What is Volume Study?

Volume study is basically the quantitative interpretation of the number of vehicles crossing a particular section of a road per unit time. The traffic volume is dynamic as we can observe variations in traffic volume daily, weekly, monthly and yearly. Normally, in a day, we usually observe two peaks in traffic volume called the AM and PM peak. It is can be represented as vehicle/min, vehicle/hr or vehicle/day. There are mainly two methods for counting vehicles; manual and automatic count. Manual count is over preferred over automatic count due to its simplicity and inexpensive nature. Traffic volume study is essential for designing transportation networks and ensuring smooth flow of traffic throughout the country. It can give us an idea of the current scenario of a road network as well as predict future growth in traffic. Based on the study, transport planners and policy makers can improve and suggest if a certain road network needs any kind of modification. It can also be adopted as a measure of relative importance of a road in deciding which road is of a higher priority. Another important use of the volume study is in designing the pavement. Overall, volume study is one of the fundamentals of transportation planning.

Study Area

When performing traffic volume study, the area or the road network of particular interest is normally cordoned off by a boundary line. The area inside is often referred to as the cordon area. The location of interest in this study is chosen to be Belmont Ave, Phoenix, AZ, USA. (33.548804, -112.106129) The road network chosen to be studied is shown below in Figure 1 Road Network for Volume Study. The area chosen for the study is an urban area in the city of Phoenix. In urban areas, we typically see an AM peak when people start for their work and a PM peak is observed when they return back to their respective home.

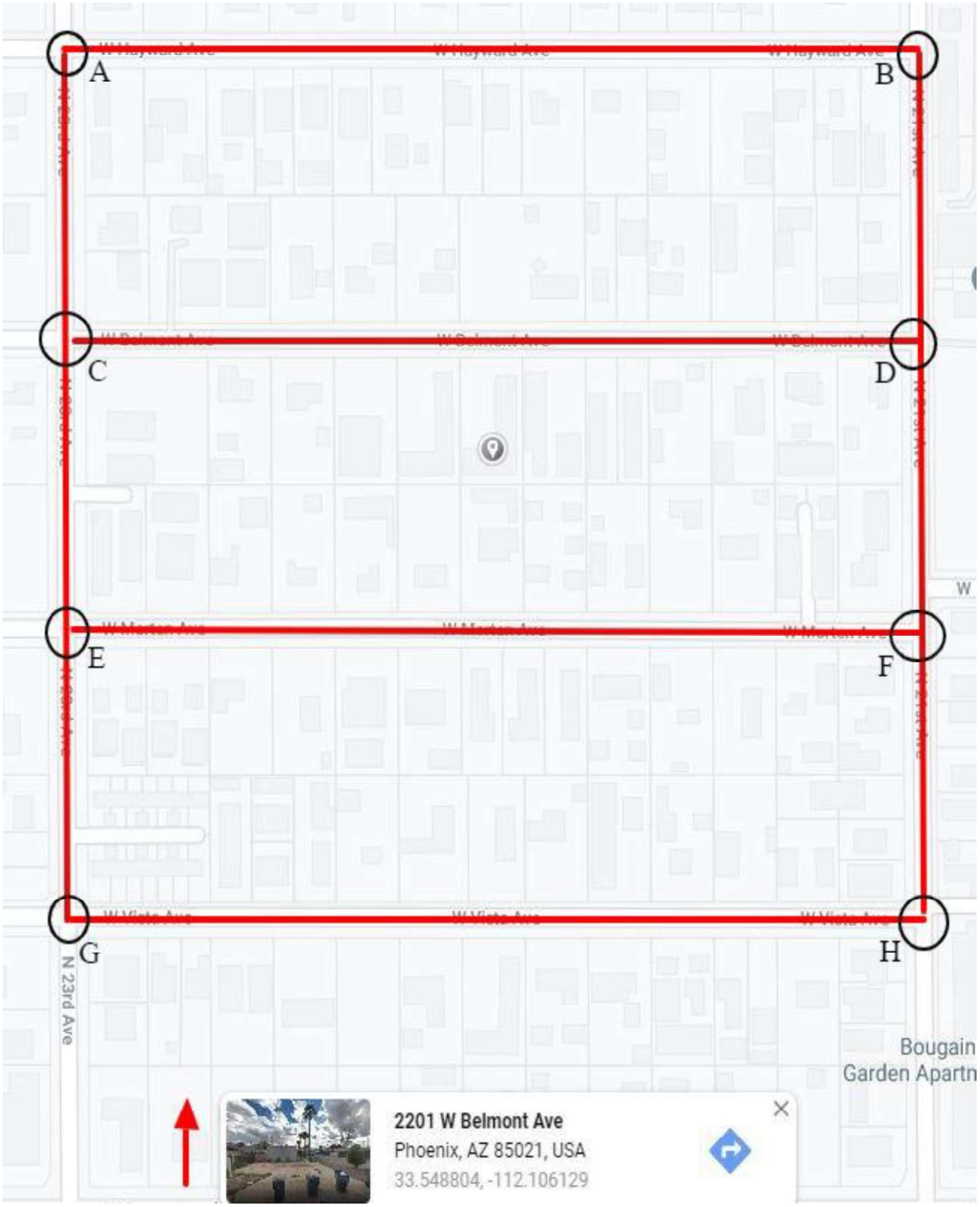

Figure 1 Road Network for Volume Study

Methodology

Traffic volume studies are based on vehicle counts on a particular section of a road. The volume is counted to identify peak flows, seasonal and yearly variations in traffic. Designing a traffic volume survey is the most critical part of the study since improper counts can give us a contradicting scenario of the area of interest. The methods used in a survey can vary depending on certain factors such as availability of manpower, duration of the study, technology available and budget. Manual counts are performed for short periods of study and it has a few advantages over automatic count such as the ability to classify vehicle types and low initial cost. In contrary, automatic methods can record vehicles for a longer period of time compared to a human counterpart.

In our study, the manual count was performed over a 5-day study period. An urban road network consisting of 8 intersections, 1 control and 9 coverages was surveyed from Monday to Friday. The survey lasted for 8 hours each day with an aggregation unit of 5 minutes. The control (C to D in Figure 1 Road Network for Volume Study) was studied for 5 days while each of the coverages were counted for only a day and adjusted later. Enumerators counted the first 4 minutes of each 5 minutes interval for only one lane. Similarly, the other lane was counted in the next interval.

Data was collected in both lanes of both directions, from 12 PM to 8 PM of each weekday (Monday to Friday).

Data Analysis and Results

For control count, the temporal distribution on Monday for both directions are shown below:

Control							
Direction: C to D							
Monday							
Time Period		Heavy Truck	Light Truck	Light Vehicle	Motorbike	Bus	PCU/hr
12:00 PM	1:00 PM	14	22	172	96	30	418
1:00 PM	2:00 PM	8	29	130	107	24	366.5
2:00 PM	3:00 PM	14	32	163	95	18	402.5
3:00 PM	4:00 PM	8	32	155	86	22	384
4:00 PM	5:00 PM	16	37	172	111	16	434.5
5:00 PM	6:00 PM	8	24	192	124	31	443
6:00 PM	7:00 PM	16	30	178	105	26	446.5
7:00 PM	8:00 PM	13	17	150	106	26	371

Table 1 Traffic flow rate (PCU/hr) from C to D

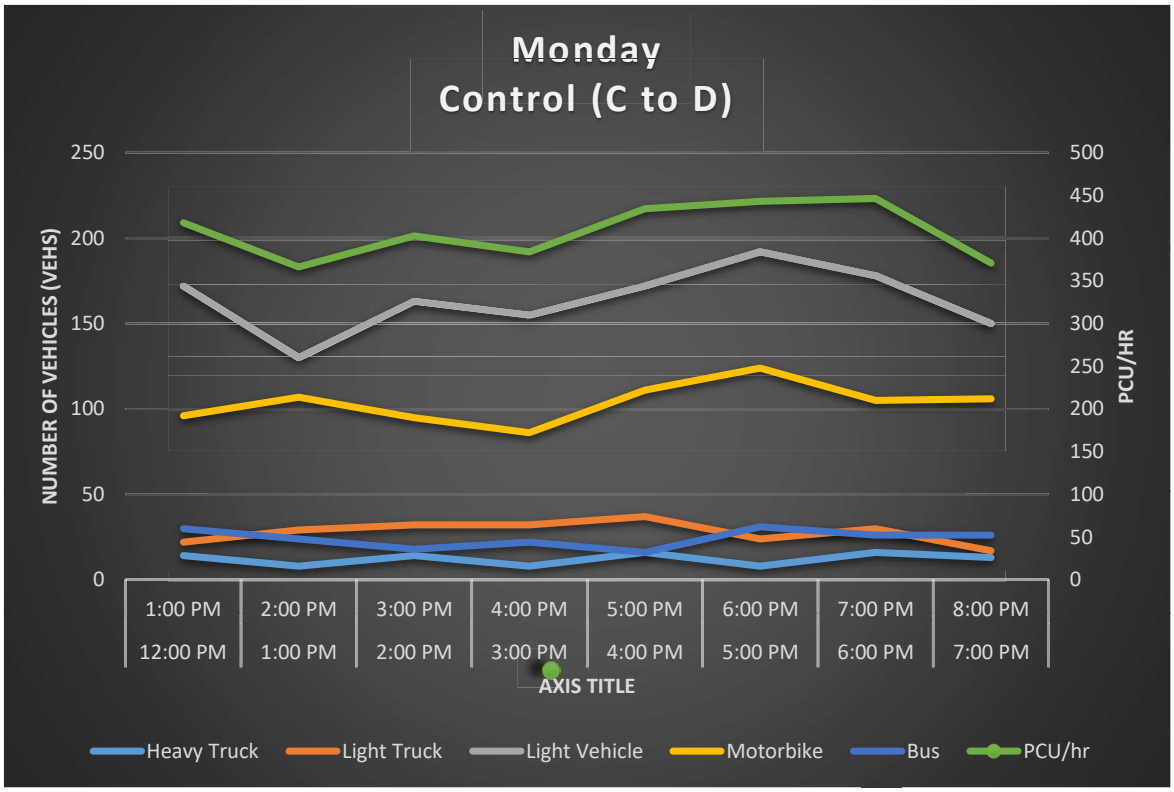

Figure 2 Temporal Distribution of Control (C to D)

Control							
Direction: D to C							
Monday							
Time Period		Heavy Truck	Light Truck	Light Vehicle	Motorbike	Bus	PCU/hr
12:00 PM	1:00 PM	12	26	168	86	19	382
1:00 PM	2:00 PM	10	37	189	111	26	463.5
2:00 PM	3:00 PM	15	29	161	87	31	429.5
3:00 PM	4:00 PM	16	32	188	91	28	461.5
4:00 PM	5:00 PM	10	15	189	112	33	419
5:00 PM	6:00 PM	22	48	246	143	49	674.5
6:00 PM	7:00 PM	15	33	136	115	30	427.5
7:00 PM	8:00 PM	9	20	163	106	19	360

Table 2 Traffic flow rate (PCU/hr) from D to C

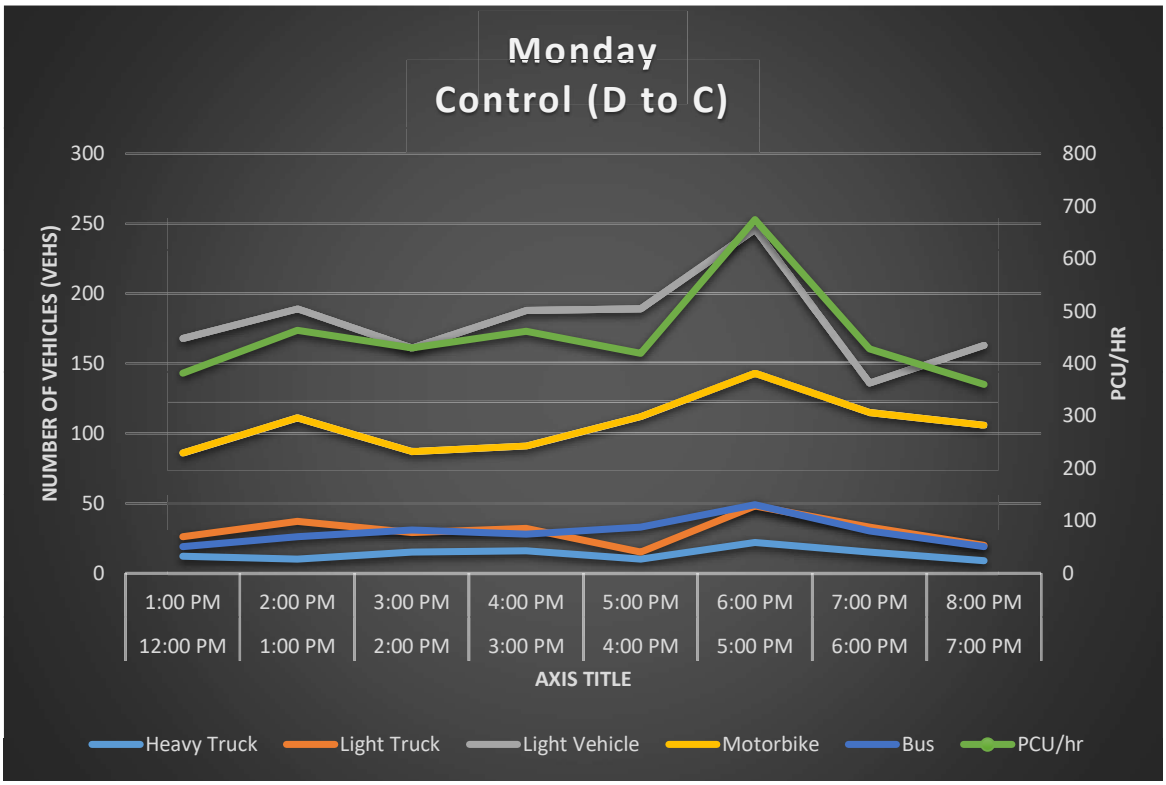

Figure 3 Temporal Distribution of Control (D to C)

Vehicle composition of control on Monday in both directions is shown below:

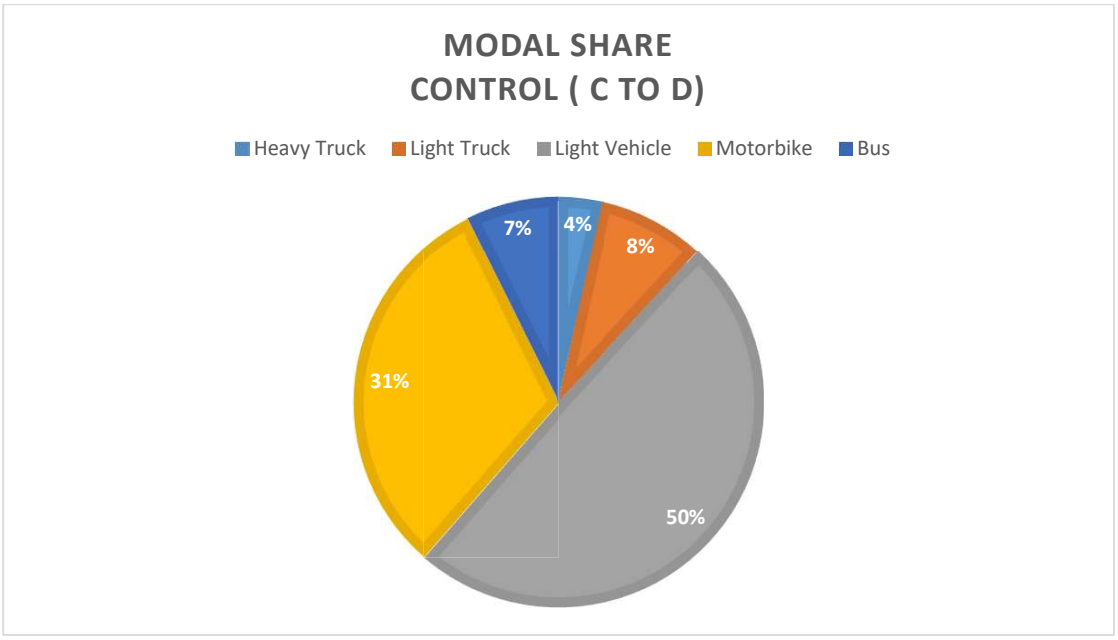

Figure 4 Modal Share of Control (C to D)

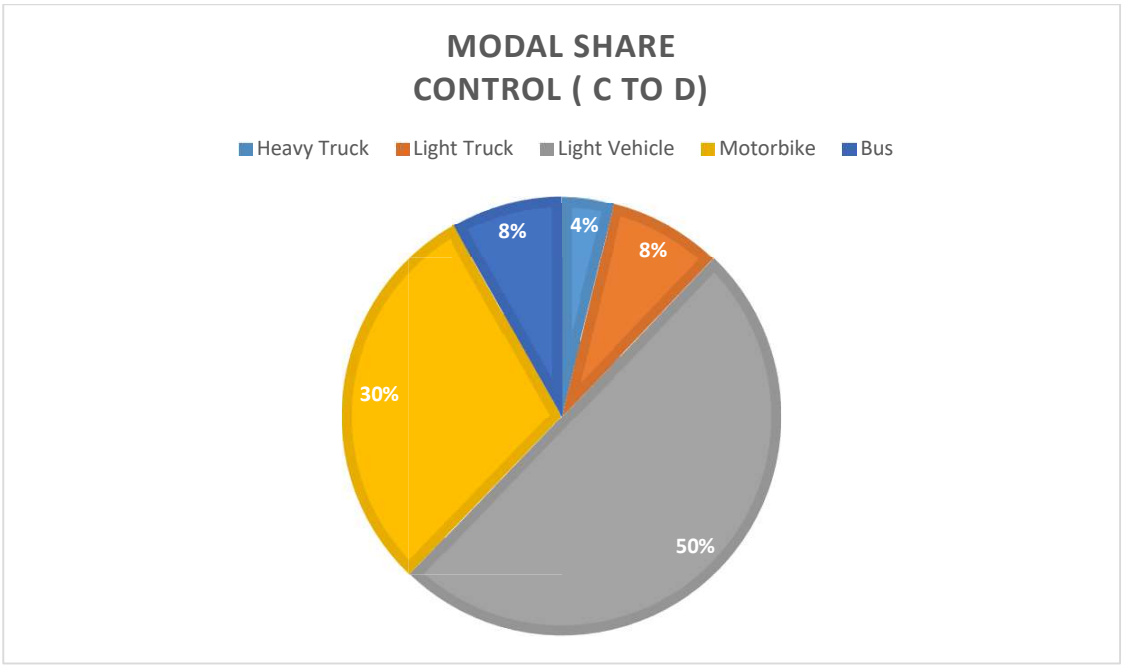

Figure 5 Modal Share of Control (D to C)

The peak hourly factor of a sample day from the 5-day study is shown below:

Peak Hourly Factor (PHF)		
Wednesday		
Direction: C to D		
Time Period		**PHF**
12:00 PM	1:00 PM	0.879
1:00 PM	2:00 PM	0.814
2:00 PM	3:00 PM	0.845
3:00 PM	4:00 PM	0.788
4:00 PM	5:00 PM	0.773
5:00 PM	6:00 PM	0.841
6:00 PM	7:00 PM	0.810
7:00 PM	8:00 PM	0.774

Table 3 Peak Hourly Factor in Wednesday (Control)

The Average Daily Traffic (ADT) and Directional Design Hour Volume (DDHV) of both control and coverages are shown below:

ADT of Control Count							
Day	**Direction**	**Estimated 8 -hours count**	**Estimated Total 8-hours count**	**Estimated Total 24-hours count**	**Adjusted Total 24-hours count**	**Adjusted Total 5-day count**	**Average Daily Traffic (ADT) vehs/day**
Monday	C to D	6650	13540	40620	22341	111557	**22311**
	D to C	6890					
Tuesday	C to D	6713	13785	41355	22745		
	D to C	7072					
Wednesday	C to D	6926	13454	40362	22199		
	D to C	6528					
Thursday	C to D	6624	13563	40689	22379		
	D to C	6939					
Friday	C to D	6586	13268	39804	21892		
	D to C	6682					

Table 4 Average Daily Traffic of Control

Directional Design Hour Volume of Control			
ADT (vehs/day)	**K factor (30th hour, Urban)**	**D factor (Urban)**	**DDHV**
22311	0.105	0.5	**1171**

Table 5 Directional Design Hour Volume

ADT of Coverage Count									
Coverage No.	**Day**	**Direction**	**Estimated 8 -hours count**	**Estimated Total 8-hours count**	**Daily Adjustment Factor**	**Adjusted 8-hours count**	**Estimated Total 24-hours count**	**Adjusted Total 24-hours count**	**Average Daily Traffic (ADT) vehs/day**
1	Monday	A to B	6979	13794	0.999	13776	41327	20663	**20663**
		B to A	6815						
2	Monday	B to D	6578	13090		13073	39218	19609	**19609**
		D to B	6512						
3	Monday	A to C	6657	13362		13344	40033	20016	**20016**
		C to A	6705						
4	Tuesday	C to E	6597	13305	0.98	13051	39153	19577	**19577**
		E to C	6708						
5	Tuesday	D to F	6507	13047		12798	38394	19197	**19197**
		F to D	6540						
6	Wednesday	E to F	6771	13475	1.01	13543	40629	20315	**20315**
		F to E	6704						
7	Wednesday	E to G	6622	13084		13150	39450	19725	**19725**
		G to E	6462						
8	Thursday	F to H	6587	13262	1.00	13222	39666	19833	**19833**
		H to F	6675						
9	Friday	G to H	6829	13786	1.02	14050	42150	21075	**21075**
		H to G	6957						

Table 6 Average Daily Traffic of Coverages

Directional Design Hour Volume of Control				
Coverage No.	**ADT (vehs/day)**	**K factor (30th hour, Urban)**	**D factor (Urban)**	**DDHV**
1	20663	0.105	0.5	**1085**
2	19609			**1029**
3	20016			**1051**
4	19577			**1028**
5	19197			**1008**
6	20315			**1067**
7	19725			**1036**
8	19833			**1041**
9	21075			**1106**

Table 7 Directional Design Hour Volume of Coverages

Based on the Average Daily Traffic (ADT) values of the control and coverage points, a network flow map is generated. The map represents the amount of traffic on a road by the thickness of the road. The greater the thickness of the road, the higher the traffic. The flow map of the study area is attached below:

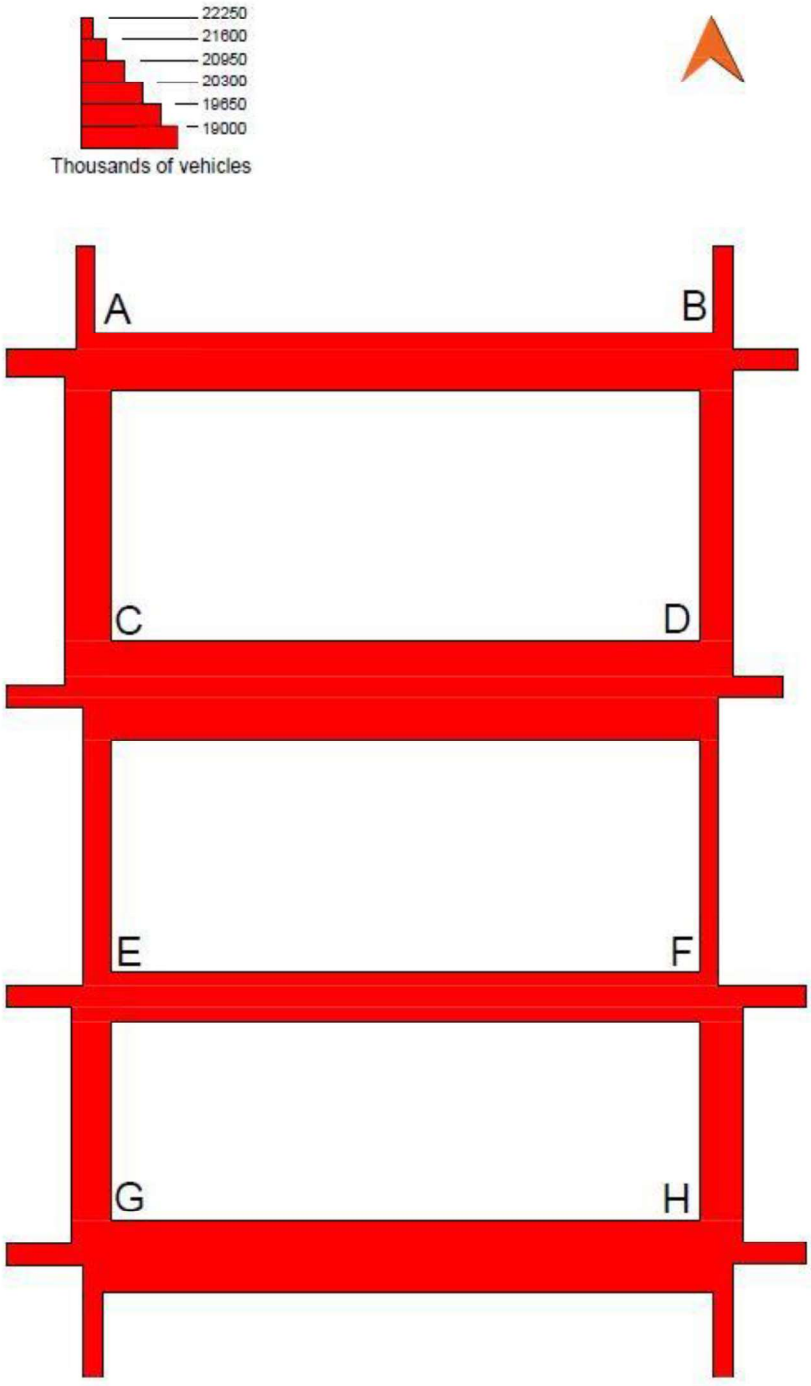

Figure 6 Network Flow Map Based on ADT

For the intersection summary diagram, the intersection C was chosen and the day and time duration were Monday from 4 PM to 5 PM. The graphic presentation of the intersection summary diagram is presented below:

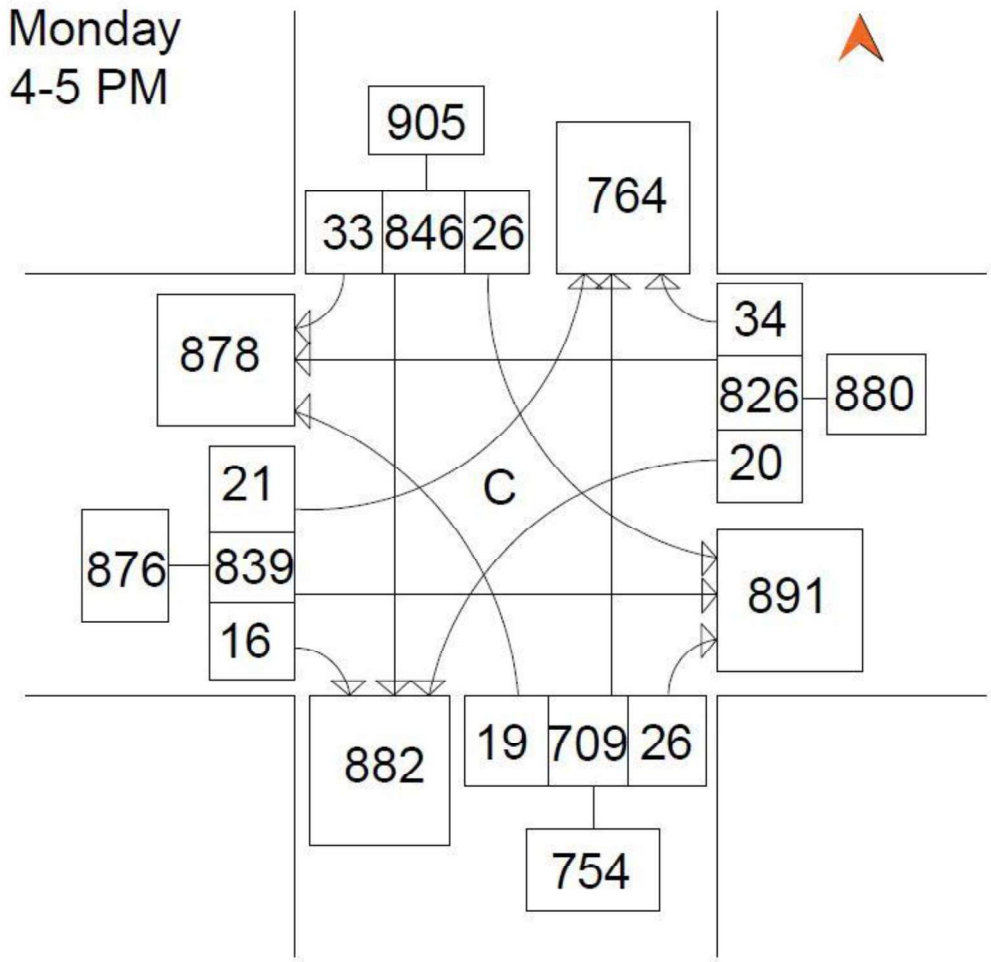

Figure 7 Intersection C Summary Diagram

Budgeting

The budget allocated for the study is in the following table:

Budget Preparation							
8-hour manual count - 10 sites							
#	Item	Unit	Shift	Location	Direction	Unit Cost	Total (BDT)
1	Supervisor	4	1	10	2	2500	200000
2	Surveyor	8	1	10	2	1500	240000
3	Transportation	3	1	10	2	300	18000
4	Printing forms	1	1	1	1	5500	5500
5	Refreshment	12	1	10	2	300	72000
6	Other arrangements	1	1	10	1	800	8000
7	Training + Pilot	1	1	1	1	10500	10500
8	Data entry	1	1	10	2	350	7000
9	Miscellaneous	1	1	1	1	9500	9500
10	Consulting firm's overhead	1	1	1	1	1	570500
11	City VAT + Tax (15% + 10%)						142625
	Total						713125
	After 5% discount						**677469**

Table 8 Budget allocation

Discussion

From the above analysis, it can be seen that the volume mostly peaks during 3-6 PM, which is known as the PM peak. As the survey was conducted from 12-8 PM, no AM peak was found out. The modal share pie charts from the control and coverages show a very high percentage (49-50% of total vehicles) of light vehicles. This is justified since the study area chosen was an urban road surrounded by residential and commercial facilities. There is a low percentage of buses suggesting less use of public transport.

The Directional Design Hour Volume (DDHV) in almost all the coverages and control point show that the approaching and exiting vehicle are roughly the same. Fluctuation of curve mainly occurs during the PM peak, otherwise, there are not any noticeable irregularities. To conclude, the survey shows typical patterns of traffic volume of an urban area.

Appendix

Data collection form used in the survey:

Traffic Volume Count Tally Sheet of Control																			
Direction: C to D																			
Friday																			
Time Period		Lane 1					Lane 2					Actual Count		Expanded Counts (*5/4=1.25)		Estimated Count (vehs)		Estimated Flow Rates (vehs)	
		Heavy Truck	Light Truck	Light Vehicle	Motorbike	Bus	Heavy Truck	Light Truck	Light Vehicle	Motorbike	Bus	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2	Lane 1	Lane 2
12:00 PM	12:05 PM	0	3	9	12	3						27		33.75		34	42	272	336
12:05 PM	12:10 PM						2	0	16	9	2		29		36.25	34	37	272	296
12:10 PM	12:15 PM	1	3	15	5	3						27		33.75		34	36	272	288
12:15 PM	12:20 PM						1	3	14	9	1		28		35	30	35	240	280
12:20 PM	12:25 PM	2	1	9	8	1						21		26.25		26	35	208	280
12:25 PM	12:30 PM						2	2	13	7	3		27		33.75	31	34	248	272
12:30 PM	12:35 PM	0	0	14	11	4						29		36.25		36	27	288	216
12:35 PM	12:40 PM						0	2	7	5	2		16		20	43	20	344	160
12:40 PM	12:45 PM	2	4	18	13	2						39		48.75		49	28	392	224
12:45 PM	12:50 PM						0	4	17	4	3		28		35	44	35	352	280
12:50 PM	12:55 PM	0	0	15	14	2						31		38.75		39	34	312	272
12:55 PM	1:00 PM						2	2	7	12	2		25		31.25	43	32	344	256
1:00 PM	1:05 PM	2	2	19	14	0						37		46.25		46	38	368	304
1:05 PM	1:10 PM						0	1	21	11	1		34		42.5	41	43	328	344
1:10 PM	1:15 PM	2	2	11	12	2						29		36.25		36	36	288	288
1:15 PM	1:20 PM						0	2	7	10	4		23		28.75	38	29	304	232
1:20 PM	1:25 PM	0	4	14	12	1						31		38.75		39	35	312	280
1:25 PM	1:30 PM						1	1	19	10	1		32		40	33	40	264	320
1:30 PM	1:35 PM	2	0	8	8	3						21		26.25		26	32	208	256
1:35 PM	1:40 PM						2	5	6	3	3		19		23.75	34	24	272	192
1:40 PM	1:45 PM	2	1	20	8	2						33		41.25		41	28	328	224
1:45 PM	1:50 PM						2	5	5	10	3		25		31.25	44	32	352	256
1:50 PM	1:55 PM	0	4	17	12	4						37		46.25		46	35	368	280
1:55 PM	2:00 PM						1	2	21	3	2		29		36.25	30	37	240	296
2:00 PM	2:05 PM	0	0	6	5	0						11		13.75		14	38	112	304
2:05 PM	2:10 PM						1	1	17	9	2		30		37.5	24	38	192	304
2:10 PM	2:15 PM	2	2	13	9	0						26		32.5		33	34	264	272
2:15 PM	2:20 PM						1	4	11	6	2		24		30	32	30	256	240
2:20 PM	2:25 PM	0	0	19	6	0						25		31.25		31	26	248	208
2:25 PM	2:30 PM						0	0	5	8	4		17		21.25	36	22	288	176
2:30 PM	2:35 PM	0	0	22	8	2						32		40		40	26	320	208
2:35 PM	2:40 PM						0	1	11	9	3		24		30	40	30	320	240
2:40 PM	2:45 PM	1	1	20	8	1						31		38.75		39	31	312	248
2:45 PM	2:50 PM						0	3	18	3	1		25		31.25	43	32	344	256
2:50 PM	2:55 PM	1	0	22	11	3						37		46.25		46	36	368	288
2:55 PM	3:00 PM						2	4	11	12	3		32		40	40	40	320	320
3:00 PM	3:05 PM	0	1	21	5	0						27		33.75		34	35	272	280
3:05 PM	3:10 PM						1	3	11	4	4		23		28.75	35	29	280	232
3:10 PM	3:15 PM	0	2	17	8	1						28		35		35	29	280	232
3:15 PM	3:20 PM						2	2	9	5	4		22		27.5	33	28	264	224
3:20 PM	3:25 PM	0	0	12	11	1						24		30		30	36	240	288
3:25 PM	3:30 PM						0	1	21	9	4		35		43.75	30	44	240	352
3:30 PM	3:35 PM	0	4	12	5	2						23		28.75		29	36	232	288
3:35 PM	3:40 PM						1	1	13	4	2		21		26.25	24	27	192	216
3:40 PM	3:45 PM	1	1	7	4	2						15		18.75		19	33	152	264
3:45 PM	3:50 PM						2	4	16	7	1		30		37.5	28	38	224	304
3:50 PM	3:55 PM	1	2	9	15	2						29		36.25		36	39	288	312
3:55 PM	4:00 PM						1	0	21	7	3		32		40	41	40	328	320
4:00 PM	4:05 PM	2	4	20	11	0						37		46.25		46	45	368	360
4:05 PM	4:10 PM						2	2	22	11	3		40		50	43	50	344	400
4:10 PM	4:15 PM	1	1	14	12	4						32		40		40	40	320	320
4:15 PM	4:20 PM						1	3	8	7	4		23		28.75	37	29	296	232
4:20 PM	4:25 PM	1	4	6	14	1					3	26		32.5		33	28	264	224
4:25 PM	4:30 PM						0	5	10	5	1		21		26.25	34	27	272	216
4:30 PM	4:35 PM	1	3	15	5	3						27		33.75		34	38	272	304
4:35 PM	4:40 PM						0	5	22	11	1		39		48.75	32	49	256	392
4:40 PM	4:45 PM	0	0	7	13	3						23		28.75		29	44	232	352
4:45 PM	4:50 PM						2	0	17	7	4		30		37.5	30	38	240	304
4:50 PM	4:55 PM	0	4	9	8	3						24		30		30	32	240	256
4:55 PM	5:00 PM						0	4	5	8	3		20		25	33	25	264	200
5:00 PM	5:05 PM	1	2	18	7	0						28		35		35	24	280	192
5:05 PM	5:10 PM						0	4	7	4	2		17		21.25	35	22	280	176
5:10 PM	5:15 PM	0	1	20	6	0						27		33.75		34	27	272	216
5:15 PM	5:20 PM						1	4	14	4	2		25		31.25	36	32	288	256
5:20 PM	5:25 PM	1	4	14	10	1						30		37.5		38	35	304	280
5:25 PM	5:30 PM						2	2	15	7	3		29		36.25	31	37	248	296
5:30 PM	5:35 PM	2	2	10	4	0						18		22.5		23	39	184	312
5:35 PM	5:40 PM						2	0	17	12	1		32		40	24	40	192	320
5:40 PM	5:45 PM	2	2	8	5	2						19		23.75		24	35	192	280
5:45 PM	5:50 PM						2	5	5	9	2		23		28.75	29	29	232	232
5:50 PM	5:55 PM	1	0	21	4	1						27		33.75		34	31	272	248
5:55 PM	6:00 PM						0	3	15	6	2		26		32.5	37	33	296	264
6:00 PM	6:05 PM	1	4	17	9	0						31		38.75		39	33	312	264
6:05 PM	6:10 PM						1	1	19	3	2		26		32.5	43	33	344	264
6:10 PM	6:15 PM	2	4	14	15	2						37		46.25		46	31	368	248
6:15 PM	6:20 PM						2	0	11	9	1		23		28.75	40	29	320	232
6:20 PM	6:25 PM	2	1	9	13	2						27		33.75		34	37	272	296
6:25 PM	6:30 PM						1	2	21	9	3		36		45	32	45	256	360
6:30 PM	6:35 PM	0	3	14	6	0						23		28.75		29	34	232	272
6:35 PM	6:40 PM						0	0	10	6	1		17		21.25	32	22	256	176
6:40 PM	6:45 PM	1	3	10	12	2						28		35		35	23	280	184
6:45 PM	6:50 PM						1	0	5	11	1		18		22.5	40	23	320	184
6:50 PM	6:55 PM	0	3	16	13	3						35		43.75		44	33	352	264
6:55 PM	7:00 PM						0	1	18	12	3		34		42.5	39	43	312	344
7:00 PM	7:05 PM	2	1	10	13	1						27		33.75		34	36	272	288
7:05 PM	7:10 PM						2	5	10	4	2		23		28.75	30	29	240	232
7:10 PM	7:15 PM	1	0	8	7	4						20		25		25	36	200	288
7:15 PM	7:20 PM						1	3	15	11	3		33		41.25	34	42	272	336
7:20 PM	7:25 PM	1	2	15	14	2						34		42.5		43	34	344	272
7:25 PM	7:30 PM						0	3	5	9	3		20		25	36	25	288	200
7:30 PM	7:35 PM	0	0	9	13	1						23		28.75		29	26	232	208
7:35 PM	7:40 PM						2	1	6	11	1		21		26.25	34	27	272	216
7:40 PM	7:45 PM	1	0	18	12	0						31		38.75		39	36	312	288
7:45 PM	7:50 PM						1	4	19	10	1		35		43.75	39	44	312	352
7:50 PM	7:55 PM	1	3	14	10	3						31		38.75		39	38	312	304
7:55 PM	8:00 PM						2	2	14	5	2		25		31.25	40	32	320	256
Total												1335	1266	1668.75	1582.5	3365	3221	26920	25768
% in Lane												51.3	48.7	51.3	48.7	51.1	48.9	51.1	48.9