Redesign of Three Intersections in Sulaymania City

Prepared By

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ABSTRACT

Research of Redesign of three intersections in Sulaimani city is the highway traffic article research type which have been done to redesign of Parki Azadi, Mamostayan and amna Suraka. So these intersections needed to be observed for data collecting, especially at its peak hour volume that have the most numbers of vehicle in presence and time of signals. These informations are to understand the situation of the intersections. After realizing that level of service of intersections are F which is poor, redesigning of these intersections are necessary to have better LOS. Synchro traffic simulation program is proper field to deal with traffic of roads and intersections and redesigning if necessary. After creating intersections geometry in the program, practical collected data of intersections are required to redesign them. Inputting data had been taken with changing conditions, adding traffics and merging some bounds of intersections to provide better LOS of intersections. These operations caused increasing of LOS of intersections for making drivers feel more comfortable and go to their destination with desired time travel and avoiding difficulty, accident and delay.

LIST OF ABBRIVIATION

SYMBOL	DESCRIPTION
LOS	LEVEL OF SERVICE
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
ST.	STREET
PHV	PEAK HOUR VOLUME
PHF	PEAK HOUR FACTOR
∑	SUMMATION
KM	KILOMETER
MIN	MINUTES
SEC	SECONDS
NO.	NUMBERS
NB	NORTH BOUND
SB	SOUTH BOUND
WB	WEST BOUND
EB	EAST BOUND
EBR	EAST BOUND RIGHT

SYMBOL	DESCRIPTION
EBT	EAST BOUND THROUGH
EBL	EAST BOUND LEFT
SBR	SOUTH BOUND RIGHT
SBT	SOUTH BOUND THROUGH
SBL	SOUTH BOUND LEFT
WBR	WEST BOUND RIGHT
WBT	WEST BOUND THROUGH
WBL	WEST BOUND LEFT
NBR	NORTH BOUND RIGHT
NBT	NORTH BOUND THROUGH
NBL	NORTH BOUND LEFT
ETC.	ETCETERA

CHAPTER ONE

INTRODUCTION

1.1 Background

Highway designing is a part of civil engineering that includes the arranging, plan, development, activity, and upkeep of various kinds of streets to make them protected and powerful.

An intersection is defined as "the general area where two or more roadways join or cross, including the roadway and roadside facilities for traffic movements within the area. Each roadway radiating from an intersection and forming part of it is an intersection leg. The most common intersection configuration is a four-leg intersection at which two roadways cross one another. Three-leg intersections are also common. It is recommended that an intersection have no more than four legs." (AASHTO Green Book – 2018)

Figure 1.1: Intersection sample

1.2 The significance of the study

In the project three intersections have taken as samples to redesign. By using Synchro traffic simulation program to redesign the streets in Sulaimani City network, the street network capacity will be increased, as well as the safety will be improved.

1.3 Objectives of the study

The objective of the study is to redesign three existing intersections in Sulaiymaniah City. The intersections include (Saeed Kaban St. and Khak St.), (Saeed Kaban St and Kareza Wishk St.) and (Saeed Kaban St. and Ardalan St.) as shown in Figure (1.2). Based on traffic situations of intersections - such as road geometric, traffic flow, and existing landscape – the street is designed by using Synchro program. The Synchro program software provides analysis of traffic flow, optimization, and simulation applications. AASHTO and Iraqi standard specifications are used to the redesign purpose.

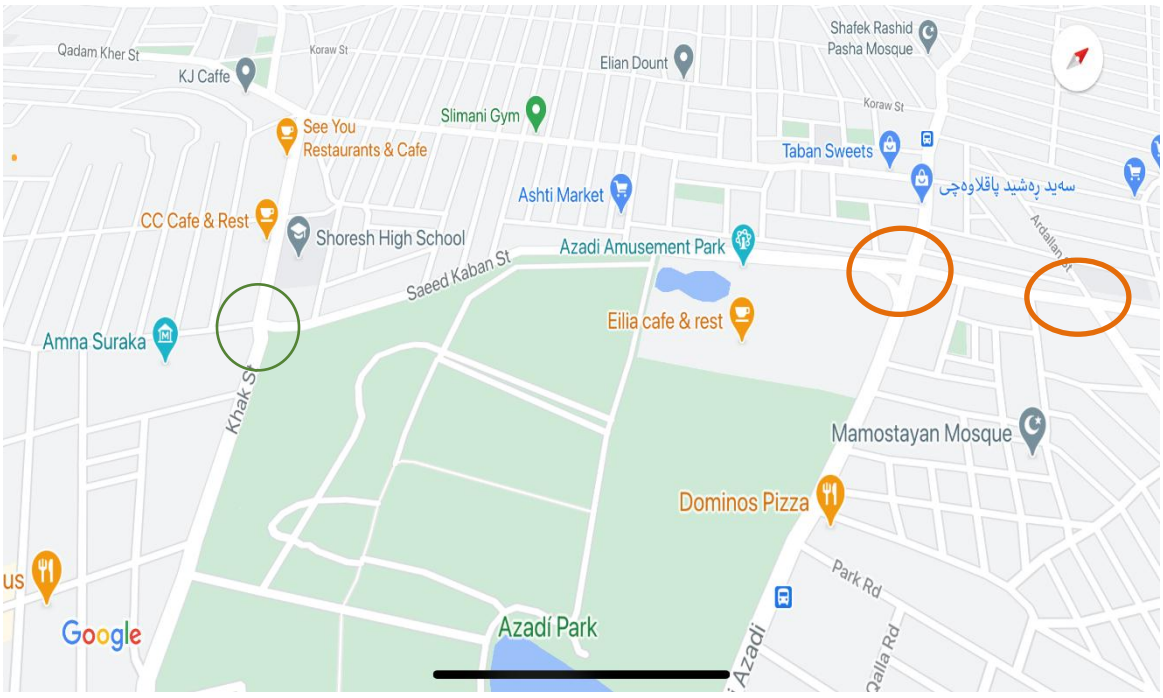


Figure 1.2: Shown three intersections

1.4 Methodology

The methodology of the project is as follows:

- Selection of intersections: preparing of intersections map, as shown in **Figure 1.2**.
- Observation of intersections: counting number of cars in the intersections in peak hour.
- Data (program): putting collected data into the program.
- 0Redesign: it means choosing anew proper design for the intersections if design intersection is not permitted with respect to data and program give large capacity road use.
- Traffic investigation based on capacity: activity frameworks are planned as the capacity street utilize.
- Choice comparison: it implies compared unused plan or result to plan of the crossing point and Choice plan crossing point is satisfactory or not worthy.

1.5 Report outline

The outline of the project is as follows:

- Chapter one introduction of highway which is foundation of our research, explaining the context of intersections and mentioning the intersections.
- Chapter two could be a writing review in which a few projects are said that have been done around plan and update of the highway and activity projects.
- Chapter three is methodology of the project which is step by step carrying on its procedure.
- Chapter four is result and discussion of the project which contain calculation, histograms and analysis.
- Chapter five is conclusions which give us outcome of the project, it means increasing LOS of intersections.

CHAPTER TWO

LITERATURE REVIEW

In previous years several projects have been done about highway engineering which cover geometric, for instance pavement design, design of multi-lane, design of intersections, redesign of intersection, volume and cost estimation.

The following projects are example of some projects about design and redesigns in highway engineering that have been done: -

- Project of "Redesign of Mamostayan Intersection"
  Adding storage lanes, changing traffic volume and in the result Mamostayan intersection LOS alternated from F to C. by Using Synchro software program (Ahmed Yusuf 2019 – 2020).

- Project of "Traffic Signal Coordination of Sulaimani City",
  The project was done by redesigning of three intersections due to geometric of these intersections and alternating the traffic flow so that increase Dastaraka intersection capacity from F to C, because of using Synchro software program (Sima N. Sdiq 2018-2019)

- Project design of "Geometric Design of Bypass Road between Arbat and Darbandikhan"
  It was required design the road as a bypass route for managing the traffic system at there. The design have been done by using Total Station instrument and AutoCAD Civil 3D program with respect to 'AASHTO Green Book Design Geometric – 2011' specification (Azad Salih 2015-2016)

- The project of “Redesign of Ashti Intersection”

  It was redesigning of four leg intersection for more than 1 km length. By utilizing Theodolite Instrument the road alignments was surveyed and then cut and fill volume were indicated to be designed (Kochar Abdullah 2008)

- Highway project of “Design of New Road in Sulaimani City (Darbandikhan-Warmawa Road)”

  The location of the road was at North-East of Sulaimani city. Length of 2.3 km was taken for surveying and design to the project. Road design, that was four-lane two-way, have been done due to usage of Total Station instrument and AutoCAD Civil 3D program. Elements of the design of the road (Design Speed, Side Distance Alignment, Super Elevations and Width of Road) according to ‘AASHTO Green Book Geometric Design – 2011’ had been checked manually (Mohammed 2012)

- Another project of “Design of a New Road in Sulaimani City (Dabashan Road)”

  It was designing for two-lane two-way roadway of more than 1 km length depending on AASHTO standard specifications. The survey was carried by Theodolite Instrument. The project volumes of cut and fill of the project were indicated and the road geometric was designed manually (Shad Mohammed)

CHAPTER THREE

METHODOLOGY

3.1 Locating

Determining locations of three intersections: Parki Azadi, Mamostayan and Amna Suraka, which they are three major intersections of Sulaimani city having high traffic volume. It was to reduce congestion and upgrading level of service LOS of intersections.

3.2 Collecting data

Observation of intersections due to recording video by three cameras from suitable places to have full view of intersections at (4:00-5:00) pm, which is peak hour traffic of these intersections, for accounting number of cars going to left, through and right for each phase.

3.3 Analysis

Creating shapes of intersections as real as present and putting collected data from the sight into Synchro traffic simulation program for each intersection separately. And analyzing of data due to program, which is presenting in reports.

3.4 Redesigning

Redesigning of intersections by changing traffics and merging some phases, it means creating new group lanes of intersections. With remaining geometry of the sight, of course achieving results as reports.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Calculation

Calculating PHV and PHF of intersections using these equations: -

1. $PHV = \sum No.of\ cars$
2. $PHF = \frac{Volume\ of\ Peak}{Volume\ of 15\min *4}$

The results of PHV and PHF of intersections and number of cars for each 5 minutes interval recorded in tables, as shown in **Table 4.1**, **Table 4.2** and **Table 4.3**.

Table 4.1: Parki Azadi intersection data

Time	NB			SB			WB			EB		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
4:00 – 4:05	10	34	9	12	23	66	9	63	19	39	16	13
4:05 – 4:10	4	19	17	16	24	46	10	49	27	75	43	11
4:00 – 4:15	10	39	7	9	19	60	8	50	26	57	32	14
4:00 – 4:20	6	24	8	9	36	72	19	85	19	50	37	14
4:00 – 4:25	10	23	11	13	33	64	17	67	26	75	20	16
4:00 – 4:30	11	40	16	5	24	58	13	57	29	75	28	12
4:00 – 4:35	10	25	8	7	45	62	10	87	18	47	23	12
4:00 – 4:40	12	42	8	16	43	68	5	39	28	87	30	13
4:00 – 4:45	19	42	19	6	34	73	9	50	29	85	30	12
4:00 – 4:50	19	36	15	7	32	49	8	106	17	47	20	9
4:00 – 4:55	11	29	12	14	35	54	8	50	27	83	34	9
4:00 – 5:00	19	43	12	18	23	64	10	96	24	53	29	17
Total	141	396	142	132	371	736	126	799	289	773	342	152
PHF	0.70	0.82	0.68	0.84	0.76	0.90	0.64	0.79	0.96	0.88	0.76	0.86

Table 4.2: Mamostayan intersection data

Time	NB			SB			WB			EB		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
4:00 – 4:05	16	56	60	51	40	16	46	16	15			4
4:05 – 4:10	19	50	37	45	44	27	38	21	17			3
4:00 – 4:15	16	62	45	50	46	12	36	11	14			3
4:00 – 4:20	17	61	49	54	49	17	54	16	13			4
4:00 – 4:25	15	71	65	52	60	22	45	14	16			4
4:00 – 4:30	13	46	39	41	43	21	64	16	12			3
4:00 – 4:35	23	88	42	44	62	23	32	10	9			5
4:00 – 4:40	16	76	41	21	47	29	56	17	17			6
4:00 – 4:45	10	35	53	50	51	30	67	28	21			5
4:00 – 4:50	25	83	44	54	43	26	35	14	16			3
4:00 – 4:55	21	74	52	31	41	20	47	16	14			6
4:00 – 5:00	19	38	31	49	66	29	50	24	20			4
Total	210	740	558	542	592	272	570	203	184			50
PHF	0.81	0.88	0.88	0.87	0.90	0.80	0.87	0.86	0.85			0.78

Table 4.3: Amna Suraka intersection data

Time	NB			SB			WB			EB		
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
4:00 – 4:05	18	5	5	42	32	17	7	75	28	10	32	43
4:05 – 4:10	22	9	13	37	26	12	3	37	34	22	55	42
4:00 – 4:15	21	12	16	17	9	25	11	64	30	13	26	45
4:00 – 4:20	9	3	14	41	32	13	1	55	35	31	57	45
4:00 – 4:25	10	3	11	42	34	4	2	49	30	28	54	33
4:00 – 4:30	36	11	9	15	11	23	14	91	33	18	38	51
4:00 – 4:35	16	6	18	33	27	22	4	86	25	27	55	51
4:00 – 4:40	34	17	9	18	15	19	3	60	35	28	48	35
4:00 – 4:45	40	14	9	22	13	14	8	102	52	16	33	38
4:00 – 4:50	14	10	8	37	35	13	6	81	39	30	33	46
4:00 – 4:55	45	22	7	15	11	10	5	78	26	22	51	38
4:00 – 5:00	16	5	8	35	31	10	6	110	29	16	18	41
Total	281	117	127	354	276	182	70	888	396	261	500	508
PHF	0.71	0.64	0.74	0.89	0.90	0.71	0.83	0.83	0.79	0.85	0.84	0.93

4.2 Histograms

Creating histograms from collected data for each lane.

4.2.1 Histograms of Parki Azadi intersection

Histograms are shown in Figure 4.1, Figure 4.2, Figure 4.3, Figure 4.4, Figure 4.5, Figure 4.6, Figure 4.7, Figure 4.8, Figure 4.9, Figure 4.10, Figure 4.11 and Figure 4.12.

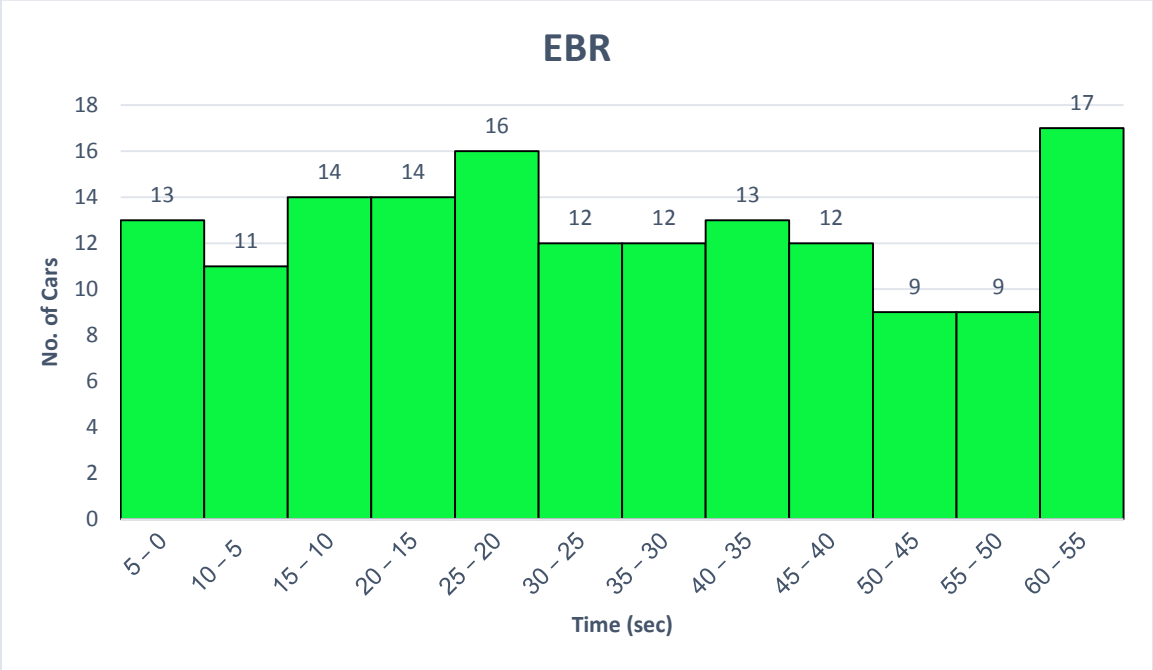


Figure 4.1: Histogram of East Bound Right of Parki Azadi intersection

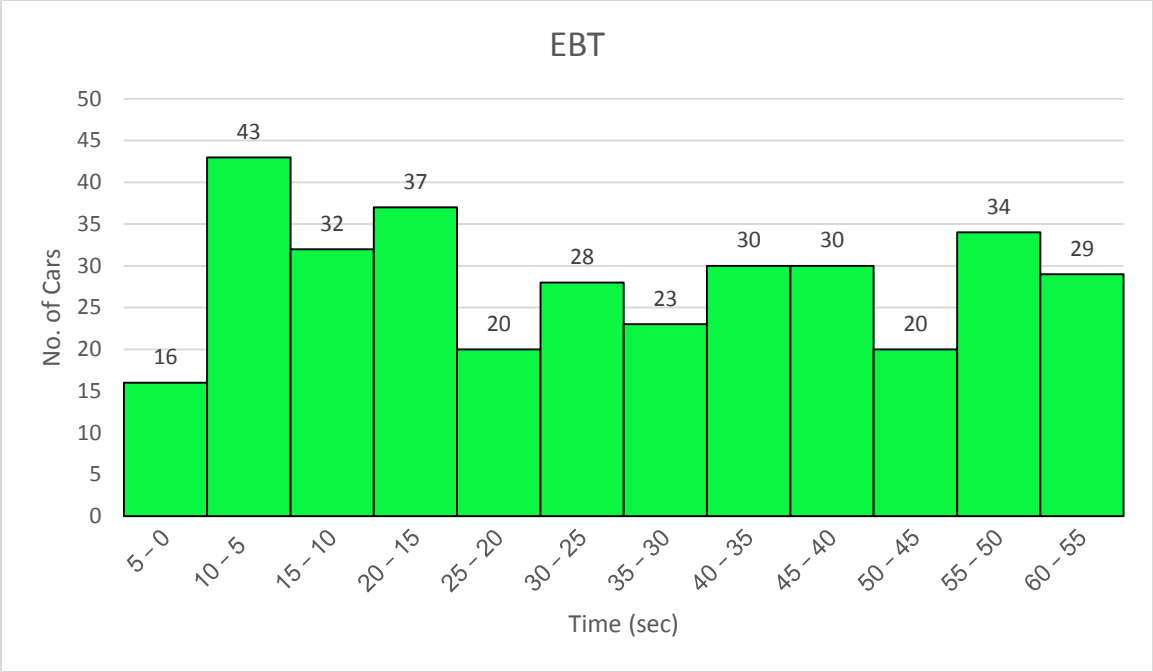


Figure 4.2: Histogram of East Bound Through of Parki Azadi intersection

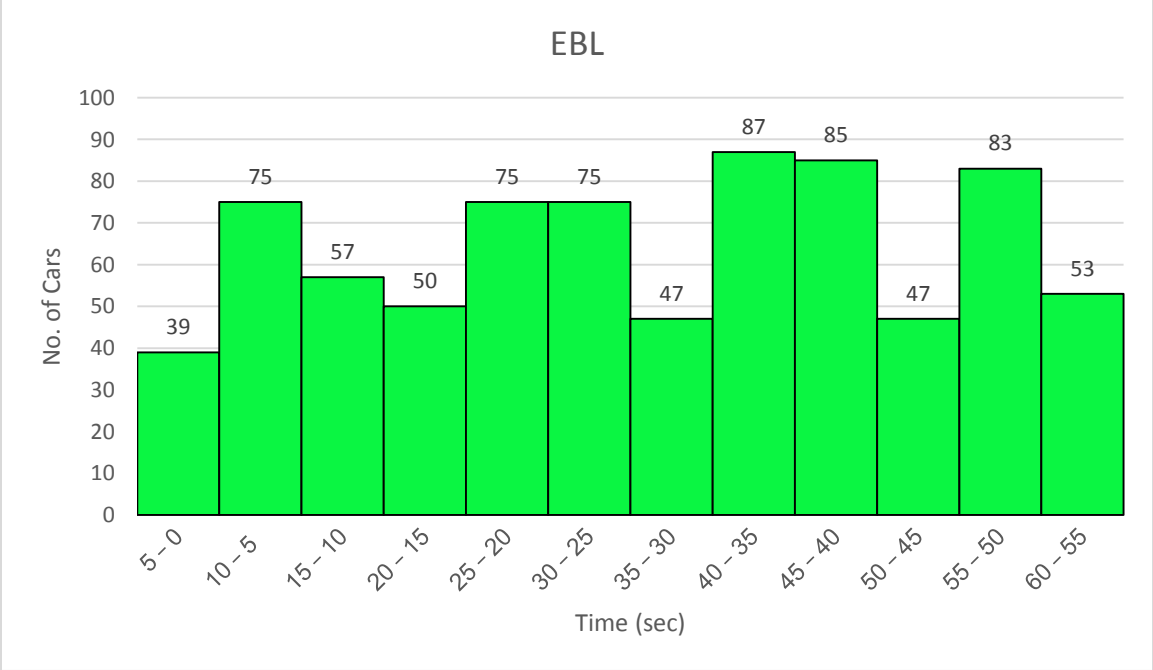


Figure 4.3: Histogram of East Bound Left of Parki Azadi intersection

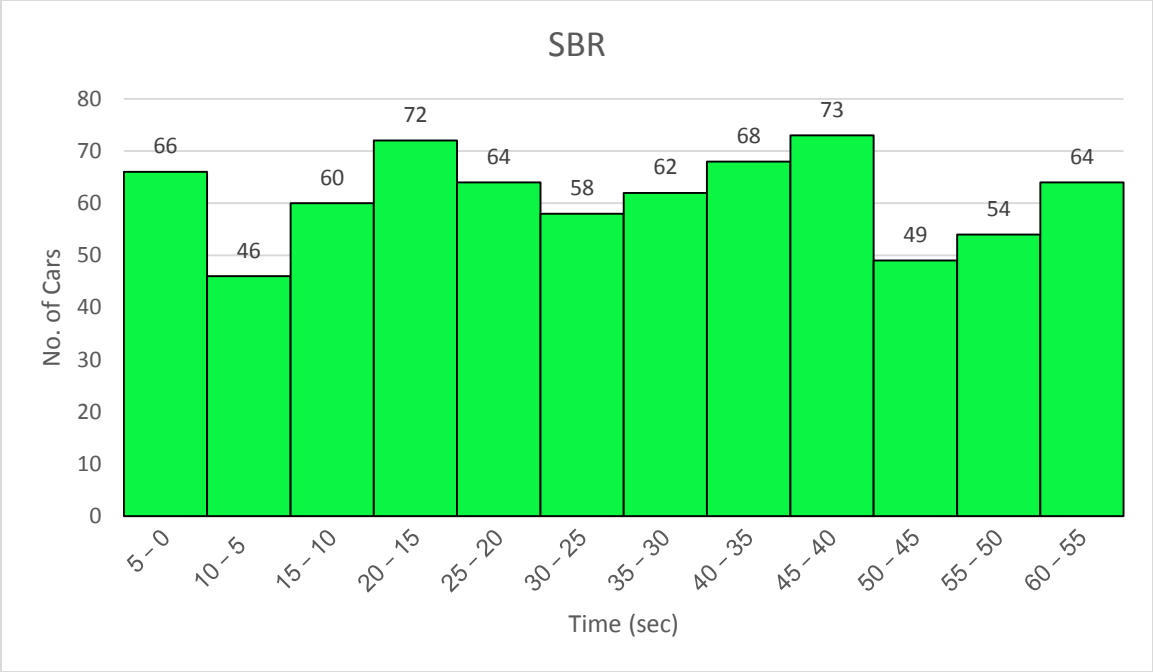


Figure 4.4: Histogram of South Bound Right of Parki Azadi intersection

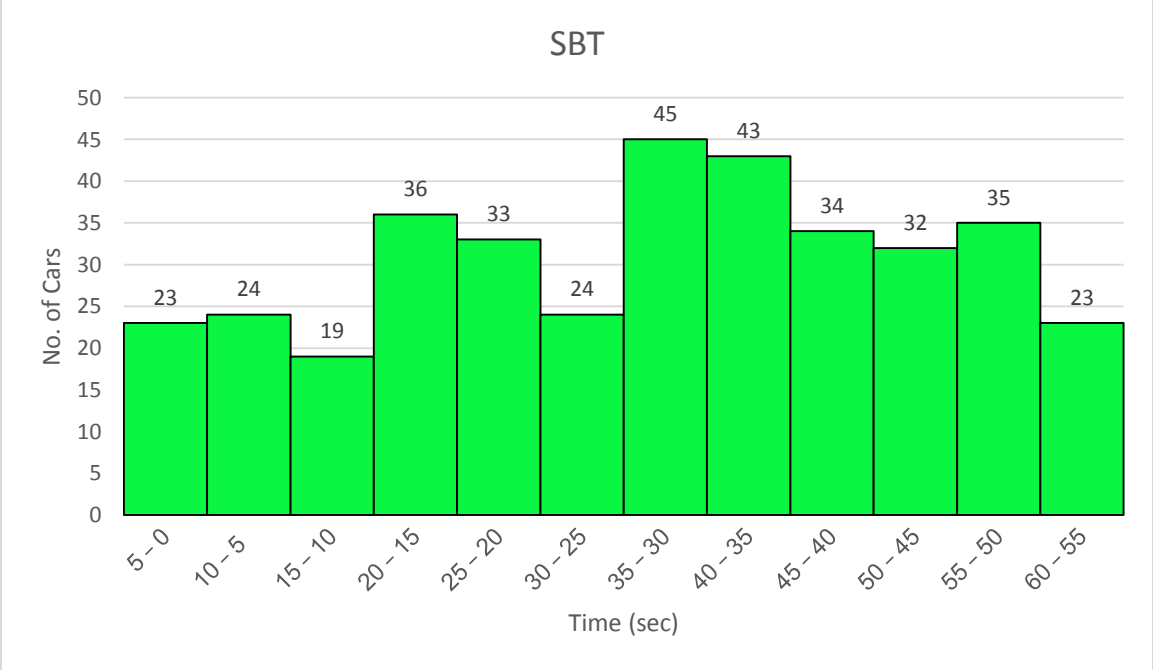


Figure 4.5: Histogram of South Bound Through of Parki Azadi intersection

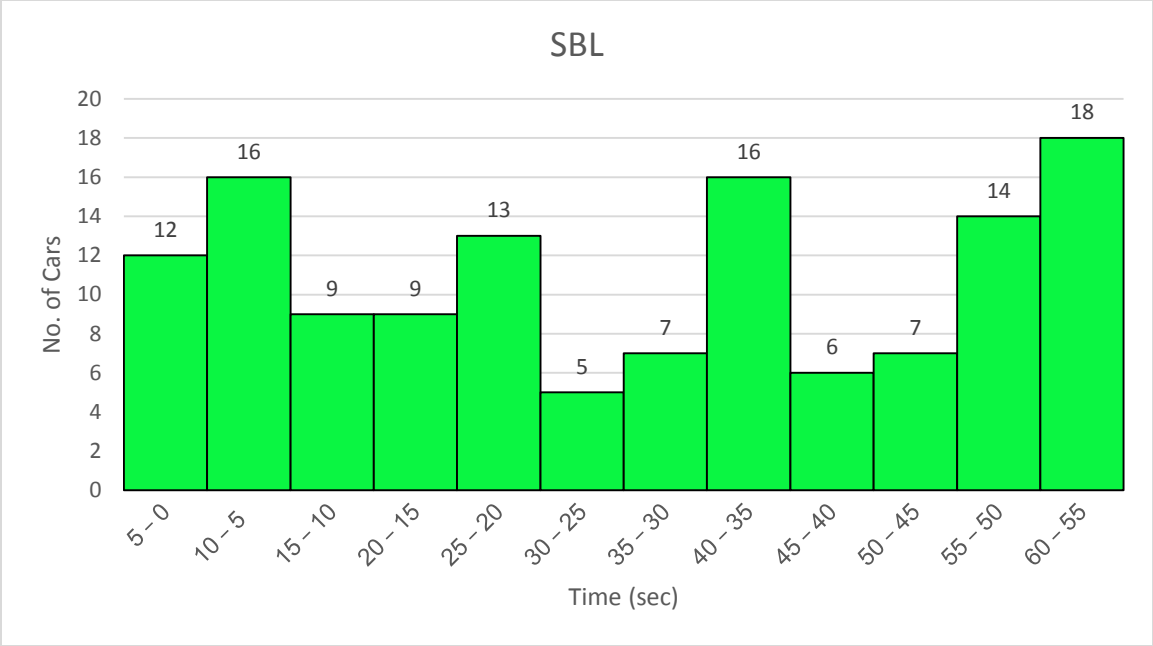


Figure 4.6: Histogram of South Bound Left of Parki Azadi intersection

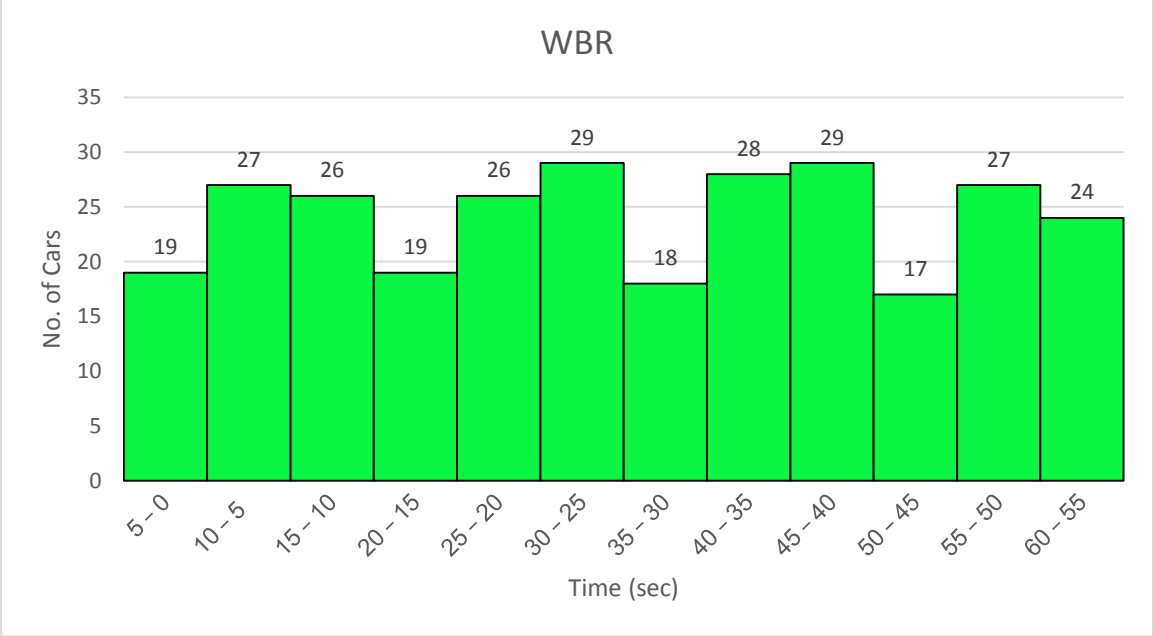


Figure 4.7: Histogram of West Bound Right of Parki Azadi intersection

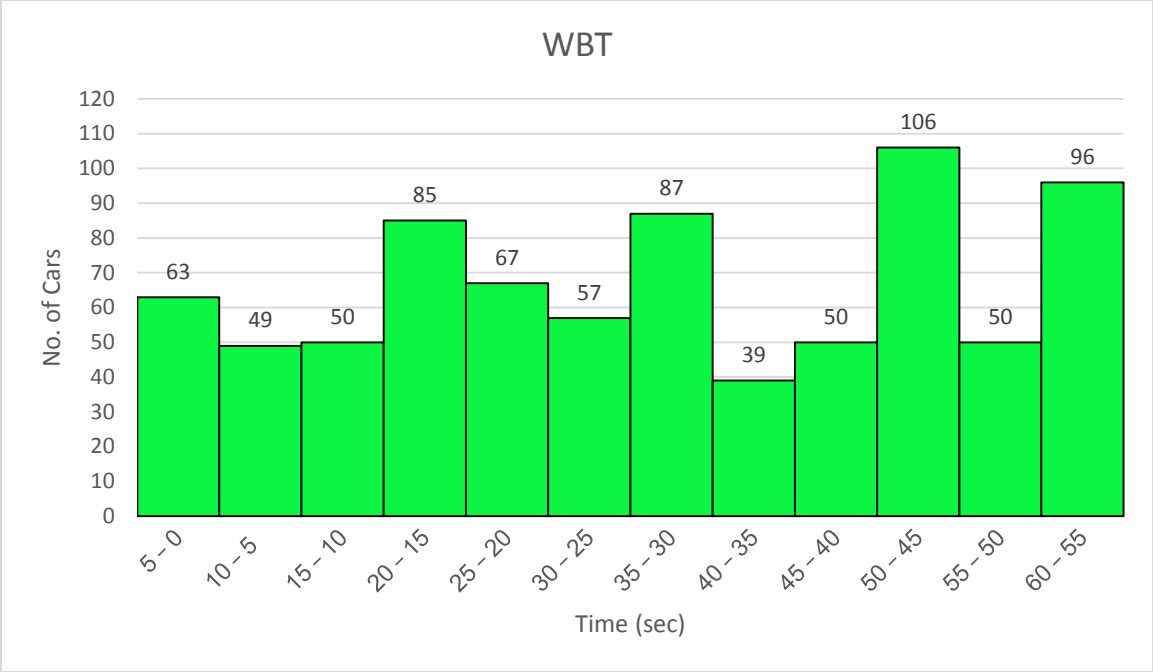


Figure 4.8: Histogram of West Bound Through of Parki Azadi intersection

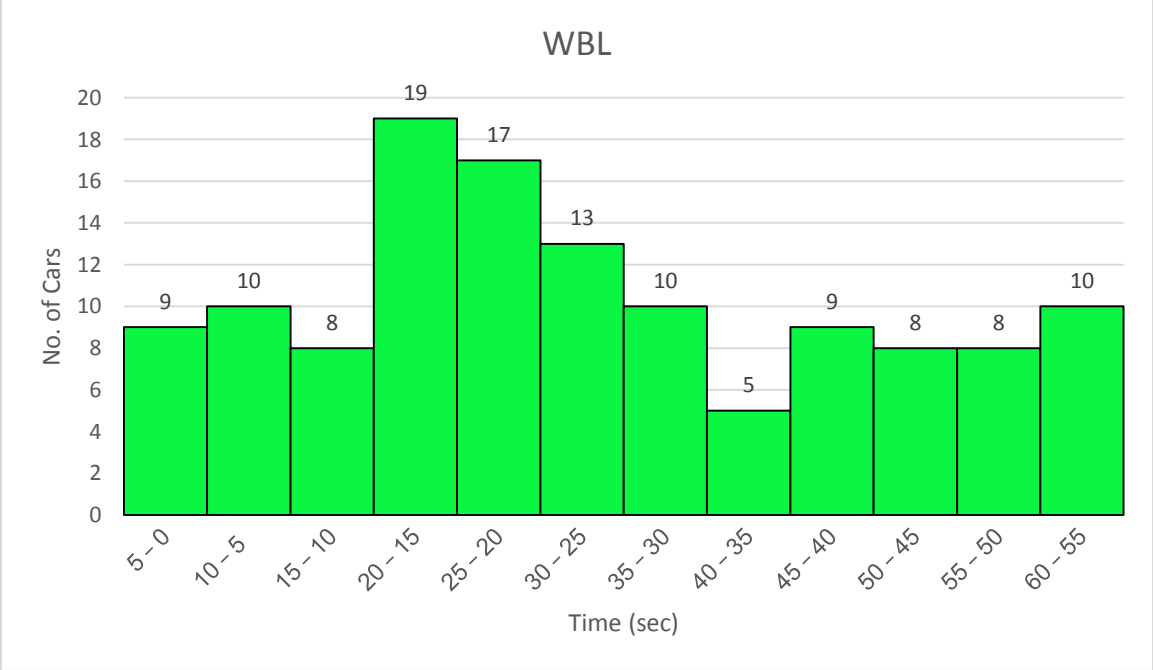


Figure 4.9: Histogram of West Bound Left of Parki Azadi intersection

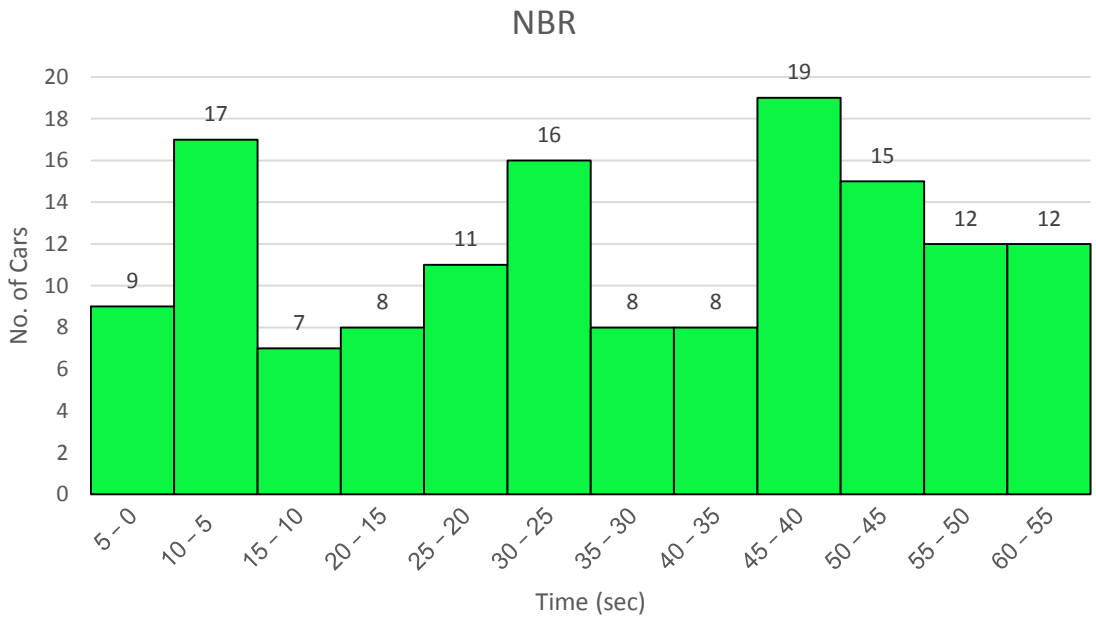


Figure 4.10: Histogram of North Bound Right of Parki Azadi intersection

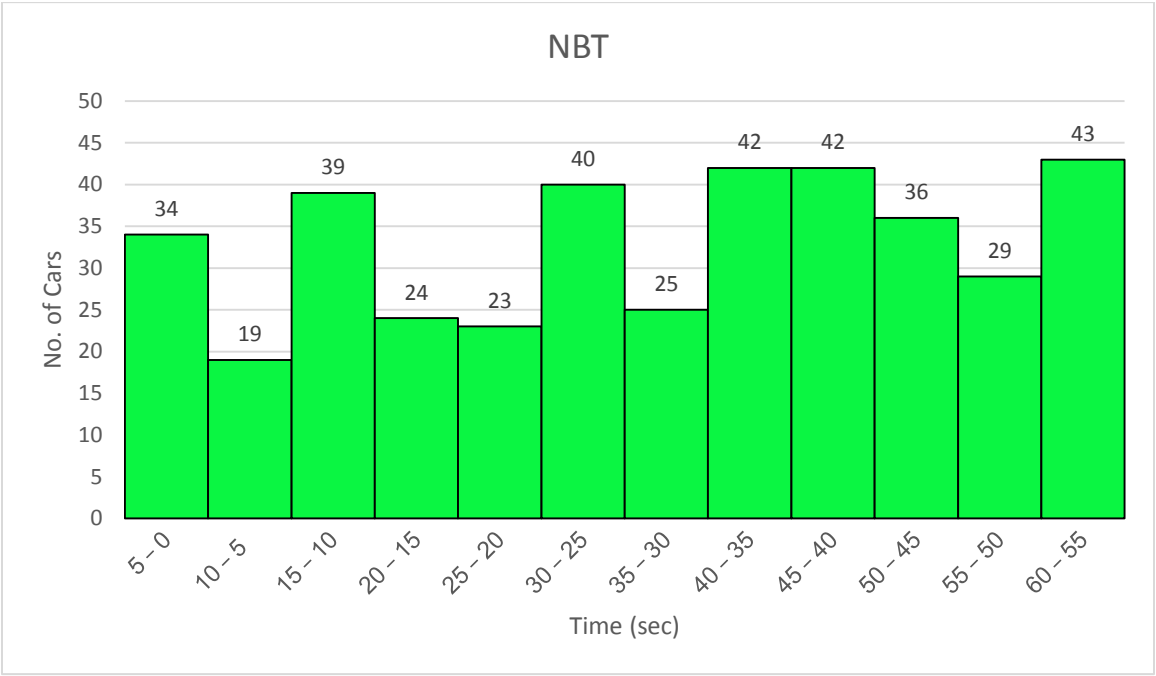


Figure 4.11: Histogram of North Bound Through of Parki Azadi intersection

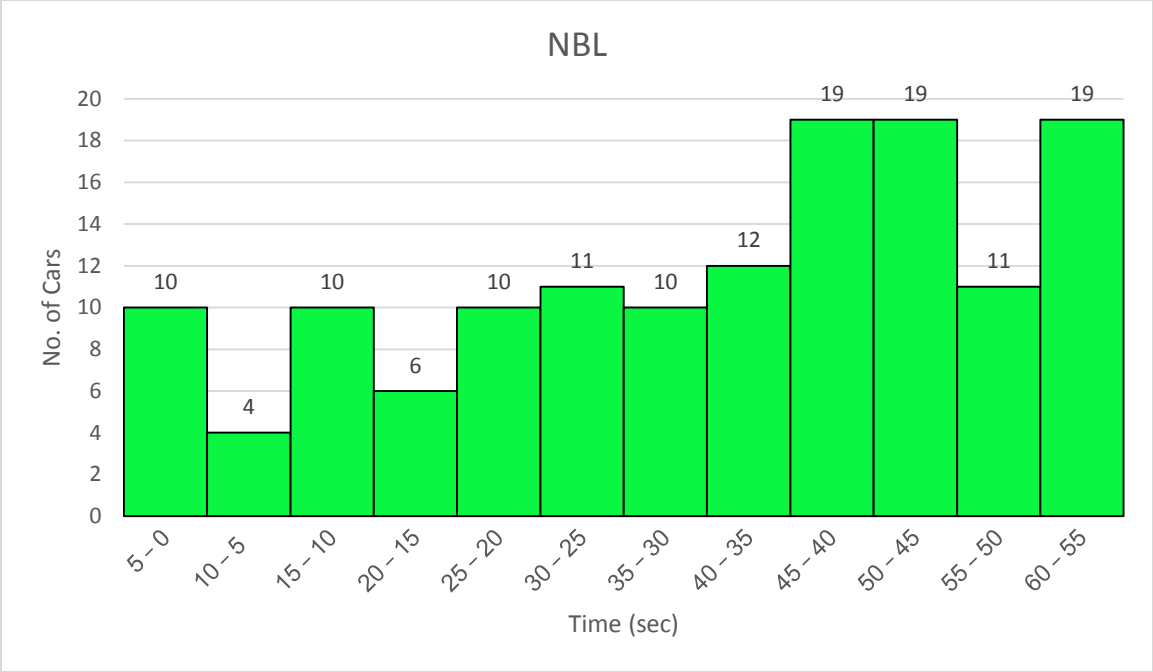


Figure 4.12: Histogram of North Bound Left of Parki Azadi intersection

4.2.2 Histograms of Mamostayan intersection

Histograms are shown in Figure 4.13, Figure 4.14, Figure 4.15, Figure 4.16, Figure 4.17, Figure 4.18, Figure 4.19, Figure 4.20, Figure 4.21, Figure 4.22 and Figure 4.23.

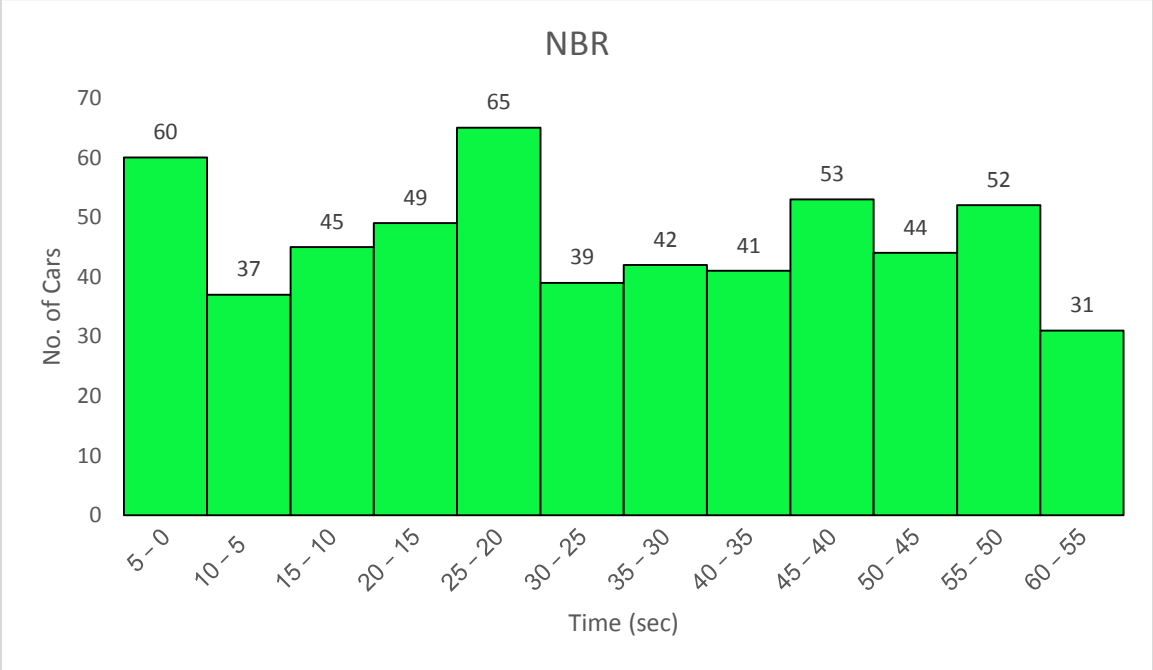


Figure 4.13: Histogram of North Bound Right of Mamostayan intersection

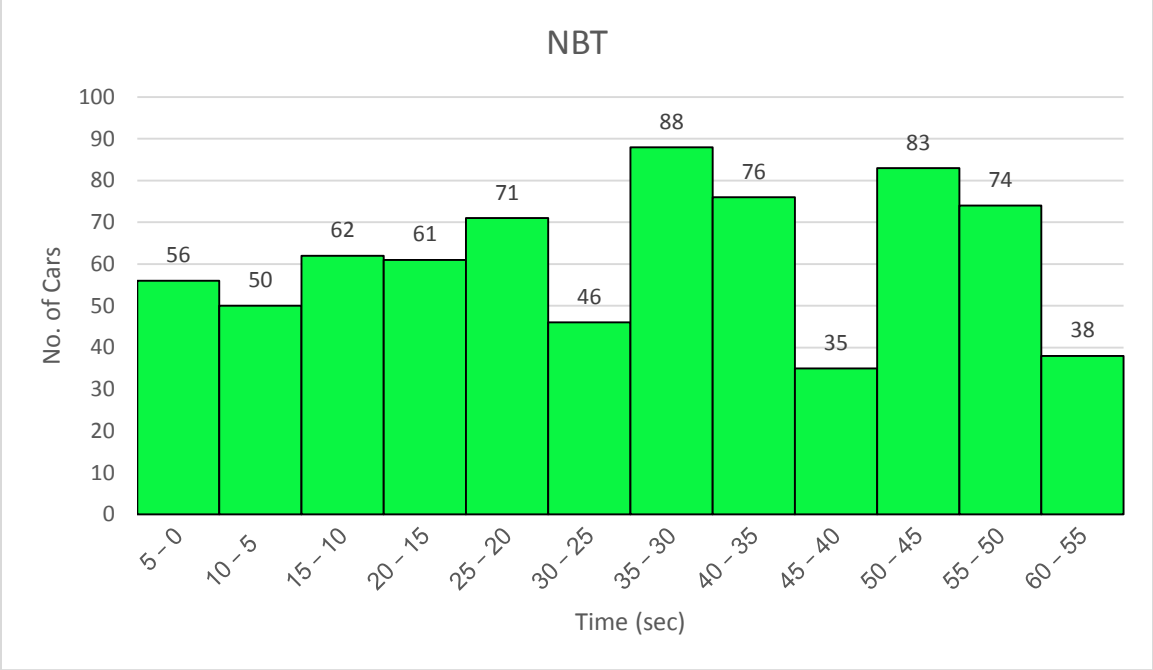


Figure 4.14: Histogram of North Bound Through of Mamostayan intersection

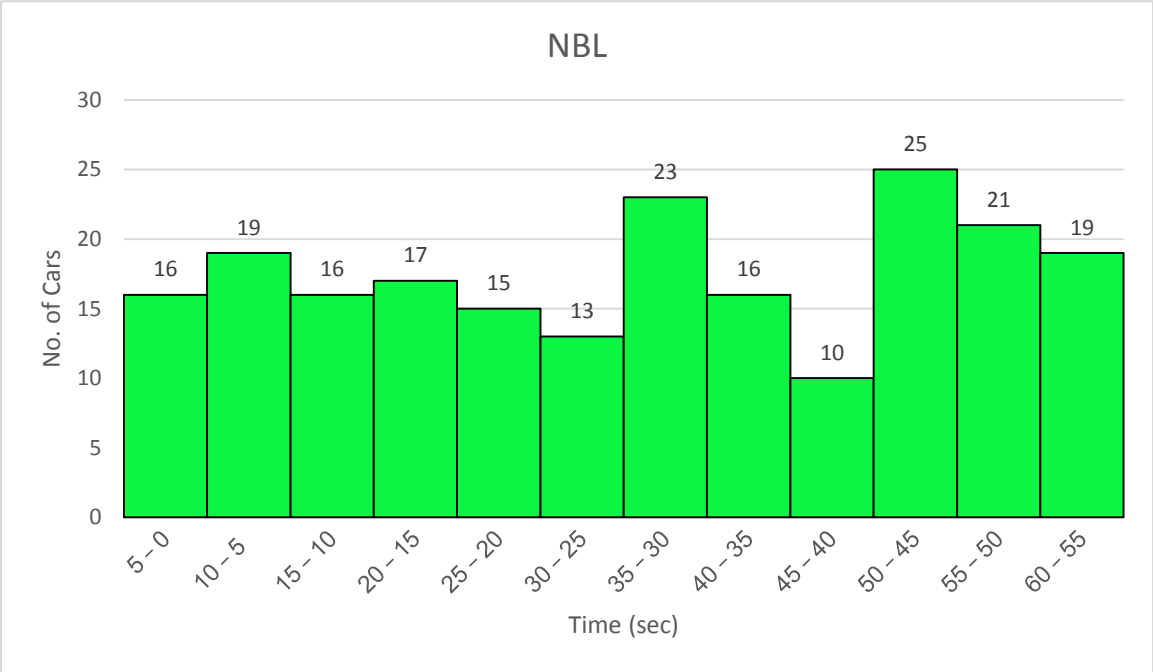


Figure 4.15: Histogram of North Bound Left of Mamostayan intersection

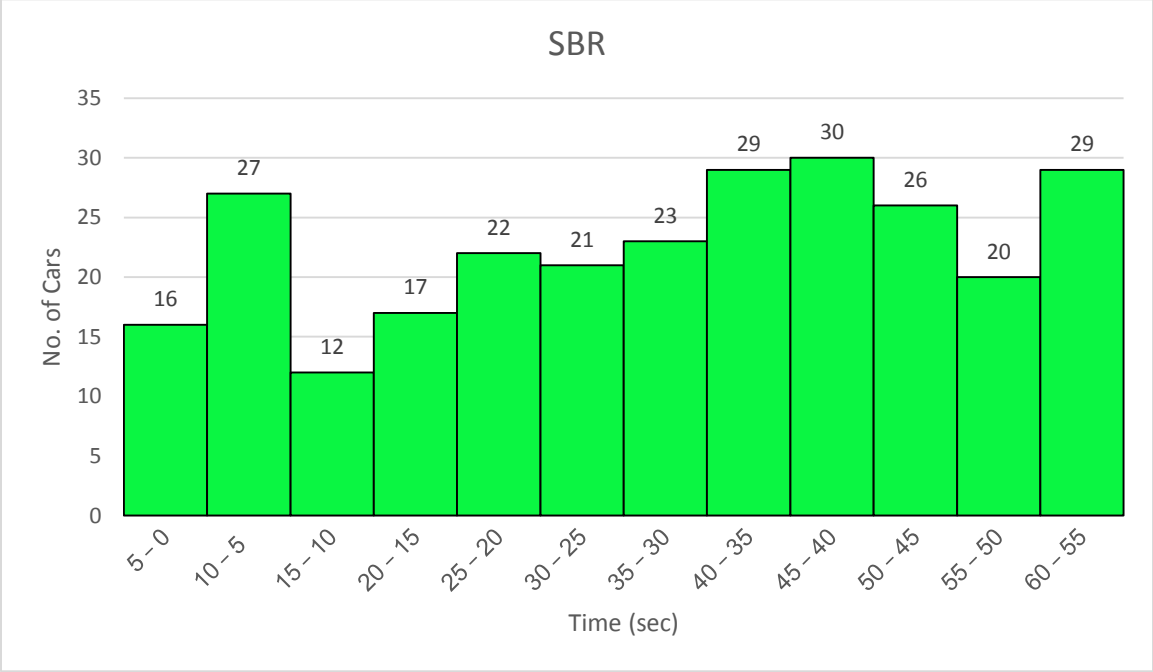


Figure 4.16: Histogram of South Bound Right of Mamostayan intersection

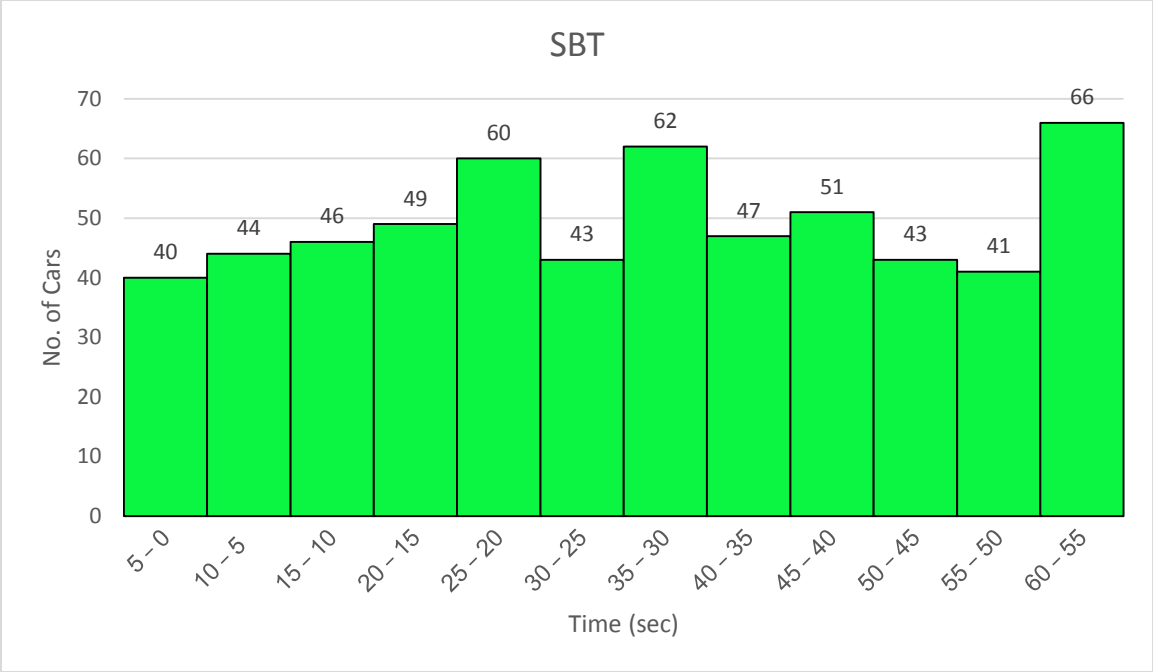


Figure 4.17: Histogram of South Bound Through of Mamostayan intersection

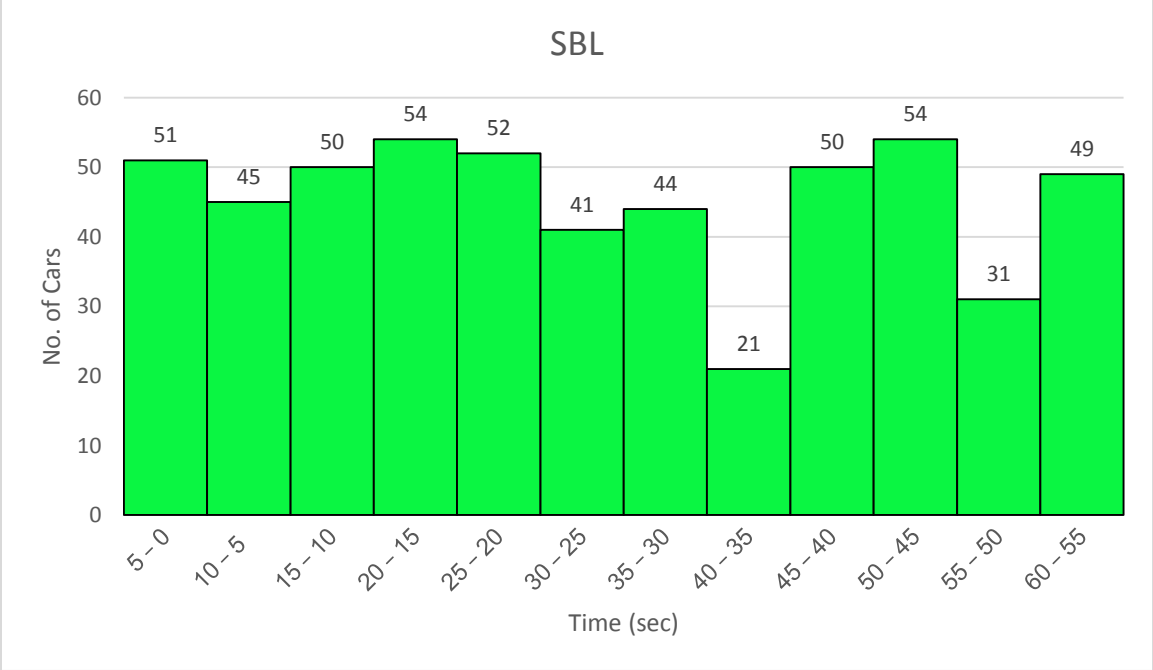


Figure 4.18: Histogram of South Bound Left of Mamostayan intersection

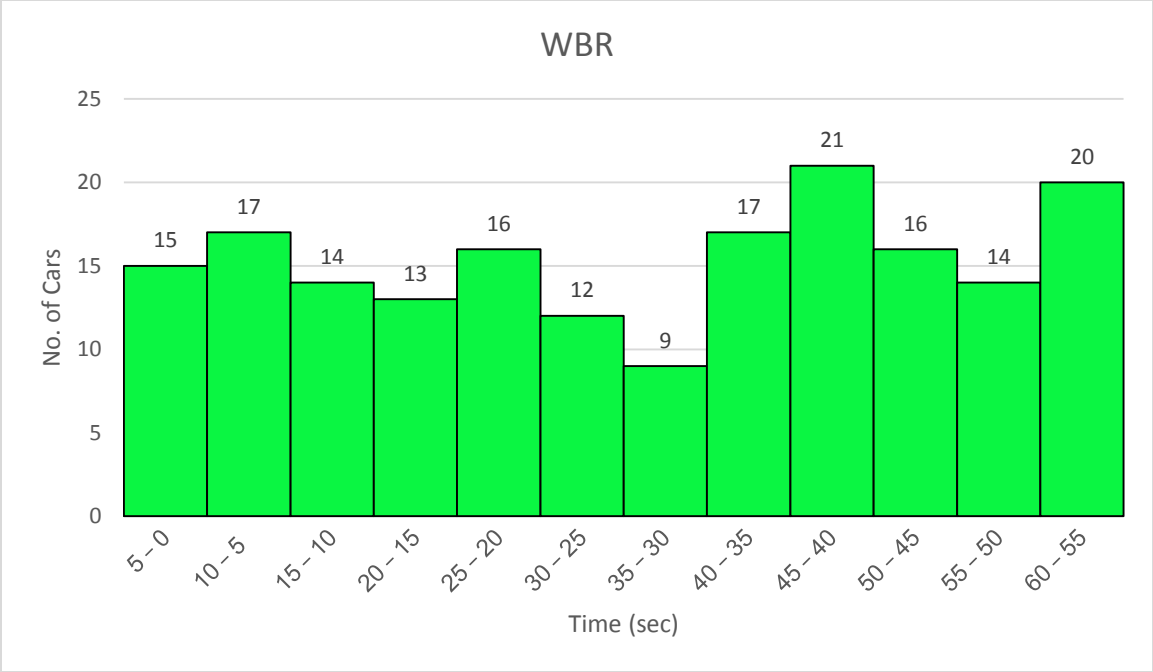


Figure 4.19: Histogram of West Bound Right of Mamostayan intersection

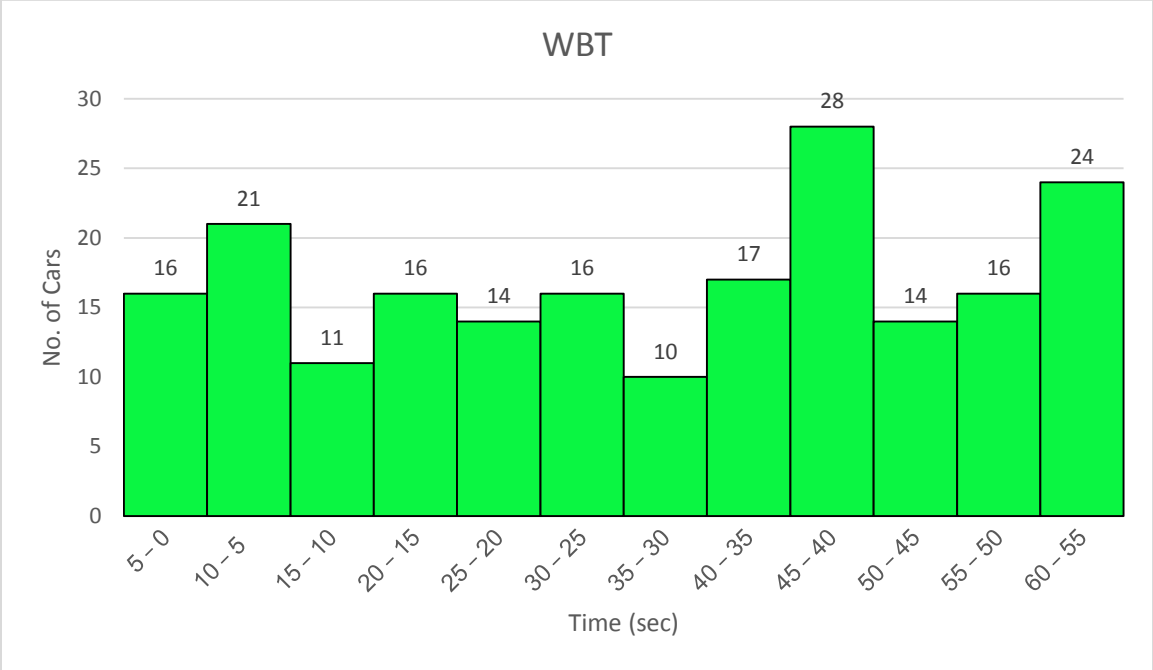


Figure 4.20: Histogram of West Bound Through of Mamostayan intersection

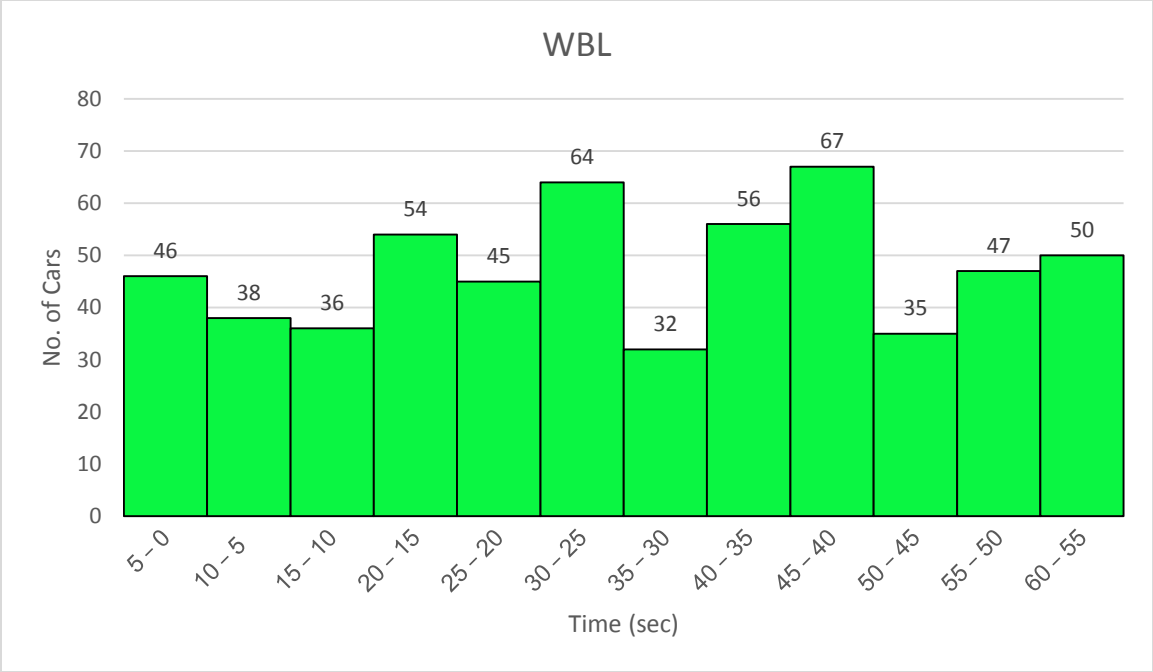


Figure 4.21: Histogram of West Bound Left of Mamostayan intersection

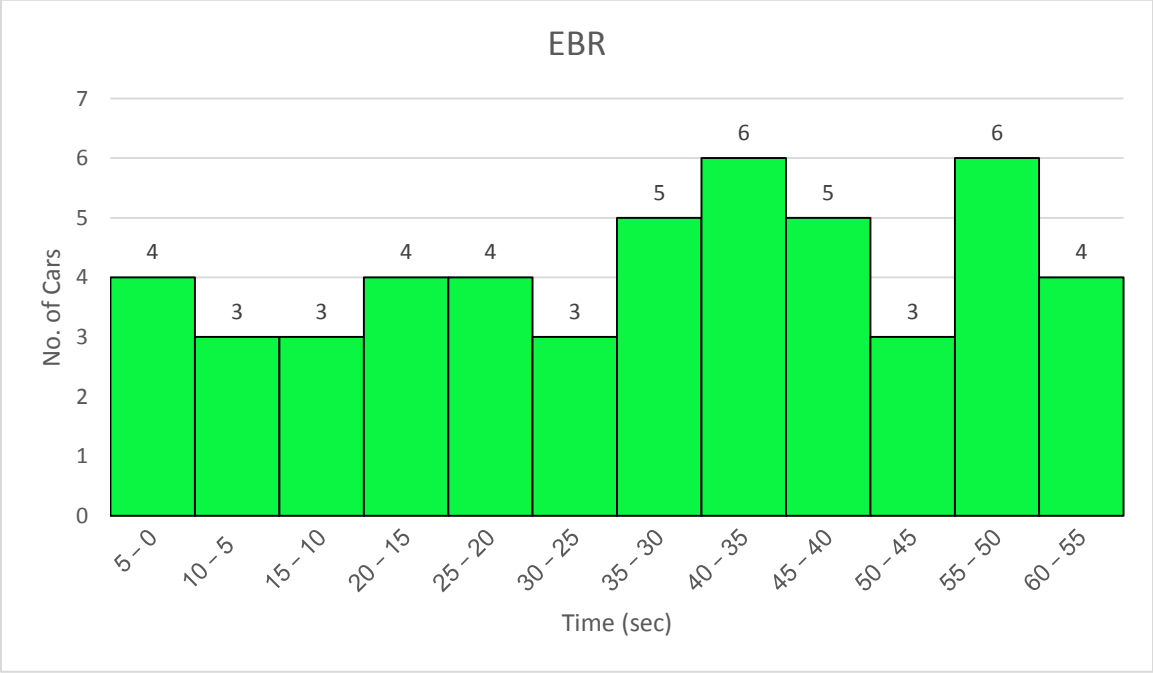


Figure 4.22: Histogram of East Bound Right of Mamostayan intersection

4.2.3 Histograms of Amna Suraka intersection

Histograms are shown in Figure 4.23, Figure 4.24, Figure 4.25, Figure 4.26, Figure 4.27, Figure 4.28, Figure 4.29, Figure 4.30, Figure 4.31, Figure 4.32, Figure 4.33 and Figure 4.34.

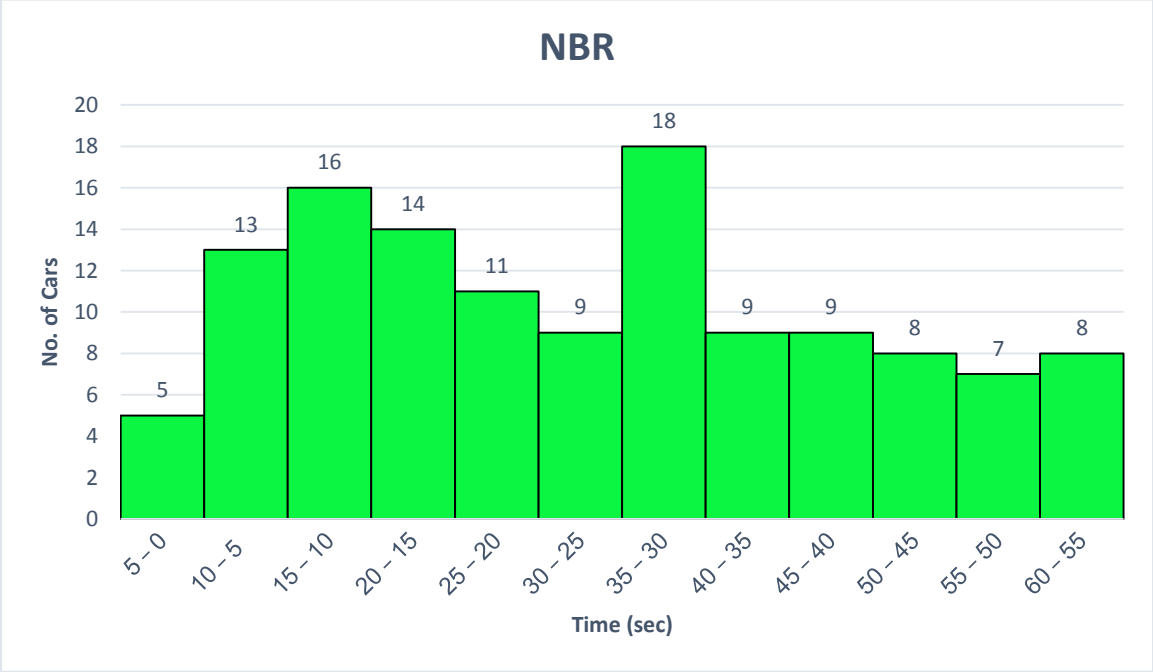


Figure 4.23: Histogram of North Bound Right of Amna Suraka intersection

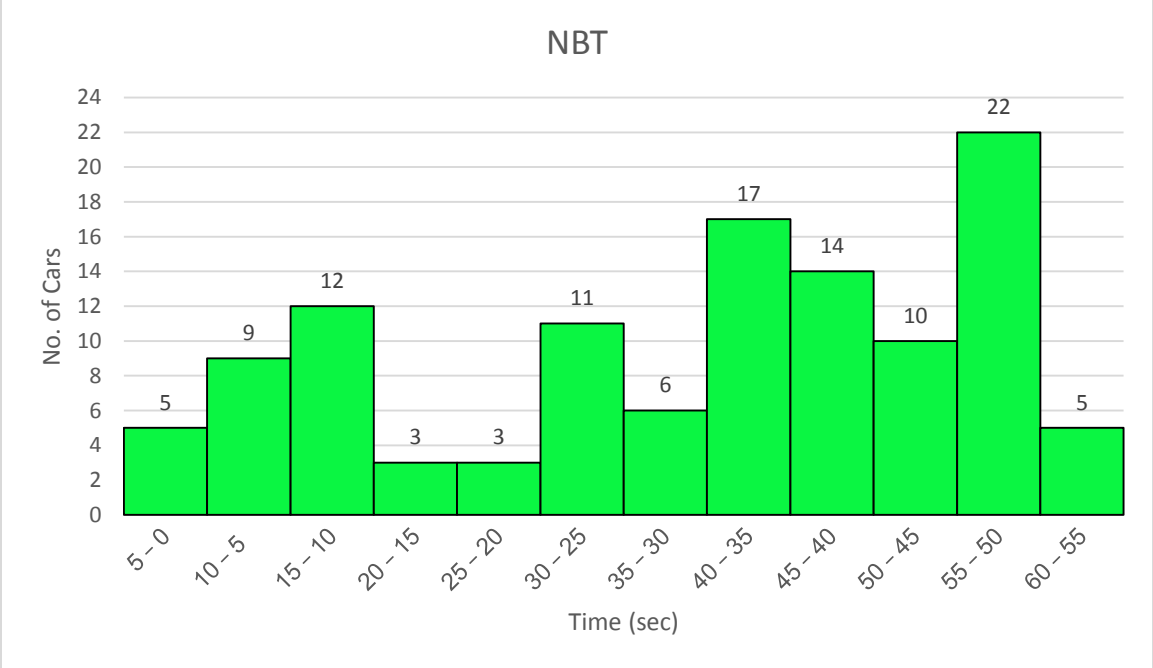


Figure 4.24: Histogram of North Bound Through of Amna Suraka intersection

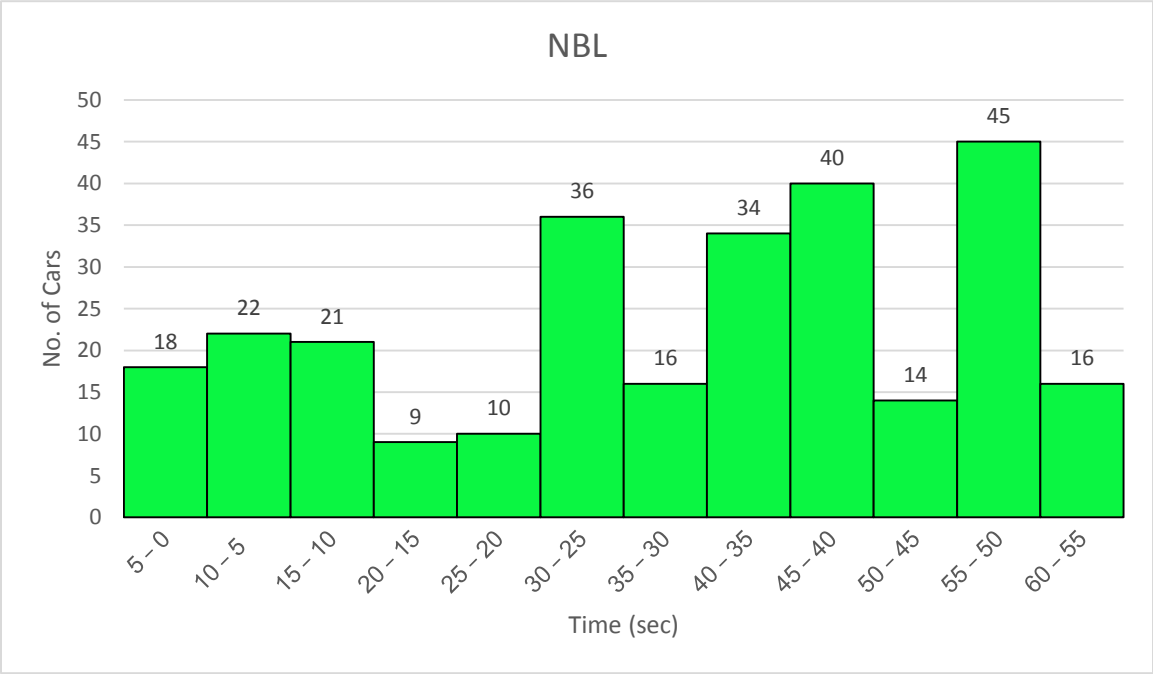


Figure 4.25: Histogram of North Bound Left of Amna Suraka intersection

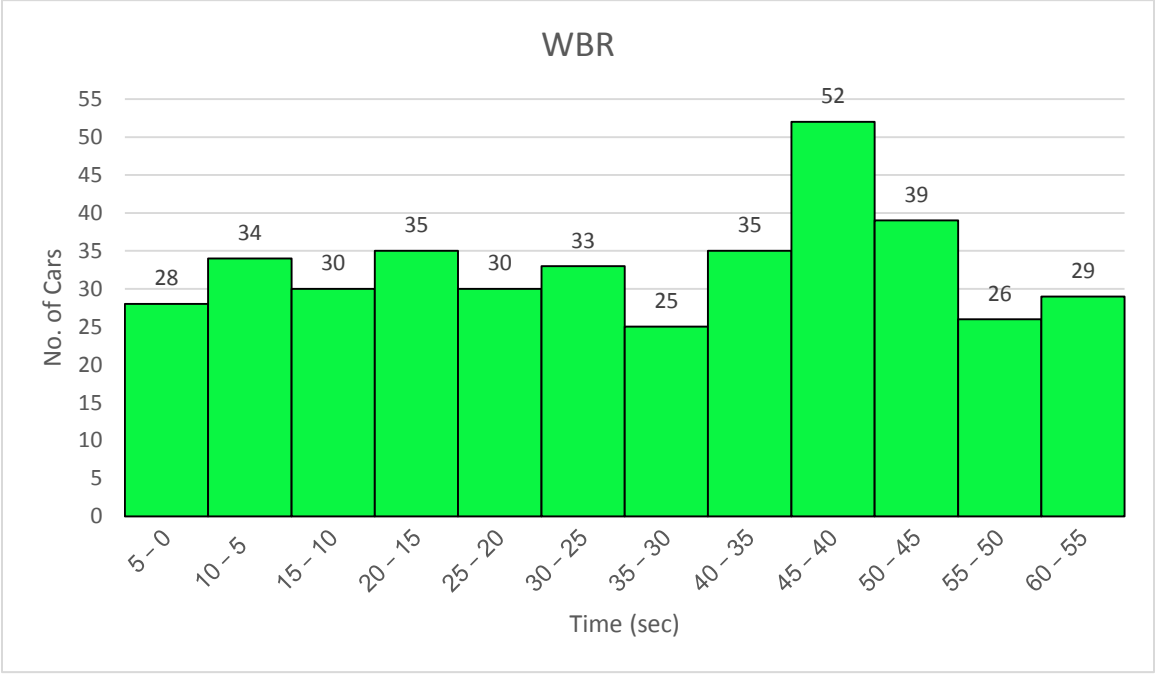


Figure 4.26: Histogram of West Bound Right of Amna Suraka intersection

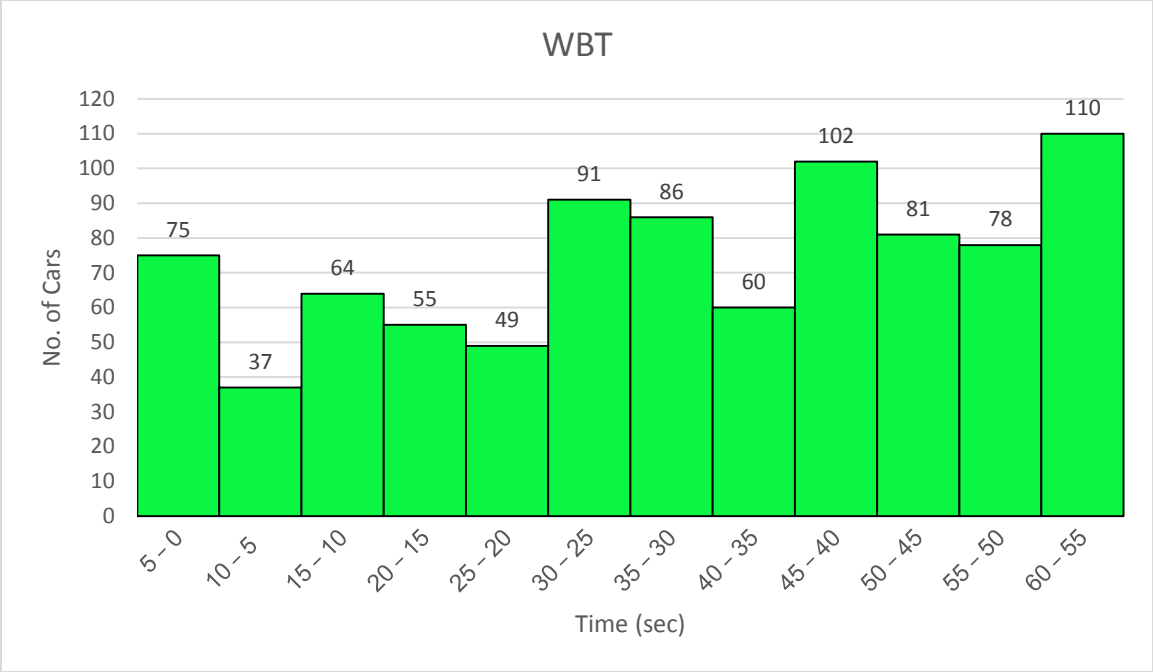


Figure 4.27: Histogram of West Bound Through of Amna Suraka intersection

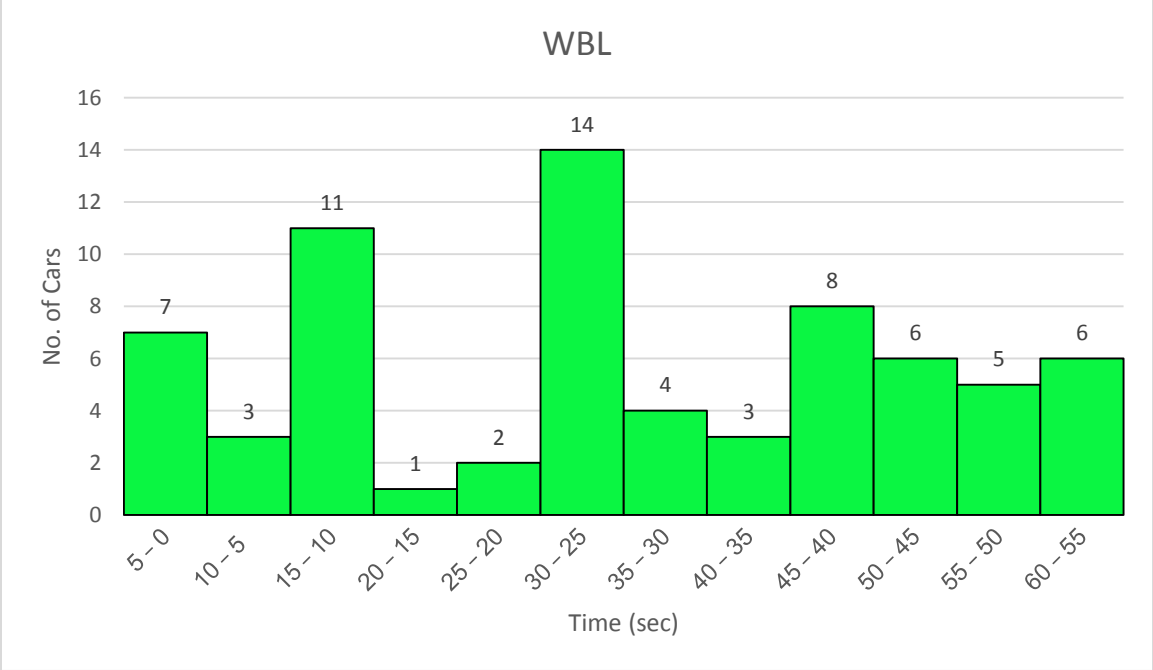


Figure 4.28: Histogram of West Bound Left of Amna Suraka intersection

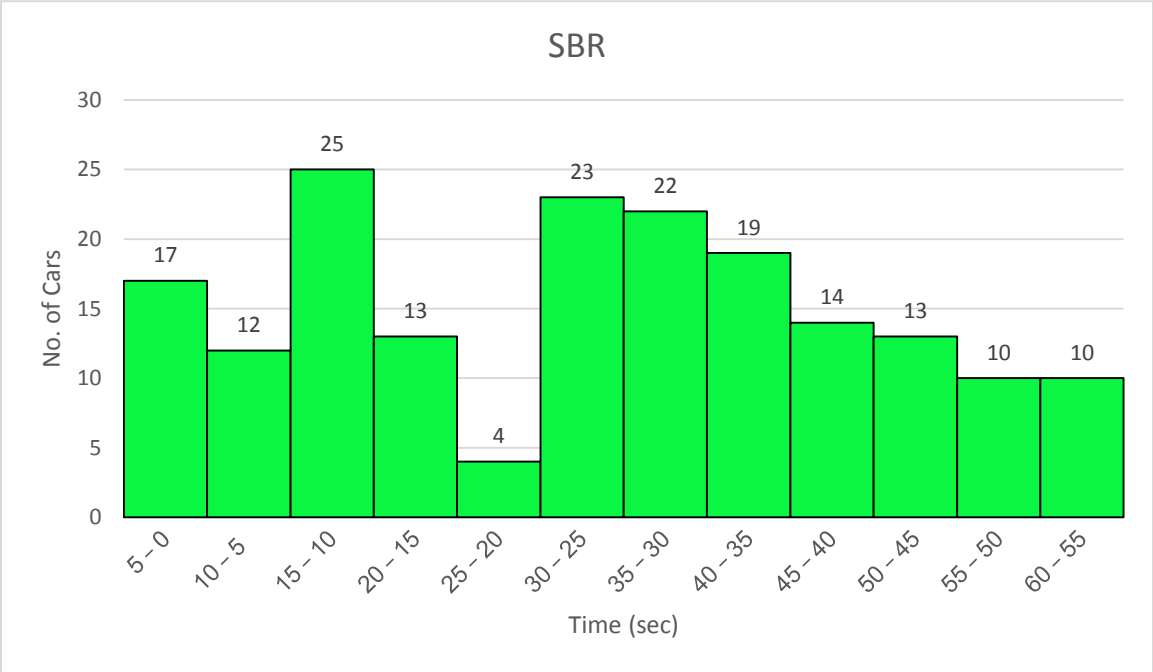


Figure 4.29: Histogram of South Bound Right of Amna Suraka intersection

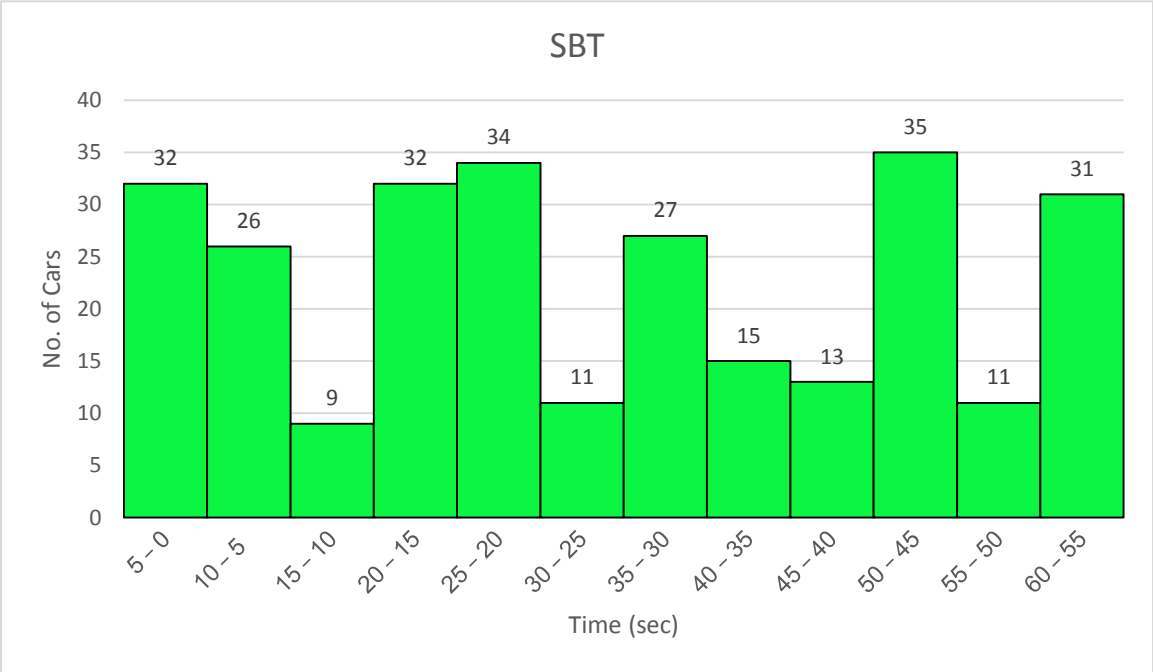


Figure 4.30: Histogram of South Bound Through of Amna Suraka intersection

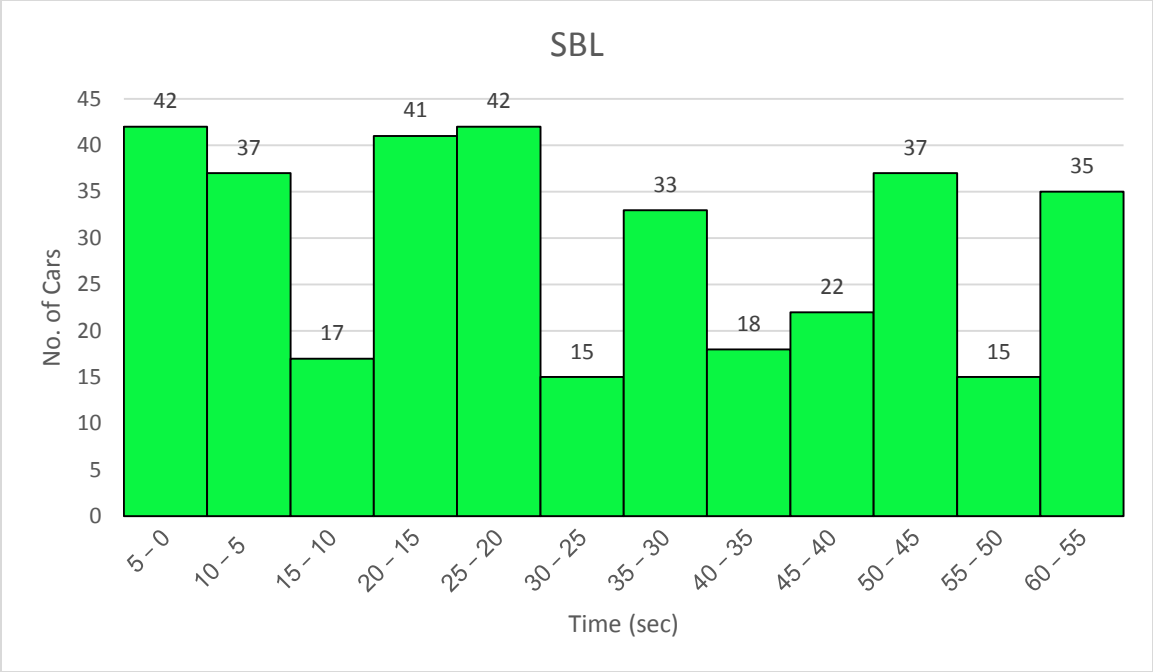


Figure 4.31: Histogram of South Bound Left of Amna Suraka intersection

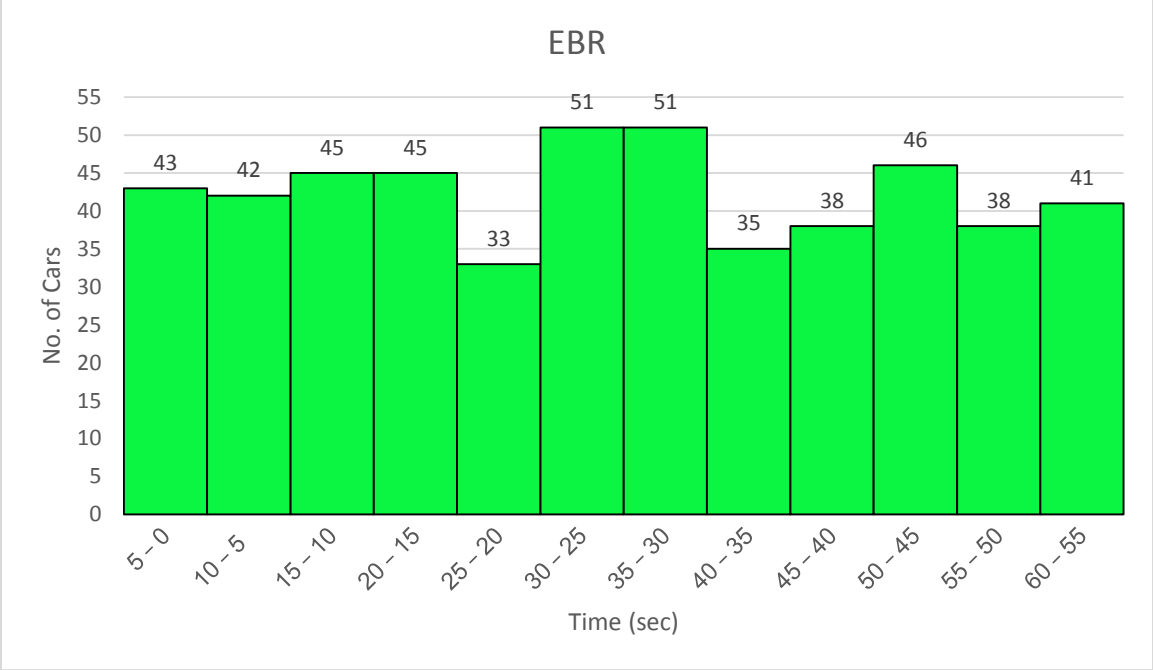


Figure 4.32: Histogram of East Bound Right of Amna Suraka intersection

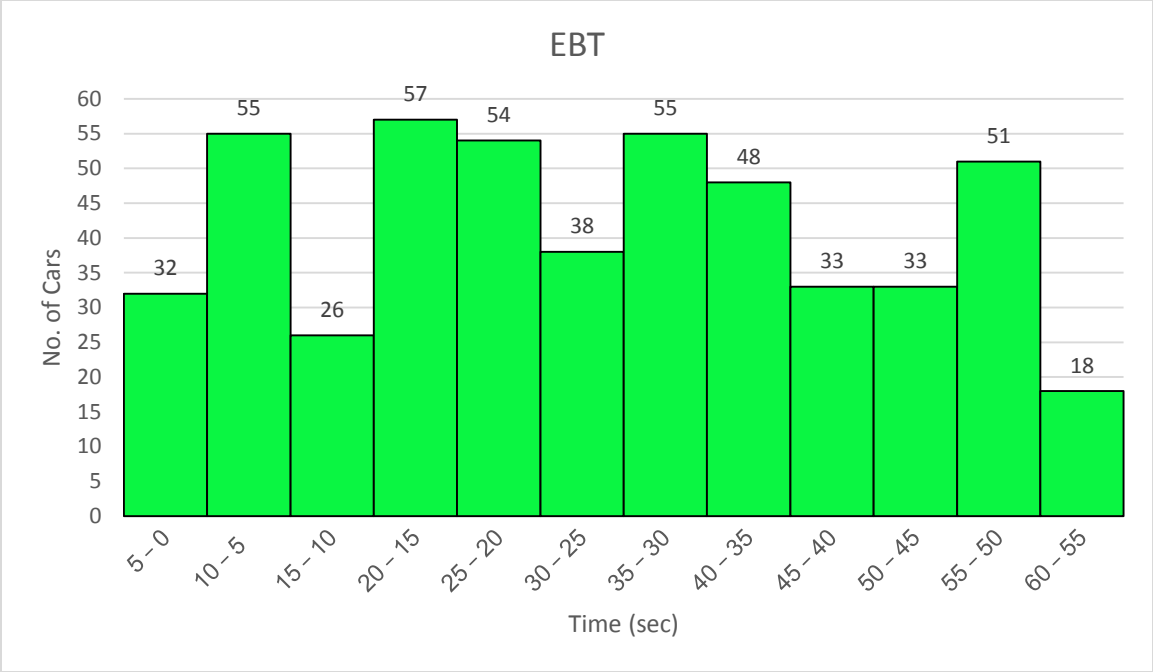


Figure 4.33: Histogram of East Bound Through of Amna Suraka intersection

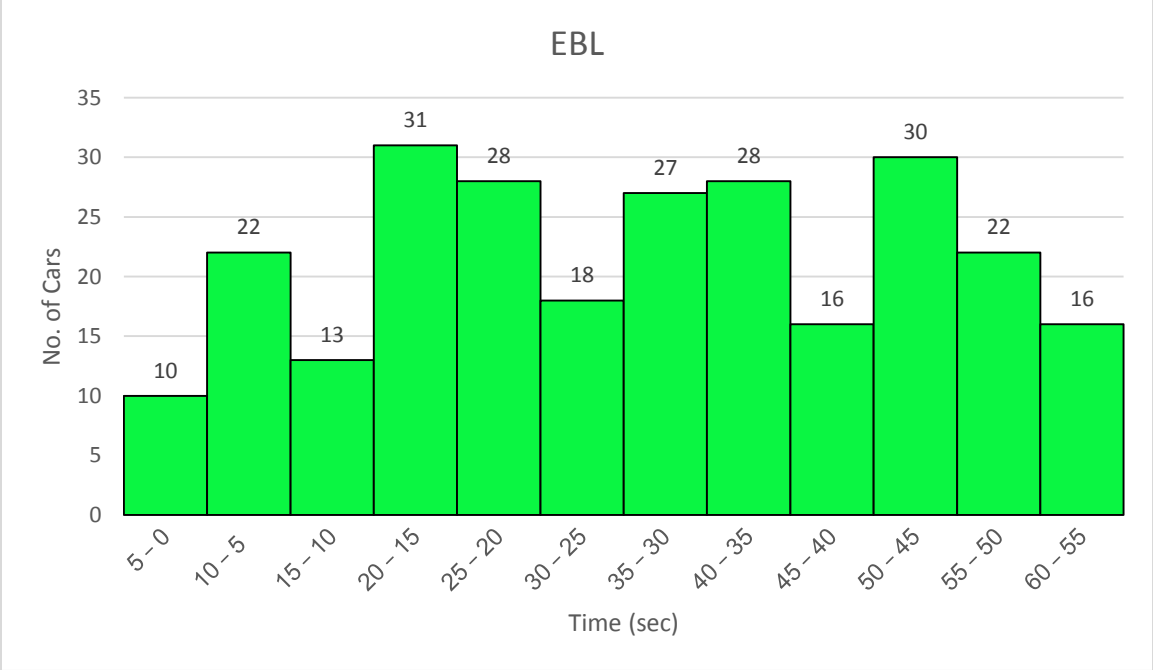


Figure 4.34: Histogram of East Bound Left of Amna Suraka intersection

4.3 Analysis

Before design LOS of intersections was F, as shown in **Figure 4.35**, **Figure 4.36** and **Figure 4.37**. Because, these intersections are major of the city, which Parki Azadi and Mamostayan intersections connecting bazar, Karezawshk, Parki Azadi and Dabashan St. And Amna Suraka connecting bazar, Ashti St, Parki Azadi and Reaya St. these intersections contain mosque, barber shop, garage, markets, etc.

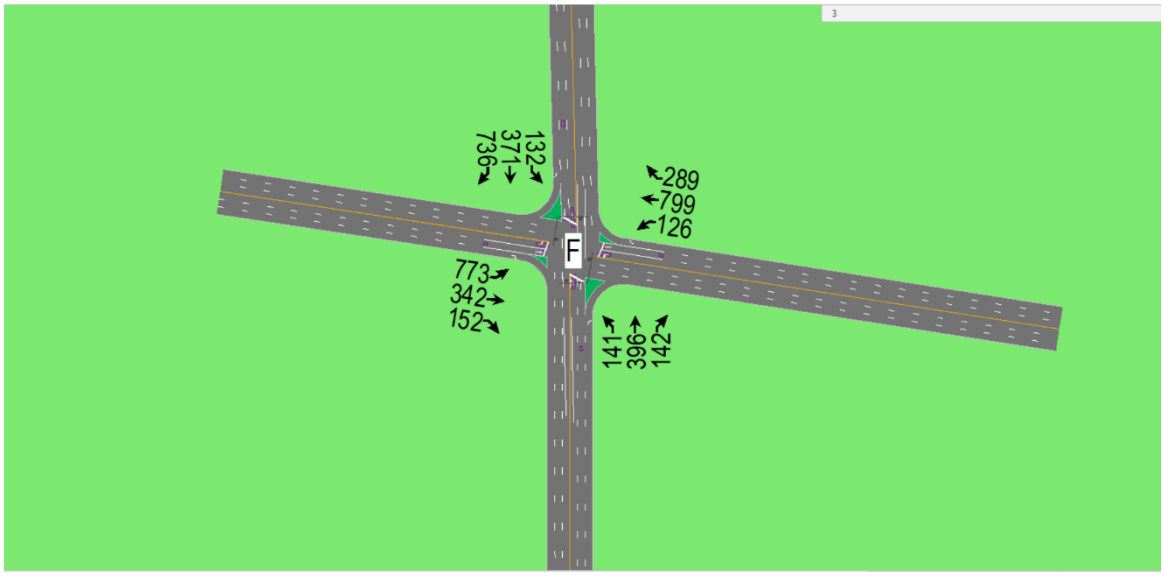


Figure 4.35: Volume and LOS of Parki Azadi intersection before design

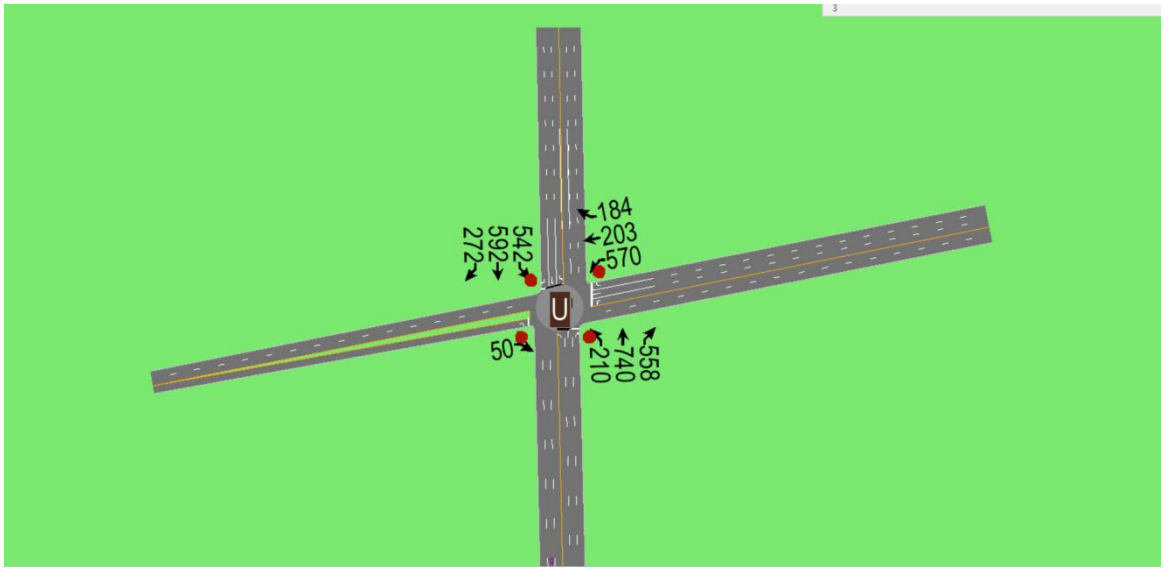


Figure 4.36: Volume of Un-signalized Mamostayan intersection before design

Figure 4.37: Volume and LOS of Amna Suraka intersection before design

Analysis of collected data due to Synchro program as reports, as shown in **Figure 4.38**, **Figure 4.39, Figure 4.40, Figure 4.41** and **Figure 4.42**. Reports consist of volume of cars, PHF, cycle length, all-red time of 1 second, maximum green time, yellow time of 3.5 second, LOS, etc.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	773	342	152	126	799	289	141	396	142	132	371	736
Future Volume (vph)	773	342	152	126	799	289	141	396	142	132	371	736
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1883	1601
Flt Permitted	0.088			0.503			0.195			0.488		
Satd. Flow (perm)	166	1883	1601	947	1883	1601	367	1883	1601	919	1883	1601
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			149			113			132			479
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		176.0			241.8			300.0			125.0	
Travel Time (s)		13.2			18.1			22.5			9.4	
Peak Hour Factor	0.88	0.76	0.86	0.64	0.79	0.96	0.70	0.82	0.68	0.84	0.76	0.90
Adj. Flow (vph)	878	450	177	197	1011	301	201	483	209	157	488	818
Shared Lane Traffic (%)												
Lane Group Flow (vph)	878	450	177	197	1011	301	201	483	209	157	488	818
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(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	50.0	50.0	50.0	50.0	50.0	50.0	25.0	25.0	25.0	25.0	25.0	25.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	16.7%	16.7%	16.7%	16.7%	16.7%	16.7%
Maximum Green (s)	45.5	45.5	45.5	45.5	45.5	45.5	20.5	20.5	20.5	20.5	20.5	20.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lag	Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effct Green (s)	45.5	45.5	45.5	45.5	45.5	45.5	20.5	20.5	20.5	20.5	20.5	20.5
Actuated g/C Ratio	0.30	0.30	0.30	0.30	0.30	0.30	0.14	0.14	0.14	0.14	0.14	0.14
v/c Ratio	17.56	0.79	0.30	0.69	1.77	0.53	4.02	1.88	0.63	1.26	1.90	1.29
Control Delay	7493.4	59.1	10.1	60.0	385.3	30.3	1420.6	443.4	32.0	214.9	451.7	163.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7493.4	59.1	10.1	60.0	385.3	30.3	1420.6	443.4	32.0	214.9	451.7	163.9

Figure 4.38: Report of Parki Azadi intersection before design Part 1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	F	E	B	E	F	C	F	F	C	F	F	F
Approach Delay		4390.4			272.0			567.1			265.3	
Approach LOS		F			F			F			F	

Intersection Summary			
Area Type:	Other		
Cycle Length: 150			
Actuated Cycle Length: 150			
Offset: 0 (0%), Referenced to phase 6:SBTL, Start of Green			
Natural Cycle: 90			
Control Type: Pretimed			
Maximum v/c Ratio: 17.56			
Intersection Signal Delay: 1473.5		Intersection LOS: F	
Intersection Capacity Utilization 128.0%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 6:

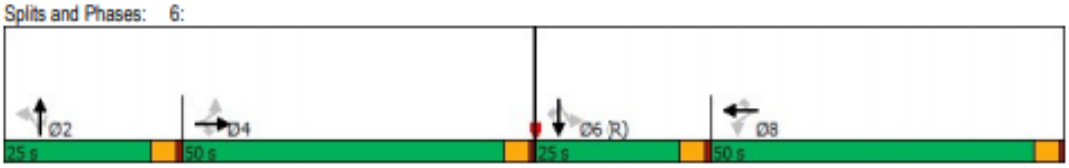
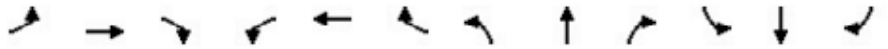


Figure 4.39: Report of Parki Azadi intersection before design Part 2



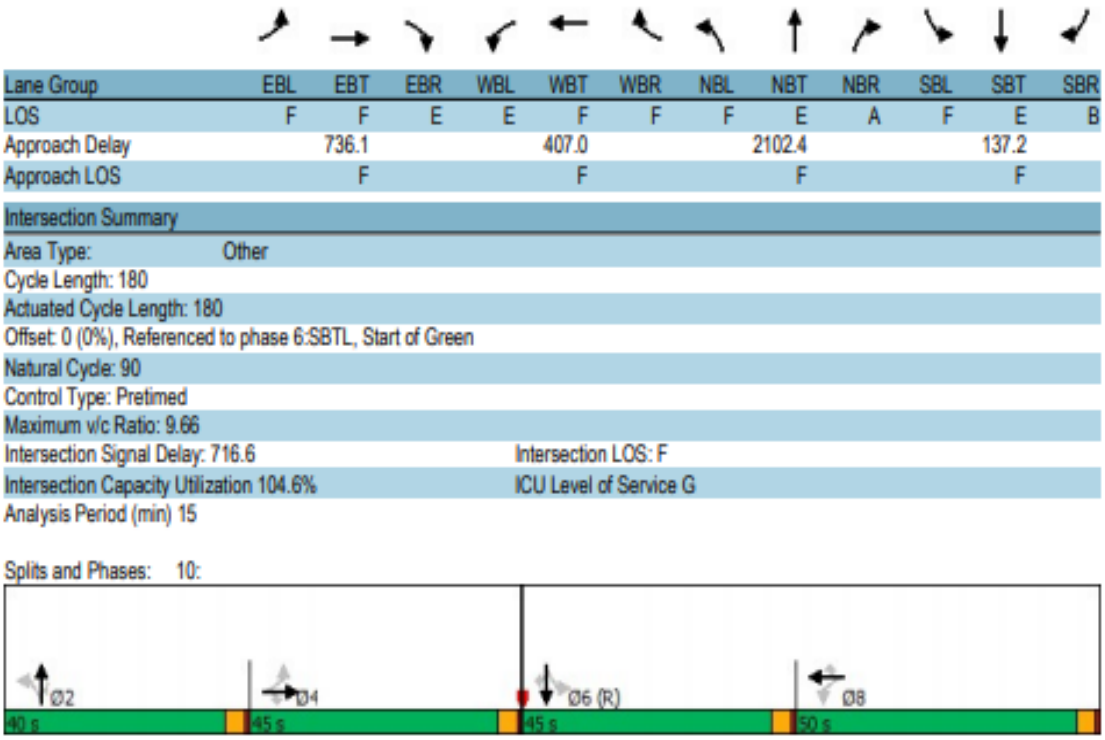
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	50	570	203	184	210	740	558	542	592	272
Future Volume (vph)	0	0	50	570	203	184	210	740	558	542	592	272
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt			0.865			0.850			0.850			0.850
Flt Protected				0.950			0.950			0.950		
Satd. Flow (prot)	0	0	1629	1789	1883	1601	1789	1883	1601	1789	1883	1601
Flt Permitted				0.950			0.950			0.950		
Satd. Flow (perm)	0	0	1629	1789	1883	1601	1789	1883	1601	1789	1883	1601
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		202.8			213.6			125.0			137.5	
Travel Time (s)		15.2			16.0			9.4			10.3	
Peak Hour Factor	0.92	0.92	0.78	0.87	0.86	0.85	0.81	0.88	0.88	0.87	0.90	0.80
Adj. Flow (vph)	0	0	64	655	236	216	259	841	634	623	658	340
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	64	655	236	216	259	841	634	623	658	340
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(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 110.6%		ICU Level of Service H	
Analysis Period (min) 15			

Figure 4.40: Report of Mamostayan intersection before design

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	261	500	508	70	888	396	281	117	127	354	276	182
Future Volume (vph)	261	500	508	70	888	396	281	117	127	354	276	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1883	1601
Flt Permitted	0.098			0.440			0.111			0.642		
Satd. Flow (perm)	185	1883	1601	829	1883	1601	209	1883	1601	1209	1883	1601
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			261			138			172			238
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		243.4			410.7			176.2			200.0	
Travel Time (s)		18.3			30.8			13.2			15.0	
Peak Hour Factor	0.85	0.84	0.93	0.83	0.83	0.79	0.71	0.64	0.74	0.89	0.90	0.71
Adj. Flow (vph)	307	595	546	84	1070	501	396	183	172	398	307	256
Shared Lane Traffic (%)												
Lane Group Flow (vph)	307	595	546	84	1070	501	396	183	172	398	307	256
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(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	45.0	45.0	45.0	50.0	50.0	50.0	40.0	40.0	40.0	45.0	45.0	45.0
Total Split (%)	25.0%	25.0%	25.0%	27.8%	27.8%	27.8%	22.2%	22.2%	22.2%	25.0%	25.0%	25.0%
Maximum Green (s)	41.0	41.0	41.0	46.0	46.0	46.0	36.0	36.0	36.0	41.0	41.0	41.0
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lag	Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effct Green (s)	41.0	41.0	41.0	46.0	46.0	46.0	36.0	36.0	36.0	41.0	41.0	41.0
Actuated g/C Ratio	0.23	0.23	0.23	0.26	0.26	0.26	0.20	0.20	0.20	0.23	0.23	0.23
v/c Ratio	7.31	1.39	0.96	0.40	2.22	0.98	9.66	0.49	0.38	1.45	0.72	0.47
Control Delay	2896.5	237.5	64.8	62.3	586.1	82.1	3951.0	68.9	9.8	266.6	74.8	11.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2896.5	237.5	64.8	62.3	586.1	82.1	3951.0	68.9	9.8	266.6	74.8	11.1

Figure 4.41: Report of Amna Suraka intersection before design Part 1



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	F	F	E	E	F	F	F	E	A	F	E	B
Approach Delay		736.1			407.0			2102.4			137.2	
Approach LOS		F			F			F			F	

Intersection Summary			
Area Type:	Other		
Cycle Length: 180			
Actuated Cycle Length: 180			
Offset: 0 (0%), Referenced to phase 6:SBTL, Start of Green			
Natural Cycle: 90			
Control Type: Pretimed			
Maximum v/c Ratio: 9.66			
Intersection Signal Delay: 716.6		Intersection LOS: F	
Intersection Capacity Utilization 104.6%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 10:

Figure 4.42: Report of Amna Suraka intersection before design Part 2

4.3 Redesign

Attempted had been taken to upgrading LOS of intersection by rearranging traffic. So, redesigning by changing traffic conditions from permitted to actuated-uncoordinated for Parki Azadi and Amna Suraka intersections had been carried out, as shown in Figure 4.43 and Figure 4.44 respectively. And merging West Bound Through and West Bound Right (WBT & WBR) of Parki Azadi intersection to create new group lanes and increasing its LOS, as shown in Figure 4.43. For Amna Suraka intersection, merging West Bound Right and West Bound Through (WBR & WBT), East Bound Left and East Bound Through (EBL & EBT), as shown in Figure 4.44.

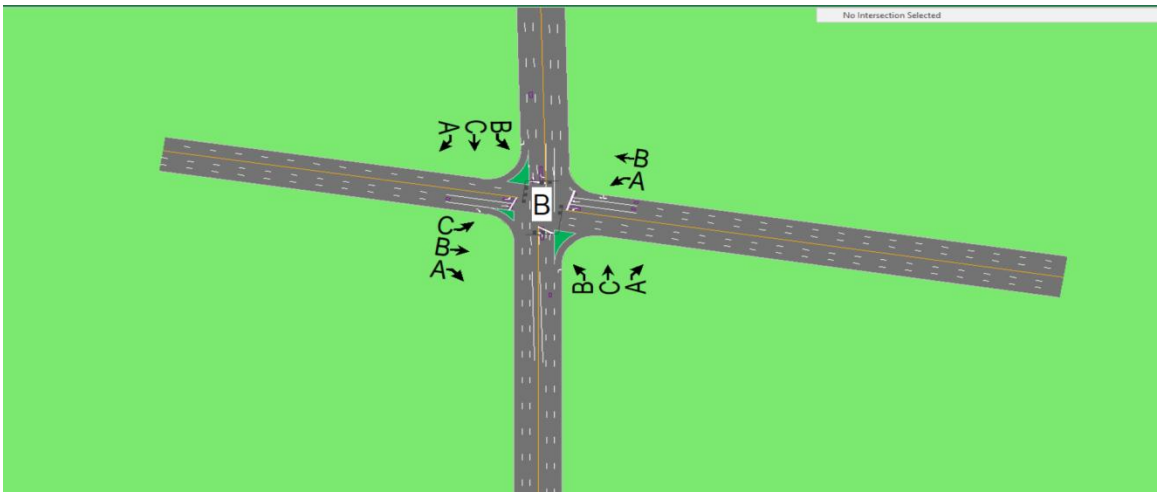


Figure 4.43: Volume and LOS of Parki Azadi intersection after design

The figure show phases and total cycle length for parki azadei intersection 65 sec,which phases of (1,2,5,6)have 25 sec, and phase of (3,4,7,8) have 40 sec

When the traffic light green northbound (through and left) and southbound (through and left) go and right turns are free as shown in figure

When the traffic light green eastbound (through and left) and westbound (through and left) go and right turns are free as shown in figure

Figure 4.44: Volume and LOS of Amna Suraka intersection after design

The figure show phases and total cycle length for amna swraka intersection 70 sec,which phases of (1,2,5,6) have 34.6 sec, and phase of (3,4,7,8) have 35.4 sec

When the traffic light green northbound (through and left) and southbound (through and left) go and right turns are free as shown in figure.

When the traffic light green eastbound (through and left) and westbound (through and left) go and right turns are free as shown in figure

And Adding actuated-uncoordinated traffic condition for Mamostayan Un-signalized intersection, ignoring East Bound Right (EBR) and merging North Bond Through and North Bound Right (NBT & NBR) to create new group lanes, as shown in **Figure 4.45**.

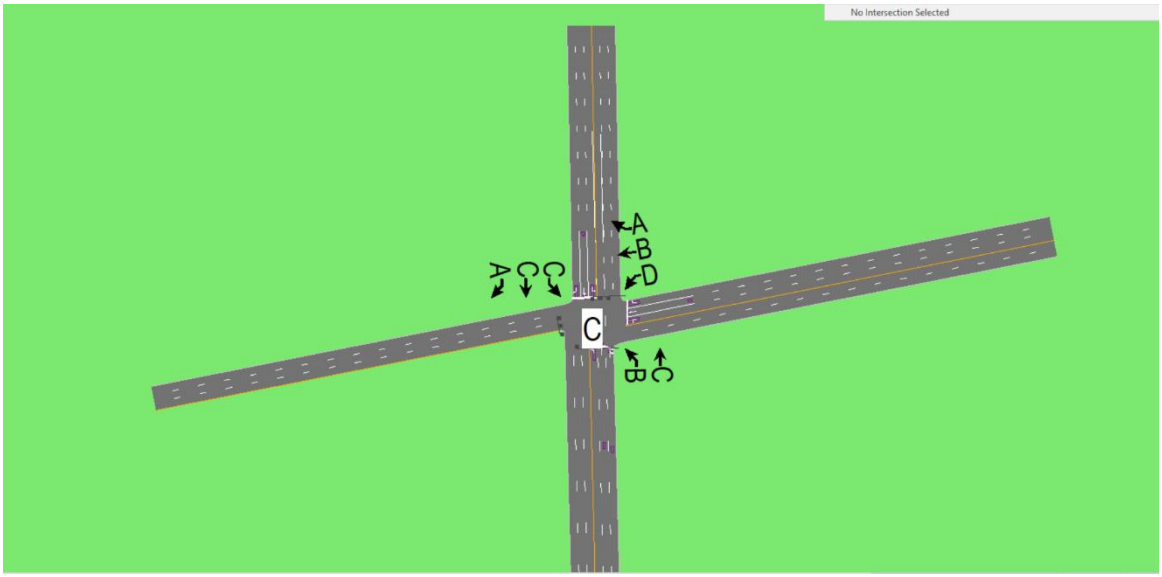


Figure 4.45: Volume and LOS of Mamostayan intersection after design

The figure show phases and total cycle length for mamostayan intersection 60 sec,which phases of (1,2,5,6) have 32sec, and phase of (7,8) have 28 sec

When the traffic light green northbound (through and left) and southbound (through and left) go and right turn is free as shown in

When the traffic light green westbound (through and left) go a and right turn is free as shown in figure

After redesigning by Synchro program, reports of redesigned intersections are as shown in Figure 4.46, Figure 4.47, Figure 4.48, Figure 4.49, Figure 4.50 and Figure 4.51. Reports consist of volume of cars, PHF, cycle length, all red time of 1 second, maximum green time, yellow time of 3.5 second, new LOS, etc.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	773	342	152	126	1088	0	141	396	142	132	371	736
Future Volume (vph)	773	342	152	126	1088	0	141	396	142	132	371	736
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850						0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	3579	0	1789	1883	1601	1789	1883	1601
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1789	1883	1601	1789	3579	0	1789	1883	1601	1789	1883	1601
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			177						209			199
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		176.0			241.8			300.0			125.0	
Travel Time (s)		13.2			18.1			22.5			9.4	
Peak Hour Factor	0.88	0.76	0.86	0.64	0.79	0.96	0.70	0.82	0.68	0.84	0.76	0.90
Adj. Flow (vph)	878	450	177	197	1377	0	201	483	209	157	488	818
Shared Lane Traffic (%)												
Lane Group Flow (vph)	878	450	177	197	1377	0	201	483	209	157	488	818
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(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	6.1	30.5	6.1	6.1	30.5		6.1	30.5	6.1	6.1	30.5	6.1
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8	6.1	6.1	1.8		6.1	1.8	6.1	6.1	1.8	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	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	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	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	0.0	0.0	0.0
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
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	Split	NA	Free	Split	NA		Split	NA	Free	Split	NA	Free
Protected Phases	4!	4!		8!	8!		2!	2!		6!	6!	
Permitted Phases			Free						Free			Free
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	

Figure 4.46: Report of Parki Azadi intersection after design Part 1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	22.5	22.5		22.5	22.5		22.5	22.5		22.5	22.5	
Total Split (s)	40.0	40.0		40.0	40.0		25.0	25.0		25.0	25.0	
Total Split (%)	61.5%	61.5%		61.5%	61.5%		38.5%	38.5%		38.5%	38.5%	
Maximum Green (s)	35.5	35.5		35.5	35.5		20.5	20.5		20.5	20.5	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	None		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	34.8	34.8	65.0	34.8	34.8		21.2	21.2	65.0	21.2	21.2	65.0
Actuated g/C Ratio	0.54	0.54	1.00	0.54	0.54		0.33	0.33	1.00	0.33	0.33	1.00
v/c Ratio	0.92	0.45	0.11	0.21	0.72		0.34	0.79	0.13	0.27	0.79	0.51
Control Delay	30.6	10.8	0.1	8.3	14.0		19.1	31.8	0.2	18.2	32.3	1.2
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.6	10.8	0.1	8.3	14.0		19.1	31.8	0.2	18.2	32.3	1.2
LOS	C	B	A	A	B		B	C	A	B	C	A
Approach Delay		21.1			13.3			21.5			13.4	
Approach LOS		C			B			C			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 65			
Actuated Cycle Length: 65			
Offset: 0 (0%), Referenced to phase 6:SBTL, Start of Green			
Natural Cycle: 65			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.92			
Intersection Signal Delay: 16.8		Intersection LOS: B	
Intersection Capacity Utilization 116.1%		ICU Level of Service H	
Analysis Period (min) 15			

! Phase conflict between lane groups.

Splits and Phases: 6:

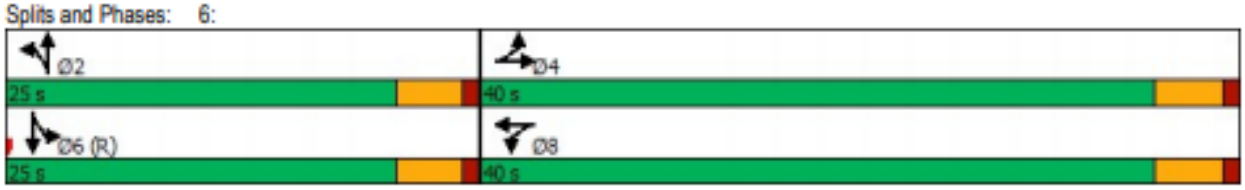


Figure 4.47: Report of Parki Azadi intersection after design Part 2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	570	203	184	210	1298	0	542	592	272
Future Volume (vph)	0	0	0	570	203	184	210	1298	0	542	592	272
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected				0.950			0.950			0.950		
Satd. Flow (prot)	0	0	0	1789	1883	1601	1789	3579	0	1789	1883	1601
Flt Permitted				0.950			0.950			0.950		
Satd. Flow (perm)	0	0	0	1789	1883	1601	1789	3579	0	1789	1883	1601
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						216						340
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		202.8			213.6			125.0			137.5	
Travel Time (s)		15.2			16.0			9.4			10.3	
Peak Hour Factor	0.92	0.92	0.78	0.87	0.86	0.85	0.81	0.88	0.88	0.87	0.90	0.80
Adj. Flow (vph)	0	0	0	655	236	216	259	1475	0	623	658	340
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	655	236	216	259	1475	0	623	658	340
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(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors				1	2	1	1	2		1	2	1
Detector Template				Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)				6.1	30.5	6.1	6.1	30.5		6.1	30.5	6.1
Trailing Detector (m)				0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)				0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)				6.1	1.8	6.1	6.1	1.8		6.1	1.8	6.1
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(m)					28.7			28.7			28.7	
Detector 2 Size(m)					1.8			1.8			1.8	
Detector 2 Type					Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)					0.0			0.0			0.0	
Turn Type				Split	NA	Free	Split	NA		Split	NA	Free
Protected Phases				8	8		2!	2!		6!	6!	
Permitted Phases						Free						Free
Detector Phase				8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)				5.0	5.0		5.0	5.0		5.0	5.0	

Figure 4.48: Report of Mamostayan intersection after design Part 1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)				22.5	22.5		22.5	22.5		22.5	22.5	
Total Split (s)				28.0	28.0		32.0	32.0		32.0	32.0	
Total Split (%)				46.7%	46.7%		53.3%	53.3%		53.3%	53.3%	
Maximum Green (s)				23.5	23.5		27.5	27.5		27.5	27.5	
Yellow Time (s)				3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)				1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)				0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)				4.5	4.5		4.5	4.5		4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode				None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)				7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)				11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)				0	0		0	0		0	0	
Act Effct Green (s)				23.4	23.4	60.0	27.6	27.6		27.6	27.6	60.0
Actuated g/C Ratio				0.39	0.39	1.00	0.46	0.46		0.46	0.46	1.00
v/c Ratio				0.94	0.32	0.13	0.31	0.90		0.76	0.76	0.21
Control Delay				43.2	14.3	0.2	11.6	24.2		21.2	20.9	0.3
Queue Delay				0.0	0.0	0.0	0.0	0.8		0.0	0.0	0.0
Total Delay				43.2	14.3	0.2	11.6	25.0		21.2	20.9	0.3
LOS				D	B	A	B	C		C	C	A
Approach Delay					28.6			23.0			16.7	
Approach LOS					C			C			B	

Intersection Summary	
Area Type:	Other
Cycle Length: 60	
Actuated Cycle Length: 60	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.94	
Intersection Signal Delay: 22.1	Intersection LOS: C
Intersection Capacity Utilization 108.7%	ICU Level of Service G
Analysis Period (min) 15	

! Phase conflict between lane groups.

Splits and Phases: 3:

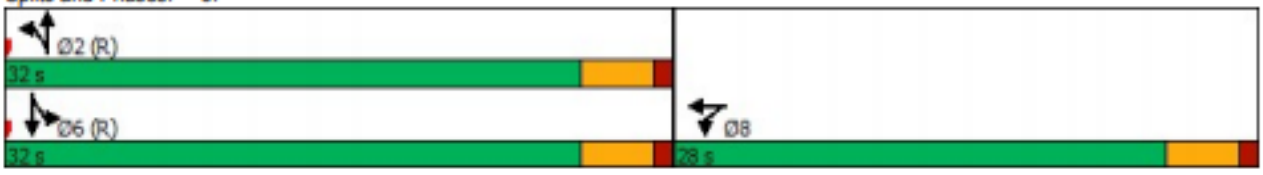


Figure 4.49: Report of Mamostayan intersection after design Part 2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	761	508	70	1284	0	281	117	127	354	276	182
Future Volume (vph)	0	761	508	70	1284	0	281	117	127	354	276	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850						0.850			0.850
Flt Protected				0.950			0.950			0.950		
Satd. Flow (prot)	0	3579	1601	1789	3579	0	1789	1883	1601	1789	1883	1601
Flt Permitted				0.215			0.496			0.632		
Satd. Flow (perm)	0	3579	1601	405	3579	0	934	1883	1601	1190	1883	1601
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			546						172			171
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		243.4			410.7			176.2			200.0	
Travel Time (s)		18.3			30.8			13.2			15.0	
Peak Hour Factor	0.85	0.84	0.93	0.83	0.83	0.79	0.71	0.64	0.74	0.89	0.90	0.71
Adj. Flow (vph)	0	906	546	84	1547	0	396	183	172	398	307	256
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	906	546	84	1547	0	396	183	172	398	307	256
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(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2	1	1	2		1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	6.1	30.5	6.1	6.1	30.5		6.1	30.5	6.1	6.1	30.5	6.1
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8	6.1	6.1	1.8		6.1	1.8	6.1	6.1	1.8	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	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	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	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	0.0	0.0	0.0
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
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		NA	Free	D.Pm	NA		D.Pm	NA	Free	D.Pm	NA	Free
Protected Phases		4			8			2			6	
Permitted Phases	4		Free	4			6		Free	2		Free
Detector Phase	4	4		4	8		6	2		2	6	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	

Figure 4.50: Report of Amna Suraka intersection after design Part 1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	22.5	22.5		22.5	22.5		22.5	22.5		22.5	22.5	
Total Split (s)	35.4	35.4		35.4	35.4		34.6	34.6		34.6	34.6	
Total Split (%)	50.6%	50.6%		50.6%	50.6%		49.4%	49.4%		49.4%	49.4%	
Maximum Green (s)	31.4	31.4		31.4	31.4		30.6	30.6		30.6	30.6	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	None		None	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		31.4	70.0	31.4	31.4		30.6	30.6	70.0	30.6	30.6	70.0
Actuated g/C Ratio		0.45	1.00	0.45	0.45		0.44	0.44	1.00	0.44	0.44	1.00
v/c Ratio		0.56	0.34	0.46	0.96		0.97	0.22	0.11	0.77	0.37	0.16
Control Delay		16.0	0.6	24.0	35.8		61.1	13.2	0.1	28.9	14.9	0.2
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		16.0	0.6	24.0	35.8		61.1	13.2	0.1	28.9	14.9	0.2
LOS		B	A	C	D		E	B	A	C	B	A
Approach Delay		10.2			35.2			35.5			16.8	
Approach LOS		B			D			D			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 70			
Actuated Cycle Length: 70			
Offset: 0 (0%), Referenced to phase 6:NBSB, Start of Green			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.97			
Intersection Signal Delay: 24.0		Intersection LOS: C	
Intersection Capacity Utilization 98.3%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 10:

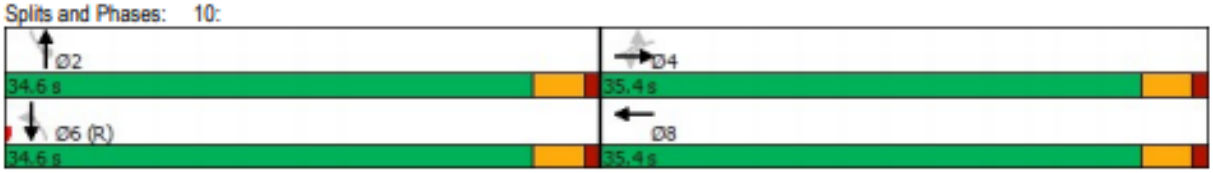


Figure 4.51: Report of Amna Suraka intersection after design Part 2

Finally, just by changing traffic conditions and merging one phase, LOS of Parki Azadi intersection from F to B, Amna Suraka intersection from F to C and Mamostayan intersection from F to C, upgrading of LOS have been done.

CHAPTER FIVE

CONCLUSIONS

After analyzing, redesigning of intersection have been taken, which the results was upgrading LOS of Parki Azadi intersection from F to B and both Mamostayan and Amna Suraka intersections from F to C, causing reduce of intersection traffic jam and passengers feel more comfortable with avoiding delay in traffics and drivers getting to their destination on time. Due to this research, new design of known intersections can be applied for obtaining higher LOS in present time.

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