



## Traffic and Circulation Study

Montvale Historic District  
April 19, 2023

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Petition:	Councilor Sean M. Rose on behalf of the citizens of the Montvale Historic District request a comprehensive traffic review be completed of the immediate neighborhood, including traffic patterns on Upper Monadnock Rd., Sagamore Rd., Whitman Rd. and Pratt St. Further, request traffic calming methods be explored in the interim, while the traffic review be completed.
Scheduled Committee Hearing:	April 26, 2023 Traffic & Parking Committee, Item 6a
Prepared by:	Todd M. Kirrane., Assistant Director Stephen S. Rolle, P.E., Commissioner

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### Summary

Study of traffic conditions in and around the Montvale neighborhood demonstrates that the neighborhood is experiencing very high levels of cut through traffic that are excessive for the local street classification. DTM recommends improvements to turn prohibition signing on Salisbury Street, traffic calming on neighborhood streets, and (pending funding) revisions to improve safety and operations at the Salisbury St/Park Avenue intersection. Should these measures prove insufficient, more drastic traffic calming and network interruption measures could be considered.

### Introduction

The purpose of this study is to establish and review baseline conditions for the Montvale Historic District to identify any safety or operational deficiencies and determine if alterations to the public way, including, but not limited to, traffic signal operation changes on Park Avenue, traffic calming, grid network changes, etc. are warranted. Recommendations will be based on federal, state, and industry best practices.

Councilor Rose submitted the traffic review request on behalf of his constituents who reside in the neighborhood. The problems identified through conversations with local residents include pedestrian and bicycle safety, speeding vehicles, high cut through traffic volume, difficulty to cross street, and a high volume of cut-through traffic.

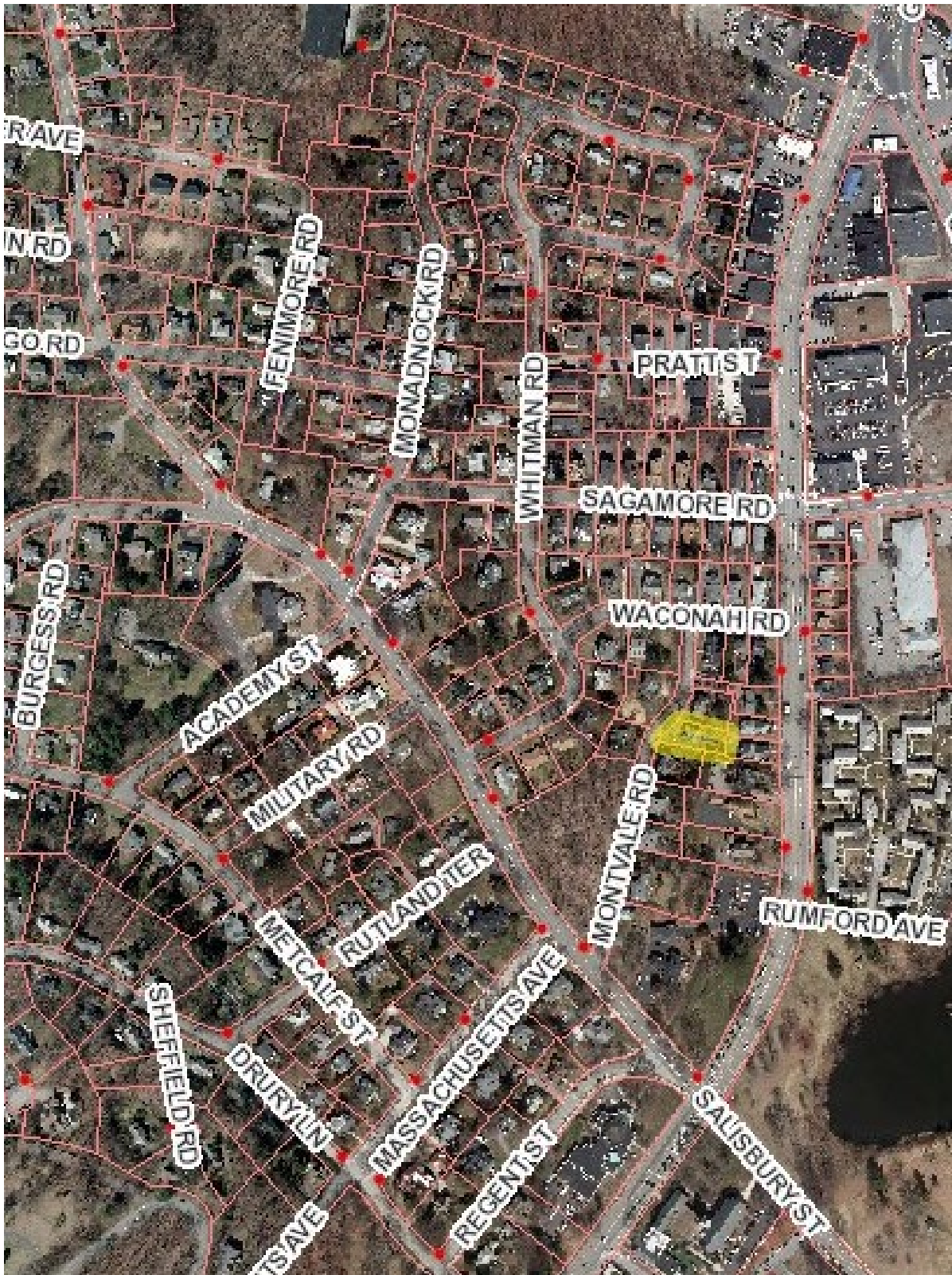


IMAGE 1: MONTVALE HISTORIC DISTRICT

## **Existing Conditions**

### ***Roadways***

Monadnock Road is classified by the Massachusetts Department of Transportation (MassDOT) as a Local Roadway under City jurisdiction. The roadway is 30 feet curb to curb and provides residential connections to Sagamore Road and Salisbury Street. Monadnock Road is two way and provides one general purpose motor vehicle travel lane in each direction. On Street parking is restricted only December 1 to March 31<sup>st</sup> during the overnight hours; ordained NO PARKING ANYTIME easterly from Salisbury to Sagamore easterly, and otherwise it is unrestricted. The statutory (unposted) speed limit is 30 mph. Land use is primarily single family residential. Continuous sidewalks exist along both sides of the street from Salisbury Rd to approximately 288 feet north of Ostego Rd. and then along the even numbered curb between the two intersections with Whitman Rd.

Montvale Road is classified by the Massachusetts Department of Transportation (MassDOT) as a Local Roadway under City jurisdiction. The roadway is 22 feet curb to curb and provides residential connections to Sagamore Road and Waconah Road. Montvale Road is two way and provides one general purpose motor vehicle travel lane in each direction. On Street parking is restricted only December 1 to March 31<sup>st</sup> during the overnight hours on the even side; otherwise, it is unrestricted. The statutory (unposted) speed limit is 30 mph. Land use is primarily single family residential. Continuous sidewalks exist along eastern curb line of the street for the entire length and from Salisbury Road to 188 feet north of Sagamore Road along the western curblines.

Pratt Street is classified by the Massachusetts Department of Transportation (MassDOT) as a Local Roadway under City jurisdiction. The roadway is 23 feet curb to curb and provides residential connections to Park Avenue. Pratt Street is two way and provides one general purpose motor vehicle travel lane in each direction. On Street parking is restricted only December 1 to March 31<sup>st</sup> during the overnight hours on the even side and a posted NO PARKING ANYTIME on the odd side. The statutory (unposted) speed limit is 30 mph. Land use is primarily multi-family residential with some commercial closer to Park Avenue. Continuous sidewalks exist along both sides of the roadway.

Sagamore Road is classified by the Massachusetts Department of Transportation (MassDOT) as a Local Roadway under City jurisdiction. The roadway is 30 feet curb to curb and provides residential connections to Park Avenue and Monadnock Road. Sagamore Road is two way and provides one general purpose motor vehicle travel lane in each direction. On Street parking is restricted only December 1 to March 31<sup>st</sup> during the overnight hours on the both sides in the study area and from 72 feet east of Whitman Road to Whitman Road; otherwise, it is unrestricted. The statutory (unposted) speed limit is 30 mph. Land use is primarily single family residential. Continuous sidewalks exist along both sides of the street for the entire length.

Waconah Road is classified by the Massachusetts Department of Transportation (MassDOT) as a Local Roadway under City jurisdiction. The roadway is 30 feet curb to curb and provides residential connections to Park Avenue. Waconah Road is two way and provides one general purpose motor vehicle travel lane in each direction. On Street parking is restricted only December 1 to March 31<sup>st</sup> during the overnight hours on the even side and the first 55 feet from Park Avenue on the odd side; otherwise, it is unrestricted. The statutory (unposted) speed

limit is 30 mph. Land use is primarily single family residential. Continuous sidewalks exist along both sides of the roadway.

Whitman Road is classified by the Massachusetts Department of Transportation (MassDOT) as a Local Roadway under City jurisdiction. The roadway is 30 feet curb to curb and provides residential connections to Sagamore Road and Salisbury Street. Whitman Road is two way and provides one general purpose motor vehicle travel lane in each direction. On Street parking is restricted only December 1 to March 31<sup>st</sup> during the overnight hours; otherwise it is unrestricted. The statutory (unposted) speed limit is 30 mph. Land use is primarily single family residential. Continuous sidewalks exist along eastern curb line of the street for the entire length and from Salisbury Road to 188 feet north of Sagamore Road along the western curbline.

All street, except Pratt Street, include mature street trees, ornamental street lighting, and a tree lawn.

### ***Intersections***

The neighborhood street network is accessed by three intersections connecting with Salisbury Street and three intersections connecting with Park Avenue.

Monadnock Road meets Salisbury Street to form a T type unsignalized intersection. As the minor approach, the Monadnock Road approach is required to yield the right of way to the Salisbury Street approaches, which operate free under no control. The Monadnock Road approach provides one general purpose travel lane in each direction while the Salisbury Road approach provides two general purpose lanes in the westbound direction and one general purpose lane in the eastbound direction. Sidewalks are provided on both sides of both streets. Marked crosswalks and non-compliant wheelchair ramps are provided across Monadnock Road and across Salisbury Street along the eastern side of the intersection. There is no PEDESTRIAN CROSSWALK signage. Land use at the intersection consists of residential housing. There is a posted NO LEFT TURN 7am to 9am restriction from Salisbury Street onto Monadnock Road.

Whitman Road meets Salisbury Street to form a T type unsignalized intersection. As the minor approach, the Whitman Road approach is required to yield the right of way to the Salisbury Street approaches, which operate free under no control. The Whitman Road approach provides one general purpose travel lane in each direction while the Salisbury Road approach provides two general purpose lanes in the westbound direction and one general purpose lane in the eastbound direction. Sidewalks are provided on both sides of both streets. No marked crosswalks are provided at the intersection. Land use at the intersection consists of residential housing. There is a posted NO LEFT TURN 7am to 9am restriction from Salisbury Street onto Whitman Road.

Montvale Road meets Salisbury Street to form a T type unsignalized intersection. As the minor approach, the Montvale Road approach is required to yield the right of way to the Salisbury Street approaches, which operate free under no control. The Montvale Road approach provides one general purpose travel lane in each direction while the Salisbury Road approach provides two general purpose lanes in each direction. Sidewalks are provided on both sides of both streets. No marked crosswalks are provided at the intersection. Land use at the intersection

consists of residential housing. There is a posted NO LEFT TURN 7am to 9am restriction from Salisbury Street onto Whitman Road.

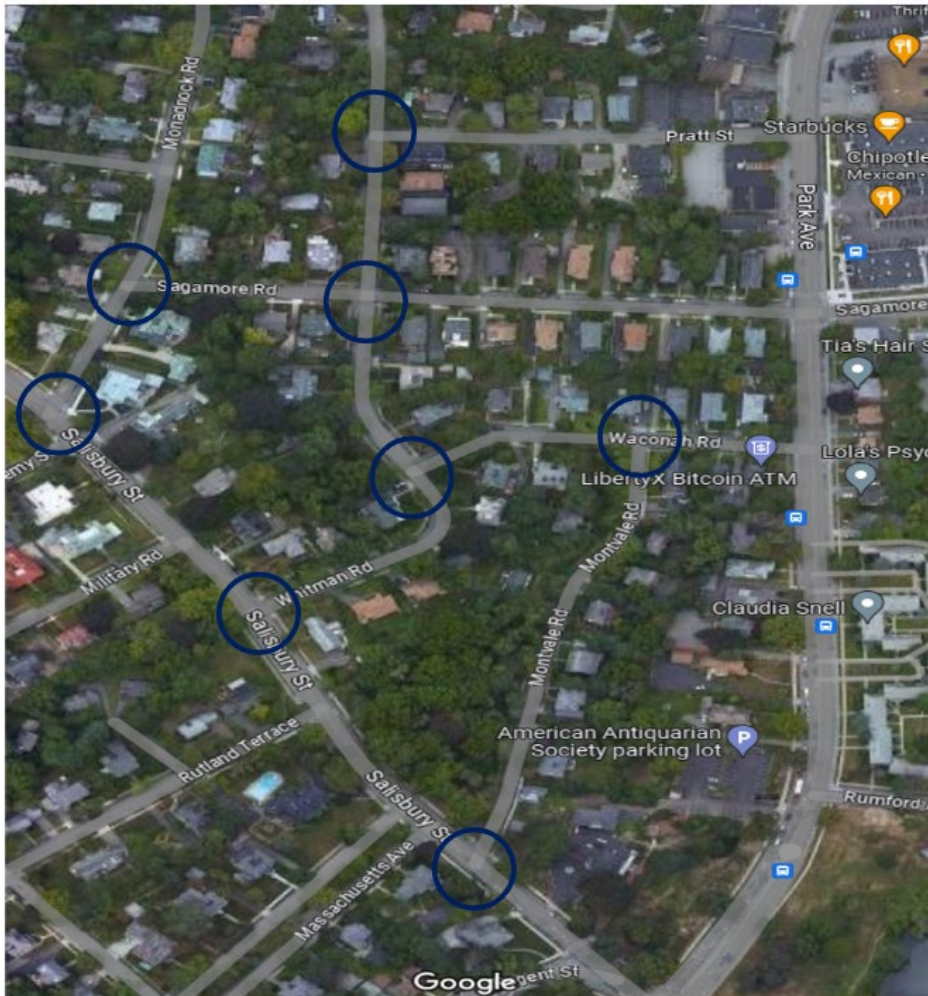
Monadnock Road meets Sagamore Road to form a T type unsignalized intersection. Sagamore Road approach operates under a STOP control while the Monadnock Road approaches operate free under no control. Both approaches provide one general purpose travel lane in each direction. Sidewalks are provided on both sides of both streets. No marked crosswalks or compliant wheelchair ramps are provided across either street. Land use at the intersection consists of residential housing.

Whitman Road meets Sagamore Road to form a four way unsignalized intersection. Both streets are under STOP control forming an ALL WAY STOP. Both approaches provide one general purpose travel lane in each direction. Sidewalks are provided on both sides of both streets. No marked crosswalks or compliant wheelchair ramps are provided across either street. Land use at the intersection consists of residential housing.

Whitman Road meets Pratt Street to form a T type unsignalized intersection. As the minor approach, the Pratt Street approach is required to yield the right of way to the Whitman Road approaches, which operate free under no control. Both approaches provide one general purpose travel lane in each direction. Sidewalks are provided on both sides of Pratt Street and the eastern curblineline of Whitman Road. No marked crosswalks or compliant wheelchair ramps are provided across either street. Land use at the intersection consists of residential housing.

Whitman Road meets Waconah Road to form a T type unsignalized intersection. As the minor approach, the Waconah Road approach is required to yield the right of way to the Whitman Road approaches, which operate free under no control. Both approaches provide one general purpose travel lane in each direction. Sidewalks are provided on both sides of both streets. No marked crosswalks or compliant wheelchair ramps are provided across either street. Land use at the intersection consists of residential housing.

Montvale Road meets Waconah Road to form a T type unsignalized intersection. As the minor approach, the Montvale Road approach is required to yield the right of way to the Waconah Road approaches, which operate free under no control. Both approaches provide one general purpose travel lane in each direction. Sidewalks are provided on both sides of both streets. No marked crosswalks or compliant wheelchair ramps are provided across either street. Land use at the intersection consists of residential housing.



**IMAGE 2: MONTVALE HISTORIC DISTRICT INTERSECTIONS**

### **Speed Study**

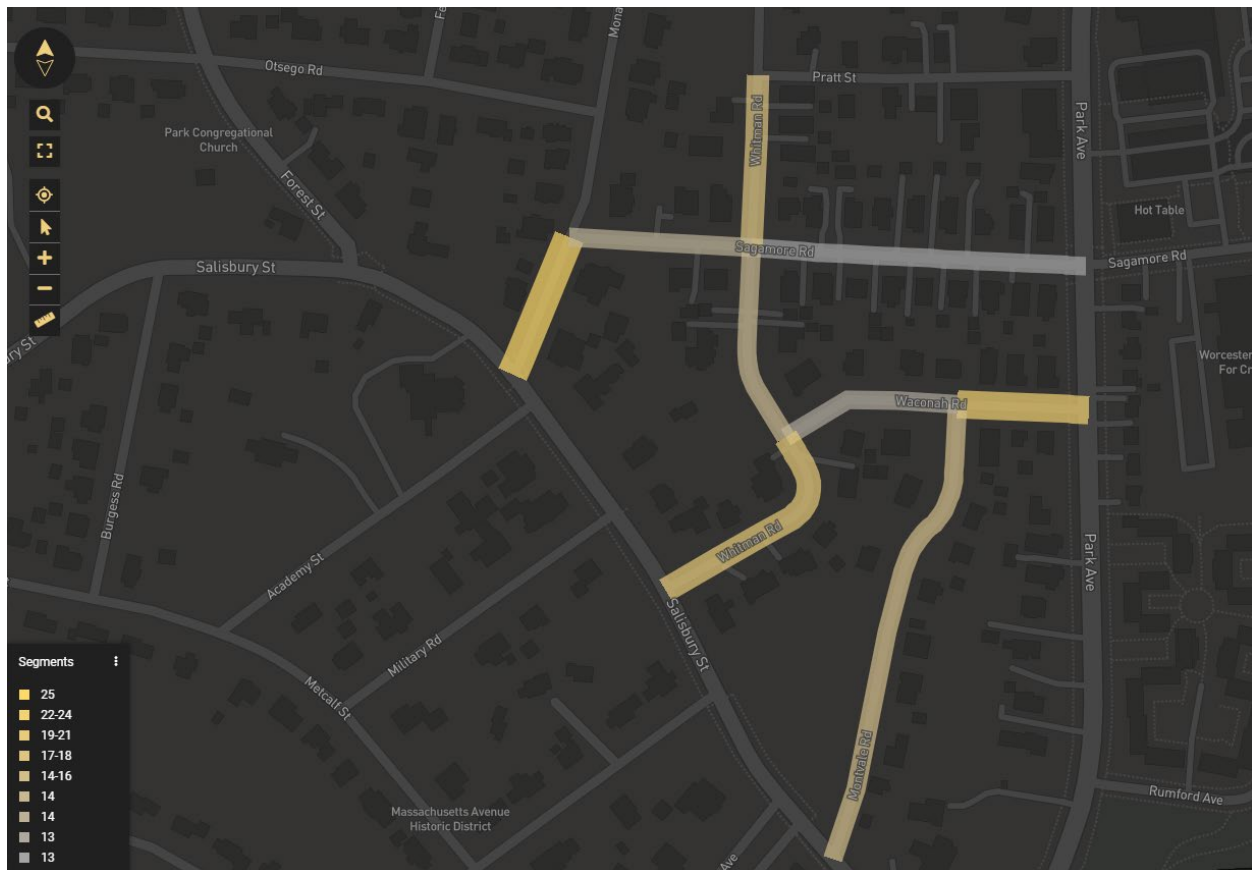
A speed study was conducted using StreetLight Insight vehicle volume data. StreetLight vehicle speeds are calculated by StreetLight’s machine learning algorithm. The learning algorithm gathers anonymized location records from smart phones and navigation device in connected cars and trucks. The data is processed using StreetLight Route Science algorithm which uses the location data points over time into contextualized, aggregated, and normalized travel patterns.

The unposted statutory speed limit for all streets within the study area is 30 mph per Chapter 90, Section 17 of the Massachusetts General Laws. To evaluate the incidence and severity of speeding, two measures are evaluated. The *average speed* is as the name implies, the average or mean speed of all travelers on a particular roadway segment. The 85<sup>th</sup> percentile speed is the speed below which 85% of the vehicles on the road are traveling (conversely, 15% of drivers are traveling faster than the 85<sup>th</sup> percentile speed). The results for 2021 data are summarized below in Table 1:

**TABLE 1**  
**2021 Study Area Travel Speeds**

<u>Street (from/to)</u>	<u>Speed Limit</u>	<u>Travel Speed</u>	
		<u>Average</u>	<u>85<sup>th</sup> Percentile</u>
<b>Monadnock (Salisbury/Sagamore)</b>	<b>30 mph</b>	<b>25 mph</b>	<b>38 mph</b>
Montvale	30 mph	14 mph	20 mph
Sagamore (Park/Whitman)	30 mph	13 mph	18 mph
Sagamore (Whitman/Monadnock)	30 mph	14 mph	19 mph
<b>Waconah (Park/Montvale)</b>	<b>30 mph</b>	<b>22 mph</b>	<b>44 mph</b>
Waconah (Montvale/Whitman)	30 mph	13 mph	20 mph
Whitman (Salisbury/Waconah)	30 mph	19 mph	31 mph
Whitman (Waconah/Sagamore)	30 mph	14 mph	21 mph
Whitman (Sagamore/Pratt)	30 mph	17 mph	25 mph

The StreetLight analysis depicted below shows the average vehicle speeds along segments within the study area. The thicker the bands, the higher the average speed.



**IMAGE 3 STREETLIGHT AVERAGE SEGMENT SPEEDS FOR MONTVALE HISTORIC DISTRICTS**

Based on this data, from a speed perspective only, the roadway segments that are of particular concern are Monadnock Road (Salisbury to Sagamore), Waconah Road (Park to Montvale), and Whitman Road (Salisbury to Waconah) and the impacted intersections within those areas.

However, it should be noted that Waconal Road and Whitman Road carry a low volume of traffic, whereas Monadnock Road and Sagamore Road carry very high volumes of traffic, as described in the following section.

## **Traffic Volumes**

### ***Daily Traffic***

A traffic volume study was conducted also using StreetLight vehicle volume data.

As reviewed earlier, all of the streets within the study area are classified as Local Roads under City jurisdiction by the Massachusetts Department of Transportation (MassDOT). Local roadways within an urban setting typical carry fewer than 1000 vehicles per day, on average. The results for 2021 data are summarized below in Table 2 and depicted graphically in Image 4.

**TABLE 2**  
**2021 Study Area Average Volume**

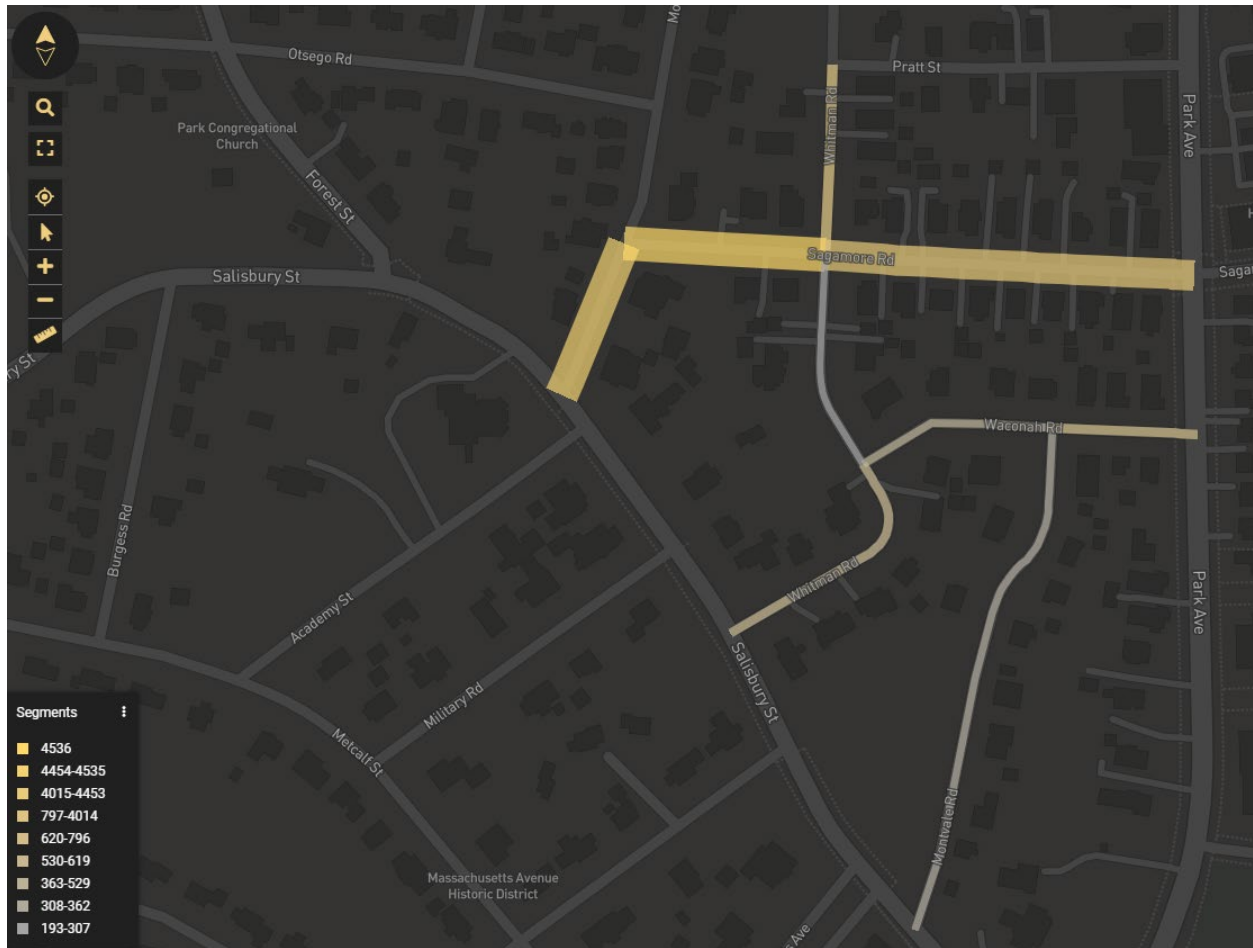
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<b><u>Street (from/to)</u></b>	<b><u>Average Daily Traffic</u></b>
Monadnock (Salisbury/Sagamore)	4454
Montvale	308
Sagamore (Park/Whitman)	4015
Sagamore (Whitman/Monadnock)	4536
Waconah (Park/Montvale)	620
Waconah (Montvale/Whitman)	363
Whitman (Salisbury/Waconah)	530
Whitman (Waconah/Sagamore)	193
Whitman (Sagamore/Pratt)	797

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These results demonstrate far higher than expected traffic volumes on Monadnock Road (Salisbury to Sagamore) and Sagamore Road, which indicates a significant amount of cut-through traffic traveling between Salisbury Street and Park Avenue.





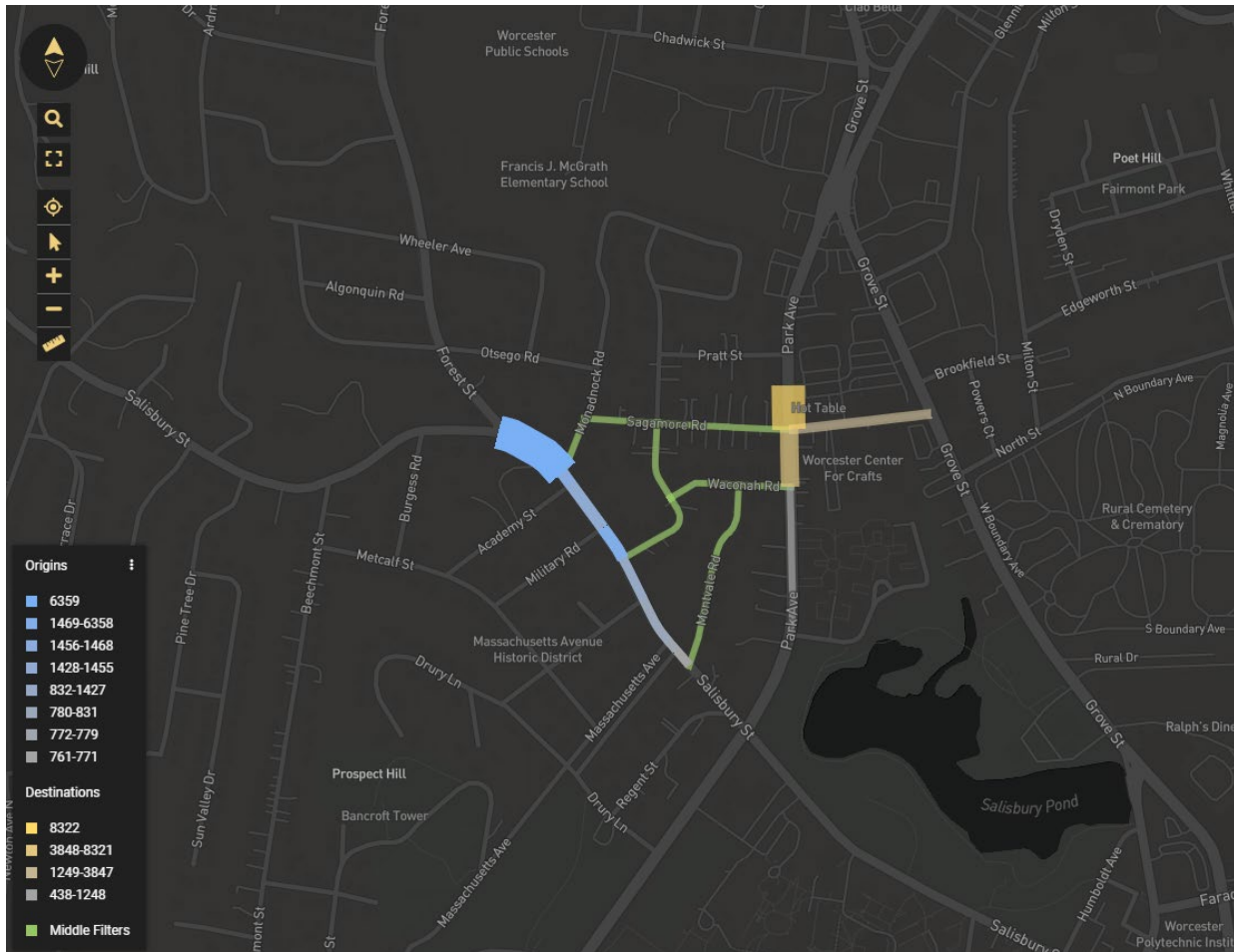
**IMAGE 4 STREETLIGHT AVERAGE SEGMENT VOLUMES FOR MONTVALE HISTORIC DISTRICTS**

### ***Origin/Destination of Cut-Through Vehicles***

To better understand travel patterns, the locations of vehicles as they immediately enter the Montvale Historic District and then exit the neighborhood were reviewed (Image 5).

This data confirms that the vast majority of the cut-through traffic is entering the neighborhood by making a left turn from Salisbury Road, including in violation of the posted NO LEFT TURN restriction during AM peak hours. Traffic then distributes to Park Avenue and Grove Street, with the majority exiting the neighborhood by making a left turn onto Park Avenue and traveling to points north of the study area. The pattern repeats in the opposite direction as well, although no turn prohibitions are violated in the Park Avenue to Salisbury Street direction.

Analysis of trip patterns also shows that the number of trips cutting through the neighborhood is comparable or greater than the number who choose to instead stay on Salisbury Street and turn left onto Park Avenue (and vice versa).



**IMAGE 5 STREETLIGHT ORIGIN/DESTINATION IMMEDIATELY OUTSIDE THE MONTVALE HISTORIC DISTRICT**

## Crash Summaries

In order to identify crash trends and safety characteristics for the study area, crash reports were obtained from MassDOT Crash Database for the latest five-year period available. The reported accidents are outlined below in **Table 3**. The **Appendix** contains crash data from MassDOT.

Eleven crashes were reported in the MassDOT Crash database for the study for the latest five-year period available from 2018 to 2022. Out of those eleven crashes, one occurred at the intersection of Sagamore and Whitman, though the roadway surface condition was listed as ice and was attributed for crash. All remaining crashes took place at mid-block locations. No crashes were reported on Montvale or Waconet.

The crash data do not indicate an elevated level of collisions, however, the volume of traffic cutting through the neighborhood on residential streets is of concern and elevates the potential for crashes, particularly with vulnerable roadway users such as pedestrians.

**Table 3**  
**MassDOT Crash Summary**

	<u>Monadnock</u>	<u>Sagamore</u>	<u>Whitman</u>
<u>Data Category</u>			
<b>Year:</b>			
2018		4	
2019		1	
2020		1	
2021		1	1
2022	<u>2</u>	<u>1</u>	-
<b>Total</b>	2	8	1
<b>Type:</b>			
Angle		2	
Rear-End	1	1	
Head-On			1
Sideswipe-Same		3	
Direction		1	
Sideswipe-Opposite	1	1	
Direction		1	
Unknown/Other		1	
<b>Event:</b>			
Collision with			
Pedestrian			
Collision with Bicycle			
Collision with Moped			
Collision with Vehicle	2	3	
Collision with Parked		5	
Car			
Collision with Object			1
Unknown/Other			
<b>Severity:</b>			
P. Damage Only	1	5	1
Non-Fatal Injury	1		
Fatality			
Unknown/Other		3	
<b>Conditions:</b>			
Dry	2	5	1
Wet			
Snow/Ice		2	
Other/Unreported		1	
<b>Time:</b>			
7:00 AM to 9 AM	1	1	1
4:00 PM to 6 PM			
Rest of Day	1	7	

## **Traffic Signal Analysis for Salisbury Rd at Park Ave Intersection**

Cut-through traffic occurs when travelers perceive an advantage for using the cut through route. Often the cut through route offers a travel time advantage, but drivers may at times choose a slower route to avoid some other perceived impediment such as congestion, a safety concern, etc.

Therefore, optimizing the efficient and safe operation of the Salisbury Street & Park Avenue intersection is an important aspect of addressing cut through traffic in the Montvale neighborhood. DTM staff engaged a transportation engineering consultant, TEC, to analyze the operations of the traffic signal at Salisbury and Park to determine if operational or timing related changes could reduce delay or otherwise improve the safe flow of traffic for the Salisbury approach to decrease the desire to cut through the Montvale Historic District neighborhood. This memo is attached as Appendix A.

### **Conclusion**

Despite the posted NO LEFT TURN 7AM TO 9AM, the traffic study indicates a high level of cut-through traffic being generated by areas to the west and southwest of the neighborhood going to and from points to the east and north. Roadways classified as Local Roads generally expect to accommodate fewer than 1000 vehicle trips per day, but the reported traffic volumes are quadruple that amount on Monadnock and Sagamore, which is more typical of urban collector roadways.

This cut-through traffic is generally traveling at a higher than desired speeds for a residential neighborhood, particularly on Monadnock and Waconah where the 85<sup>th</sup> percentile speeds are 8 to 14 mph above the statutory speed limits. The result is that the safety and access of neighborhood residents, particular vulnerable roadway users such as pedestrians, cyclists, school aged-children, and seniors is severely compromised.

The approach to address these issues cannot be taken on a street by street basis, but must involve a comprehensive approach at a neighborhood level; addressing one street in isolation will likely result in simply pushing the problem to the next street.

Any approach will affect both neighborhood residents and cut through drivers. The balance that needs to be achieved will result in a level of inconvenience that is tolerable to residents but sufficient to discourage cut through traffic,

DTM recommends a stepped approach. If initial actions are not sufficient, more drastic responses can be implemented. Following this approach, DTM recommends the following initial actions:

1. Replace and supplement the existing NO TURN ON LEFT 7AM-9AM signage along Salisbury Road to improve visibility with supplemental signage and better placement.

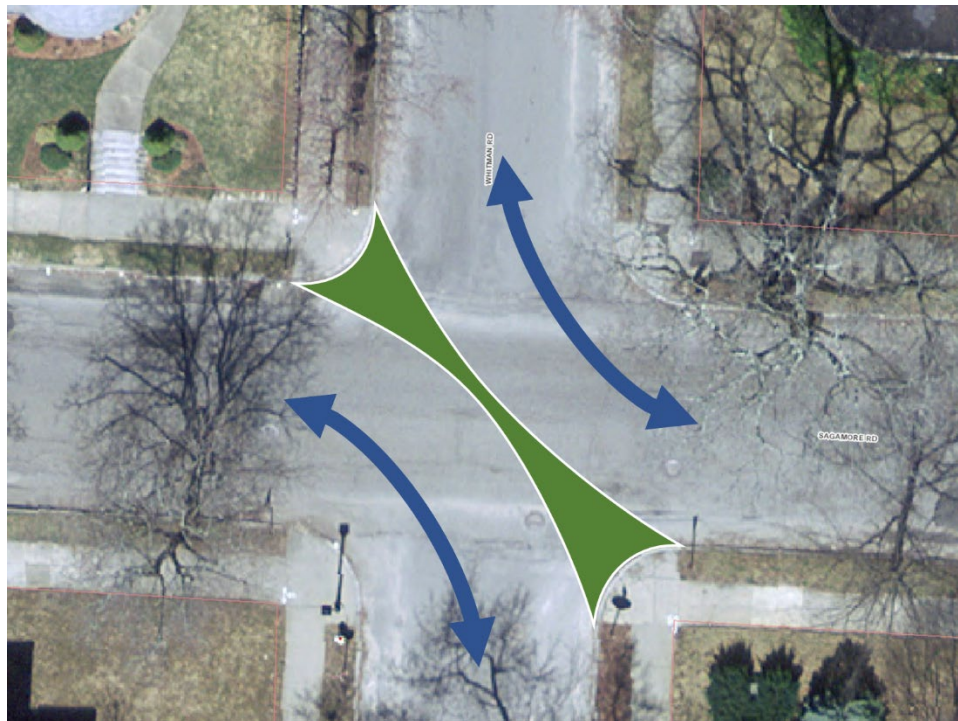
2. Implement traffic calming within the neighborhood. A neighborhood meeting should be convened to review traffic calming options, but DTM's preliminary recommendations are as follows:
  - a. Install 1 permanent, MassDOT standard raised speed humps along Monadnock Road (between Salisbury Road and Sagamore Road).
  - b. Install 2 permanent, MassDOT standard raised speed humps along Whitman Road (between Salisbury Road and Sagamore Road).
  - c. Install 2 permanent, MassDOT standard raised speed humps along Montvale Road.
  - d. Install 1 permanent, MassDOT standard raised speed hump on Sagamore Road, where it levels off, at approximately 73/76 Sagamore Road.
3. Pending availability of funding, implement the following lane marking and traffic signal changes at the intersection of Salisbury Road and Park Avenue:
  - a. Modify the two Salisbury Street approaches to create an exclusive left-turn lane and a single through-right lane eastbound and westbound. This creates an opportunity to create a 5-foot unbuffered bike lanes with a 10-foot left-turn lane and an 11-foot through lane for each Salisbury Street approach. This should improve safety by eliminating the abrupt lane drop east of the intersection and create opportunities for a "road diet" further west.
  - b. Eliminate the existing split-phased operation for the two Salisbury Street approaches, which currently operates inefficiently for the mix of through traffic and turning movements on each approach with the following enhancements. This will require a reconfiguration of the signal heads for the Salisbury Street approached to mount a left turn signal indication on the mast arms to create a "protected" movement. The supplemental signal head for the through lane can be mounted on the mast arm pole at a minimum of 10 feet above the sidewalk surface; and
  - c. Adjust the clearance times for each phase to reflect current guidance from MassDOT as documented in the attachments to this memorandum.
  - d. Reduce the overall cycle length to no more than 130 seconds, including the pedestrian phase. The City can retain the current dynamic max settings to adapt to acute demands on each approach.
  - e. Remove the left-turn arrow indication from the signal housings that are aligned with the middle through lane on the Park Avenue southbound

approach to avoid the unintended guidance that right turns are allowed from the inner lane.

- f. Eradicate the existing pavement markings on the Salisbury Street approaches and reapply roadway striping for the recommended roadway cross-section with an exclusive left-turn lane and single through-right lane on each approach. Reapply the pavement markings on each Park Street approach.

Should these actions not prove sufficient, more drastic actions could be considered, including:

4. Installation of a center median on Salisbury Street to physically prevent left turns onto neighborhood streets. This approach would also eliminate left turns from the neighborhood onto Salisbury Street, but wouldn't address the Park Avenue to Salisbury cut-through movement.
5. Installation of additional speed humps on streets that experience diverted trips.
6. Installation of horizontal traffic calming features such as chicanes (can be employed on steeper gradients).
7. Install a Diagonal diverter at the intersection of Sagamore Road and Whitman Road. This treatment would prevent through trips on both streets, forcing cut-through traffic to complete the entire Monadnock to Whitman loop, which would presumably be enough of a detriment to eliminate most, if not all, cut through traffic.



**IMAGE 6 DIAGONAL DIVERTER TREATMENT**

## MEMORANDUM

**TO:** City of Worcester  
Dept. of Transportation & Mobility  
76 E. Worcester Street  
Worcester, MA 01604  
Attn: Stephen S. Rolle, P.E., Commissioner  
Todd M. Kirrane, Assistant Director

**DATE:** April 24, 2023

**FROM:** Kevin R. Dandrade, PE, PTOE, Principal  
Frankie Ann Schripsema, Project Engineer

**PROJECT NO.:** T1353.01

**RE:** Traffic Signal Operations Assessment  
Park Avenue at Salisbury Street – Worcester, MA

### INTRODUCTION

TEC, Inc. (TEC) has been retained by the City of Worcester Department of Transportation and Mobility ("DTM") to perform a preliminary Traffic Signal Operations Assessment at the intersection of Park Avenue and Salisbury Street in Worcester, Massachusetts. The traffic signal at Park Avenue and Salisbury Street lies under the jurisdiction of the City of Worcester.

TEC performed multiple field visits and evaluated the traffic operations under existing conditions with record traffic data provided by the DTM to determine what, if any, traffic signal timing or phasing adjustments may provide additional intersection capacity.

### EXISTING CONDITIONS

#### Geometry

Park Avenue intersects Salisbury Street from the east and west to create a four-legged, signalized intersection. The Salisbury Street eastbound and westbound approaches consist of a shared left-through lane and shared through-right lane, with directional flow separated by a marked double-yellow centerline. Both approaches have No Turn on Red regulatory signs. The Park Avenue northbound and southbound approaches consists of a protected left-turn lane, one exclusive through lane, and one shared through-right lane, with directional flow separated by a raised median or double-yellow centerline. The intersection corners have smaller radii, which provide a more prominent pedestrian space, but meanwhile result in slower right-turning vehicle speeds.

Sidewalks are provided on both sides of all roadway approaches. However, the pedestrian curb ramps at the intersection do not appear to be compliant with current ADA/AAB regulations.

There are no formal bicycle accommodations on the roadway approaches. Land use adjacent to the intersection is primarily institutional and recreational in nature given the intersection's proximity to Institute Park and the WPI campus.

### **Traffic Signal Phasing / Operations**

The existing traffic signal cabinet contains a Siemens M50 TS 2 Type 2 traffic signal controller and an Iteris Vantage video detection system. The Park Avenue left turn lanes operate in a protected-only phasing pattern whereby traffic may only enter the intersection on a green arrow indication. The Salisbury Street approaches operate under a split-phased sequence, during which all movements from each of those approaches may enter the intersection without conflicting traffic. However, these approaches do not currently have a left arrow indication within the housings to inform motorists that they may turn left under a "protected" movement. This has the potential to introduce inefficiencies for those motorists that are unfamiliar with the intersection because they may pause before turning left even though they have no conflicts. The Salisbury Street approaches have "No Turn on Red" regulatory signs present, but it does not appear to significantly affect the capacity of the approach given the volume of through traffic. The existing traffic signal timing and phasing information is provided within Attachment A.

### **Traffic Volumes**

TEC obtained turning movement counts (TMCs) from DTM's Streetlight Data system at the study intersection during the weekday morning (8:00 AM – 9:00 AM) and weekday evening (4:15 PM – 5:15 PM) peak periods. The traffic count represents average operating conditions for each peak period from multiple data points in 2022. A detailed summary of the turning movement counts is provided within Attachment B.

### **Field Observations**

TEC observed the following characteristics at the subject intersection:

- The existing traffic signal cabinet was recently updated with a video detection system. The system was efficiently detecting traffic on all four approaches with no apparent faults or false calls.
- The traffic signal controller was utilizing its "dynamic max" timings, which allows for a stepped increase in the maximum green time for that particular approach if the vehicular traffic consistently requires it to "max out". This was effectively managing traffic and skewed the timings, in a temporary fashion, toward the more saturated approaches (e.g. Salisbury St eastbound in the morning and Salisbury Street westbound in the afternoon/evening). The queues were excessive, but they typically cleared within one cycle.
- One Opticom preemption detector was visible for the Salisbury Street westbound approach only.



- Three of the four existing mast arms are an older Type 1 (truss-style) construction and are likely decades old. The mast arm base on the northwest corner of the intersection is visibly damaged and should be replaced. The mast arm on the northeast corner is a newer black-painted unit that incorporates the left-turn signal indication over the road for the northbound approach.
- The WALK indication on the southeast corner (facing west) is not currently functioning.
- During weekday morning peak hour, TEC witnessed long queues, particularly on the Salisbury Street eastbound approach. The use of the dynamic max setting allows the signal to adapt and generally clears the standing queue each cycle length. TEC witnessed a few signal cycles that did not allow for the waiting traffic to get through the signal in one cycle.



- TEC observed several cycles where motorists were primarily using the inner through lane on Salisbury Street eastbound and it resulted in "lane imbalance". For those isolated cycles, the queue was not fully processed in one cycle.
- During the evening peak hour, TEC observed long queues on the Salisbury Street westbound and Park Avenue Southbound approaches.
- During periods of multiple successive activations of the exclusive pedestrian phase, the cycle length becomes longer and traffic has more time to queue. TEC observed that the pedestrian phase was activated approximately every-other cycle, on average.

### **Alternative Lane Use & Phasing - Intersection Capacity Analysis**

At DTM's request, TEC performed limited capacity analysis for alternative lane use and phasing alternatives for the subject intersection to verify whether it would yield lower overall delays and queuing. TEC evaluated the following scenarios:

1. Optimized timings using the existing phasing;

2. Modification of the Salisbury Street approaches to create an exclusive left-turn lane and a single through-right lane eastbound and westbound.

During the weekday morning peak hour period (the higher of the two peak periods), Scenario 2 provided the lowest overall vehicle delay at approximately 64 seconds per vehicle. Scenario 1 was less efficient and resulted in a delay of at least 165 seconds per vehicle. Scenario 2 also results in a significantly more efficient eastbound left-turn operation with approximate vehicle delay at 66 seconds, compared to Scenario 1's delay at approximately 256 seconds. Based on TEC's field observations and the capacity analysis, TEC recommends that the City implement Scenario 2, creating an exclusive left-turn lane and a single through-right lane for each Salisbury Street approach.

TEC also analyzed the elimination of the exclusive pedestrian phase in lieu of concurrent pedestrian operations with a Leading Pedestrian Interval (LPI), which allows for an early start of the pedestrian movement for each adjacent approach. This case operates with optimal efficiency.

The detailed intersection capacity and queue analysis worksheets for existing conditions and each scenario are provided in Attachment C.

### **Traffic Signal Clearance Timings**

TEC has provided the Pedestrian Clearance Worksheet and Traffic Signal Clearance Worksheet within Attachment D.

### Intersection Capacity and Queue Analysis Summary

Intersection / Lane Group	Existing Conditions				Scenario 1 Optimized Existing Conditions				Scenario 2 Exclusive Left Conditions			
	V/C <sup>(a)</sup>	Delay <sup>(b)</sup>	LOS <sup>(c)</sup>	Queue <sup>(d)</sup>	V/C	Delay	LOS	Queue	V/C	Delay	LOS	Queue
<b>Park Avenue / Salisbury Street</b>												
<i>Weekday Morning Peak Period</i>												
Salisbury Street EBL	-	-	-	-	-	-	-	-	0.85	66.2	E	134/313
Salisbury Street EBT	3.34	289.6	F	408/611	3.55	256.3	F	422/623	1.01	71.2	E	392/734
Salisbury Street WBL	-	-	-	-	-	-	-	-	1.02	147.3	F	64/167
Salisbury Street WBT	1.47	277.0	F	194/340	1.30	203.7	F	191/337	0.69	39.1	D	189/355
Park Avenue NBL	0.84	97.2	F	52/154	0.89	114.1	F	55/161	0.80	84.2	F	49/126
Park Avenue NBT	1.08	98.4	F	293/532	1.18	142.5	F	351/583	0.99	69.2	E	276/500
Park Avenue SBL	0.68	67.4	E	42/119	0.72	76.9	E	45/125	0.86	106.9	F	40/116
Park Avenue SBT	0.74	43.9	D	183/291	0.82	51.5	D	203/326	0.72	41.3	D	178/285
<b>Overall Intersection</b>	<b>1.23</b>	<b>171.0</b>	<b>F</b>	<b>-</b>	<b>1.22</b>	<b>165.2</b>	<b>F</b>	<b>-</b>	<b>0.95</b>	<b>64.1</b>	<b>E</b>	<b>-</b>
<i>Weekday Evening Peak Period</i>												
Salisbury Street EBL	-	-	-	-	-	-	-	-	0.70	68.6	E	42/98
Salisbury Street EBT	1.61	355.5	F	201/380	1.12	136.9	F	135/300	0.60	36.6	D	151/359
Salisbury Street WBL	-	-	-	-	-	-	-	-	0.73	57.7	E	95/184
Salisbury Street WBT	1.29	189.9	F	455/664	1.30	190.4	F	412/595	1.27	169.4	F	573/899
Park Avenue NBL	1.11	174.4	F	116/306	1.43	296.1	F	130/300	1.14	173.1	F	95/264
Park Avenue NBT	0.57	37.8	D	214/361	0.68	40.9	D	210/338	0.66	36.7	D	186/313
Park Avenue SBL	0.66	75.1	E	45/107	0.84	112.9	F	41/126	0.78	87.9	F	36/114
Park Avenue SBT	0.91	55.9	E	359/653	1.08	98.0	F	350/655	1.09	99.1	F	320/620
<b>Overall Intersection</b>	<b>1.08</b>	<b>132.6</b>	<b>F</b>	<b>-</b>	<b>1.12</b>	<b>127.7</b>	<b>F</b>	<b>-</b>	<b>1.08</b>	<b>98.2</b>	<b>F</b>	<b>-</b>

<sup>a</sup> Volume-to-capacity ratio

<sup>b</sup> Delay expressed in seconds per vehicle (average)

<sup>c</sup> Level of service

<sup>d</sup> 50<sup>th</sup> / 95<sup>th</sup> Percentile Queue (feet)

## CONCLUSIONS AND RECOMMENDATIONS

TEC examined the traffic signal operations at the intersection of Park Avenue at Salisbury Street in Worcester, Massachusetts. In general terms, the current traffic signal phasing operates with degraded efficiency for vehicular traffic. TEC offers the following recommendations to improve intersection capacity and other related traffic operations in the vicinity of the traffic signal:

1. Modify the two Salisbury Street approaches to create an exclusive left-turn lane and a single through-right lane eastbound and westbound. This creates an opportunity to create a 5-foot unbuffered bike lanes with a 10-foot left-turn lane and an 11-foot through lane for each Salisbury Street approach. This should improve safety by eliminating the abrupt lane drop east of the intersection and create opportunities for a "road diet" further west.
2. Eliminate the existing split-phased operation for the two Salisbury Street approaches, which currently operates inefficiently for the mix of through traffic and turning movements on each approach with the following enhancements. This will require a reconfiguration of the signal heads for the Salisbury Street approached to mount a left-turn signal indication on the mast arms to create a "protected" movement. The supplemental signal head for the through lane can be mounted on the mast arm pole at a minimum of 10 feet above the sidewalk surface; and
3. Adjust the clearance times for each phase to reflect current guidance from MassDOT as documented in the attachments to this memorandum.
4. Reduce the overall cycle length to no more than 130 seconds, including the pedestrian phase. The City can retain the current dynamic max settings to adapt to acute demands on each approach.
5. Remove the left-turn arrow indication from the signal housings that are aligned with the middle through lane on the Park Avenue southbound approach to avoid the unintended guidance that right turns are allowed from the inner lane.
6. Eradicate the existing pavement markings on the Salisbury Street approaches and reapply roadway striping for the recommended roadway cross-section with an exclusive left-turn lane and single through-right lane on each approach. Reapply the pavement markings on each Park Street approach.

We are available to assist the City with other design or field operations assistance to perform timing adjustments as you see fit. Please reach out to us with any questions regarding this assessment at (774) 701-0550 or Kevin's mobile number at (508) 868-5104. Thank you for your consideration.



4/24/2023

**Attachment A**

Traffic Signal Inventory

**Traffic Signal Inventory**

<b>Project:</b>	Park Street / Salisbury Street Traffic Signal Assessment	<b>Job #:</b>	T1353.01
<b>Location:</b>	Park Ave at Salisbury Street	<b>Eval Date:</b>	Wednesday, April 5, 2023
<b>Analyst:</b>	TEC Inc. / KRD, FAS	<b>Municipality:</b>	Worcester, Massachusetts

	Description
<b>Phase 1</b>	Park Avenue SB-L
<b>Phase 2</b>	Park Avenue NB
<b>Phase 3</b>	Salisbury Street EB
<b>Phase 4</b>	Salisbury Street WB
<b>Phase 5</b>	Park Avenue NB-L
<b>Phase 6</b>	Park Avenue SB
<b>Phase 7</b>	XXX
<b>Phase 8</b>	XXX
<b>Phase 9</b>	Exclusive Pedestrian

<b>Notes:</b>	<ul style="list-style-type: none"> <li>- new video detection equipment</li> <li>- no coordination data programmed in controller</li> <li>- Opticom pre-emption detector for Salisbury WB only</li> <li>- Park Avenue queues clear in cycle</li> <li>- Salisbury WB queues clear most cycles</li> <li>- northwest corner mast arm pole has significant damage</li> <li>- no protected left indicators for Salisbury EB &amp; WB</li> <li>- Salisbury EB approach (heading Park NB) walking indicator light out</li> <li>- No Turn on Red on Salisbury St approaches</li> <li>- lane merge sign needed Salisbury EB</li> <li>- should check vertical clearance of traffic heads at Salisbury EB</li> <li>- skewed offset on Salisbury WB approach</li> </ul>
---------------	--

	Phase #								
	1	2	3	4	5	6	7	8	9
<b>Minimum Green</b>	6	6	6	6	6	6	-	-	
<b>Passage</b>	2	3	2	2	2	3	-	-	
<b>Max 1</b>	10	31	39	20	10	31	-	-	
<b>Max 2</b>	15	45	20	40	15	45	-	-	
<b>Yellow</b>	3	3	3	3	3	3	-	-	3
<b>Red</b>	2	2	2	2	2	2	-	-	2
<b>Recall</b>	Off	Soft	Off	Off	Off	Soft	-	-	Off
<b>Detectors</b>	Lock	Non-Lock	Non-Lock	Non-Lock	Lock	Non-Lock	-	-	Lock
<b>Walk</b>							-	-	7
<b>Flash Don't Walk</b>							-	-	15
<b>Don't Walk</b>							-	-	1
<b>Dynamic Max Steps</b>		5	5	5		5	-	-	
<b>Dynamic Max</b>		15	15	20		15	-	-	
<b>Phase Sequence</b>	#Ø1/Ø5 to Ø2/Ø6 (or Ø5/Ø2 or Ø1/Ø6) to Ø3 to Ø4 to Ø9								

Note: Any phase not called will be skipped.

**Attachment B**

Turning Movement Counts (TMCs)

Weekday, Peak AM	8:00 AM to 9:00 AM											
	Park N (Southbound)			Salisbury E (Westbound)			Park S (Northbound)			Salisbury W (Eastbound)		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Hourly Total	55	480	36	78	250	28	68	680	80	209	510	45
PHF	0.84	0.85	0.81	0.77	0.84	0.65	0.85	0.86	0.91	0.92	0.83	0.75
Approach Total		571			356			828			764	
Int Total												2519

Weekday, Peak PM	4:15 PM to 5:15 PM											
	Park N (Southbound)			Salisbury E (Westbound)			Park S (Northbound)			Salisbury W (Eastbound)		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Hourly Total	55	708	138	141	610	33	128	528	60	50	232	25
PHF	0.94	0.9	0.74	0.89	0.81	0.93	0.87	0.88	0.93	0.74	0.91	0.62
Approach Total		901			784			716			307	
Int Total												2708





















**Attachment C**

Capacity and Queue Analysis Worksheets

## Existing Conditions Report

Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Future Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	125		0	125		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.990			0.985			0.985			0.989	
Flt Protected		0.988			0.989		0.950			0.950		
Satd. Flow (prot)	0	3462	0	0	3448	0	1770	3486	0	1770	3500	0
Flt Permitted		0.551			0.646		0.950			0.950		
Satd. Flow (perm)	0	1931	0	0	2252	0	1770	3486	0	1770	3500	0
Right Turn on Red			No			No			Yes			Yes
Satd. Flow (RTOR)								8			6	
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		500			500			500			500	
Travel Time (s)		11.4			11.4			9.7			9.7	
Peak Hour Factor	0.92	0.83	0.75	0.77	0.84	0.65	0.85	0.86	0.91	0.84	0.85	0.81
Adj. Flow (vph)	227	614	60	101	298	43	80	791	88	65	565	44
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	901	0	0	442	0	80	879	0	65	609	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		3			4		5	2		1	6	
Permitted Phases	3			4								

Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

04/14/2023

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	

Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

04/14/2023

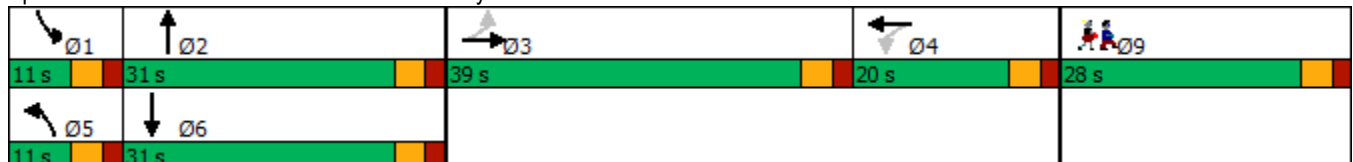


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	3	3		4	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		6.0	10.0		6.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0		11.0	15.0		11.0	15.0	
Total Split (s)	39.0	39.0		20.0	20.0		11.0	31.0		11.0	31.0	
Total Split (%)	30.2%	30.2%		15.5%	15.5%		8.5%	24.0%		8.5%	24.0%	
Maximum Green (s)	34.0	34.0		15.0	15.0		6.0	26.0		6.0	26.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lead		Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	3.0		2.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		34.3		15.1	15.1		6.1	26.2		6.1	26.2	
Actuated g/C Ratio		0.31		0.14	0.14		0.06	0.24		0.06	0.24	
v/c Ratio		3.34dl		1.43	1.43		0.82	1.05		0.67	0.72	
Control Delay		260.8		245.1	245.1		106.0	85.2		85.2	45.3	
Queue Delay		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		260.8		245.1	245.1		106.0	85.2		85.2	45.3	
LOS		F		F	F		F	F		F	D	
Approach Delay		260.8		245.1	245.1		87.0			49.1		
Approach LOS		F		F	F		F			D		

Intersection Summary

Area Type: Other  
 Cycle Length: 129  
 Actuated Cycle Length: 109.8  
 Natural Cycle: 150  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 1.49  
 Intersection Signal Delay: 154.5  
 Intersection LOS: F  
 Intersection Capacity Utilization 74.7%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Splits and Phases: 3: Park Avenue & Salisbury Street



Lane Group	Ø9
Detector Phase	
Switch Phase	
Minimum Initial (s)	6.0
Minimum Split (s)	22.0
Total Split (s)	28.0
Total Split (%)	22%
Maximum Green (s)	23.0
Yellow Time (s)	3.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	7.0
Flash Dont Walk (s)	10.0
Pedestrian Calls (#/hr)	15
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues

3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	901	442	80	879	65	609
v/c Ratio	3.34dl	1.43	0.82	1.05	0.67	0.72
Control Delay	260.8	245.1	106.0	85.2	85.2	45.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	260.8	245.1	106.0	85.2	85.2	45.3
Queue Length 50th (ft)	~408	~194	52	293	42	183
Queue Length 95th (ft)	#611	#340	#154	#532	#119	291
Internal Link Dist (ft)	420	420		420		420
Turn Bay Length (ft)			125		125	
Base Capacity (vph)	603	310	97	839	97	841
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.49	1.43	0.82	1.05	0.67	0.72

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.



















Queue shown is maximum after two cycles.

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

# HCM Signalized Intersection Capacity Analysis

## 3: Park Avenue & Salisbury Street

04/14/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Future Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		0.95			0.95		1.00	0.95		1.00	0.95	
Frt		0.99			0.99		1.00	0.98		1.00	0.99	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3460			3448		1770	3486		1770	3501	
Flt Permitted		0.55			0.65		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1930			2252		1770	3486		1770	3501	
Peak-hour factor, PHF	0.92	0.83	0.75	0.77	0.84	0.65	0.85	0.86	0.91	0.84	0.85	0.81
Adj. Flow (vph)	227	614	60	101	298	43	80	791	88	65	565	44
RTOR Reduction (vph)	0	0	0	0	0	0	0	6	0	0	5	0
Lane Group Flow (vph)	0	901	0	0	442	0	80	873	0	65	604	0
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		3			4		5	2		1	6	
Permitted Phases	3			4								
Actuated Green, G (s)		34.3			15.1		6.1	26.2		6.1	26.2	
Effective Green, g (s)		34.3			15.1		6.1	26.2		6.1	26.2	
Actuated g/C Ratio		0.30			0.13		0.05	0.23		0.05	0.23	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		2.0			2.0		2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)		586			301		95	809		95	813	
v/s Ratio Prot							c0.05	c0.25		0.04	0.17	
v/s Ratio Perm		c0.47			c0.20							
v/c Ratio		3.34dl			1.47		0.84	1.08		0.68	0.74	
Uniform Delay, d1		39.2			48.9		52.9	43.3		52.4	40.2	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		250.4			228.1		44.3	55.1		15.0	3.7	
Delay (s)		289.6			277.0		97.2	98.4		67.4	43.9	
Level of Service		F			F		F	F		E	D	
Approach Delay (s)		289.6			277.0			98.3			46.2	
Approach LOS		F			F			F			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			171.0				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			1.23									
Actuated Cycle Length (s)			112.8				Sum of lost time (s)			25.0		
Intersection Capacity Utilization			74.7%				ICU Level of Service			D		
Analysis Period (min)			15									
dl Defacto Left Lane. Recode with 1 though lane as a left lane.												
c Critical Lane Group												



Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕↕		↕	↕↕	
Traffic Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Future Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	125		0	125		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.983			0.994			0.985			0.971	
Flt Protected		0.991			0.992		0.950			0.950		
Satd. Flow (prot)	0	3448	0	0	3490	0	1770	3486	0	1770	3437	0
Flt Permitted		0.578			0.797		0.950			0.950		
Satd. Flow (perm)	0	2011	0	0	2804	0	1770	3486	0	1770	3437	0
Right Turn on Red			No			No			Yes			Yes
Satd. Flow (RTOR)								8			19	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		500			500			500			500	
Travel Time (s)		11.4			11.4			11.4			11.4	
Peak Hour Factor	0.74	0.91	0.62	0.89	0.81	0.93	0.87	0.88	0.93	0.94	0.90	0.74
Adj. Flow (vph)	68	255	40	158	753	35	147	600	65	59	787	186
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	363	0	0	946	0	147	665	0	59	973	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		3			4		5	2		1	6	
Permitted Phases	3			4								

Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	

Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

04/14/2023

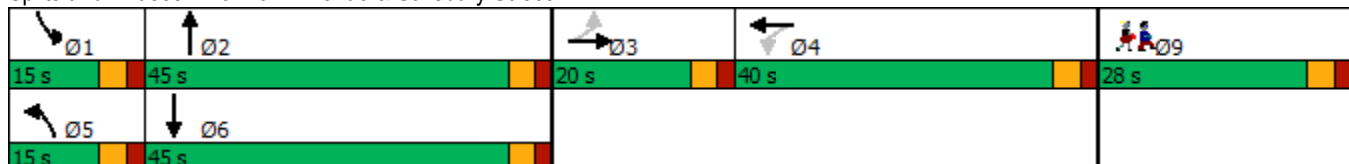


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	3	3		4	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Total Split (s)	20.0	20.0		40.0	40.0		15.0	45.0		15.0	45.0	
Total Split (%)	13.5%	13.5%		27.0%	27.0%		10.1%	30.4%		10.1%	30.4%	
Maximum Green (s)	15.0	15.0		35.0	35.0		10.0	40.0		10.0	40.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lead		Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	3.0		2.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		15.1		35.3	35.3		10.1	44.7		8.2	40.4	
Actuated g/C Ratio		0.12		0.27	0.27		0.08	0.34		0.06	0.31	
v/c Ratio		1.56		1.25	1.25		1.08	0.56		0.53	0.91	
Control Delay		309.5		163.0	163.0		155.7	39.8		79.9	55.9	
Queue Delay		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		309.5		163.0	163.0		155.7	39.8		79.9	55.9	
LOS		F		F	F		F	D		E	E	
Approach Delay		309.5		163.0	163.0		60.8			57.3		
Approach LOS		F		F	F		E			E		

Intersection Summary

Area Type:	Other
Cycle Length:	148
Actuated Cycle Length:	130.8
Natural Cycle:	150
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	1.56
Intersection Signal Delay:	118.9
Intersection LOS:	F
Intersection Capacity Utilization:	78.4%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 3: Park Avenue & Salisbury Street



Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023

Lane Group	Ø9
Detector Phase	
Switch Phase	
Minimum Initial (s)	6.0
Minimum Split (s)	28.0
Total Split (s)	28.0
Total Split (%)	19%
Maximum Green (s)	23.0
Yellow Time (s)	3.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	7.0
Flash Dont Walk (s)	15.0
Pedestrian Calls (#/hr)	15
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues

3: Park Avenue & Salisbury Street

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Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	363	946	147	665	59	973
v/c Ratio	1.56	1.25	1.08	0.56	0.53	0.91
Control Delay	309.5	163.0	155.7	39.8	79.9	55.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	309.5	163.0	155.7	39.8	79.9	55.9
Queue Length 50th (ft)	~201	~455	116	214	45	359
Queue Length 95th (ft)	#380	#664	#306	361	107	#653
Internal Link Dist (ft)	420	420		420		420
Turn Bay Length (ft)			125		125	
Base Capacity (vph)	233	757	136	1195	136	1074
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.56	1.25	1.08	0.56	0.43	0.91

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.



















# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 3: Park Avenue & Salisbury Street

04/14/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Future Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		0.95			0.95		1.00	0.95		1.00	0.95	
Frt		0.98			0.99		1.00	0.99		1.00	0.97	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3448			3490		1770	3487		1770	3438	
Flt Permitted		0.58			0.80		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		2011			2806		1770	3487		1770	3438	
Peak-hour factor, PHF	0.74	0.91	0.62	0.89	0.81	0.93	0.87	0.88	0.93	0.94	0.90	0.74
Adj. Flow (vph)	68	255	40	158	753	35	147	600	65	59	787	186
RTOR Reduction (vph)	0	0	0	0	0	0	0	5	0	0	13	0
Lane Group Flow (vph)	0	363	0	0	946	0	147	660	0	59	960	0
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		3			4		5	2		1	6	
Permitted Phases	3			4								
Actuated Green, G (s)		15.1			35.3		10.1	44.7		6.9	41.5	
Effective Green, g (s)		15.1			35.3		10.1	44.7		6.9	41.5	
Actuated g/C Ratio		0.11			0.26		0.07	0.33		0.05	0.31	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		2.0			2.0		2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)		225			734		132	1156		90	1058	
v/s Ratio Prot							c0.08	c0.19		0.03	c0.28	
v/s Ratio Perm		c0.18			c0.34							
v/c Ratio		1.61			1.29		1.11	0.57		0.66	0.91	
Uniform Delay, d1		59.9			49.8		62.4	37.1		62.8	44.8	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		295.6			140.1		112.1	0.7		12.3	11.1	
Delay (s)		355.5			189.9		174.4	37.8		75.1	55.9	
Level of Service		F			F		F	D		E	E	
Approach Delay (s)		355.5			189.9			62.6			57.0	
Approach LOS		F			F			E			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			132.6				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			1.08									
Actuated Cycle Length (s)			134.8				Sum of lost time (s)			25.0		
Intersection Capacity Utilization			78.4%				ICU Level of Service			D		
Analysis Period (min)			15									

c Critical Lane Group

## Optimized Existing Conditions Report

Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕↕		↕	↕↕	
Traffic Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Future Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	125		0	125		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.990			0.985			0.985			0.989	
Flt Protected		0.988			0.989		0.950			0.950		
Satd. Flow (prot)	0	3462	0	0	3448	0	1770	3486	0	1770	3500	0
Flt Permitted		0.547			0.639		0.950			0.950		
Satd. Flow (perm)	0	1917	0	0	2228	0	1770	3486	0	1770	3500	0
Right Turn on Red			No			No			Yes			Yes
Satd. Flow (RTOR)								8			5	
Link Speed (mph)		30			30			35			35	
Link Distance (ft)		500			500			500			500	
Travel Time (s)		11.4			11.4			9.7			9.7	
Peak Hour Factor	0.92	0.83	0.75	0.77	0.84	0.65	0.85	0.86	0.91	0.84	0.85	0.81
Adj. Flow (vph)	227	614	60	101	298	43	80	791	88	65	565	44
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	901	0	0	442	0	80	879	0	65	609	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		3			4		5	2		1	6	
Permitted Phases	3			4								



Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

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Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	

Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023

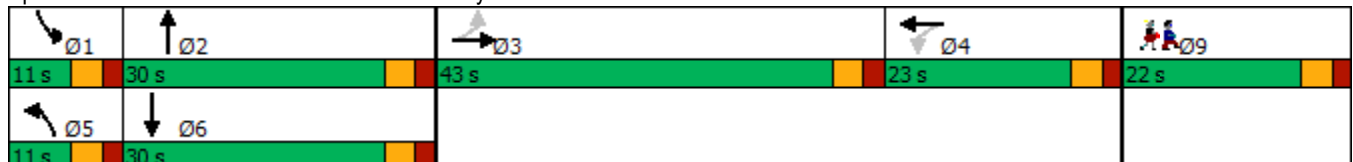


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	3	3		4	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		6.0	10.0		6.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0		11.0	15.0		11.0	15.0	
Total Split (s)	43.0	43.0		23.0	23.0		11.0	30.0		11.0	30.0	
Total Split (%)	33.3%	33.3%		17.8%	17.8%		8.5%	23.3%		8.5%	23.3%	
Maximum Green (s)	38.0	38.0		18.0	18.0		6.0	25.0		6.0	25.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lead		Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	3.0		2.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		38.3			18.2		6.1	25.2		6.1	25.2	
Actuated g/C Ratio		0.33			0.16		0.05	0.22		0.05	0.22	
v/c Ratio		3.55dl			1.27		0.87	1.15		0.71	0.80	
Control Delay		230.5			182.0		119.1	122.7		93.5	52.5	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		230.5			182.0		119.1	122.7		93.5	52.5	
LOS		F			F		F	F		F	D	
Approach Delay		230.5			182.0			122.4			56.4	
Approach LOS		F			F			F			E	

Intersection Summary

Area Type: Other  
 Cycle Length: 129  
 Actuated Cycle Length: 115.8  
 Natural Cycle: 150  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 1.42  
 Intersection Signal Delay: 149.0  
 Intersection LOS: F  
 Intersection Capacity Utilization 74.7%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 dl Defacto Left Lane. Recode with 1 though lane as a left lane.

Splits and Phases: 3: Park Avenue & Salisbury Street



Lane Group	Ø9
Detector Phase	
Switch Phase	
Minimum Initial (s)	6.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	17%
Maximum Green (s)	17.0
Yellow Time (s)	3.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	7.0
Flash Dont Walk (s)	10.0
Pedestrian Calls (#/hr)	15
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues

3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	901	442	80	879	65	609
v/c Ratio	3.55dl	1.27	0.87	1.15	0.71	0.80
Control Delay	230.5	182.0	119.1	122.7	93.5	52.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	230.5	182.0	119.1	122.7	93.5	52.5
Queue Length 50th (ft)	~422	~191	55	~351	45	203
Queue Length 95th (ft)	#623	#337	#161	#583	#125	#326
Internal Link Dist (ft)	420	420		420		420
Turn Bay Length (ft)			125		125	
Base Capacity (vph)	634	348	92	765	92	765
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.42	1.27	0.87	1.15	0.71	0.80

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.



















Queue shown is maximum after two cycles.

dl Defacto Left Lane. Recode with 1 though lane as a left lane.

# HCM Signalized Intersection Capacity Analysis

## 3: Park Avenue & Salisbury Street

04/14/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Future Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		0.95			0.95		1.00	0.95		1.00	0.95	
Frt		0.99			0.99		1.00	0.98		1.00	0.99	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3460			3448		1770	3486		1770	3501	
Flt Permitted		0.55			0.64		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1917			2229		1770	3486		1770	3501	
Peak-hour factor, PHF	0.92	0.83	0.75	0.77	0.84	0.65	0.85	0.86	0.91	0.84	0.85	0.81
Adj. Flow (vph)	227	614	60	101	298	43	80	791	88	65	565	44
RTOR Reduction (vph)	0	0	0	0	0	0	0	6	0	0	4	0
Lane Group Flow (vph)	0	901	0	0	442	0	80	873	0	65	605	0
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		3			4		5	2		1	6	
Permitted Phases	3			4								
Actuated Green, G (s)		38.3			18.2		6.1	25.2		6.1	25.2	
Effective Green, g (s)		38.3			18.2		6.1	25.2		6.1	25.2	
Actuated g/C Ratio		0.32			0.15		0.05	0.21		0.05	0.21	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		2.0			2.0		2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)		617			341		90	738		90	742	
v/s Ratio Prot							c0.05	c0.25		0.04	0.17	
v/s Ratio Perm		c0.47			c0.20							
v/c Ratio		3.55dl			1.30		0.89	1.18		0.72	0.82	
Uniform Delay, d1		40.3			50.4		56.1	46.9		55.6	44.6	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		216.0			153.4		58.0	95.7		21.3	6.9	
Delay (s)		256.3			203.7		114.1	142.5		76.9	51.5	
Level of Service		F			F		F	F		E	D	
Approach Delay (s)		256.3			203.7			140.2			54.0	
Approach LOS		F			F			F			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			165.2				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			1.22									
Actuated Cycle Length (s)			118.9				Sum of lost time (s)			25.0		
Intersection Capacity Utilization			74.7%				ICU Level of Service			D		
Analysis Period (min)			15									
dl Defacto Left Lane. Recode with 1 though lane as a left lane.												
c Critical Lane Group												

Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕↕		↕	↕↕	
Traffic Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Future Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	125		0	125		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.983			0.994			0.985			0.971	
Flt Protected		0.991			0.992		0.950			0.950		
Satd. Flow (prot)	0	3448	0	0	3490	0	1770	3486	0	1770	3437	0
Flt Permitted		0.558			0.799		0.950			0.950		
Satd. Flow (perm)	0	1941	0	0	2811	0	1770	3486	0	1770	3437	0
Right Turn on Red			No			No			Yes			Yes
Satd. Flow (RTOR)								8			21	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		500			500			500			500	
Travel Time (s)		11.4			11.4			11.4			11.4	
Peak Hour Factor	0.74	0.91	0.62	0.89	0.81	0.93	0.87	0.88	0.93	0.94	0.90	0.74
Adj. Flow (vph)	68	255	40	158	753	35	147	600	65	59	787	186
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	363	0	0	946	0	147	665	0	59	973	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		3			4		5	2		1	6	
Permitted Phases	3			4								

Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	

Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	3	3		4	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		6.0	10.0		6.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0		11.0	15.0		11.0	15.0	
Total Split (s)	25.0	25.0		36.0	36.0		12.0	36.0		11.0	35.0	
Total Split (%)	19.2%	19.2%		27.7%	27.7%		9.2%	27.7%		8.5%	26.9%	
Maximum Green (s)	20.0	20.0		31.0	31.0		7.0	31.0		6.0	30.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lead		Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	3.0		2.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)		20.2		31.3	31.3		7.1	33.6		6.0	30.2	
Actuated g/C Ratio		0.17		0.27	0.27		0.06	0.29		0.05	0.26	
v/c Ratio		1.08		1.26	1.26		1.39	0.66		0.65	1.08	
Control Delay		119.6		163.7	163.7		260.5	42.1		87.9	92.9	
Queue Delay		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		119.6		163.7	163.7		260.5	42.1		87.9	92.9	
LOS		F		F	F		F	D		F	F	
Approach Delay		119.6		163.7	163.7		81.7			92.6		
Approach LOS		F		F	F		F			F		

Intersection Summary

Area Type:	Other
Cycle Length:	130
Actuated Cycle Length:	116.8
Natural Cycle:	150
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	1.39
Intersection Signal Delay:	114.2
Intersection LOS:	F
Intersection Capacity Utilization:	78.4%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 3: Park Avenue & Salisbury Street





Lane Group	Ø9
Detector Phase	
Switch Phase	
Minimum Initial (s)	6.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	17%
Maximum Green (s)	17.0
Yellow Time (s)	3.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	7.0
Flash Dont Walk (s)	10.0
Pedestrian Calls (#/hr)	15
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues

3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	363	946	147	665	59	973
v/c Ratio	1.08	1.26	1.39	0.66	0.65	1.08
Control Delay	119.6	163.7	260.5	42.1	87.9	92.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	119.6	163.7	260.5	42.1	87.9	92.9
Queue Length 50th (ft)	~135	~412	~130	210	41	~350
Queue Length 95th (ft)	#300	#595	#300	338	#126	#655
Internal Link Dist (ft)	420	420		420		420
Turn Bay Length (ft)			125		125	
Base Capacity (vph)	335	752	106	1009	91	905
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.08	1.26	1.39	0.66	0.65	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.



















# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 3: Park Avenue & Salisbury Street

04/14/2023























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Future Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		0.95			0.95		1.00	0.95		1.00	0.95	
Frt		0.98			0.99		1.00	0.99		1.00	0.97	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3448			3490		1770	3487		1770	3438	
Flt Permitted		0.56			0.80		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1942			2812		1770	3487		1770	3438	
Peak-hour factor, PHF	0.74	0.91	0.62	0.89	0.81	0.93	0.87	0.88	0.93	0.94	0.90	0.74
Adj. Flow (vph)	68	255	40	158	753	35	147	600	65	59	787	186
RTOR Reduction (vph)	0	0	0	0	0	0	0	6	0	0	16	0
Lane Group Flow (vph)	0	363	0	0	946	0	147	659	0	59	957	0
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		3			4		5	2		1	6	
Permitted Phases	3			4								
Actuated Green, G (s)		20.2			31.3		7.1	33.6		4.8	31.3	
Effective Green, g (s)		20.2			31.3		7.1	33.6		4.8	31.3	
Actuated g/C Ratio		0.17			0.26		0.06	0.28		0.04	0.26	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		2.0			2.0		2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)		324			727		103	968		70	889	
v/s Ratio Prot							c0.08	0.19		0.03	c0.28	
v/s Ratio Perm		c0.19			c0.34							
v/c Ratio		1.12			1.30		1.43	0.68		0.84	1.08	
Uniform Delay, d1		50.4			44.9		57.0	38.9		57.7	44.9	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		86.5			145.5		239.2	2.0		55.2	53.1	
Delay (s)		136.9			190.4		296.1	40.9		112.9	98.0	
Level of Service		F			F		F	D		F	F	
Approach Delay (s)		136.9			190.4			87.1			98.8	
Approach LOS		F			F			F			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			127.7				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			1.12									
Actuated Cycle Length (s)			121.0				Sum of lost time (s)			25.0		
Intersection Capacity Utilization			78.4%				ICU Level of Service			D		
Analysis Period (min)			15									

c Critical Lane Group

## Exclusive Left Conditions Report

Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Future Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		0	250		0	125		0	125		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.987			0.981			0.985			0.989	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1839	0	1770	1827	0	1770	3486	0	1770	3500	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1839	0	1770	1827	0	1770	3486	0	1770	3500	0
Right Turn on Red			No			No			Yes			Yes
Satd. Flow (RTOR)								9				6
Link Speed (mph)		30			30			35				35
Link Distance (ft)		500			500			500				500
Travel Time (s)		11.4			11.4			9.7				9.7
Peak Hour Factor	0.92	0.83	0.75	0.77	0.84	0.65	0.85	0.86	0.91	0.84	0.85	0.81
Adj. Flow (vph)	227	614	60	101	298	43	80	791	88	65	565	44
Shared Lane Traffic (%)												
Lane Group Flow (vph)	227	674	0	101	341	0	80	879	0	65	609	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases												

Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

04/14/2023

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	

Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

04/14/2023

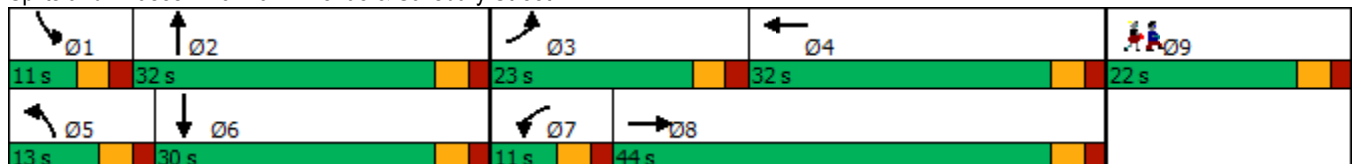


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	3	8		7	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		6.0	10.0		6.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0		11.0	15.0		11.0	15.0	
Total Split (s)	23.0	44.0		11.0	32.0		13.0	32.0		11.0	30.0	
Total Split (%)	19.2%	36.7%		9.2%	26.7%		10.8%	26.7%		9.2%	25.0%	
Maximum Green (s)	18.0	39.0		6.0	27.0		8.0	27.0		6.0	25.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	3.0		2.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	16.4	39.6		6.1	29.3		7.6	27.4		6.1	25.9	
Actuated g/C Ratio	0.16	0.38		0.06	0.28		0.07	0.26		0.06	0.25	
v/c Ratio	0.82	0.97		0.98	0.67		0.62	0.96		0.63	0.70	
Control Delay	68.1	61.9		137.2	44.4		72.1	60.1		79.2	42.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	68.1	61.9		137.2	44.4		72.1	60.1		79.2	42.8	
LOS	E	E		F	D		E	E		E	D	
Approach Delay		63.4			65.6			61.1			46.3	
Approach LOS		E			E			E			D	

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	104.6
Natural Cycle:	140
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.98
Intersection Signal Delay:	59.1
Intersection LOS:	E
Intersection Capacity Utilization:	77.6%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 3: Park Avenue & Salisbury Street



Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

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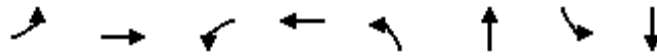
Lane Group	Ø9
Detector Phase	
Switch Phase	
Minimum Initial (s)	6.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	18%
Maximum Green (s)	17.0
Yellow Time (s)	3.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	7.0
Flash Dont Walk (s)	10.0
Pedestrian Calls (#/hr)	15
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	



Queues

3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	227	674	101	341	80	879	65	609
v/c Ratio	0.82	0.97	0.98	0.67	0.62	0.96	0.63	0.70
Control Delay	68.1	61.9	137.2	44.4	72.1	60.1	79.2	42.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.1	61.9	137.2	44.4	72.1	60.1	79.2	42.8
Queue Length 50th (ft)	134	392	64	189	49	276	40	178
Queue Length 95th (ft)	#313	#734	#167	#355	#126	#500	#116	285
Internal Link Dist (ft)		420		420		420		420
Turn Bay Length (ft)	250		250		125		125	
Base Capacity (vph)	309	696	103	512	137	920	103	871
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.97	0.98	0.67	0.58	0.96	0.63	0.70























Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 3: Park Avenue & Salisbury Street

04/14/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Future Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1838		1770	1828		1770	3486		1770	3501	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1838		1770	1828		1770	3486		1770	3501	
Peak-hour factor, PHF	0.92	0.83	0.75	0.77	0.84	0.65	0.85	0.86	0.91	0.84	0.85	0.81
Adj. Flow (vph)	227	614	60	101	298	43	80	791	88	65	565	44
RTOR Reduction (vph)	0	0	0	0	0	0	0	7	0	0	5	0
Lane Group Flow (vph)	227	674	0	101	341	0	80	872	0	65	604	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	16.4	39.6		6.1	29.3		6.2	27.4		4.7	25.9	
Effective Green, g (s)	16.4	39.6		6.1	29.3		6.2	27.4		4.7	25.9	
Actuated g/C Ratio	0.15	0.36		0.06	0.27		0.06	0.25		0.04	0.24	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	267	669		99	492		100	878		76	834	
v/s Ratio Prot	c0.13	c0.37		0.06	0.19		c0.05	c0.25		0.04	0.17	
v/s Ratio Perm												
v/c Ratio	0.85	1.01		1.02	0.69		0.80	0.99		0.86	0.72	
Uniform Delay, d1	45.0	34.5		51.3	35.7		50.6	40.6		51.7	38.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	21.2	36.6		96.0	3.4		33.6	28.6		55.3	3.1	
Delay (s)	66.2	71.2		147.3	39.1		84.2	69.2		106.9	41.3	
Level of Service	E	E		F	D		F	E		F	D	
Approach Delay (s)		69.9			63.8			70.4			47.6	
Approach LOS		E			E			E			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			64.1				HCM 2000 Level of Service			E		
HCM 2000 Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			108.7				Sum of lost time (s)			25.0		
Intersection Capacity Utilization			77.6%				ICU Level of Service			D		
Analysis Period (min)			15									

c Critical Lane Group

Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Future Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		0	250		0	125		0	125		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.980			0.993			0.985			0.971	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1825	0	1770	1850	0	1770	3486	0	1770	3437	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1825	0	1770	1850	0	1770	3486	0	1770	3437	0
Right Turn on Red			No			No			Yes			Yes
Satd. Flow (RTOR)								9			22	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		500			500			500			500	
Travel Time (s)		11.4			11.4			11.4			11.4	
Peak Hour Factor	0.74	0.91	0.62	0.89	0.81	0.93	0.87	0.88	0.93	0.94	0.90	0.74
Adj. Flow (vph)	68	255	40	158	753	35	147	600	65	59	787	186
Shared Lane Traffic (%)												
Lane Group Flow (vph)	68	295	0	158	788	0	147	665	0	59	973	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	7		8	4		5	2		1	6	
Permitted Phases												

Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

04/14/2023

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(ft)	
Link Offset(ft)	
Crosswalk Width(ft)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (mph)	
Number of Detectors	
Detector Template	
Leading Detector (ft)	
Trailing Detector (ft)	
Detector 1 Position(ft)	
Detector 1 Size(ft)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(ft)	
Detector 2 Size(ft)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	

Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

04/14/2023

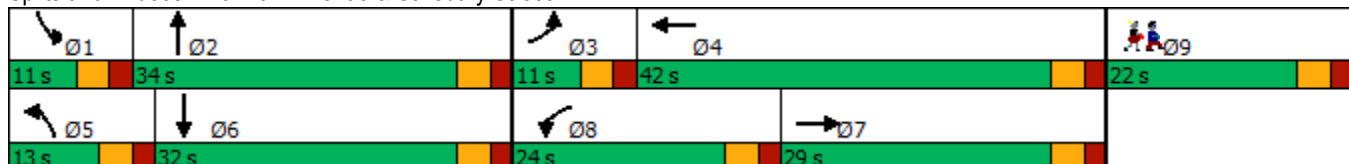


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	3	7		8	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		6.0	10.0		6.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0		11.0	15.0		11.0	15.0	
Total Split (s)	11.0	29.0		24.0	42.0		13.0	34.0		11.0	32.0	
Total Split (%)	9.2%	24.2%		20.0%	35.0%		10.8%	28.3%		9.2%	26.7%	
Maximum Green (s)	6.0	24.0		19.0	37.0		8.0	29.0		6.0	27.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	3.0		2.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	6.1	29.9		13.5	37.4		8.1	31.7		6.1	27.3	
Actuated g/C Ratio	0.06	0.28		0.13	0.35		0.08	0.30		0.06	0.26	
v/c Ratio	0.68	0.58		0.71	1.22		1.10	0.64		0.59	1.09	
Control Delay	84.5	42.0		63.2	144.1		154.6	37.9		76.1	95.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	84.5	42.0		63.2	144.1		154.6	37.9		76.1	95.0	
LOS	F	D		E	F		F	D		E	F	
Approach Delay		49.9			130.6			59.1			93.9	
Approach LOS		D			F			E			F	

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	106.8
Natural Cycle:	150
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	1.22
Intersection Signal Delay:	90.9
Intersection LOS:	F
Intersection Capacity Utilization:	86.8%
ICU Level of Service:	E
Analysis Period (min):	15

Splits and Phases: 3: Park Avenue & Salisbury Street



Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

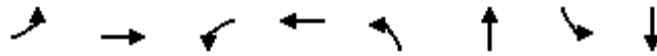
04/14/2023

Lane Group	Ø9
Detector Phase	
Switch Phase	
Minimum Initial (s)	6.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	18%
Maximum Green (s)	17.0
Yellow Time (s)	3.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	7.0
Flash Dont Walk (s)	10.0
Pedestrian Calls (#/hr)	15
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Queues

3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	68	295	158	788	147	665	59	973
v/c Ratio	0.68	0.58	0.71	1.22	1.10	0.64	0.59	1.09
Control Delay	84.5	42.0	63.2	144.1	154.6	37.9	76.1	95.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	84.5	42.0	63.2	144.1	154.6	37.9	76.1	95.0
Queue Length 50th (ft)	42	151	95	~573	~95	186	36	~320
Queue Length 95th (ft)	#98	#359	184	#899	#264	313	#114	#620
Internal Link Dist (ft)		420		420		420		420
Turn Bay Length (ft)	250		250		125		125	
Base Capacity (vph)	100	511	318	647	134	1040	100	893
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.58	0.50	1.22	1.10	0.64	0.59	1.09

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 3: Park Avenue & Salisbury Street

04/14/2023



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Future Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.99		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1825		1770	1850		1770	3487		1770	3438	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1825		1770	1850		1770	3487		1770	3438	
Peak-hour factor, PHF	0.74	0.91	0.62	0.89	0.81	0.93	0.87	0.88	0.93	0.94	0.90	0.74
Adj. Flow (vph)	68	255	40	158	753	35	147	600	65	59	787	186
RTOR Reduction (vph)	0	0	0	0	0	0	0	6	0	0	16	0
Lane Group Flow (vph)	68	295	0	158	788	0	147	659	0	59	957	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	7		8	4		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	6.1	30.0		13.5	37.4		8.1	31.7		4.8	28.4	
Effective Green, g (s)	6.1	30.0		13.5	37.4		8.1	31.7		4.8	28.4	
Actuated g/C Ratio	0.05	0.27		0.12	0.34		0.07	0.29		0.04	0.26	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	97	492		215	622		129	994		76	878	
v/s Ratio Prot	0.04	0.16		c0.09	c0.43		c0.08	c0.19		0.03	c0.28	
v/s Ratio Perm												
v/c Ratio	0.70	0.60		0.73	1.27		1.14	0.66		0.78	1.09	
Uniform Delay, d1	51.6	35.3		47.1	36.8		51.5	35.0		52.6	41.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	17.0	1.3		10.7	132.5		121.6	1.7		35.3	57.7	
Delay (s)	68.6	36.6		57.7	169.4		173.1	36.7		87.9	99.1	
Level of Service	E	D		E	F		F	D		F	F	
Approach Delay (s)		42.6			150.7			61.4			98.4	
Approach LOS		D			F			E			F	

### Intersection Summary

HCM 2000 Control Delay	98.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	111.1	Sum of lost time (s)	25.0
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		























c Critical Lane Group



## Concurrent Pedestrian Phase Conditions Report

Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Future Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		0	250		0	125		0	125		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.987			0.981			0.985			0.989	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1839	0	1770	1827	0	1770	3486	0	1770	3500	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1839	0	1770	1827	0	1770	3486	0	1770	3500	0
Right Turn on Red			No			No			Yes			Yes
Satd. Flow (RTOR)								10				7
Link Speed (mph)		30			30			35				35
Link Distance (ft)		500			500			500				500
Travel Time (s)		11.4			11.4			9.7				9.7
Peak Hour Factor	0.92	0.83	0.75	0.77	0.84	0.65	0.85	0.86	0.91	0.84	0.85	0.81
Adj. Flow (vph)	227	614	60	101	298	43	80	791	88	65	565	44
Shared Lane Traffic (%)												
Lane Group Flow (vph)	227	674	0	101	341	0	80	879	0	65	609	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases												

Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

04/14/2023

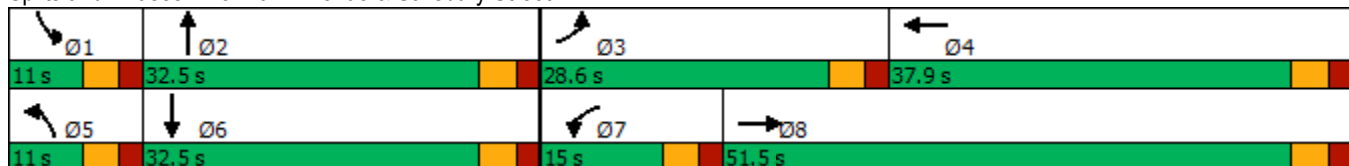


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	3	8		7	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	6.0		5.0	6.0		6.0	10.0		6.0	10.0	
Minimum Split (s)	22.5	27.0		22.5	27.0		11.0	27.0		11.0	27.0	
Total Split (s)	28.6	51.5		15.0	37.9		11.0	32.5		11.0	32.5	
Total Split (%)	26.0%	46.8%		13.6%	34.5%		10.0%	29.5%		10.0%	29.5%	
Maximum Green (s)	23.6	46.5		10.0	32.9		6.0	27.5		6.0	27.5	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	2.0		3.0	2.0		2.0	3.0		2.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)		7.0			7.0			7.0			7.0	
Flash Dont Walk (s)		12.0			12.0			10.0			10.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	18.0	41.0		9.4	28.8		6.3	28.7		6.3	25.3	
Actuated g/C Ratio	0.18	0.41		0.09	0.29		0.06	0.29		0.06	0.26	
v/c Ratio	0.71	0.89		0.60	0.64		0.72	0.87		0.59	0.68	
Control Delay	52.9	43.5		63.5	37.5		85.2	46.9		72.1	38.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	52.9	43.5		63.5	37.5		85.2	46.9		72.1	38.8	
LOS	D	D		E	D		F	D		E	D	
Approach Delay		45.9			43.4			50.1			42.0	
Approach LOS		D			D			D			D	

Intersection Summary

Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	99.2
Natural Cycle:	110
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.89
Intersection Signal Delay:	46.0
Intersection LOS:	D
Intersection Capacity Utilization:	76.9%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 3: Park Avenue & Salisbury Street



Queues

3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	227	674	101	341	80	879	65	609
v/c Ratio	0.71	0.89	0.60	0.64	0.72	0.87	0.59	0.68
Control Delay	52.9	43.5	63.5	37.5	85.2	46.9	72.1	38.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.9	43.5	63.5	37.5	85.2	46.9	72.1	38.8
Queue Length 50th (ft)	152	425	69	194	57	321	46	201
Queue Length 95th (ft)	228	520	108	280	#134	#430	#103	248
Internal Link Dist (ft)		420		420		420		420
Turn Bay Length (ft)	250		250		125		125	
Base Capacity (vph)	439	899	186	649	111	1015	111	1017
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.52	0.75	0.54	0.53	0.72	0.87	0.59	0.60























Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

# HCM Signalized Intersection Capacity Analysis

## 3: Park Avenue & Salisbury Street























04/14/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Future Volume (vph)	209	510	45	78	250	28	68	680	80	55	480	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.98		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1838		1770	1828		1770	3486		1770	3501	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1838		1770	1828		1770	3486		1770	3501	
Peak-hour factor, PHF	0.92	0.83	0.75	0.77	0.84	0.65	0.85	0.86	0.91	0.84	0.85	0.81
Adj. Flow (vph)	227	614	60	101	298	43	80	791	88	65	565	44
RTOR Reduction (vph)	0	0	0	0	0	0	0	7	0	0	5	0
Lane Group Flow (vph)	227	674	0	101	341	0	80	872	0	65	604	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	18.0	41.0		7.3	30.3		6.3	28.7		4.4	26.8	
Effective Green, g (s)	18.0	41.0		7.3	30.3		6.3	28.7		4.4	26.8	
Actuated g/C Ratio	0.18	0.40		0.07	0.30		0.06	0.28		0.04	0.26	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	2.0		3.0	2.0		2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	314	743		127	546		109	986		76	925	
v/s Ratio Prot	c0.13	c0.37		0.06	0.19		c0.05	c0.25		0.04	0.17	
v/s Ratio Perm												
v/c Ratio	0.72	0.91		0.80	0.62		0.73	0.88		0.86	0.65	
Uniform Delay, d1	39.3	28.4		46.3	30.6		46.7	34.8		48.2	33.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.0	14.4		28.1	1.6		19.6	9.5		55.3	1.7	
Delay (s)	47.3	42.8		74.4	32.3		66.3	44.3		103.5	34.8	
Level of Service	D	D		E	C		E	D		F	C	
Approach Delay (s)		44.0			41.9			46.1			41.4	
Approach LOS		D			D			D			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			43.8				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			101.4				Sum of lost time (s)			20.0		
Intersection Capacity Utilization			76.9%				ICU Level of Service			D		
Analysis Period (min)			15									

c Critical Lane Group

Lanes, Volumes, Timings  
3: Park Avenue & Salisbury Street

04/14/2023

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Future Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		0	250		0	125		0	125		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.980			0.993			0.985			0.971	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1825	0	1770	1850	0	1770	3486	0	1770	3437	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1825	0	1770	1850	0	1770	3486	0	1770	3437	0
Right Turn on Red			No			No			Yes			Yes
Satd. Flow (RTOR)								10			24	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		500			500			500			500	
Travel Time (s)		11.4			11.4			11.4			11.4	
Peak Hour Factor	0.74	0.91	0.62	0.89	0.81	0.93	0.87	0.88	0.93	0.94	0.90	0.74
Adj. Flow (vph)	68	255	40	158	753	35	147	600	65	59	787	186
Shared Lane Traffic (%)												
Lane Group Flow (vph)	68	295	0	158	788	0	147	665	0	59	973	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases												

Lanes, Volumes, Timings  
 3: Park Avenue & Salisbury Street

04/14/2023

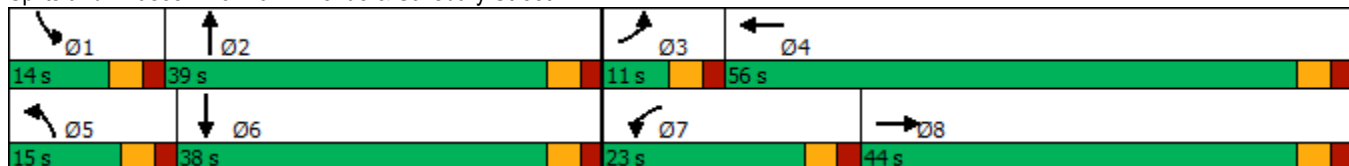


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	3	8		7	4		5	2		1	6	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Minimum Split (s)	11.0	28.0		11.0	28.0		11.0	26.0		11.0	26.0	
Total Split (s)	11.0	44.0		23.0	56.0		15.0	39.0		14.0	38.0	
Total Split (%)	9.2%	36.7%		19.2%	46.7%		12.5%	32.5%		11.7%	31.7%	
Maximum Green (s)	6.0	39.0		18.0	51.0		10.0	34.0		9.0	33.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	3.0		2.0	3.0	
Recall Mode	None	None		None	None		None	Min		None	Min	
Walk Time (s)		7.0			7.0			7.0			7.0	
Flash Dont Walk (s)		12.0			12.0			10.0			10.0	
Pedestrian Calls (#/hr)		20			20			20			20	
Act Effct Green (s)	6.0	42.6		14.4	51.0		10.0	37.3		7.9	33.0	
Actuated g/C Ratio	0.05	0.36		0.12	0.42		0.08	0.31		0.07	0.28	
v/c Ratio	0.77	0.46		0.75	1.00		1.00	0.61		0.51	1.01	
Control Delay	104.4	33.5		71.5	67.7		129.6	38.4		69.6	74.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	104.4	33.5		71.5	67.7		129.6	38.4		69.6	74.2	
LOS	F	C		E	E		F	D		E	E	
Approach Delay		46.8			68.3			54.9			73.9	
Approach LOS		D			E			D			E	

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Natural Cycle:	110
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	1.01
Intersection Signal Delay:	64.2
Intersection LOS:	E
Intersection Capacity Utilization:	86.8%
ICU Level of Service:	E
Analysis Period (min):	15

Splits and Phases: 3: Park Avenue & Salisbury Street



Queues

3: Park Avenue & Salisbury Street

04/14/2023



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	68	295	158	788	147	665	59	973
v/c Ratio	0.77	0.46	0.75	1.00	1.00	0.61	0.51	1.01
Control Delay	104.4	33.5	71.5	67.7	129.6	38.4	69.6	74.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	104.4	33.5	71.5	67.7	129.6	38.4	69.6	74.2
Queue Length 50th (ft)	53	176	119	~604	116	234	45	~397
Queue Length 95th (ft)	#98	271	186	#725	#241	294	90	#544
Internal Link Dist (ft)		420		420		420		420
Turn Bay Length (ft)	250		250		125		125	
Base Capacity (vph)	88	647	265	786	147	1091	132	962
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.46	0.60	1.00	1.00	0.61	0.45	1.01

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.























Queue shown is maximum after two cycles.



# HCM Signalized Intersection Capacity Analysis

## 3: Park Avenue & Salisbury Street

04/14/2023

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Future Volume (vph)	50	232	25	141	610	33	128	528	60	55	708	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.99		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1825		1770	1850		1770	3487		1770	3438	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1825		1770	1850		1770	3487		1770	3438	
Peak-hour factor, PHF	0.74	0.91	0.62	0.89	0.81	0.93	0.87	0.88	0.93	0.94	0.90	0.74
Adj. Flow (vph)	68	255	40	158	753	35	147	600	65	59	787	186
RTOR Reduction (vph)	0	0	0	0	0	0	0	7	0	0	17	0
Lane Group Flow (vph)	68	295	0	158	788	0	147	658	0	59	956	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	6.0	42.6		14.4	51.0		10.0	37.3		6.7	34.0	
Effective Green, g (s)	6.0	42.6		14.4	51.0		10.0	37.3		6.7	34.0	
Actuated g/C Ratio	0.05	0.35		0.12	0.42		0.08	0.31		0.06	0.28	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	3.0		2.0	3.0	
Lane Grp Cap (vph)	87	642		210	779		146	1074		98	966	
v/s Ratio Prot	0.04	0.16		c0.09	c0.43		c0.08	c0.19		0.03	c0.28	
v/s Ratio Perm												
v/c Ratio	0.78	0.46		0.75	1.01		1.01	0.61		0.60	0.99	
Uniform Delay, d1	56.9	30.3		51.6	35.0		55.5	35.7		55.8	43.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	33.2	0.2		12.6	35.1		76.3	1.0		7.0	26.0	
Delay (s)	90.1	30.5		64.2	70.1		131.8	36.7		62.8	69.4	
Level of Service	F	C		E	E		F	D		E	E	
Approach Delay (s)		41.7			69.1			53.9			69.0	
Approach LOS		D			E			D			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			62.0				HCM 2000 Level of Service				E	
HCM 2000 Volume to Capacity ratio			1.00									
Actuated Cycle Length (s)			121.0				Sum of lost time (s)			20.0		
Intersection Capacity Utilization			86.8%				ICU Level of Service			E		
Analysis Period (min)			15									

c Critical Lane Group

**Attachment D**

Pedestrian & Traffic Signal Clearance Worksheets



## CLEARANCE INTERVAL CALCULATIONS

JOB: Park Avenue at Salisbury Street  
 LOCATION: Worcester, MA  
 TITLE: Park Avenue at Salisbury Street  
 CALCULATED BY: TEC, Inc. / FAS

JOB NUMBER: T1353.01  
 DATE: 4/6/2023  
 SHEET: 1 OF 6  
 CHECKED BY: TEC, Inc. / KRD

Assumptions:  $t = 1$  sec (driver reaction time)  
 $g = 32.2$  ft/s<sup>2</sup> (acceleration due to gravity)  
 $a = 10.0$  ft/s<sup>2</sup> (deceleration rate of vehicles)  
 $L = 20$  ft (Length of a standard vehicle)

Definition of Input Values:  $S_{85}$  = (85<sup>th</sup> Percentile Speed of Roadway, mph)  
 $G$  = (Grade of approach, %)  
 $W$  = (distance from the departure STOP line to the far side of the farthest conflicting traffic lane, ft)  
 $P$  = (distance from the departure STOP line to the near side of the farthest conflicting crosswalk, ft)

<u>Approach</u>	<u>Input Values</u>	<u>Calculated Values</u>			
<b>Salisbury Street EB</b>	$S_{85} = 30$ mph	<b>Yellow Clearance (sec)</b>	<b>All Red Clearance (sec)</b>		
	$G = -5$ %		<small>CW &lt; 40 ft from farthest conflict</small>	<small>CW ≥ 40 ft from farthest conflict</small>	
	$w = 90$ ft		<b>3.6</b>	<b>1.5</b>	<b>1.3</b>
	$P = 80$ ft				

<u>Approach</u>	<u>Input Values</u>	<u>Calculated Values</u>			
<b>Salisbury Street WB</b>	$S_{85} = 30$ mph	<b>Yellow Clearance (sec)</b>	<b>All Red Clearance (sec)</b>		
	$G = 2$ %		<small>CW &lt; 40 ft from farthest conflict</small>	<small>CW ≥ 40 ft from farthest conflict</small>	
	$w = 90$ ft		<b>3.1</b>	<b>1.5</b>	<b>1.3</b>
	$P = 80$ ft				

<u>Approach</u>	<u>Input Values</u>	<u>Calculated Values</u>			
<b>Park Avenue NB</b>	$S_{85} = 35$ mph	<b>Yellow Clearance (sec)</b>	<b>All Red Clearance (sec)</b>		
	$G = 0$ %		<small>CW &lt; 40 ft from farthest conflict</small>	<small>CW ≥ 40 ft from farthest conflict</small>	
	$w = 90$ ft		<b>3.6</b>	<b>1.1</b>	<b>1.0</b>
	$P = 60$ ft				

<u>Approach</u>	<u>Input Values</u>	<u>Calculated Values</u>			
<b>Park Avenue SB</b>	$S_{85} = 35$ mph	<b>Yellow Clearance (sec)</b>	<b>All Red Clearance (sec)</b>		
	$G = 0$ %		<small>CW &lt; 40 ft from farthest conflict</small>	<small>CW ≥ 40 ft from farthest conflict</small>	
	$w = 90$ ft		<b>3.6</b>	<b>1.1</b>	<b>1.0</b>
	$P = 70$ ft				

*\*Updated based on MassDOT guidelines (January 8, 2013)*

JOB / JOB NUMBER: Park Avenue at Salisbury Street / T1353.01

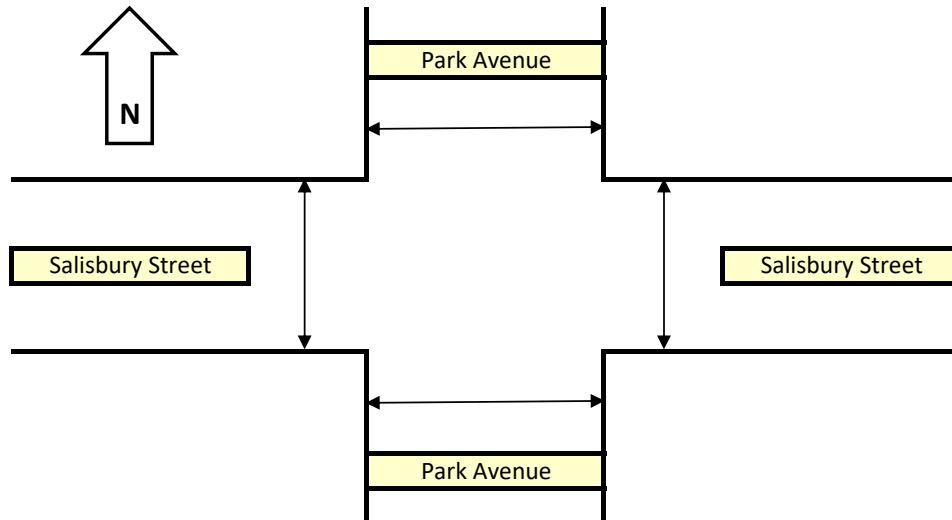
LOCATION: Worcester, MA

DATE: 4/11/2023

CALCULATED BY: TEC, Inc. / FAS

CHECKED BY: TEC, Inc. / KR D

### Pedestrian Clearance Time (PCT)



Crosswalk Distances (feet)	
Eastbound	48
Westbound	54
Northbound	72
Southbound	70

Yellow Clearance (seconds)	
Eastbound	3
Westbound	3
Northbound	3
Southbound	3

Walking Speed (ft/sec) = 3.5

$$\text{Exclusive PCT} = \frac{\text{Longest Crosswalk Distance}}{\text{Walking Speed}} - 4s$$

**Exclusive PCT = 17**

**FWD = 17      DW = 4**

$$\text{Concurrent PCT} = \frac{\text{Crosswalk Distance}}{\text{Walking Speed}} - \text{Adjacent Yellow Clearance}$$

<b>Eastbound PCT =</b>	<b>11</b>
<b>Westbound PCT =</b>	<b>13</b>
<b>Northbound PCT =</b>	<b>18</b>
<b>Southbound PCT =</b>	<b>17</b>

<b>FWD =</b>	<b>11</b>	<b>DW =</b>	<b>3</b>
<b>FWD =</b>	<b>13</b>	<b>DW =</b>	<b>3</b>
<b>FWD =</b>	<b>18</b>	<b>DW =</b>	<b>3</b>
<b>FWD =</b>	<b>17</b>	<b>DW =</b>	<b>3</b>