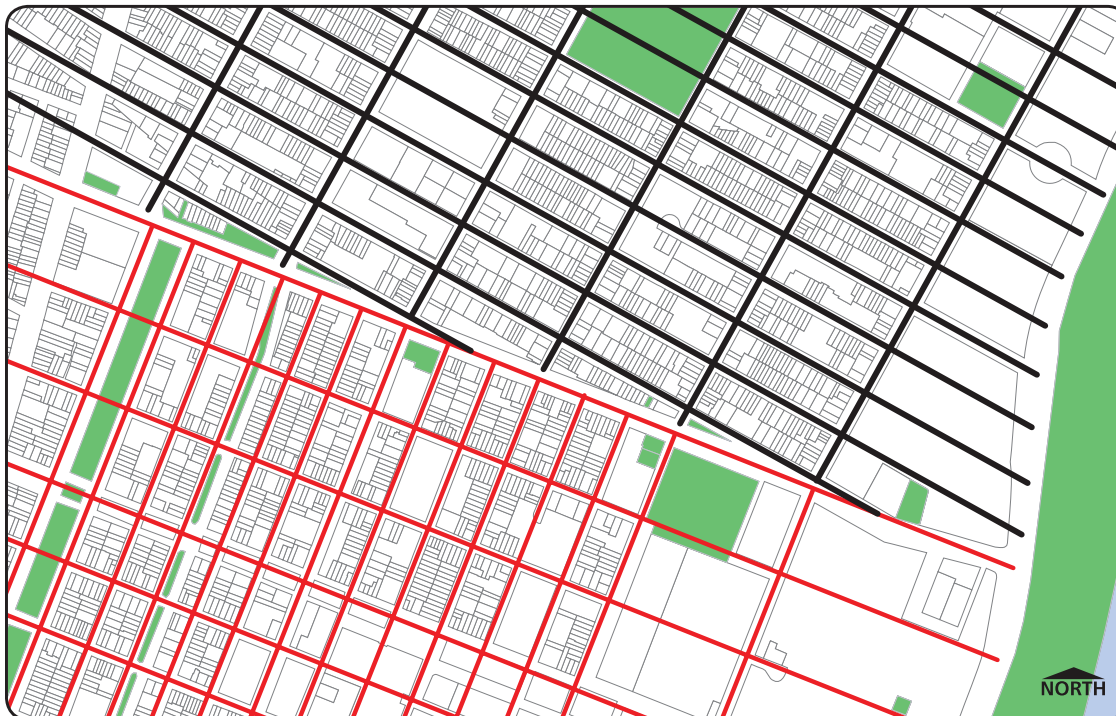
Corridor-Wide Issues

An inspection of the East Houston Street corridor revealed several reoccurring issues at various intersections. Because of the frequency at which these issues appeared, they will be addressed on the corridor-wide level.

Non-continuous Traffic Flow

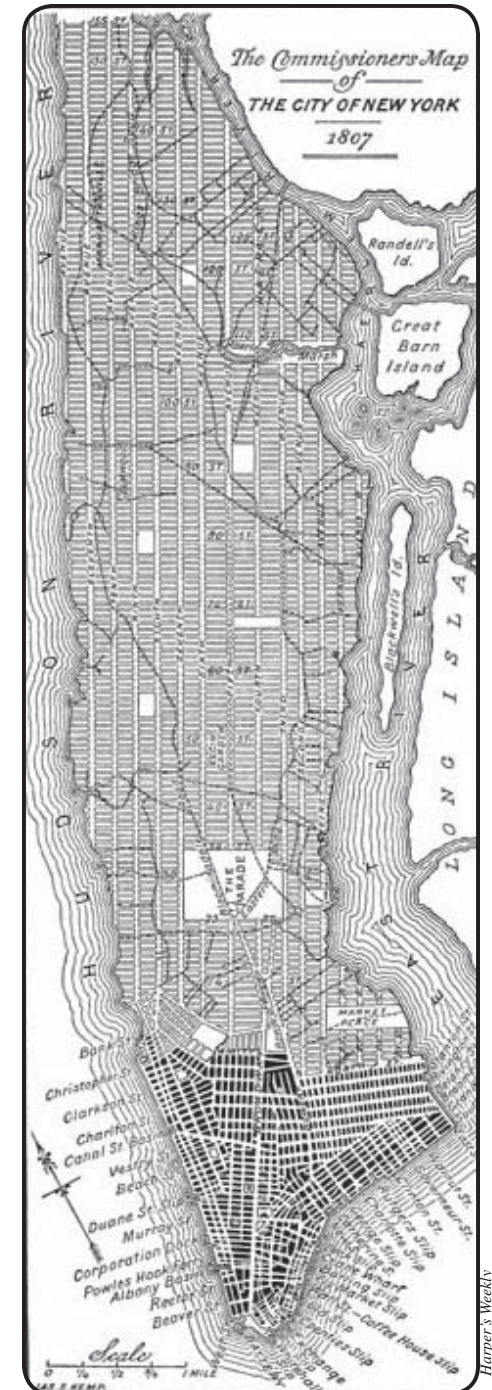
East Houston Street functions as the border where the disjointed street geometry of early development meets the modern, symmetric geometry of the grid. Prior to 1811, streets in Manhattan were laid out haphazardly, as still evident today in many neighborhoods south of Houston Street. The *Commissioner's Plan of 1811* established a street grid of north-south avenues and east-west streets starting north of Houston Street but not exactly parallel to it. As a result, certain cross streets begin at East Houston Street, then skew away from it, causing discontinuities in pedestrian circulation and forcing pedestrians to cross streets against traffic.

In addition, the 1811 Plan mapped fewer north-south streets. As a result, there are a number of T-intersections where streets begin or terminate, and intersections where two-way streets meet one-way streets, resulting in a disruption of the continuity of north-south traffic along the corridor. This poses problems for both pedestrians and motorists when trying to determine the direction of oncoming traffic.



New York City Department of City Planning

The street plan to the south of East Houston Street (left, in red) was established prior to the *Commissioner's Plan of 1811* (right), which proposed a grid that would extend from Houston Street north to regulate the development of Manhattan as its population expanded.



Harper's Weekly

Figure 8: Irregular Street Geometry

Lack of East-West Bicycle Facilities

Currently, there are no east-west bicycle routes on Houston Street, and the lack of east-west connectors between the Manhattan Waterfront Greenway and striped north-south on-street bicycle routes is a borough-wide issue. East Houston Street is a recommended route in the *New York City Bicycle Master Plan*, and would be the first east-west bicycle connection in Manhattan south of Central Park. The existing Second Avenue bicycle lane ends abruptly at East Houston Street, and cyclists are discharged onto the street into East Houston Street traffic.

Varied Crosswalk Styles

A lack of appropriate crosswalk markings may result in decreased pedestrian safety. With a truck route from the Bowery to First Avenue/Allen Street, the western end of the corridor from the Bowery to Avenue C is primarily commercial. The eastern end from Avenue C to the FDR Drive, however, is primarily residential, with a number of schools nearby. Crosswalk types are employed inconsistently throughout the corridor, without reference to land use. Also, at several intersections there are crossings that do not have pedestrian ramps. Pedestrian ramps should be paired with crosswalks to improve circulation and access for all populations, including pedestrians with disabilities and the elderly.

Constricted Access to Open Spaces

There are many open spaces throughout the study area; however, much of that space is obscured from the street, particularly East River Park due to the elevated entrance and exit ramps for the FDR Drive which block views of the park. Jersey barriers along the eastern side of the FDR Drive also block views and limit access to East River Park. The entrance to Hamilton Fish Park does not front East Houston Street, but is located on a side street, making it more difficult for pedestrians to locate.



Clockwise from above: a bicyclist on East Houston Street; detail of the NYC Cycling Map; the entrance to Hamilton Fish Park; the entrance to East River Park.

Figure 9: NYC Cycling Map



Focus Intersection Issues

In addition to the corridor-wide issues, this study focuses on eight specific intersections along East Houston Street. The intersections were targeted based on collected traffic data and its analysis, an analysis of accident data, numerous site visits, and an examination of the complex traffic flow resulting from streets that terminate at East Houston Street.

The Bowery

The intersection of the Bowery at East Houston Street is the crossroads of two major through-corridors, and therefore, services a heavy volume of vehicular traffic. As such, the Bowery and East Houston Street had the highest number of overall accidents (261), the highest number of vehicular accidents (73) and the highest number of bicycle accidents (8) in the study area. Additionally, cars making left turns conflict with pedestrians using the crosswalks. This intersection had the second highest number of pedestrian accidents (15).

Second Avenue/Chrystie Street

Two-way Chrystie Street meets one-way, southbound Second Avenue at East Houston Street, creating irregular street geometry and non-continuous traffic flow. Cars traveling north along Chrystie Street must turn either right or left onto East Houston Street. Left-turning vehicles conflict with pedestrians in the crosswalks at this intersection as well. The Second Avenue bicycle lane ends abruptly at East Houston Street, leaving cyclists to fend for themselves in an area of heavy traffic.

First Avenue/Allen Street

Irregular street geometry is an issue at East Houston Street where two-way Allen Street meets one-way, northbound First Avenue. The intersection of Allen Street at East Houston Street is extraordinarily wide. Pedestrians crossing either East Houston Street or Allen



Street must walk across six lanes of traffic in just 35 seconds of pedestrian walk time, only four seconds of which is designated exclusively for pedestrians.

Avenue A/Essex Street

Avenue A/Essex Street at East Houston Street had the highest number of pedestrian accidents (16) in the period studied. Westbound First Street begins at this intersection, where it angles away from East Houston Street, creating a traffic triangle, and leaving pedestrians on the north side of the corridor to cross the street without the benefit of a crosswalk. The street geometry permits fast-moving vehicles to bear right onto First Street without slowing, creating unsafe conditions for pedestrians. Excess roadbed at the northwest corner of Avenue A at First Street affords opportunities to recapture a portion of the street for the use of pedestrians.

From the top: the irregular street geometry of First Avenue and East Houston Street; the long crossing at the north crosswalk of East Houston Street at First Avenue; the irregular street geometry of Second Avenue and East Houston Street; the end of the Second Avenue bike lane; a woman trying to cross First Street near Avenue A and East Houston Street.



Avenue B/Clinton Street

One-way northbound Clinton Street meets two-way Avenue B at East Houston Street, creating irregular street geometry and non-continuous traffic flow. Southbound vehicles on Avenue B must make left or right turns onto East Houston Street, thereby conflicting with pedestrians.

The north side of East Houston Street is lined with the backs of buildings. East Houston Street was widened in the 1930s for the construction of the subway lines running underneath the street. Buildings fronting the north side of East Houston Street were removed to accommodate the subway. As a result, the backs of buildings abut the East Houston Street sidewalk and roadway, sometimes contributing to “pedestrian unfriendly” activities such as parking on the sidewalk near service stations.

Avenue C/Pitt Street

One-way Pitt Street meets two-way Avenue C at East Houston Street, creating issues of non-continuous traffic flow and irregular street geometry. Vehicles turning left onto eastbound East Houston Street conflict with pedestrians in the crosswalk. As with Avenue B, backs of buildings fronting East Houston Street at this intersection have been neglected. The buildings are boarded up in the back and are covered in graffiti; the property lines are fenced by unattractive corrugated metal.



Left: Cars blocking the sidewalk at the service station. Below: A view looking west at the intersection of Avenue D and East Houston Street and a diagram displaying the street geometry of the intersection.



Avenue D/Columbia Street

At this intersection, as with Avenue A/Essex Street at East Houston Street, Second Street diverges from East Houston Street, creating a traffic triangle, and leaving pedestrians on the north side of the corridor to cross the street mid-block without the benefit of a traffic signal or a crosswalk. The street geometry permits fast-moving vehicles to bear right onto Second Street without slowing, creating unsafe conditions for pedestrians. As a result, this intersection has had a relatively high number of pedestrian accidents (7).

FDR Drive

Pedestrians at the northwest corner of the FDR Drive at East Houston Street are unable to safely cross either the FDR Drive or East Houston Street. The lack of signage, change in grade, presence of jersey barriers along the eastern side of the FDR, and difficulty of crossing an unsignalized intersection result in constricted access to East River Park for both pedestrians and cyclists. Eastbound Houston Street traffic has the right-of-way at its intersection with the FDR Drive; the left turn to the northbound FDR Drive entrance ramp or the right turn to southbound FDR Drive entrance ramp is uncontrolled. Because there is no traffic control device, cars traveling eastbound on East Houston Street make right turns at high speeds onto the southbound FDR Drive entrance ramp, conflicting with pedestrians using the crosswalk to get to and from East River Park. The lack of a traffic control may contribute to confusion amongst pedestrians, cyclists and motorists as to who has the right-of-way. Also, it is difficult for crosswalk users seeking to access the park to see approaching eastbound traffic because they must look behind them for traffic.

There is limited queuing space for vehicles exiting northbound FDR and turning west onto East Houston Street. However, in the peak hours, vehicles use the painted roadway to effectively turn one marked travel lane into two lanes and thereby maximize traffic flow. Poor sight lines make it difficult to see oncoming traffic, so vehicles inch out into the intersection in order to have a clearer view.



Top-left: Pedestrians crossing from the northwest corner of the intersection of East Houston Street and the FDR Drive. Top-center: Pedestrians crossing the southbound FDR Drive entrance ramp. Top-right: Ramp to East River Park, east of the FDR Drive. Above: The entrance to the East River Park across the northbound FDR Drive exit ramp. Right: A detail showing the lack of pedestrian ramps at the crossing.

Recommendations

The following recommendations address the issues presented in the previous section. Recommended improvements include: curb realignments, traffic calming devices, re-striping, improved signage, and signal timing adjustments. The recommendations presented here may or may not address all of the issues either corridor-wide, or at each intersection, and those involving either structural or operational changes may be subject to a traffic analysis to determine feasibility. Implementation funds of \$910,000 are allocated for this project.

Corridor-Wide Improvements

The following recommended improvements should be applied through the East Houston Street corridor to improve pedestrian and bicycle safety and circulation.

East Houston Street Bicycle Lane

The *New York City Bicycle Master Plan* designates Houston Street from Sixth Avenue to East River Park as a recommended on-street route for cyclists. This route provides connections to north-south on-street bicycle routes at its intersections with Second Avenue, First Avenue and Allen Street, Ridge Street, Avenue C and Pitt Street, and just east of FDR Drive. It connects to the Manhattan Waterfront Greenway at East River Park.

This study recommends installing Class 2 striped on-street bicycle lanes from Forsyth Street to the FDR Drive in the both directions. The bicycle lane would nearly connect with the existing southbound bicycle lane on Second Avenue and its northbound pair (First Avenue) with the Manhattan Waterfront Greenway at the East River Park. A traffic analysis (see next section) was conducted to assess the impacts of removing a travel lane in each direction along East Houston Street from the Second Avenue to the FDR Drive. The study showed that traffic conditions could be improved to feasibly permit the installation of a five-foot bicycle lane with a two-foot buffer along this section of East Houston Street. However, congested traffic conditions from Second Avenue to the Bowery could not be improved, and therefore, this portion of the route would be a signed Class 3 Route only. The reconfiguration of East Houston Street would leave two 12-foot travel lanes, an eight-foot parking lane, and a bicycle lane in each direction.



Views of East Houston Street looking east from Norfolk Street and west from Mangin Street (top and middle). Renderings of the proposed on-street bike lane (above and top right). A sectional and plan view of the proposed East Houston Street bicycle lane.

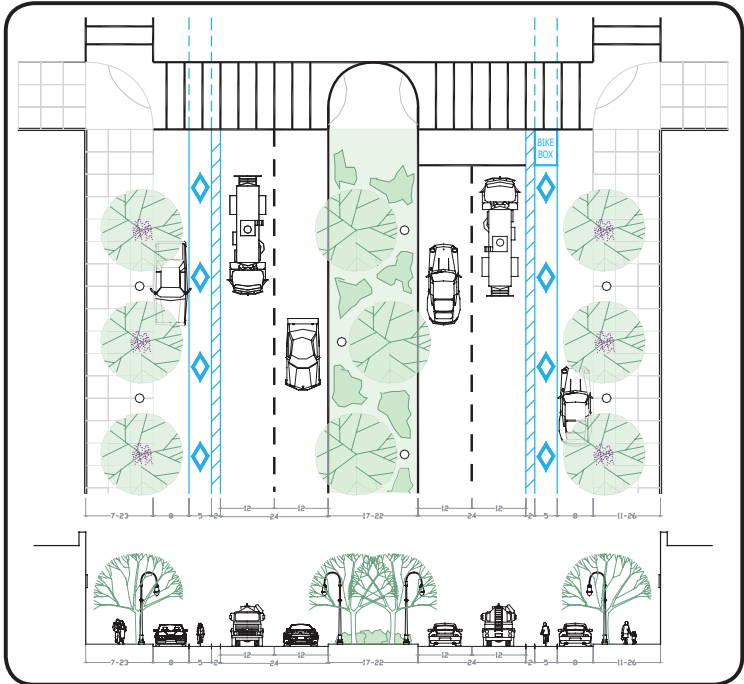


Figure 10: Bicycle Lane Section

Recommendations

Widened Medians

Raised medians on East Houston Street act as both a pedestrian refuge within the roadway and a pedestrian amenity, when planted. The reconfiguration of East Houston Street to provide two travel lanes, a parking lane, and a bicycle lane in each direction would still leave some excess roadbed throughout most of the corridor. This study recommends widening the medians along East Houston Street to recapture needed space for the pedestrian. Widening the medians would maximize pedestrian safety and enhance pedestrian amenities by creating additional space for landscaping. Currently, the width of the median ranges from 14-and-a-half feet at the east end of the corridor to nearly 16 feet at the west end (see below). Medians could be widened to anywhere from 17 feet, as at Mangin Street, to nearly 22 feet, as at Ludlow and Orchard streets. The widened medians could be implemented as part of a long-term capital project that would reconstruct East Houston Street to match West Houston Street.

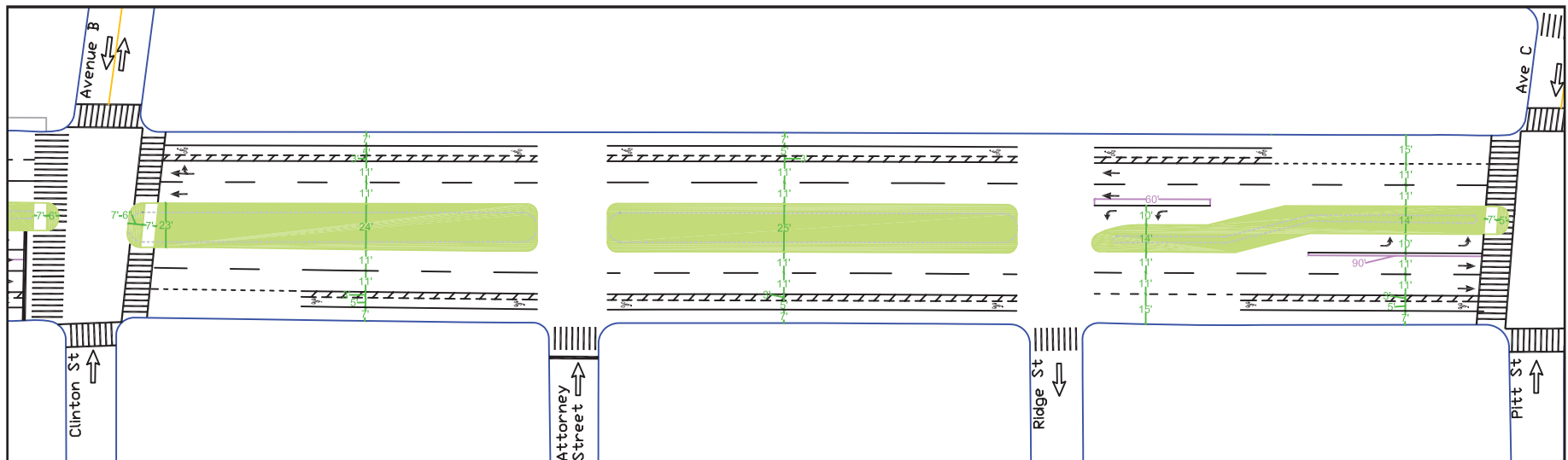
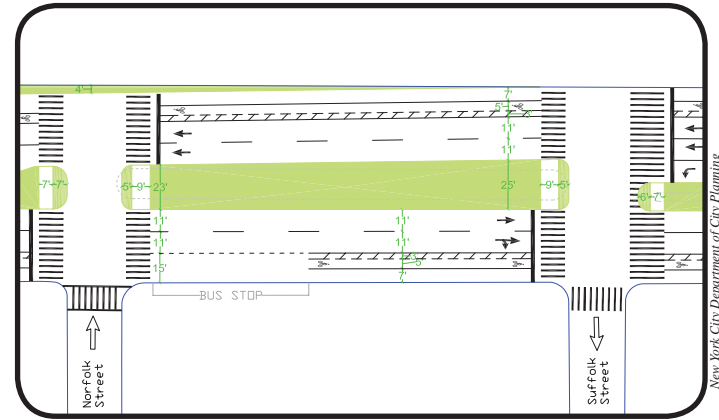


Figure 11: Widened Medians

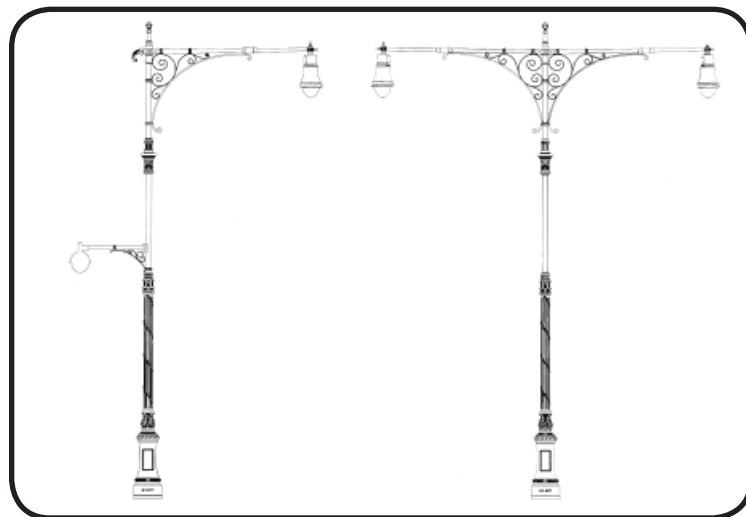
Curb and Median Tip Extensions

In addition to widening the medians, extending the curbs to shorten crossing distances and extending median tips through crosswalks is another means by which to improve pedestrian safety on East Houston Street. Where feasible, neckdowns are recommended at corners of signalized intersections and at T-intersections. This recommended improvement will shorten the crossing distance for pedestrians by five to ten feet. In some instances, the installation of neckdowns may require the removal of on-street parking spaces. Extending medians, which currently stop short of the crosswalks, to extend through the crosswalks will provide needed pedestrian refuge space for pedestrians who cannot make this long crossing and are stranded on the medians.

Plan view with recommended street improvements.



The north side of Houston Street at Norfolk Street, and a rendering of the proposed curb extension. Left: Type “M” lamppost with pedestrian arm and Type “M” twin lamppost.



New York City Department of Transportation

Pedestrian Amenities

This study recommends installing pedestrian-scale lighting to illuminate the sidewalks for pedestrians navigating the study area’s lively late night street scene. However, DOT requires the signing of a maintenance agreement by a local organization for the installation of additional lighting along the corridor. Alternatively, or additionally, decorative street lighting fixtures could be installed to improve the appearance of the streetscape (see illustration, left).

New York City Department of City Planning

Recommendations

Uniform Crosswalks

Crosswalks should be marked appropriately and consistent with the land use of the area in which they are located. This study recommends three different crosswalk styles for the corridor:

High-visibility crosswalks are parallel lines, spaced 12" to 24" apart, perpendicular to the direction of pedestrian movements. High-visibility crosswalks increase visibility and awareness of a shared intersection, and are recommended at intersections along the western portion of the corridor from the Bowery to Avenue C, where there is a higher concentration of commercial activity, and truck and commercial vehicular traffic.

School crosswalks are two parallel lines running from curb to curb connected by perpendicular lines spaced 12" to 24" apart. School (sometimes called ladder)



crosswalks increase visibility and awareness of a shared intersection even further. These enhanced, high-visibility crosswalks are recommended at intersections at the east end of the corridor where there are schools and high pedestrian volumes.

Barnes Dance crosswalks are used to mark a signal-controlled intersection with an all-pedestrian phase that permits pedestrians to cross the intersection in all directions at once. Barnes Dance crosswalks, as illustrated in the *Manual of Uniform Traffic Control Devices* (MUTCD), use striping to mark two diagonal pathways at the corners intersecting the typically-marked crosswalks. This study recommends the installation of a Barnes Dance crosswalk at Baruch Drive and East Houston Street, where there is an existing all-pedestrian signal phase.

Also, pedestrian ramps should be installed for the west crosswalk at Baruch Drive, the west crosswalk at Baruch Place, the crossing at the southbound entrance ramp to the FDR Drive, the crossing at the northbound exit ramp to the FDR Drive, as well as any additional crossings where pedestrian ramps are not present.

Trailblazer Signage

There are twelve parks and recreational facilities in and around the study area. However, some of these spaces are obscured from view, such as Hamilton Fish Park, or access is constricted, such as East River Park. This study recommends improving orientation and access to open spaces by installing signage to direct pedestrians to entry points of open spaces that are otherwise obscured. Parks Department logo banners, affixed to light fixtures at every open space, could be installed as a possible, short-term signage solution. New signage could be developed and placed at every open space. One option is to use neighborhood maps, to indicate the area's open spaces.

Recommended crosswalk styles:
High-visibility crosswalk (top left),
School crosswalk (top right), and
Barnes Dance crosswalk (left).

Trailblazer signage for the Brooklyn Children's Museum (right).



inner sidewalk line, discourage vehicles from parking there, and clear the sidewalk for pedestrians.

Avenue C/Pitt Street @ East Houston Street

As with Avenue B/Clinton Street, left-turning vehicles from southbound Avenue C onto East Houston Street conflict with pedestrians in the crosswalk. This study recommends allotting dedicated signal time for left turns to reduce the conflict between pedestrians and motorists at the intersection.

Although the backs of buildings front nearly all of East Houston Street's north side, some areas along the corridor are better kept than others. The block on the north side of East Houston Street, between Avenues B and C, is particularly challenged with both traffic-related issues, as discussed above, and aesthetic issues, most notably at the intersection of East Houston Street at Avenue C. The buildings are boarded up in the back and are covered in graffiti. Also, the building lots are bordered by unattractive corrugated metal fencing.

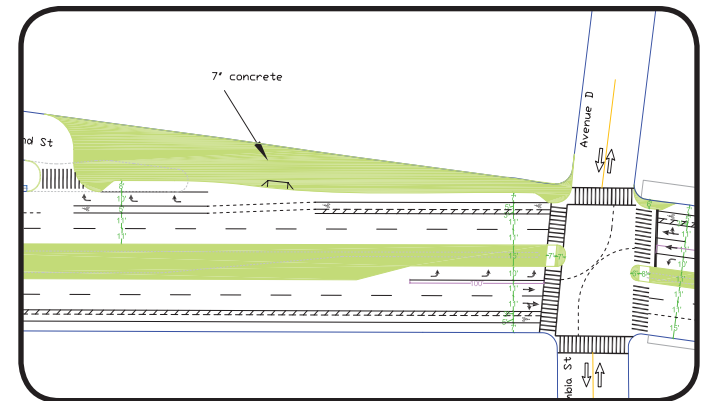
While the upkeep of privately owned buildings is beyond the scope of this study, this study recommends appealing to the community and the local Business Improvement District (BID) to press upon the building owners to maintain their property. Additionally, more attractive fencing, such as at Liz Chrystie Gardens, would be a vast improvement over what is there and is recommended at this location. Another option might be to host an open competition for local artists and community members for the design of an effective treatment.

Avenue D/Columbia Street @ East Houston Street (including Second Street @ East Houston Street)

As at Avenue A, the traffic triangle created by the junction of East Houston Street and Second Street poses challenges for pedestrians and cyclists when vehicles traveling at high speeds on East Houston Street bear right onto Second Street. Pedestrians on the south side of East Houston Street must cross the street without any safe means of crossing to the curb.

This study recommends extending the curb to the traffic triangle, replacing Second Street from the intersection of East Houston Street and Second Street to the intersection of East Houston Street and Avenue D. The traffic triangle would be truncated to allow vehicles to turn onto Second Street. A crosswalk would be installed to connect the traffic triangle to the curb extension. A turning lane should be installed on East Houston Street between the bicycle lane and the extended curb to allow vehicles to turn onto

Left: Examples of alternatives to unkempt backs of properties abutting the north side of East Houston Street include a fenced rear patio area and a mural in memory of the singer Celia Cruz.



Planned improvements for Avenue D

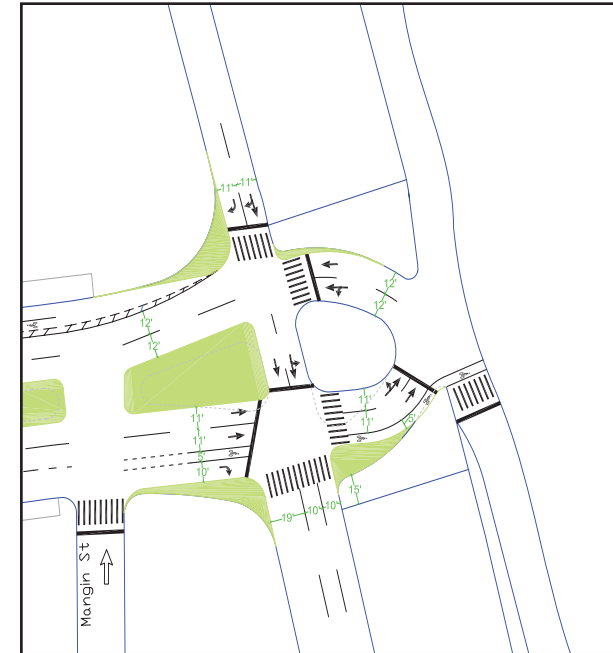
Recommendations

Second Street. Neckdowns should be installed at both ends of the curb extension to reduce pedestrian crossing time and improve pedestrian safety. The bus stop would be relocated from the tip of the traffic triangle to the end of the recommended truncated traffic triangle.

FDR Drive @ East Houston Street

High speeds on East Houston Street present problems throughout the corridor for both pedestrians and vehicular circulation. This issue is particularly problematic at the junction of East Houston Street and the FDR Drive. Eastbound vehicles make uncontrolled right turns from East Houston Street onto southbound FDR Drive at high speeds, conflicting with pedestrians using the striped crosswalk. Roadbed striping at the corners of East Houston Street and FDR Drive should be replaced with raised curb extensions to sharpen the turn onto East Houston Street and FDR Drive as a traffic calming measure. The curbs on East Houston Street between south bound and north bound FDR Drive should be extended to create a uniform road bed width on East Houston Street. The curb extensions would reduce pedestrian crossing time and improve pedestrian safety. Crosswalks should be striped on East Houston Street and FDR Drive to further improve pedestrian safety. Also, jersey barriers on the eastern end of the intersection block views of, and constrict access to, East River Park. This study recommends removing the jersey barriers and replacing them with a more pedestrian and cyclist-friendly traffic barrier, such as bollards.

New York State DOT is currently studying the FDR Drive, including this intersection, and seeking a comprehensive solution to traffic flow issues. Another DCP study, the *East River Esplanade Access Study*, proposes the reconfiguration of this intersection as a roundabout.



Improvements at the intersection of East Houston Street and FDR Drive



**From left to right:
A vehicle driving over
striping at East Houston
Street and the FDR
Drive; Pedestrians in the
crosswalk; The striped
area should be paved to
slow turning vehicles.**

Traffic Analysis

This section presents a traffic study conducted by the NYC Department of City Planning in order to determine the feasibility of installing a bicycle lane along the East Houston Street corridor. The analysis assesses existing traffic conditions and any future impacts that a bicycle lane would pose on vehicular traffic. This analysis was conducted by evaluating traffic data with Highway Capacity Software (HCS), the standard and accepted methodology to assess traffic conditions and impacts. HCS is a computer application that processes data on variables such as street geometry, signal timing and traffic volumes and determines the optimal capacity of the roadway. HCS assigns a Level of Service (LOS) value to transportation facilities, including intersections and roadways, as well as facilities for transit, bicycles and pedestrians.

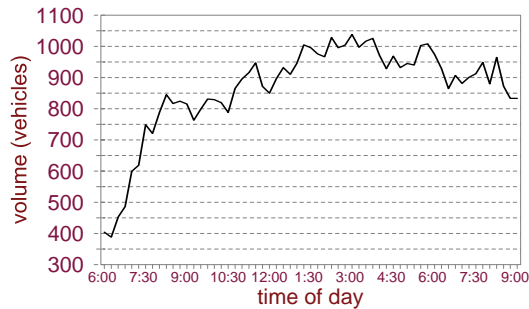
Data Collection

Traffic data sets were collected to perform analyses of existing traffic operations in the study area. The data collection included Automatic Traffic Recorder (ATR) counts, manual turning movement counts, and manual vehicle classification counts. According to NYCDOT, it was not necessary to collect traffic data on the surrounding streets in order to determine the feasibility of installing a bicycle lane along East Houston Street; as a result this analysis does not balance the network.

Counts were conducted at eight major intersections along the East Houston Street corridor: the Bowery, Second Avenue and Chrystie Street, First Avenue and Allen Street, Avenue A and Essex Street, Avenue B and Clinton Street, Avenue C and Pitt Street, Avenue D and Columbia Street, and the FDR. Additionally, three of these eight intersections, the Bowery and Second and First avenues, are part of the designated truck route network, and therefore, vehicles were classified by type and number of axles.

Typical Weekday Profile

for an intersection of East Houston St



Automatic Traffic Recorder (ATR) Counts

Over the course of three weeks the NYC Department of Transportation installed ATRs at eight intersections along East Houston Street to collect 24-hour traffic volume data for a one week period. Traffic data was recorded at the following locations from September 9 through September 16, 2002:

- Bowery at East Houston Street
- Second Avenue and Chrystie Street at East Houston Street
- Avenue C and Pitt Street at East Houston Street

Traffic data was recorded at the following locations from September 23 through September 30, 2002:

- First Avenue and Allen Street at East Houston Street
- Avenue A and Essex Street at East Houston Street
- Avenue B and Clinton Street at East Houston Street

Traffic data was recorded at the following locations from September 30 through October 7, 2002:

- Avenue D and Columbia Street at East Houston Street
- FDR Drive at East Houston Street

Additional data was collected at certain locations where ATRs malfunctioned. For the periods essential to the analysis, NYC Department of City Planning staff collected the missing through movement data on June 11 and June 19, 2003. During the midday period of 12:00noon-2:00 pm data was collected at Avenue A and Essex Street at East Houston Street. During the evening period of 4:00pm-6:00pm data was collected at the following locations:

- First Avenue and Allen Street at East Houston Street
- Avenue A and Essex Street at East Houston Street
- Avenue B and Clinton Street at East Houston Street

Turning Movement Counts

Manual turning movement counts were conducted on the Thursday of each week that ATR counts were recorded. This day was chosen because the traffic data was representative of typical weekday traffic. Traffic data from the days which manual counts were collected were compared to the other days of the week in order to determine which day represented typical weekday traffic. Figure 1 represents typical weekday vehicular traffic volumes on East Houston Street between 6:00 am and 9:00 pm.

Manual turning movements were collected on Thursday, September 12, 2002 at the following locations:

- Bowery at East Houston Street
- Second Avenue and Chrystie Street at East Houston Street
- Avenue C and Pitt Street at East Houston Street

On Thursday, September 26, 2002 at the following locations:

- First Avenue and Allen Street at East Houston Street
- Avenue A and Essex Street at East Houston Street
- Avenue B and Clinton Street at East Houston Street

On Thursday, October 3, 2002 at the following locations:

- Avenue D and Columbia at East Houston Street
- FDR Drive at East Houston Street

Turning movement counts were conducted by NYC Department of City Planning employees for the 8:00am-10:00am, 12:00noon-2:00pm (MD or midday) and 4:00pm-6:00pm peak periods. Continuous counts were recorded in 15-minute intervals for all eight intersections.

At some locations data collected was incomplete due to rain. In order to complete the analysis NYC Department of City Planning staff collected the missing data on June 11 and June 19, 2003. During the midday period of 12:00noon-2:00pm data was collected at Avenue A and Essex Street at East Houston Street. During the evening period of 4:00pm-6:00pm data was collected at the following locations:

- First Avenue and Allen Street at East Houston Street
- Avenue A and Essex Street at East Houston Street
- Avenue B and Clinton Street at East Houston Street

Vehicle Classification Counts

Vehicle classification counts were conducted by the NYC Department of City Planning at three intersections along East Houston Street. These counts were conducted simultaneously with the vehicular turning movement counts.

The recorded vehicle classifications were used to determine the percentage of heavy vehicles for each approach at the three intersections. The calculated percentage of heavy vehicles for each approach was entered into the Highway Capacity Software (HCS), in order to accurately measure delay and the resulting level of service (LOS) and to count the number of buses traveling along the corridor.

Counts were recorded in 15-minute intervals for each peak period. Vehicles were classified as autos, buses, small two-axle trucks, large three-axle trucks, oversized trucks with more than three axles. Vehicle classification counts were conducted as follows:

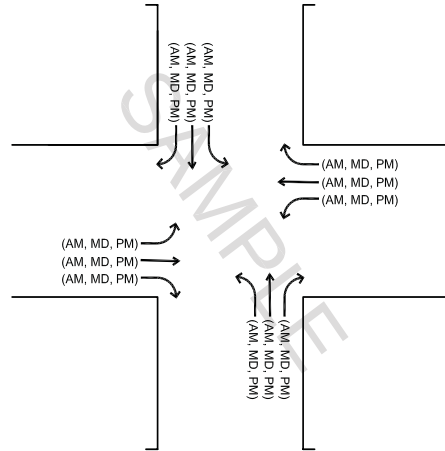
Thursday, September 12, 2002

- Bowery at East Houston Street
- Second Avenue and Chrystie Street at East Houston Street

Thursday, September 26, 2002

- First Avenue and Allen Street at East Houston Street

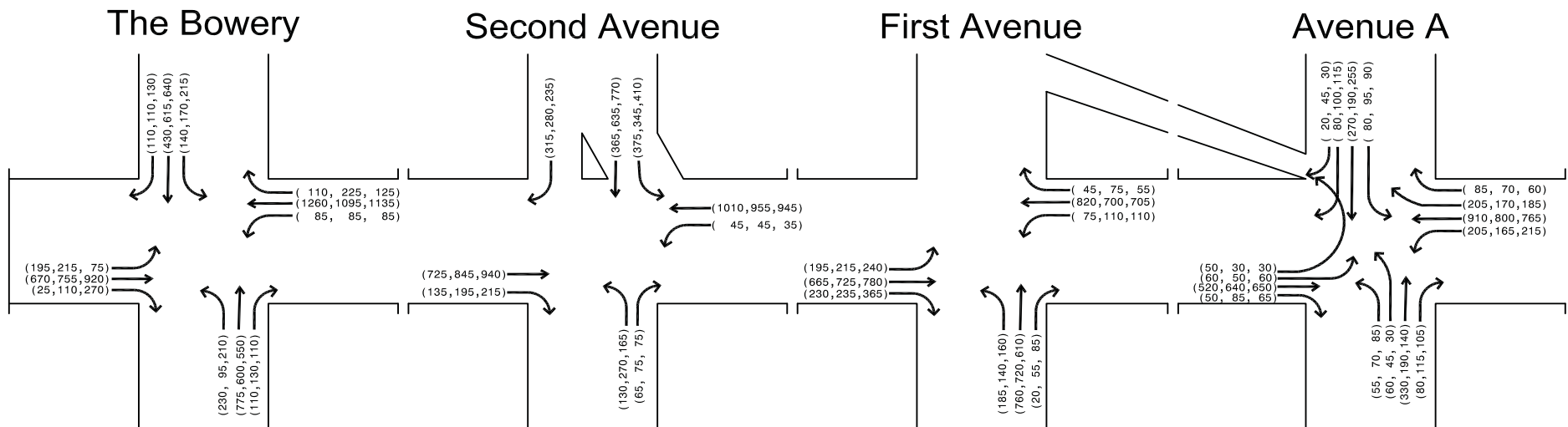
Figure 12: Traffic Volumes Map



The north-south corridors which traverse East Houston Street experience higher truck volumes than East Houston Street. The Bowery experienced the highest volume of truck traffic along the corridor, particularly during the midday peak period (38.81% of northbound traffic). Truck traffic along the Bowery consisted primarily of small, two-axle trucks (36.65%). The highest percentage of large trucks with three axles (2.15%) was found along First Avenue during the midday peak period. The vehicle classification percentages are detailed in Appendix 1.

Existing Traffic Network

Figure 12, below, shows the existing traffic network using traffic volumes obtained from ATR counts and manual turning movement counts as described.



Traffic was generally heavier for the eastbound direction in the PM period, while westbound traffic was heaviest in the AM period. Southbound traffic approaching East Houston Street was highest in the PM period, while northbound traffic was generally higher in the AM period.

Supplementary Counts

Department of Transportation conducted supplementary manual traffic counts on 30 March and 31 March, 2005 at the following locations:

First Avenue and Allen Street at East Houston Street

East First Street at East Houston Street

East First Street at First Avenue

Ludlow Street and East First Street at East Houston Street

Avenue A and East First Street at East Houston Street

Suffolk Street at East Houston Street

Avenue B and Clinton Street East Houston Street

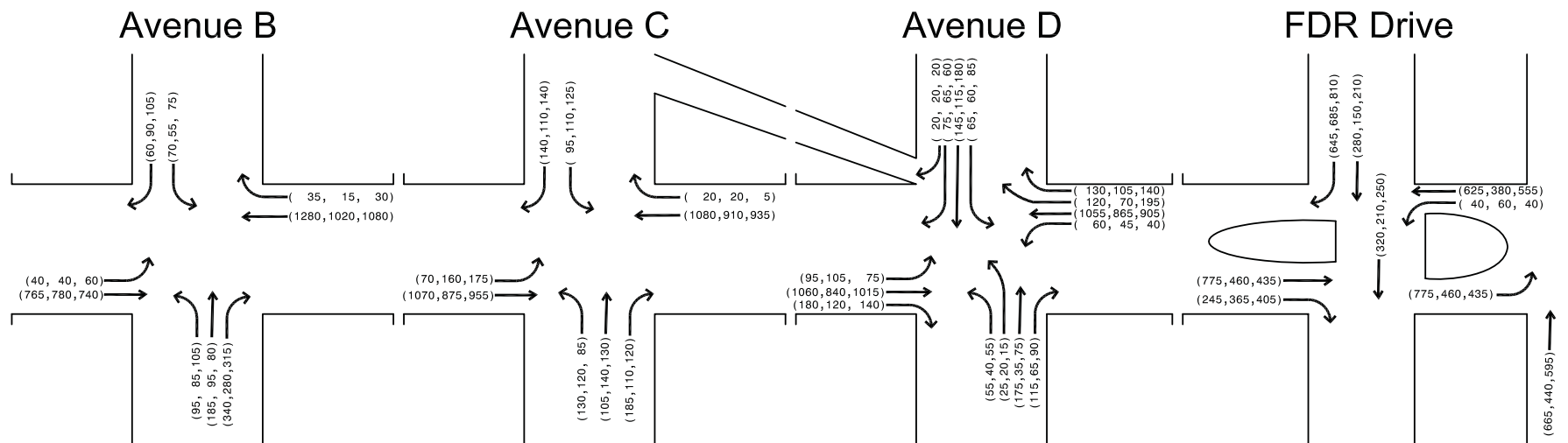
Ridge Street at East Houston Street

East Second Street at East Houston Street

Avenue D and Columbia Street at East Houston Street

Baruch Place and East Houston Street

The counts were recorded in 15-minute intervals for the 8:00am-10:00am, 12:00noon-2:00pm, and 4:00pm-6:00pm peak period. Vehicles were classified as cars, taxis, large trucks, buses, and bicycles. The average volume of the two days was incorporated in the traffic analysis.



Methodology

Existing conditions at the eight intersections were analyzed for the peak morning, midday and evening hours of traffic volume, as determined through analysis of the data collected for the ATR counts. The peak hour for each period is defined as the four consecutive 15 minute intervals whose sum of traffic volumes measures the highest. Upon determination of the peak hours for the focus areas each identified period was analyzed by applying the accepted methodology of the 2000 Highway Capacity Manual (HCM) and its accompanying Highway Capacity Software (HCS). The HCM has established separate approaches to the analysis of signalized and unsignalized intersections. Five intersections analyzed, including the First Avenue, Avenue A, Avenue B, Avenue C and Avenue D, are signalized intersections.

Signalized Intersections

The capacity analysis methodology divides an intersection approach into lane groups on the basis of the movements occurring during each signal phase. The lane groups are then analyzed to determine the specific vehicular capacity and level of service (LOS). The analysis requires the following information: number and width of travel lanes, on-street parking conditions, locations of bus stops, number of buses stopping per hour, vehicle movements, vehicle classification, conflicting pedestrian movements, traffic signal length, and allocation of green time.

The operating characteristics of signalized intersections may be estimated and evaluated by analyzing capacity and performance. The capacity of the intersection represents the through put of the facility, or the maximum number of vehicles that may be processed in one hour. An important outcome of capacity analysis is the volume-to-capacity ratio (v/c ratio). This ratio indicates the proportion of the capacity (supply) utilized by the existing traffic volume (demand). High v/c ratios (>0.85) indicate some traffic congestion and low v/c ratios (<0.60) indicate smooth traffic flow.

The delay time, or the average stopped time per vehicle, is determined based on the capacity of a lane group, the amount of green time allotted to a lane group, and the signal cycle length. The performance of an intersection is based on the estimated average delay for each vehicle utilizing a roadway segment. The delay time is the

Table 1: Level of Service Definitions for Signalized Intersections

Flow Quality	Description
Level A	Describes operation with very low delay, i.e., less than 10.0 seconds per vehicle. This occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
Level B	Describes operation with delay in the range of 10.1 to 20.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than LOS A, causing higher levels of average delay.
Level C	Describes operation with delay in the range of 20.1 to 35.0 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although some may still pass through the intersection without stopping.
Level D	Describes operation with delay in the range of 35.1 to 55.0 seconds per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, longer cycle lengths, or high v/c ratios. Many vehicles stop and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
Level E	Describes operation with delay in the range of 55.1 to 80.0 seconds per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.
Level F	Describes operation with delay in excess of 80.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with saturation, i.e., when arrival flow rates exceed capacity of the intersection. It may also occur at high v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.
<p>Source: <i>Highway Capacity Manual</i>, Transportation Research Board, National Research Council, Washington, D.C., 2000.</p>	

determining factor in assigning a LOS to a lane group. Short delays result in an acceptable LOS, and long delays result in a poor LOS (e.g., an average delay of up to five seconds per vehicle corresponds to LOS A and 30 seconds per vehicle corresponds to LOS D). LOS definitions for signalized intersections are defined in Table 1 above.

Table 2: Level of Service Definitions for Unsignalized Intersections

Flow Quality	Description
Level A	Describes operation with very low delay, i.e., 10.0 seconds or less per vehicle. This occurs when there is no conflicting traffic for a minor street.
Level B	Describes operation with delay in the range of 10.1 to 15.0 seconds per vehicle. This generally occurs with light levels of conflicting traffic for a minor street. More vehicles stop than LOS A, causing higher levels of average
Level C	Describes operation with delay in the range of 15.1 to 25.0 seconds per vehicle. These higher delays may result from fair levels of conflicting traffic. The number of vehicles stopping is significant at this level.
Level D	Describes operation with delay in the range of 25.1 to 35.0 seconds per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays result from increased conflicting traffic.
Level E	Describes operation with delay in the range of 35.1 to 50.0 seconds per vehicle. This is considered to be the limit of acceptable delay.
Level F	Describes operation with delay in excess of 50.0 seconds per vehicle. This is considered to be unacceptable to most drivers. There are insufficient gaps of suitable size to allow a side street demand to cross safely through a major traffic stream. This level of service is generally evident from extremely long total delays and queues on the minor approaches.

Source: *Highway Capacity Manual*, Transportation Research Board, National Research Council, Washington, D.C., 2000.

Unsignalized Intersections

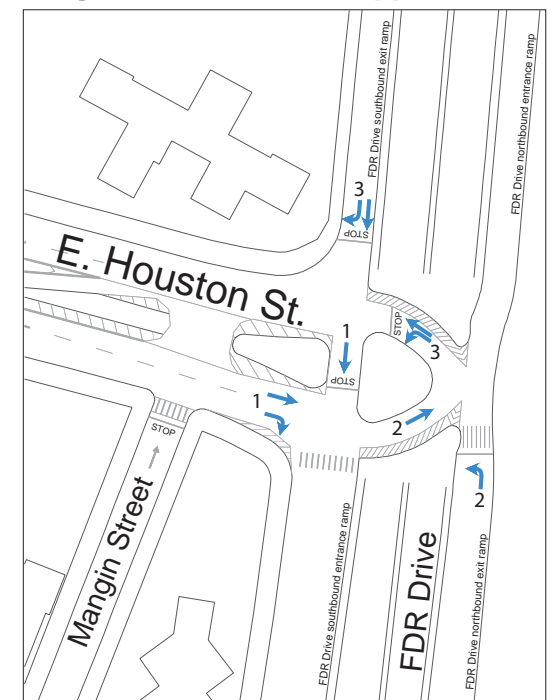
The intersection of East Houston Street and the FDR is the only unsignalized intersection analyzed in this study. The LOS criteria for stop-controlled intersections are different from the criteria used for signalized intersections, primarily because of the expectation that a signalized intersection is designed to carry higher traffic volumes and experience greater delay than an unsignalized intersection. The intersection of the FDR Drive and East Houston Street has many approaches so it has been analyzed as three separate intersections, FDR 1, FDR 2, and FDR 3 (see inset, right).

The capacity analysis is based on the use of “gaps” in a major traffic stream by vehicles crossing through or turning into that stream. At unsignalized intersections, “Stop” or “Yield” signs are used to assign the right-of-way to one street while controlling the movements from the other street. The methodology assumes that major street traffic is not affected by minor street flows. Left turns from the major street are assumed to be affected by the opposing major street flow. Minor street traffic is obviously affected by all conflicting movements, vehicular and pedestrian. LOS definitions for unsignalized intersections are detailed in Table 2.

An explanation of the FDR Drive intersection

The first intersection included eastbound traffic on Houston Street that was accessing the northbound and southbound entrance ramps to the FDR Drive, and southbound traffic continuing south on the FDR entrance ramp. The second intersection included traffic entering the northbound entrance ramp, and traffic exiting the FDR from the northbound exit ramp. The third intersection included southbound traffic exiting the FDR to westbound Houston Street, southbound exit ramp traffic continuing south to the southbound entrance ramp, and northbound exit ramp traffic entering westbound Houston Street. Due to the complicated nature of the intersection of the FDR Drive and East Houston Street, the intersection is not analyzed.

Figure 13: FDR Drive Approaches



Existing Conditions

Existing levels of service and signal timing for traffic operations at all eight intersections analyzed in this study are explored in this section. The capacity analysis of the existing traffic conditions indicates that most intersection approaches operate acceptably at mid-LOS D or better for all peak hours.

Table 3.1: Existing Intersection LOS and Signal Timing

First Avenue and Houston Street

AM				MD				PM				Signal Timing*			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	Phase	G	Y/R
Eastbound				Eastbound				Eastbound				EB LTR+PED /WB LTR+Ped			
L	0.55	30.0	C	L	0.57	28.1	C	L	0.65	29.0	C		1	30.0	5.0
T	0.78	33.3	C	T	0.79	33.2	C	T	0.83	26.4	C		2	12.0	5.0
R	0.68	35.8	D	R	0.72	38.2	D	R	0.94	59.2	E		3	4.0	
Westbound				Westbound				Westbound				NB Ped /SB Ped			
L	0.25	19.1	B	L	0.33	21.9	C	L	0.34	25.3	C		4	29.0	5.0
TR	0.69	20.0	C	TR	0.60	18.6	B	TR	0.58	26.5	C		Cycle Length 90.0		
Northbound				Northbound				Northbound				NB LTR+Ped /SB Ped			
LTR	0.81	33.2	C	LTR	0.73	30.4	C	LTR	0.69	29.4	C		* Signal timing is constant throughout the day		
Southbound				Southbound				Southbound							
Inters.Delay 29.0 LOS = C				Inters.Delay 28.2 LOS = C				Inters.Delay 17.5 LOS = C							

In the AM period, the intersection operates at LOS C with 29.0 seconds of delay.

In the MD period, the intersection operates at LOS C with 28.2 seconds of delay.

In the PM period, the intersection operates at LOS C with 17.5 seconds of delay.

Table 3.2: Existing Intersection LOS and Signal Timing

Avenue A and Houston Street

AM				MD				PM				Signal Timing*			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	Phase	G	Y/R
Eastbound				Eastbound				Eastbound				EB LTR+PED /WB LTR+Ped			
L	0.41	31.7	C	L	0.26	22.3	C	L	0.30	22.8	C		1	32.0	5.0
TR	0.41	22.8	C	T	0.53	24.4	C	T	0.51	15.7	B		2	9.0	5.0
Westbound				Westbound				Westbound				NB Ped /SB Ped			
L	0.53	22.1	C	L	0.48	23.0	C	L	0.60	28.4	C		4	27.0	6.0
TR	0.87	24.1	C	TR	0.75	19.6	B	TR	0.72	28.1	C		Cycle Length 90.0		
Northbound				Northbound				Northbound				NB LTR+Ped /SB Ped			
LTR	1.02	74.5	E	LTR	0.83	42.3	D	LTR	0.64	32.2	C		* Signal timing is constant throughout the day		
Southbound				Southbound				Southbound							
LTR	0.93	54.9	D	LTR	0.82	41.6	D	LTR	0.58	31.1	C				
Inters.Delay 37.2 LOS = D				Inters.Delay 27.7 LOS = C				Inters.Delay 25.5 LOS = C							

In the AM period, the intersection operates at LOS C with 37.2 seconds of delay.

In the MD period, the intersection operates at LOS C with 27.7 seconds of delay.

In the PM period, the intersection operates at LOS C with 25.5 seconds of delay.

Table 3.3: Existing Intersection LOS and Signal Timing

Avenue B and Houston Street

AM				MD				PM				Signal Timing*			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	Phase	G	Y/R
Eastbound				Eastbound				Eastbound				EB LTR+PED /WB LTR+Ped	1	45.0	5.0
L	0.35	20.9	C	L	0.23	15.6	B	L	0.48	16.4	B	EB L /WB L	2		
T	0.38	14.4	B	T	0.39	14.5	B	T	0.37	5.1	A	NB Ped /SB Ped	3	6.0	
Westbound				Westbound				Westbound				NB LTR+Ped /SB Ped	4	29.0	5.0
TR	0.67	7.3	A	L	0.53	6.0	A	L	0.56	16.6	B	<i>Cycle Length</i> 90.0			
Northbound				Northbound				Northbound				* Signal timing is constant throughout the day			
LTR	0.85	38.9	D	LTR	0.63	29.8	C	LTR	0.68	31.1	C				
Southbound				Southbound				Southbound							
L	0.60	43.9	D	L	0.32	27.3	C	L	0.47	33.2	C				
R	0.17	22.8	C	R	0.25	24.0	C	R	0.29	24.7	C				
Inters.Delay 17.4 LOS = B				Inters.Delay 14.4 LOS = B				Inters.Delay 16.9 LOS = B							

In the AM period, the intersection operates at LOS B with 17.4 seconds of delay.

In the MD period, the intersection operates at LOS B with 14.4 seconds of delay.

In the PM period, the intersection operates at LOS B with 16.0 seconds of delay.

Table 3.4: Existing Intersection LOS and Signal Timing

Avenue C and Houston Street

AM				MD				PM				Signal Timing*			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	Phase	G	Y/R
Eastbound				Eastbound				Eastbound				EB LTR+PED /WB LTR+Ped	1	45.0	5.0
L	0.62	37.6	D	L	0.81	44.8	D	L	0.89	43.8	D	EB L /WB L	2		
T	0.54	16.3	B	T	0.44	15.1	B	T	0.47	5.6	A	NB Ped /SB Ped	3	6.0	
Westbound				Westbound				Westbound				NB LTR+Ped /SB Ped	4	29.0	5.0
TR	0.92	17.9	B	L	0.75	9.5	A	L	0.78	22.9	C	<i>Cycle Length</i> 90.0			
Northbound				Northbound				Northbound				* Signal timing is constant throughout the day			
LTR	0.58	28.5	C	LTR	0.47	26.1	C	LTR	0.48	26.5	C				
Southbound				Southbound				Southbound							
L	0.46	31.4	C	L	0.45	30.2	C	L	0.60	36.6	D				
R	0.39	26.6	C	R	0.31	25.0	C	R	0.39	26.5	C				
Inters.Delay 20.1 LOS = C				Inters.Delay 17.4 LOS = B				Inters.Delay 19.5 LOS = B							

In the AM period, the intersection operates at LOS B with 20.1 seconds of delay.

In the MD period, the intersection operates at LOS B with 17.4 seconds of delay.

In the PM period, the intersection operates at LOS B with 19.5 seconds of delay.

Table 3.5: Existing Intersection LOS and Signal Timing

Avenue D and Houston Street

AM				MD				PM				Signal Timing*			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	Phase	G	Y/R
Eastbound				Eastbound				Eastbound				EB LTR+PED /WB LTR+Ped			
L	0.75	48.4	D	L	0.69	37.6	D	L	0.75	42.4	D		1	45.0	5.0
TR	0.91	29.8	C	T	0.69	19.8	B	T	0.82	11.3	B	NB Ped /SB Ped			
Westbound				Westbound				Westbound				NB LTR+Ped /SB Ped			
L	0.72	44.1	D	L	0.36	11.7	B	L	0.33	20.2	C	Cycle Length			
TR	0.92	17.5	B	LTR	0.75	9.4	A	LTR	0.88	27.9	C	90.0			
Northbound				Northbound				Northbound				* Signal timing is constant throughout the day			
LTR	0.59	29.3	C	LTR	0.27	23.7	C	LTR	0.39	25.4	C				
Southbound				Southbound				Southbound							
L	0.48	26.7	C	L	0.38	25.0	C	L	0.52	27.4	D				
Inters.Delay 25.5 LOS = C				Inters.Delay 17.0 LOS = B				Inters.Delay 21.7 LOS = C							

In the AM period, eastbound and westbound left turning vehicles experience delay (48.4 and 44.1 seconds) due to the high volume of eastbound and westbound through traffic. The intersection operates at a LOS C with a 25.5 second delay.

In the MD period, the intersection operates at a LOS B with a 17.0 second delay.

In the PM period, eastbound left turning vehicles experience delay (42.4 seconds) due to the high volume of eastbound through traffic. The intersection operates at a LOS C with a 21.7 second delay.

Remove a travel lane in each direction and change signal timing

An analysis of the future build conditions indicates that several intersection approaches would experience deteriorated levels-of-service which would not permit the removal of travel lanes and installation of a bicycle lane unless improved. Therefore, signal timing changes are recommended to improve conditions resulting from the removal of travel lanes. The negative impacts of removal of travel lanes at the Bowery cannot be improved through signal timing changes and all three travel lanes are necessary to maintain acceptable levels-of-service. Also, the removal of a westbound travel lane at Second Avenue results in conditions which cannot be sufficiently improved through signal timing changes. Therefore, the recommended street improvements include the removal of a travel lane from Forsyth Street to FDR Drive in both directions. This would allow for the striping of a Class 2 on-street bicycle lane from Forsyth Street to the FDR Drive in the both directions. The recommended signal timing changes and their impacts are outlined in this section.

Table 4.1: Improvements Intersection LOS
First Avenue and Houston Street

AM				MD				PM			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS
Eastbound				Eastbound				Eastbound			
L	0.68	39.7	D	L	0.66	34.3	C	L	0.65	29.0	C
T	0.73	29.1	C	T	0.74	29.0	C	T	0.83	26.4	C
R	0.66	32.5	C	R	0.71	34.9	C	R	0.94	59.2	E
Westbound				Westbound				Westbound			
L	0.29	20.4	C	L	0.36	23.3	C	L	0.34	25.3	C
T	0.85	24.5	C	T	0.72	19.0	B	T	0.58	26.5	C
R	0.68	32.8	C	R	0.69	33.1	C	R			
Northbound				Northbound				Northbound			
LTR	0.83	34.3	C	LTR	0.75	31.0	C	LTR	0.69	29.4	C
Southbound				Southbound				Southbound			
Inters.Delay 30.4 LOS = C				Inters.Delay 28.3 LOS = C				Inters.Delay 26.5 LOS = C			

Recommended Signal Timing				
AM / MD				
Approach	Phase	G	Y/R	
EB LTR+PED /WB LTR+Ped	1	33.0	5.0	
EB L /WB L	2	9.0	5.0	
NB Ped /SB Ped	3	4.0		
NB LTR+Ped /SB Ped	4	29.0	5.0	
Cycle Length		90.0		
PM				
Approach	Phase	G	Y/R	
EB LTR+PED /WB LTR+Ped	1	37.0	5.0	
EB L /WB L	2	6.0	5.0	
NB Ped /SB Ped	3	3.0		
NB LTR+Ped /SB Ped	4	29.0	5.0	
Cycle Length		90.0		

First Avenue

The existing cycle length is 90 seconds with four phases as follows:

- Phase one is 30 seconds of green time for eastbound and westbound traffic.
- Phase two is 12 seconds of green time for the eastbound and westbound exclusive left turn.
- Phase three is a four second LPI for northbound and southbound pedestrian traffic.
- Phase four is 29 seconds of green time for northbound traffic.

The recommended allocation of green time would be as follows for AM and MD periods:

- Phase one would have 33 seconds of green time for eastbound and westbound traffic.
- Phase two would continue to have 9 seconds of green time for the eastbound and westbound exclusive left turn.
- Phase three would remain a four second LPI for northbound and southbound pedestrian traffic.
- Phase four would have 29 seconds of green time for northbound traffic.

The recommended allocation of green time would be as follows for PM period:

- Phase one would have 37 seconds of green time for eastbound and westbound traffic.
- Phase two would continue to have 6 seconds of green time for the eastbound and westbound exclusive left turn.
- Phase three would remain a Three second LPI for northbound and southbound pedestrian traffic.
- Phase four would have 29 seconds of green time for northbound traffic.

In the AM period, the signal timing changes would slightly decline the overall operation of the intersection from LOS C with 29 second delay to LOS C with 30.4 second delay.

In the MD period, the overall intersection operation would decline slightly from LOS C with 28.2 seconds of delay to LOS C with 28.3 seconds of delay.

In the PM period, the overall intersection operation would improve from LOS C with 31.2 seconds of delay to LOS C with 26.5 seconds of delay.

Table 4.2: Improvements Intersection LOS

Avenue A and Houston Street

AM				MD				PM				Recommended Signal Timing			
AM				MD				PM				AM			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	Phase	G	Y/R
Eastbound				Eastbound				Eastbound				EB LTR+PED /WB LTR+Ped			
L	0.53	40.2	D	L	0.34	29.1	C	L	0.37	28.7	C		1	37.0	5.0
TR	0.53	21.6	C	T	0.72	27.1	C	T	0.69	16.6	B	EB L /WB L			
Westbound				Westbound				Westbound				NB LTR+Ped /SB Ped			
L	0.64	28.5	C	L	0.57	29.8	C	L	0.69	35.2	D	Cycle Length			
T	1.02	44.3	D	T	0.94	30.0	C	T	0.90	37.1	D	90.0			
R	0.20	10.0	A	R	0.17	18.8	B	R	0.15	18.5	B	MD / PM			
Northbound				Northbound				Northbound				Approach			
LTR	0.90	45.5	D	LTR	0.73	32.9	C	LTR	0.66	30.6	C	EB LTR+PED /WB LTR+Ped			
Southbound				Southbound				Southbound				EB L /WB L			
LTR	0.81	37.5	D	LTR	0.73	32.5	C	LTR	0.74	32.5	C	NB LTR+Ped /SB Ped			
Inters.Delay 37.1 LOS = D				Inters.Delay 29.8 LOS = C				Inters.Delay 29.6 LOS = C				Cycle Length			
												90.0			

Avenue A

The existing cycle length is 90 seconds with four phases as follows:

- Phase one is 32 seconds of green time for eastbound and westbound traffic.
- Phase two is 9 seconds of green time for the eastbound and westbound exclusive left turn.
- Phase three is a six second LPI for northbound and southbound pedestrian traffic.
- Phase four is 27 seconds of green time for northbound and southbound traffic.

The recommended allocation of green time would be as follows for AM period:

- Phase one would have 37 seconds of green time for eastbound and westbound traffic.
- Phase two would have six seconds of green time for the eastbound and westbound exclusive left turn.
- Phase three would continue to have 31 seconds of green time for northbound traffic.

The recommended allocation of green time would be as follows for MD / PM period:

- Phase one would have 35 seconds of green time for eastbound and westbound traffic.
- Phase two would have eight seconds of green time for the eastbound and westbound exclusive left turn.
- Phase three would continue to have 31 seconds of green time for northbound traffic.

In the AM period, the recommended signal timing changes would slightly improve the overall operation of the intersection from a LOS D with a 37.2 second delay, to a LOS D with a 37.1 second delay.

In the MD period, the overall operation of the intersection would decline slightly from a LOS C with a 27.7 second delay, to a LOS C with a 29.8 second delay.

In the PM period, the recommended signal timing changes would decline the overall operation of the intersection from a LOS B with a 25.5 second delay, to a LOS C with a 29.6 second delay.

Table 4.3: Improvements Intersection LOS

Avenue B and Houston Street

AM				MD				PM				Recommended Signal Timing			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	Phase	G	Y/R
Eastbound				Eastbound				Eastbound				EB LTR+PED /WB LTR+Ped	1	46.0	5.0
LT	0.77	22.8	C	LT	0.73	20.7	C	LT	0.87	15.7	B	NB LTR+Ped /SB Ped	3	34.0	5.0
Westbound				Westbound				Westbound				<i>Cycle Length</i> 90.0			
TR	0.97	23.8	C	TR	0.76	9.0	A	TR	0.81	22.9	C	* Signal timing is constant throughout the day			
Northbound				Northbound				Northbound							
LTR	0.73	28.9	C	LTR	0.55	24.2	C	LTR	0.59	25.0	C				
Southbound				Southbound				Southbound							
L	0.47	30.3	C	L	0.27	22.1	C	L	0.39	25.7	C				
R	0.14	19.1	B	R	0.22	20.0	C	R	0.25	20.5	C				
Inters.Delay 24.6 LOS = C				Inters.Delay 16.4 LOS = B				Inters.Delay 21.1 LOS = C							

Avenue B

The existing cycle length is 90 seconds with three phases as follows:

- Phase one is 45 seconds of green time for eastbound and westbound traffic
- Phase two is a six second LPI for northbound and southbound pedestrian traffic
- Phase three is 29 seconds of green time for northbound and southbound traffic

The recommended allocation of green time would be as follows:

- Phase one would have 46 seconds of green time for eastbound and westbound traffic
- Phase two would have 34 seconds of green time for northbound and southbound traffic

In the AM period, the recommended signal timing changes would decline the overall operation of the intersection from a LOS B with a 17.4 second delay, to a LOS C with a 24.6 second delay.

In the MD period, the overall operation of the intersection would decline slightly from a LOS B with a 14.4 second delay, to a LOS B with a 16.4 second delay.

In the PM period, the overall operation of the intersection would decline from a LOS B with a 16.9 second delay, to a LOS C with a 21.1second delay.

**Table 4.4: Improvements Intersection LOS
Avenue C and Houston Street**

AM				MD				PM				Recommended Signal Timing			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	Phase	G	Y/R
Eastbound				Eastbound				Eastbound				Eastbound			
L	0.68	44.4	D	L	0.80	41.7	D	L	0.88	39.8	D	EB LTR+PED /WB LTR+Ped	1	46.0	5.0
T	0.78	21.8	C	T	0.61	16.2	B	T	0.66	5.6	A	NB LTR+Ped /SB Ped	2	34.0	5.0
Westbound				Westbound				Westbound				<i>Cycle Length</i> 90.0			
TR	0.91	15.8	B	L	0.75	7.1	A	L	0.84	23.2	C	MD / PM			
Northbound				Northbound				Northbound				Approach	Phase	G	Y/R
LTR	0.50	23.3	C	LTR	0.45	23.8	C	LTR	0.43	23.4	C	EB LTR+PED /WB LTR+Ped	1	48.0	5.0
Southbound				Southbound				Southbound				NB LTR+Ped /SB Ped	2	32.0	5.0
L	0.39	24.8	C	L	0.49	29.2	C	L	0.60	33.3	C	<i>Cycle Length</i> 90.0			
R	0.33	21.8	C	R	0.28	22.4	C	R	0.36	23.6	C				
Inters.Delay 20.2 LOS = C				Inters.Delay 16.1 LOS = B				Inters.Delay 19.0 LOS = B							

Avenue C

The existing cycle length is 90 seconds with three phases as follows:

- Phase one is 45 seconds of green time for eastbound and westbound traffic
- Phase two is a six second LPI for northbound and southbound pedestrian traffic
- Phase three is 29 seconds of green time for northbound and southbound traffic

The recommended allocation of green time would be as follows for AM period:

- Phase one would have 46 seconds of green time for eastbound and westbound traffic
- Phase two would have 34 seconds of green time for northbound and southbound traffic

The recommended allocation of green time would be as follows for MD and PM period:

- Phase one would have 48 seconds of green time for eastbound and westbound traffic
- Phase two would have 32 seconds of green time for northbound and southbound traffic

In the AM period, the recommended signal timing changes would slightly decline the overall operation of the intersection from a LOS C with a 20.1 second delay, to a LOS C with a 20.2 second delay.

In the MD period, the overall operation of the intersection would improve from a LOS B with a 17.4 second delay, to a LOS B with a 16.1 second delay.

In the PM period, the overall operation of the intersection would improve slightly from a LOS B with a 19.5 second delay, to a LOS B with a 19.0 second delay.

**Table 4.5: Improvements Intersection LOS
Avenue D and Houston Street**

AM				MD				PM				Recommended Signal Timing						
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	Phase	G	Y/R			
Eastbound				Eastbound				Eastbound				AM						
L	0.74	43.2	D	L	0.69	35.7	D	L	0.73	36.2	D	EB LTR+PED /WB LTR+Ped	1	49.0	5.0			
TR	0.89	25.6	C	T	0.71	19.0	B	T	0.79	8.0	A	NB LTR+Ped /SB Ped	2	31.0	5.0			
Westbound				Westbound				Westbound				<i>Cycle Length</i> 90.0						
L	0.70	37.7	D	L	0.37	11.0	B	L	0.30	16.7	B	MD						
TR	0.90	12.2	B	LTR	0.77	8.3	A	LTR	0.85	23.8	C	Approach Phase G Y/R						
Northbound				Northbound				Northbound				EB LTR+PED /WB LTR+Ped				1	47.0	5.0
LTR	0.57	27.1	C	LTR	0.24	20.6	C	LTR	0.36	22.8	C	NB LTR+Ped /SB Ped				2	33.0	5.0
Southbound				Southbound				Southbound				<i>Cycle Length</i> 90.0						
L	0.46	24.9	C	L	0.34	21.7	C	L	0.48	24.6	C	PM						
Inters.Delay 21.2 LOS = C				Inters.Delay 15.6 LOS = B				Inters.Delay 18.1 LOS = B				Approach Phase G Y/R						
												EB LTR+PED /WB LTR+Ped				1	48.0	5.0
												NB LTR+Ped /SB Ped				2	32.0	5.0
												<i>Cycle Length</i> 90.0						

Avenue D

The existing cycle length is 90 seconds with three phases as follows:

- Phase one is 45 seconds of green time for eastbound and westbound traffic
- Phase two is a six second LPI for northbound and southbound pedestrian traffic
- Phase three is 29 seconds of green time for northbound and southbound traffic

The recommended allocation of green time would be follows for AM period:

- Phase one would have 49 seconds of green time for eastbound and westbound traffic
- Phase two would have 31 seconds of green time for northbound and southbound traffic

The recommended allocation of green time would be follows for MD period:

- Phase one would have 47 seconds of green time for eastbound and westbound traffic
- Phase two would have 33 seconds of green time for northbound and southbound traffic

The recommended allocation of green time would be follows for PM period:

- Phase one would have 48 seconds of green time for eastbound and westbound traffic
- Phase two would have 32 seconds of green time for northbound and southbound traffic

In the AM period, the recommended signal timing changes would improve the overall operation of the intersection from a LOS C with a 25.5 second delay, to a LOS B with a 21.2 second delay.

In the MD period, the overall operation of the intersection would improve from a LOS B with a 17.0 second delay, to a LOS B with a 15.6 second delay.

In the PM period, the recommended signal timing changes would improve the overall operation of the intersection from a LOS C with a 21.7 second delay, to a LOS B with a 18.1 second delay.

Conclusion

The traffic analysis assessed existing traffic conditions along East Houston Street and the impacts that a bicycle lane would pose on vehicular traffic. This recommended action would stripe a five-foot Class 2 bicycle lane with buffer on East Houston Street in each direction. If implemented, this action would complete a portion of the route recommended in the *NYC Bicycle Master Plan* and provide an important crosstown bicycle connection between the Second Avenue bicycle lane and the Manhattan Waterfront Greenway at East River Park. Project data indicates that any impacts from the installation of a bicycle lane on East Houston Street, from Second Avenue to the FDR Drive eastbound and from First Avenue to the FDR Drive westbound, could be mitigated through signal timing changes. The installation of bicycle route signs is recommended to guide riders on-street between the Bowery and First and Second avenues where bicycle lanes are not feasible.

Appendix 1

Figure 1: Total Accidents from 1998 through 2000

The total sum of accidents includes all reportable and non-reportable accidents involving any motor vehicles, pedestrians and cyclists.



NYS Department of Transportation

Figure 2: Total Reportable Accidents from 1998 through 2000

The sum of reportable accidents refers to those accidents which are reportable to an insurance company. Such accidents must involve either an injury or at least \$1000.00 worth of damages.



NYS Department of Transportation

Figure 4: Total Pedestrian Accidents from 1998 through 2000

The sum of pedestrian accidents represents all accidents that occurred between pedestrians and motor vehicles.



NYS Department of Transportation

Figure 5: Total Bicycle Accidents from 1998 through 2000

The sum of bicycle accidents represent all accidents that occurred between cyclists and motor vehicles.



NYS Department of Transportation

Figure 6: Total Fatalities from 1998 through 2000

The sum of fatalities represents accidents that resulted in a fatality.



NYS Department of Transportation

Appendix 2

Table 1.1: No Build Intersection LOS and Signal Timing at the First Avenue, Avenue A and Avenue B

First Avenue and Houston Street

AM				MD				PM			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS
Eastbound				Eastbound				Eastbound			
L	0.58	31.5	C	L	0.59	29.6	C	L	0.67	30.5	C
T	0.81	34.4	C	T	0.81	34.4	C	T	0.86	27.9	C
R	0.70	36.8	D	R	0.75	39.7	D	R	0.97	64.9	E
Westbound				Westbound				Westbound			
L	0.26	19.8	B	L	0.35	22.9	C	L	0.35	26.6	C
TR	0.71	20.5	C	TR	0.62	18.9	B	TR	0.60	26.8	C
Northbound				Northbound				Northbound			
LTR	0.83	34.3	C	LTR	0.75	31.0	C	LTR	0.71	29.9	C
Southbound				Southbound				Southbound			

Inters.Delay 29.9 LOS = C

Inters.Delay 29.0 LOS = C

Inters.Delay 32.7 LOS = C

Signal Timing*

Approach	Phase	G	Y/R
EB LTR+PED /WB LTR+Ped	1	30.0	5.0
EB L /WB L	2	12.0	5.0
NB Ped /SB Ped	3	4.0	
NB LTR+Ped /SB Ped	4	29.0	5.0
<i>Cycle Length</i>		90.0	

* Signal timing is constant throughout the day

Avenue A and Houston Street

AM				MD				PM			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS
Eastbound				Eastbound				Eastbound			
L	0.42	32.4	C	L	0.27	23.4	C	L	0.31	23.9	C
TR	0.43	22.9	C	TR	0.55	24.6	C	TR	0.53	15.8	B
Westbound				Westbound				Westbound			
L	0.55	23.2	C	L	0.50	24.3	C	L	0.62	29.9	C
TR	0.90	26.0	C	TR	0.78	20.2	C	TR	0.74	28.7	C
Northbound				Northbound				Northbound			
LTR	1.06	86.2	F	LTR	0.86	45.4	D	LTR	0.78	39.8	D
Southbound				Southbound				Southbound			
LTR	0.97	61.9	E	LTR	0.86	44.9	D	LTR	0.87	44.5	D

Inters.Delay 41.1 LOS = D

Inters.Delay 29.1 LOS = C

Inters.Delay 29.4 LOS = C

Signal Timing*

Approach	Phase	G	Y/R
EB LTR+PED /WB LTR+Ped	1	32.0	5.0
EB L /WB L	2	9.0	5.0
NB Ped /SB Ped	3	6.0	
NB LTR+Ped /SB Ped	4	27.0	6.0
<i>Cycle Length</i>		90.0	

* Signal timing is constant throughout the day

Avenue B and Houston Street

AM				MD				PM			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS
Eastbound				Eastbound				Eastbound			
L	0.38	22.9	C	L	0.26	16.3	B	L	0.53	19.4	B
T	0.40	14.6	B	T	0.40	14.6	B	T	0.38	5.1	A
Westbound				Westbound				Westbound			
TR	0.69	7.5	A	TR	0.54	6.1	A	TR	0.57	16.9	B
Northbound				Northbound				Northbound			
LTR	0.87	40.9	D	LTR	0.65	30.3	C	LTR	0.70	31.7	C
Southbound				Southbound				Southbound			
L	0.64	48.5	D	L	0.34	28.0	C	L	0.50	34.9	C
R	0.17	22.8	C	R	0.26	24.1	C	R	0.30	24.9	C

Inters.Delay 18.2 LOS = B

Inters.Delay 14.6 LOS = B

Inters.Delay 17.3 LOS = B

Signal Timing*

Approach	Phase	G	Y/R
EB LTR+PED /WB LTR+Ped	1	45.0	5.0
NB Ped /SB Ped	2	6.0	
NB LTR+Ped /SB Ped	3	29.0	5.0
<i>Cycle Length</i>		90.0	

* Signal timing is constant throughout the day

Table 1.2: No Build Intersection LOS and Signal Timing at Avenue C and Avenue D

Avenue C and Houston Street

AM				MD				PM			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS
Eastbound				Eastbound				Eastbound			
L	0.69	45.8	D	L	0.82	47.2	D	L	0.91	48.7	D
T	0.55	16.5	B	T	0.45	15.2	B	T	0.49	5.7	A
Westbound				Westbound				Westbound			
TR	0.95	21.1	C	TR	0.77	10.1	B	TR	0.81	23.9	C
Northbound				Northbound				Northbound			
LTR	0.59	28.8	C	LTR	0.48	26.4	C	LTR	0.47	26.3	C
Southbound				Southbound				Southbound			
L	0.49	32.5	C	L	0.47	31.1	C	L	0.68	41.3	D
R	0.40	26.8	C	R	0.32	25.2	C	R	0.40	26.7	C

Inters.Delay 21.7 LOS = C

Inters.Delay 17.8 LOS = B

Inters.Delay 20.5 LOS = C

Signal Timing*

Approach	Phase	G	Y/R
EB LTR+PED /WB LTR+Ped	1	45.0	5.0
NB Ped /SB Ped	2	6.0	
NB LTR+Ped /SB Ped	3	29.0	5.0
Cycle Length		90.0	

* Signal timing is constant throughout the day

Avenue D and Houston Street

AM				MD				PM			
Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS	Approach	v/c	Delay	LOS
Eastbound				Eastbound				Eastbound			
L	0.77	51.2	D	L	0.75	44.5	D	L	0.77	46.1	D
TR	0.93	32.8	C	TR	0.71	20.4	C	TR	0.84	12.3	B
Westbound				Westbound				Westbound			
L	0.73	45.6	D	L	0.40	13.4	B	L	0.38	22.5	C
TR	0.95	20.9	C	TR	0.77	10.0	A	TR	0.91	30.2	C
Northbound				Northbound				Northbound			
LTR	0.62	29.9	C	LTR	0.28	23.8	C	LTR	0.41	25.8	C
Southbound				Southbound				Southbound			
LTR	0.50	27.1	C	LTR	0.40	25.3	C	LTR	0.54	27.9	C

Inters.Delay 28.1 LOS = C

Inters.Delay 17.7 LOS = B

Inters.Delay 23.2 LOS = C

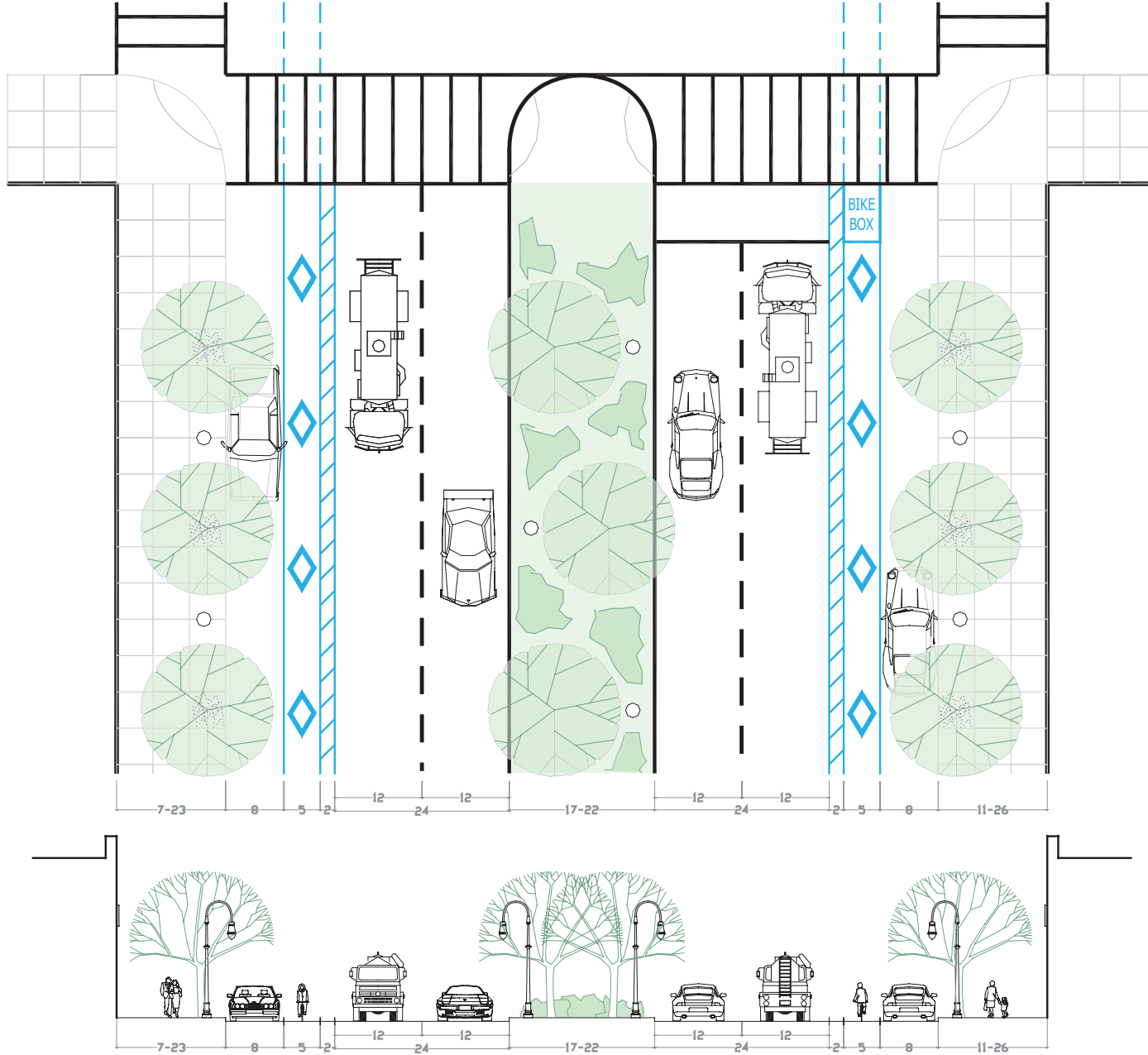
Signal Timing*

Approach	Phase	G	Y/R
EB LTR+PED /WB LTR+Ped	1	45.0	5.0
NB Ped /SB Ped	2	6.0	
NB LTR+Ped /SB Ped	3	29.0	5.0
Cycle Length		90.0	

* Signal timing is constant throughout the day

Appendix 3

Figure 7: Bicycle Lane Section



Acknowledgments: Advisory Committee

Elected Officials

Honorable Alan Gerson, Council Member, Manhattan Council District 1

Honorable Margarita Lopez, Council Member, Manhattan Council District 2

Honorable Sheldon Silver, State Assembly Member, State Assembly District 64

Honorable Deborah J. Glick, State Assembly Member, State Assembly District 66

Honorable Steven Sanders, State Assembly Member, State Assembly District 74

Honorable Martin Connor, State Senate Member, State Senate District 25

Honorable Jerrold Nadler, Congressman, Congressional District 8

Honorable Nydia M. Velazquez, Congresswoman, Congressional District 12

Honorable Carolyn B. Maloney, Congresswoman, Congressional District 14

Manhattan Community Districts

Aubrey Lees, former Chair, Community District 2

Jim Smith, Chair, Community District 2

Aurthur Strickler, District Manager, Community District 2

Harvey Epstein, former Chair, Community District 3

Martha Danziger, former District Manager, Community District 3

David McWater, Chair, Community District 3

Susan Stetzer, District Manager, Community District 3

David Crane, Transportation Committee Chair, Community District 3

New York City Agencies

Vishaan Chakrabarti, former Director, Manhattan Office, Department of City Planning

Raymond Gastil, Director, Manhattan Office, Department of City Planning

Meenakshi Srinivasaan, former Deputy Director, Manhattan Office, Department of City Planning

Edith Hsu-Chen, Deputy Director, Manhattan Office, Department of City Planning

Vivian Awner, Manhattan Office, Department of City Planning

Joshua Laird, Planning Director, Department of Parks and Recreation

Linda Black, Department for the Aging

Civic Groups

Wendy Brawer, Greenmap

Noah Budnick, Projects Director, Transportation Alternatives

Harriet Fields, NoHo NY BID

Acknowledgments

Andrew Flamm, Executive Director, Lower East Side BID

Gene Golombeck, Executive Director, South Manhattan Development Corporation

Tiziana Hardy, Friends of Noho Architecture

Holly Kaye, Senior Executive Consultant, Lower East Side Conservancy

Stan Ries, NoHo Neighborhood Association

Sean Sweeney, SoHo Alliance

Benjamin Waranke, Acting Manager, Renaissance Economic Development Corporation

Chet Wargocki, Chairperson, Pedestrian Safety Team, Lower Manhattan Together

Credits

Department of City Planning

Amanda M. Burden, AICP, Director

Richard Barth, Executive Director

Sandy Hornick, Deputy Executive Director, Strategic Planning

Transportation Division

Jack Schmidt, Director

Kevin Olinger, Deputy Director

Scott Wise, former Team Leader, Pedestrian, Bicycle, and Greenway Projects

Stratos Prassas, Team Leader, Engineering Team

Laura Fink, former Project Manager

Karen Blatt, former Project Manager

Rex Hodgson, former Project Manager

Kim Lua, Project Manager

Indradeep Chakrabarty

Miriam Herzfeld

staff data collection:

Yigal Deutscher, Jen Dickson, Lise Dorestant, Emilio Feliz, Caroline Forger, Karen Johnson,

Angela Kelly, Altan Kolsal, Ken Laidlow, Andre McGlashen, Amy Pfeiffer, Alan Ripps, Erik

Seims, Hisa Tanaka, Britta Van Aartsen, Ted Wright

Department of Transportation

Iris Weinshall, Commissioner

Margaret Forgione, Manhattan Borough Commissioner

Evan Korn, former Manhattan Deputy Borough Commissioner

Maurice Bruet, Manhattan Deputy Borough Commissioner

Michael Primeggia, Traffic Operations Deputy Commissioner

Gerard Soffian, Office of Signs & Markings Assistant Commissioner

Dan Orlando, Director of Alternative Transportation Modes

Randy Wade, Director of Pedestrian Projects

Andrew Vesselinovich, Bicycle Program Director

Rachel Bright, Project Manager

Inessa Lipsky, Traffic Engineer

Raisa Saratovsky, Urban Designer