ANATOMY OF A ROUTE

Reducing Delays on the M96 Bus

Prepared for

Transportation Alternatives

NYPIRG Straphangers Campaign

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Summary

With an average noontime speed of 4.3 mph, the M96 crosstown bus along 96 St. in Manhattan is the slowest bus route in New York City. Long travel times are produced by:

- Long dwell times at bus stops as numerous passengers board and exit the bus.
- Delays at intersections because of backups created by turning vehicles
- Double-parked vehicles
- Buses stopping at red lights at nearly every intersection.

The following combination of steps address the problems on the route improve the speed and reliability of service:

- Pre-boarding fare payment at Central Park West and Lexington Avenue stops where large numbers of passengers board the bus.
- Eliminate parking at the approaches to each intersection to create two lanes for through traffic and one lane for vehicles making turns.
- Police enforcement of double-parked vehicles.
- Move the eastbound bus stop on Lexington Avenue from the west side of the intersection (near side) to the east side of the intersection (far side).
- Reexamine traffic signal timings, looking for possible improvements.
- Develop a plan to reduce double-parking in front of a school on 96 Street between Madison and Fifth Avenues.

These solutions would reduce M96 running times for the main part of the route (Second Avenue to Broadway) by 2-4 minutes and 15-21%:

- Eastbound travel time reduced from 13-19 minutes to 11-15 minutes.
- Westbound travel time reduced from 15-19 minutes to 13-15 minutes.

The variability in bus travel times would be reduced by 33% to 50%.

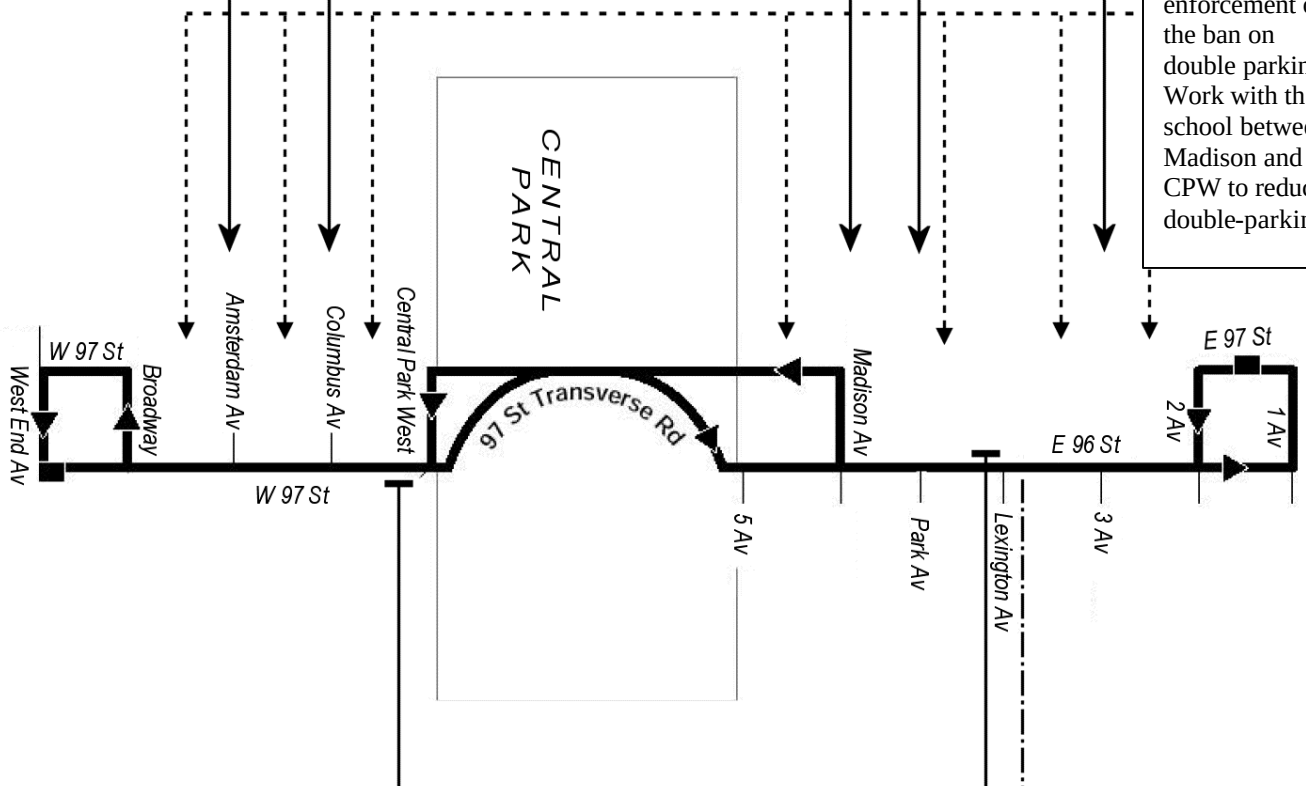
How to Cut M96 Running Time By Up To 4 Minutes or 21 Percent One-Way

Problem: Turning vehicles create backups at intersections.
Solution: Use curb lane for through travel at each intersection by eliminating parking near intersections.

Problem: Buses spend several minutes stopped at red lights.
Solution: Re-examine traffic signal timings for possible improvements

Problem: Double-parked vehicles create traffic jams on 96 St.

Solutions: Police enforcement of the ban on double parking. Work with the school between Madison and CPW to reduce double-parking.



Problem: Buses stop for over a minute at peak-direction subway transfer points
Solution: Pre-boarding fare payment at Central Park West and Lexington Avenue

Problem: Buses stop for an unusually long time at Lexington Avenue eastbound
Solution: Move this bus stop to the east side of Lexington Avenue

Introduction

With an average noontime speed of 4.3 mph, the M96 crosstown bus along 96 St. in Manhattan is the slowest bus route in New York City. Why are M96 buses so slow? What can be done to speed them up? This report analyzes the sources of delay on the M96 and proposes solutions to address the problems.

M96 Facts

Length of route: 1.8 miles

Peak-hour scheduled time between buses: 4 minutes

Peak hour capacity: 900 passengers in each direction (at any one point)

Average passengers
Weekdays: 16,303
Saturdays: 7,028
Sundays: 5,571

To identify problems and opportunities on the M96 route, eight bus trips were observed in detail. Observations were made between June 17 and June 26, 2002 during the morning and afternoon rush hours and midday. Four eastbound trips and four westbound trips were observed. Each trip was observed in its entirety, between West End Avenue and First Avenue. Measurements were taken on how long buses spend at bus stops, at red lights, and in motion. Qualitative observations were made as well regarding the specific problems afflicting the M96.

The extreme ends of the route where buses turn around – between West End Avenue and Broadway and between Second and First Avenues – are among the slowest portions of the route. Because these tail portions of the route carry few passengers, the analysis below focuses on the main portion of the route between Broadway and Second Avenue. This part of the route carries the vast majority of the route's passengers. Speeds are still slow between Broadway and Second Avenue, with average speeds of less than six miles per hour. (See map of the route on the last page of this report.)

Current M96 Operations

On the eight observed trips, the range of travel times between Broadway and Second Avenue was 13 to 18 minutes for eastbound buses and 15 to 18 minutes for westbound buses. Table 1 shows in detail how these buses spent their time.

Table 1. How buses spent their time on the eight observed trips

	Eastbound	Westbound
Stopped at red lights	1½ to 4 minutes	3½ to 7 minutes
Stopped at bus stops	3½ to 5½	2 to 5
In motion	6½ to 8½	8 to 9
Total trip time	13 to 18 minutes	15½ to 18 minutes

Buses on the M96 spend barely one-half of their time in motion. Buses spend at least one-half of their time stopped, either at red lights or at bus stops. Improving the in-motion speeds of buses obviously can improve total trip times but there is also an opportunity to improve trip times significantly simply by reducing the time spent at bus stops and red lights. Reducing passenger boarding times at busy stops can reduce the total time stopped at bus stops. Eliminating congestion at intersections can reduce time stopped at red lights. Preventing double-parking can reduce traffic congestion and improve bus speeds in motion. These are three of the key ideas discussed below.

Note that observed trip times do not reflect the congestion that can occur between Fifth Avenue and Madison Avenue in the morning as a result of double-parking in front of a private school. Such congestion was not observed because school was not in session when observations were made in late June, but bus drivers and passengers cite this problem as a major source of delay on the bus route.

Problems and Solutions

Based on the observations discussed above, specific problems were identified that are responsible for the slow running times on the M96. The recommended actions are targeted at each major problem. In combination, these actions can produce significant improvements in bus travel times.

1. **Problem:** Buses stop for over a minute at peak-direction subway transfer points
   Solution: Pre-boarding fare payment at Central Park West and Lexington Avenue

Large crowds of passengers transfer from subway to bus at certain M96 stops and it takes a long time for these crowds to board the bus. This problem is most prevalent at Broadway and Central Park West eastbound, and at Lexington Avenue westbound. Buses spend between 50 and 95 seconds at these stops compared with 15 to 35 seconds at other busy stops such as Madison Avenue.

The long dwell times at Central Park West and Lexington Avenue create significant delays for bus riders already on board when the bus stops. The long dwell times at Broadway is not a major problem in terms of passenger delay, because only a handful of riders board at the start of the route at West End Avenue.

Pre-boarding fare payment at Central Park West (eastbound) and Lexington Avenue (westbound) would mean that passengers pay their fares before boarding the bus. Customers would pay their fare at the end of the line at a portable MetroCard farebox. The “paid area” can be separated from the rest of the sidewalk with a railing parallel to the avenue and several feet from the curb. Transit employees would need to be stationed at each stop during pre-boarding operations.

When a bus arrives, passengers can board much more quickly because they do not need to stop at the onboard farebox. Passengers can board through both the rear and front doors of the bus, which would also speed up boarding. Dwell times will be reduced very substantially.

When pre-boarding fare payment is not operational, customers will line up and board in the usual manner and pay fares on the bus.

Based on observations of the time needed for on-board fare payment, we estimate that pre-boarding fare payment would reduce the time that the bus spends at these locations to 15 to 35 seconds, comparable to the time spent at most other bus stops on the route.

It would also be useful to paint bus stops a distinctive color in order to discourage other vehicles from stopping or parking in bus stops.

2. **Problem:** Turning vehicles create backups at intersections
   Solution: Create a third lane of travel curbside on 96 St. at each intersection

Ninety-Sixth Street has two travel lanes in each direction. At intersections, at least one of these lanes often becomes congested with cars waiting to turn on to the intersecting avenue. Cars turning right must wait for pedestrians crossing the avenue in front of them. Cars turning left must wait for traffic in the opposite direction to clear. Buses that are traveling across 96 St. are often stuck behind a line of cars waiting to make the turn. This slows down the bus and in some cases causes the bus to wait through two red lights at the intersection – an additional delay of over one minute. The problem is most severe when a vehicle double-parks near the intersection, effectively reducing 96 St. to one travel lane for all turns and through traffic.

Eliminating a few parking spaces along the curb in advance of each intersection can create a third travel lane. With a third lane, one lane can be used by turning vehicles and two lanes by buses and other through traffic.

These turning lanes already exist in a few places – for example on 96 St. westbound at Madison Avenue. At other intersections, bus stops, fire hydrants, or other parking restrictions create *de facto* curbside turning lanes. Turning lanes should be added at the following intersections, where parking is currently allowed:

- Eastbound: Amsterdam, Columbus, Madison, and Third Aves.
- Westbound: Third, Park, and Columbus Aves.

In addition, NYC DOT should analyze whether protected left turns (green arrows) could be added at selected intersections.

3. **Problem:** Double-parked vehicles create traffic jams on 96 St.
   Solution: Police enforcement of the ban on double parking

Double-parking is mainly a problem at intersections and the turning lane concept discussed above would greatly alleviate that problem. To a lesser extent, double-parking also causes traffic jams mid-block. A double-parked vehicle renders one of the two travel lanes on 96 St. impassable. All traffic, including buses, must use the one remaining travel lane. Traffic proceeds slowly through these bottlenecks. These bottlenecks help account for low bus speeds even when time stopped at bus stops and red lights is excluded; average speeds for M96 buses *while in motion* are between 10.5 and 13.5 miles per hour.

Better police enforcement against double-parked vehicles would reduce double-parking and improve bus speeds. Ticketing would discourage repeat offenders and would encourage delivery vehicles at least to keep their stays as short as possible. We recommend this as at least a first step.

A more sweeping step would be to create a curbside bus lane across 96 Street. A bus lane would eliminate "alternate side of the block" parking spaces that are currently available along most of the street. A bus lane would be very effective in eliminating double parking. Any vehicle that stops or parks illegally would do so along the curb, thus maintaining two through lanes for buses and other traffic.

A bus lane on 96 Street would, however, inconvenience neighborhood residents who park their cars on the street. Given that blockages at intersections are a more important problem than mid-block double-parking, we recommend eliminating a relatively few parking spaces near intersections (to devote the curb lane for through traffic) and enforcement against mid-block double-parking.

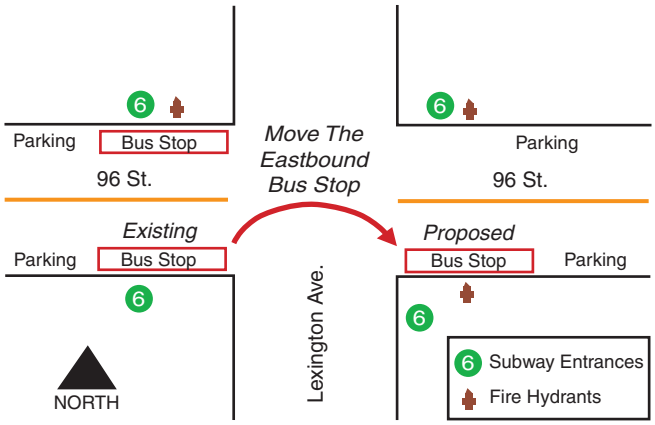
4. **Problem:** Buses stop for an unusually long time at Lexington Avenue eastbound
   Solution: Move this bus stop to the far side of Lexington Avenue

Eastbound buses spend between 40 and 60 seconds at Lexington Avenue. While this is a busy stop, part of the problem is that the bus stop is on the near side of Lexington Avenue (i.e. buses stop before crossing the intersection).

The current location of the stop extends dwell times for several reasons. First, buses may go through several passenger loading cycles. This occurs when a bus arrives at the stop and picks up passengers while the traffic signal turns red. While the bus is waiting at the red light, more passengers arrive at the stop and need to be let on to the bus. Loading these additional passengers continues even after the traffic light turns green, thereby delaying the bus.

Another problem with near side bus stops is that vehicles turning right conflict with buses using the bus stop. Cars turning on to Lexington Avenue use the bus stop as a

turning lane, so incoming buses are blocked from entering the bus stop. Alternatively, when a bus is stopped in the bus stop, cars in the travel lane to the left of the bus turn right on to Lexington Avenue in front of the bus, blocking the bus from pulling out of the stop.



Most bus stops on the M96 are far side bus stops, and are not subject to these problems. The few others that are near side stops are on the near side for a good reason, for example where Central Park interrupts 96 St. The bus stop at Lexington Avenue should be moved to the far side of the intersection. (See figure above.) Curbside parking would not be affected because the far side of Lexington Avenue currently has a fire hydrant. A far side bus stop would not be farther from the subway, because there are subway entrances on both sides of the street.

We estimate that if this bus stop were moved to the far side, the bus would spend only 15 to 35 seconds at the stop, comparable to the time spent at most other busy stops.

5. **Problem:** Buses spend several minutes stopped at red lights
   Solution: Reexamine traffic signal timings, looking for possible improvements

As every Manhattan driver knows, traffic lights along the one-way avenues are synchronized so that, in the absence of congestion, vehicles can travel for dozens of blocks without stopping at a red light. Along the crosstown streets, traffic signals are not synchronized, so vehicles randomly encounter red lights. Our observations indicate that buses heading eastbound on 96 St. are stopped by a red light at 60% to 70% of the intersections. With nine lights between Broadway and Second Avenue, a bus traveling in light traffic stops at about five lights, spending a total of about three minutes stopped at red lights. Heading westbound, the problem is even worse. The traffic lights seem to be timed in such a way that the buses stop at nearly every red light, so buses can spend nearly seven minutes stopped at red lights.

While it would not be desirable to change the timing of traffic signals in such a way that would slow down traffic on the avenues, the New York City Department of Transportation (NYCDOT) should reexamine signal timings on 96 St. Refinements may be possible that would help crosstown traffic, particularly for travel in the westbound direction.

Analysis of the westbound direction should bear in mind the apparent inverse relationship between time spent at red lights and time spent boarding and unloading passengers, noted later in this report. Simply reducing dwell times at bus stops will not improve overall bus speeds if this is the case.

6. **Problem:** Double-parking in front of a school on 96 St. between Fifth and Madison Avenues.
   Solution: Work with the school administration to devise a solution

There is a private school on the block between Fifth and Madison Avenues. According to an M96 bus driver, numerous parents double-park there throughout the morning rush hour while dropping off their children. This creates a severe traffic jam at Fifth Avenue. (We did not observe this particular problem because the school was not in session during our June observations.) In front of the school, parking is restricted to drop-offs and faculty vehicles, but apparently that restriction is insufficient to prevent double-parking.

NYCDOT should to work with the school to devise a solution that is mutually beneficial to traffic and school needs. The goal should be to accommodate the needs of parents and other school-related vehicles legally while reducing double-parking.

Reducing Delays on the M96

How would these solutions translate into reduced M96 running times?

A simple model was created in a spreadsheet to project time savings, based on the data collected on the eight observed trips. The same approach used for the M96 was used for First and Second Avenue in our report, "Bus Rapid Transit for New York City."

The model predicts how M96 buses spend their time between Broadway and Second Avenue. The model predicts a range of travel times of 13 to 19 minutes for eastbound buses and 15 to 19 minutes for westbound buses, as shown in Table 2.

Table 2. How M15 buses spend their time (model)

	Eastbound	Westbound
Stopped at red lights	3 to 4 minutes	3 to 7 minutes
Stopped at bus stops	3 to 7	3 to 6
In motion	7 to 8	8 to 9
Total trip time	13 to 19 minutes	15 to 19 minutes

The "best" and "worst" cases presented in Table 2 are meant to illustrate typical good and bad cases, not the absolute best or worst case that could ever occur. All of the eight trips actually observed fell inside the ranges in the table, because each of these trips – like most actual trips – had a mix of good and bad elements.

It is important to note that the best and worst total trip times noted in the table are not necessarily just the sums of the best and worst times at red lights, bus stops, and in motion. On westbound trips, there appears to be an inverse relationship between the time spent at red lights and the time spent at bus stops. Trips were observed in which the bus spent very much time at red lights and very little time at bus stops; and trips were observed in which buses spent very little time at red lights and very much time at bus stops. This apparent relationship between bus stops and red lights could be a coincidence, but it could also be a result of the timing of traffic signals along 96 St. No similar relationship was found for eastbound buses.

To model time savings from our recommendations, the following quantitative effects were assumed:

- Pre-boarding fare payment at Central Park West eastbound and Lexington Avenue westbound reduces time spent at those stops from 50-95 seconds to 15-35 seconds. The 15-35 seconds is comparable to time spent at other busy bus stops.

- Turning lanes speed movement through red lights and reduction of double-parking speeds movement generally. Together, these effects are assumed to improve bus speeds in motion from 11-13.5 mph to 13-14.5 mph eastbound, and

from 10.5-11.5 mph to 12-13.5 mph westbound. The improved speeds are comparable to bus speeds on uncongested Manhattan avenues.

- Turning lanes reduce the number of instances in which a bus must stop twice at the same red light. This reduces time spent at red lights by two minutes, in the worst case only. In the best case, buses already do not ever stop twice at the same red light.

- Moving the Lexington Avenue eastbound bus stop to the far side of the intersection reduces time spent at that stop from 40-60 seconds to 15-35 seconds.

- Reexamining the timing of traffic lights could result in a 10% reduction in the time spent at traffic lights. This would be a reduction of 18 seconds eastbound, and 19 seconds westbound. These 18-19 second reductions would occur in the best and worst cases, although in the worst case the overall reduction would be less than 10%.

Overall, these improvements would reduce M96 running times between Broadway and Second Avenue to 11 to 15 minutes eastbound, and 13 to 15 minutes westbound. Table 3 shows the percentage reductions in travel times, and in travel time variability.

Table 3. Predicted reductions in travel time and travel time variability

	Eastbound	Westbound
Reduction in travel time	2 to 4 minutes	2 to 4 minutes
% reduction in travel time	15% to 21%	13% to 21%
Reduction in variability	2 minutes	2 minutes
% reduction in variability	33%	50%

The model does not include the effects of reducing double-parking at the school between Fifth and Madison Aves. If this is done successfully as well, even greater reductions in travel time and variability could be achieved.

In sum, with the implementation of these recommendations, New York's slowest bus route could become noticeably faster and more reliable.