Traffic Engineering for Optimal TSP Success

GPI Engineering | Construction | Design | Planning

PennState College of Engineering

TRANSPORTATION ENGINEERING AND SAFETY CONFERENCE

Agenda

- Introduction
- Challenges
- Solution Process
- Traffic Engineering Decisions
- Case Study
- Results

About Presenter

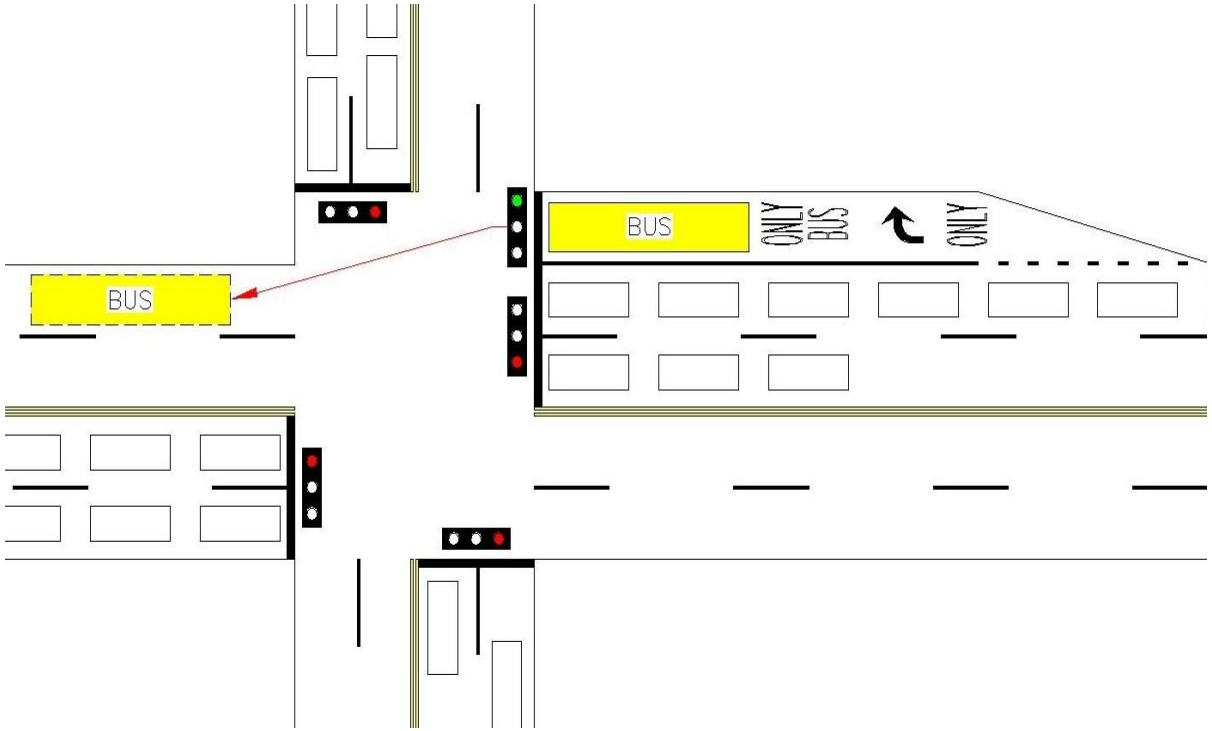
Mark Yedlin

- PI of 1981 FHWA research on TSP
- 21 TSP projects since 1997
- Traffic engineering consultant for NYCDOT city-wide TSP since 2011

GPI:

- Full service Engineering Firm
- Staff of 1500 in over 40 US offices
- **6 offices in Pennsylvania**

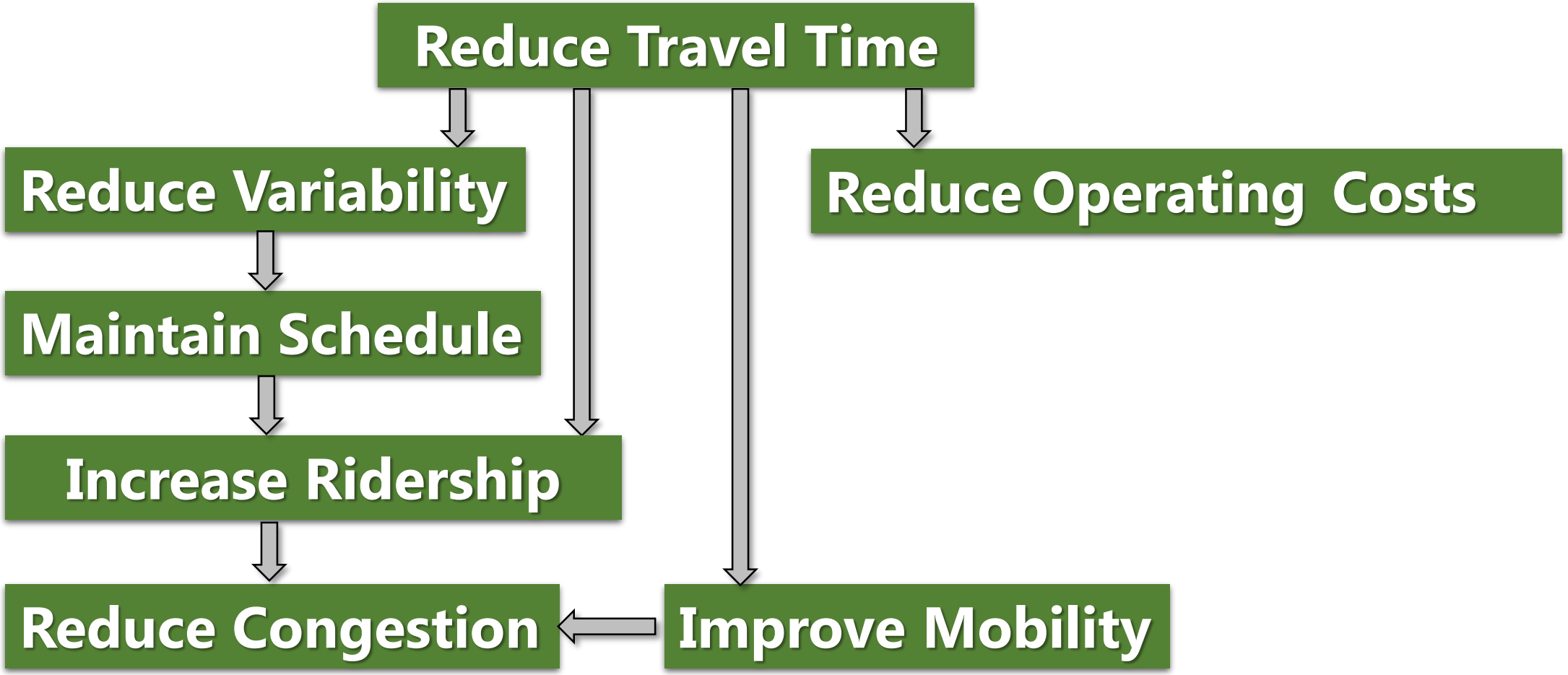
What is TSP?



Real Time signal adjustments to expedite buses:

- Extend Green
- Early Green
- Advance Green (Queue jump)

Why TSP?


Reduce Travel Time
Reduce Variability
Reduce Operating Costs
Maintain Schedule
Increase Ridership
Reduce Congestion
Improve Mobility

The devil is in the details

- Can you see it?
- Now?

We work in the realm of the devil

- Lots of details!!
- Many pitfalls
  - Political
  - Institutional
  - Technical
  - Many voices and choices
- Decisions influence success

Keys to Success

- Start small think big!
- Find a champion!
- Bring agencies together
- Communicate x 3
- Know what's needed
- Understand constraints
- Address bottlenecks
- Good traffic engineering!!

Start Small – Think BIG

- Pick pilot to succeed
  - Opportunities for improvement
  - Reasonable cross street volumes
- Keep eye on the future
  - Anticipate full roll-out
  - Plan system wide policies, hardware

Find a Champion!

- Lead process
- Take responsibility
- Shephard agencies to consensus
- Keep pushing!!

Bring Agencies Together

- Department of Transportation
- Transit Agency
- Consultants
- Multiple staff in each

- Recognize different:
  - Priorities
  - Agendas
  - Responsibilities
  - Cost/Benefit realities

Communicate, Communicate, Communicate!

- Throughout process
  - Objectives
  - Policies
  - Design
  - Implementation
  - Acceptance testing
  - Ongoing operations
- Even within same agency!

What are the constraints?

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

How should it work?

- Primary objectives?
- Conditional, Unconditional TSP?
- Coordination?
- Transition?
- Competing calls?
- How soon to accept next call?
- Door switches?

What do we have to Decide?

- What timings/offsets?
- Which intersections?
- What phases?
- How much time?
- When to act?
- Which call?
- Queue jumps?
- What are effects?
- Is it worth it?

Answers vary by time of day

Also vary by direction

Simulation invaluable!

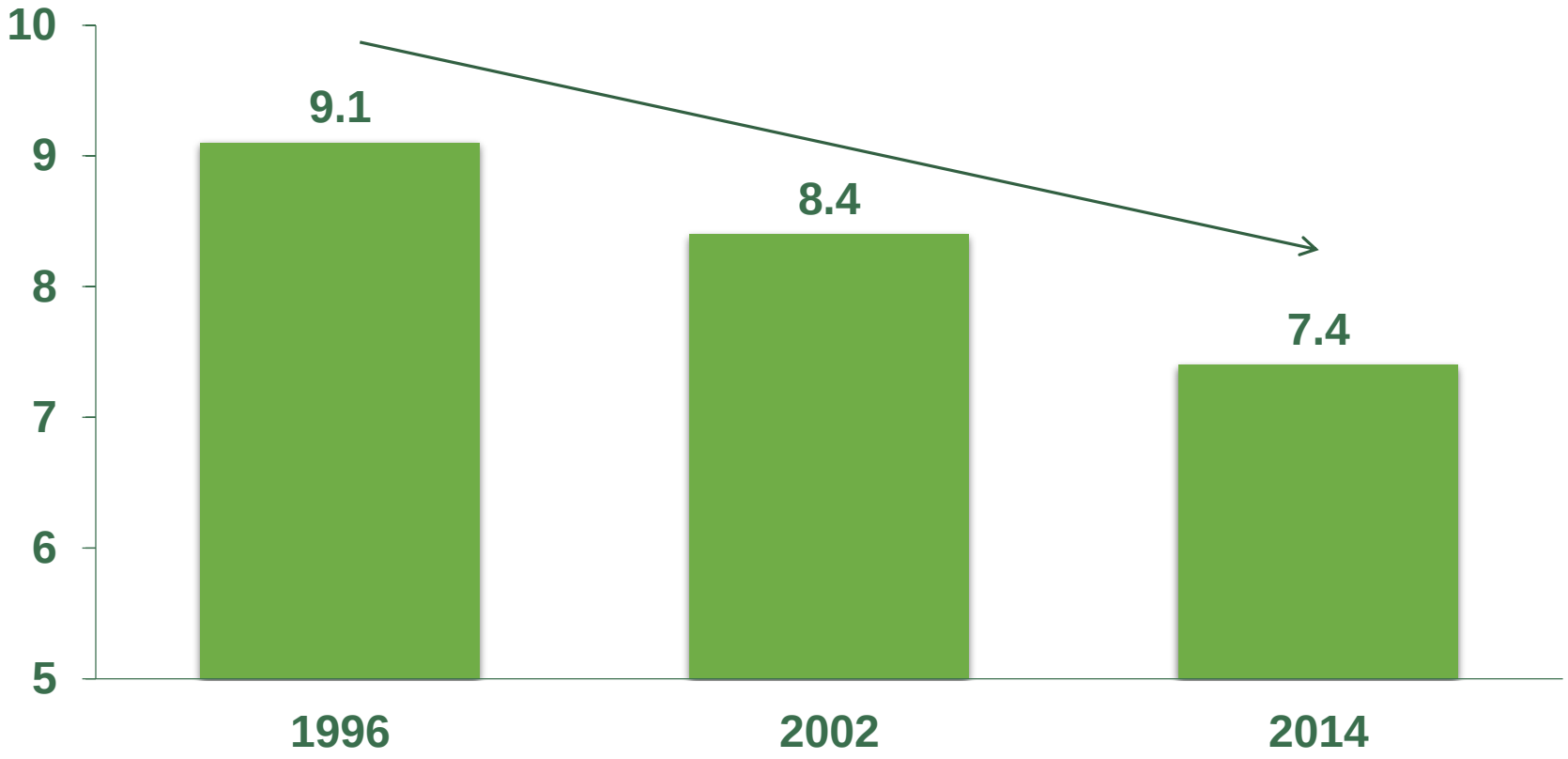
Why simulate?

- Resolve the decisions
- Determine savings for buses
- Determine effects on others
- Examine tradeoffs
- Optimize system
- Justify funding!!!

Public Transit in NYC

- 5.7 million subway, 2.4 million bus riders per day
- **5,700** buses on 2,800 miles of routes
- Public transit system operated by MTA NYC Transit
- Streets and **13,000** signalized intersections operated by NYCDOT

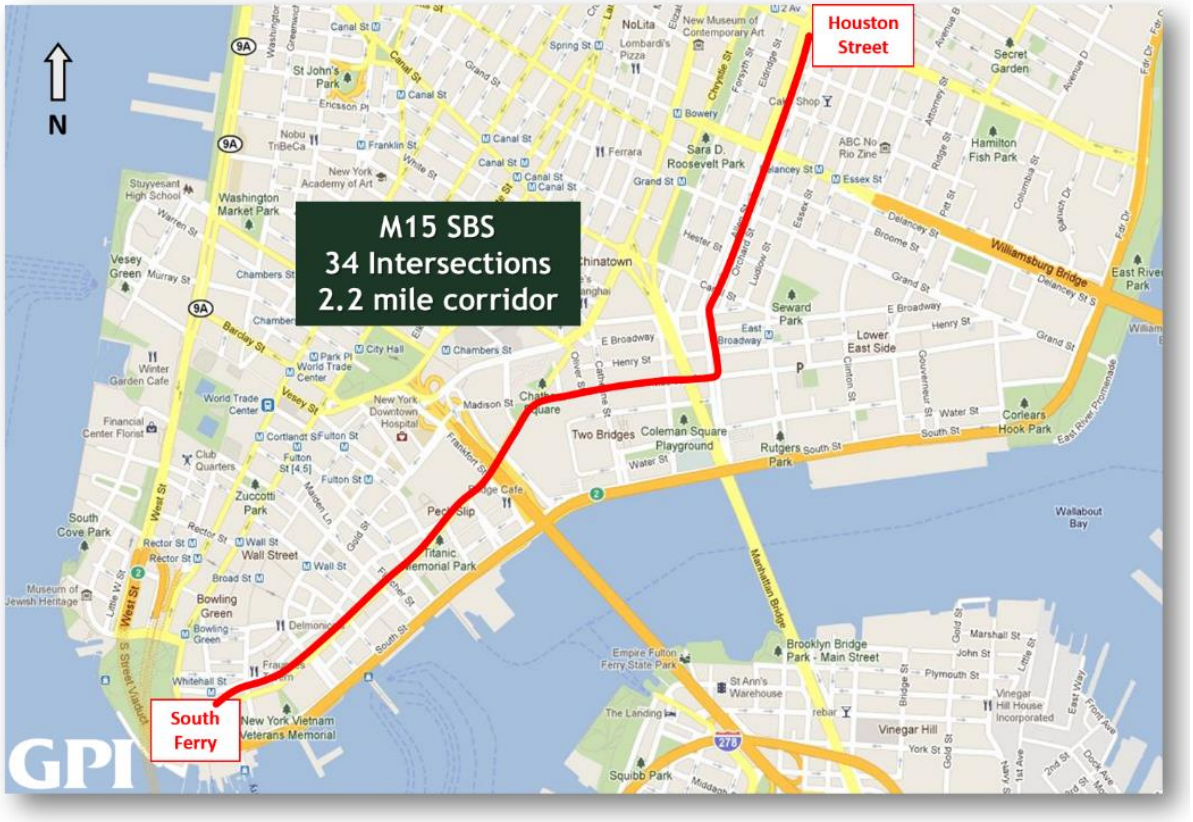
Problem: Bus Speeds in NYC



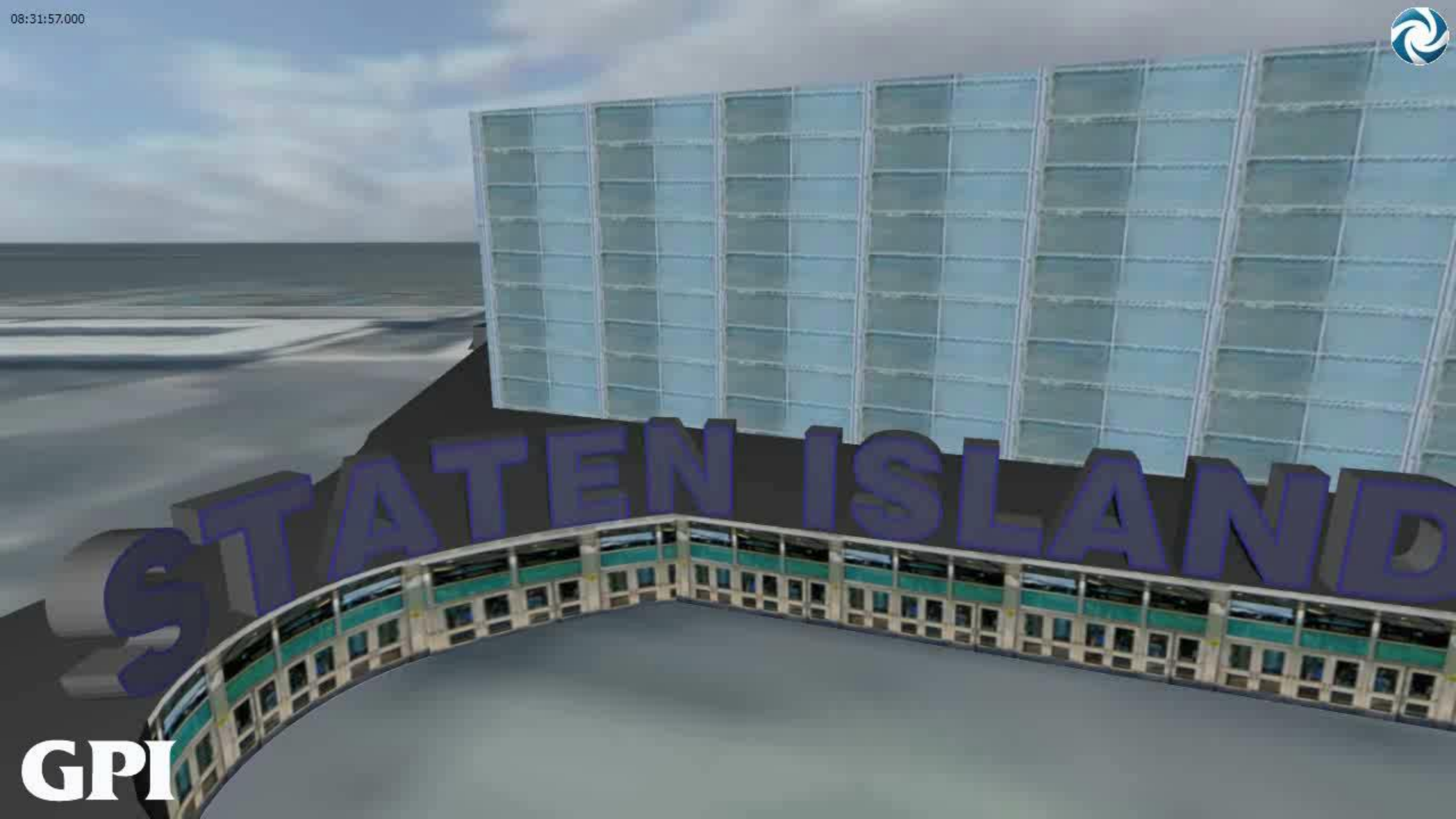
Sources: MTA

National Transit Database

Case Study: TSP in NYC



- Wall Street Financial District
- 2nd highest ridership in city
- Intermodal route
- Lots of pedestrians, bicycles
- Unloading trucks
- Congested
- Coordination
- Canyon for GPS signal
- Success ***unlikely!***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STATEN ISLAND
GPI

Comparing Bus Operations With and Without TSP

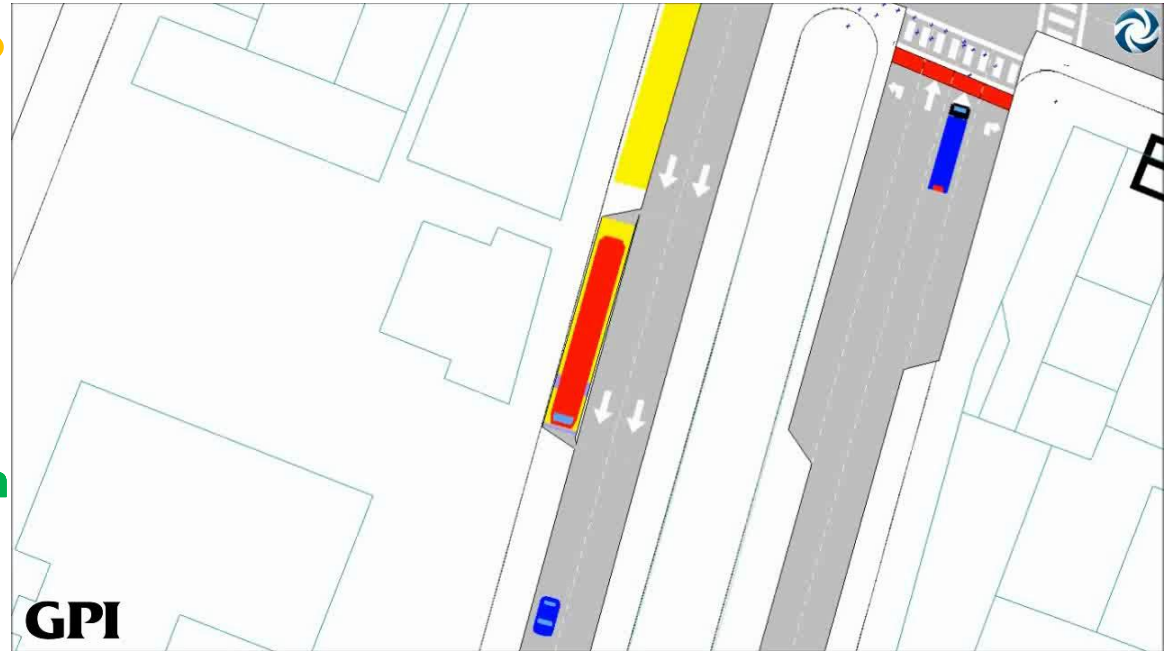
Without TSP

Intersections Crossed: [redacted]

Next:

[redacted]

Active TSP



Intersections Crossed: [redacted]

Next:

[redacted]

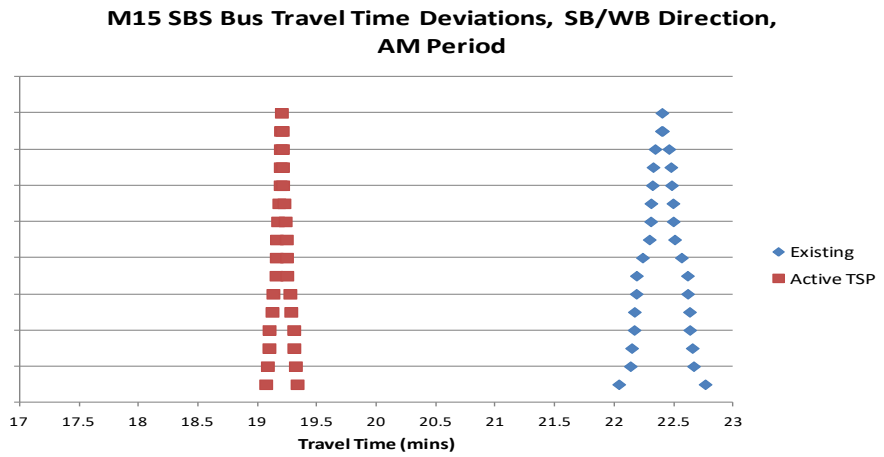
Time saved to last intersection:

0[redacted]:[redacted]

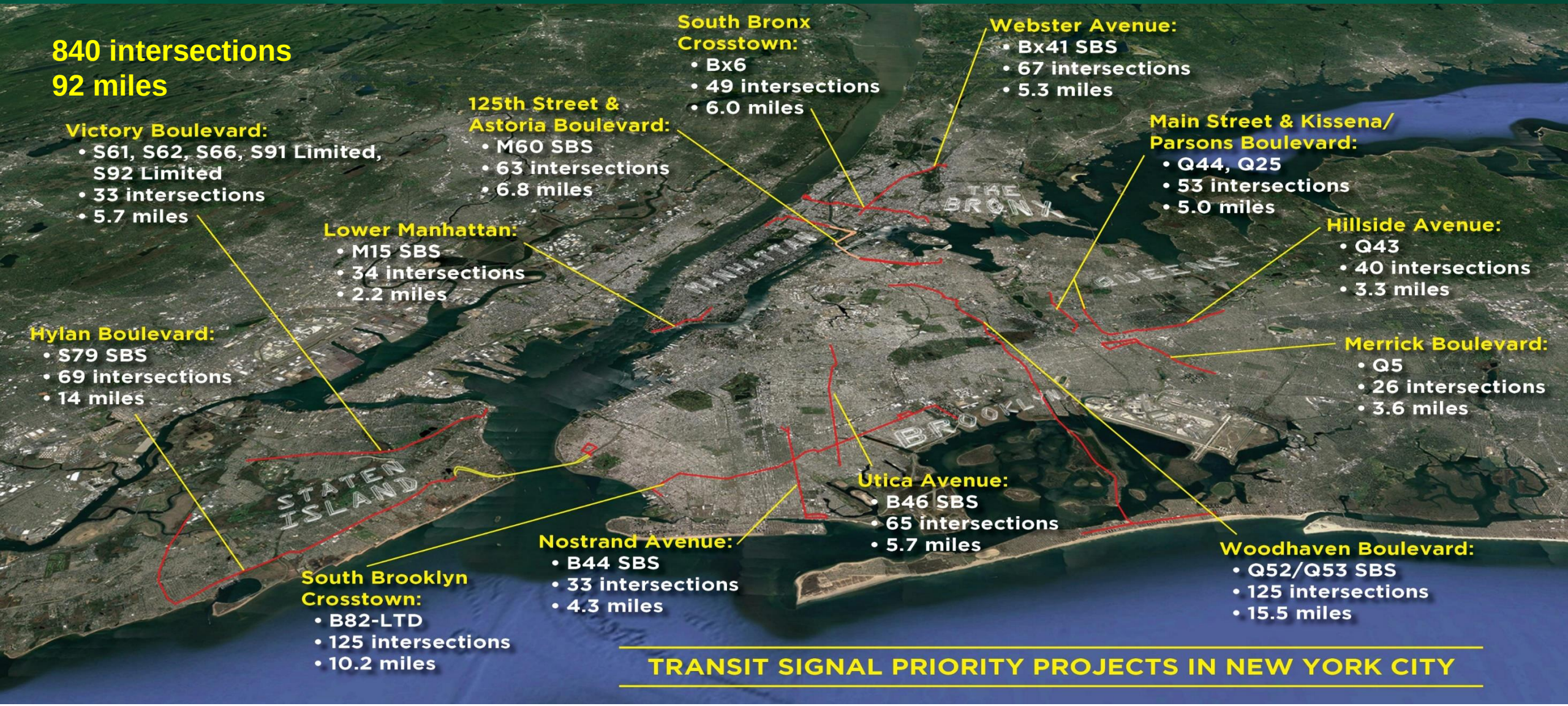
Results: Win-Win!

Travel Time Savings

Period	Min/Bus trip		%	
	NB	SB	NB	SB
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



- Lowered Bus Travel Time
  - Up to 18.4%
- Reduced Delay for Other Traffic
  - Side streets improved too!
  - Side street delay: 3.2 to 10.3%
  - Peak hour delay for corridor: 12.4 to 15.1%
  - Peak hour delay for all traffic: 8.3 to 11.9%
- Lowered Variability
  - Improved reliability


840 intersections
92 miles
Victory Boulevard:
• S61, S62, S66, S91 Limited, S92 Limited
• 33 intersections
• 5.7 miles
Hylan Boulevard:
• S79 SBS
• 69 intersections
• 14 miles
Lower Manhattan:
• M15 SBS
• 34 intersections
• 2.2 miles
125th Street & Astoria Boulevard:
• M60 SBS
• 63 intersections
• 6.8 miles
South Bronx Crosstown:
• Bx6
• 49 intersections
• 6.0 miles
Webster Avenue:
• Bx41 SBS
• 67 intersections
• 5.3 miles
Main Street & Kissena/ Parsons Boulevard:
• Q44, Q25
• 53 intersections
• 5.0 miles
Hillside Avenue:
• Q43
• 40 intersections
• 3.3 miles
Merrick Boulevard:
• Q5
• 26 intersections
• 3.6 miles
Utica Avenue:
• B46 SBS
• 65 intersections
• 5.7 miles
Nostrand Avenue:
• B44 SBS
• 33 intersections
• 4.3 miles
South Brooklyn Crosstown:
• B82-LTD
• 125 intersections
• 10.2 miles
Woodhaven Boulevard:
• Q52/Q53 SBS
• 125 intersections
• 15.5 miles
STATEN ISLAND
MANHATTAN
THE BRONX
QUEENS
BROOKLYN
TRANSIT SIGNAL PRIORITY PROJECTS IN NEW YORK CITY

Keys to Success

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- Communicate!!!
- Know what's needed
- Understand constraints
- Address bottlenecks
- **Simulation and good traffic engineering!!**

Questions?

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Thank you!