A Green Light for Improved Bus Service

Transit Signal Priority - The New York Experience

Chicago Metropolitan Agency for Planning

Joint RTOC / ATTF Meeting

October 29, 2015

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Greenman-Pedersen, Inc.

Agenda

- Background
- Why revolutionary
- Universal Issues
- Implementation
- Current status
- Future plans

Image from NY Daily News

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Public Transit in NYC

- 5.6 million subway and 2.5 million bus trips daily
- 5,700 buses operating on 2,800 miles of routes
- Public transit system operated by MTA NYC Transit
- Streets and traffic signals operated and maintained by NYCDOT

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Traffic Signals in US Cities

City	Number of Signalized Intersections
Atlanta, GA	970
Detroit, MI	1,300
Chicago, IL	2,800
Houston, TX	2,500
Los Angeles, CA	4,900
Total	12,470
New York City, NY	12,743

Source: NYCDOT

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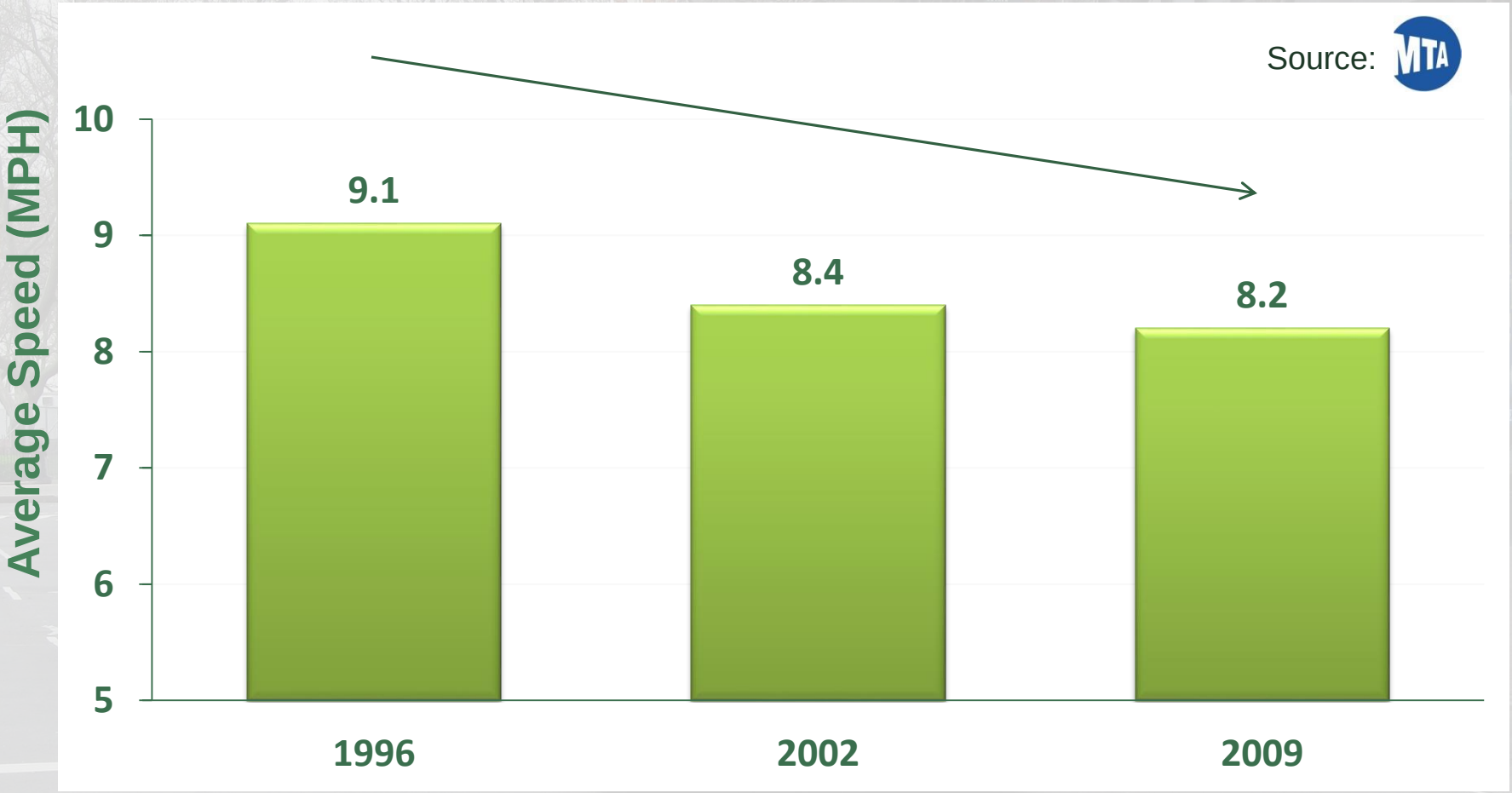
Problem: Bus Speeds in NYC



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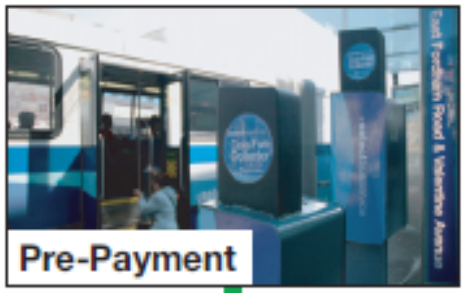
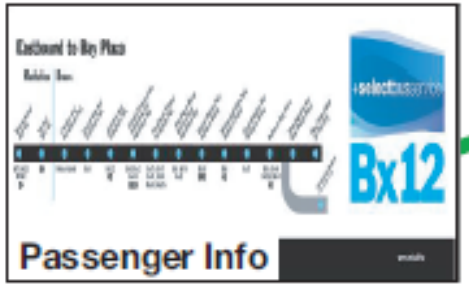
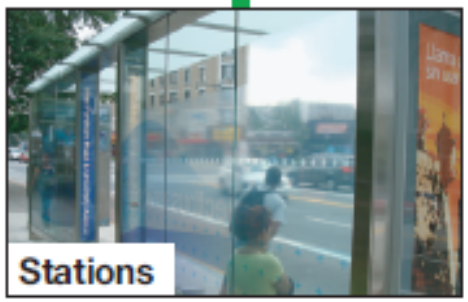
Solution: Select Bus Service (SBS)

Features



SBS



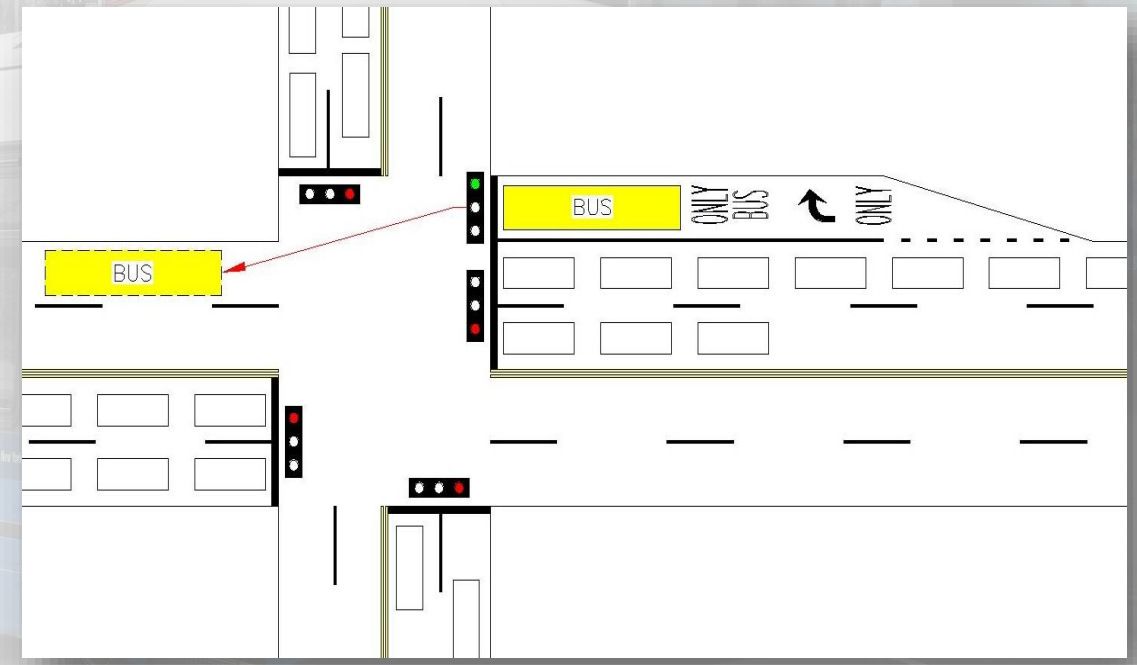


Bus Rapid Transit branded as "Select Bus Service" in New York City

Transit Signal Priority (TSP)

Automatic real time signal adjustments to expedite approaching buses:

- **Extend green**
- **Shorten red**
- **Advance green for queue jump**



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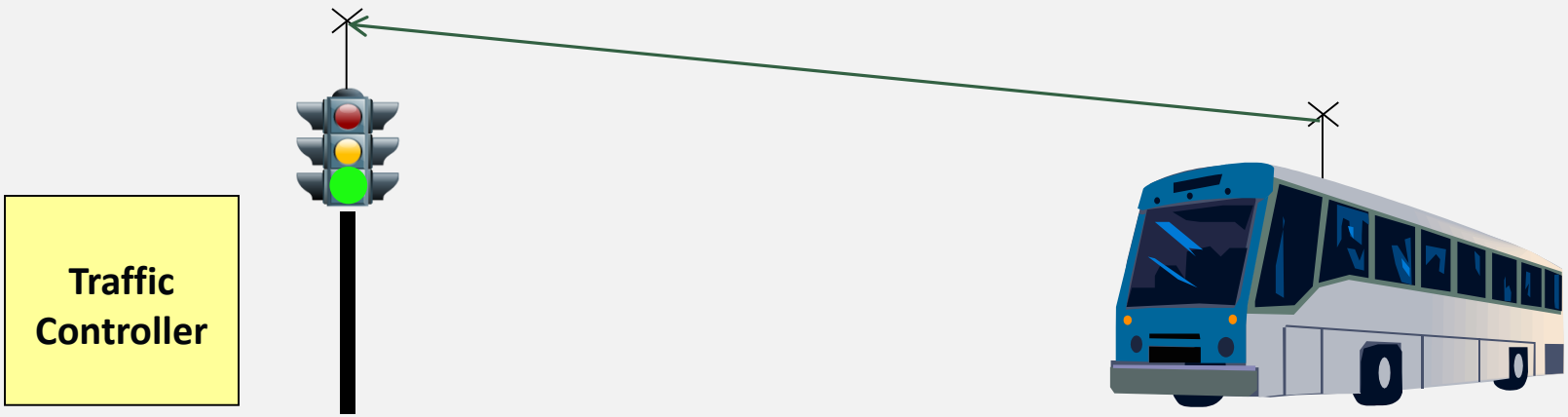
Typical TSP



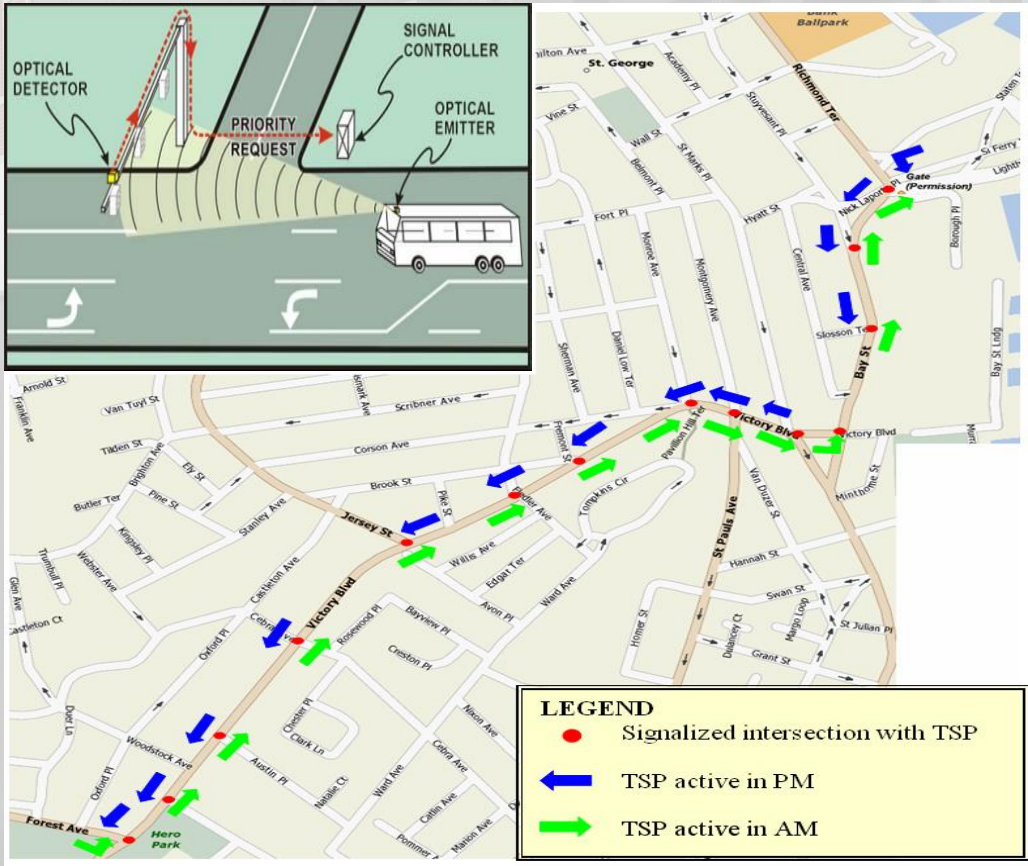
Direct communication between bus and signal

Requires equipment to receive message

Expensive for thousands of intersections!

NYC TSP Design/Build Pilot (2008)

- A 2.3 mile segment between Saint George ferry terminal and Forest Avenue / Victory Boulevard
- 14 Signalized Intersections
- Limited and Local bus routes
  - 33 individual routes in the AM; 36 in the PM



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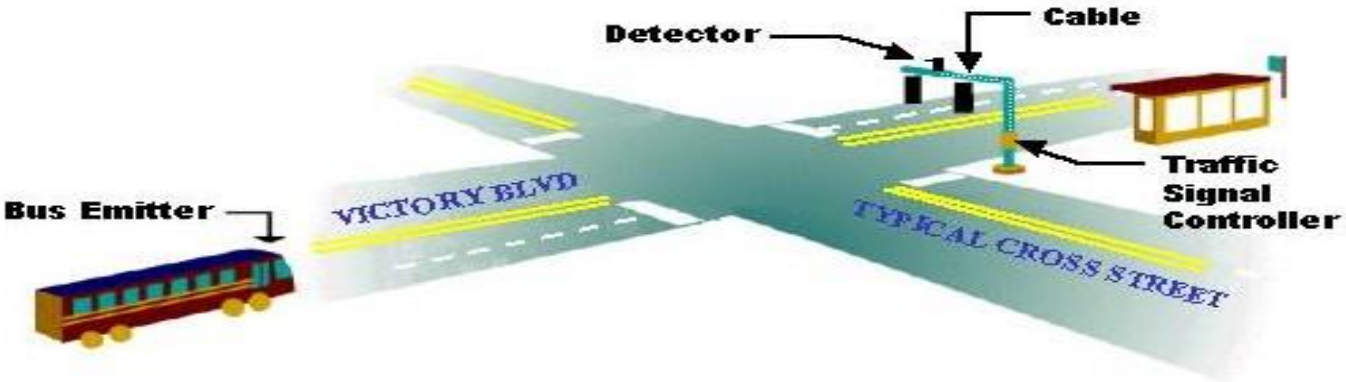
Victory Boulevard TSP Pilot (2008)

Detector for SE Approach to Victory Blvd on Forest Ave

Detector

Detector for NB/EB Approach on Victory Blvd at Cebra Ave



Bus Emitter Mounted on Bus Dashboard

Signal Controller Box

Bus Emitter Mounted on Bus Dashboard

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TSP Pilot Results

Comparative bus travel times (minutes) derived from modeling

AM Peak Period	Existing	Optimization	% Improvement	TSP	% Improvement
TO FERRY	8:48	7:54	10.2%	7:18	7.6%

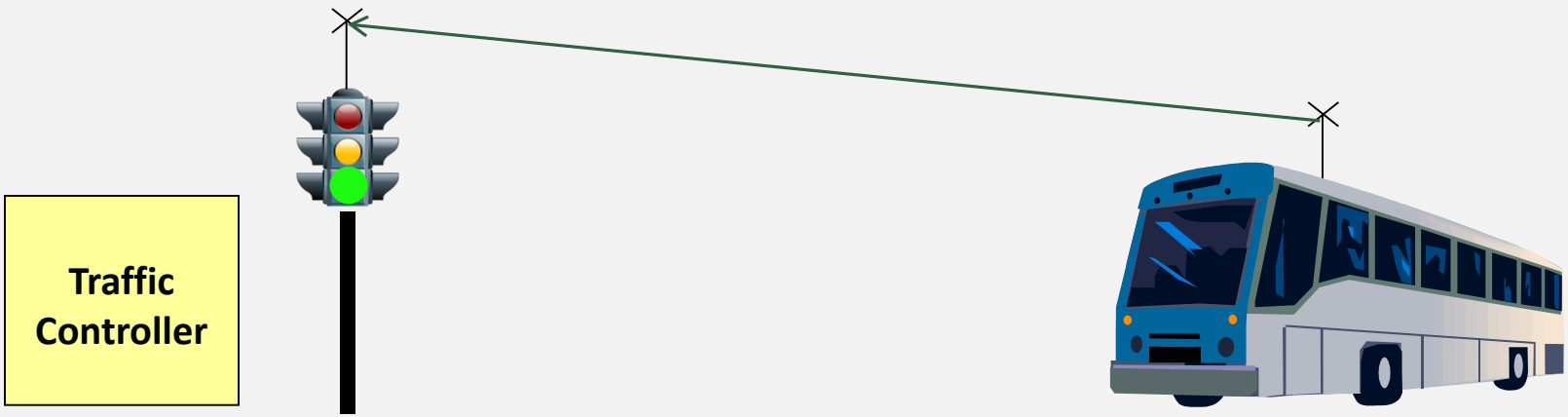
PM Peak Period	Existing	Optimization	% Improvement	TSP	% Improvement
FROM FERRY	8:12	8:12	0%	7:24	9.8%

Actual bus travel times (minutes) by NYCDOT

AM Peak Period	Existing	Optimization	% Improvement	TSP	% Improvement
TO FERRY	11:48	11:00	6.8%	9:54	10%

PM Peak Period	Existing	Optimization	% Improvement	TSP	% Improvement
FROM FERRY	12:00	11:38	3.3%	10:42	7.8%

Typical TSP



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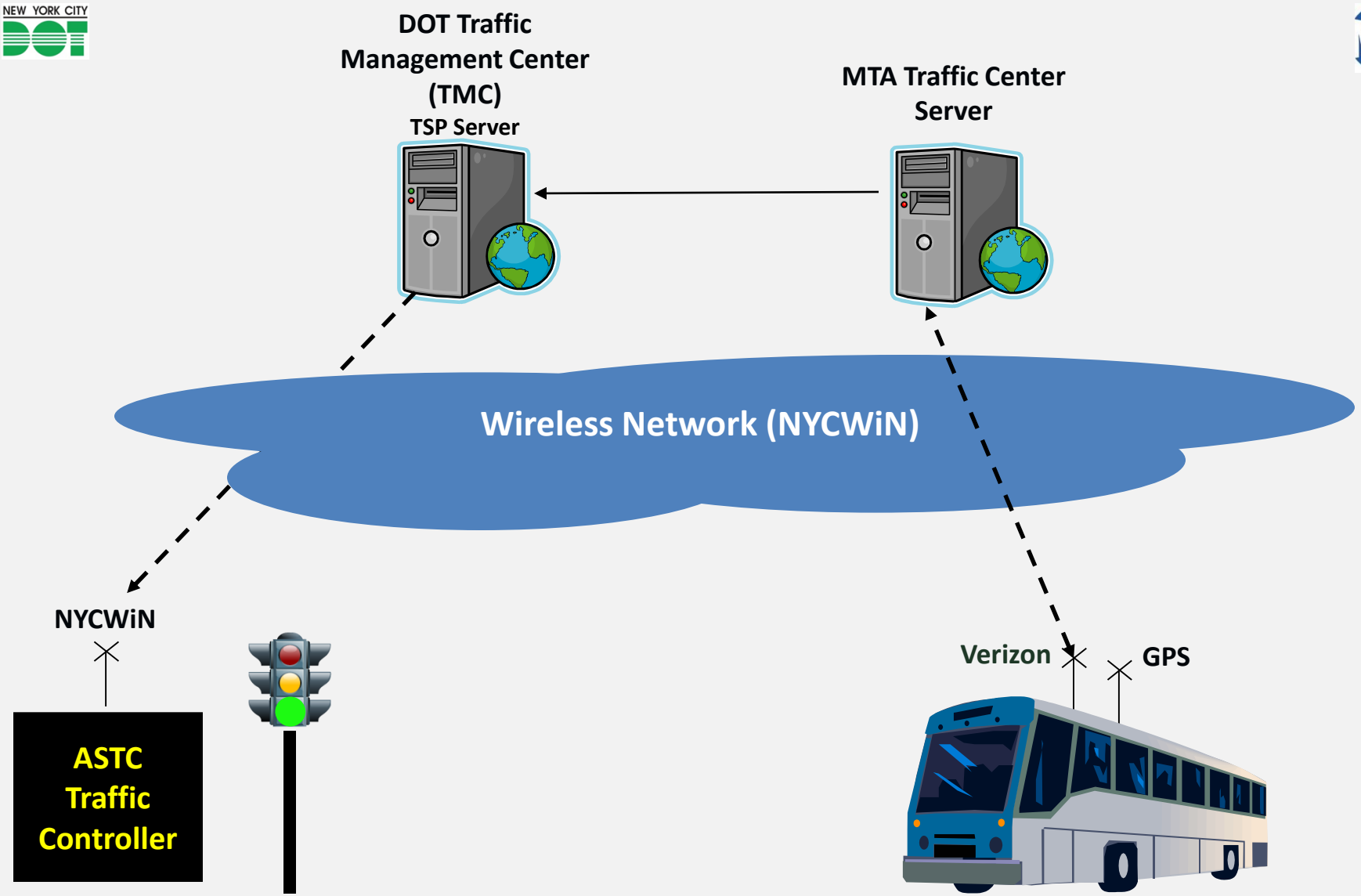
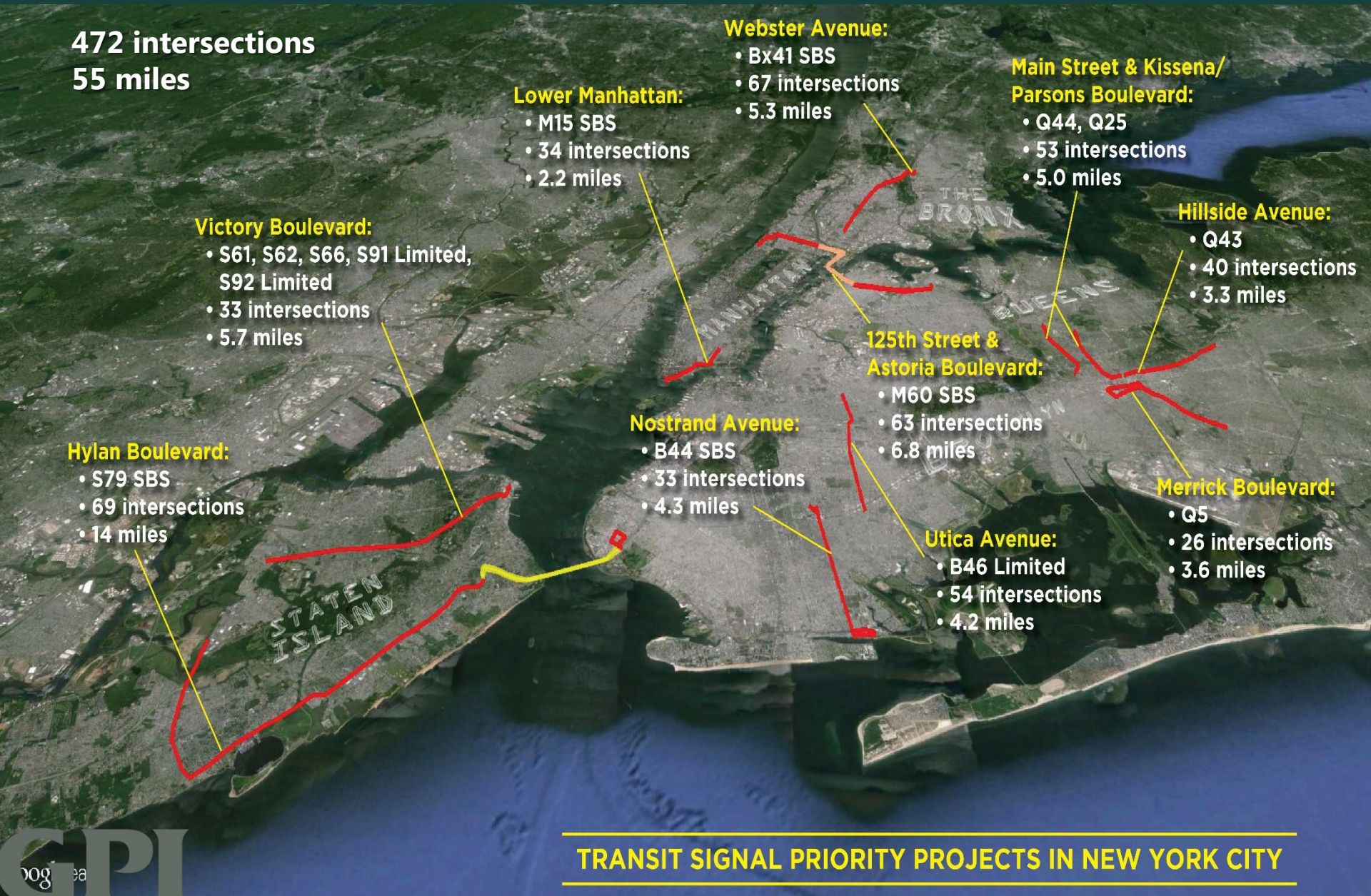
TSP with NYCWiN



Benefits of NYCWiN for TSP

- **Eliminates need for infrastructure changes to traffic controllers**
- **Requires only in-vehicle systems – GPS modem and computer to locate vehicle's position**
- **Cost effective for TSP city-wide!**
- ***Potential for chaos!***

First Corridors

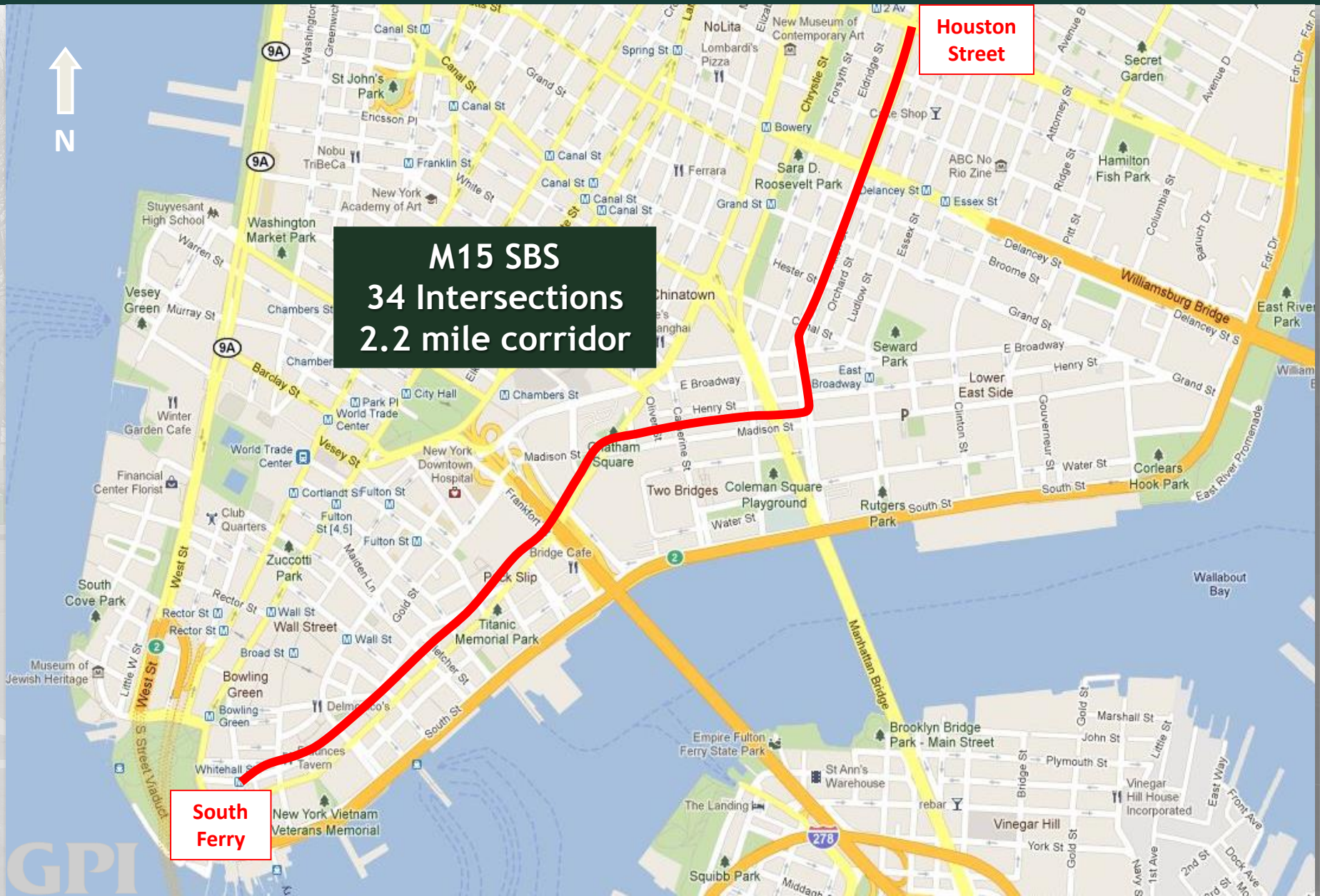


TRANSIT SIGNAL PRIORITY PROJECTS IN NEW YORK CITY

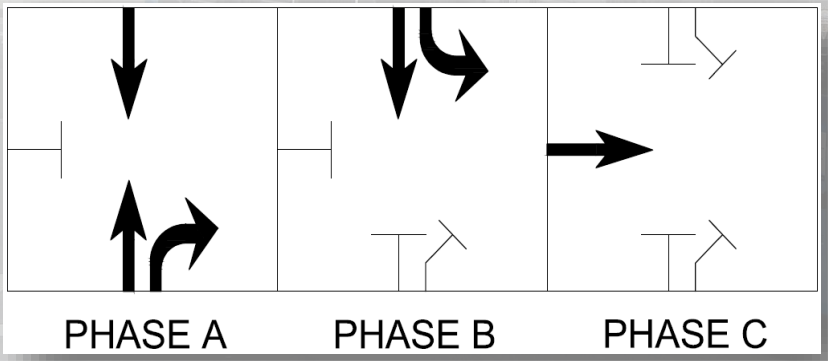
Participants and Roles

Agency	Contractor	Responsibilities
NYCDOT		Project Management, TMC, Roadways, Signals
	GPI	Traffic Engineering, TSP Operating Parameters
	TransCore	TMC Systems for TSP, Provide/Support Signals, System Integration
	Peek	Traffic controllers & their TSP software
MTA		Bus on-board systems, messaging to TMC
	GTT	GPS on-board software to request TSP
	Verizon	Wireless communication between buses and MTA
NYC DoITT		NYCWiN wireless communication between TMC and traffic signals

Lower Manhattan TSP



Implementation Questions



- Which intersections?
- What phases?
- How much time?
- When to act?
- Which call?
- Queue jumps?
- What are the effects?

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Constraints

- Coordination
- Capacity
- Cross-street traffic
- Bus stops
- Other corridor traffic
- Pedestrians, seniors

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Why Simulate?

- Answer implementation questions
- Optimize system to maximize ridership
- Determine travel time savings for riders
- Determine effects on other traffic
- Provide justification for funding

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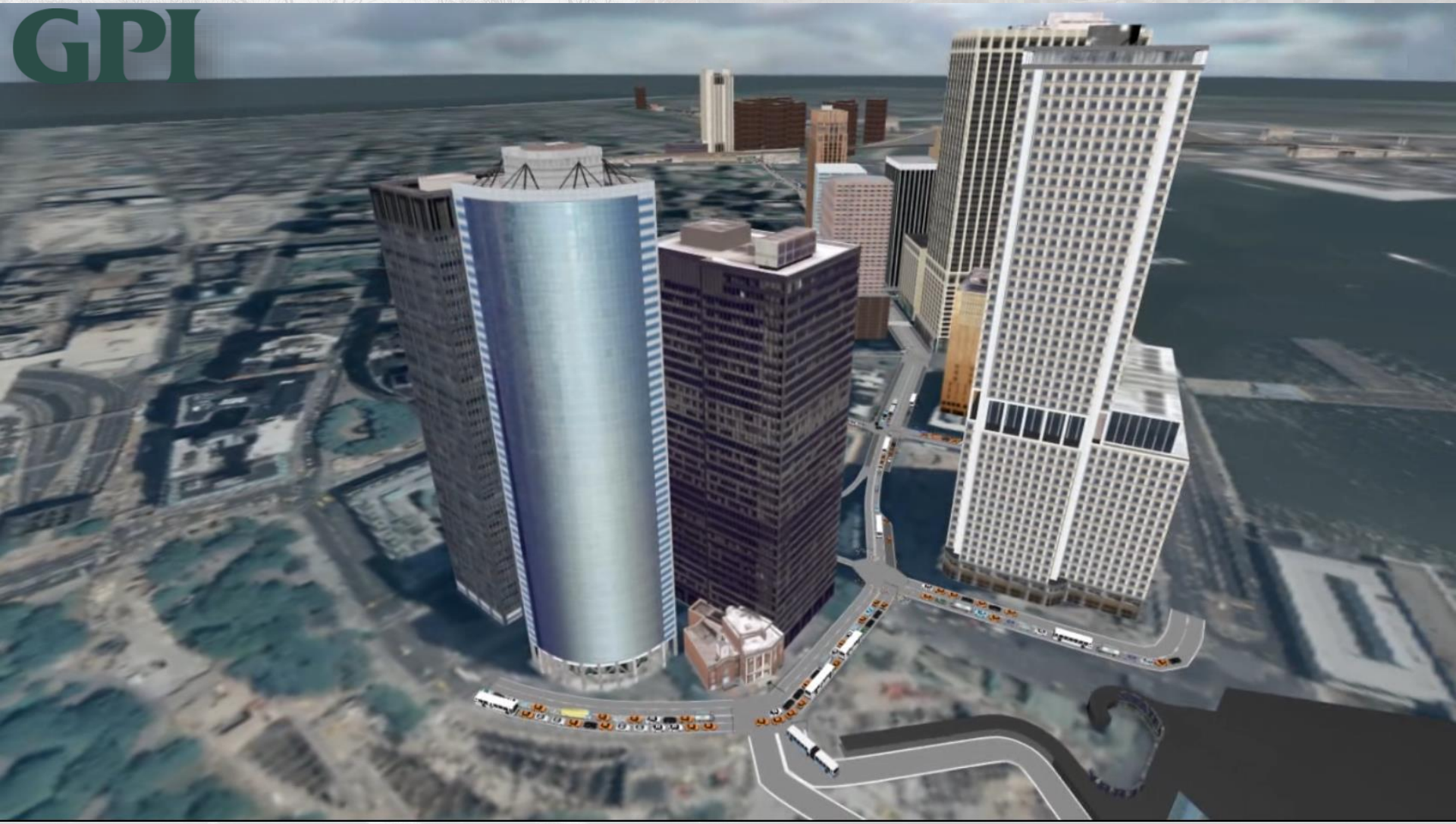
3-D Simulation of Lower Manhattan



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Results

- **Intersections and their approaches recommended for TSP:**

Intersection	Extended Phase	Truncated Phase(s)	Max. Extension/ Truncation (s)	Detection Zone[1] (ft)
Water Street and Whitehall Street	A	C	7	208
Water Street and Broad Street	A	B	7	220
Water Street and Coenties Slip	A	B	8	273
Water Street and 55 Water Street (mid-block)	A	B	8	200
Water Street and Old Slip	A	B	9	222
Water Street and Gouverneur Lane	A	B	8	238
Water Street and Wall Street	A	B	17	422

  - **Where and how queue jumping should be applied**
- **Travel time savings for buses**
- **Effects on other traffic**

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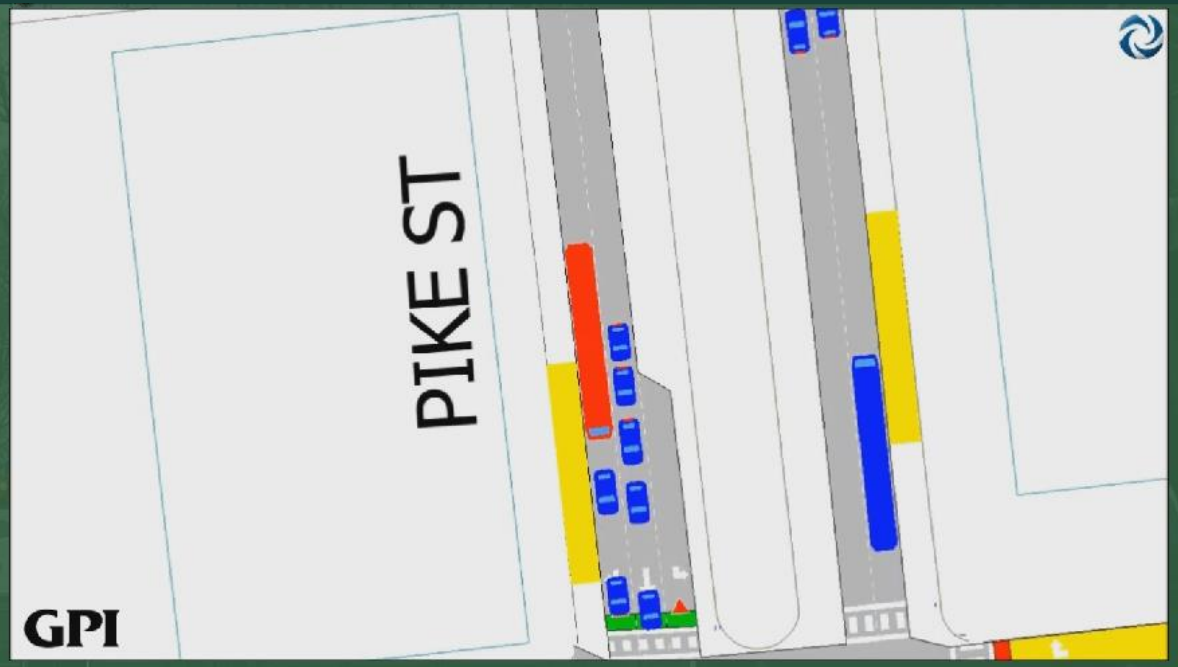
Comparison with and without TSP

Existing (no TSP)



Intersections Crossed: 10

Next:

Pike / Madison

Active TSP

Intersections Crossed: 13

Next:

Madison / Oliver

Early return to green

Time saved to last intersection:

02:50

Results

Previous illustration:

- **Typical savings of 3 min. 14 sec. for AM SB buses**
- **TSP actions at 8 of 24 available intersections**
- **6 TSP actions were early return to green and 2 were green extensions**

The benefits of this type of analysis to optimize TSP operation are clear.

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High Quality Visualization

Allen and Delancey Street, Lower Manhattan

Actual Benefits – M15 Select Buses

Travel Time Savings				
Period	Min/Bus-Trip		%	
	NB/EB	SB/WB	NB/EB	SB/WB
AM Peak	3.5	2.6	**18.4**	**13.7**
Mid-Day	0.7	1.7	**4.4**	**9.1**
PM Peak	3.2	2.6	**16.2**	**14.5**

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Current Status

- TSP operational in Lower Manhattan
- "After Study" confirmed effectiveness
- Analyses underway for 10 other corridors
- Four corridors coming on line in fall 2015:
  - ✓ Brooklyn – Nostrand Avenue, Utica Avenue
  - ✓ Bronx – Webster Avenue
  - ✓ Staten Island – Hylan Boulevard (including portion in Brooklyn)
- More corridors being selected for future expansion

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Next Steps

- **Perform After Studies on 4 new corridors**
- **Implement TSP on remaining 6 study corridors**
- **Develop TMC systems for on-going monitoring and fine-tuning of TSP operations**
- **Develop TSP plans for more corridors – 10 more envisioned now!**

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Next Steps – TSP Support Systems

- **New simulation displays to:**
  - **Confirm input specifications**
  - **Visualize impacts on signal operations**

- **New displays in Traffic Management Center:**
  - **Confirm input specifications**
  - **Verify field operations**
  - **Assess impacts**

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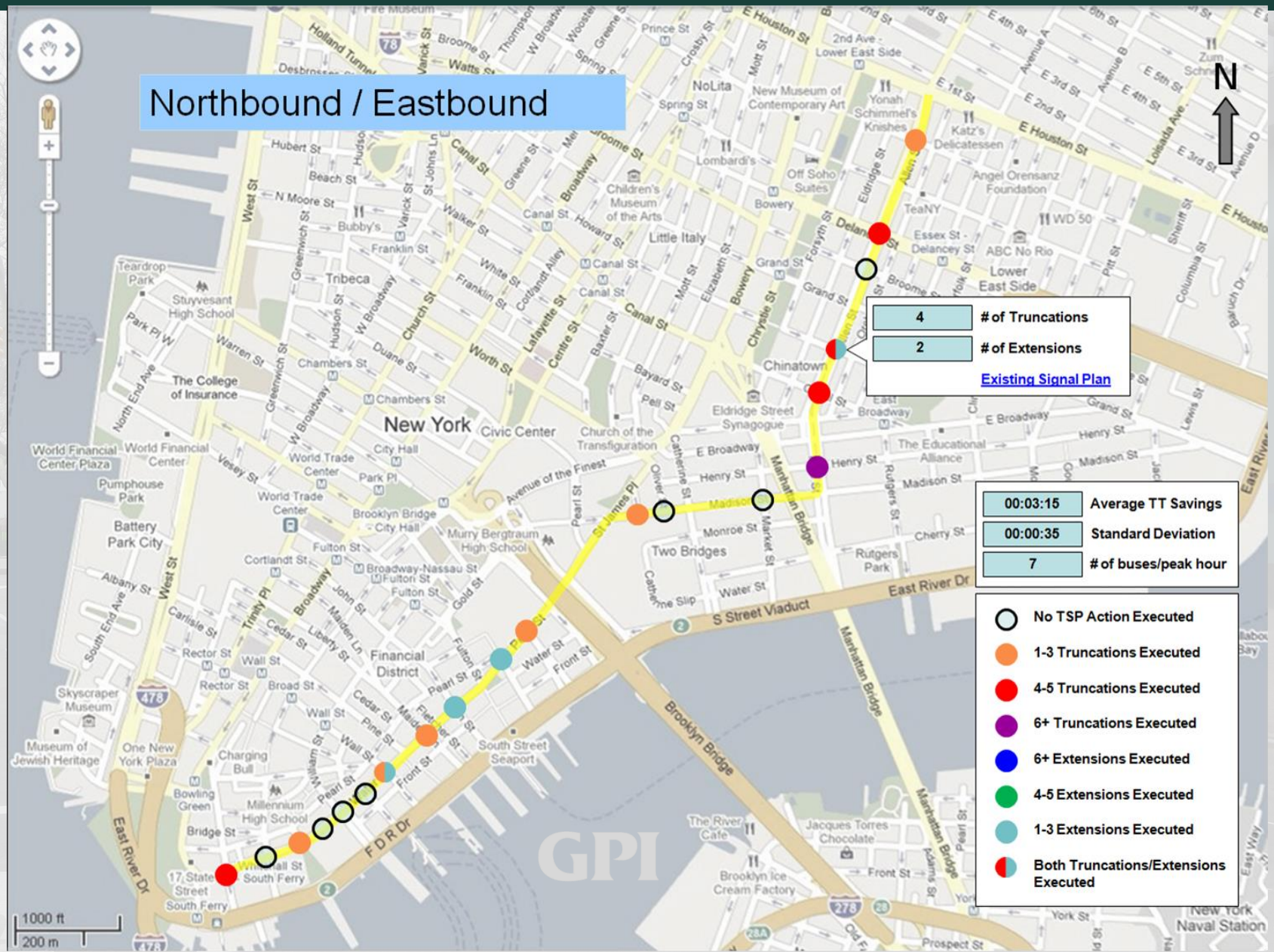
New Displays- TSP Action Map



New Displays- TSP Signal Operations

	Normal Cycle	Max TSP Cycle	Avg TSP Cycle
1st Avenue & E. 1st Street	45 / 55	30 / 70	40 / 60
Allen Street & Stanton Street	40 / 60	35 / 65	37 / 63
Allen Street & Delancey Street	48 / 52	40 / 60	45 / 55

- Main Street Green
- Main Street Red

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Questions?

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