



January 11th 2022

PTAC Engineering/Evaluation Subcommittee

Pedestrian Signal Timing

- Signaling Basics
 - Exclusive pedestrian phasing
 - Concurrent pedestrian phasing
 - Leading pedestrian/transit/bike intervals – LPIs, LTIs, & LBIs
- Discussion of tradeoffs
 - Pedestrian delay vs crossing comfort
 - Perception of safety vs proven safety
 - Compliance concerns
 - Impacts on transit service
- What do other local cities do?
- Washington/Webster/Somerville Ave intersection
 - Challenges with existing signal timing
 - Possible modifications
 - What we want to know from the committee

Local Guidance

City of Cambridge:

- Pedestrians long noted to cross concurrently no matter what the pedestrian signal indicated, (when traffic signals were set to run exclusive, most pedestrians crossed with the vehicle green light rather than wait)
- As of 1997, concurrent with LPIs is official policy, except for at 'T' intersections and at intersections with many turning vehicles.

Boston

- Complete Streets Guidelines encourages concurrent phasing, except when conflicting turning vehicle volumes are equal to or greater than 250 vehicles per hour.

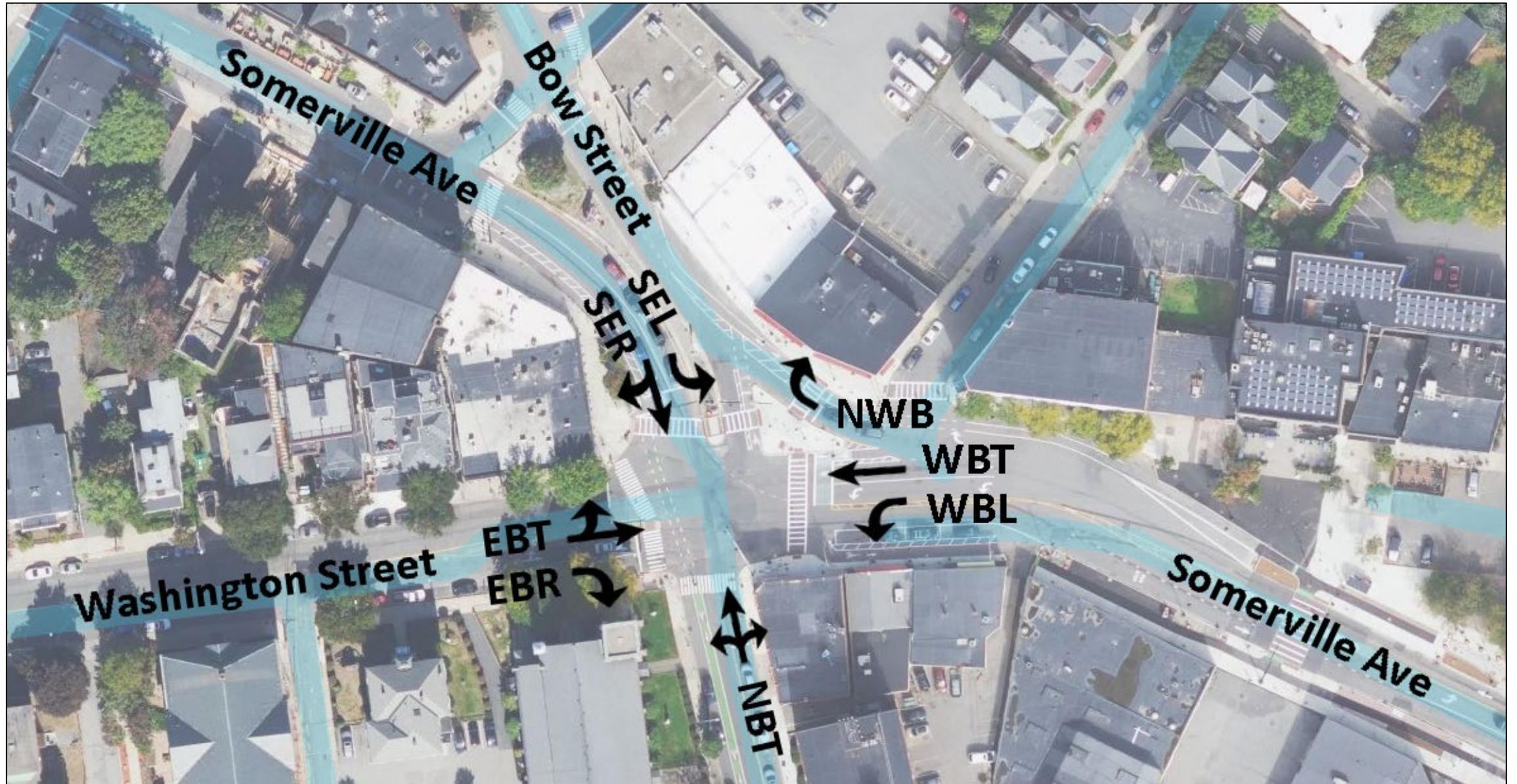
Walk Boston (Advocacy Group)

- Recommends concurrent with LPIs and NTOR if there are not high turning movements.
- Notes studies showing pedestrians will only wait 30 seconds.

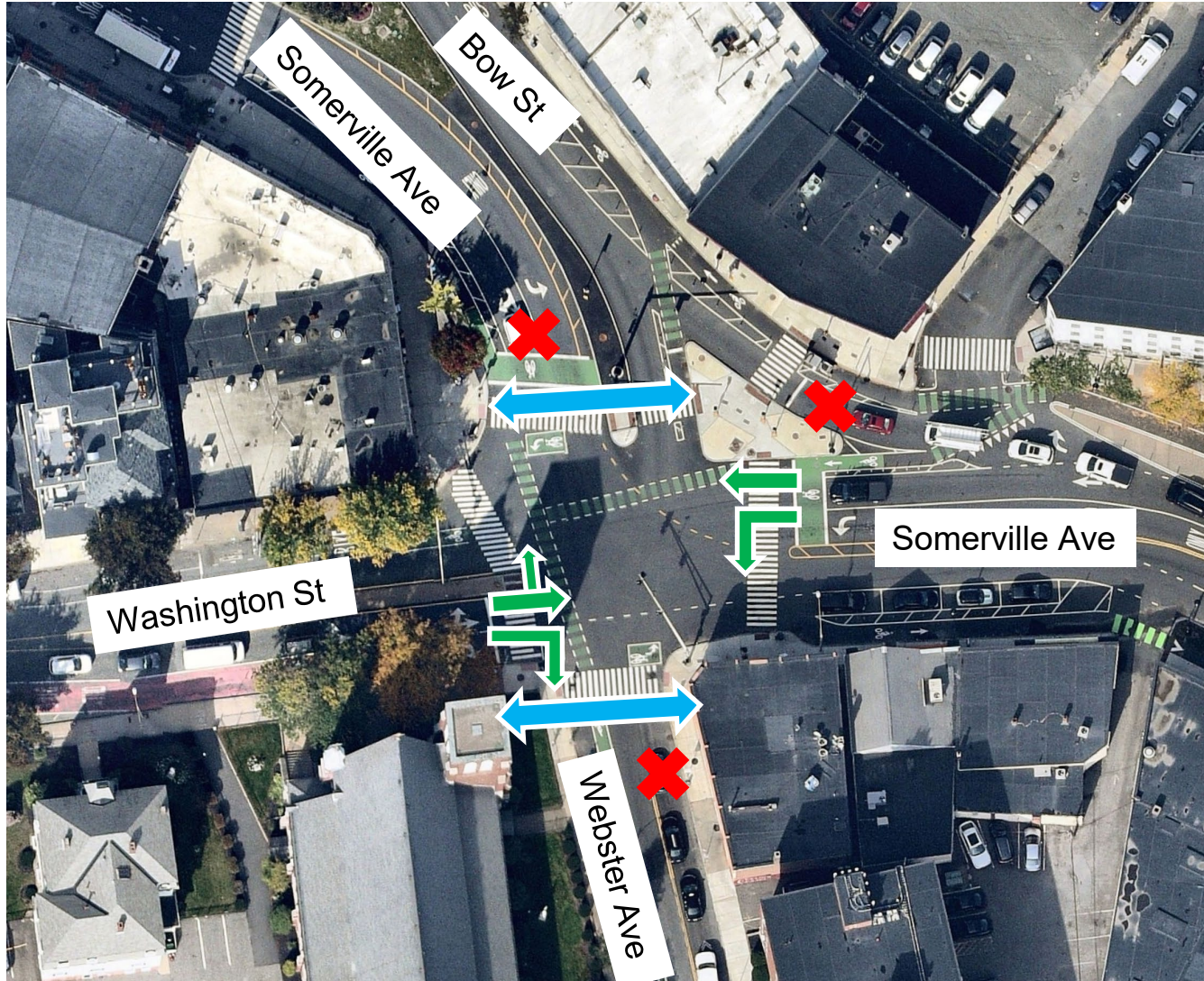
MAPC (Regional Planning Agency)

- Also recommends considering the overall pedestrian volume and crossing distance.

Washington/Webster/Somerville Intersection

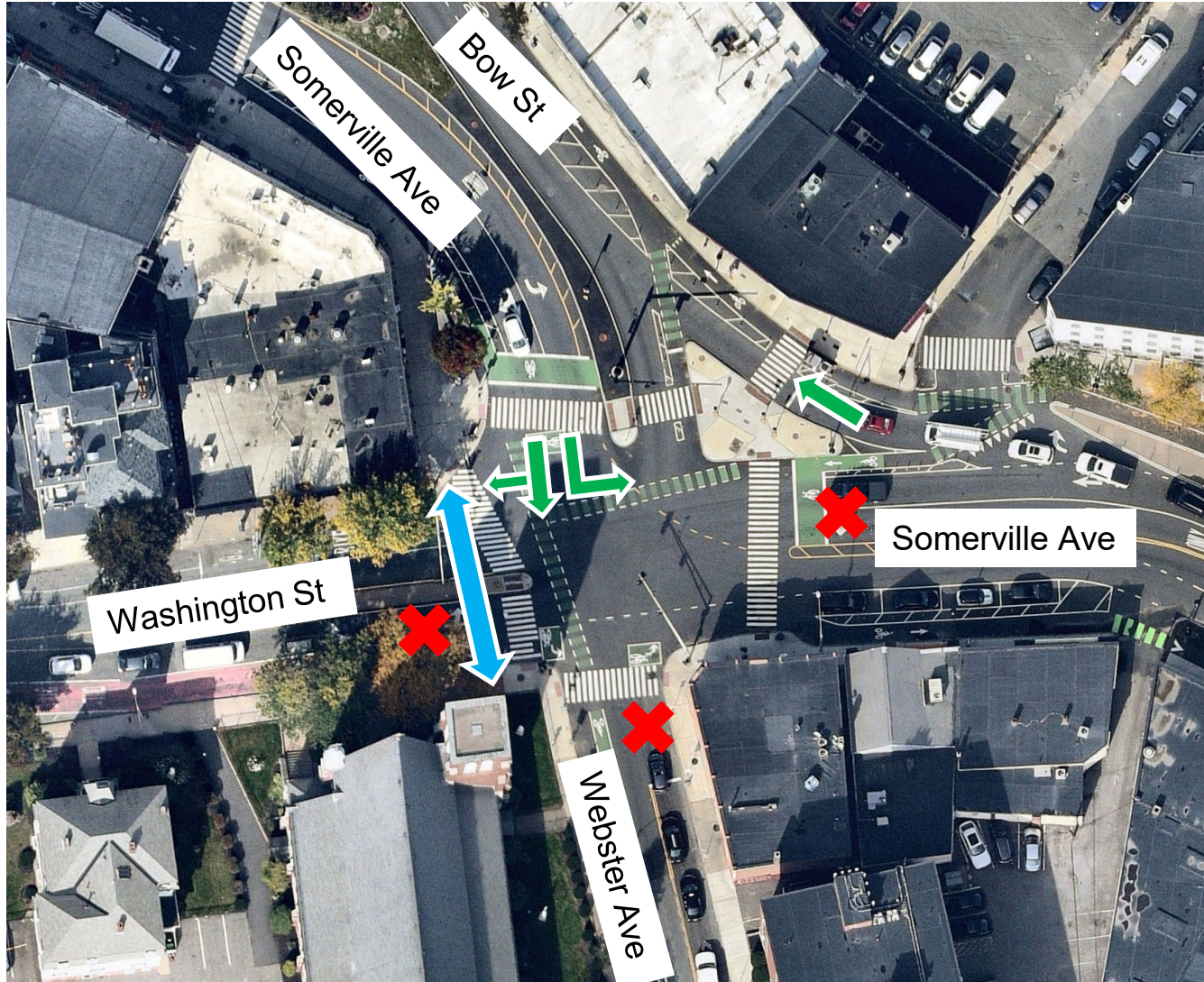


Phasing Pattern



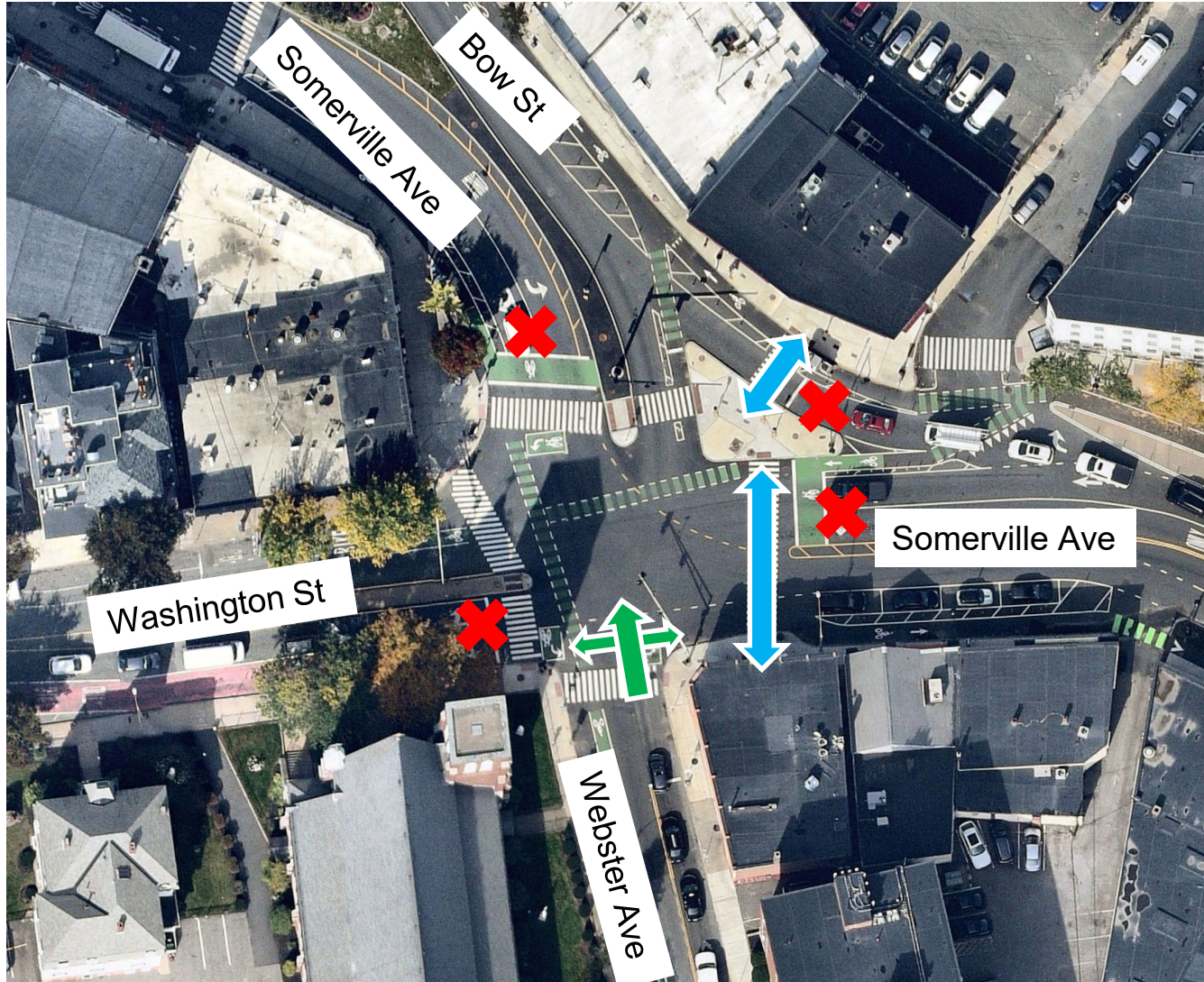
- 5 second LPI for pedestrians

Phasing Pattern



- 5 second LPI for pedestrians

Phasing Pattern



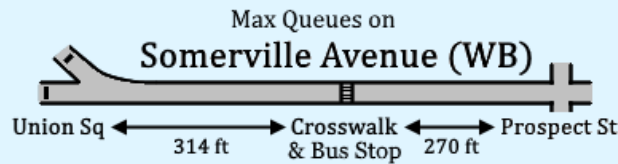
- 5 second LPI for pedestrians

Alternatives Analysis

UNION SQUARE - SOMERVILLE Alternatives Analysis



D Vehicular Level of Service (A-F)
55 Average Pedestrian Wait Time (in Seconds)



Scenario #1 (Existing)
 Concurrent Pedestrian Phasing

Time	Level of Service	Average Pedestrian Wait Time (s)	Max Queue (ft)
AM	D	55	220ft
PM	F	55	700ft

Scenario #2
 Exclusive Pedestrian Phasing

Time	Level of Service	Average Pedestrian Wait Time (s)	Max Queue (ft)
AM	E	55*	278ft
PM	F	70*	811ft

Scenario #3
 Exclusive Pedestrian Phasing
 Prohibition of Eastbound Left Turn

Time	Level of Service	Average Pedestrian Wait Time (s)	Max Queue (ft)
AM	D	55*	155ft
PM	D	55*	382ft

Scenario #5
 Concurrent Pedestrian Phasing

Time	Level of Service	Average Pedestrian Wait Time (s)	Max Queue (ft)
AM	D	55	56ft
PM	D	70	115ft

Westbound Right Turn operates at all times under yield conditions, except when pedestrian phase is called.

Scenario #6
 Exclusive Pedestrian Phasing

Time	Level of Service	Average Pedestrian Wait Time (s)	Max Queue (ft)
AM	D	70*	93ft
PM	D	70*	199ft

Westbound Right Turn operates at all times under yield conditions, except when pedestrian phase is called.

A Leading Bus Interval can be added on Washington Street Eastbound for minimal impact. Short queues on Somerville Avenue Westbound limit bus-delaying blockages.

Average Pedestrian Wait Times are directly proportional to signal cycle length. This assumes equal pedestrian distribution in terms of time and direction.

Intersection Analysis done using the Synchro 11 software. Level of Service is based off of average vehicle delay.

Delisted Scenarios

Scenario #4 Scenario 4 was the addition of an exclusive pedestrian phase to the existing phasing, with no other changes. Delisted due to poor performance.



Wait time to cross one leg of intersection (both only if crossing diagonally). See detailed wait time analysis.

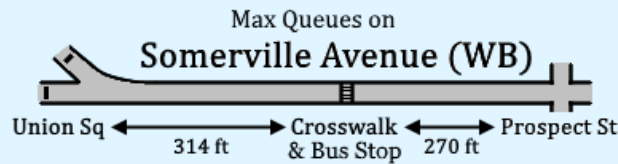
Alternatives Analysis

UNION SQUARE - SOMERVILLE Alternatives Analysis



D Vehicular Level of Service (A-F)

55 Average Pedestrian Wait Time (in Seconds)



Scenario #1:

Existing phasing scenario. PM queues can block midblock crosswalk and Prospect St intersection. Queues of this length to access Bow St block access to WB through lane to Washington St. Of particular concern for transit operations.

Conditions like this observed at time of the day outside of PM Peak.

This is the baseline condition this analysis seeks to improve upon.

Scenario #1
(Existing)



Scenario #2



Scenario #3



* Wait time to cross one leg of intersection (both only if crossing diagonally). See detailed wait time analysis.

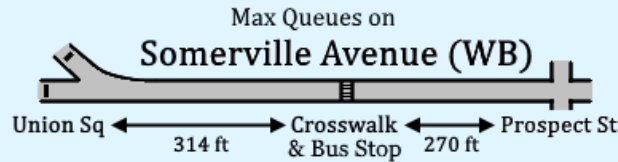
Alternatives Analysis

UNION SQUARE - SOMERVILLE Alternatives Analysis



D Vehicular Level of Service (A-F)

55 Average Pedestrian Wait Time (in Seconds)



Scenario #1 (Existing)

Time	Level of Service	Avg. Wait Time	Max Queue
AM	D	55	220ft
PM	F	55	700ft

Concurrent Pedestrian Phasing

Scenario #2

Time	Level of Service	Avg. Wait Time	Max Queue
AM	E	55*	278ft
PM	F	70*	811ft

Exclusive Pedestrian Phasing

Scenario #3

Time	Level of Service	Avg. Wait Time	Max Queue
AM	D	55*	155ft
PM	D	55*	382ft

Exclusive Pedestrian Phasing
Prohibition of Eastbound Left Turn

Scenario #2:

Adds exclusive pedestrian phase to existing pattern, lengthens PM cycle length to mitigate queue length impacts.

Queue still increase along with wait times.

Alternative not recommended.

[Note – Scenario 4 is the same as 2, but without cycle length adjustments, leading to even poorer performance. Not recommended.]

Delisted Scenarios

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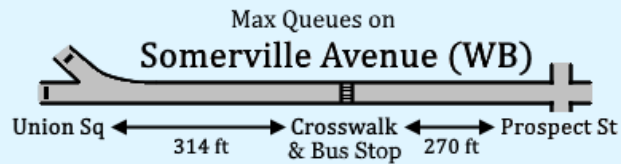
Alternatives Analysis

UNION SQUARE - SOMERVILLE Alternatives Analysis



D Vehicular Level of Service (A-F)

55 Average Pedestrian Wait Time (in Seconds)



Scenario #1 (Existing)
Concurrent Pedestrian Phasing

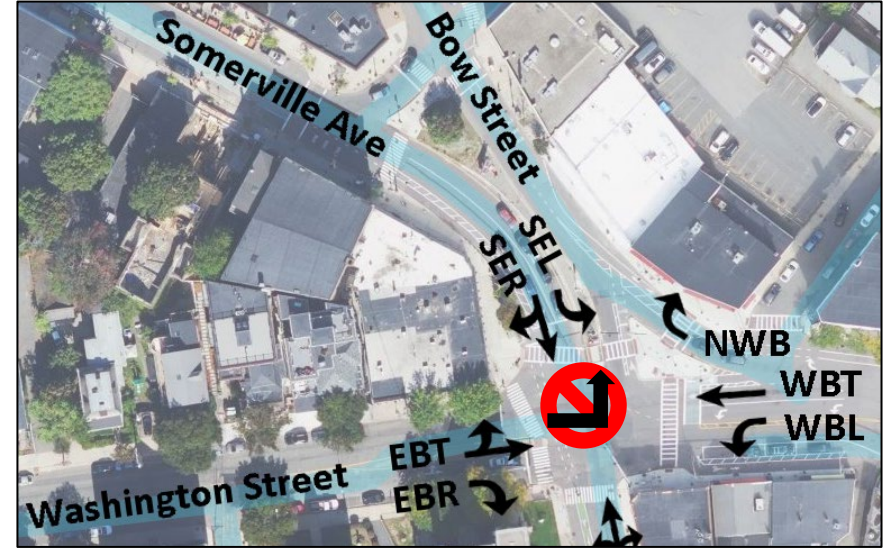
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Scenario #3
Exclusive Pedestrian Phasing
Prohibition of Eastbound Left Turn

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Scenario #3:

Alternative prohibits left turns on to Bow St from eastbound Washington St, includes an exclusive pedestrian phase.

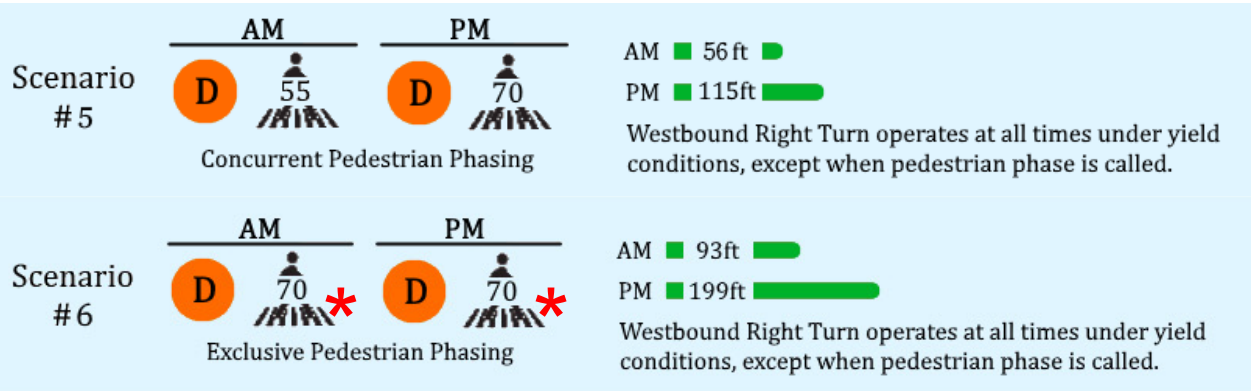
Queues mitigated, but still extend to the mid block crosswalk. This would still block access to WB through lane to Washington St. Concern for transit operations.

Compliance with turning restriction and spillover traffic onto Hawking St are also a concerns.

Alternative not recommended.

* Wait time to cross one leg of intersection (both only if crossing diagonally). See detailed wait time analysis.

Alternatives Analysis



Scenario #5:

Concurrent pedestrian signaling alternative that allows Bow St slip lane to operate at all times under yield conditions.

Can operate with a push button for a red light / pedestrian signal, or without either vehicle or ped signals (like the entrance to a roundabout, for example Powder House Cir).

Option without signals allows pedestrians to cross at any time – given single direction of traffic and very short 20' crossing distance a high rate of yielding would be expected. This may be a preferable option for all users.

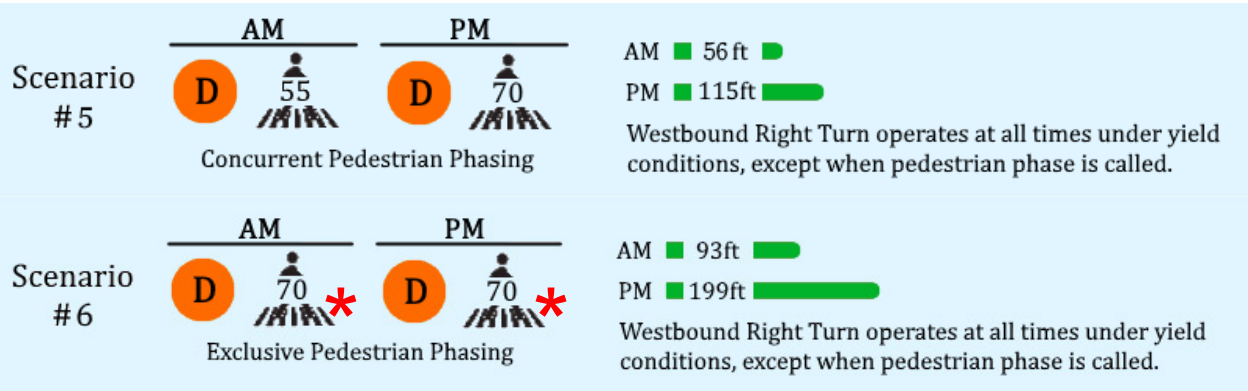
Best alternative with concurrent pedestrian signals.

We can test this scenario without new equipment or programming by bagging the signals and adding signage

- A Leading Bus Interval can be added on Washington Street Eastbound for minimal impact. Short queues on Somerville Avenue Westbound limit bus-delaying blockages.
- Average Pedestrian Wait Times are directly proportional to signal cycle length. This assumes equal pedestrian distribution in terms of time and direction.
- Intersection Analysis done using the Synchro 11 software. Level of Service is based off of average vehicle delay.

* Wait time to cross one leg of intersection (both only if crossing diagonally). See detailed wait time analysis.

Alternatives Analysis



Scenario #6:

Exclusive pedestrian signaling alternative that allows Bow St slip lane to operate at all times under yield conditions.

Can operate with a push button for a red light / pedestrian signal, or without either vehicle or ped signals (like the entrance to a roundabout, for example Powder House Cir).

Option without signals allows pedestrians to cross at any time – given single direction of traffic and very short 20' crossing distance a high rate of yielding would be expected. This may be a preferable option for all users.

Best alternative with exclusive pedestrian signals.

A Leading Bus Interval can be added on Washington Street Eastbound for minimal impact. Short queues on Somerville Avenue Westbound limit bus-delaying blockages.

Average Pedestrian Wait Times are directly proportional to signal cycle length. This assumes equal pedestrian distribution in terms of time and direction.

Intersection Analysis done using the Synchro 11 software. Level of Service is based off of average vehicle delay.

* Wait time to cross one leg of intersection (both only if crossing diagonally). See detailed wait time analysis.

Alternatives Analysis

- The alternatives analysis identified the best concurrent alternative (5) and exclusive alternative (6).
- Both alternatives allow Bow St slip lane to operate at all times under yield conditions for motor vehicle traffic and have similar options for managing pedestrian crossings.
- Both alternatives mitigate queuing conditions that could block crosswalks/intersections and impact transit operations.
- Major differences are:
 - Exclusive vs concurrent pattern
 - Pedestrian wait times
 - Overall cycle length

Detailed Wait Time Analysis

<u>EXCLUSIVE PED PHASING</u>	Destination			
Origin	NW Corner (Gracie's)	SW Corner (Prospect Hill Academy)	SE Corner (Mama Gina's)	NE Corner (Reliable Market)
NW Corner (Gracie's)		52	127	52
SW Corner (Prospect Hill Academy)	52		52	127
SE Corner (Mama Gina's)	127	52		52
NE Corner (Reliable Market)	52	127	52	
Average wait to cross one xwalk	52 seconds			
Average wait to cross two xwalks	127 seconds	<i><- Does not include the time walking across the first crosswalk, only time spent waiting</i>		
<u>CONCURRENT PED PHASING</u>	Destination			
Origin	NW Corner (Gracie's)	SW Corner (Prospect Hill Academy)	SE Corner (Mama Gina's)	NE Corner (Reliable Market)
NW Corner (Gracie's)		52	81	52
SW Corner (Prospect Hill Academy)	52		52	81
SE Corner (Mama Gina's)	43	52		52
NE Corner (Reliable Market)	52	43	52	
Average wait to cross one xwalk	52 seconds			
Average wait to cross two xwalks	62 seconds	<i><- Does not include the time walking across the first crosswalk, only time spent waiting</i>		

- Pedestrian wait time for the exclusive phasing is significant longer when crossing more than one crosswalk (a.k.a. crossing to the opposite corner of the intersection).
- Wait times include time waiting for signal, not time crossing.

Summary

- There is not a black and white “right answer” for this intersection, however we have concern with the pedestrian wait times in the exclusive phase.
- There are additional measures we can take to improve pedestrian comfort in concurrent phasing:
 - Low/Medium impact:
 - “Turning vehicles yield” signage on all approaches
 - Blinking yellow turn arrows in certain directions.
 - Medium/High impact
 - Longer LPIs of 7-10 seconds
 - Dedicated left turn phases that eliminate most concerning conflicts (being explored now)
- Goals for this meeting:
 - Analyze and discuss the options
 - Understand how PTAC weights the different tradeoffs at this intersection.
 - Understand which turning conflicts are of most concern
- We will also have future opportunities to keep improving and simplifying operations at this intersection through the Union Square Plaza and Streetscape Design.