

Synchronization of Traffic Signal System:- A Case Study of Godh -Dod Road, Surat

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Abstract:- Nowadays because of mixed flow of traffic, congestion has become a major problem at intersections because of conflicting streams in big cities. For traffic congestion at intersection, somewhere one reason is because of improper traffic signal design at different intersections. So, for smooth operation or friction-less movement of vehicles at an intersection it is necessary to resolve this traffic congestion by providing proper coordinated traffic signal systems. Traffic congestion at intersections results in delay and causes halt of vehicles at different junctions, which increase frustration & stress on driver. Because of delay in traffic clearance at intersection leads to more fuel consumption & also create unhealthy environment. Proper coordination between traffic signal at intersection helps in reducing the travelling time i.e. delay time is reduced, reduces fuel consumption and pollution & which can help to improve mental health of communities. For the study of traffic congestion, the area selected is Majura-gate to Parle Point road. Selected intersection is busiest junction especially in peak hours. After the study of this area, proposal for coordinated signal systems throughout the route will be provided. This will minimize the delay time & will provide flawless & friction-less traffic signal at intersection for easy & smooth functioning.

Key Words:- Synchronization, Traffic, Signal, Delay time Intersection, Pollution.

1. INTRODUCTION Urbanization is taking place rapidly in our country. This urbanization is because of rapid industrial growth which brings employment and therefore there is migration from rural to urban. With this transportation from one place to another of goods, travelling, etc. increases. Urbanization also leads in increase population and high standard of living, so number of personal vehicles also increases. So for better transportation, better roads are provide and this leads to numbers of road intersection in urban city. Therefore in many areas of urban cities intersection has a problem of traffic congestion. This causes delay and so it becomes necessary to monitor the delay at urban roads. Also there is conflicting traffic movement at intersection. So to overcome this problem and for smooth and unhindered flow coordinated signaling system is provided, but if this provided signal system is not properly coordinated than the delay time increases i.e. it causes problems such as congestion and unhealthy environment. Therefore it is necessary to provide proper coordinated or synchronized signal system. It helps in reducing delay time and creates unhindered path for the traffic to flow. It reduces fuel consumption, pollution, health problem, etc.

Study Area :- For study the route selected is from Majura-gate to Parle Point through Ghod-dod road. We have selected this route because ghod-dod road is such a link which connects Parle point and turning point and also has high standard of living. Reasons of using this road link is because many commercial building are situated on the road such as a school named Saint Xavier's, Abhinandan market, Agrawal samaj bhavan, Ram chawk Temple, many jewelry showrooms, many banks, Malls and Residencies and in nearby areas there is Indoor stadium, Convent school, Narmad Library, jogger's park, etc. Because of this it is a busiest route especially during peak hours. Mainly three junctions are selected for which coordinated signal system is required they are:

1. Majura Fire-Station
2. Ram Chawk
3. Narmad Library or Union Park



Fig :-1Route of study area from Majura-gate to Parle point

Objectives of Study-

- To study current scenario of traffic volume from Majura-gate to parlepoin.
- To study the parameters causing traffic congestion.
- To study traffic volume, traffic composition and turning movements of vehicles at the junctions.
- To study the existing traffic signal system and its significance.
- To design coordinated traffic signal system for the study area.

Data Collection:- Field study is an important aspect of any planning process as it helps in knowing the present scenario of the site. Similarly to analyze the present or current scenario of the traffic and its characteristics traffic studies or surveys are conducted. These surveys or studies helps in deciding the features of geometric design of road and for safe and efficient traffic movements. Simple field studies are fast and easy to conduct. For any planning process preparation of database is a pre requisite step and it is carried out through inventory studies, field studies and personal interview etc. Then after the collection of data regarding the past and existing socio-economic, traffic and travel characteristics is to be carried out. This is a major activity in the whole planning process and requires a lot of time resources and efforts. An accuracy of the database decides the reliability of the problem assessment and formulation of policy and plans for future. Therefore proper data collection is very important. The collected, processed, arranged and interpreted data should be free from any bias. The different types of traffic surveys which are generally carried out are as follows:

Traffic Volume Study

Traffic volume means the number of vehicles crossing a section of road per unit time at any selected period. Traffic volume is used as a quantity which measures the traffic flow and its commonly used units are vehicles per day and vehicles per hour. A complete traffic volume study may include the classified volume study by recording the volume of various types and classes of traffic, the distribution by direction and turning movements and the distribution on different lanes per unit time. The objects and uses of traffic volume studies are given below:

- Traffic volume usually given the idea of relative importance of roads and it helps in deciding the priority for expansion and improvement of the existing roads.
- Traffic volume study is useful in planning the traffic control and operation of the existing roads and also for planning and designing new roads.
- This study can be used for the analysis of traffic pattern trends.
- Classified volume studies are useful for the structural and geometric designs of the pavement and computing road user's capacity.
- Turning movement studies are used in the design of intersections, planning of signal timings, channelization and other controls etc.

- Pedestrian volume study is used for planning cross walks and side-walks for pedestrians.
- Volume distribution study is used for regulatory measures.

This traffic count can be done either by manually or by means of mechanical device.

The methods of Volume counting are as follows:

- Manual Counts
- Automatic counters
- Moving Car Method

Manual Counts

In this counting are done manually by means of group of member's record the counts on sheets. By this method it is possible to obtain data which cannot be obtained by mechanical counters, such as vehicle classification, turning movements and direction of movements and count where loading conditions or number of occupants are required. In this method however it is not possible to have manual counts for all the 24 hours of the day and on all days of year, still it is the most reliable and best method to obtain classified and directional volume for short counts.

In this method it is necessary to resort to statistical sampling techniques to cut down the manual hours involved in taking complete counts. By selecting typical short counts periods, the traffic volume as well as the average daily traffic volumes are calculated. This method is very commonly adopted due to its specific advantages over other methods.

Automatic counter

The counters may be either fixed or portable type. These counters automatically record the total number of vehicles crossing a section of the road in a desired period. The working may be caused by the effect of impulses caused by the traffic movements on a pneumatic hose placed across the roadway or by using any other type of sensor.

In the electrical recorder the count is actuated by the closing of an electric by the passage of a vehicle. The photocell recorder and the automatic recorder is actuated by the interruption of a light beam falling on the road side as the vehicle passes.

In the case of pneumatic method, the counter is actuated by air switch attached to a flexible hose stretched across the road over which the vehicle passes

Data Analysis:- The data collected is then analyzed and the vehicular count is converted into the PCU counts. This conversion of vehicular count into PCU counts is done with the help of handbook from IRC that is IRC SP 41. The collected data is kept in tabular form as shown below. This collected data shows the counts at the different intersection and from different approaches towards the intersection. Survey was done at the peak hours for four days of a week which includes weekends that is Saturday and Sunday and starting of the week that is Monday and Tuesday.

5.11 Traffic Volume Survey (PCU Counts)

Traffic Volume Survey Conducted on Monday during morning peak hour (10:00 to 11:00)

	Intersection	From	Towards/ Turn	Vehicles						Total	PCU Count	
				2 Wheelers	4 Wheelers	Rickshaw	Bicycle	Bus	Other			
1	NARMAD LIBRARY	Narmad Library	Left	95	85	15	3	0	1	199	152	
			Straight	230	159	62	0	0	0	451	336	
			Right	127	53	19	1	0	0	200	136	
		Majura		Left	144	101	58	11	0	1	315	240
				Straight	680	288	290	0	10	0	1268	948
				Right	110	56	40	2	0	5	213	167
		Jogars Park		Left	55	20	19	4	0	0	98	69
				Straight	318	134	42	0	1	0	495	338
				Right	422	306	42	3	0	0	773	561
		Parle Point		Left	37	19	19	0	0	1	76	60
				Straight	793	297	278	0	0	0	1368	972
				Right	88	87	54	8	4	0	241	201
2	Ram Chawk	Bhatar	Left	235	132	74	17	0	2	460	338	
			Right	544	302	154	29	0	4	1033	755	
		Parle Point	Straight	938	496	389	27	2	0	1852	1374	

			Right	39	32	26	8	0	1	106	85
		Majura	Left	295	249	97	4	0	0	645	496
			Straight	488	403	159	14	1	0	1065	816
3	Parle Point	Ghod-Dod	Parle Point	665	298	289	29	0	5	1286	949
		Parle Point	Ghod-Dod	1120	632	367	49	2	0	2170	1590
4	Turning Point Circle	Majura	Ghod-Dod	2256	1123	598	134	0	0	4111	2916
			Bhattar	Bhattar	834	289	320	67	0	0	1510
		Bhattar	Majura	698	156	256	24	1	4	1139	788
		Bhattar	Ghod-Dod	267	74	78	4	0	0	423	288
		Ghod-Dod	Majura	1820	435	507	65	0	0	2827	1885
		RamChawk	Turning All	1568	1206	355	57	0	0	3186	2374

Traffic Volume Survey Conducted on Monday during morning peak hour

Traffic Volume Survey Conducted on Tuesday during morning peak hour (10:00 to 11:00)

	Intersection	From	Towards/ Turn	Vehicles						Total	PCU Count
				2 Wheelers	4 Wheelers	Rickshaw	Bicycle	Bus	Other		
1	NARMAD LIBRARY	Narmad Library	Left	123	163	30	9	3	2	330	274

			Straight	302	196	96	1	0	0	595	444
			Right	164	85	27	5	1	0	282	200
		Majura	Left	201	155	62	15	0	2	435	331
			Straight	745	345	315	6	8	0	1419	1060
			Right	125	85	47	2	0	4	263	208
		Jogars Park	Left	74	39	14	10	0	1	138	98
			Straight	395	156	92	6	0	1	650	452
			Right	526	345	74	0	1	0	946	685
		Parle Point	Left	78	29	21	3	0	2	133	97
			Straight	905	276	198	4	0	0	1383	929
			Right	96	92	43	2	2	1	236	193
2	Ram Chawk	Bhatar	Left	303	169	89	14	0	1	576	420
			Right	622	374	112	32	0	6	1146	831
		Parle Point	Straight	1125	497	379	41	5	2	2049	1480
			Right	63	52	13	10	0	1	139	105
		Majura	Left	356	284	102	6	0	4	752	579

			Straight	555	399	176	13	0	0	1143	859
3	Parle Point	Ghod-Dod	Parle Point	825	349	279	39	0	3	1495	1069
		Parle Point	Ghod-Dod	1325	652	411	55	3	1	2447	1765
4	Turning Point Circle	Majura	Ghod-Dod	2456	1102	602	109	0	3	4272	2996
		Majura	Bhattar	899	294	387	76	0	0	1656	1169
		Bhattar	Majura	802	174	229	22	0	6	1233	833
		Bhattar	Ghod-Dod	345	98	58	7	0	2	510	338
		Ghod-Dod	Majura	1896	402	498	79	0	1	2876	1891
		RamChawk	Turning All	1763	1452	348	94	0	0	3657	2729

Traffic Volume Survey Conducted on Tuesday during morning peak hour

Traffic Volume Survey Conducted on Saturday during morning peak hour (10:00 to 11:00)

	Intersection	From	Towards/ Turn	Vehicles						Total	PCU Count
				2 Wheelers	4 Wheelers	Rickshaw	Bicycle	Bus	Other		
1	NARMAD LIBRARY	Narmad Library	Left	245	225	105	9	1	4	589	472
			Straight	452	178	114	3	0	0	747	520
			Right	241	96	75	0	0	1	413	295
		Majura	Left	398	195	85	9	0	2	689	490
			Straight	825	452	498	3	7	2	1787	1391
			Right	206	78	222	1	0	0	507	404
		Jogars Park	Left	105	65	19	4	1	2	196	148
			Straight	464	301	105	2	0	5	877	654
			Right	698	436	112	2	1	1	1250	904
		Parle Point	Left	46	36	45	6	0	2	135	113
Straight	1145		512	384	1	0	1	2043	1472		
Right	178		123	67	7	3	2	380	298		
2	Ram Chawk	Bhatar	Left	426	335	148	20	0	2	931	712
			Right	756	456	308	59	1	1	1581	1178
		Parle Point	Straight	1356	712	436	45	2	1	2552	1858
			Right	65	95	56	21	1	0	238	197
		Majura	Left	405	398	124	3	0	5	935	741

			Straight	669	604	396	31	2	2	1704	1362
3	Parle Point	Ghod-Dod	Parle Point	958	445	421	49	0	1	1874	1373
			Parle Point	1245	728	559	76	1	1	2610	1954
4	Turning Point Circle	Majura	Ghod-Dod	2698	1356	762	158	0	5	4979	3561
			Raj Empire	1285	454	456	94	1	1	2291	1606
		Bhattar	Majura	996	252	281	65	0	5	1599	1079
		Bhattar	Ghod-Dod	502	175	127	4	0	2	810	561
		Ghod-Dod	Majura	2254	742	856	96	2	3	3953	2788
RamChawk	Turning All	1965	1658	589	95	0	1	4308	3280		

Traffic Volume Survey Conducted on Saturday during morning peak hour

Traffic Volume Survey Conducted on Sunday during morning peak hour (10:00 to 11:00)

	Intersection	From	Towards/ Turn	Vehicles						Total	PCU Count
				2 Wheelers	4 Wheelers	Rickshaw	Bicycle	Bus	Other		
1	NARMAD LIBRARY	Narmad Library	Left	178	124	156	11	4	5	478	402
			Straight	525	324	145	2	0	2	998	739
			Right	325	122	85	8	1	2	543	383

		Majura	Left	356	287	96	28	1	2	770	584
			Straight	1022	524	345	9	7	5	1912	1421
			Right	201	102	98	1	0	3	405	310
		Jogars Park	Left	96	85	35	11	1	2	230	183
			Straight	725	324	145	6	0	4	1204	847
			Right	795	654	102	2	0	1	1554	1158
		Parle Point	Left	129	52	51	3	1	1	237	175
			Straight	1256	478	304	4	0	0	2042	1412
			Right	97	212	59	2	2	5	377	342
2	Ram Chawk	Bhatar	Left	558	254	154	29	0	1	996	705
			Right	956	654	209	46	0	5	1870	1379
		Parle Point	Straight	1598	814	675	58	1	2	3148	2326
			Right	94	56	29	25	0	2	206	151
		Majura	Left	578	425	196	9	0	3	1211	924

			Straight	758	572	282	26	0	1	1639	1249
3	Parle Point	Ghod-Dod	Parle Point	852	504	451	49	0	3	1859	1415
		Parle Point	Ghod-Dod	1765	843	589	76	3	5	3281	2377
4	Turning Point Circle	Majura	Ghod-Dod	2997	1478	786	196	0	4	5461	3873
		Majura	Bhatar	1345	268	389	75	0	0	2077	1367
		Bhatar	Majura	1070	284	395	29	1	5	1784	1247
		Bhatar	Ghod-Dod	412	114	98	14	0	4	642	437
		Ghod-Dod	Majura	2487	465	690	95	0	3	3740	2455
		RamChawk	Turning All	2145	1956	584	172	0	2	4859	3705

Traffic Volume Survey Conducted on Sunday during morning peak hour

Traffic Volume Survey Conducted on Monday during evening peak hour (6:30 to 7:30)											
	Intersection	From	Towards/ Turn	Vehicles						Total	PCU Count
				2 Wheeler	4 Wheeler	Rickshaw	Bicycle	Bus	Other		
1	NARMAD LIBRARY	Narmad Library	Left	86	74	12	2	0	0	174	130
			Straight	236	150	52	0	0	0	438	320
			Right	112	46	16	0	0	0	174	118
		Majura	Left	150	90	44	8	0	0	292	213
			Straight	668	262	250	0	8	0	1188	870
			Right	116	42	30	0	0	4	192	142
		Jogars Park	Left	50	18	14	4	0	0	86	59
			Straight	306	122	40	0	0	0	468	315
			Right	430	288	42	2	0	0	762	546
		Parle Point	Left	32	18	14	0	0	0	64	48

			Straight	818	258	242	0	0	0	1318	909
			Right	74	66	34	6	2	0	182	146
2	Ram Chawk	Bhatar	Left	238	102	68	14	0	2	424	302
			Right	534	270	108	24	0	4	940	669
		Parle Point	Straight	934	444	352	22	2	0	1754	1280
			Right	32	22	12	6	0	0	72	53
		Majura	Left	282	222	80	4	0	0	588	445

			Straight	470	378	148	12	0	0	1008	767
3	Parle Point	Ghod-Dod	Parle Point	700	262	246	26	0	4	1238	883
		Parle Point	Ghod-Dod	1126	590	328	46	2	0	2092	1510
4	Turning Point Circle	Majura	Ghod-Dod	2184	1034	514	98	0	0	3830	2689
		Majura	Bhattar	808	248	284	52	0	0	1392	962
		Bhattar	Majura	674	130	204	20	0	4	1032	693
		Bhattar	Ghod-Dod	222	68	64	2	0	0	356	244
		Ghod-Dod	Majura	1760	388	468	48	0	0	2664	1760
		RamChawk	Turning All	1508	1132	306	44	0	0	2990	2214

Traffic Volume Survey Conducted on Monday during evening peak hour
Traffic Volume Survey Conducted on Tuesday during evening peak hour (6:30 to 7:30)

	Intersection	From	Towards/Turn	Vehicles							PCU Count
				2 Wheelers	4 Wheelers	Rickshaw	Bicycle	Bus	Other	Total	
1	NARMAD LIBRARY	Narmad Library	Left	99	63	25	6	2	1	196	150
			Straight	286	176	73	1	0	0	536	393
			Right	155	67	20	3	1	0	246	169
		Majura	Left	168	107	55	12	0	2	344	258
			Straight	723	306	270	6	7	0	1312	962
			Right	109	59	42	1	0	3	214	165
		Jogars Park	Left	62	32	11	9	0	1	115	82
			Straight	366	148	70	6	0	1	591	407
			Right	479	307	62	0	0	0	848	609
		Parle Point	Left	60	26	18	3	0	1	108	79
			Straight	856	223	198	2	0	0	1279	850
			Right	77	79	33	2	2	1	194	161
2	Ram Chawk	Bhatar	Left	293	134	83	16	0	1	527	375
			Right	588	303	110	30	0	5	1036	737

		Parle Point	Straight	1024	466	370	36	3	2	1901	1381
			Right	42	30	13	11	0	1	97	73
		Majura	Left	322	258	93	5	0	3	681	524

			Straight	506	367	169	13	0	0	1055	796
3	Parle Point	Ghod-Dod	Parle Point	765	299	268	33	0	3	1368	975
		Parle Point	Ghod-Dod	1228	635	383	43	3	1	2293	1666
4	Turning Point Circle	Majura	Ghod-Dod	2345	986	566	109	0	3	4009	2788
		Majura	Bhattar	861	244	333	63	0	0	1501	1039
		Bhattar	Majura	712	140	223	18	0	5	1098	743
		Bhattar	Ghod-Dod	286	77	55	6	0	2	426	284
		Ghod-Dod	Majura	1826	383	477	65	0	1	2752	1809
		RamChawk	Turning All	1705	1352	346	94	0	0	3497	2598

Traffic Volume Survey Conducted on Tuesday during evening peak hour

Traffic Volume Survey Conducted on Saturday during evening peak hour (6:30 to 7:30)

	Intersection	From	Towards/ Turn	Vehicles						PCU Count	
				2 Wheelers	4 Wheelers	Rickshaw	Bicycle	Bus	Other		
1	NARMAD LIBRARY	Narmad Library	Left	206	199	86	6	0	2	499	397
			Straight	423	169	102	3	0	0	697	484
			Right	213	79	62	1	0	1	356	251
		Majura	Left	355	167	65	9	0	1	597	417
			Straight	799	396	425	1	6	2	1629	1245
			Right	206	65	157	1	0	0	429	326
		Jogars Park	Left	96	62	16	5	0	2	181	135
			Straight	413	257	95	2	0	3	770	569
			Right	672	436	106	1	0	1	1216	882
		Parle Point	Left	39	25	29	4	0	1	98	79
Straight	1044		427	336	1	0	1	1809	1289		
Right	149		99	57	6	2	2	315	246		
2	Ram Chawk	Bhatar	Left	389	299	132	16	0	1	837	637
			Right	721	405	266	52	0	1	1445	1061
		Parle Point	Straight	1265	629	436	36	2	1	2369	1725
			Right	54	65	36	17	0	0	172	137
		Majura	Left	385	362	109	3	0	3	862	674
			Straight	591	562	364	27	0	2	1546	1241
3	Parle Point	Ghod-Dod	Parle Point	897	426	351	43	0	2	1719	1253
			Ghod-Dod	1126	728	542	69	1	1	2467	1874
4	Turning Point	Majura	Ghod-Dod	2595	1265	740	135	0	3	4738	3379

	Circle										
		Majura	Raj Empire	1201	389	420	65	0	1	2076	1445
		Bhattar	Majura	967	209	268	32	0	4	1480	989
		Bhattar	Ghod-Dod	459	165	96	4	0	2	726	499
		Ghod-Dod	Majura	2195	687	859	87	0	3	3831	2696
		RamChaw k	Turning All	1892	1542	541	84	0	1	4060	3074

Traffic Volume Survey Conducted on Saturday during evening peak hour

Traffic Volume Survey Conducted on Sunday during evening peak hour (6:30 to 7:30)

	Intersection	From	Towards/ Turn	Vehicles						PCUCount		
				2 Wheelers	4 Wheelers	Rickshaw	Bicycle	Bus	Other			
1	NARMAD LIBRARY	Narmad Library	Left	159	89	42	9	2	3	304	230	
			Straight	468	285	106	1	0	2	862	632	
			Right	286	97	43	6	1	1	434	292	
			Majura	Left	301	203	87	24	0	2	617	459
				Straight	989	486	364	8	7	2	1856	1376
				Right	201	86	79	1	0	3	370	275
		Jogars Park	Left	85	46	25	9	0	2	167	124	
			Straight	684	265	101	6	0	2	1058	717	
			Right	756	568	95	1	0	1	1421	1045	
		Parle Point	Left	101	34	26	3	0	1	165	115	
			Straight	1185	365	289	2	0	0	1841	1248	
			Right	97	102	49	2	2	1	253	210	
2	Ram Chaw k	Bhatar	Left	546	198	120	26	0	1	891	607	
			Right	897	543	185	46	0	5	1676	1215	
		Parle Point	Straight	1432	721	625	45	3	2	2828	2100	
			Right	56	42	24	20	0	1	143	107	
		Majura	Left	532	425	165	8	0	3	1133	869	

			Straight	702	512	251	21	0	1	1487	1128
3	Parle Point	Ghod-Dod	Parle Point	835	465	387	45	0	3	1735	1301
			Parle Point	Ghod-Dod	1645	843	525	65	3	2	3083
4	Turning Point Circle	Majura	Ghod-Dod	2895	1349	768	164	0	3	5179	3656
			Majura	Bhattar	1245	244	333	63	0	0	1885
		Bhattar	Majura	958	201	342	21	0	5	1527	1048
		Bhattar	Ghod-Dod	348	83	74	12	0	2	519	343
		Ghod-Dod	Majura	2312	465	598	87	0	3	3465	2272
		RamChaw k	Turning All	2116	1825	467	152	0	2	4562	3432

Traffic Volume Survey Conducted on Sunday during evening peak hour

Vehicle Composition:- Narmad Library Circle or Union Park Circle

NARMAD LIBRARY	Two Wheelers	Four Wheelers	Rickshaw	Bicycle	Bus	Other	Total
Total	3099	1605	938	32	15	8	5697
Percentage	54.39	28.17	16.46	0.56	0.26	0.14	

Ram chowk :-

Ram Chawk	Two Wheelers	Four Wheelers	Rickshaw	Bicycle	Bus	Other	Total
Total	2539	1614	899	99	3	7	5161
Percentage	49.19	31.27	17.41	1.91	0.0	0.13	

Turning Point Circle:-

Turning Point Circle	Two Wheelers	Four Wheelers	Rickshaw	Bicycle	Bus	Other	Total
Total	12779	5018	4198	660	13	5	22673
Percentage	56.36	22.13	18.51	2.91	0.05	0.02	

Narmad Library Circle or Union Park Circle

Narmad Library	Two Wheeler	Four Wheeler	Rickshaw	Bicycle	Bus	Other	Total
Total	3078	1434	790	22	10	4	5338
Percentage	57.66	26.86	14.79	0.41	0.18	0.07	

Turning Movements:-Narmad Library Circle or Union Park Circle

			Hourly Volume
NARMAD	Narmad	Left	152
		Straight	336
		Right	136
	Majura	Left	240
		Straight	948
		Right	167
	Jogars Park	Left	69
		Straight	338
		Right	561
	Parle Point	Left	60
		Straight	972
		Right	201

Ram chowk:-

			Hourly Volume
Ram Chawk	Bhatar	Left	338
		Right	755
	Parle Point	Straight	1374
		Right	85
	Majura	Left	496
		Straight	816

Parle Point :-

			Hourly Volume
Parle Point	Ghod-Dod	Parle Point	949
	Parle Point	Ghod-Dod	1590

Turning point circle:-

			Hourly Volume
Turning Point Circle	Majura	Ghod-Dod	2916
	Majura	Bhattar	1060
	Bhattar	Majura	788
	Bhattar	Ghod-Dod	288
	Ghod-Dod	Majura	1885
	RamChawk	Turning All	2374

Webster’s Approach/Model

To design a signal system firstly we have to calculate its cycle length on basis of its demand (as per the vehicular/PCU counts). For higher number of counts cycle length is different than the lesser number of counts at each intersection. Thus intersection having higher demand can be said as critical intersection. For these critical intersections optimum cycle length is calculated. This optimum cycle length helps in designing the signal system at particular intersection. This higher demand may also be at other intersection which is nearer to the intersection which may also have higher demand. Therefore there may be more number of critical intersections in a single route, which may have lesser distances between them. So it may not be possible to get the optimum cycle length which is best suited for the intersections.

As described earlier, to design a signal system optimum cycle length has to be calculated, for this Webster’s approach is used. Webster had given a formula to obtain a optimum cycle length to minimize the delay period. The formula to calculate optimum cycle length is as,

$$C = (1.5L + 5) / (1.0 - Y)$$

Where,

C = Optimum cycle Length

Y = Critical Lane Volume divided by the saturation flow, summed over the phases

L = Lost time per cycle

Signal Designing by Webster’s Approach

The data obtained from the survey that is traffic volume survey is analyzed and the vehicular counts are converted to the PCU counts using standard format of IRC SP 41. From these counts at different intersections traffic signal design can be done. Here with the help of the analyzed data using Webster’s approach to design an isolated signal system at the intersections.

Narmad Library Circle/Union Park Circle/Rangeela Circle												
Approach	Narmad Library			Jogger’s Park			Ram Chawk			Parle Point		
	L	S	R	L	S	R	L	S	R	L	S	R
Veh./Hr.	199	451	200	98	495	773	315	1268	213	76	1368	241

PCU/Hr.	152	336	136	69	338	561	240	948	167	60	972	201
Saturation	2216			2216			5697			5697		

Phase Wise	Phase-I	Phase-II	Phase-III	Phase-IV
Main Road vph	972			
Right Turn vph		240		
Side Road 1			336	
Side Road 2				338
Saturation	3027	1796	2216	2216
Critical y-	0.32	0.1336	0.1516	0.1518

For Y

$= y_1 + y_2 + y_3 + y_4$ Where, $y_1 = 0.32$,

$$y_2 = 0.1336,$$

$$y_3 = 0.1516,$$

$$y_4 = 0.1518$$

Therefore, $Y = 0.32 + 0.1336 + 0.1516 + 0.1518$

$$Y = 0.75$$

Lost Time $L = nl + a$

$$= (4 \times 2) + (3 \times 4)$$

$$= 20 \text{ sec}$$

Optimum Cycle Time, $C = C = (1.5L + 5) / (1.0 - Y)$ $C = \{(1.5 \times 20) + 5\} / (1 - 0.75)$

Therefore, $C = 140 \text{ sec}$

Now, Effective Green $E_g = C - L$

$$= 140 - 20$$

$$= 120 \text{ sec}$$

Therefore, for Main road $E_{gm} = (0.32/0.75) \times 120 = 52 \text{ sec}$ For right turn $E_{gr} = (0.1336/0.75) \times 120 = 22 \text{ sec}$

For side road 1 $E_{gs1} = (0.1516/0.75) \times 120 = 18 \text{ sec}$ For side road 2 $E_{gs2} = (0.1525/0.75) \times 120 = 18 \text{ sec}$

Therefore, the obtained optimum cycle length for Narmad library Circle is 170 sec. Similarly for other two intersections optimum cycle length is calculated from which, one is as follows:

Purdy's Method:

A balanced directional progression is often desired on streets during off-peak hours or during the entire day. In such cases, a simple method of obtaining the widest equal two-way "through" bands is desired. Purdy's method (1967) is one such technique that can be applied to a new or existing series of intersections.

Using the Purdy's method for coordination of signal system designing is as follow:

For optimum cycle length 120 sec.

Cycle Length = 120 Sec				
Intersection	Distance From A (M)	Cycle Time (Sec)	Green Period (Sec)	Red Time (Sec)
A	0	120	72	48
B	580	120	72	48
C	1180	120	84	36

INTERSECTION			
Line	A	B	C
1	0	580	1180
2	0%	70%	142%
3	0	20	-8
4	60%	60%	70%
5	30/-30	30/-30	35/-35
6	30/-30	50/-10	27/-43
7	30/-30	50/-10	27/-43

Each line given in above table is explained in detail below

Line – 1: Cumulative distance in meters to each intersection from base intersection A.

Line – 2: Speed = 50 kmph = 13.8 m/sec. convert distance in meter to travel time in seconds and in terms of cycles (as a percentage). 1 cycle = 60 sec = 828 m/cycle.

Line – 3: The algebraic numerical difference between the nearest multiple of 50% and the percentage appearing on line 2 (e.g., x - 50%, x - 100%, x - 150%).

Line – 4: Percentage green as given.

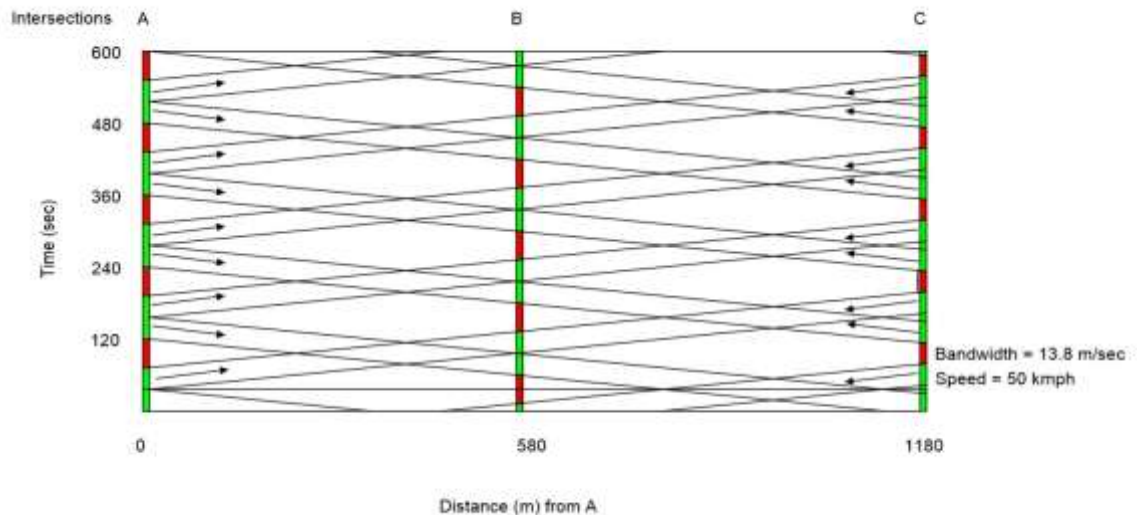
Line – 5: Each green is placed in its initial reference position with respect to the common datum line.

Line – 6: Add lines 5 and 3 algebraically (numerator and denominator separately). The smallest “plus” = 5 and the smallest “minus” = 17. The through band in both directions = 5 + 17 = 22% of the cycle.

Line – 7: It may be necessary to adjust values in numerator and denominator by adding

+50/+50 or -50/-50 to any values in line 6 to obtain a wider bandwidth. For example, C can be (+53/-17) + (-50/-50) = +3/-67.

The time space diagram drawn on the basis of the calculated data is given in Figure given below.



Conclusion:- The study has been carried out for the selected route which is Ghod-dod road connecting Majura gate and Parle Point. This road is majorly used especially during peak hours as on this road two types of activities are there that is commercial and residential activities. Traffic volume survey has been conducted on this road to get the total PCU counts. The selected route or stretch requires a coordinated signal system at the intersection to have a smooth flow of traffic throughout the route. Because of this coordination there will be reduction in delay time which makes less travel time and improves the traffic flow performance.

- **Reference:-** “Traffic Engineering and Transport Planning” by Dr. L.R. Kadiyali, published by Khanna Publishers
- “Traffic Engineering” by Roger P. Roess and El., published by Pearson
- “Highway Engineering” by S.K. Khanna & C.E.G. Justo, published by Nemchand & Bros., Roorkee, U.K., India
- “Roads, Railway, Bridges, Tunnels & Harbour Dock Engineering” by B.L. Gupta and Amit Gupta, published by Standard Publishers Distributors