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Traffic Management on Broadway Corridor, Everett, MA

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ABSTRACT

During peak periods, Everett's Upper Broadway Corridor – from Ferry St. and Gladstone Street – faces crippling traffic congestion that hurts the street's businesses, makes bus service on this important transit corridor slow and unreliable, and imposes substantial delay on residents Everett and other travelers. This study focuses on investigating the causes of traffic congestion and developing traffic management solutions to increase capacity and thus reduce the congestion and its impacts on road users without increasing the number of lanes, thus keeping the street pedestrian-friendly.

Two significant capacity bottlenecks were identified. One is the school crossing at the (unsignalized) intersection of Broadway with Gladstone. The problem there is not the crossing pedestrians, but rather the left-turning cars from Gladstone that use the pedestrian interruptions as a chance to force their way into traffic, leaving little time for Broadway traffic to run. The other is the all-pedestrian phases that are part of the signalized intersections. They consume a substantial amount of capacity, force signal cycles to be long (132 s at one of the intersections), and lead to intolerably long waiting time for pedestrians, most of whom don't wait for their phase but rather cross concurrent with parallel traffic.

Proposed remedies were changes to traffic circulation on Gladstone Street and new signal timing plans for the signalized intersections with shorter cycle lengths, concurrent pedestrian crossings at all signalized intersections except Ferry Street, and leading pedestrian intervals for crossings with moderate right turn conflicts.

A traffic microsimulation model was built using VISSIM and calibrated to existing conditions in the a.m. peak period. With the proposed remedies, average delay falls from 132 s per vehicle to 45 s, average travel time southbound (the peak direction) is reduced by up to 3 minutes, and average pedestrian delay at signalized intersections is substantially reduced.

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Chapter 1: Introduction and Objectives

Broadway Everett (Figure 1 and 2), MA formerly known as Charlestown Road, functions as a main street (with compact, mixed-use development, a strong retail and entertainment emphasis) particularly the section called Upper Broadway which extends from the traffic Circle at route 16 North to the Malden City line.

Figure 1: Everett Square North Bound, 1911

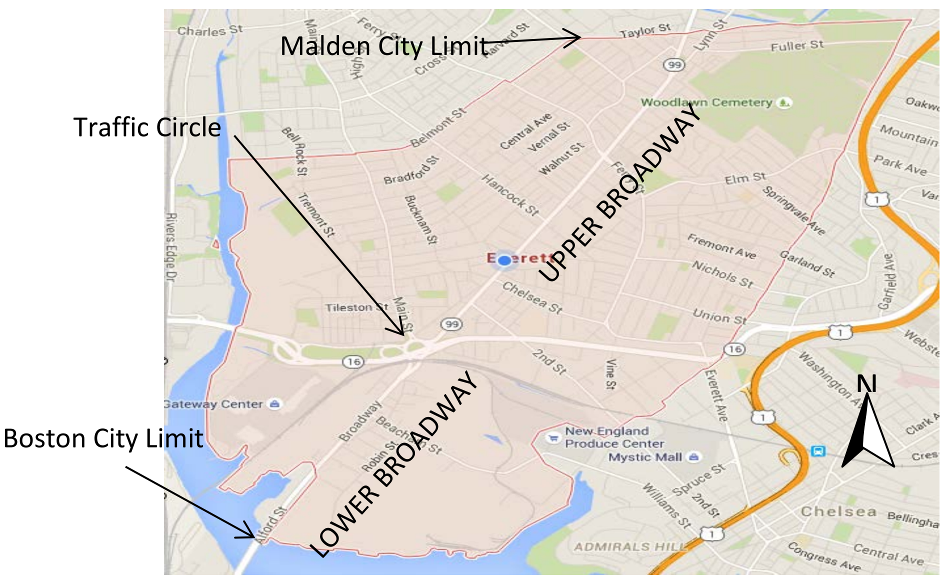


Figure 2: Upper and Lower Broadway, Everett, MA

In recent times, Upper Broadway, especially between Gladstone St and Ferry St, has being facing rising in traffic congestion. It is bad Southbound (SB) in the AM and Northbound (NB) in the PM. This congestion is becoming a major concern to the general public (videos of AM peak traffic congestion on Broadway can be found at https://youtu.be/nPYwpyY1Qzg and https://youtu.be/fXtU5QCiuO0). According to a resident, "the City Locals know better to use other routes instead of Broadway during peak periods". During the peak periods, traffic is overwhelming with long queues; wasting productive hours, threatening the economy, and increasing air pollution (a major contributing factor in global warming). Buses which are Everett's only form of public transportation face large delays and cannot run on schedule. The effect on transit is especially bad because they cannot switch to alternative routes as other road users. There are five bus routes plying Upper Broadway significantly affected by the traffic congestion namely; 112 (Wellington – Wood Island), 104 (Malden Station – Sullivan Sq), 109 (Linden Square - Sullivan Square Station), 110 (Wonderland Station – Wellington Station) and 97 (Malden Station – Wellington Station).

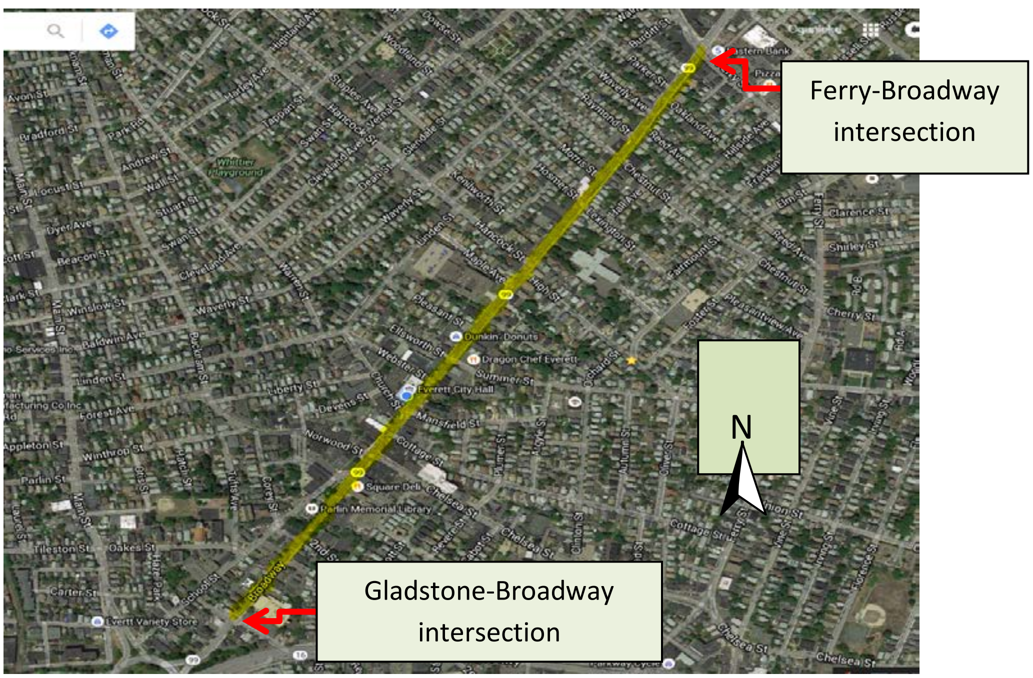


Figure 3: Project Corridor

Problem and Objective

The table below identifies the problem on the corridor, how well individual road user is served and reasons they are not served well.

Table 1: Road users and traffic impact on Broadway, Everett.

User	Well Served?	Comment
Local & Collector Traffic	No	Lots of Congestion.
Transit User	No	Lots of Congestion.
Through Traffic	No, but they are not an intended user.	Through Traffic Should use Route 1, not Route 99 (Broadway).
Pedestrians	Yes and No	- Unsignalized crossings are short (2 lanes) and traffic is slow, crossing is safe. - At Gladstone, crossing guard helps school children cross - All-pedestrian phases give safe crossing, but force long cycles and therefore, long wait. Most pedestrians don't wait.

The objective of this project is to understand the source of congestion and develop ways to reduce congestion and reduce delay for pedestrians. Safety for pedestrians and economic vitality remains top priorities, and so the option of eliminating parking lanes to make Broadway a four-lane road is explicitly ruled out.

The Scope of the project includes traffic data collection (roadway geometry, Signal timing data, traffic volumes, queue length observation) on the Corridor, studying the traffic mix (vehicles, transit, bikers, and pedestrians), modeling the present condition of the corridor to provide both visual and analytical representation of traffic, calibrating the base model created by visually comparing the statistical output with existing conditions observed, developing strategies and plans for improving traffic flow, and then testing them using simulation.

Due to time limitations, only A.M peak was studied. However, the solutions described are likely to apply to midday and PM peak as well.

Roadmap to the report

The Report is organized into 6 Chapters outlined as follows;

Chapter 1: Introduction and Objectives: This Chapter provides an introduction of the project area in its historic context and functional intent. It goes further to identify the objectives of the project, the scope of work and states the road map to the report.

Chapter 2: Description of Existing condition and Data collection: The chapter analyses the existing situation in relation to cause and effect; critically examines the corridor and identifies the bottlenecks and discusses the characteristics of the bottlenecks.

Chapter 3: Broadway/Gladstone Intersection: The focus of this chapter is on the unique characteristics of Gladstone school crossing and its impact on traffic during the morning peak.

Chapter 4: Modeling and Calibrating the Corridor: This chapter describes the creation of a base model in vissim and calibration to reflect the on-ground situation of the corridor during the morning peak. vissim is a well-respected traffic simulation software.

Chapter 5: Design and testing of Local Engineering Remedies: The local engineering remedies involve changes to traffic circulation and signal timing, and then testing. The results will be observed at each intersection and along the Corridor.

Chapter 6: Conclusion: The final chapter reviews the aims and objectives that set off the project to determine if the deliverables for this project was met. The limitations encountered in the course of the project will be discussed and lastly, recommendations will be made to the City of Everett, MA with possible direction of further study.

Chapter 2: Description of Existing condition and Data collection

Existing Condition on Upper Broadway (Gladstone to Ferry Street)

The Corridor has 22 intersections, 5 of which are pre-timed signalized. There is also one intersection with flashing traffic signals (flashing Yellow for the major street and flashing red for the minor street). All the Signalized intersections have an All-Ped phase which works with a push-button. Travel lane width on the main street (Broadway) is approximately 12ft, parking lane is approximately 10ft, sidewalk is also approximately 12ft.Quite a number of the Side streets are one-way streets, and have varying widths.

The Signalized intersections on Upper Broadway from Gladstone St. to Ferry St. shown in figure 4 are as follows;

- Corey/ Second intersection (a four-way Staggered intersection with 2-way traffic on both the minor streets)
- Norwood/ Chelsea intersection (a four- way skewed intersection with one-way out on Norwood but 2-way traffic on Chelsea)
- Hancock/ High intersection (a four-way Staggered intersection with two way traffic on Hancock but one-way in on High Street)
- Hosmer/ Lexington intersection (a four- way skewed intersection with two-way traffic on Lexington but one-way in on Hosmer.
- Ferry St Intersection (a four-way skewed intersection with two-way traffic on both Broadway and Ferry st.)

In addition, school crossing at Gladstone (although not a signalized intersection) has a traffic guard in the AM during school opening and PM during school closing to guard children and parents mostly crossing to Sumner G Whittier School.

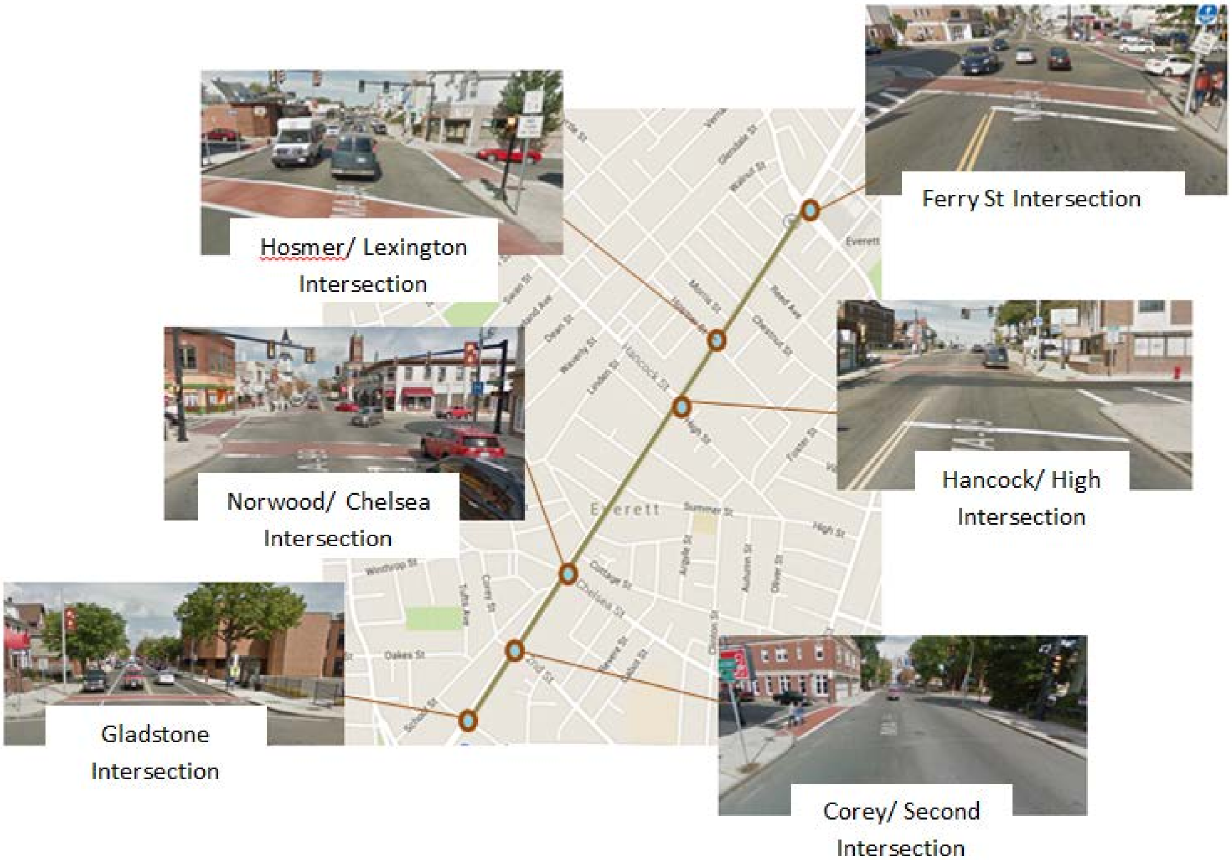


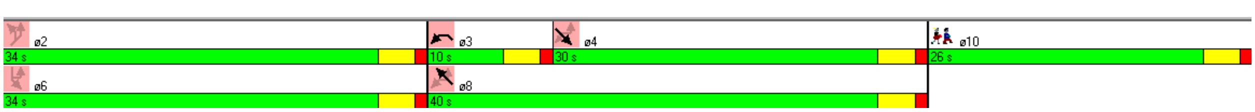
Figure 4: Signalized intersections on the corridor and signalized intersection with school crossing

Splits and Phases

The section describes the cycle length and splits at each of the signalized intersections, splits include green, yellow and all-red clearance time

<u>At Broadway/Ferry Street Intersection </u>(cycle length = 100sec)

Both North and South bound traffic (Broadway) has 34 sec splits. Westbound left has 10sec, the through phase has 30sec split, and Eastbound has 40 sec split. The all-pedestrian phase lasts 26 sec.



<u>At Lexington/Hosmer St Intersection</u> (cycle length = 110sec)

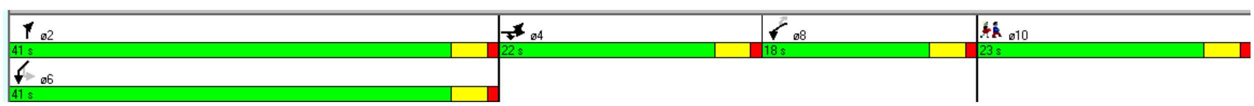
Both North and South bound traffic (Broadway) has 60sec splits, the Westbound has 27sec. The all-pedestrian phase lasts 22 sec.

<u>At Hancock/High St Intersection</u> (cycle length = 117sec)

Both North and South bound traffic (Broadway) has 74sec splits, the Eastbound has 16sec. The all-pedestrian phase lasts 27 sec.

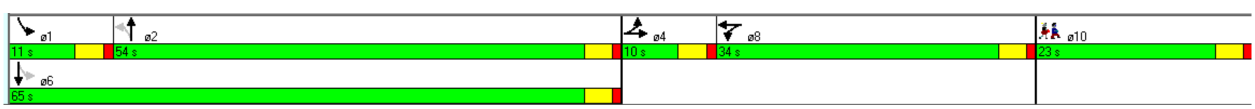
<u>At Chelsea/ Norwood Intersection</u> (cycle length = 104sec)

Both North and South bound traffic (Broadway) has 41sec splits. Eastbound has 22sec and Westbound has 18sec. The all pedestrian phase lasts 23 sec



<u>At Corey/Second Street</u> (cycle length = 132sec)

Corey/Second Street intersection has a protected southbound left of 11sec split. Southbound through has 65sec splits, Northbound has 54sec split, Eastbound has 10 sec split and Westbound has 34 sec split. The all-pedestrian phase last 23 sec



Diagnosing the Problem

To understand the cause of congestion, the project will focus on observed bottlenecks which usually occur at signalized intersections. During the traffic studies conducted on the corridor (Traffic Counts, Video records for the AM peak and observation during PM Peak), intersections of Norwood/Chelsea st. and School crossing at Gladstone were observed to be bottlenecks by virtue of queues.

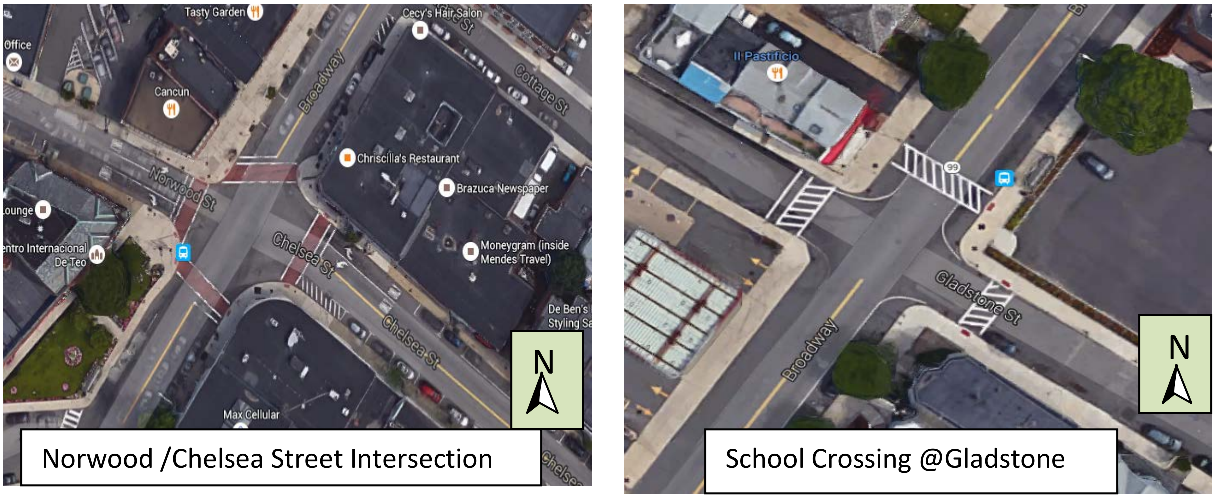


Figure 5: Norwood/ Chelsea intersection and school crossing @Gladstone st.

Reasons for Capacity limitation include;

- *School Crossing at Gladstone*: At the corner of Broadway and Gladstone is the Summer G. Whittier School. Many students and parents cross Broadway to get to and from school during the AM peak with the help of a crossing guard. Frequent stopping of vehicles causes vehicle backup to Corey/Second Street intersection, which further backs up to Chelsea/Norwood intersection.

-*Interlocking protected lefts*: Because of how the intersection with Corey/Second Street is staggered, all vehicles not turning right must turn left before either entering the adjacent minor street or staying on the main street. Hence, eastbound and westbound traffic cannot run simultaneously, but must have distinct signal phases. That creates a long traffic cycle with 4 traffic phases inclusive of an all-pedestrian phase (Lexington/Hosmer is also a staggered intersection, but one of its side street is one-way traffic, making it less of a bottleneck).

- *Lost time for pedestrian phase and Pedestrian interference:* All signalized intersections have all-pedestrian phases pushed nearly every cycle. It's all lost time that hurts capacity, it forces the signal cycle to be long which means long wait for pedestrians. Many pedestrians do not wait, but cross concurrently thereby adding to lost time by blocking cars during car phases.

- *High Input Traffic Volume:* Upper Broadway has high input volume Southbound at Ferry Street. However, there isn't any obvious way to divert traffic. Because of the serious congestion on Broadway, it is likely that most people who can divert to another road do so already, so that most of the traffic on Broadway has a local destination.

Data Collection

The roadway geometry from google maps was used for this project. Signal timing plans were collected at all the intersections. 7-9AM traffic volumes were recorded at each of the intersection, each on a different day, and queue lengths were observed intermittently and recorded as well. In other of understand queuing phenomenon, simultaneous data collection was conducted. Five people (each at an intersection) simultaneously collected 7-8AM peak hour data (at Gladstone Intersection, Corey/Second St. Intersection, School Street off Broadway, Chelsea/Norwood intersection and Hancock/High St Intersection). The data included traffic volume and intermittent queue length with time (volume shown in Table 2). The traffic mix is such that there are a lot of vehicles, pedestrians and a busy transit route consisting of five transit routes. There were only a few bicyclists on the corridor during this field observation and data collection.

Table 2: Peak hour volume recorded at each signalized intersection of Broadway corridor, Everett, MA. (Also see Figure 11.)

Gladstone

EBL	EBR	EBT	WBL	WBR	WBT	NBL	NBR	NBT	SBL	SBR	SBT
64	14	60	0	0	0	0	184	4	11	435	0
	138			0			188			446	

2nd /Corey

EBL	EBR	EBT	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR
33	41	15	12	202	46	32	472	4	159	88	20
	89			260			508			267	

Norwood/Chelsea

EBL	EBT	EBR	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR
70	203	60		138	13	8	417	17	194	0	31
	333			151			442			225	

Hancock /High

EBL	EBT	EBR	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR
121	50	55	58	303	32	26	400	65	0	0	0
	226			393			491			0	

Lexington/ Hosmer

EBL	EBT	EBR	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR
0	0	0	14	403	7	32	472	11	14	10	19
	0			424			515			43	

Ferry St

EBL	EBT	EBR	NBL	NBT	NBR	SBL	SBT	SBR	WBL	WBT	WBR
11	387	52	20	195	87	66	427	45	109	398	59
	450			302			538			566	

Chapter 3: Broadway/Gladstone intersection

This intersection is unique in the project because it does not have a traffic signal but a traffic guard to guard parents and Children mostly crossing to Sumner G Whittier School around 7:30AM - 8:00AM before school opening and also in the afternoon after school closing. When the crossing guard is active, there is an effective cycle, like a signal cycle – a time for vehicles, then a time for peds. Data collected at this intersection included the time that every southbound vehicle passed through, the start and end time at each crossing interval (controlled by the crossing guard), and vehicular turning volumes. The data was used to plot time series plot (Figure 6) showing the relationship between intermittent vehicle stops (Cycle Length), duration for pedestrian crossing (Ped green) and car crossing (car green). Histogram with fit plot also showed that the pedestrian green time follows a normal distribution (Figure 7) with a mean of 22.16 sec and a standard deviation of 12.9 sec. Calculation showed that the pedestrian interval consumed 46 percent of the time. The car green time also follows a normal distribution with mean of 26.2 sec and Standard deviation of 10.5 sec

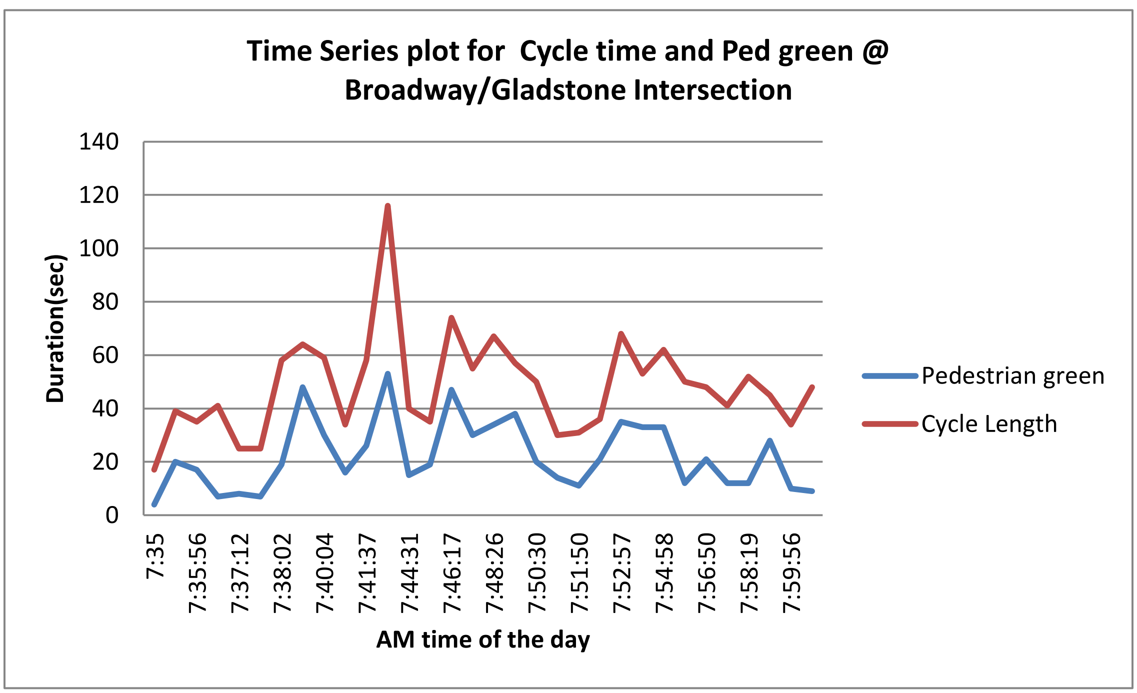


Figure 6: Time Series plot showing Cycle Length and Pedestrian green time at Gladstone Intersection

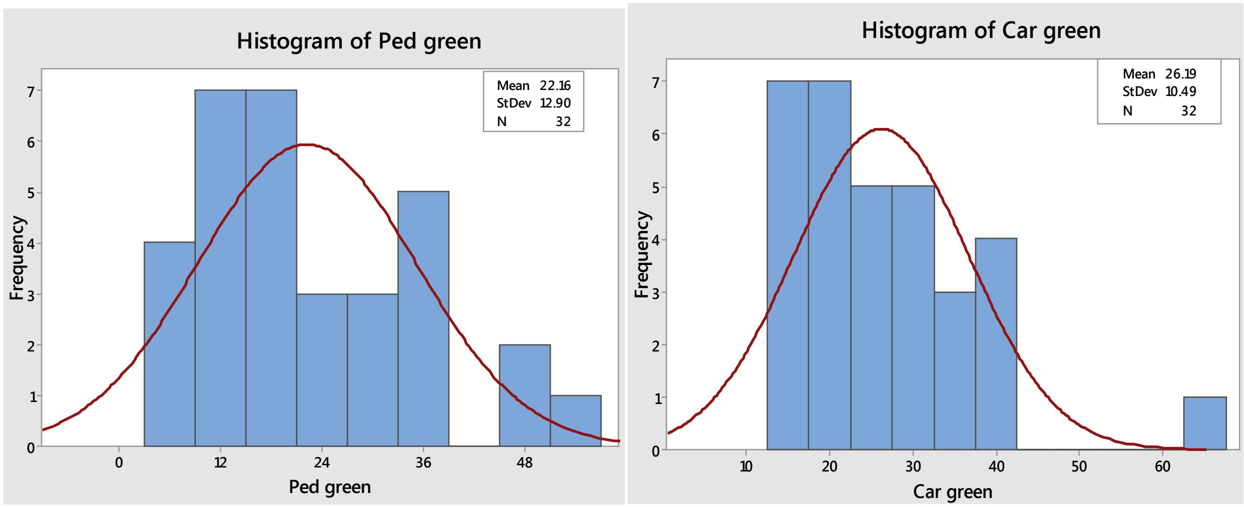


Figure 7 : Histogram of Pedestrian and car green times

The headway measurement shows average saturation headway (h_{sat}) of 2.99 sec (calculated from the data). Saturation headway was large as a result of gaps due to cars pulling into and out of parking to drop off school children and cars informally yielding to turning cars.

Startup lost time was also measured and the graph (figure 8) shows its zigzag behavior but with a very steep rise from 7:41 AM.

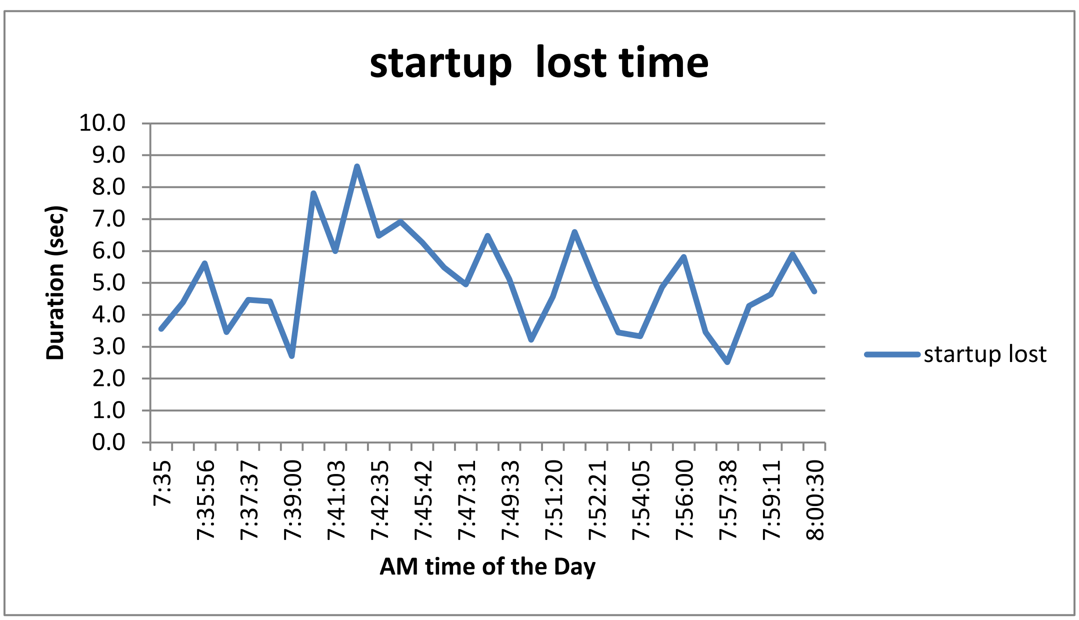


Figure 8 : start up lost time at Gladstone (7:30 – 8:00 AM)

The analysis of these data shows that the average start-up lost time for the period analyzed was 5sec with a standard deviation of 1.5sec, the maximum value as 8.7sec and the minimum value as 2.5 sec. The large start up lost time was partly as a result of cars pulling in and out of parking spaces and as a result of Drivers' consciousness to make sure that the crossing is free of any pedestrian (children or the guard) before moving.

The saturation headway was used to calculate the lost time between the second and fourth position cars which resulted to 1sec lost time and 3 sec End lost time. Hence, the total lost time was 9sec/cycle (Table 3).

Table 3: Summary of lost time/cycle at Gladstone intersection

Lost time	time (sec)
First car	5
cars 2-4	1
End	3
TOTAL	9

Comparison between Intersection Capacity and Volume at Gladstone

Traffic Counts at the intersection show that a total of 435 veh/hr got through the intersection while 646 veh/hr were discharged from the upstream signal at Second/ Corey between the hours of 7:00AM to 8:00AM (Figure 9). Hence, Volume is greater than capacity (V/C >1) and so, the volume counted can be considered the capacity. In addition, the field observation of cycle length, car green and red time, lost time and saturation headway were used to calculate the intersection capacity (Table 4). The resulting capacity was 428veh/hr. This result confirms the count of 435veh/hr.

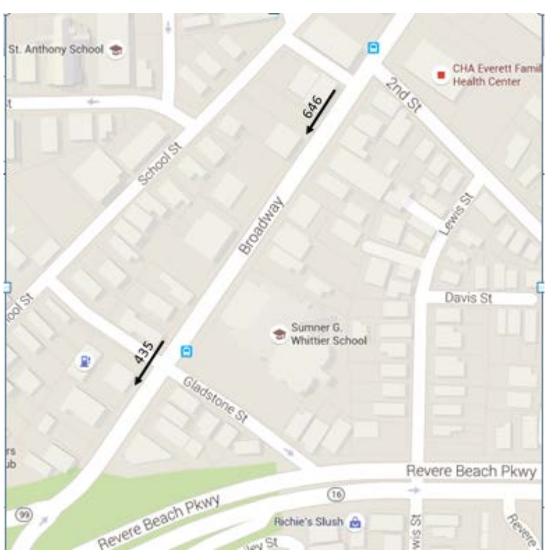


Figure 9 : Approach versus discharge volume at Gladstone

Parameters	
Cycle time	48sec
Car red	22sec
Total Lost time	9sec
Car green	17sec
hSat	2.99sec
cars/cycle	6
Intersection Capacity	428veh/hr

Table 4: Gladstone intersection Capacity

Chapter 4: Modeling of the Corridor and Calibration

The corridor's existing situation was modeled in PVT Vissim 7. The collected data such as the roadway geometry, turning counts (Figure 10), and signal timing plan was used to build the model. At each link in the model, the exact hourly volume was used as vehicle input; on entry links, input volume is applied directly; otherwise, input volumes are used to calculate ratio of relative flow for vehicle decision routing. Some volumes were assigned to side streets to help balance flows.

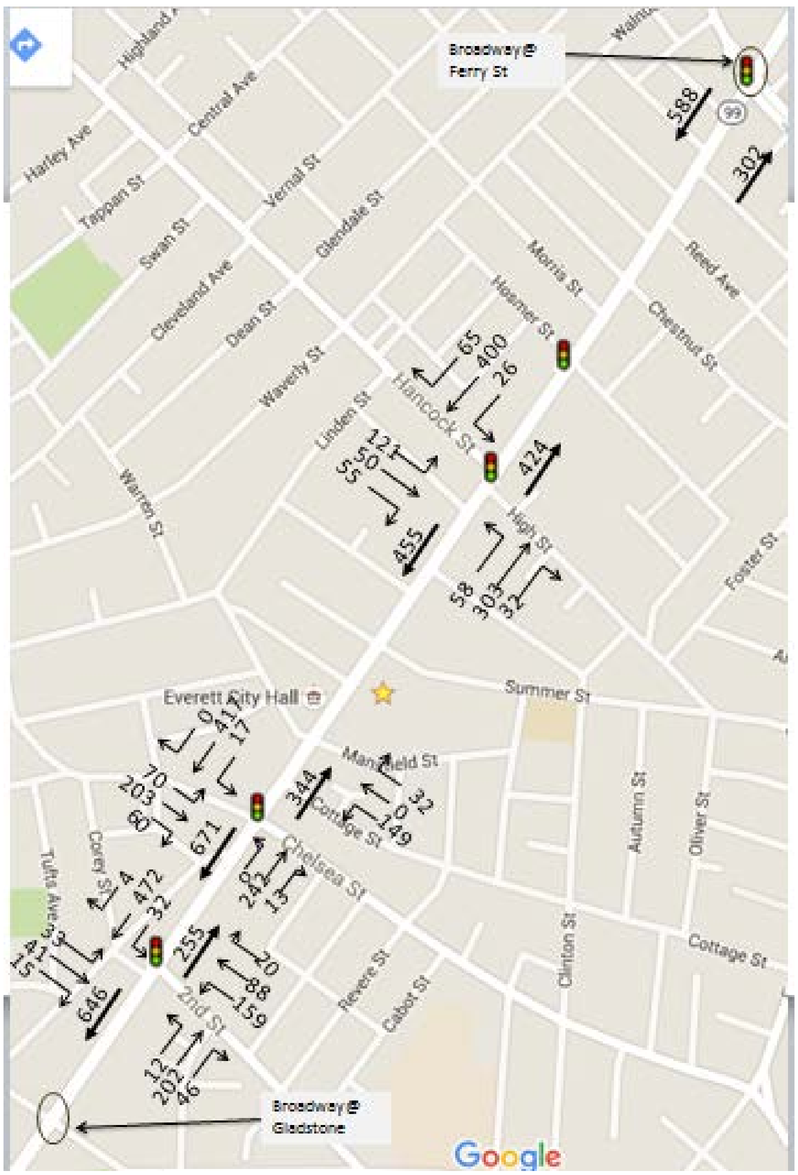


Figure 10: Broadway Corridor peak hour Turning Counts

Ring-barrier-controller (RBC) was used to model the signals, with protected and permitted movements modeled accordingly. For the minor intersections (intersections without traffic signals), STOP signs and the conflict tool were used to indicate which traffic stream has priority over the other. Almost all the time, the main street (Broadway Northbound and Southbound) traffic has priority over the side streets. Vehicle speed used was 25 mph typical of a main street; at the school crossing area, speed was reduced to 15 mph between Second/Corey intersection and Gladstone intersection.

Modeling the Broadway/Gladstone intersection required the use of time intervals since pedestrian volume varies so much (crossing volumes are in Table 5). For period 7:30-8:00, when the crossing guard is active, a "pedestrian stop" was applied with mean duration of 26.2sec, and standard deviation of 10.5 sec in keeping with results in chapter 3.

Model calibration was based on matching field volumes to model counts at various points along Broadway. Large discrepancies found in the initial model were corrected by adding short turn lanes where in practice, through traffic is able to get past traffic queued to turn left by using the parking lane (Comparison between Field count and model count Table 6 and Figure 11). The model count showed minimal variation from observed volumes especially in the southbound direction which is most seriously affected by the bottlenecks described earlier in this report.

Table 5: Pedestrian crossing at Gladstone (ped/hr)

	AM		
	7:00-7:30	7:30-8:00	8:00-9:00
To School	100	200	50
From School	50	50	50

Table 6: Field Volume Count versus Model count

Intersection	Northbound Count		Southbound Count	
	Field	Model	Field	Model
Broadway @Ferry Street	302	278	588	588
Broadway @Lexington St.	385	387	486	500
Broadway @Hancock St.	424	396	455	458
Broadway @Chelsea St.	344	345	671	664
Broadway @ Second St.	255	261	646	659

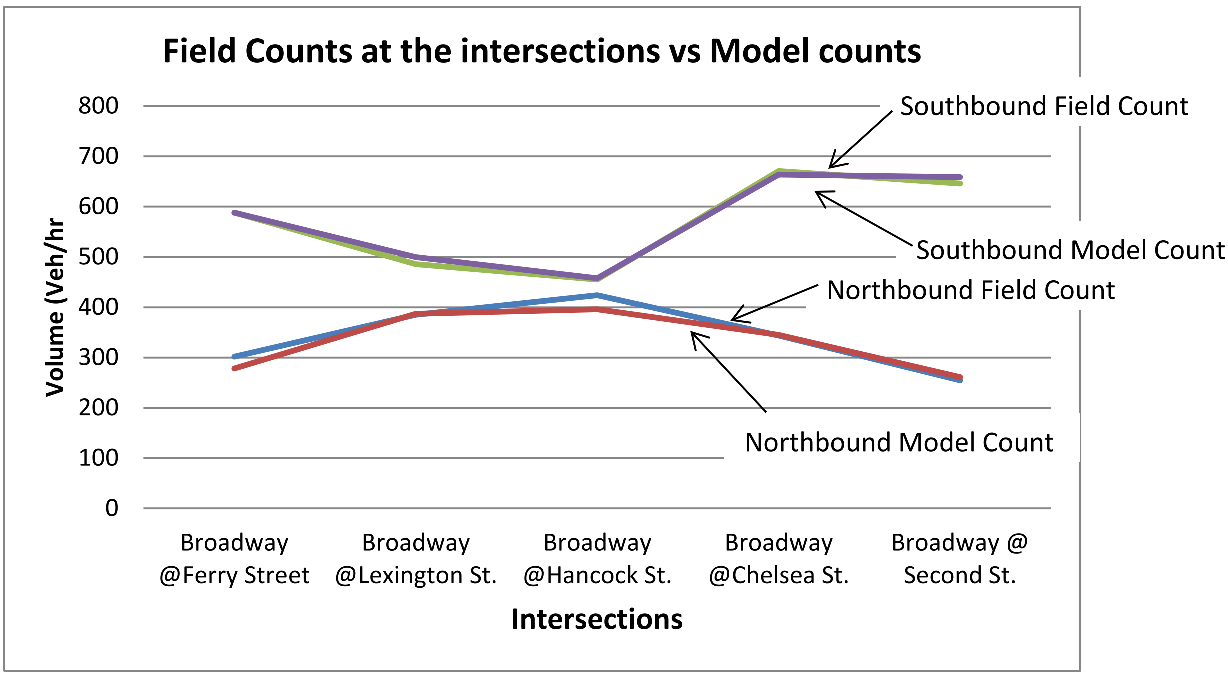


Figure 11: Field Volume Count vs Model count

The Corridor is characterized with high volume of pedestrians. This was incorporated into the model as pedestrians randomly cross at all of the crosswalks and the 'conflict area tool' was used to give them priority over other road users.

Chapter 5 : Design and Testing of Local Engineering Remedies

Three main Engineering remedies were combined for the traffic management and tested in the model;

1. Optimization of the Splits and Cycle lengths at each signalized intersection: Cycle length and split optimization was carried out using Synchro, resulting in reduced cycle lengths and improved capacity of the intersections.
2. Elimination of both through and left turn phases at Broadway/Gladstone Intersection: Elimination of both traffic phases improved the intersection capacity and more vehicles were able to pass through with less delay. Majority of the vehicles making left turns are parents trying to drop off their children in front of the school. A way to still allow them to drop off children and not affect Southbound traffic on Broadway is to change the direction of traffic flow on lower Gladstone from one-way-out to one-way-in (only right turns permitted at Broadway) (Figure 12). With this change, Parents can connect lower Gladstone from Revere Beach Parkway and turn right onto Broadway Northbound that has less traffic volume and more gaps.

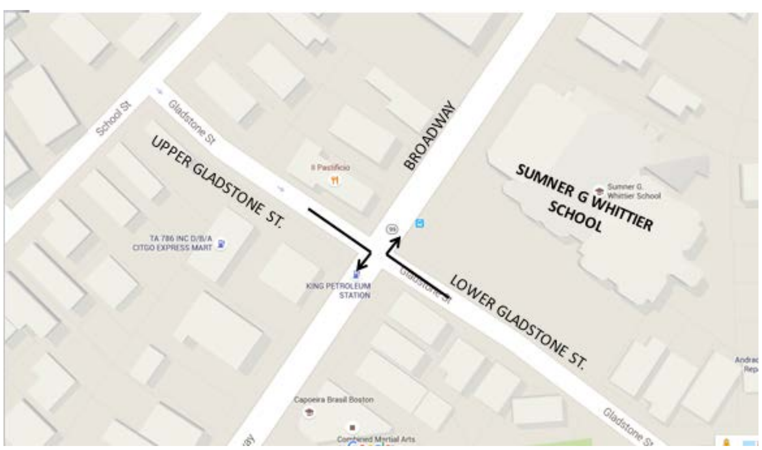


Figure 12: Right turning movements only from Gladstone to Broadway.

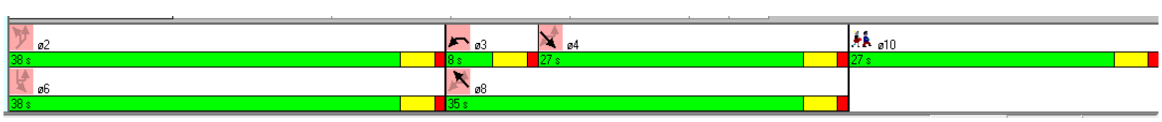
3. Elimination of All pedestrian phase except at Ferry Street and introducing Leading pedestrian (LPI) interval of 3sec head start (in addition to the head start in-space already created by the roadway geometry) thereby reducing the lost time due to all pedestrian phase. For example, a typical intersection of three conflicting streams that has 23sec for an All Ped phase now only has an extra 9 sec instead of 23sec to accommodate the pedestrians especially since the pedestrians require less time than the conflicting traffic. LPI is a treatment for intersections with high turning movements in conflict with high pedestrian volume where a separate pedestrian phase might be required. The treatment gives pedestrians a head start of 3-7 sec before the conflicting turning movement (right or left). LPI in combination with other Engineering remedies like advance stop line gives the pedestrians priority over turning vehicles .The treatment has proved to be safe for pedestrians in different case studies in that the odds of pedestrian conflict with vehicle was reduced by 95% if pedestrians start walking at the beginning of walk interval. Study also shows that pedestrians feel safe with the change in time interval and only a few of them were able to recognize the change.

(Source: Aaron C. Fayish and Frank Gross. Safety Effectiveness of Leading Pedestrian Intervals Evaluated by a Before–After Study with Comparison Groups. http://nacto.org/wp-content/uploads/2015/04/safety_effectiveness_of_lpi_fayish.pdf)

Optimized Splits and Phases

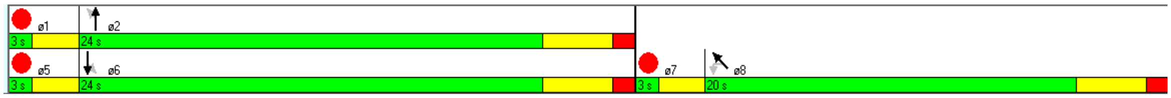
- At Broadway/Ferry Street Intersection Cycle length =100s

  New splits are 38sec for Broadway Northbound and Southbound, 8sec for Westbound left, 27sec for Westbound through and 35 sec for Eastbound Movement. The pedestrian phase requires 27sec



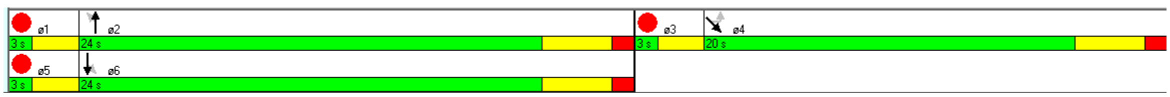
- <u>At Lexington/Hosmer St Intersection</u>

  Cycle length was reduced from 110sec to 50 sec (55% reduction). The new splits are 24sec for Broadway traffic (Northbound and Southbound) and 20sec for Westbound. Each traffic phase has a LPI of 3 sec.



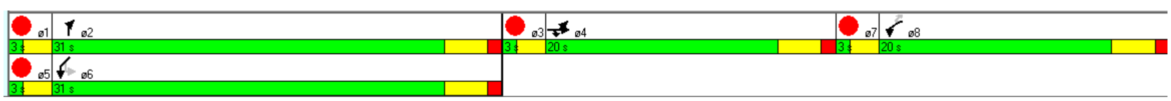
- At Hancock/High St Intersection

  Cycle length was reduced from 117sec to 50 sec (57% reduction) .The new splits are 24sec for Broadway traffic (Northbound and Southbound) and 20sec for Eastbound. Each traffic phase has a LPI of 3 sec.



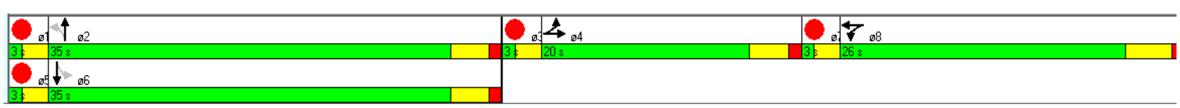
- At Chelsea/ Norwood Intersection

  Cycle length was reduced from 104sec to 80sec (23% reduction) .The new splits are 31sec for Broadway traffic (Northbound and Southbound), 20sec for Eastbound and 20sec for Westbound. Each traffic phase has a LPI of 3 sec.



- At Corey/Second Street

  Cycle length was reduced from 132sec to 90sec (32% reduction) .The new splits are; 34sec for Broadway traffic (Northbound and Southbound), 20sec for Eastbound and 26sec for Westbound. Each traffic phase has a LPI of 3 sec.



Result of the remedies

The engineering remedies implemented in the model showed a substantial reduction in average vehicle delay, from 132 s per vehicle to 44 s. Delay reductions at individual intersections ranged from 8 s to 56 s. Results are for a two-hour simulation (7:00AM – 9:00AM) after a warm-up period of 10 min. Intersection delay was based on travel time from 400ft upstream of an intersection to 400 ft downstream.

Table 7: Average vehicle delay, systemwide and by intersection, before and after treatment

	Av.Delay (sec)		
	Base Model	Modified Model	change (sec)
Systemwide	132	45	88
Intersection			
Broadway@ Gladstone	23	12	11
Broadway @ Corey/second	45	31	15
Broadway@ Chelsea/Norwood	52	31	21
Broadway @ Hancock/High St	75	18	56
Broadway @ Lexington/Hosmer	26	18	8
Broadway @ Broadway/Ferry	49	38	12

Corridor delay, which applies to vehicles traveling the full length of the corridor (like most buses) was measured for Southbound traffic. Results (Table 8) are shown for 30-minute intervals ending at 7:30AM, 8:00AM, 8:30AM and 9:00AM. Delay reductions ranged from 1.1 min for the earliest period to 3.3 min during the 8:00-8:30 AM period.

Table 8: Difference in Southbound corridor delay before and after treatment

Southbound Average Corridor delay (min)			
Time (AM)	Base model	After treatment	decrease
7:00 -7:30	3.78	2.69	1.09
7:30 -8:00	5.14	3.21	1.93
8:00 -8:30	6.36	3.05	3.32
8:30 -9:00	5.48	2.98	2.50

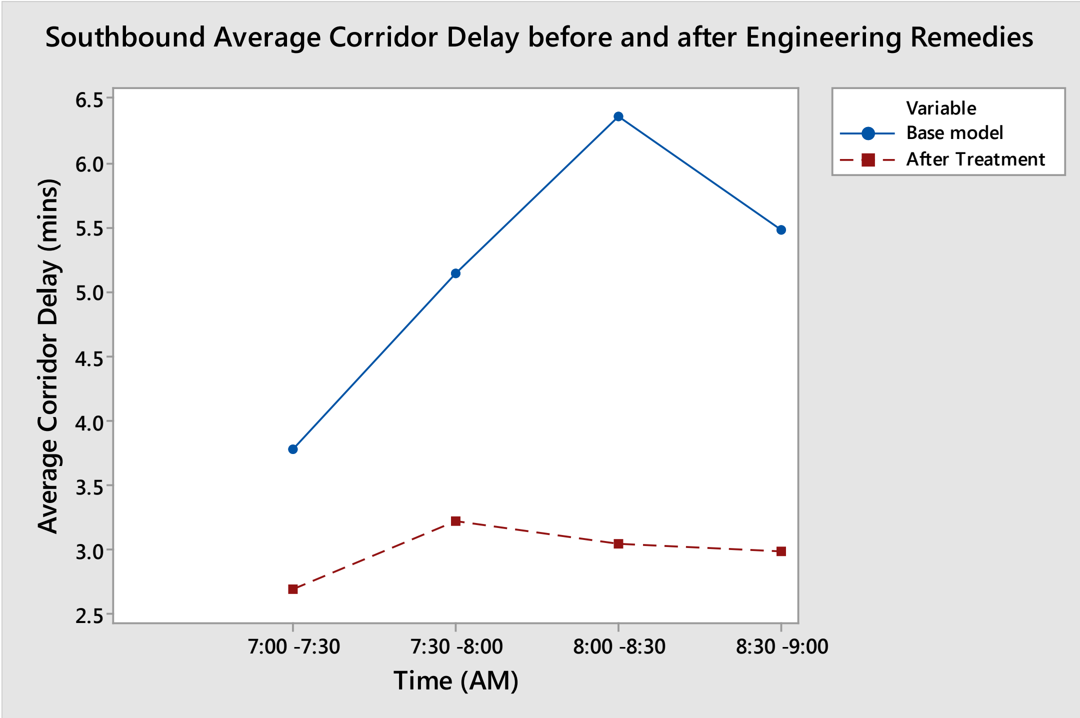


Figure 13: SB. Average corridor delay before and after implementation of Engineering remedies

Chapter 6 : Conclusion

Review

Chapter one states that the objectives of this project are to understand Broadway corridor traffic congestion, develop ways to reduce the congestion and reduce delay for pedestrians with safety and economic vitality as a top priority. Understanding the traffic congestion was met in chapters 2 (critical examination of the corridor and identification of bottleneck), chapter 3 (Gladstone school crossing impact on traffic during the AM peak) and chapter 4 (modeling with VISSIM to reflect the present situation of the corridor). Traffic congestion and pedestrian delay reductions were met in chapter 5 (changes to traffic circulation and traffic signal timing of the corridor with prohibition of left and through phases on Broadway @ Gladstone intersection)

Limitations

The Limitations encountered in this study include but not limited to;

- Inability to acquire several days of data by sophisticated means such as video recording (that captures typical traffic characteristics such as speeds, headways, density etc) of the whole corridor to calculate a design volume and inability to record field data on the minor streets.
- In VISSIM, the parking lane was prohibited from use by the vehicles (to discourage free lane selection) even when they were blocked by turning vehicles but in reality, drivers use the parking lane to maneuver when they are obstructed by left turning vehicles.

Recommendations

The City of Everett, MA could critically study this project and its benefits to the community as a whole, possibly implement or carryout more study to implement the proposed engineering remedies on the Corridor. I recommend that the City should engage in further study on transit buses and how to further make the corridor a congestion free zone for them. Further research is as well required on how to divert more through traffic to use Route 1 instead of Route 99.

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