IMPROVING PEDESTRIAN SAFETY and MOBILITY at HARRIET TUBMAN TRIANGLE Harlem, New York

Report to Manhattan Borough President C. Virginia Fields

by
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Transportation Alternatives

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Cover photo of Harriet Tubman by Moorland-Spingam Research, Howard University.

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at
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Executive Summary

The Harriet Tubman Triangle Pedestrian Study was initiated by Manhattan Borough President C. Virginia Fields to complement her comprehensive efforts to redevelop central Harlem. The study's objectives were to improve pedestrian safety, access and traffic flow in and around the Tubman Triangle, a postage stamp, park-like space defined by the intersection of the newly renamed Harriet Tubman (formerly St. Nicholas) Avenue and Frederick Douglass Boulevard just south of West 122nd Street. To this end, the project team collected data, held a community design workshop and developed both operational and capital recommendations. The intent is to maximize the development potential of the Triangle from a traffic (pedestrian, cyclist and vehicle) point of view in order to create a much more fitting space for a memorial to this amazing woman.

The operational measures are designed to be submitted to the Department of Transportation for immediate implementation. The capital measures are designed to be incorporated into the Fiscal Year 2004 Economic Development Corporation project (also funded by the Borough President) which will create a setting for a monument honoring Harriet Tubman.

Figure 1: View Looking North at Tubman Triangle

Tubman Avenue on left, Douglass Boulevard on right

From a pedestrian point of view the problems around the Triangle relate to the irregular intersections, especially the 6-leg intersection of West 121st Street, Tubman Avenue and Douglass Boulevard, and the lack of safe crossing opportunities along desire lines, especially along Tubman Avenue and Douglass Boulevard. The recommendations consist of curb extensions, realigned crosswalks, stop lines, and more efficient signal timing that provide safer, more convenient pathways.

From a traffic point of view, the problems around the Triangle can be traced directly to the large proportion of northbound (NB) vehicles making turns from Douglass Boulevard onto Tubman Avenue at West 121st Street. The base measure is to add a left turn lane. Currently, the intersection operates at level of service[1] (LOS) E in the PM peak, with this leg having LOS F. By simply adding the turn lane, the intersection LOS rises to B.

The combination of a left turn lane, curb extensions and reorganized West 121st Street intersection yields cross-benefits for drivers, cyclists and pedestrians. The curb extensions and median will improve traffic safety by channeling traffic and managing driver actions. The turn lane allows the signals to be retimed and more time given to safer pedestrian crossings via leading pedestrian intervals. This works together to improve and balance level of service for all users. Pedestrian delay LOS goes from D to B. Vehicle delay LOS goes from E to B. Cyclist LOS remains constant at C. Similar benefits are predicted at the other intersections surrounding the triangle, see Table 1.

These solutions grew out of a Community Design Workshop that had the enthusiastic participation of agency officials and members of the community. The project team hopes the good will the process engendered will be further harnessed to produce a superior Harriet Tubman Triangle.

Intersection	Mode	Existing	Proposed
W 121 St, Tubman Ave, and Douglass Blvd	Walking	C	**B**
	Cycling	C	C
	Driving	E	**B**
W 122 St and Tubman Ave	Walking	C	**B**
	Cycling	B	B
	Driving	B	**A**
W 122 St and Douglass Blvd	Walking	B	B
	Cycling	D	D
	Driving	B	B

Table 1: Levels of Service (PM Peak) - Existing and Proposed

[1] Level of Service is a report card-like measure that allows one to quickly compare efficiency and quality across different modes. A is good, F is failing.

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Purpose of Study

The Harriet Tubman Triangle Pedestrian Study was initiated by Manhattan Borough President C. Virginia Fields to complement her comprehensive efforts to redevelop central Harlem. The study's objectives were to improve pedestrian safety, access and traffic flow in and around the Tubman Triangle, a postage stamp park-like space defined by the intersection of newly renamed Harriet Tubman (formerly St. Nicholas) Avenue and Frederick Douglas Boulevard just south of West 122nd Street. The intent of this report is to maximize the development potential of the Triangle from a traffic (pedestrian, cyclist and vehicle) point of view in order to create a much more fitting space for a memorial to this amazing woman.

Existing Conditions

Land Use

The study area for the Harriet Tubman Triangle encompasses both Harriet Tubman Avenue and Frederick Douglass Boulevard, two broad 2-way streets, and extends from north of West 122nd Street to south of West 121st Street, see panoramic photo in Executive Summary. The angled intersection of the two streets creates two triangles, a small one named for Harriet Tubman north of West 121st Street, and a much larger block to the south called Mathew Turner Triangle. The latter houses the New Song Community Church, which serves as a community center as well as a church. Traffic operations are principally dictated by the 6-leg intersection of West 121st Street, Tubman Avenue and Douglass Boulevard.

The surrounding area is a predominantly residential part of central Harlem that is undergoing extensive redevelopment, including housing for the elderly. On the west side of Douglass Boulevard, the new Tubman Gardens apartment building occupies the block front between West 120th and 121st Streets. These units are among 1,600 new units being constructed in the vicinity. Just north of West 121st Street, there are two food stores on either side of the combined streets that are the major pedestrian destination in the immediate area. The other block fronts facing the Tubman Triangle are more auto-oriented with a parking garage and a gas station on the western flank and the 28th Police Precinct station house and its associated parking on the north end. An aerial view of the area is shown in Figure 2.

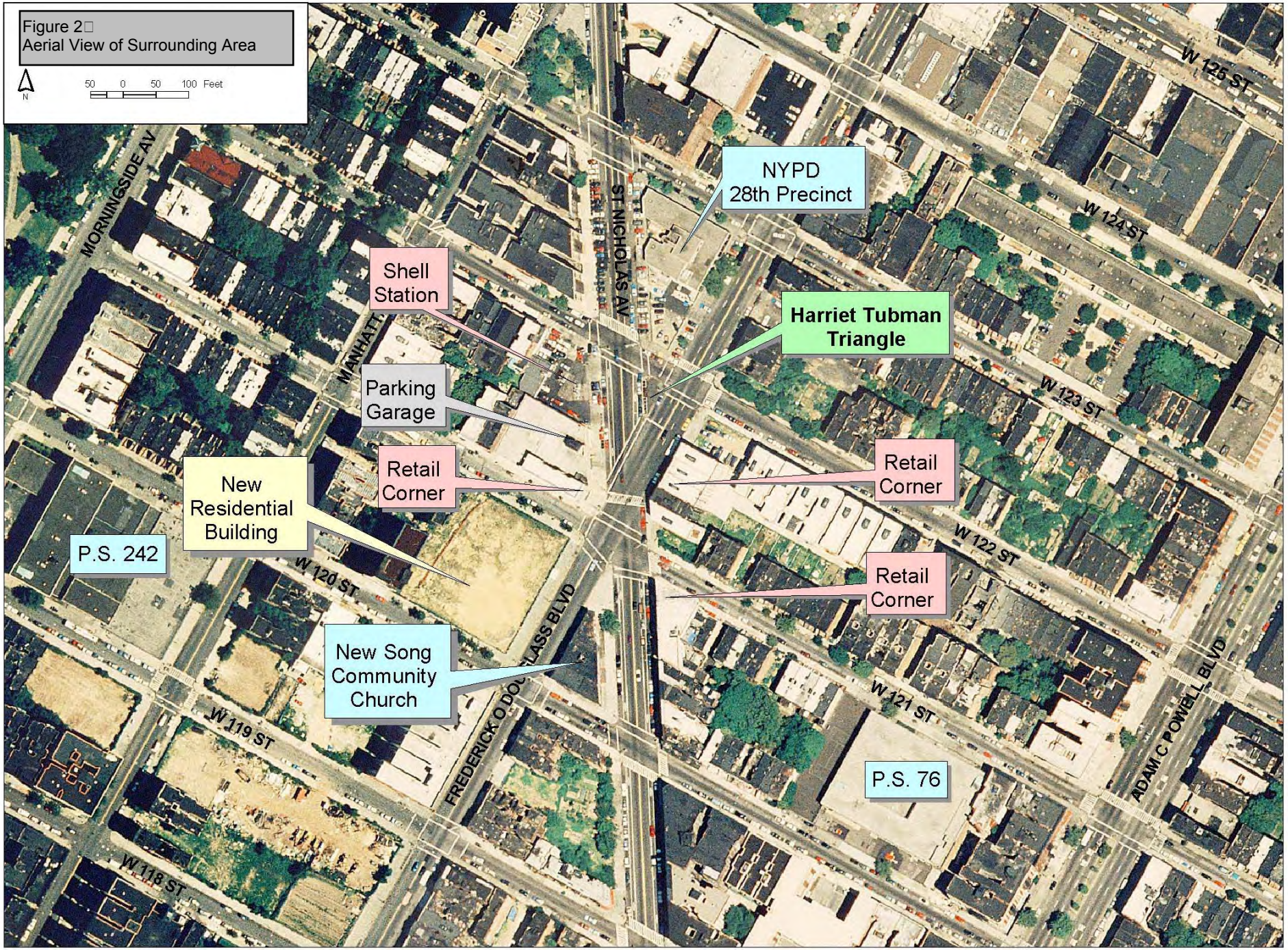
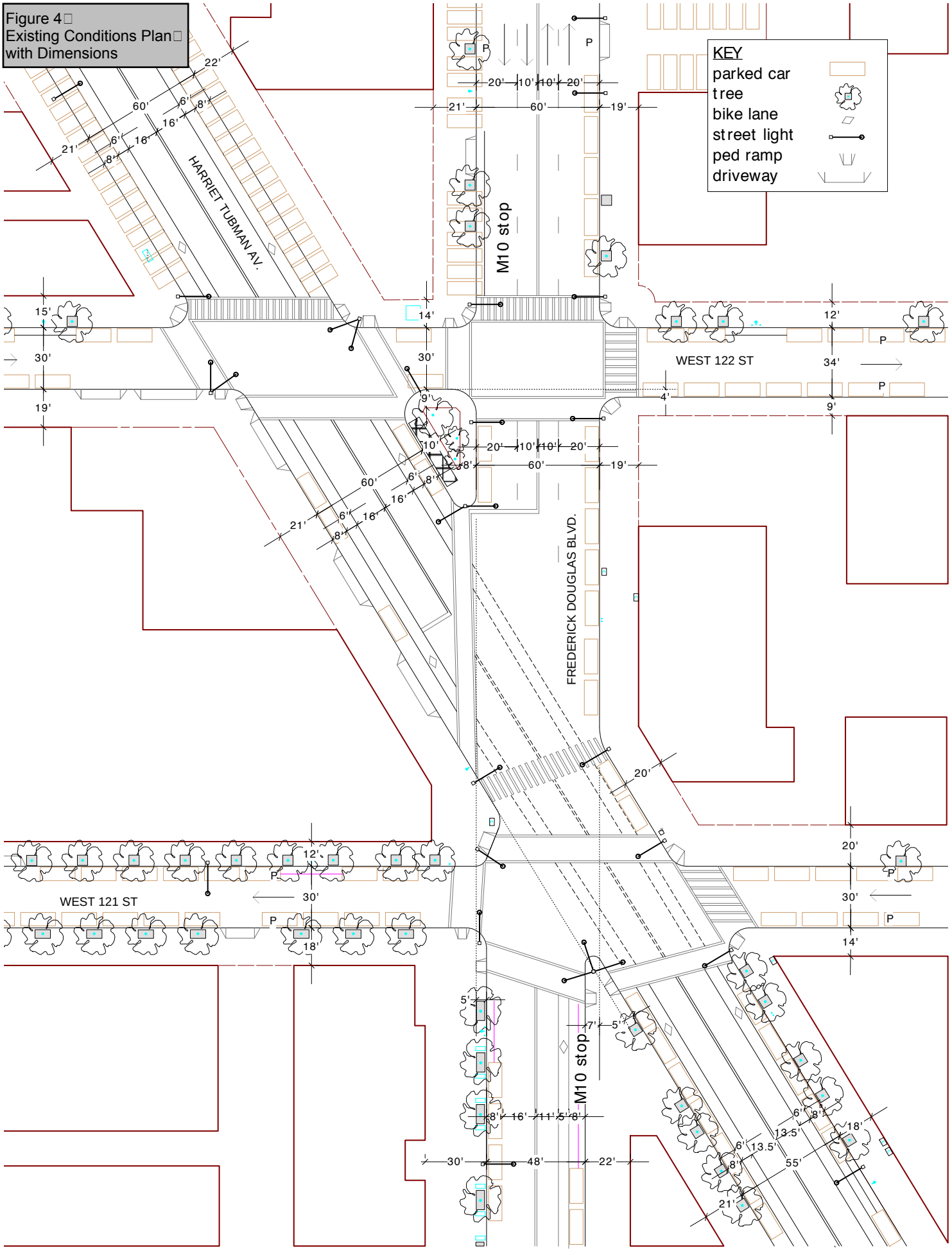


Figure 2
Aerial View of Surrounding Area
N
50 0 50 100 Feet
MORNINGSIDE AV
MANHATT
ST NICHOLAS AV
W 125 ST
W 124 ST
W 123 ST
W 122 ST
W 121 ST
W 120 ST
W 119 ST
W 118 ST
FREDERICK D DOUGLASS BLVD
ADAM C POWELL BLVD
NYPD 28th Precinct
Shell Station
Harriet Tubman Triangle
Parking Garage
Retail Corner
Retail Corner
New Residential Building
P.S. 242
Retail Corner
New Song Community Church
P.S. 76

Figure 4
Existing Conditions Plan
with Dimensions



Street System

The circulation map in Figure 3 shows the street directions, truck, bus, bicycle, and school routes. None of the four streets in the study area are designated truck routes. The M10 bus travels on Douglass Boulevard with a northbound stop south of West 121st Street and a southbound (SB) stop north of West 122nd Street. The latter stop is nearly always blocked by parked (private) vehicles of police officers. The northbound M3 and M18 buses turn from West 122nd Street onto Tubman Avenue, a maneuver that is necessitated by the fact that Manhattan Avenue is one-way southbound between West 122nd and 124th Streets.[2] These bus lines have no stops in the study area. There are marked bicycle lanes on Tubman Avenue through the study area and Douglass Boulevard south of West 121st Street. The Tubman lanes are the principle connection between Central Park and the George Washington Bridge. The Douglass lanes serve as the final link from Hudson Street, Eighth Avenue and Central Park West. Public School 76 is east of the study area between West 120th and 121st Streets and 'ladder' crosswalks mark the official route to school.

The detailed drawing of the study area in Figure 4 depicts existing street dimensions, pavement markings, trees, light poles, fire hydrants, pedestrian ramps, bus stops, building lines and street offsets. Parked cars (light brown rectangles) are shown as observed in the field, not as regulations permit. This shows the perpendicularly parked (private) vehicles of police officers. The plan shows that Tubman Avenue and Douglass Boulevard are 60 feet wide north of West 121st Street, whereas to the south, Douglass narrows to 48 feet and Tubman to 55 feet. The narrower section of Tubman Avenue has the same traffic configuration but narrower travel lanes and sidewalks. The narrower section of Douglass Boulevard has only one travel lane in each direction and a strikingly wide 30-foot sidewalk in front of the new Tubman Gardens building that provides a sitting area with planters. The Turner Triangle (south of W. 121st Street) has an open plaza between the two avenues which is expected to be developed into an outdoor café, see Appendix II.

Two constraining design elements are curb cuts for the garage and gas station on the west side of Tubman Avenue between 121st and 122nd Streets, and a large subway grate at Tubman Triangle. The grate is located where the subway tunnel turns from Douglass Boulevard to Tubman Avenue and provides ventilation for the uptown trains as they enter the 125th Street Station. The braking and turning conspire to emit an unusually high pitch noise every few minutes.

Traffic

Weekday PM peak traffic conditions (4 to 6 PM) are displayed in Figure 5. The project team chose these hours because they capture the greatest mix of pedestrians, cyclist and vehicles. The map arrays hourly vehicle, bicycle and pedestrian volumes and turning movements based on half-hour spot counts.[3] The composite LOS by mode is shown at each intersection, vehicle delay is listed per approach, average and maximum pedestrian delay is listed per crosswalk, and bicycle compatibility is shown per block. Existing signal timing and offsets are shown at each intersection, see also Table 9. A spot speed survey was performed along Tubman Avenue south of West 121st Street during the evening.[4] Additionally, five years of crash data is shown for total incidents, vehicle-vehicle injury crashes, vehicle-bicycle incidents and vehicle-pedestrian incidents, see also Table 8.

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[2] Manhattan Avenue is one-way southbound to allow for a simplified intersection at West 124th Street and Tubman Avenue.

[3] Given the tight project budget, data collection had to be limited. Other time periods may have different traffic characteristics, but in the project team's professional judgment, the PM peak shows the most extreme scenario of all modes.

[4] Speeds are generally higher just after the rush hours, 10-12 AM and 7-9 PM.

Driving Conditions

Vehicle volumes in the study area are remarkably low for north-south avenues in Manhattan; under 700/hour on Douglass Boulevard and under 400/hour on Tubman Avenue (both directions). The especially low volume on Tubman Avenue is most likely due to the fact that it extends south only as far as 116th Street. This suggests that it serves mostly local motorists.[5] Volumes on the cross streets are low in part because both end at Morningside Park, two blocks to the west.

In spite of these low volumes, the intersection at West 121st Street rates a LOS E due to extreme delay (LOS F) on the northbound Douglass Boulevard approach. This is generally caused by vehicles attempting to turn left onto Tubman Avenue. These conditions were analyzed with a traffic operations model, Synchro-SimTraffic, which calculates the LOS and produces animated simulations of vehicular movements, see Table 2. Figure 6 illustrates the long queue at the West 121st Street intersection.

The low levels of service suggests that vehicle speeds are likewise low. This was confirmed using a hand-held radar gun; speeds were at or below the speed limit during weekday afternoons and evenings. The project team attributes this largely to the signal offsets, which do not give drivers a running set of green lights. To exemplify, a driver turning from southbound Tubman Avenue onto southbound Douglass Boulevard immediately faces a queue of vehicles stopped at the red light at West 120th Street. The only stretch with any sustained speeds is Tubman Avenue below West 121st Street, so a speed survey was performed, see Table 3.

Intersection	Volume	Delay (sec/veh)	LOS
W 121 St, Tubman Ave, and Douglass Blvd			
• WB W 121 St	112	30	C
• NB Douglass Blvd	414	120	F
• NB Tubman Ave	136	29	C
• SB Frederick Douglass Blvd	278	22	C
• SB Harriet Tubman Ave	216	24	C
Total	**1156**	**59**	**E**
W 122 St and Tubman Ave			
• EB W 122 St	104	27	C
• NB Tubman Ave	234	7	A
• SB Tubman Ave	242	7	A
Total	**580**	**11**	**B**
W 122 St and Douglass Blvd			
• EB W 122 St	104	13	B
• NB Douglass Blvd	328	21	C
• SB Douglass Blvd	298	10	B
Total	**730**	**15**	**B**

Table 2: Existing Vehicle Delay

[LOS Thresholds: A 0-10 sec/veh delay, B 11-20, C 21-35, D 36-55, E 56-80, F >80]

[5] When the Central Park Loop Road is open to traffic (during the AM and PM peaks), it is possible to travel via Tubman Avenue and Adam Clayton Powell Boulevard into the park. This is not a heavy movement during the PM peak as commuters generally travel uptown, but it could be significant during the AM peak (downtown). The maneuver is complicated by the forced turn from Tubman Avenue at West 117th Street. However the Loop Road should not be viewed as primary traffic conduit because it is closed often for special events and might be permanently closed in the future.

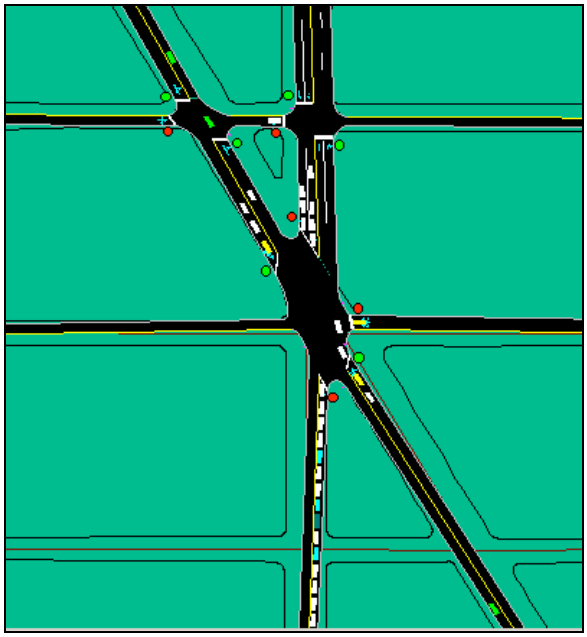


Figure 6:Simulation of Existing PM Peak Traffic

	speed
Average speed	26 mph
85th percentile speed	30 mph
Maximum Speed	40 mph

Table 3: Spot Speeds Along Tubman Avenue South of West 121st Street[6]

Cycling Conditions

As stated above, Tubman Avenue is a primary link from Central Park to points north. This is borne out by the number of cyclists counted: up to 11 percent of all traffic; higher on weekends. The overall figure for Manhattan is about eight percent. In the 1990's the NYC Department of Transportation, seeking to enhance this route, replaced two of the travel lanes on Tubman Avenue with bike lanes. The travel lanes are 11 feet wide and the bike lanes six feet. In other cases (Hudson Street, Second Avenue, Lafayette Street) the excess width is striped to provide a separation between the cyclists and drivers. On Tubman Avenue this was not done so the travel lanes are 13.5 to 16 feet wide. Overly wide lanes contribute to driver confusion; they function as two at times (a typical car is 6.5 feet wide), and provide generous space for double parking.

Similar to motorized traffic, cycling operations can be evaluated using the Bicycle Compatibility Index, a level of service measure developed for the Federal Highway Administration.[7] This index considers road and roadside conditions (number of lanes, width of lanes, land use), vehicle traffic operations (vehicle speed, vehicle volume, truck rate, right turn rate, parking rate) and bicycle facility type. Generally the cycling compatibility is very high on Tubman Avenue (LOS B) due in large part to the bike lanes and low vehicle volumes. Douglass Boulevard has moderately high cycling compatibility (LOS C) where there is

[6] 43 vehicles in both directions with speeds over 20 mph were surveyed on Wednesday, 24 September 2003, starting at 7:30 PM. Weather was clear and dry.

[7] www.hsrc.unc.edu/research/pedbike/bci/

a bike lane and moderately low compatibility (LOS D) where there is none. The levels are displayed in Tables 4 and 5.

Street segment	Bike Lane Width, ft.	BCI (per direction)	LOS
Tubman Ave, W 120 – 121 St	6	1.94-1.94	B
Tubman Ave, W 121 – 122 St	6	1.64-1.64	B
Tubman Ave, W 122 – 123 St	6	1.69-1.69	B
Douglass Blvd, W 120 – 121 St[8]	5	2.82-2.82	C
Douglass Blvd, W 121 – 122 St	0	3.87-3.87	D
Douglass Blvd, W 122 – 123 St	0	3.87-3.87	D

Table 4: Existing Bicycle Compatibility

[LOS Thresholds: A 1-150, B 151-230, C 231-340, D 341-440, E 441-530, F >530]

Intersection	BCI	LOS
W 121 St & Douglass Blvd & Tubman Ave	2.57	**C**
W 122 St & Tubman Ave	1.67	**B**
W 122 St & Douglass Blvd	3.87	**D**

Table 5: Existing Bicycle Compatibility – Intersection[9]

Walking Conditions

Existing level of service for pedestrians was analyzed using the Highway Capacity Manual formula for pedestrian delay at intersections. The intersection averages range from LOS B to D, see Table 6. At the West 121st Street intersection the high delay is due to the long crossing distances formed by the irregular intersection, and the signal phases which are dictated by the turning maneuvers on the north-south streets.[10] In terms of maximum delay[11] the crosswalks range from LOS D to F. On the southern legs (crosswalks #7 and #8) of the West 121st Street intersection, one can calculate combined-maximum delay[12] because these crosswalks act as one for the person who is walking along West 121st Street. It is 156 seconds, more than two and a half minutes. During site visits, no one was observed to wait this long, people simply crossed against the light.

[8] There is currently no bike lane on southbound Douglass Blvd between W. 120 and 121 Street, but it is planned to be installed soon. The calculations reflect the planned condition.
[9] The BCI measures the level of service for roadway segments, not intersections. Currently there is no intersection LOS measure for cyclists. The LOS rating shown at each intersection is an average of the adjoining segments.
[10] After waiting 30 seconds, pedestrians tend to disregard signals and take advantage of any gaps in traffic. This corresponds to LOS C.
[11] Maximum delay is defined as the time one would have to wait if he or she arrived at the end of the cycle.
[12] Combined-maximum delay is calculated by adding the maximum delay and subtracting the time that it takes to walk one crosswalk and to the other.

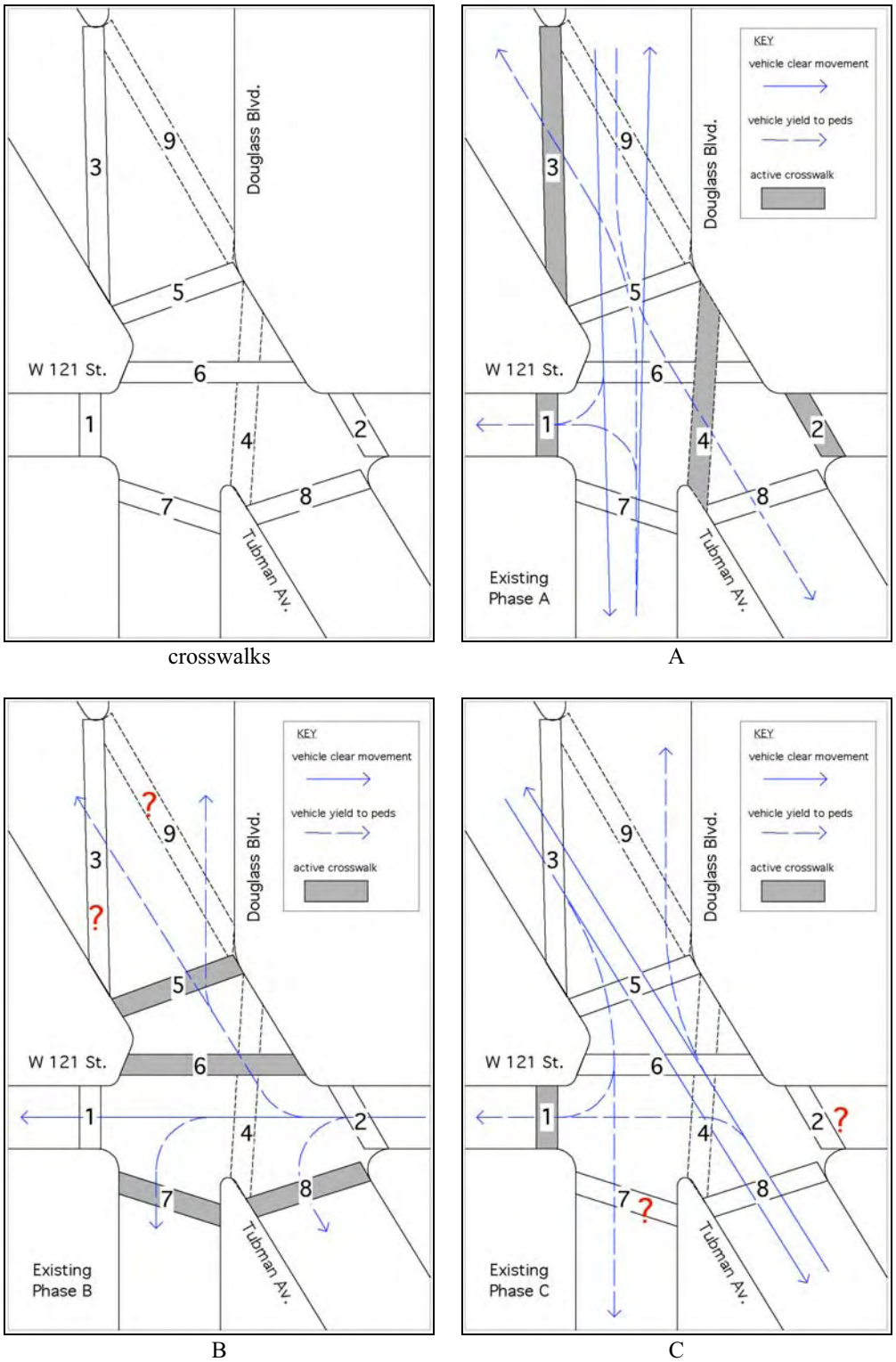
Intersection	Effective Green Time	Average Delay, sec.	Average LOS	Maximum Delay, sec.	Maximum LOS
W 121 St & Douglass Blvd & Tubman Ave					
1. west leg crossing 121	45	11	B	45	E
2. east leg crossing 121	18	29	C	72	F
3. west leg crossing Tubman	18	29	C	72	F
4. east leg crossing 121 & Tubman (not marked)	18	29	C	72	F
5. crossing Tubman & Douglass	10	36	D	80	F
6. north leg crossing Tubman & Douglass	10	36	D	80	F
7. south leg crossing Douglass	10	36	D	80	F
8. south leg crossing Tubman	10	36	D	80	F
9. east leg crossing Douglass (not marked or signaled)	--	--	--	--	--
Average		**30**	**C**		
W 122 St & Tubman Ave					
• west leg	50	9	A	40	D
• east leg	50	9	A	40	D
• north leg	11	35	D	79	F
• south leg	11	35	D	79	F
Average		**22**	**C**		
W 122 St & Douglass Blvd					
• west leg	44	12	B	46	E
• east leg	44	12	B	46	E
• north leg	22	26	C	68	F
• south leg	22	26	C	68	F
Average		**19**	**B**		

Table 6: Existing Pedestrian Delay

[LOS Thresholds: A 0-9 sec delay, B 10-20, C 21-30, D 31-40, E 41-60, F >80]

The existing signal phase layout does not consolidate pedestrian phases[13], which would provide longer crossing times. As shown in Figure 7, crosswalks #3 and #9 could be activated during Phase B, for the only conflicts would be low speed turns from West 121st Street. In Phase C, crosswalk #7 could be activated as most of the people would have crossed during Phase B. There is no reason that crosswalk #2 should not be active in Phase C; the signal is red for West 121st Street vehicles. This demonstrates that signals can be designed for pedestrians as well as vehicular traffic, in turn, increasing compliance by both.

[13] Phase consolidation provides more green time for pedestrians resulting in a higher level of service.



crosswalks A

B C

Figure 7: Existing Signal Phasing

The existing signal timing is such that at some crosswalks there is not enough clearance interval time for a walking speed of four feet per second, see Table 7. This is due to the long crossings across the irregular

shaped intersection and, again, signal times set to vehicular needs. Any signal timing changes at these intersections should provide acceptable clearance intervals.

Crosswalk	Critical Cross Walk Width (ft)	Clearance (sec) @4ft/sec	Available Clearance (sec)
W 121 St & Douglass Blvd & Tubman Ave			
1. west leg crossing 121	30	8	19
2. east leg crossing 121	37	9	19
3. west leg crossing Tubman	120	30	19
4. east leg crossing 121 & Tubman (not marked)	98	25	19
5. crossing Tubman & Douglass	59	14	14
6. north leg crossing Tubman & Douglass	79	20	14
7. south leg crossing Douglass	50	13	14
8. south leg crossing Tubman	57	14	14
9. east leg crossing Douglass (not marked or signaled)	--	--	--
W 122 St & Tubman Ave			
• west leg	37	9	11
• east leg	37	9	11
• north leg	71	18	14
• south leg	71	18	14
W 122 St & Douglass Blvd			
• west leg	30	8	9
• east leg	34	9	9
• north leg	60	15	11
• south leg	60	15	11

Table 7: Existing/Required Clearance Intervals

The actual crossing patterns of pedestrians in the study area were observed, recorded and plotted in Figure 8. Many people cross according to the marked crosswalks, but some do not. For example, people walking up the east side of Tubman Avenue or Douglass Boulevard tend to cross the street at the natural extension of the sidewalk, where there is no marked crosswalk. Some 'bend' away from the intersection proper so as to reduce both crossing distance and conflicts with turning vehicles. Those crossing the south legs of the West 121st Street intersection rarely follow the marked crosswalks. Instead they tend to cross directly with West 121st Street, or cross as soon as they pass the New Song Church building. At the northern portion of the triangle area, the desire lines are more widely distributed as people tend to 'feel' their way from the triangle across the avenues.

During site visits it was noted that there is a crossing signal along the east side of Douglass Boulevard at West 121st Street yet no markings (crosswalk #4 in Figure 7). As shown in the tracking survey above, people use this crossing regardless. This maneuver is documented in a series of time-lapse images presented in Figure 9. Here we see the woman in white casually cross the street as there is no conflicting traffic. Figure 10 shows a man crossing Douglass Boulevard north of West 121st Street where there is no marked crosswalk or pedestrian indicator. He crosses behind a queue of vehicles, so it is a relatively safe location. Nevertheless he looks over his left shoulder in frames A, C and F to watch for turning vehicles. The tracking survey and these graphics belie the notion of "jaywalking" as necessarily dangerous, since people appear to be choosing both the safest and most convenient routes.

Figure 8
Pedestrian Tracking Survey

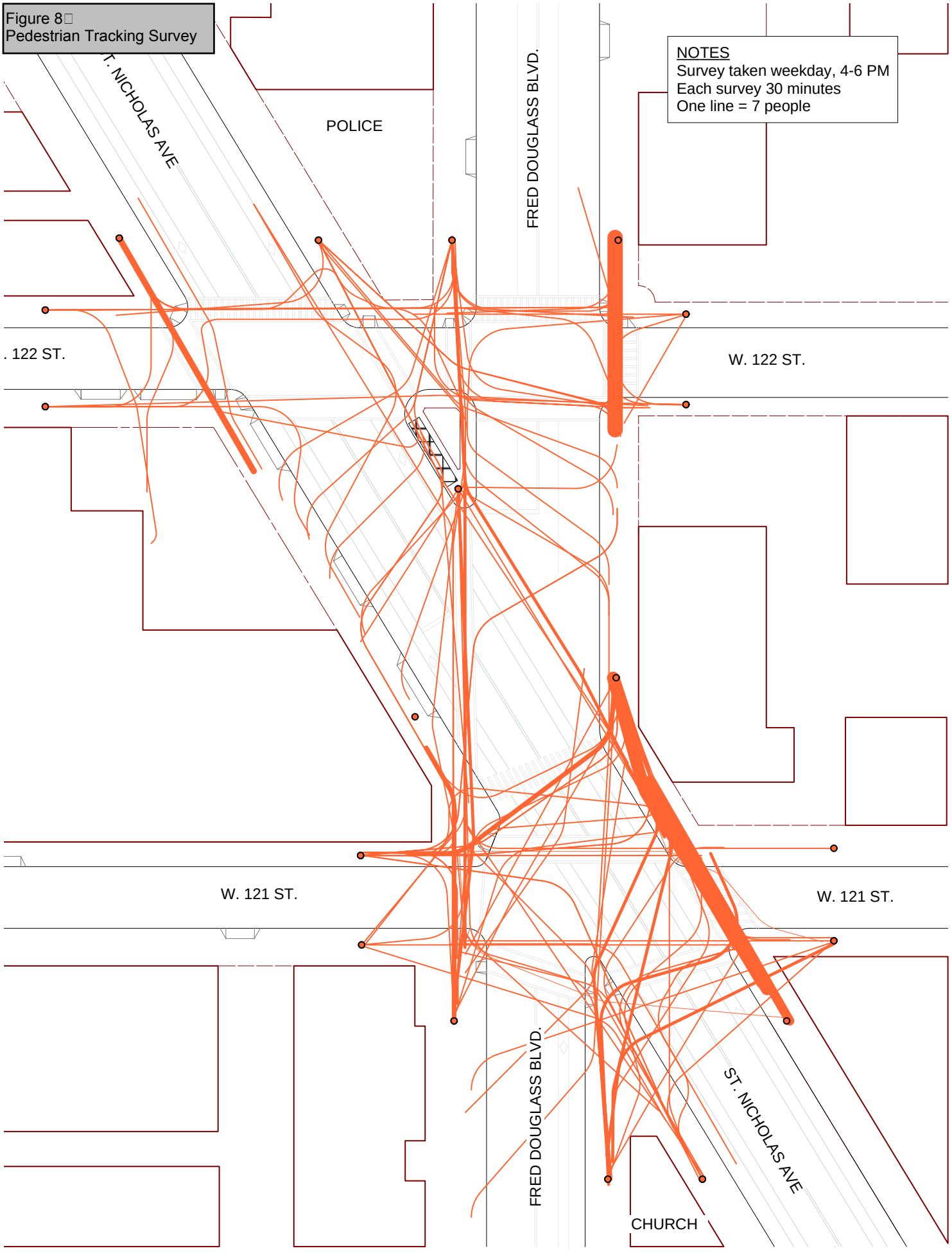


Figure 9: Time-lapse images of woman in white crossing Tubman Avenue

Crash History

Crash (accident) data obtained from the NYC Department of Transportation is presented in Table 8 and show pedestrian injury rates of only 0.3 to 1.2/year. Officers at the 28th Police Precinct were interviewed and expressed surprise, as did members of the community during the workshop, that there were not more crashes. With so few reported crashes it is hard to confirm why the area sees so few incidents, but here are some postulations:

- vehicle speeds are not terribly high as the signals keep drivers in check,[14]
- pedestrian volumes are relatively low for Manhattan,[15]
- the perpendicularly parked police vehicles narrow the street and make it shorter to cross,
- the bike lanes have replaced a travel lane; two lanes are easier to cross than four, and
- drivers, cyclists and pedestrians are not entirely clear of the traffic patterns, so they proceed with caution.

Any redesign of the area should recognize the current safety record and build on it.

Intersection	W 121 St & Douglass Blvd & Tubman Ave	W 122 St & Tubman Ave	W 122 St & Douglass Blvd	Total
Total Crashes/Year	13.2	7.8	9.2	30.2
Total Injuries/Year	8.6	1.3	3.3	13.2
Veh-Ped Injuries/Year	1.2	0.3	1.2	2.7
Percent of Total Injuries	14%	23%	36%	20%
Veh-Bike Injuries/Year	1.2	0.0	0.3	1.5
Percent of Total Injuries	14%	0%	9%	11%
Veh-Veh Injuries/Year	6.2	1.0	1.8	9.0
Percent of Total Injuries	72%	77%	55%	68%

Table 8: 1998-2002 Crash Data[16]

[14] High vehicle speeds are generally a proxy for high fatality rates.
[15] High pedestrian volumes are generally a proxy for a high injury rate.
[16] Pedestrian and bicycle figures are increased by 50 percent to account for underreporting.

Community Workshop

Description

A key part of the Harriet Tubman Triangle Pedestrian Study was a Community Design Workshop held at New Song Community Church on Wednesday evening, September 24, 2003. This workshop was based on the *Real Intersection Design* series that project team members utilize as consensus building and training exercises. About 25 members of the community, city agencies and interested professionals attended the workshop, see Figures 11 through 16. Participants were distributed randomly into teams, each one representing a transportation constituency (walking, cycling, driving, and parking) and led by an expert in the field. The teams walked the site, made notations of problems and potential fixes, sketched detailed solutions on large-scale drawings, and listed their analysis of the site and recommendations (summarized below). Towards the end of the evening each team presented its ideas to the reassembled group and defended it in the face of criticism from the other teams. The ideas generated at the workshop are listed below.

Participants were universally enthusiastic about the process. A full workshop report including the drawings of each team, discussion notes, evaluation, and contact list is presented in Appendix I. To assist the participants during the workshop, most of the existing conditions data was made available. Also included were excerpts from previous Manhattan Borough President-sanctioned studies of the area, presented in Appendix II.

Figure 11: Walking the Site

Figure 12: Getting Views of Community Residents

Team Site Analyses

Positives

- Bike lanes.
- East side of Douglas Blvd. at West 122nd Street is positive because of the businesses.
- Lines, striping, markings visible.
- Low traffic along Tubman Avenue.
- Relatively low traffic along some portions of the area can allow experimentation in directing traffic flow.
- Signals clearly visible.
- Unused parking space in nearby parking garage.
- West side of Douglas Blvd. below West 121st Street is most inviting streetscape, a model for the area.

Negatives

- Aesthetics of Precinct building and illegal parking surrounding it.
- Bus stop on NB Douglas Blvd. at West 121st Street blocks visibility; move it to far side of intersection.
- Confusion for cyclists and drivers in terms of where to go.
- Crosswalk (#3 in Figure 7) is too long and does not connect to a desirable place.
- Disorientating effects on a six-legged intersection
- Double parking often makes the lanes impossible to pass (most on Tubman Ave north of West 122nd St.).
- Entrance to parking garage.
- Hard right and left turns.
- Matthew Turner Triangle has no benches.
- No bike lanes on Douglas Blvd above West 121st Street.
- No bike racks.
- No differentiation between gas station and sidewalk.
- Parking on Tubman Ave sidewalk at West 122nd Street.
- Roadway in disrepair; it needs to be repaved and re-striped.
- Sight distance blockage on Tubman Ave To Douglas Blvd. northbound.
- Subway ventilation grates on Tubman Triangle produces noise.
- The bus stop on SB Douglas Blvd at West 122nd Street is not ADA-compliant.
- Tubman Triangle sidewalk needs to be repaired and expanded.
- Very tricky to understand what movements are being made by each mode during any phase.
- Yellow striping at gas station driveway is illegal.

Team Recommendations

Do Right Away

- Add another lane on NB Douglas Blvd; shift bike lane over.
- Add bike lane on SB Douglas Blvd. below West 121st Street.
- Add crosswalk between Tubman Triangle and NE corner of West 121st St. intersection (#9 in Figure 7).
- Add exclusive left turn phases on NB and SB Douglas Blvd.
- Add protected red phase at West 121st Street intersection.
- Clean up pavement and striping.
- Expand Tubman Triangle.
- Make physically impossible for police to park around the Precinct using bollards and a bus shelter.
- Prohibit hard right and left turns at West 121st Street intersection.
- Remove parking around Tubman Triangle and expand the sidewalk from eight to 16 ft. in all directions.
- Remove parking on east side of Douglas Blvd. between West 120th and 121st Streets.
- Re-stencil all bike lane symbols.

Should Also Do

- Add a dedicated bus lane on Douglas Blvd. (remove parking).
- Add advance stop line (bike box) on Douglas Blvd. at West 121st Street.
- Add colored bike lanes and dashed lines through intersections.
- Add curb extensions to channel vehicle movements.
- Add curb extensions to shorten all crossing distances.
- Add Leading Pedestrian Intervals for bikes and pedestrians at West 121st Street intersection.
- Convert Douglas Blvd. to one way southbound.
- Convert Tubman Ave. to one way northbound.
- Extend Turner Triangle to unify the crosswalks (however the crossing would still not be continuous).
- Find alternate entrance for parking garage.
- Reconfigure lanes on southbound Douglas Blvd.
- Relocate northbound M10 bus stop 50 ft. south towards West 120th Street.
- Remove parking on the sidewalk around the gas station. Distinguish gas station from pedestrian space via planters (ventilators make it impossible to plant trees).
- Subway ventilation: muffle the noise and separate it from the sitting area.
- Widen the sidewalks and use higher curbs around Tubman Triangle. The garden shouldn't have bushes but a statue and benches (however there is no space).

It Would Be Nice

- Add a "Red light" camera for violators of bike lane.
- Add a bus bay on Turner Triangle.
- Add an all-pedestrian phase at the West 121st Street intersection.
- Add bollards on some curb extensions.
- Connect Tubman triangle to the Precinct block by narrowing or eliminating West 122nd Street between Tubman Avenue and Douglass Boulevard.
- Make Harriet Tubman Triangle significantly bigger.
- Make Turner Triangle functional (café) while Harriet Tubman is visual.
- Relocate northbound M10 bus stop to Douglas Blvd. and West 122nd Street. The businesses in the block would like it.
- Relocate southbound M10 bus stop to Tubman Triangle.

- Replicate sidewalk scheme (benches, plantings) at Tubman Gardens to unify the architecture and streetscape.

Figure 13: Brainstorming

Figure 14: Making a Point

Figure 15: Drawing on the Floor

Figure 16: Presenting and Critiquing

Recommendations

Building upon the ideas generated during the workshop, the project team developed a single proposal with 16 operational and 11 capital measures, described below. The operational measures are items such as signal timing, turn restrictions and pavement markings that DOT could implement relatively quickly. The capital items are designed to be incorporated into the upcoming EDC reconstruction project. Both operational and capital measures are shown in the scale drawings in Figures 18 and 19. See also examples of similar installations in Figures 20 through 29.

Operational Measures

1. Ban U-turns from NB Tubman Avenue onto SB Douglass Boulevard at West 121st Street.

2. Ban U-turns from NB Douglass Boulevard onto SB Tubman Avenue at West 121st Street.

3. Ban U-turns from SB Douglass Boulevard onto NB Tubman Avenue at West 121st Street.

4. Ban U-turns from SB Tubman Avenue onto NB Douglass Boulevard at West 121st Street.

5. Ban right turns from NB Tubman Avenue onto West 122nd Street.

6. Add 100-foot left turn lane to NB Douglass Boulevard at West 121st Street. This will require removing parking from most of the east side of Douglass Boulevard (two spaces may remain at the corner of West 120th Street) and relocating the bus stop. To ensure that the left turn lane is used properly, a median is to be added to the north side of the intersection and turn lane markings are to be dashed through the intersection.

7. Relocate the NB M10 bus stop on Douglass Boulevard from south of West 121st Street to north of West 122nd Street. This is necessary to allow the left turn lane, described above. The transit team at the workshop suggested moving it south of West 122nd Street, but this would create long queues in this short block, thus blocking the intersection. Another option would be to relocate or add another stop at West 120th Street. As a point of reference the next bus stops are at West 118th and 125th Streets. Relocating the bus stop should be thoroughly explored with NYC Transit and the community.

8. By placing the NB M10 bus stop north of West 122nd Street one can employ a "bus bulb," which allows the bus to stop in the lane of traffic. This block has two lanes, so drivers may pass the bus easily. It is common knowledge that busses routinely stop in the travel lane; a bus bulb merely codifies this condition. They also allow the bus stop to be shorter, thus more on-street parking, and provide more space for bus shelters, also recommended. The traffic modeling indicated the bus bulbs would have no adverse effect on traffic flow. A "bus bulb" is also recommended for the SB bus stop opposite.

9. Add a bicycle lane to SB Douglass Boulevard. DOT has previously approved this installation, but it is not yet marked.

10. Add "separation" striping between the parking and bicycle lanes along Tubman Avenue. This striping is commonly found along side bike lanes in other parts of the city, but between the bicycle and moving lane. Double parking is such in this area that the striping should be in this zone. Otherwise cyclists will constantly be riding on the striping.

11. Remove crosswalk #5 (see Figure 7) and install a crosswalk in line with Tubman Avenue's east sidewalk at Douglass Boulevard (#9 in Figure 31) in The current crosswalk is just out of the sight line of turning drivers, making it dangerous. This is evidenced by the "zebra" striping which is generally employed at locations with high crash numbers.

12. Stripe the crosswalk in line with Douglass Boulevard's east sidewalk at West 121st Street (#4 in Figure 7). Presently, there is a pedestrian signal here but no markings. With the addition of the curb extensions, this crosswalk becomes remarkably shorter.

13. Set back the stop lines on the southern legs of the West 121 Street intersection. The tracking survey showed that people tend to veer across the street as soon as they pass the New Song Church building.

14. Set back the other stop lines at least eight feet to provide room for cyclists (especially those turning left) to queue ahead of waiting cars.

15. Mark the locations of the curb extensions and wider sidewalks described below in advance of their construction. This was done by DOT at Mulry Square in the mid-90's ahead of the recently completed curb extensions, see Figure 17.

16. Re-time signals as per Table 9 and Figure 31. Cycle length and offsets are to remain the same.

Figure 17: Mulry Square pre-Curb Extension Markings[17]

[17] photo by Project for Public Spaces.

Intersection	Existing Timing (sec)				Proposed Timing (sec)				
	Green	Yellow	All Red	Total	LPI	Green	Yellow	All Red	Total
W 121 St, Tubman Ave, Douglass Blvd									
• Douglass Blvd	31	3	4	38	8	21	3	2	34
• W 121 St	20	3	2	25	9	16	3	2	30
• Tubman Ave	22	3	2	27	4	17	3	2	26
Total				90					90
W 122 St and Tubman Ave									
• Tubman Ave	57	3	2	62	4	37	3	2	46
• W 122 St	23	3	2	28	6	33	3	2	44
Total				90					90
W 122 St and Douglass Blvd									
• Douglass Blvd	49	3	2	54	4	34	3	2	43
• W 122 St	31	3	2	36	6	36	3	2	47
Total				90					90

Table 9: Existing and Proposed Signal Timing

Capital Measures

17. Add curb extensions to shorten the crossing distance, slow turning drivers and physically restrict parking at all three intersections of the study area. The width of the curb extension is generally two feet less than the width of the parking lane. The corner radii shown is 18 feet if there is an curbside turning movement, four feet if there is no turning movement and 10 feet otherwise.

18. The large curb extension on the east side of the West 121st Street intersection is designed to limit double parking within the intersection. This location was identified by community members as particularly problematic. In fact during one of the site visits a double-parked vehicle was rear-ended.

19. Widen the sidewalks around Harriet Tubman Triangle to align with the adjacent curb extensions. Shown is an additional 13 feet on the Tubman Avenue side, seven feet on the Douglass Boulevard side and six feet on the West 122nd Street side.

20. Widen the north sidewalk on West 122nd Street between Tubman Avenue and Douglass Boulevard. This will mirror the wider sidewalk at Tubman Triangle and will complement the decorative paving recommended in the First Action Plan study, see Appendix II. It will also narrow the street to restrict parking.

21. Add decorative bollards to all curbs where sidewalk parking is endemic - around the police station and in front of the gas station and parking garage. The bollards shown are placed 18 inches behind the face of curb.

22. Add protective bollards to all corners and curb extensions where drivers may mount the curb and injure people on the sidewalk. Generally this occurs at three of four corners of an intersection. The bollards shown are placed six inches behind the face of curb.

23. As recommended in the First Action Plan (Appendix II), install planters where it is impractical to plant trees over the subway line. Place raised planters over the subway grate on Tubman Triangle (to the extent that they do not interfere with necessary ventilation). Install planters at the property line of the gas station on the west side of Tubman Avenue south of West 122nd Street. A planter with vines to support a wall of foliage on the Police Precinct wall on West 122nd Street is suggested to create a green backdrop for Tubman Triangle.

24. Close the driveway to the gas station on West 122nd Street closer to Tubman Avenue. It interferes with the crosswalk and there is another driveway immediately to the west.

25. Consider closing the driveway to the gas station on Tubman Avenue south of West 122nd Street. It interferes with the crosswalk and there is another driveway to the south, however it is used as a primary access to the gas station for northbound traffic. If the land use changes, then this driveway should be immediately closed.

26. Add colored bicycle lanes through the intersections, especially the complex intersection at West 121st Street. This will augment the dashed lanes currently in the intersection.[18]

27. Explore increasing the capacity of the Police vehicle storage facility on the east side of Douglass Blvd. between West 122nd and West 123rd Streets by taking advantage of new space-saving "automatic garage" technology. It uses robotic, computer-controlled carriers to maximize movement and storage space within multilevel garage facilities on small urban lots. A local example is in Hoboken, New Jersey where a seven-level garage parks 324 cars on a 100-foot square lot.[19]

[18] Blue bicycle lanes were one of the few successful traffic calming test in the Downtown Brooklyn Traffic Calming Study and DOT should be amendable to increased applications.
[19] Martin, Antoinette. "Space-Age Garage That Saves Space," *New York Times*, 9-21-03, Section 11, page 1.

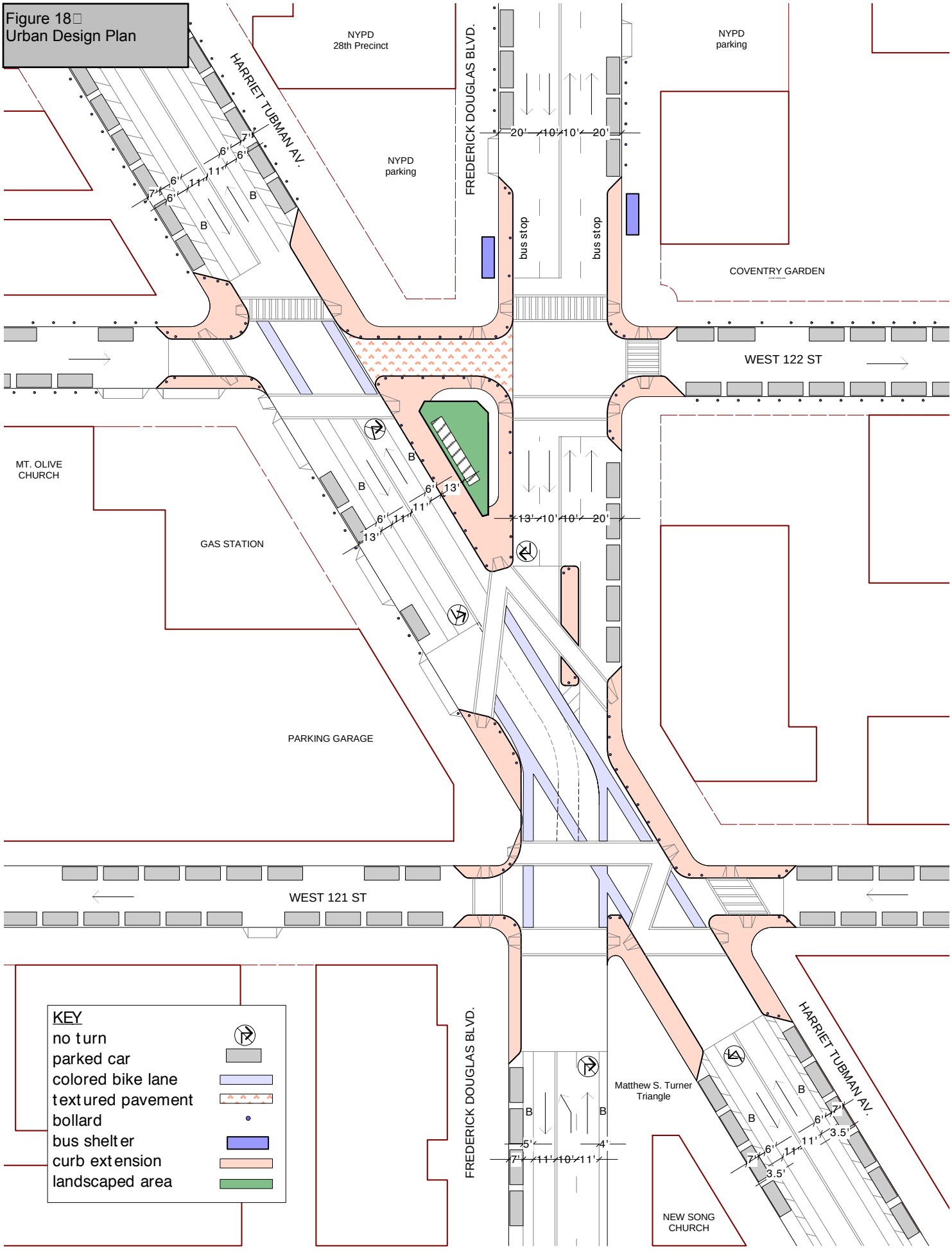


Figure 18
Urban Design Plan
NYPD
28th Precinct
HARRIET TUBMAN AV.
FREDERICK DOUGLAS BLVD.
NYPD
parking
NYPD
parking
bus stop
bus stop
COVENTRY GARDEN
WEST 122 ST
MT. OLIVE
CHURCH
GAS STATION
PARKING GARAGE
WEST 121 ST
Matthew S. Turner
Triangle
NEW SONG
CHURCH
KEY
no turn
parked car
colored bike lane
textured pavement
bollard
bus shelter
curb extension
landscaped area

Analysis

Level of Service

The proposed changes compare favorably to the existing condition both in terms of level of service and urban design. Table 1 shows that the level of service will improve for walking and driving in two of the three intersections with cycling LOS remaining the same. The improved driving conditions are reported in Table 10 and shown graphically in Figure 30. The latter shows screen shots from the SimTraffic simulation, one every seven seconds for a total of 90 seconds (one cycle). As mentioned above the main change is the introduction of the left turn on Douglass Boulevard at Tubman Avenue. This raises the level of service from E to B.

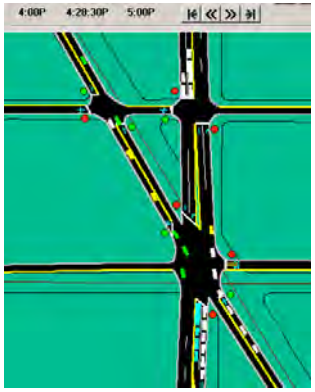
Cycling conditions in the proposed scheme are reported in Tables 11 and 12. Cyclists will benefit marginally, but not as much as drivers and walkers. This is due primarily to the existing bike lanes through the study area. If bike lanes were to be added to Douglass Boulevard north of West 121st Street, the level of compatibility would rise.

The improved walking conditions are reported in Table 13. LOS rises primarily because of the shorter crosswalks and increased time given to pedestrians. The combined-maximum delay for the southern legs of the West 121st Street intersection is now 122 or 137 seconds, depending on direction of travel. This compares favorably to the existing 156 seconds. All crosswalks are provided with, at minimum, clearance intervals of 4 feet per second. An overlay of the pedestrian desire lines and the proposed curb extensions and pavement markings shows how well they correspond, see Figure 32.

Intersection	Volume	Delay (sec/veh)	LOS
W 121 St, Tubman Ave, and Douglass Blvd			
• WB W 121 St	112	30	C
• NB Douglass Blvd	414	26	C
• NB Tubman Ave	136	26	C
• SB Frederick Douglass Blvd	278	7	A
• SB Harriet Tubman Ave	216	16	B
Total	**1156**	**20**	**B**
W 122 St and Tubman Ave			
• EB W 122 St	104	12	B
• NB Tubman Ave	234	4	A
• SB Tubman Ave	242	15	B
Total	**580**	**10**	**A**
W 122 St and Douglass Blvd			
• EB W 122 St	104	17	B
• NB Douglass Blvd	328	15	B
• SB Douglass Blvd	298	15	B
Total	**730**	**15**	**B**

Table 10: Proposed Vehicle Delay


A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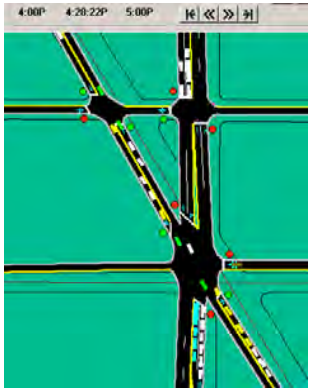
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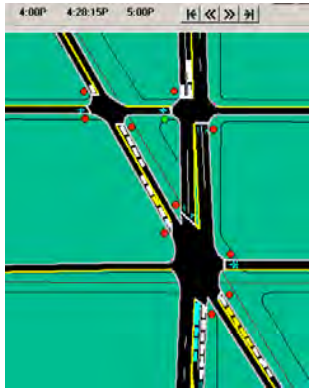
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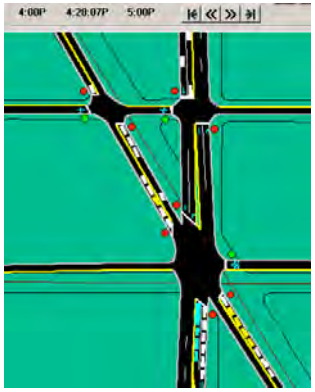
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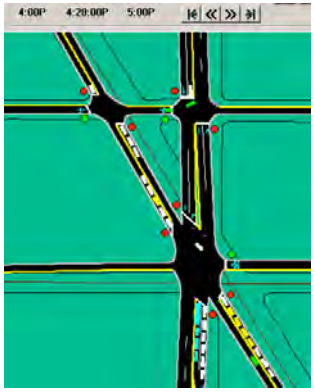
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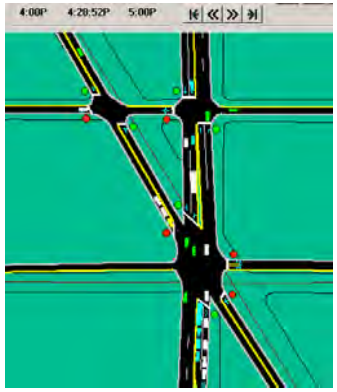
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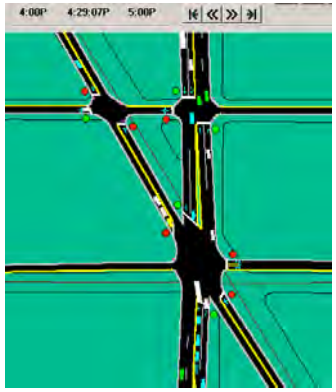
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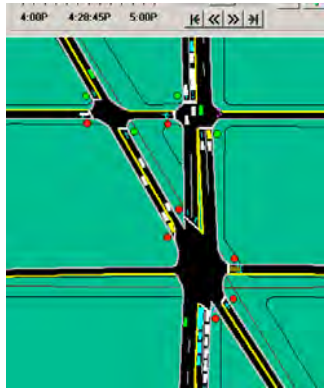
L

Figure 30: Simulation of PM Peak Traffic - Proposed

Street segment	Bike Lane Width, ft.	BCI (per direction)	LOS
Tubman Ave, W 120 – 121 St	6	2.22-2.22	B
Tubman Ave, W 121 – 122 St	6	1.49-2.29	A-B
Tubman Ave, W 122 – 123 St	6	2.35-2.35	C
Douglass Blvd, W 120 – 121 St	4-5	1.82-2.82	B-C
Douglass Blvd, W 121 – 122 St	0	3.06-3.87	C-D
Douglass Blvd, W 122 – 123 St	0	3.87-3.87	D

Table 11: Proposed Bicycle Compatibility

Intersection	BCI	LOS
W 121 St & Douglass Blvd & Tubman Ave	2.35	**C**
W 122 St & Tubman Ave	1.92	**B**
W 122 St & Douglass Blvd	3.87	**D**

Table 12: Proposed Bicycle Compatibility – Intersection

Intersection	Effective Green Time	Average Delay, sec.	Average LOS	Maximum Delay, sec.	Maximum LOS
W 121 St & Douglass Blvd & Tubman Ave					
1. west leg crossing 121	54	7	A	36	D
2. east leg crossing 121	54	7	A	36	D
3. west leg crossing Tubman	45	11	B	45	E
4. east leg crossing 121 & Tubman	22	26	C	68	F
5. removed	--	--	--	--	--
6. north leg crossing Tubman & Douglass	9	36	D	81	F
7. south leg crossing Douglass	44	12	B	46	E
8. south leg crossing Tubman	19	28	C	71	F
9. east leg crossing Douglass	34	17	B	56	E
Average		**18**	**B**		
W 122 St & Tubman Ave					
• west leg	40	14	B	50	E
• east leg	40	14	B	50	E
• north leg	33	18	B	57	E
• south leg	29	21	C	61	F
Average			**B**		
W 122 St & Douglass Blvd					
• west leg	37	16	B	53	E
• east leg	37	16	B	53	E
• north leg	34	17	B	56	E
• south leg	33	18	B	57	E
Average		**17**	**B**		

Table 13: Proposed Pedestrian Delay

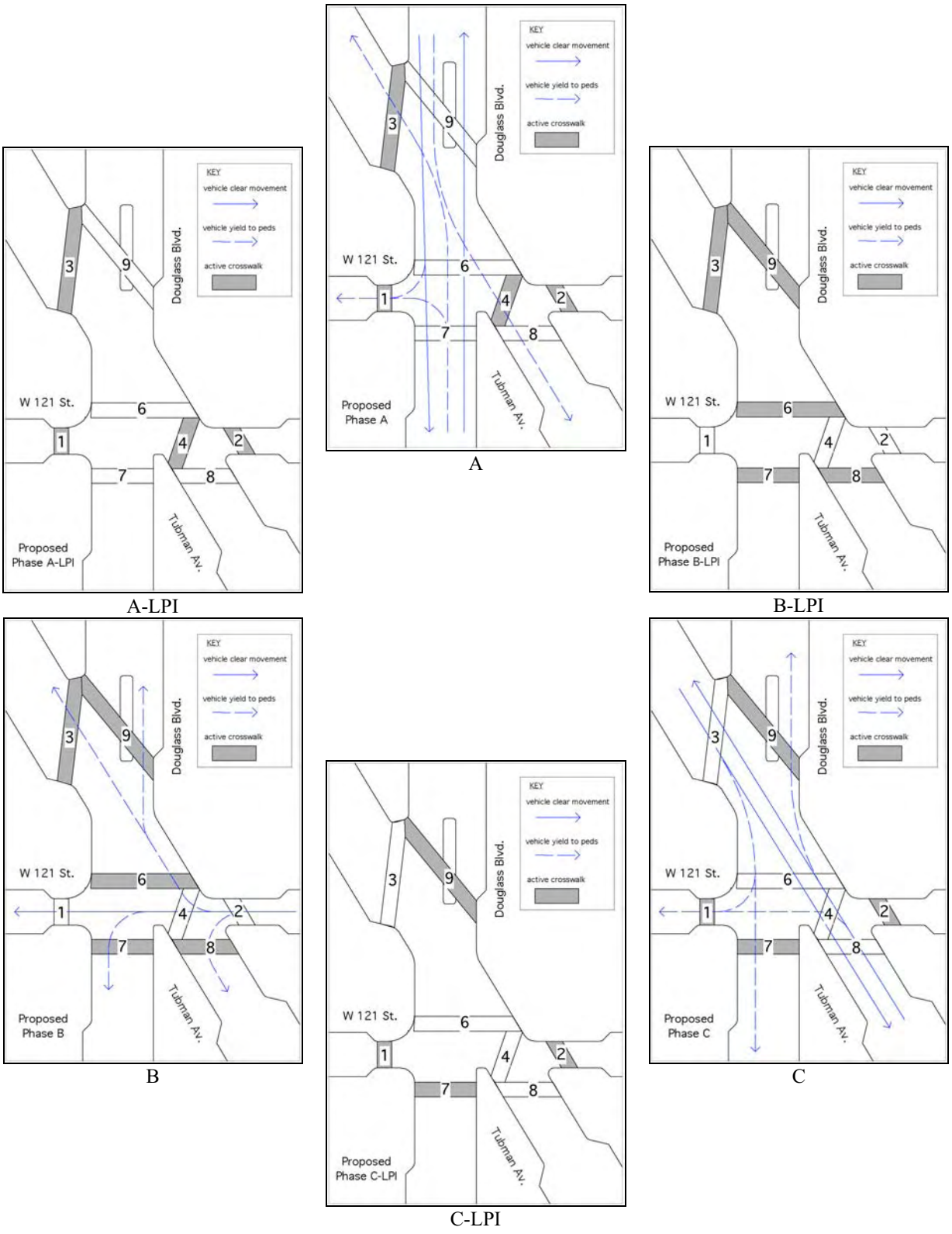

Figure 31: Proposed Signal Phasing