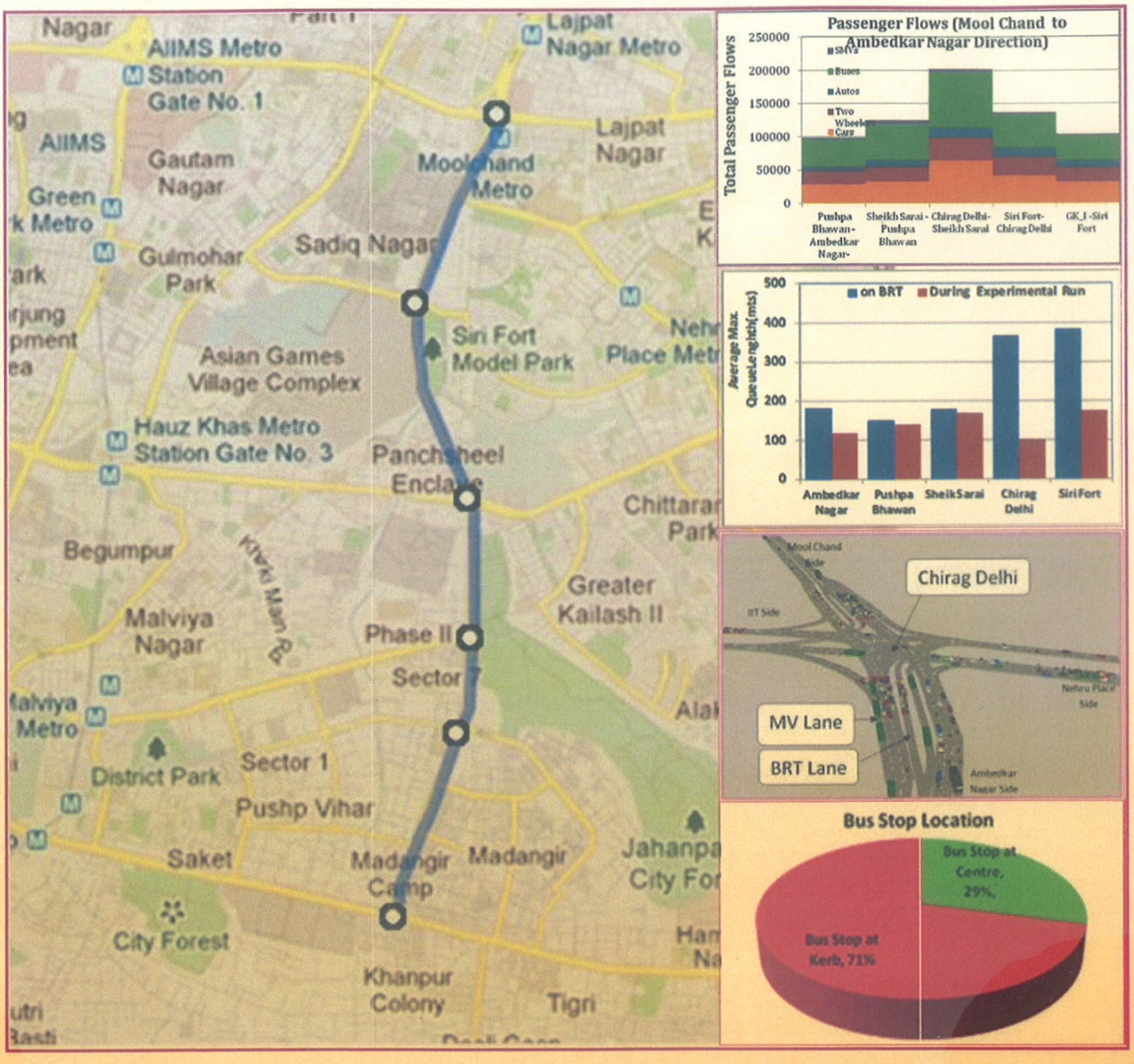
Evaluating Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Moolchand, Delhi

Sponsored by

Transport Department, GNCTD, Delhi

Final Report



July, 2012

केंद्रीय सड़क अनुसंधान संस्थान, नई दिल्ली – 110025

CENTRAL ROAD RESEARCH INSTITUTE

NEW DELHI - 110025

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CSIR-Central Road Research Institute
New Delhi-25

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The study is sponsored by the Transport Department at the instance of Honourable High Court. The study team would like to record, their appreciation and thanks to the Transport Department, Government of National Territory of Delhi *(GNCTD)* for providing CSIR-CRRI an opportunity to undertake a challenging project and accomplish the same within the stipulated timeline fixed by the Honourable High Court.

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Last but not the least, the enumerators who have worked very hard and sincerely to gather the data covered under study deserves special mention. Without the dedication of the enumerators *(hundreds in number)* the CSIR –CRRI study team could not have been completed the study in the manner as it is today.

CSIR - CRRI Study Team

FOREWORD

The recent growth in economic activity and average incomes have resulted in increased mobility and motorization in the metropolitan cities of India with Delhi leading the pack. To address the increased need for transport infrastructure and services, Government of National Capital Territory of Delhi *(GNCTD)* has launched several infrastructure projects, including the construction of a metro system, Bus Rapid Transit System *(BRTS)*, new roads and flyovers. The BRTS initiative undertaken by GNCTD was realized as a pilot project *(spanning for 5.8 Km)* on April 20th 2008 and this BRTS stretch starts from the junction of signal-controlled Mehrauli - Badarpur Road *(near Ambedkar Nagar)* and runs on J. B. Tito Marg in South Delhi and ultimately terminating before Mool Chand Hospital Intersection on the Inner Ring Road. This study is in response to the Public Interest Litigation *(PIL)* Case filed by M/s. Nyaya Bhoomi, versus Government of NCT of Delhi, as the Honourable High Court, Delhi had passed the order directing the Transport Department, GNCTD for carrying out an evaluation of the BRTS corridor and to report to the Honourable High Court.

At the instance of the above Court Order, the Transport Department, GNCTD had requested CSIR-Central Road Research Institute *(CRRI)*, New Delhi to undertake the study towards the evaluation of the BRTS corridor conforming to the Terms of Reference *(TOR)* prepared by Transport Department, GNCTD. Complying with the request of Transport Department, GNCTD and the Court order, CSIR-CRRI study team carried out an exhaustive list of studies on the BRT corridor and selected traffic studies on other adjoining Non-BRTS road sections in Delhi. The studies conducted include intersection traffic volume counts, Mid-block counts, Speed and delay studies, Spot Speed studies, Queue Length and Saturation Flow Studies, Pedestrian Volume counts at strategic locations, Parking studies, Users Perception on the BRTS corridor, Fuel Consumption studies using probe vehicle and Bus Passenger Boarding / Alighting studies.

Based on the results derived from the above-mentioned surveys, the efficacy analysis of allowing other vehicles to ply on the BRT lane on experimental basis was accomplished as per the Court order which was outlined in the TOR as well. This report also presents detailed account of the performance measures derived under 'normal BRT operations' and 'experimental trial run' operations. Further the report also presents the results of the simulation experiment aimed at assessing 'with' and 'without' BRTS scenarios for the study corridor as mandated by the court which is indicated in the ToR as well.

The recommendation emanating out of the study is presented in two parts. The possible improvement measures in the form of traffic engineering measures, bus route rationalization measures suggested in the report are mainly aimed at enhancing the safety of the road users in the event of continued operation of the road under 'normal BRT mode' of operations. Secondly, the traffic impact evaluation of the proposed capacity augmentation measures *(considered by the apex body like UTTIPEC)* in the form of 'New Link connecting Saket with Outer Ring Road' scenario has been evaluated. Moreover, traffic impact evaluation of different scenarios like 'with' and 'without BRT' on the study corridor has been evaluated through critical comparison of the essential performance measures and presented in this report.

It is hoped that this report will be of immense use to the Honourable High Court while taking their decision on the PIL as well as for the Transport Department, GNCTD towards the consideration of the study recommendations keeping in view the safe and efficient movement of people on the study corridor.

16th July, 2012
CSIR-CRRI, New Delhi

(S.Gangopadhyay)
Director

CSIR-CENTRAL ROAD RESEARCH INSTITUTE

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1 PREAMBLE

1.1 Public Transport System in India

The recent growth in economic activity and average incomes have resulted in increased mobility and motorization in the metropolitan cities of India with Delhi leading the pack. To address increased need for transport infrastructure and services, the state Government of Delhi has launched several infrastructure projects, including the construction of a metro system, new roads and flyovers. Since the road based Public transport systems is the lifeline for providing easy access and regress for various types of land uses, Government of National Capital Territory of Delhi (GNCTD) approved for the improvement of existing road based PT system by recommending for the provision of the popular form of Bus Rapid Transit System (BRT) covering seven dedicated corridors in the city totaling 115.5 km. Basically, this endeavor is also aimed at promoting multimodal transit to complement the extensive metro system which is being developed connecting various parts of the city and National Capital Region (NCR). It is an established fact that Bus Rapid Transit (BRT) is one of the cost effective public transport services extensively deployed in various metropolitan cities around the world, due to its lesser investment cost compared with other forms of public transit like Light Rail Transport (LRT) and Mono Rail and Metro systems. Moreover, the basic advantage of this system over other forms of public transit is primarily due to its adaptability to run either on dedicated infrastructure, or in shared corridors with dedicated lanes coupled with exclusive signal phasing to regulate the traffic which plays a crucial role on the resultant performance of the system. The succeeding sections will dwell on the evolution of the BRT followed by International and national BRTS experiences.

1.2 Evolution of Bus Rapid Transit System

Though the concept of BRT emerged as early as in 1937 by way of implementation in the city of Chicago, the system gained its popularity when the city of Curitiba *(Brazil)* in 1970 developed a quality public transport system using limited financial resources. This implementation was followed by several Latin American cities as BRT is considered very efficient in terms of cost, engineering and environmental prospective. BRT systems are bringing out more equitable allocation of road space among the road users rather the vehicles on the road. With the rapid increase in the automobiles leading to traffic congestion, urban sprawl, air pollution and other such ill effects, immediate need was emerged for improving the transportation systems around the urban cities in the world. Though there is no precise definition of BRT in the literature, some of the researchers have defined it in their terms. Wright (2005) defines it as a *"bus-based mass transit system that delivers fast, comfortable, and cost-effective urban mobility"*. In Levinson et al. (2003), it is defined as *"a flexible, rubber-tired rapid-*

transit mode that combines stations, vehicles, services, running ways and Intelligent Transportation System (ITS) elements into an integrated system with a strong positive identity that evokes a unique image". The different components of the BRT system (BRTS) are running ways, stations, vehicles, route structure, fare collection, ITS, integration and institutional setup. BRTS can also be of different kind like open system, closed system or hybrid system. Open systems are the one in which the system is open to all the bus fleet in the city and the buses can enter and leave the BRT system, this kind of system does not require a feeder system. Closed systems are the one in which a special fleet of buses are particularly allotted for the BRT system and these buses cannot leave or enter the system. The glimpses of various salient features of the BRTS experiences from abroad and India are discussed in the following sections.

1.3 International BRTS Experiences

1.3.1. BRTS across American, European and Australian Cities

The salient features of the BRT system operational in different cities across the United States of America (USA) European and Australian cities are furnished in Table 1.3.1, 1.3.2 and 1.3.3. In 1977, Pittsburgh and Pennsylvania of USA opened its first south bus way to address the adverse impacts of the growing congestion in the urban areas. Another BRT proto type was built in Los Angeles in the early 1970's to ease the travel connections to the downtown Los Angeles. Later on these proto type systems were converted into full fledged BRT systems. At least twenty American cities are presently of which seven cities of Cleveland, Eugene, Los Angeles, Pittsburgh, Las Vegas, Boston and New York appeared to have effective BRT. Institute for Transportation and Development Policy (ITDP) have developed a scoring system to score the different BRT systems on a 100 point scale which gives gold, silver or bronze rating to the system. Higher the score on 100 point scale the BRT rating is better. Cleveland BRT has the highest score of 63 in USA. It is observed that in Cleveland and Eugene there is substantial rise in the ridership of about 60% and 74% respectively. There is an average time saving for the bus commuter varying from 10 to 20 min in various BRT systems mentioned above and a maximum of 31 minutes average time saving was observed in Los Angeles.

In the case of European BRTS, it is observed that the quantum of weekday bus riders in Paris, Dublin and Stockholm is ranging from 50,000 to as high as 1,40,000. The demand for the BRT systems in European cities is obviously low due to the presence of *very effective good transportation facilities.*

In the case of Australian BRTS, it can be observed from the literature that the infrastructure in Australian BRT systems is very strong. Further, it is observed that the average scheduled speed of the buses in the corridors is very high as much as 80 kmph in Adelaide and averaging about 60 kmph in Brisbane and a substantial speed of 35 kmph in Sydney. It can be observed that this high speed for a reasonable amount of ridership may be attributed to the large station spacing which is almost 5 km in Adelaide city and nearly 1.7 km Brisbane.

Table 1.3.1: Salient Features of BRTS across American Cities

City	Cleveland	Eugene	Los Angeles	Pittsburgh	Las Vegas	Boston	New York
Opening Year	2008	2007	2005	1983 *(extended in 2003)*	2004	2004	2009
BRT Standard Score	63	61	61	57	50	N.A.	N.A.
System Length (Km)	11.4	6.4	22.7	14.6	26.4	14.2	25.6
Average Bus Speed Before (Kmph)	14.9	18.4	N.A.	N.A.	16.0	N.A.	12.8
Average Bus Speed After (Kmph)	20.0	24.0	28.8	56.0	19.2	22.4	15.0
Speed increase (%)	34	30.4	N.A.	N.A.	20	25	20
Average time saving (min)	12	12	31	15	7	N.A.	18-20
Ridership increase (%)	60	74	N.A.	N.A.	25	98	N.A.
Frequency (min)	2.1	N.A.	10	2	12	N.A.	4-5

Table 1.3.2: Salient Features of BRT across some of the European Cities

City	Paris	Dublin	Stockholm
Year opened	1993	1997	1998
Population *(millions)*	8.3	1.1	1.5
Length *(km)*	12.5	100	24.1
Cost per km *(US $)*	7.2	1.5	3.4
Average station spacing*(m)*	540	-	500
Weekday bus riders	53,000	65,000	1,46,000
AM peak hour buses *(frequency)*	60	60	50
AM peak hour riders	4,800	6,700	4,500
Speed *(km/hr)*	23	18	15
Travel time reduction	N.A.	22	N.A.

Source: ITDP Report (2011) on Recapturing global leadership in Bus Rapid Transit: A survey of select U.S. cities, web document downloaded from http://www.itdp.org/documents/.

Table 1.3.3: Salient Features of BRT across Australian Cities

City	Adelaide	Sydney	Brisbane	
Section	Adelaide Busway	Sydney L-P Transitway	Brisbane East Busway	Brisbane Inner Northern Busway
Busway	Guided	Mixed unguided Busway and on street bus lanes	Un-guided	Unguided
Length *(km)*	12	31 km *(out of 20 km only bus only roads; 10 km bus only lanes)*	16.5	2.8 *(stage 1)* 4.7 *(full system)*
Avg. scheduled speed *(kmph)*	80	29-34	55-58	N.A.
Average Run time	9 min	54-64 min	17-18 min	N.A.
Station spacing (m)	5000	861	1650	671
Peak hour buses per hour	65	6	150	23
Ridership *(week day average)*	25,000	6,800	93,000	N.A.
Peak hour ridership	4,500	N.A.	15,000	N.A.
Direct corridor Ridership Growth *(%)*	24	56 *(47% new journeys)*	56 *(17% new journeys)*	N.A.

1.3.2. BRTS across Latin American Cities

The salient features of the BRT system operational in different cities across the Latin American Cities are furnished in Table 1.3.4. There are around ten BRT systems in Latin America with seven of them in Brazil and each one in Ecuador, Colombia and Mexico. The BRT systems are very extensive in this part of the world due to its success and hence a few sections of the major cities are cited in the above Table 1.3.4 and from that it is observed that ridership in all these sections are high and are ranging from 17,000 passengers per hour per direction (pphpd) to 40,000 pphpd. It is also observed that the average peak hour speed in these corridors is also substantial and ranging from 16 to 25 kmph. Bogota's TransMilenio, which was developed at 1999, became a world famous system due to its high volume and high-quality mass transit system, providing the backbone of services in one of the region's mega-cities. Particularly Curitiba and Bogotá have shown that, despite the BRTs' at-grade alignment through signalized intersections, it is possible to accommodate high levels of passenger demand which previously were thought to be manageable only by rail mass transit and that too at fairly high commercial speeds *(ranging from 15 to 32 km/h)*.

Table 1.3.4: Salient Features of BRT across Latin American Cities

City	Sao Paulo		Curitiba	Porto Alegere			Quito	Bogota
Name of the Section	Santa Amaro	Sao Mateus	Sul	Joao Pessoa	Corr. Exclusive. brasil	1st Peri-metral	Trole	Troncal Ave. Caracas
Length (km)	14.6	33	10.08	8.8	-	6.4	11	16
Segregated Length *(km)*	10.8	30	10.08	-	8.2	-	11	16
Volume *(passengers /day in '000)*	196.2	206.8	156.2	178.9	131.8	147.3	180.0	372.7
Peak ridership *(pphpd)*	17,658	21,600	13,014	14,309	10,543	11,783	-	36,500
Average Speed *(kmph)*	16	22	18.61	19.06	14.67	6.77	20-25	18
Number of Stops	23	110	18	13	29	14	39	32

In a nutshell, it can be inferred from the above tables *(refer Table 1.3.1 to 1.3.4)* that the concept of BRTS has gained its momentum after its grand success in the Latin American cities. Where the main mode of travel is by car and the traffic is homogeneous in nature.

1.3.3. BRTS across Chinese Cities

The salient features of the BRT system operational in different cities across the China are furnished in Table 1.3.5. In Asia, although the concept of BRT has emerged mainly in Indonesia, India and Chinese cities during the last decade, the patronage rate in China is very high and the first BRT system was implemented in Kunming in the year 1999. Some of the BRTS in China are having peak ridership ranging from 1500 pphpd to more than 27,000 pphpd.

Table 1.3.5: Salient Features of BRT across Chinese Cities

City	Beijing	Guangzhou	Dalian	Hangzhou	Kunming	Xiamen
Peak ridership *(pphpd)*	8,000	4,500	6,500	1500	8,600	3,600
Peak Hour speed *(kmph)*	21	18	24	15	18	29
Number of Corridors	3	1	1	1	5	2
Length of Dedicated Busway *(km)*	37	21.2	9	7	46.7	38.2
Length including Mixed Traffic Proportion *(km)*	55	24.6	13.7	27.2	46.7	N.A.
Number of Stations	61	26	14	17	63	30
Average distance. between stations *(m)*	940	984	940	1,700	500	1,300
Buses per hour per direction	55	55	80	40	140	50
System Passenger Trips per day	1,20,000	N.A.	N.A.	40,000	1,56,000	N.A.
Fleet of Buses	87	60	64	48	20	N.A.

Source: www.nsl.ethz.ch/index.php/content/download/429/2783/file

In this regard, the BRTS operational in Guangzhou since February 2010 has already received the distinction of accounting for 2nd largest traffic flow pphpd *(i.e. 27,000 pphpd)* amongst the different forms of public transport operating in China.

1.4 Indian BRTS Experiences

Despite the fact that the usage of public transport is substantially high in our Indian cities, the Level of Service (LOS) provided in the systems in terms of comfort, safety and reliability are not noteworthy. This aspect can be addressed if the bus systems (in the form of BRTS) are designed effectively so as to make them an efficient and attractive option at a fraction of cost of the rail based system like LRT, metro, mono rail etc. A brief description of couple of Indian experiences is outlined in the next sections.

1.4.1. Delhi BRT

The first idea of BRT system was mooted in Delhi, capital city of India. Taking cue out of the various BRT experiences worldwide, Government of National Capital Territory of Delhi (GNCTD) incorporated Delhi Integrated Multi-Modal Transit Systems Limited (DIMTS), in April 2006 to implement various Multi-modal Transit Projects of which BRT is a part. Eventually, the above BRT initiative undertaken by GNCTD was realized as a pilot project spanning for 5.8 Km and became operational on April 20th 2008. This corridor is at present functional from the junction of signal-controlled Mehrauli - Badarpur Road *(near Ambedkar Nagar)* and runs on J. B. Tito Marg in South Delhi and ultimately terminating before Mool Chand Hospital Intersection on the Inner Ring Road as shown in Figure 1.4.1. The corridor infrastructure (as shown in Figure 1.4.2 and 1.4.3) consisted of single median lanes for buses with physical segregation integrated with double platform bus stops located close to the intersections as shown in Figure 1.4.2. This included provision of two lanes for other motorized traffic coupled with the provision of cycle tracks and sidewalks on both directions of travel. At mid block section, it becomes two lanes for motor vehicles (MV) and one lane for bus in each direction as shown in Figure 1.4.3.

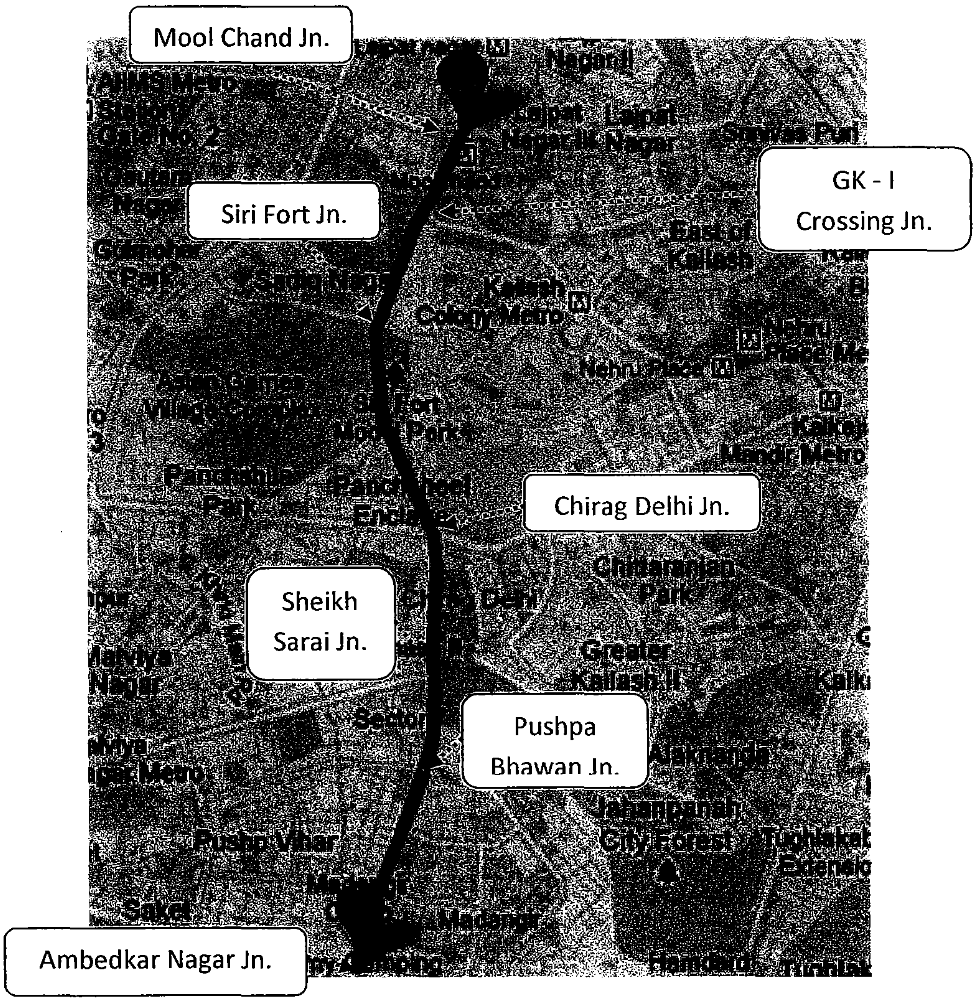


Figure 1.4.1: Location of Delhi BRT Corridor on J. B. Tito Marg from Mool Chand to Ambedkar Nagar

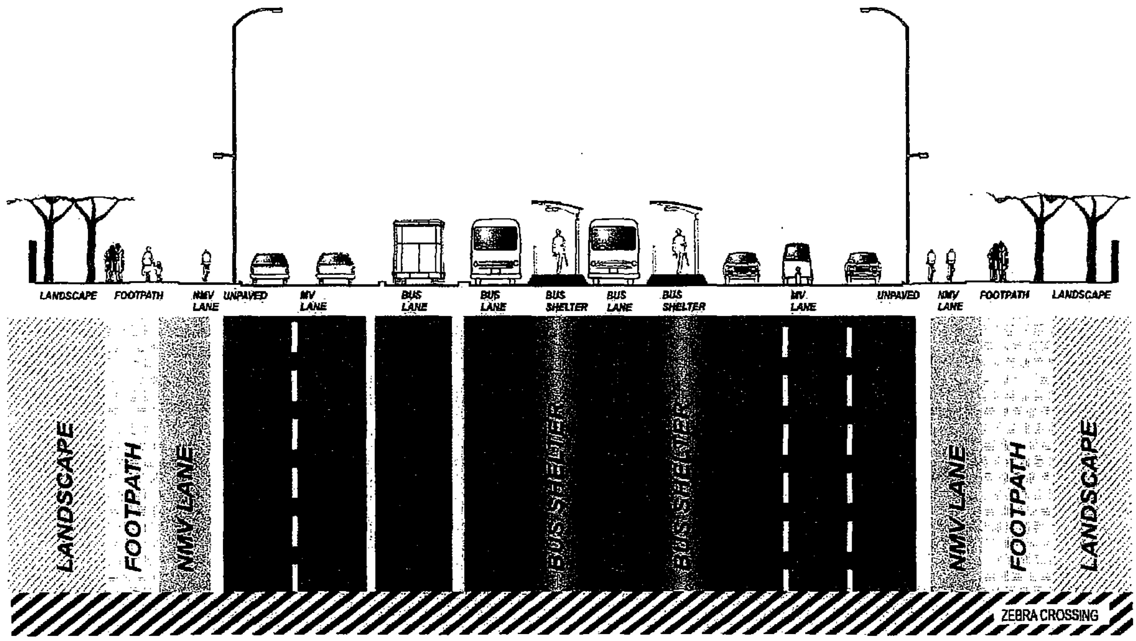


Figure 1.4.2: Infrastructure on Delhi BRT Corridor near At-grade Intersection

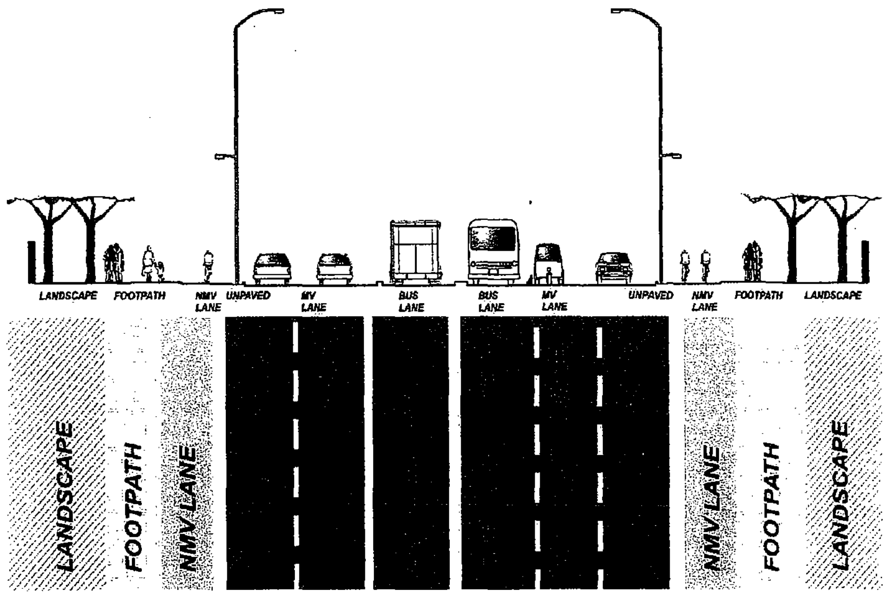


Figure 1.4.3: Infrastructure on Delhi BRT Corridor on Mid Block Section

The salient aspects of the pilot BRT project which is in operation on J. B. Tito Marg are listed below:

- Starting Date of Operation : April 2008
- Length : 5.8 Km
- No. of Stations : 9
- Peak Ridership : 12,000 pphpd in 2012 (Present Study)

- Frequency : 250 buses/hr *(esp. during the peak hours) (CRRI current study, 2012)*
- Investment Infrastructure : Rs 14 crores/km
- Minimum User Fare : Rs 5 per passenger

1.4.2. Ahmadabad BRT

Following the Delhi BRT, the city of Pune implemented BRT system on a pilot corridor in the year 2008 which faced some glitches. Following the implementation in these two cities it was then implemented in Ahmadabad in the year 2009 which has become a great success in India.

Ahmadabad BRT corridor presently starts at RTO Office, Ahmedabad and destines at a major township namely Mani Nagar by passing through major commercial and industrial developments which is unlike south Delhi pilot project alignment passing through couple of over saturated intersections and dense residential developments. Moreover, the overall traffic volume on MV lane in the case of Ahmadabad BRT is relatively less, coupled with system being a closed system, wherein buses do not go out and other buses are not allowed in. Further the width of the MV lane is around 10 m unlike 7 - 8 m width available on the Delhi BRT at some of the locations. The central island bus stops are located at 200 meters before the intersection and have platform screen doors operated by sensors to prevent people from getting hit by buses. The doors open when a bus arrives, and all buses stop in perfect alignment with the shelters.

1.4.3. BRT in Other Indian Cities

BRTS is in operation currently in Delhi and Ahmadabad and as many as seven more cities are under planning / implementation stage and are likely to open BRT systems soon. The BRTS in Delhi is an open system with a stretch of 5.8 km while the Ahmadabad is a 25 km operational system which is a closed BRT system. Except for the Delhi BRT system all the other systems are being funded by JNNRUM. The details of various BRT systems in Indian cities are discussed in Table 1.4.1.

As mentioned earlier, ITDP studied on utility value by adopting a mechanism of BRT standard scoring system so as to prompt the city authorities for achieving greater strides in the service provision through BRTS. In this study they categorized performance of BRT systems into Gold, Silver and Bronze based on the score obtained by evaluating the individual system considering the parameters such as service planning, infrastructure, station design and station bus interface, quality of service and bus information system and, integration and access. The rating of various BRTS comparing selected cities across the world is presented in Figure 1.4.4. It can be observed from this figure that Bogotá BRT system, followed by Guangzhou and Lima falls under Gold rating score and cities such as New York and Boston, scores less than 50. Interestingly, Ahmadabad BRT system also falls under silver rating with the score of 76 (ITDP Report, 2012) illustrating its success.

Table 1.4.1: Detailed Comparison of Selected BRTS Implemented / Planned across Indian Cities

BRTS Details	Specification	Delhi BRTS	Ahmadabad BRTS	Jaipur BRTS	Pune BRTS	Indore BRTS
Bus Corridor Design Details	Type and Configuration of BRTS	Open with central bus lane	Closed with central bus lane	Hybrid with central bus lane	Open with central bus lane	Open with central bus lane
	Total planned	114 km	88.8 km	138km planned and 42 km sanctioned	117km total planned; 50km is dedicated corridor	106 km of which 11.5km is sanctioned
	Total length executed or under construction	5.6 km operating	25km operating	7km of Package 1B completed	17 km operating	11.5 km under construction
	Width of bus lanes	3.3m (3 m at stops)	3.5 m	3.3m	3.3m (3m at stops)	3.3m
	Tools to separate bus lane from mix traffic	0.6 m wide & 0.15 mm high kerbs	Railings	Kerb and fences	0.3 m wide separator with fences	Kerb
	No. of routes catered in open system on corridor	14	NA	3	NA	NA
	Existing fleet used or not	Yes	New fleet	Yes as feeder	Yes	Yes
	Passenger capacity in bus	Varies	60-70	65-70	60-70	55-60
Bus Stops	Distance between bus stops (meters)	500-700m	Average 800 m	300-750m	500-700m	Average 525 m
	Bus stop location with respect to junction/intersection	Before junction	Far-side of junction	Before junction where staggered bus stops are there	Min 60m before junction	Before junction
	Type of bus stop: staggered/island platform	Staggered	Island platform	Both staggered and island platform	Staggered	Staggered with overtaking lane

BRTS Details	Specification	Delhi BRTS	Ahmadabad BRTS	Jaipur BRTS	Pune BRTS	Indore BRTS
Bus Operations	Frequency achieved	160-180 buses per hour	2.5 min in peak hour	2 – 4 min	2 min	1.5min
	Average speed on corridor *(kmph) (achieved)*	12 in peak hour *(down from 18 in 2008)*	22-25 *(peak hour)*	25 kmph	16-18 kmph in peak hour	20
	Planned ridership	20,000 - 24,000 pphpd	15,000 – 20,000 pphpd	5,300 – 5,700 pphpd	10000-15000 pphpd	10000 pphpd upgradable to 20000 pphpd
	Achieved ridership	12,400 pphpd *(Source: CSIR-CRRI, 2012)*	2350 - 2600 pphpd		3,600 pphpd	
	Type of bus	Low floor, CNG	Low floor, CNG	Low floor, Diesel	Semi Low floor	Low floor
	Type of fare: fix/progressive	Progressive	Progressive	Progressive	Progressive	Progressive
	On-board/off-board ticketing	On-board	Off-board	Both	On-board	Off-board
	Fare amount in INR (with slabs for progressive fare)	<4km: Rs5, 4-10km: Rs10, >10km: Rs 15	Maximum fare Rs15 for existing route	81 paise per km	2km: Rs 3, 4km: Rs 5, 6km: Rs6, 8km: Rs7, 10km: Rs8	Min. Rs. 5 and Rs. 4 (smart card) Max. fare of Rs. 14 and Rs. 12 (smart card)
	Space availability for vendors along corridor	Kiosks	Yes	Yes	Yes	Yes
	Passenger information: dynamic/static	Static at present, planned for dynamic	Dynamic	Dynamic	Currently static, planned for dynamic	Dynamic
	Any other service for public convenience	Public toilets, kiosks, public telephone & dustbins	Public toilets, dustbins	Toilets, dustbins	Sitting areas, toilet and kiosks	Toilets

BRTS Details	Specification	Delhi BRTS	Ahmadabad BRTS	Jaipur BRTS	Pune BRTS	Indore BRTS
Bus Operations	Walk	2-5m wide footpaths signalized raised zebra crossing	Non-continuous 2m wide footpaths, signalized level crossing and sub-ways at mid-block	2m wide footpath with signalized crossing	Minimum 1.5 m wide barrier free footpaths, with signalized raised zebra crossing	Barrier free minimum 1.5m wide footpaths, Signalized crossing
	Cycle and cycle rickshaws	2.5m wide cycle tracks on both side with signalized crossing and parking near intersections, on rent	2 m wide cycle track with signalized crossing, parking at specific locations	2.5m wide cycle track with parking	1.5m for cycle lanes and 2.5m for cycle tracks and free parking 60m away from bus stops	Minimum 1.5 m wide cycle tracks, where ROW is not available to be combined with footpaths with cycle box for crossing. Parking near intersections
	IPT & Motorized vehicle	Parking provided near intersections. On street parking along service lane, stopping bays along main carriageway	On street 3m wide parking lane, 50m away from junction, free parking for 679 autos in front of mid-block bus stops and 3624 for 2-wheelers & 425 for 4-wheelers paid parking.	Parking provision. On street parking.	Parking near junction spaced at 500m, 30m away from bus stop	Parking at every junction
	Ownership & Financing	Transport Department, GNCTD & manned by DIMTS Ltd.	SPV & JNNURM	SPV & JNNURM	SPV & JNNURM	SPV & JNNURM

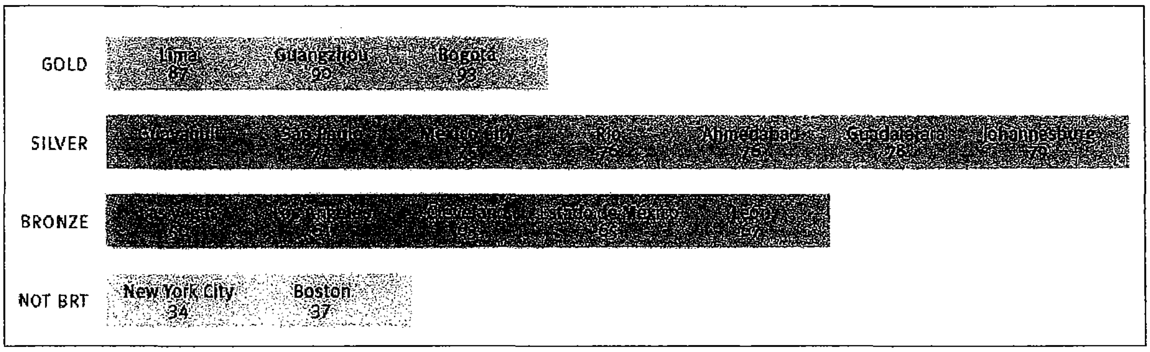


Figure 1.4.4: Rating of various BRTS across the World (ITDP, 2012)

From the above discussion it is evident that there are different forms of BRT and each city has to use the one that is best suited to it. For instance unlike the closed system in Ahmadabad, Delhi BRT being a pilot project, is an open system as it has to accommodate several other bus routes and bus types as well. Further, buses operating on this pilot project are operating on 14 routes out of these only 4 bus routes are traversing the entire stretch pilot stretch of 5.8 km. Moreover, in order to have island platform bus stops as that of Ahmadabad BRT corridor instead of staggered ones, one would have to replace the entire fleet of buses in the capital with buses having two-side openings, as plying in Ahmadabad.

1.5 Need for the Study

Though the corridor is functional since its inception in April 2008, this pilot project has faced criticism from various quarters due to huge delays reported on motor vehicle lane. In response to the Public Interest Litigation (PIL) Case filed by M/s. Nyaya Bhoomi, versus Government of NCT of Delhi the Honourable High Court had passed the Court order vide W.P. (C) 380/2012 dated 15.03.2012. In the Court Order, the Honourable Judges have directed the Transport Department of the GNCTD, for carrying out an exhaustive study and to report to the Honourable High Court on some of the major issues like as to whether the BRT corridor has served the purpose which it was intended to achieve, whether it has resulted in slowing the traffic movement of vehicles other than the buses and if so, the impact thereof on consumption of fuel, even if the said corridor has expedited the movement of buses, the proportion of commuters who have benefitted there from to the commuters who have / are suffering; the viability / desirability of having the bus stops at the centre of the carriageway and also during the course of the study comparative studies be done by allowing other vehicles on the lane reserved exclusive for the buses. Consequently, the Transport Department of the GNCTD had requested CSIR-Central Road Research Institute (CRRI), New Delhi to submit a proposal for the conduct of an exhaustive study towards the evaluation of the BRT corridor conforming to the Terms of Reference (TOR) prepared by Transport Department, GNCTD vide their letter no. F3 *(49)*/Tpt/Proj/2012/05 dated 21.03.2012.

As part of our endeavour to comply with the above High Court Order and the subsequent letter received from GNCTD, a technical proposal vide letter no. 1*(40)*TTP.12 dated 30.03.2012 was submitted by CSIR-CRRI. Eventually, the study was awarded to CSIR-CRRI by Transport Department, GNCTD vide their letter no. F.3 *(49)*/Tpt/Proj/2012/2036 dated 03.04.2012.

1.6 Assessment of Traffic Problems on the Delhi BRT Pilot Corridor

On receipt of the above referred letter from Transport Department, GNCTD, the study team immediately swung in to action and visited the corridor on 26th and 27th March, 2012 to understand the functional efficiency of traffic movement on the study stretch at different times of the day and days of the week which can help in formulating the technical proposal. During this visit, CSIR-CRRI team studied the traffic movement considering the operational issues in each of the components of the stretch which included bus lanes, bus stops, Motor Vehicle (MV) lanes, pedestrian and bicycle facilities. The main observations emanating from the broad assessment made during this reconnaissance visit include the following:

- Traffic signal cycles were very long extending up to 4 minutes per cycle during the peak hours in the case of motorized traffic lanes resulting long queues. It was observed that 3 - 4 signal cycles were required for the traffic to clear on the Motor Vehicle lane present adjacent to the BRT lane, and this scenario was specifically experienced at the Chirag Delhi intersection.
- Bus queues were longer than the station platform length, with some passengers alighting and boarding outside the platforms during the peak hour.
- Pedestrians jay walking were commonly observed in the vicinity of the intersections.
- Some private vehicles like cars and two wheelers were observed to be violating traffic rules while using the bus lanes during the peak hours.
- Bus occupancy levels were high, especially during the peak period.
- Though the cycle tracks possessed capacity to cater for a large number of bicycles, it was noted that some of the cyclists were resorting to the use of motorized traffic lane endangering their own safety.
- More importantly, many motorized two wheeler riders are encroaching on to the Non Motorized Traffic (NMT) lane to jump the queues building on the MV lane during the peak hours and thereby causing serious safety hazards for the cyclists.
- Based on the reconnaissance visits, it was also observed that the NMT lane has been totally encroached near Madangir. Further, construction materials were also dumped on these NMT lanes, which need to be removed. Of course this aspect is more of an enforcement issue rather than operational problems on the corridor.

Some of the typical observations made by the study team on the corridor are presented pictorially in Photos 1.6.1 to 1.6.29.

Photo 1.6.1: Absence of NMT Traffic prompting private vehicles to shift from the MV lane during the peak hours

Photo 1.6.2: Dilapidated barrier at Bus Stops endangering Passenger Safety

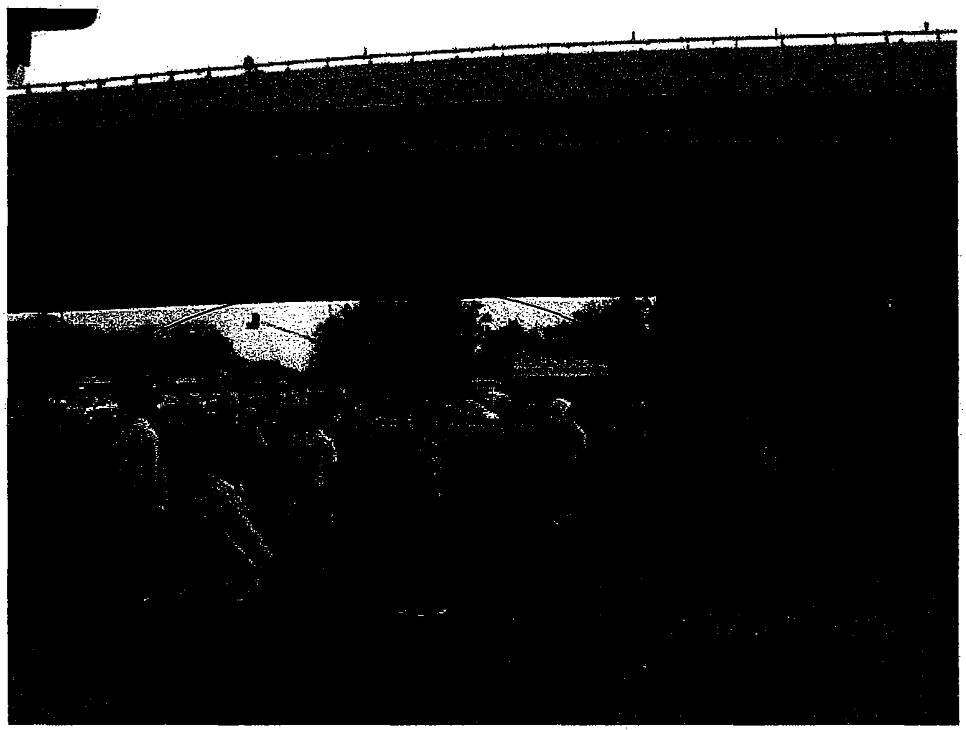


Photo 1.6.3: Jay Walkers: A Common Phenomenon on the corridor due to absence of Designated Diagonal Pedestrian Crossing and Pedestrian Phase

Photo 1.6.4: Bus Commuter in haste violating traffic rule for catching Bus

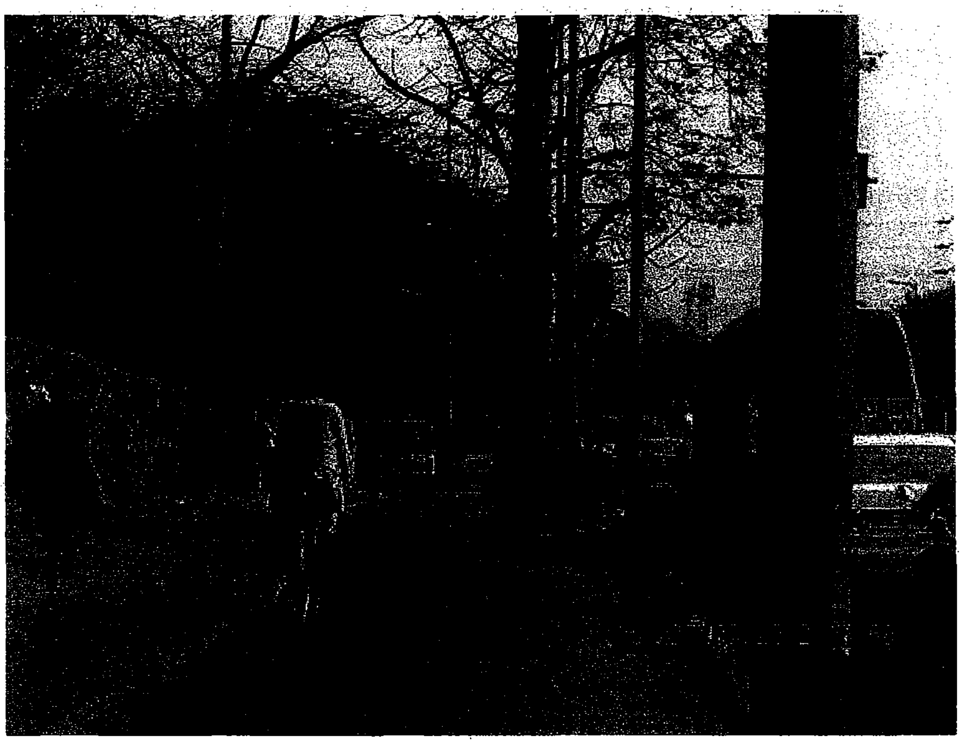


Photo 1.6.5: Non Motorized Traffic Lane being used by IPT modes for Parking

Photo 1.6.6: Foot Path being used by Private Vehicles for Parking

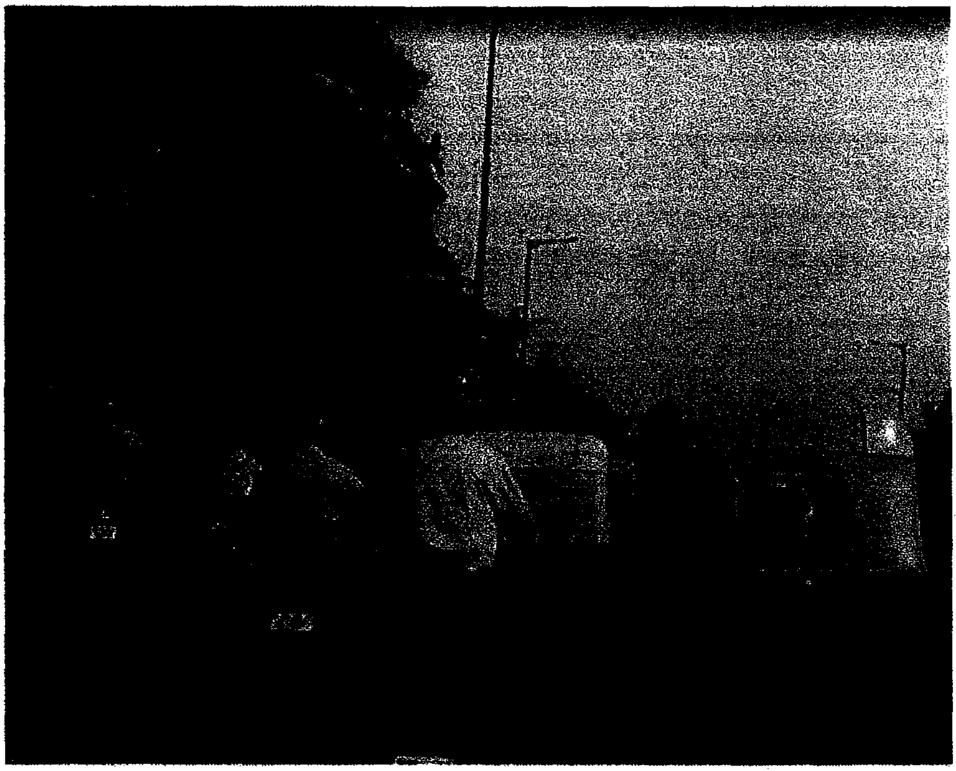


Photo 1.6.7: Empty NMT Lanes used by Motorized Two Wheelers

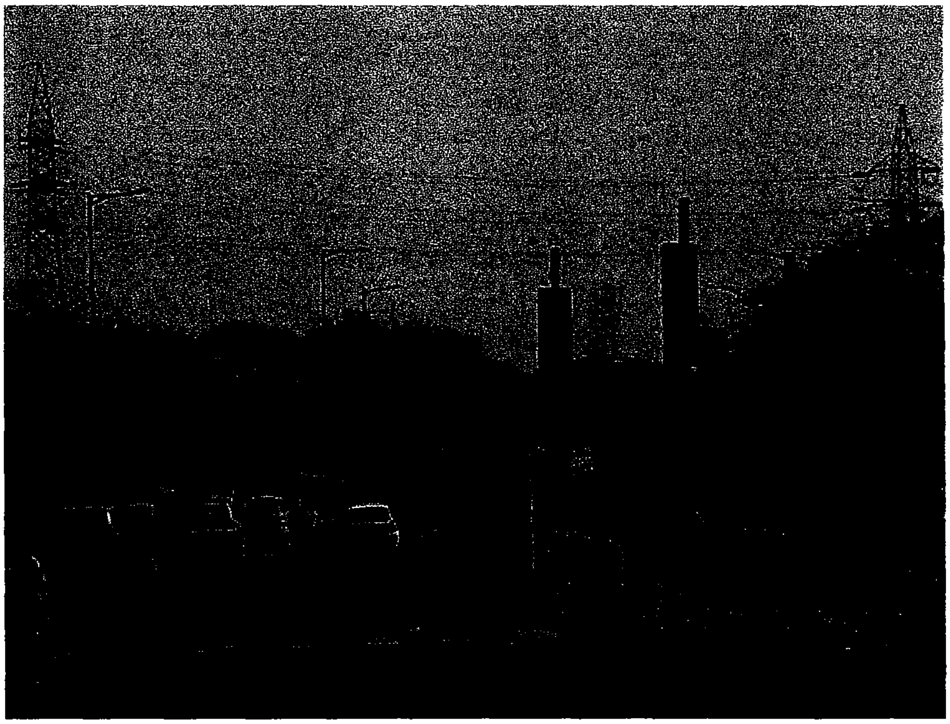


Photo 1.6.8: Pedestrians tending to take the shortest path for making diagonal crossing at the intersection area instead of Zebra Crossing

Photo 1.6.9: Most of the pedestrians are not crossing at Zebra Crossing

Photo 1.6.10: Most of the pedestrians are not crossing at Zebra Crossing

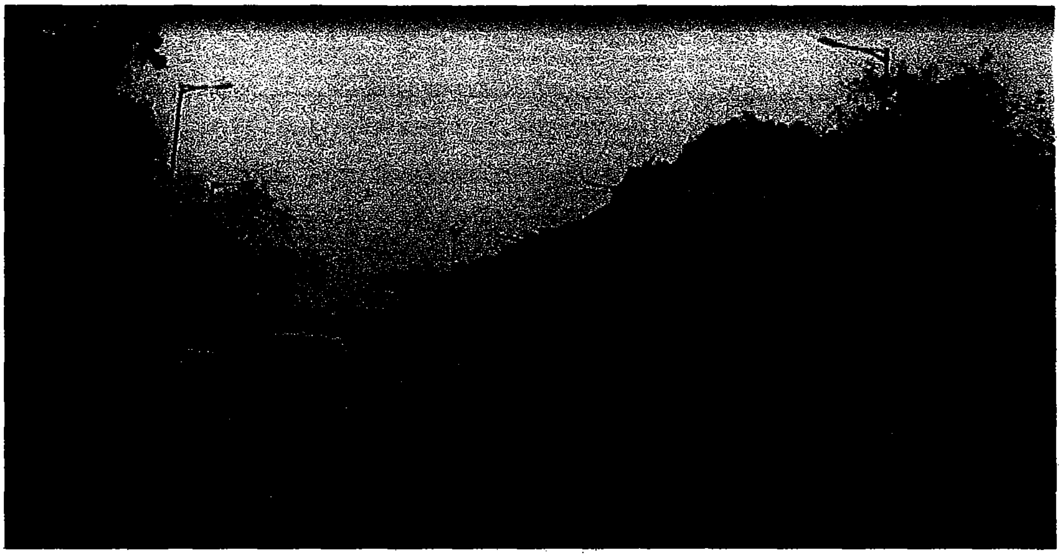


Photo 1.6.11: Most of the pedestrians are not crossing at Zebra Crossing

Photo 1.6.12: Street vendors/Hawkers and Cyclists tend to use Motor Vehicle Lane for achieving quick crossing maneuver at the Intersection area

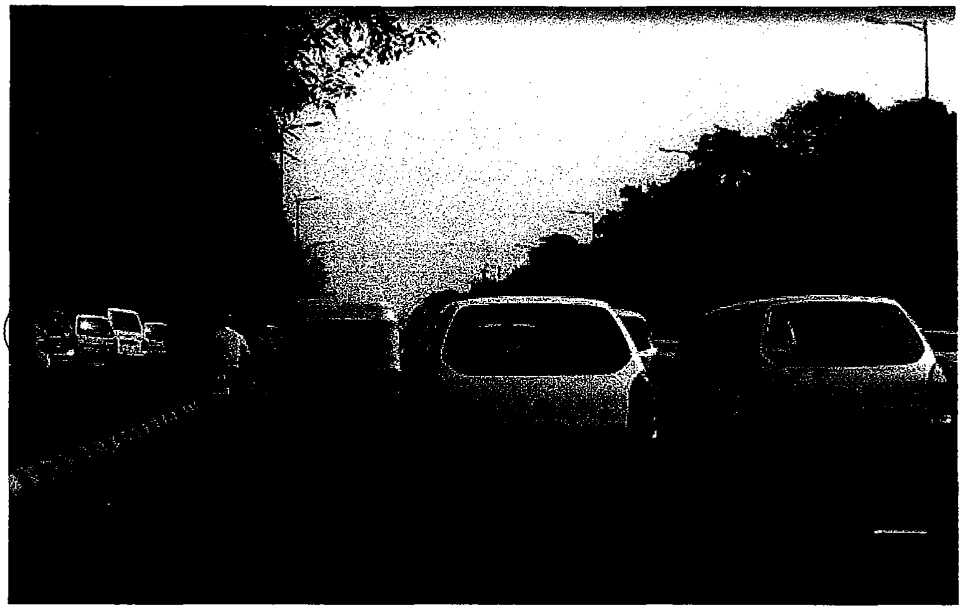


Photo 1.6.13: Rampant Parking on NMT lanes

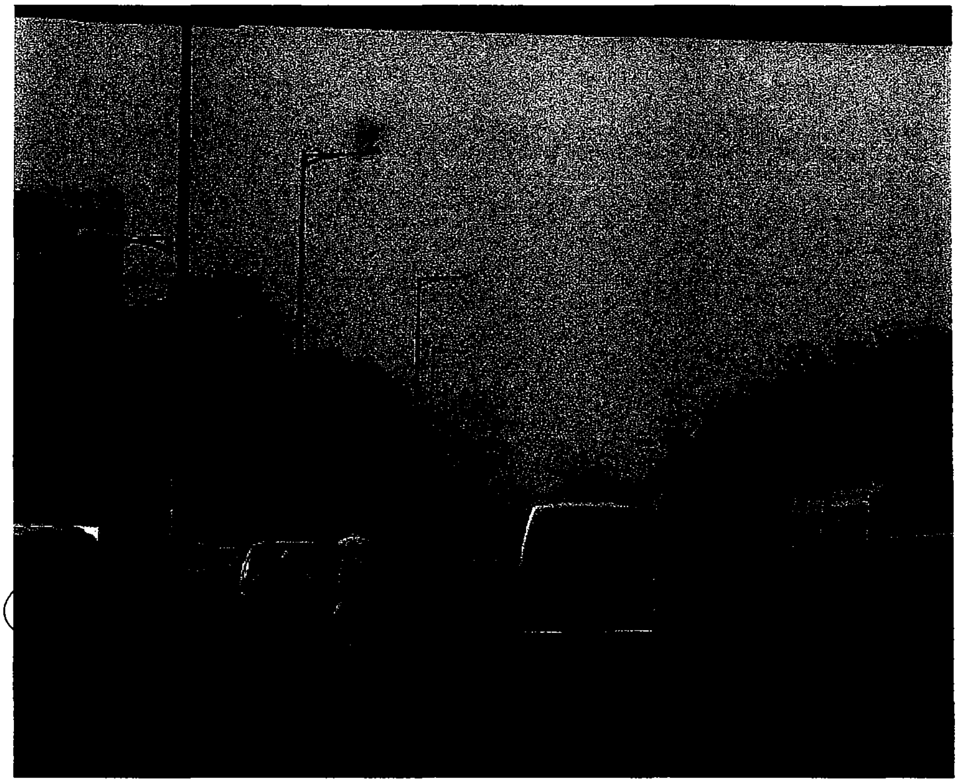


Photo 1.6.14: Rampant Parking on NMT lanes forcing the NMT users to share the road space on the Motor Vehicle Lanes

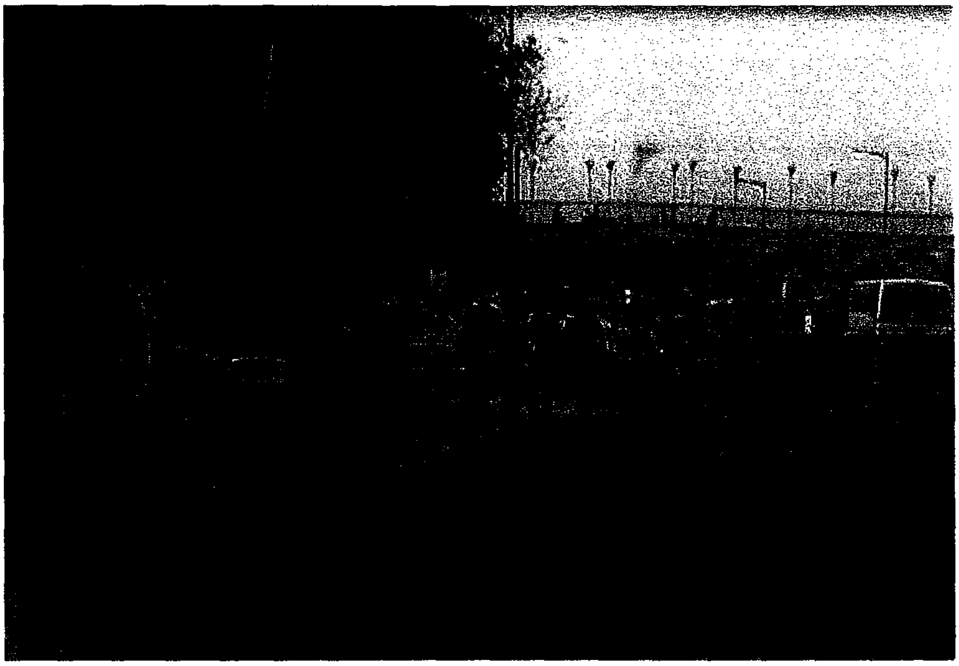


Photo 1.6.15: Rampant Parking on NMT lanes forcing the NMT users and Pedestrians to use Motor Vehicle Lanes

Photo 1.6.16: Rampant Parking on NMT lanes forcing the Pedestrians to walk on Motor Vehicle Lanes

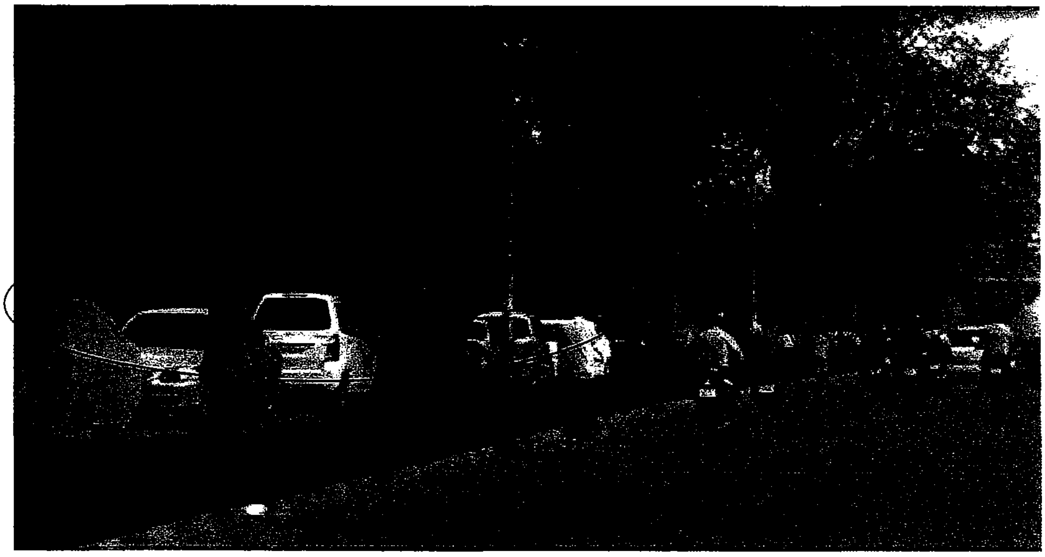


Photo 1.6.17: Rampant Parking on NMT lanes forcing the NMT users to use Motor Vehicle Lanes

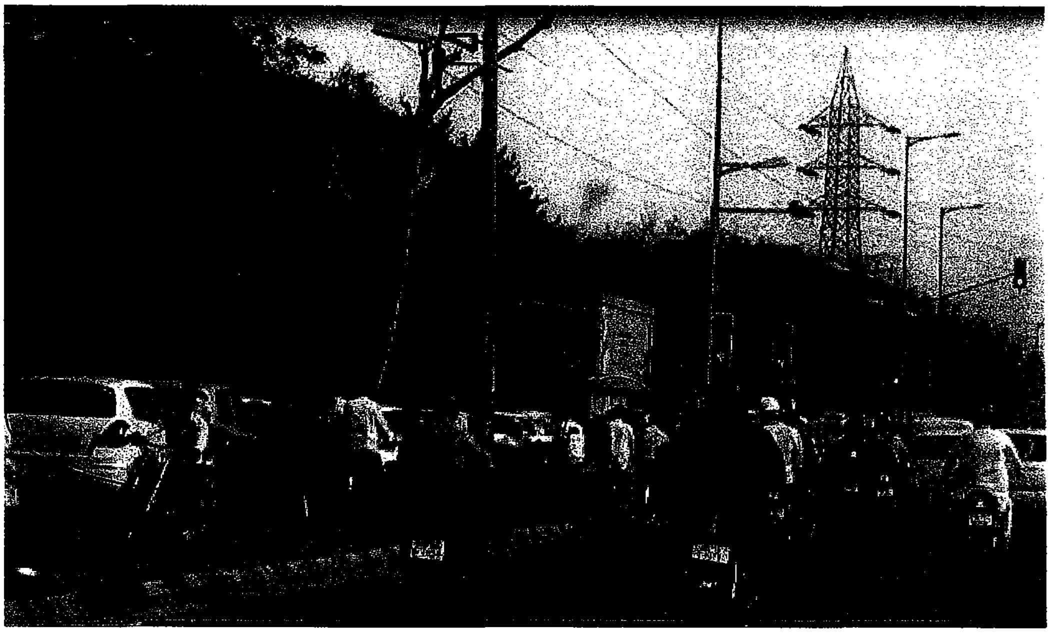


Photo 1.6.18: Rampant Parking on NMT lanes forcing the NMT users to use Motor Vehicle Lanes

Photo 1.6.19: Private Vehicle tend to use the empty BRT lanes violating Traffic Rules due to Saturation Flow during Peak Hours

Photo 1.6.20: Private Vehicle tend to use the empty BRT lanes violating Traffic Rules due to Saturation Flow during Peak Hours

Photo 1.6.21: Buses Plying on the BRT Corridor

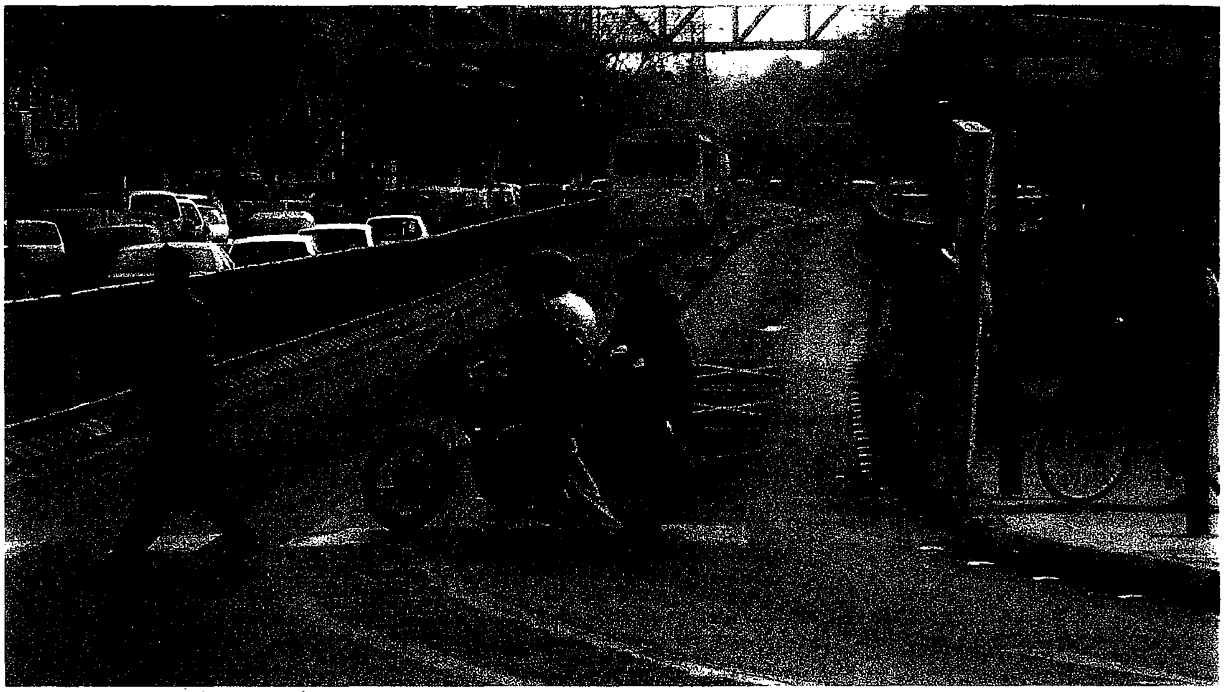


Photo 1.6.22: Breaking of Continuous barrier by the Residents along the highly Populated Madangir on the BRT to facilitate their violations

Photo 1.6.23: Breaking of Continuous barrier by the Residents along the highly Populated Madangir on the BRT to facilitate their violations

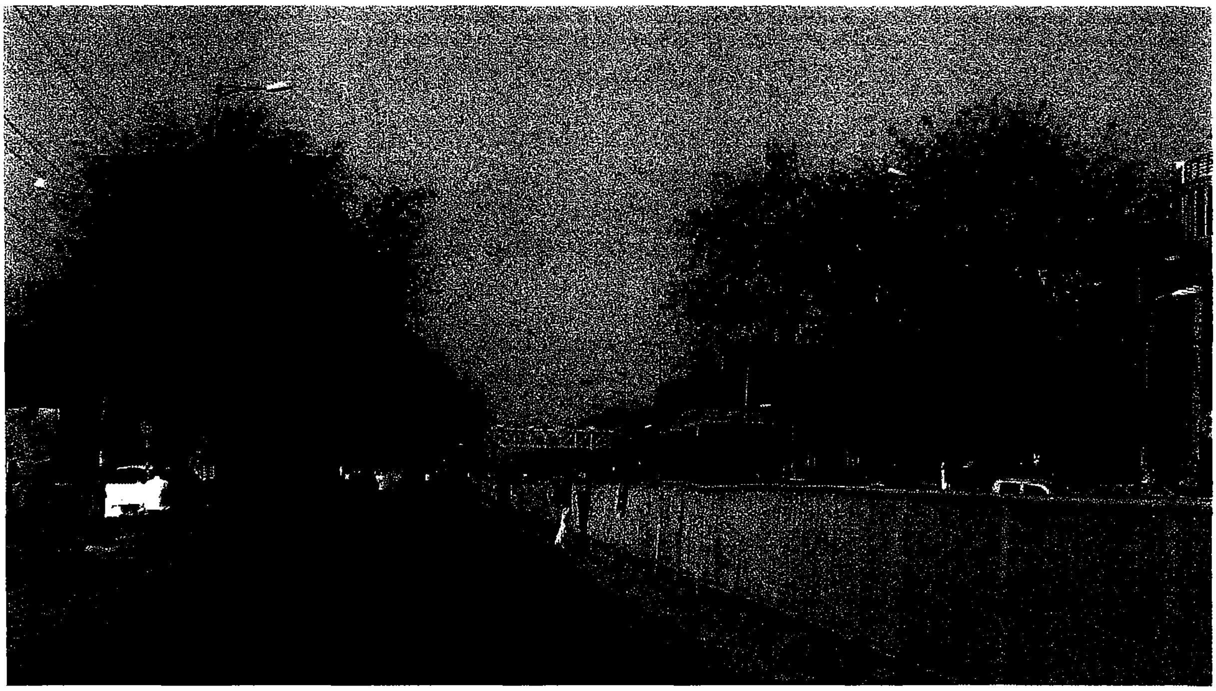


Photo 1.6.24: Breaking of Continuous barrier by the Residents along the highly Populated Madangir on the BRT to facilitate their violations

Photo 1.6.25: Breaking of Continuous barrier along the highly Populated Madangir resulting in more violations

Photo 1.6.26: Unused carriageway on BRT lane near Madangir Pedestrian Crossing

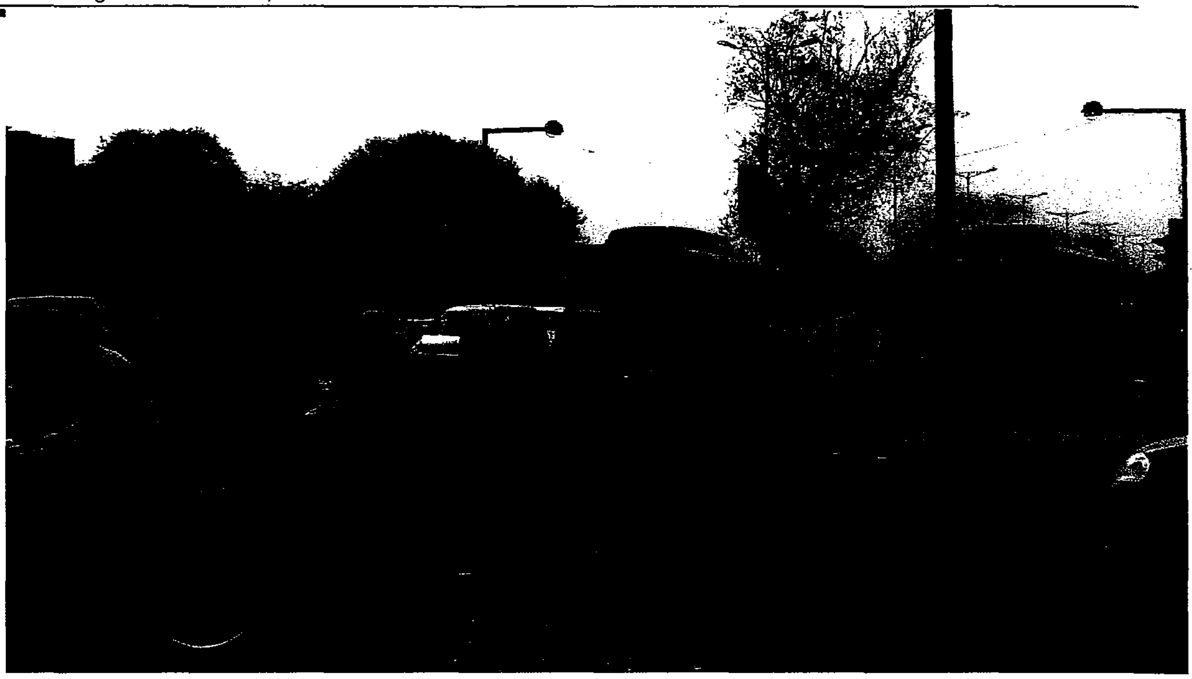


Photo 1.6.27: Traffic Management measures are required to decongest the Badarpur- Mehrauli road

Photo 1.6.28: Sparingly used Foot Over Bridge near Madangir Bus Stop due to the Unauthorized Opening of Metal Barricading

Photo 1.6.29: Under utilization of Road Space on BRT corridor

Having presented the detailed account of the International and National BRTS experiences, the succeeding section discusses the study objectives and scope followed by the structure of the report.

2 OBJECTIVES OF THE STUDY AND REPORT STRUCTURE

2.1 Objectives and Scope of the Study

2.1.1. Objectives of the Study

The objective of the study is as follows:

i) To understand the traffic flow characteristics on the study corridor and thus assess the performance parameters for evaluating the BRT corridor by considering 'with' and 'without' scenarios.

ii) To propose traffic engineering mitigation measures and thus improve the traffic circulation plan at junctions and on the corridor by taking into account the safety of the road users including the pedestrians.

iii) To present a clear direction for improving the traffic movement on the study stretch in terms of evaluating the impact of the New Link connecting Saket and Outer Ring Road

2.1.2. Scope of the Study

The scope of the study is as follows:

The study scope highlighting types of traffic studies accomplished on the study corridor are described in the succeeding sections.

i) **Classified Turning Volume Surveys** on six major intersections falling on the corridor spanning for 16 hours spread over three days consisting of two consecutive working days and one weekend day *(either Saturday or Sunday)* was conducted. The intersections to be covered comprise the following:
   a. Ambedkar Nagar Intersection *(located at Km 0/000)*
   b. Pushpa Bhavan Intersection *(located at Km 1/400)*
   c. Sheik Sarai Intersection *(located at Km 2/000)*
   d. Chirag Delhi Intersection *(located at Km 2/980)*
   e. Siri Fort Intersection *(located at Km 4/420)*
   f. Greater Kailash (GK) - I Crossing Intersection *(located at Km 5/220)*

ii) **Queue Length and Saturation Flow Studies at all the Junctions:** This survey was conducted on the above six major intersections falling on the corridor.

iii) **Pedestrian Volume Counts:** Pedestrian volume counts covering both along and across movement at the designated bus stops, covering six intersections and sidewalks falling on the corridor was conducted.

iv) **Occupancy surveys for all the modes:** This survey was accomplished by enumerating the number of persons travelling in each of the vehicle types covering cars, two wheelers, taxis, auto rickshaws and cyclists.

v) **On-street parking survey:** Based on the reconnaissance visit this survey was conducted near Madangir area spanning for 12 hours on any working day starting from 08:00 AM.

vi) **Speed and Delay studies:** This was accomplished by Probe Vehicle method on each of the motorized and non-motorized vehicle types covering Buses, Cars, Two Wheelers, Auto Rickshaws, Cycles and Cycle Rickshaws.

vii) **Fuel Consumption Studies:** This study was selected by deploying one Petrol and Diesel car as a Probe Vehicle covering time periods of the day on a typical weekend during 'normal BRT operations' as well as 'experimental trial run' operations conducted by CSIR-CRRI.

viii) **Spot speed studies at mid- blocks:** The speed profile of the different vehicle types travelling on the corridor were determined by employing Laser Guns for speed data collection.

ix) **Opinion Surveys:** A crisp interview was carried out to understand the satisfaction level of all types of commuters travelling on the study stretch which would encompass a minimum of 5 per cent stratified random sample covering bus commuters, car travellers, two wheeler riders, auto rickshaw users, cyclists and pedestrians. Here it is to be noted that though it has been envisaged in the TOR communicated by the Transport Department, GNCTD (vide Letter No. F3(49)/TpT/Proj/2012/05 dated 21.03.2012) to cover a minimum of 10 per cent respondents under each of the vehicle categories, it is clarified that it would not be possible to cover such a huge sample size within the envisaged time duration especially in the case of bus commuters, car and two wheelers users. Hence, efforts will be made to cover the above proposed minimum 5 per cent sample size in each vehicle category.

x) **Pedestrian facility including Sidewalks:** This survey was conducted at all bus stops, foot paths, and intersections to identify the available facilities and thus ascertain the adequacy level for pedestrian movement and safety of pedestrians.

xi) **Speed and Delay Studies on similar six lane divided carriageways:** As envisaged earlier, this survey was conducted by deploying Probe Vehicle method on each of the motorized and non motorized vehicle types covering cars, two wheelers, auto rickshaws and buses. However, it is to be noted that the identification of such a corridor carrying similar traffic volume and composition is not an easy task. Also no traffic database exists in CRRI covering the major arterial traffic flows in the city of New Delhi for the last three years. Since the traffic volume has increased rapidly over the last 3 years, it was felt mandatory to carry out the classified traffic volume counts at the identified location(s) to ascertain the traffic levels and thereafter speed and delay studies were carried out on the identified corridor.

xii) Efficacy analysis of allowing other vehicles to ply on the BRT lane on experimental basis for couple of days: This scenario was attempted on experimental basis for couple of days (8 days) to understand the effectiveness of re-routing of other vehicle(s) on the BRT corridor.

xiii) **Simulation of Scenarios 'without' and 'with' BRT on the study corridor:** Simulation exercise was carried out for the 'without' BRT corridor scenario and compare 'with' the existing BRT corridor through sophisticated microscopic traffic simulation software tool (i.e. VISSIM). Based on this, comparative evaluation has been made.

2.2 Study Timeline

In the Court Order vide W.P. (C) 380/2012 dated 15.03.2012, it has been pronounced that the final report to be submitted within six weeks from the date of award of the study by Transport Department, GNCTD by the appointed firm directly to the Court. However, it was clarified by the CSIR-CRRI study team that considering the vast scope of the study requiring rigorous traffic data collection on the study stretch and subsequent comparative evaluation of scenarios considering 'without' and 'with' BRT corridor on the study stretch through practical experimentation as well as microscopic traffic simulation, coupled with the need to carry out a comparative evaluation of the journey speeds and average delay occurring on the study stretch with a similar such corridor in Delhi, it was felt that it is not possible to adhere to the timeline fixed by the Honourable High Court. Eventually, this clarification was furnished by the CSIR-CRRI study team at the time of submission of the technical proposal to the Honourable High Court *(through CRRI letter no. 1 (40 TTP.12 dated 30.03.2012 submitted to GNCTD requesting the latter to file the above clarification to the court)* stating that the study would be accomplished by submitting the report in two parts as given below:

- Interim Report (at the end of six weeks)
- Final Report (time of additional 8 weeks given by Honourable High Court from interim report submission)

2.2.1. Interim Report

The Interim Report was submitted on 16th May, 2012 to the Honourable High Court of Delhi *(copy of the report was also submitted to Transport Department GNCTD and DIMTS)* at the end of six weeks from the date of start of the study. The interim report highlighted the following traffic flow characteristics on the study corridor:

- Classified Turning Flows at five major intersections
- Vehicle occupancy levels on the study across different vehicle types
- Queue lengths and Saturation Flows at the above intersections
- Journey Speeds and average Delay during peak and inter-peak hours
- Spot speed profiles at mid blocks
- Satisfaction level of different road users on the above corridor

- Inventory of the land use along the corridor by highlighting the encroachments and bottlenecks
- Preliminary results of the efficacy analysis of allowing other vehicles *(like cars / two wheelers / auto rickshaws)* to ply on the BRT lane reserved exclusively for bus operations on experimental trial basis as per the directions of the court.

2.2.2 Final Report

This report submission is being done after the grant of the extension by the court for an additional 8 weeks from the date of start of the study. In addition to the aspects listed in the Interim Report, the final report encompasses the following:

- Quantum of Passenger Flows and Passenger Hours on the study corridor
- Pedestrian flows *(at intersections, bus stops and sidewalks)*
- Pedestrian Facility adequacy assessment
- Parking characteristics
- Detailed efficacy analysis of allowing other vehicles *(like cars / two wheelers / auto rickshaws)* to ply on the BRT lane reserved exclusively for bus operations on experimental trial basis as per the directions of the court.
- Fuel Consumption during normal BRT Operations and Experimental Trial Run through Probe vehicle experimentation on one Petrol and Diesel vehicle each.
- Comparison of the normal BRT versus Experimental Trial Run across various performance measure parameters
- Critical comparison of the classified Traffic Flows and Speed characteristics on Delhi BRTS and Ahmadabad BRT corridors.
- Comparative evaluation of the Traffic Flows, Journey Speeds and Average Delay on the Delhi BRT Corridor versus the typical Non-BRTS corridors adjoining to the test section
- Simulation of scenarios 'without' and 'with' BRT on the study corridor
- Impact of New Link connecting Sheikh Sarai with Outer Ring Road through Microscopic simulation

2.3 Organization of the Final Report

The organisation of the report is as follows: Chapter 1 presented a detailed account of the BRT experiences worldwide and including selected BRTS initiatives on Indian cities followed by need for this study based on the directions of the Court Order. Chapter 2 presents the objectives and scope of the study and details of interim and final report. Chapter 3 elaborates on the study methodology conceived for evaluation and the description of traffic surveys conducted. Chapter 4 presents the traffic data analysis including user perception survey results and this is followed by the analysis of the inferences drawn from exhaustive traffic studies carried out on the road stretch. Chapter 5 presents the details of experimental trial run implemented on the BRT corridor. The comparison of various evaluation parameters to evaluate normal BRT and experimental trial run options is discussed in Chapter 6 in detail. The development of microscopic simulation model to evaluate various options on BRT corridor has been presented in Chapter 7. Chapter 8 presents the summary of findings and recommendations to improve vehicular movements on the BRT corridor.

3 STUDY METHODOLOGY AND TRAFFIC SURVEYS

3.1 Methodology Adopted

To achieve the stated objectives presented in the previous chapter, the study methodology has been devised and presented in the form of flow chart as shown in Figure 3.1.1.

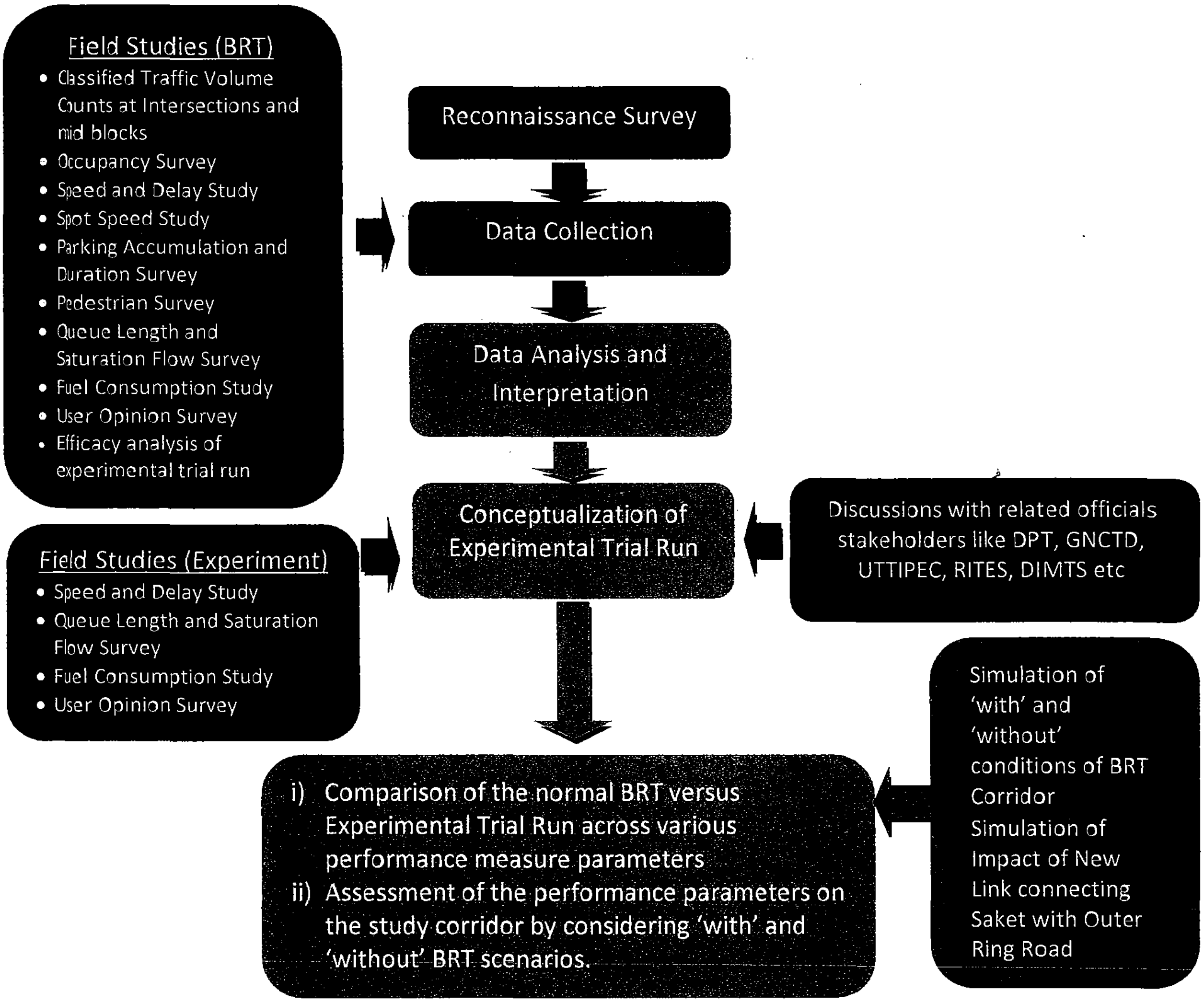


Figure 3.1.1: Devised Methodology for the Present Study

As can be seen from the methodology presented in Figure 3.1.1, the study was initiated by undertaking the reconnaissance visit aimed at understanding the existing road network and related traffic problems and based on the same, the study methodology has been devised. The traffic data collected covering wide spectrum of traffic studies has been judiciously deployed to estimate the vehicular volume, passenger flows, passenger delays, pedestrian flows, average journey speed profile, delay estimation across different vehicle types, estimation of fuel consumption (by running the probe vehicle) of passenger cars and assessment of the parking demand. Having arrived at the quantum of traffic and passenger flows occurring at different intersections during morning peak, evening peak and inter peak period hours based on the above field studies, one of the most important tasks in this project *(as mandated by the Court)*, is the need for conceiving a scientific methodology for the conduct of the experimental trial run which can handle the traffic on the corridor with reasonable degree of traffic throughput. In this regard, discussions were held with various concerned officials and stakeholders so as to make the ground arrangements for the implementation of the trial run on the ground conforming to the plan conceived by the CSIR-CRRI study team. During the course of the experimental trial run, necessary traffic data were collected and based on the same, performance evaluation of the corridor during the experimental trial was carried out and presented in this report. Further, a simulation exercise of the study corridor under 'with' and 'without' conditions of BRT scenarios was conducted *(as per the Terms of Reference given by Transport Department, GNCTD)*. The results of the simulation experiments were appropriately considered towards the assessment of the performance of the corridor by considering under 'with' and 'without' scenarios. Moreover, discussions were held with various stakeholders like DPT, GNCTD, DIMTS, Unified Traffic and Transportation Infrastructure *(Planning & Engineering)* Centre *(termed as UTTIPEC in this report) and RITES.*

Basically these interactions were of immense use in understanding the traffic engineering and transportation planning mitigation measures/ improvement proposals which are being actively considered for improving the traffic circulation plan on the corridor including the safety of the road users like pedestrians. From these discussions, it emerged that it is prudent to consider the impact of new link alternative adjoining the BRT corridor in the form of New Link connecting Sheikh Sarai with Outer Ring Road being considered by UTTIPEC has been simulated and the results are compared with the Business As Usual *(BAU)*. Here it is to be noted that BAU is obviously taken as the continued operation of BRT in its present form.

3.2 Data Collection

The traffic studies listed below were conducted in the present study:

- Classified Traffic Volume Counts of turning movements at the identified intersections of BRT corridor
- Classified Traffic Volume Counts on mid blocks similar to the sections of BRT corridor
- Occupancy Survey
- Speed and Delay Study
- Spot Speed Study
- Parking Accumulation and Duration Survey
- Pedestrian Survey

- Queue Length and Saturation Flow Survey
- Fuel Consumption Study
- User Opinion Survey
- Efficacy analysis of allowing other vehicles to ply on the BRT lane on experimental basis

3.2.1 *Classified Traffic Volume Counts at Intersections*

Classified traffic volume count survey was conducted at five intersections in the month of April 2012. The list of mid blocks selected for the conduct of the Classified Turning Volume Count Survey is presented in Table 3.2.1.

Table 3.2.1: Selected Intersections for Traffic Volume Count Surveys

S. No	Intersection Code	Name of the Intersections	Date of Survey	Time Duration
1	I-01	Ambedkar Nagar Intersection	8.4.2012 - 10.4.2012	16-Hr
2	I-02	Pushpa Bhawan Intersection	8.4.2012 - 10.4.2012	16-Hr
3	I-03	Sheik Sarai Intersection	8.4.2012 - 10.4.2012	16-Hr
4	I-04	Chirag Delhi Intersection*	12.4.2012 - 14.4.2012	24-Hr
5	I-05	Siri Fort Intersection	12.4.2012 - 14.4.2012	16-Hr
6	I-06	GK -I Crossing Intersection	12.4.2012 - 14.4.2012	16-Hr

** 24-hour survey*

These studies were conducted spanning for 16 hours *(starting from 6:00 AM to 10:00 PM)* using the Proforma given in *Annexure - I.* The survey at the above identified intersections was conducted spread over three days covering one weekend and two week days. In addition, the traffic volume count survey was conducted at Chirag Delhi intersection for 24 hours *(i.e. starting from 8:00 AM to 8:00 AM)* on one of the weekdays so as to understand the pattern of traffic movement on this major arterial during the night hours as well. Further, the Passenger Car Unit *(PCU)* factor applied in this study to estimate vehicular volume in PCU is given in Table3.2.2.

Table 3.2.2: PCU Factors deployed for Traffic Studies (IRC: 106, 1990)

S. No	Vehicle Type	PCU Factor
1	Car, Jeep and Van	1.0
2	Two wheelers (Scooter, Motor Cycles and Mopeds)	0.5
3	Three wheelers (Auto rickshaw and Vikram)	0.5
4	Bus, Two Axle Truck (HCV)and Multi axle Trucks (MCV)	3.0
5	Light Commercial Vehicle (LCV)	1.5
6	Tractors and Tractor Trailers	4.5
7	Cycle	0.5
8	Cycle Rickshaws	1.5
9	Other Slow Moving Vehicles	1.5

3.2.2 Classified Traffic Volume Counts at Mid Blocks of Non-BRT Corridors

Classified traffic volume count survey was conducted at three mid block sections in the month of April 2012 and these test sections were selected with the basic criteria that the chosen road section shall be in close proximity to the BRT corridor coupled with chosen test section catering to similar traffic characteristics *(both in terms of volume and composition)* as that of the BRT corridor to the extent possible. The list of mid blocks selected for the conduct of the Classified Traffic Volume Count Survey in the vicinity of BRT corridor is given in Table 3.2.3. These studies were conducted for 16 hours *(starting from 6:00 AM to 10:00 PM)* using the Proforma given in *Annexure - I.*

Table 3.2.3: Selected Mid Blocks for Traffic Volume Count Surveys

S. No	Mid Block Code	Name of the Mid Block Section	Date of Survey	Time Duration
1	MB-01	Aurobindo Marg (near Yusuf Sarai)	17.4.2012	16-Hr
2	MB-02	Mathura Road (near Sundar Nagar)	16.4.2012	16-Hr
3	MB-03	Khel Gaon Marg (Panch Sheel Park Marg)	16.4.2012	16-Hr

3.2.3 Occupancy Studies

In the present study, the Occupancy Survey was conducted at the first five intersections presented in Table 3.2.1 using the Proforma given in *Annexure -II.* This survey was accomplished by enumerating the number of persons travelling in each of the vehicle types covering a sample of cars, two wheelers, taxis, auto rickshaws and cyclists which included the driver / rider of the vehicle as well. Similarly, in the case of public transport, the passenger loads were determined based on the data collected across the cross section of sample of buses by categorizing the passengers loads as Overloaded *(60 persons and above)*, Full *(around 45 persons without standing)*, Half full *(around 25 persons)* and Empty *(2 persons)* as it is not possible to count the exact number of passengers on a moving bus. Based on the output of the survey, the passenger volumes at all these locations were estimated by multiplying with the enumerated traffic volume.

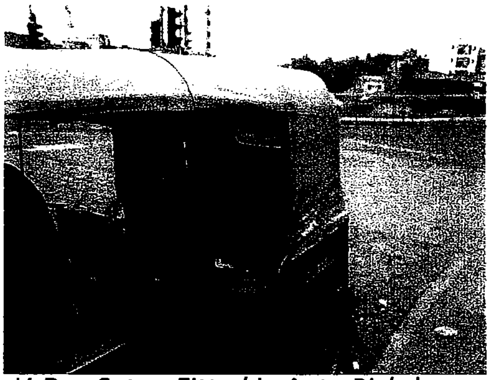
3.2.4 Speed and Delay Studies

Speed and Delay surveys were conducted using the Proforma given in *Annexure - III.* Probe Vehicle method by fitting Global Positioning System *(GPS)* was deployed to conduct this survey during different time periods of the day so as to account for the peak and inter-peak hour traffic separately. This survey was conducted on each of the motorized vehicle types covering cars, two wheelers, auto rickshaws and buses whereas in the case of non-motorized traffic too, cycle and cycle rickshaws were studied. Figure

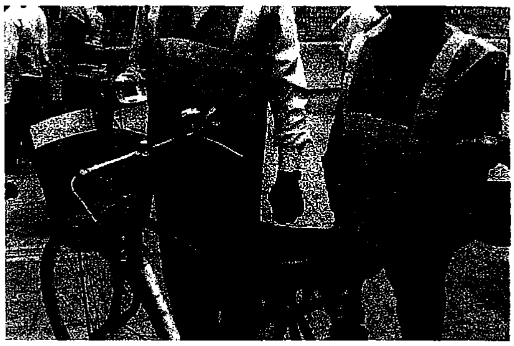
3.2.1 depicts the instrumentation setup deployed across different vehicle types including NMT *(i.e. cycle and cycle rickshaws)* for the measurement of speed and time data logging.

V-Box Setup Fitted in Bus

V-Box Setup Fitted in Car



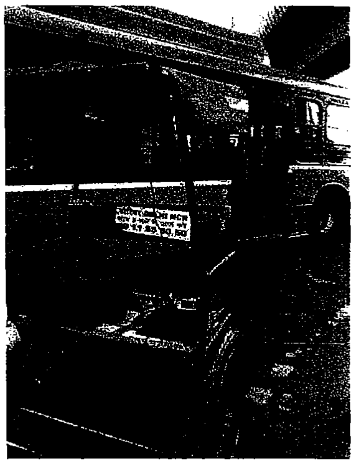
V-Box Setup Fitted in Auto Rickshaw



V-Box Setup Fitted in Cycle

V-Box Setup Fitted on Two Wheeler before the Start of Survey

Survey using V-Box Setup in progress on Two Wheeler



V-Box Setup Fitted on Cycle Rickshaw

Figure 3.2.1: GPS Instrumentation Set-up Employed during Speed and Delay Surveys

Basically, the V-Box instrument records the GPS distance coordinates coupled with speed of the vehicle and time readings at every 0.1 seconds. This means that for 10 minutes of travel time, it records 6000 readings. Sometimes if the test vehicle passes under the flyover or very dense row of trees, there may be chances of distraction of signal and the speed measured at that instance of 0.1 seconds could be erroneous (As reported in the V-Box manual, this is primarily caused due to velocity noise caused by poorly positioned antennas or by multipath reflections from nearby trees and buildings and thus can affect the measured time of an acceleration run or a deceleration run from a speed to zero). Basically the speed values so obtained at any particular instance of 0.1 seconds time observed from the GPS only illustrates the maximum speed of the test vehicle at a given instant. This is the maximum accelerated speed which does not last long continuously beyond 0.1 to 1 second even during the entire test run. Moreover, this value will not have any impact on the ultimate analysis as these instantaneous speed values are not at employed towards the determination of speed characteristics. Basically, these were used only to report the maximum speed that is achieved by the test vehicle during the experiment. Therefore, in the event of occurrence of any distorted values observed during the test run, the same were removed from the dataset and the subsequent maximum speed value obtained from the GPS data is presented in this final report. To summarize, the journey speeds used in the analysis are based on the distance coordinates tracked by GPS and their corresponding timer value in the V-BOX which is recorded continuously during the survey.

Using the above data, the journey speeds were calculated for different sections of the corridor by considering the start and end distance coordinates and their corresponding V-Box timer values.

3.2.5 Spot Speed Study

In order to assess road safety situation on BRT corridor, it is necessary to understand the operating speeds of the different vehicles. Consequently, the speed profile of the different vehicle types travelling on the corridor were determined by employing Laser Guns for speed data collection so as to understand the percentage of vehicles travelling beyond the posted speed limits on the corridor (Proforma given in *Annexure - IV*). The spot speed survey was conducted at Krishi Vihar and Mid Block Section near Sheik Sarai covering both directions of the travel.

3.2.6 Parking Studies

Based on the reconnaissance visit this survey has been conducted near Madangir area spanning for 12 hours on any working day starting from 08:00 AM (Proforma given in *Annexure - V*). These studies include parking accumulation and duration surveys at the selected locations.

3.2.7 Pedestrian Studies

The pedestrian volume counts covering both along and across movement at the six intersections and two foot over bridges and one at-grade pedestrian crossing falling on the corridor. This survey was carried out covering the morning and evening peak period of traffic flows spanning for about 4 hours each using Proforma given in *Annexure - VI*. Based on the output of the survey, quantum of pedestrian volumes was assessed.

3.2.8 Queue Length and Saturation Flow Survey

As in the case of other types of traffic surveys, the queue length survey was also conducted at the five intersections falling on the corridor. The queue build-up on the different approach roads of the intersections was accomplished by ear marking every 50 m / 100 m section in the intersection area coupled with posting of enumerators at strategic locations on each of the arms of the intersections *(approach-wise)* for the measurement of queue length (Proforma given in *Annexure - VII*). Further, the saturation flow survey was carried out in tandem with the above queue length survey so as to understand the quantum of dispersal rate occurring from each of the approach arms of the intersections during the various stages / phasing of each signal cycle. (Proforma presented in *Annexure - VIII*).

3.2.9 Fuel Consumption Studies

As part of the evaluation of the BRT corridor performance from Ambedkar Nagar to Mool Chand, fuel consumption studies were independently carried out. In this study, sophisticated fuel consumption equipments fitted with V-BOX available with CRRI were utilised. These equipments were fitted on the petrol and diesel driven cars before the start of the fuel consumption experiments. The instrumentation setup consisted of a fuel flow detector, fuel flow meter and Global Positioning System *(GPS)* based data acquisition system. The instrumentation system differs slightly across petrol *(MPFI)*, and diesel driven vehicles. Further, this instrumentation system is capable of measuring the fuel consumption data with the least count of tenth of milliliter/second *(0.1ml/sec.)* coupled with the automatic generation of the distance traversed as an output because of the GPS integration. Since the GPS equipment is part of the instrumentation system, the distance measurement yields from the system are very accurate which has enabled in arriving at the journey speed, idling time estimates. By deploying the above instrumentation system, the fuel consumption was measured under the typical Indian urban traffic conditions *(i.e. cruising conditions followed by stop and go conditions)* as well as during idling conditions *(due to signals, traffic congestion, etc)* separately.

3.2.10 User Opinion Survey

User Opinion Survey was carried out by interviewing different users on the BRT corridor to understand the satisfaction level of all types of commuters travelling on the study stretch which would encompass a minimum of 5 per cent stratified random sample covering bus commuters, car travellers, two wheeler riders, auto rickshaw users, cyclists and pedestrians. Here it is to be noted that though it has been envisaged in the TOR communicated by the Transport Department, GNCTD *(vide Letter No. F3 (49)/TpT/Proj/2012/05 dated 21.03.2012)* to cover a minimum of 10 per cent respondents under each of the vehicle categories, it is clarified that it would not be possible to cover such a huge sample size within the envisaged time duration. Hence, efforts were made to cover the above proposed minimum 5 per cent sample size in each vehicle category. The Proforma designed for collection of the user perception on the corridor covering types of road users is presented in *Annexure - IX.*

More than 9,842 respondents were interviewed starting from 16th to 27th April, 2012 covering different types of road users during the normal period of BRT operations. As can be noted from Annexure VI, the questions fielded to the different types of road users has been kept to a minimum and simple aimed at soliciting crisp answers from the respondents. Similarly about 14,105 road users were interviewed to understand the perception of the road users on the experimental trial run operations conducted by the CSIR-CRRI study team. Since this survey is focussed on understanding the user perception on the trial run, only two questions were posed to the respondents. The road users were asked to voice their opinion and time saving *(if any)* on the interim traffic arrangement which was in vogue from 12th May to 19th May 2012 managed by CSIR-CRRI study team.

3.2.11 Efficacy Analysis for Experimental Trial Run

Apart from the above traffic surveys, the efficacy analysis of allowing other vehicles to ply on the BRT lane on experimental basis for eight days was accomplished as per the Court order as well as the TOR. For this purpose, the trial run was conceptualised and implemented on the study corridor from 12.5.2012 to 19.5.2012. Here it may be noted here that though the CSIR-CRRI study team was slated to complete the experimental trial run on 17th May 2012 itself as per the initial arrangement, the management of the road corridor was continued up to 19th May, 2012, *(10:00 p.m.)* until the official formalities were completed towards the handover of the road corridor to DIMTS for subsequent road traffic management as per the communication received from Transport Department, GNCTD. Eventually, the traffic performance measure data was also collected by the CSIR-CRRI study team till 19th May, 2012.

Having clearly outlined the methodologies for the conduct of the various types of traffic surveys including user perception survey and fuel consumption experiments, the succeeding chapter discusses on the results arrived from the exhaustive analysis carried out under the normal BRT operations on the study corridor.

4 DATA ANALYSIS

4.1 Traffic Volume Study at Intersections

As detailed in Section 3.2.1, the traffic volume count survey was conducted at the six intersections spanning for 16 hours. At Chirag Delhi Intersection, flyover traffic was separately collected and considered as a Mid Block location. The collected traffic volume data *(15-minute interval)* was analysed hourly and thereafter peak hour flows are estimated in terms of vehicles/hour and converted to Passenger Car Units / hour *(PCU/hr)*. The traffic flow diagram was plotted for all the intersections to understand the turning flows. The hourly variation of traffic volume and traffic composition at the six intersections observed over three days continuously (two weekdays and one day weekend). The typical data collected analysed for Chirag Delhi Intersection is given in Table 4.1.1 and Figure 4.1.1. In that Figure 4.1.1, hourly variation of classified volume count, traffic composition and peak hour flow diagram at Chirag Delhi Intersection on normal working day is shown.

From the Table 4.1.1 and Figure 4.1.1, it can be seen that the 16 hour volume is around 1.98 Lakh vehicles and 1.54 Lakh PCUs at this junction. This volume is excluding flyover traffic. For other five intersections, the analysed data is given in *Annexure X* which shows classified volume count, traffic composition and peak hour flow diagram at each intersection observed in three days. The classified traffic volume summary of all the six intersections on all the days approaches is given in Table 4.1.2. The summary of total traffic flows, peak hour flows and peak hour for all the intersections has been given in Table 4.1.3. The daily variation of these traffic volumes at these intersections is pictorially shown in Figure 4.1.2. From the intersection traffic data analysis, the following inferences were drawn:

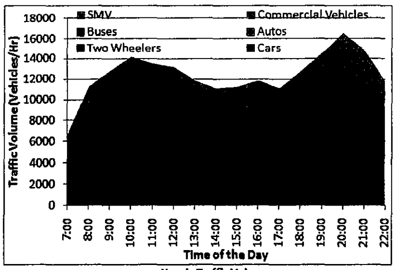
- It was observed that 16-hour traffic volume is varying from about 55,000 to 1,54,000 PCUs. The maximum traffic volume was observed at Chirag Delhi Intersection and minimum can be found at Siri Fort Intersection. The peak hour flow is varying from 12,272 PCU/hr at Chirag Delhi Intersection to 4,920 PCUs/hr at Siri Fort.
- On a working day, maximum peak hour flow is observed during the evening hours at Ambedkar Nagar, Pushpa Bhawan and Chirag Delhi whereas in the case of remaining intersections peak hour is observed during the morning peak hour.
- Fast Moving Vehicle *(FMV)* constitutes 78 percent of total traffic and Slow Moving Vehicle *(SMV)* accounts 22 percent at Ambedkar Nagar and Pushpa Bhawan whereas at the other remaining intersections, share of FMV is as high as 94 per cent.

Table 4.1.1: Classified Traffic Volume at Chirag Delhi Intersection

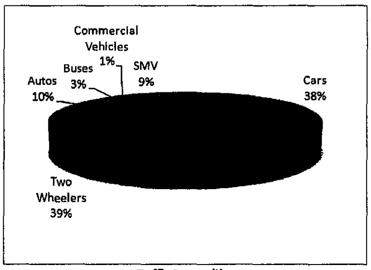
Road/ Intersection Name: **Chirag Delhi Jn** Intersection Code: **I-04**

Date: **12.4.2012** Time Period: From **06:00** To **22:00**

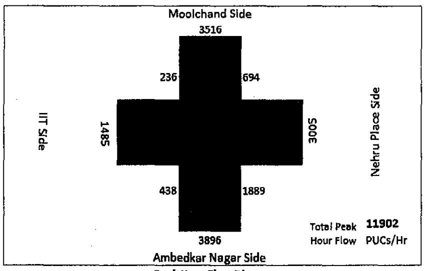
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Comme-rcial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	1539	706	290	457	374	114	2070	116	52	8	811	114	5726	925	6651	6092
7:00	8:00	2545	1464	423	754	546	123	3628	147	80	10	1382	136	9721	1518	11239	9916
8:00	9:00	2775	1421	329	1200	316	64	4297	96	38	2	2150	73	10538	2223	12761	9806
9:00	10:00	2692	1578	364	1277	326	41	5169	65	32	4	2538	47	11548	2585	14133	10472
10:00	11:00	3209	1788	451	1457	193	46	4873	110	29	0	1258	41	12156	1299	13455	10224
11:00	12:00	3224	1945	342	1215	236	25	5311	102	35	6	630	71	12441	701	13142	10261
12:00	13:00	2709	1807	340	1217	213	46	4774	117	54	8	414	88	11285	502	11788	9316
13:00	14:00	2602	1479	372	1124	257	48	4652	84	37	6	304	47	10661	351	11012	8693
14:00	15:00	2395	1522	375	1306	304	81	4640	80	44	7	387	47	10754	434	11188	8869
15:00	16:00	2590	1754	314	1419	297	49	4830	94	61	7	330	61	11415	391	11805	9388
16:00	17:00	2471	1518	317	1384	246	47	4406	91	54	9	442	49	10543	491	11033	8666
17:00	18:00	2823	1863	359	1397	208	53	4996	44	24	4	859	57	11771	916	12687	9644
18:00	19:00	2819	1730	371	1546	278	68	6181	38	23	2	1325	46	13056	1371	14427	10610
19:00	20:00	3179	2203	428	1681	212	42	7380	61	26	2	1211	39	15214	1250	16465	11902
20:00	21:00	3134	2248	378	1421	216	35	6018	63	22	1	1208	70	13536	1278	14814	11089
21:00	22:00	2586	1852	308	1133	174	12	4552	52	23	1	896	61	10693	957	11650	8851
Total		43292	26878	5761	19988	4397	894	77777	1360	634	77	16146	1047	181058	17193	198251	153799
														Peak Hour		16465	11902
														Peak Time		19:00	20:00



Hourly Traffic Volume



Traffic Composition



Peak Hour Flow Diagram

Figure 4.1.1: Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Chirag Delhi Intersection

Table 4.1.2: Summary of Classified Traffic Volume at different Intersections on BRT Corridor in different days of Week

Name of the Intersection	Approach	Small Car (CS)	Big Car / SUV (CB)	Taxi (T)	Auto (A)	Bus (B)	Mini Bus (MB)	Two Wheeler (TW)	Light Truck (LT)	Two Axle Truck (HT)	Multi Axle Truck (MT)	Cycle (CYC)	Cycle Rick-shaw and Other	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
Ambedkar Nagar (08.04.2012)	Moolchand	3528	907	508	3042	497	15	16202	412	208	45	9313	1031	25364	10344	35708	24242
	Badarpur	5688	1771	348	4037	2225	35	14314	433	300	64	8050	243	29215	8293	37508	30058
	Mehrauli	6424	2881	29	2505	3356	38	37429	631	293	86	5598	2411	53672	8009	61680	49258
	Total	**15640**	**5559**	**885**	**9583**	**6078**	**88**	**67944**	**1476**	**801**	**195**	**22961**	**3685**	**108250**	**26646**	**134896**	**103558**
Ambedkar Nagar (09.04.2012)	Moolchand	4291	4228	356	2266	968	116	13017	293	192	204	5986	179	25931	6165	32095	24880
	Badarpur	7336	2794	2088	5923	3359	373	22258	1390	821	43	14655	530	46385	15185	61569	50076
	Mehrauli	5332	3689	289	4371	2013	133	26240	1312	215	24	10375	203	43617	10578	54195	39168
	Total	**16959**	**10711**	**2732**	**12559**	**6340**	**622**	**61515**	**2995**	**1228**	**271**	**31015**	**912**	**115932**	**31927**	**147860**	**114124**
Ambedkar Nagar (10.04.2012)	Moolchand	2854	1270	578	3999	1001	98	22914	222	106	19	9650	239	33061	9889	42951	27350
	Badarpur	5152	2430	195	5742	2711	216	20902	228	79	17	22288	11	37672	22299	59971	41377
	Mehrauli	6069	5861	132	3485	1637	288	29123	1232	232	15	8490	129	48074	8619	56693	40824
	Total	**14075**	**9562**	**905**	**13226**	**5349**	**602**	**72939**	**1682**	**417**	**51**	**40428**	**379**	**118808**	**40807**	**159615**	**109551**
Pushpa Bhawan (08.04.2012)	Moolchand	6282	2222	148	9179	845	108	12147	362	57	0	11390	2186	31350	13576	44926	32796
	Dakshinpuri	2262	779	14	4416	99	47	7589	48	10	4	5566	690	15268	6256	21523	13709
	Ambedkar Nagar	4273	2499	1013	6352	1029	77	11287	40	23	6	6588	94	26599	6682	33281	23443
	Saket	2981	1868	198	4532	135	68	7502	92	4	0	2988	562	17380	3550	20930	14341
	Total	**15798**	**7368**	**1373**	**24478**	**2108**	**300**	**38525**	**542**	**94**	**10**	**26532**	**3532**	**90596**	**30064**	**120660**	**84289**
Pushpa Bhawan (09.04.2012)	Moolchand	11282	2446	1127	8508	1228	262	16512	630	44	68	12456	1465	42107	13921	56028	41983
	Dakshinpuri	8915	3554	528	8816	275	234	24092	32	2	0	8982	974	46448	9956	56404	37121
	Ambedkar Nagar	4410	2470	23	4900	1885	191	12028	47	19	2	8629	272	25975	8901	34876	26303
	Saket	3891	1386	1227	4298	293	151	7622	20	6	3	2383	245	18897	2628	21525	15312
	Total	**28498**	**9856**	**2905**	**26522**	**3681**	**838**	**60254**	**729**	**71**	**73**	**32450**	**2956**	**133427**	**35406**	**168834**	**120719**
Pushpa Bhawan (10.04.2012)	Moolchand	8643	3449	264	10199	1562	536	18771	231	44	17	11880	418	43716	12298	56014	39661
	Dakshinpuri	4236	1029	264	6156	192	111	11370	28	3	0	8644	186	23389	8830	32219	19781
	Ambedkar Nagar	5850	2065	218	9093	1153	100	12733	80	12	9	11315	272	31313	11587	42900	29054
	Saket	2673	2344	152	4600	358	149	9178	27	0	0	3974	172	19481	4146	23627	15728
	Total	**21402**	**8887**	**898**	**30049**	**3265**	**896**	**52052**	**366**	**59**	**26**	**35813**	**1048**	**117900**	**36861**	**154760**	**104224**
Sheik Sarai (08.04.2012)	Moolchand	11124	4114	1050	6628	314	40	12495	388	5	7	3821	2722	36165	6543	42708	34839
	Ambedkar Nagar	5142	3559	1115	3012	918	197	13272	751	220	5	1117	378	28191	1495	29686	24135
	Saket	8014	5962	895	3985	201	40	6779	440	17	14	639	300	26347	939	27286	22614
	Total	**24280**	**13635**	**3060**	**13625**	**1433**	**277**	**32546**	**1579**	**242**	**26**	**5577**	**3400**	**90703**	**8977**	**99680**	**81588**
Sheik Sarai (09.04.2012)	Moolchand	15151	11333	619	4859	1738	612	15448	272	44	3	2746	462	50079	3208	53287	46244
	Ambedkar Nagar	4907	2373	1178	5589	1437	232	17828	359	24	2	3080	105	33929	3185	37114	27198
	Saket	9002	7301	1102	4434	384	141	10771	191	39	13	1775	130	33378	1905	35283	27984
	Total	**29060**	**21007**	**2899**	**14882**	**3559**	**985**	**44047**	**822**	**107**	**18**	**7601**	**697**	**117386**	**8298**	**125684**	**101426**
Sheik Sarai (10.04.2012)	Moolchand	16535	11921	559	3909	1776	570	16160	303	42	1	2457	267	51776	2724	54500	47584
	Ambedkar Nagar	6344	3015	778	3479	1584	170	13089	346	119	0	2469	108	28924	2577	31501	25758
	Saket	7962	6483	1028	3551	382	145	9928	170	78	16	1312	123	29743	1435	31178	25042
	Total	**30841**	**21419**	**2365**	**10939**	**3742**	**885**	**39177**	**819**	**239**	**17**	**6238**	**498**	**110443**	**6736**	**117179**	**98384**

Table 4.1.3: Summary of Classified Traffic Volume at different Intersections on BRT Corridor in different days of Week (Contd..)

Name of the Intersection	Approach	Small Car (CS)	Big Car / SUV (CB)	Taxi (T)	Auto (A)	Bus (B)	Mini Bus (MB)	Two Wheeler (TW)	Light Truck (LT)	Two Axle Truck (HT)	Multi Axle Truck (MT)	Cycle (CYC)	Cycle Rick-shaw and Other	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
Chirag Delhi (12.04.2012)	Moolchand	9594	7725	506	5161	911	266	21639	71	29	0	3323	124	45902	3447	49349	36460
	Nehru Place	11469	8087	2720	4586	833	85	17798	443	229	9	2347	294	46259	2641	48900	39248
	Ambedkar Nagar	18316	8266	1849	8257	2283	318	31387	648	333	62	6328	116	71720	6444	78164	61227
	IIT	3913	2800	686	1984	370	226	6953	198	43	6	4147	513	17178	4660	21838	16869
	Total	**43292**	**26878**	**5761**	**19988**	**4397**	**894**	**77777**	**1360**	**634**	**77**	**16146**	**1047**	**181058**	**17193**	**198251**	**153804**
Chirag Delhi (13.04.2012)	Moolchand	10374	9411	1114	6463	646	183	19363	346	52	41	6171	329	47994	6500	54494	40630
	Nehru Place	14019	7657	1522	5959	407	136	17631	282	88	10	3520	218	47711	3738	51449	39348
	Ambedkar Nagar	16851	9618	1267	9083	1911	382	24377	539	219	43	9624	496	64290	10120	74410	58236
	IIT	4394	2685	745	1967	134	69	6381	120	8	0	2872	1	16502	2873	19375	14144
	Total	**45638**	**29371**	**4648**	**23472**	**3098**	**770**	**67752**	**1287**	**367**	**94**	**22187**	**1044**	**176497**	**23231**	**199728**	**152358**
Chirag Delhi (14.04.2012)	Moolchand	7010	5517	1687	5585	686	207	14893	249	5	1	4429	169	35840	4598	40438	29768
	Nehru Place	13229	11308	1369	4174	530	43	13775	515	128	20	5594	231	45091	5825	50915	41041
	Ambedkar Nagar	18146	11186	1375	7340	1234	118	24567	692	230	21	2864	220	64908	3084	67992	54234
	IIT	3086	2524	260	567	36	32	5705	52	5	1	2525	73	12268	2598	14866	10668
	Total	**41471**	**30535**	**4691**	**17666**	**2485**	**400**	**58940**	**1508**	**368**	**43**	**15411**	**693**	**158107**	**16104**	**174211**	**135711**
Sirifort (12.04.2012)	Moolchand	11324		605	3378	839	245	15682	760	64	6	1419	163	32902	1582	34485	26737
	GK-I	5263		185	1488	67	60	3607	100	9	0	196	29	10779	225	11004	8619
	Ambedkar Nagar	12179		1467	3257	1021	529	19234	387	86	15	2966	298	38174	3264	41439	31733
	Khel Goan	5361		301	1589	343	174	6818	162	36	5	1126	342	14788	1468	16256	12777
	Total	**34126**		**2557**	**9712**	**2269**	**1008**	**45340**	**1409**	**195**	**26**	**5708**	**832**	**96643**	**6540**	**103183**	**79866**
Sirifort (13.04.2012)	Moolchand	12387		1644	3562	995	557	4914	393	130	26	2727	452	24607	3179	27786	25453
	GK-I	4778		301	1672	329	151	1571	133	38	1	1157	277	8974	1434	10408	9365
	Ambedkar Nagar	2835		500	3796	1154	2250	726	747	106	2	1340	105	12115	1445	13560	14761
	Khel Goan	5459		286	1402	56	42	875	99	16	2	543	58	8237	601	8838	7708
	Total	**25458**		**2731**	**10432**	**2534**	**3000**	**8087**	**1372**	**290**	**31**	**5767**	**892**	**53933**	**6659**	**60592**	**57287**
Sirifort (14.04.2012)	Moolchand	10359		379	2158	1283	171	1823	460	83	214	2379	927	16929	3306	20235	21777
	GK-I	3795		237	1322	214	40	858	70	46	3	1563	137	6584	1700	8284	7136
	Ambedkar Nagar	13371		242	6423	432	116	2142	217	247	0	116	31	23191	147	23338	20553
	Khel Goan	3820		116	989	45	4	617	43	92	5	445	12	5730	457	6187	5489
	Total	**31345**		**974**	**10891**	**1974**	**330**	**5440**	**790**	**468**	**222**	**4503**	**1107**	**52434**	**5610**	**58044**	**54955**
GK-I (12.04.2012)	Moolchand	16047		562	2106	538	55	8270	90	10	4	76	47	27682	123	27805	23811
	GK-I	19318		764	2474	631	36	11181	59	21	7	147	429	34491	576	35067	29976
	Ambedkar Nagar	14741		2177	4030	1096	617	20631	391	67	4	1912	309	43754	2221	45975	35845
	Total	**50106**		**3503**	**8610**	**2265**	**708**	**40082**	**540**	**98**	**15**	**2135**	**785**	**105927**	**2920**	**108847**	**89632**
GK-I (13.04.2012)	Moolchand	15536		630	1896	376	53	7824	84	13	5	72	80	26417	152	26569	22621
	GK-I	19037		941	2020	643	49	13343	89	10	7	205	218	36139	423	36562	30399
	Ambedkar Nagar	15628		2383	4075	985	645	19607	413	125	18	1884	422	43879	2306	46185	36640
	Total	**50201**		**3954**	**7991**	**2004**	**747**	**40774**	**586**	**148**	**30**	**2161**	**720**	**106435**	**2881**	**109316**	**89660**
GK-I (14.04.2012)	Moolchand	13355		1229	2825	627	32	6981	210	135	0	248	92	25394	340	25734	22448
	GK-I	22053		1549	3859	1114	60	10044	449	141	49	419	142	39318	561	39879	35799
	Ambedkar Nagar	16134		606	4441	486	60	9110	757	90	0	761	212	31684	973	32657	27277
	Total	**51542**		**3384**	**11125**	**2227**	**152**	**26135**	**1416**	**366**	**49**	**1428**	**446**	**96396**	**1874**	**98270**	**85524**

Table 4.1.4: Summary of Intersection Traffic Flows Observed on different days of Week and Weekend

Name of the Intersection	Date	Day	Total Traffic Volume (Vehicles)	Total Traffic volume (PCUs)	Peak hour volume (Vehicles)	Peak hour volume (PCUs)	Peak hour
Ambedkar Nagar Intersection	08-04-2012	Sun	134896	103560	13762	9633	19:00-20:00
	09-04-2012	Mon	147860	114121	13198	9498	20:00-21:00
	10-04-2012	Tue	159615	109547	13964	9415	19:00-20:00
Pushpa Bhawan Intersection	08-04-2012	Sun	120660	84285	10264	7201	19:00-20:00
	09-04-2012	Mon	168834	120718	14354	9639	19:00-20:00
	10-04-2012	Tue	154760	104223	13439	8955	19:00-20:00
Sheik Sarai Intersection	08-04-2012	Sun	99680	81578	8256	6663	18:00-19:00
	09-04-2012	Mon	125684	101417	13761	10054	09:00-10:00
	10-04-2012	Tue	117179	98378	11393	8896	09:00-10:00
Chirag Delhi Intersection	12-04-2012	Thu	198251	153799	16465	11902	19:00-20:00
	13-04-2012	Fri	199728	152355	15812	12272	19:00-20:00
	14-04-2012	Sat	174211	135709	15488	11884	19:00-20:00
Siri Fort Intersection	12-04-2012	Thu	103183	79861	10114	7575	09:00-10:00
	13-04-2012	Fri	70315	67000	6942	6631	19:00-20:00
	14-04-2012	Sat	58044	54954	5388	4920	19:00-20:00
GK-I Intersection	12-04-2012	Thu	108847	89626	10293	8383	19:00-20:00
	13-04-2012	Fri	109316	89652	10180	8369	19:00-20:00
	14-04-2012	Sat	98270	85517	8113	7138	19:00-20:00

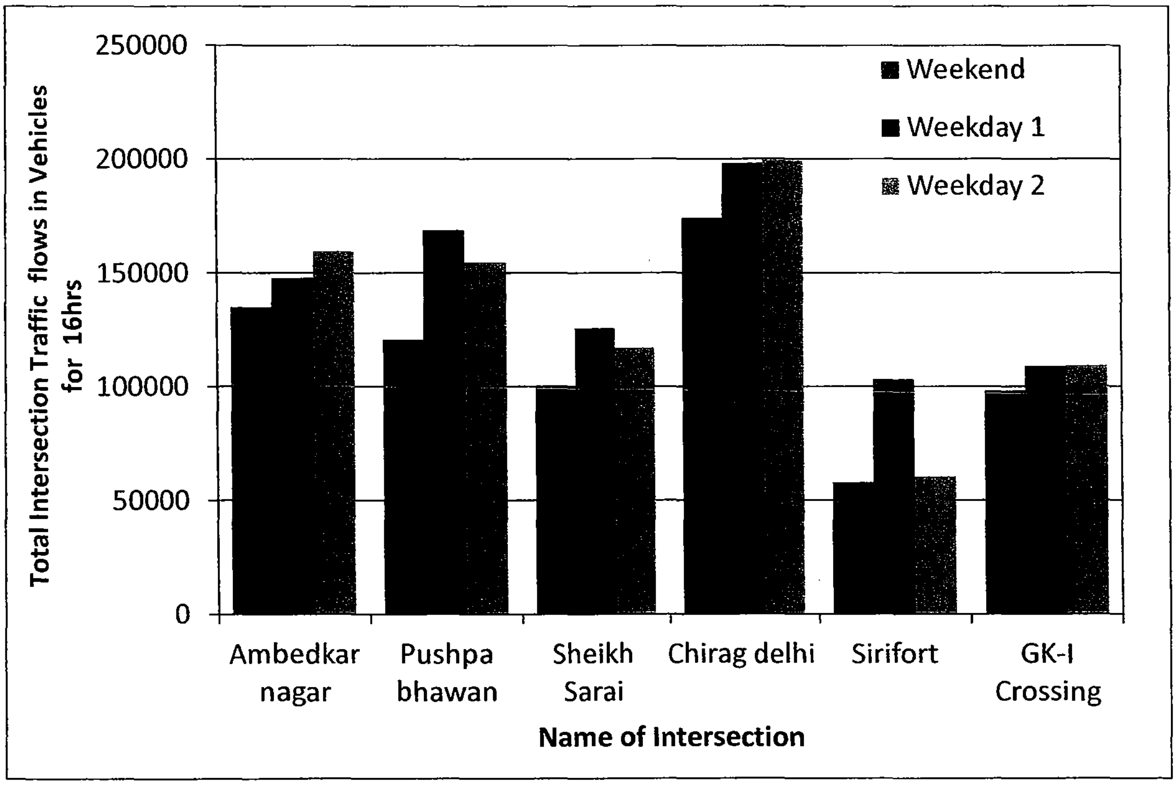


Figure 4.1.2: Daily Variation of Traffic Flows at different Intersections

- The share of Bus is about 5 percent at Ambedkar Nagar Intersection whereas at the remaining intersections, it is ranging about 2 - 5 percent.
- The share of car and two wheeler traffic is varying from about 77 to 82 percent at the three intersections namely Sheikh Sarai, Chirag Delhi and Siri Fort whereas in the case of Ambedkar Nagar and Pushpa Bhawan Intersections, the share of the same is about 60 percent.
- Auto Rickshaws composition is about 10 percent except at Pushpa Bhawan the share of autos is about 16 percent.
- Goods vehicles including Light Commercial Vehicles (LCV), Two Axle Heavy Commercial Vehicles (HCV) and Multi Axle Heavy Commercial Vehicles (MCV) constitute only about 1 to 3 percent as this is a typical urban corridor in the city wherein the entry of goods traffic is prohibited for effective part of the day.

4.2 Traffic Volume Study at Mid Blocks

As discussed in Section 3.2, the traffic volume count survey was conducted at three mid blocks for a period of 16-hours on the non-BRT road sections adjoining the study corridor i.e. J.B. Tito Marg. The collected traffic volume data (15-minute interval) was also analysed hourly and estimated peak hour flows presented in the form of both vehicles/hr and PCU /Hr. The typical data collected analysed for Aurobindo Marg is given in Table 4.2.1 and Figure 4.2.1. In that Figure 4.2.1, hourly variation of classified volume count and traffic composition on Aurobindo Marg near Yusuf Sarai on normal working day is shown.

From the Table 4.2.1 and Figure 4.2.1, it can be seen that the 16 hour volume is around 75,000 vehicles and 62,500 PCUs on this mid block section. For other two mid block sections, the analysed data is given in *Annexure X* which shows classified volume count and traffic composition at each mid block. The classified traffic volume summary of all three mid block sections showing total traffic flows and peak hour flows is given in Table 4.2.2.

From the mid block traffic data analysis, the following inferences were drawn:

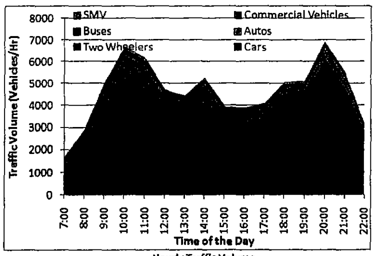
- Traffic volume is varying from about 45,000 PCUs (on Khel Gaon Marg) to 63,000PCUs (on Aurobindo Marg) for 16-hour duration. The maximum peak hour flow in PCU/hr of about 6,000 observed on Aurobindo Marg.
- The fast moving vehicles (FMV) are observed to be varying from 90 to 98 percent of total traffic and slow moving vehicle (SMV) has very insignificant. The car composition is very high and it is varying from about 40 to 55 percent followed by two wheelers accounting for about 15 to 40 percent.
- Auto rickshaws composition is also varying from 14 to 18 percent across different intersections. The commercial vehicles include LCV, HCV and MCV constitutes about 1 to 2 percent whereas buses account for a maximum percentage of 2 percent.

Table 4.2.1: Classified Traffic Volume on Aurobindo Marg (Near Yusuf Sarai)

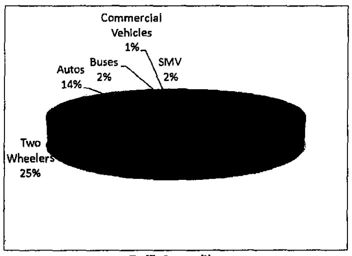
Road/ Intersection Name: **Aurobindo Marg** Intersection Code: **MB-02**

Date: **17.4.2012** Time Period: From **06:00** To **22:00**

Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Comme-rcial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	467	261	294	243	66	13	225	51	10	1	56	0	1630	56	1686	1611
7:00	8:00	897	542	444	302	107	20	504	54	11	0	48	2	2881	50	2931	2780
8:00	9:00	1570	987	446	827	125	13	951	17	3	0	107	5	4939	112	5051	4384
9:00	10:00	1897	865	644	1155	138	22	1797	15	3	0	138	1	6536	139	6675	5431
10:00	11:00	1870	912	283	1141	92	11	1670	16	6	0	149	7	6001	156	6157	4894
11:00	12:00	1463	845	190	787	74	6	1207	51	5	0	64	6	4629	70	4699	3863
12:00	13:00	1202	774	257	678	84	3	1274	94	9	0	40	6	4375	46	4421	3666
13:00	14:00	1516	921	249	905	64	10	1468	44	4	2	56	19	5183	75	5258	4233
14:00	15:00	1062	791	220	664	71	3	1007	65	7	0	30	10	3890	40	3931	3281
15:00	16:00	983	744	293	546	49	2	1204	37	3	0	21	11	3861	32	3893	3142
16:00	17:00	1140	823	283	589	65	5	1126	22	4	0	27	7	4057	34	4091	3378
17:00	18:00	1532	881	251	636	81	6	1547	31	5	0	75	14	4970	89	5059	4135
18:00	19:00	1554	945	361	571	84	8	1446	18	12	1	82	15	5000	97	5097	4271
19:00	20:00	2434	1766	291	608	87	9	1607	17	3	0	61	18	6822	79	6901	5974
20:00	21:00	1935	1254	295	645	64	3	1252	13	7	0	27	15	5468	42	5510	4713
21:00	22:00	1041	740	164	274	44	2	745	8	5	0	66	2	3023	68	3090	2653
Total		22563	14051	4965	10571	1294	138	19030	553	97	4	1046	138	73266	1184	74450	62409
															Peak Hour	6901	5974
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition

Figure 4.2.1: Hourly Traffic Variation and Traffic Composition on Aurobindo Marg (Near Yusuf Sarai)

Table 4.2.2: Summary of Mid block Section Traffic Flows

Name of the Mid-Block Section	Date	16 Hour Total Traffic Volume (Vehicles)	16 Hour Total Traffic Volume (PCUs)	Peak Hour Volume (Vehicles)	Peak Hour Volume (PCUs)	Peak Hour
Khel Gaon Marg (Near Yusuf Sarai)	16-04-2012	53460	45099	4636	3756	9:00-10:00
Aurobindo Marg (Near Panchsheel Park)	17-04-2012	74450	62409	6901	5974	19:00-20:00
Mathura Road (Sundar Nagar)	16-04-2012	71479	54963	6464	4868	18:00-19:00

4.3 Pedestrian Study

As given in previous sections, pedestrian volume count survey was conducted at 9 locations (six intersections on the study corridor, two at foot over bridges and one at-grade pedestrian crossing falling on the BRT corridor). This survey was carried out on every approach of each intersection and Foot Over Bridges (FOB). For Ambedkar Nagar Jn., Pushpa Bhavan Jn. and Chirag Delhi Jn. the pedestrian volume survey was conducted for three days spanning for 16 hours (06:00 AM to 10:00 PM). For other intersections this survey was carried out covering the morning and evening peak period of traffic flows spanning for about 4 hours each (08:00 AM to 12:00 PM & 05:00 PM to 10:00 PM). For Chirag Delhi Jn. the data was collected only for one day whereas for Siri Fort Jn. and GK Crossing Jn. the data were collected for two days. For the pedestrian FOBs and pedestrian crossing, the survey was carried out for one day only. This collected data has been analysed and results at typical intersection has been presented in Figure 4.3.1.

Location Name: Ambedkar Chowk Date:09-04-2012 Peak hour volume 801
Direction: Towards Khanpur Day:Monday Peak hour 10:00-11:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	167	129	296
07:00-08:00	283	231	514
08:00-09:00	244	423	667
09:00-10:00	291	395	686
10:00-11:00	344	457	801
11:00-12:00	362	314	676
12:00-13:00	375	217	592
13:00-14:00	382	266	648
14:00-15:00	474	259	733
15:00-16:00	473	319	792
16:00-17:00	551	201	752
17:00-18:00	321	139	460
18:00-19:00	447	135	582
19:00-20:00	471	198	669
20:00-21:00	629	150	779
21:00-22:00	215	54	269
TOTAL	6029	3887	9916

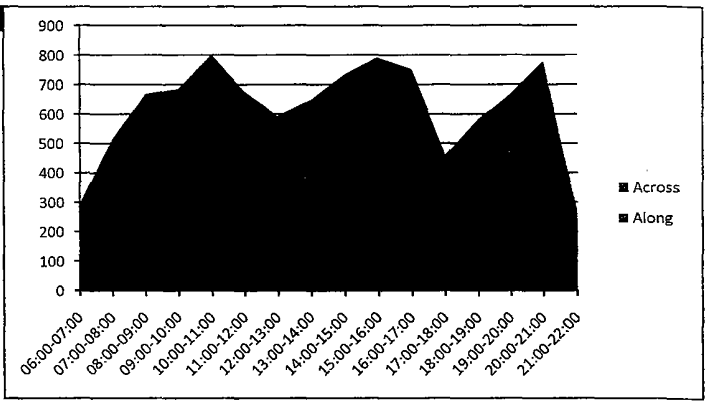


Figure 4.3.1: Typical Hourly Variation of Pedestrian Volume on Kanpur Approach of Ambedkar Nagar Jn

From the Figure 4.3.1, it can be observed that pedestrian volume is varying from 450 to 800 per hour and almost the peak is occurring in morning, afternoon and evening time periods. Similarly, the other approaches are also analysed for all the locations mentioned above and the analysed data is given in *Annexure XI* which shows hourly pedestrian volume count both along and across at each of the location. The summary of these pedestrian volumes at these locations is presented in Table 4.3.1.

Table 4.3.1: Summary of Pedestrian Volume at different Locations on different days on BRT Corridor

Intersection Name and Code	Date	Day	Direction of Flow	16-Hour Volume			Peak Hour Volume			Peak hour
				Along	Across	Total	Along	Across	Total	
Ambedkar Nagar Jn PED 01	8/4/2012	Sun	Towards Mool Chand	2707	7274	9981	348	980	1244	17:00-18:00
			Towards Khanpur	8245	5211	13456	1279	517	1796	19:00-20:00
			Towards Mehrauli	2932	2541	5473	303	289	544	08:00-09:00
	9/4/2012	Mon	Towards Mool Chand	4015	8252	12267	470	1148	1539	20:00-21:00
			Towards Khanpur	6029	3887	9916	629	457	801	10:00-11:00
			Towards Mehrauli	7833	8817	16650	993	1111	2066	09:00-10:00
	10/4/2012	Tue	Towards Mool Chand	7562	7577	15139	840	890	1679	10:00-11:00
			Towards Khanpur	4352	9699	14051	501	1641	2059	19:00-20:00
			Towards Mehrauli	5780	4973	10753	584	602	1186	09:00-10:00
Khanpur FOB PED 02	18/04/2012	Wed	-	0	2117	2117	0	423	423	19:00-20:00
Pushpa Bhavan FOB PED 03	18/04/2013	Wed	-	0	4038	4038	0	496	496	18:00-19:00
Pushpa Bhavan Jn PED 04	8/4/2012	Sun	Towards Mool Chand	3377	4764	8141	341	496	820	16:00-17:00
			Towards Dakshinpuri	5047	1533	6580	637	140	777	19:00-20:00
			Towards Khanpur	2940	3209	6149	280	301	557	19:00-20:00
			Towards Saket	1129	895	2024	110	115	214	18:00-19:00
	9/4/2012	Mon	Towards Mool Chand	7518	3551	11069	1225	723	1760	18:00-19:00
			Towards Dakshinpuri	5889	5611	11500	721	715	1124	10:00-11:00
			Towards Khanpur	3720	3523	7243	354	326	680	09:00-10:00
			Towards Saket	2302	1356	3658	234	140	362	20:00-21:00
	10/4/2012	Tue	Towards Mool Chand	6927	4798	11725	821	592	1267	19:00-20:00
			Towards Dakshinpuri	5103	1678	6781	790	240	1030	18:00-19:00
			Towards Khanpur	4558	3770	8328	529	375	861	07:00-08:00
			Towards Saket	4562	1320	5882	533	134	665	09:00-10:00

Table 4.3.2: Summary of Pedestrian Volume at different Locations on different days on BRT Corridor (Contd..)

Intersection Name and Code	Date	Day	Direction of Flow	16-Hour Volume			Peak Hour Volume			Peak hour
				Along	Across	Total	Along	Across	Total	
Sheikh Sarai Jn PED 05	8/4/2012	Sun	Towards Mool Chand	3935	1444	5379	564	263	703	17:00-18:00
			Towards Khanpur	3497	1234	4731	505	173	602	18:00-19:00
			Towards Qutub Minar	4071	3305	7376	427	392	819	19:00-20:00
	9/4/2012	Mon	Towards Mool Chand	3045	3066	6111	373	375	637	19:00-20:00
			Towards Khanpur	2309	2137	4446	295	260	555	09:00-10:00
			Towards Qutub Minar	4136	3463	7599	730	559	1289	09:00-10:00
	10/4/2012	Tues	Towards Mool Chand	1604	1465	3069	173	187	360	18:00-19:00
			Towards Khanpur	2116	3897	6013	323	400	654	10:00-11:00
			Towards Qutub Minar	2220	3700	5920	223	362	585	20:00-21:00
Chirag Delhi Jn PED 06	14/04/2012	Thu	Towards Mool Chand	2681	2333	5014	288	316	571	19:00-20:00
			Towards GK II	4018	2087	6105	446	236	621	09:00-10:00
			Towards Khanpur	2614	2861	5475	303	370	597	20:00-21:00
			Towards Airport	2026	1126	3152	210	109	319	09:00-10:00
Siri Fort Jn PED 07*	13/04/2012	Fri	Towards Mool Chand	590	669	1259	135	260	325	16:00-17:00
			Towards GK I	819	456	1275	197	163	360	18:00-19:00
			Towards Chirag Delhi	650	609	1259	157	150	222	19:00-20:00
			Towards Siri Fort	584	329	913	135	56	176	10:00-11:00
	14/04/2012	Sat	Towards Mool Chand	364	162	927	136	60	183	19:00-20:00
			Towards GK I	653	95	813	125	29	145	19:00-20:00
			Towards Chirag Delhi	658	514	1172	125	101	221	19:00-20:00
			Towards Siri Fort	642	317	959	136	60	183	19:00-20:00
Krishi Vihar PED 08	23/04/2012	Mon	-	0	1593	1593	0	253	253	09:00-10:00
Gk-I Crossing Jn PED 09*	13/04/2012	Fri	Towards Mool Chand	1106	689	1795	241	237	478	18:00-19:00
			Towards Nehru Place	1174	712	1886	290	176	443	08:00-09:00
			Towards Chirag Delhi	1586	693	2279	320	249	451	18:00-19:00
	14/04/2012	Sat	Towards Mool Chand	852	253	1105	134	62	196	09:00-10:00
			Towards Nehru Place	407	152	559	97	34	131	09:00-10:00
			Towards Chirag Delhi	847	454	1301	143	112	205	18:00-19:00

*Note: * 8 Hours Count*

From the Table 4.3.1, it can be observed that the peak hour pedestrian volume is ranging from 130 to 2000 pedestrians at the different junctions on the BRT corridor. The highest pedestrian volume per hour can be found at the junctions Ambedkar Nagar followed by Pushpa Bhawan and Sheik Sarai. On the FOBs, peak hour pedestrian volume is ranging from 250 to 500 and highest can be found at Pushpa Bhawan FOB.

The hazardous index (IRC 103, 1988) has to be necessarily calculated to assess the need for any pedestrian facility to be provided to improve pedestrian safety. For this purpose, vehicular traffic flow and pedestrian crossing flow at the particular location has to be used and estimated as per the equation given below:

$$PV^2 >= 2 \text{ X } 10^8 \qquad \text{Equation 3.1}$$

Where P: Pedestrian Peak Hour Flow

V: Vehicular Peak Hour Flow

Accordingly the hazardous index has been calculated for all the intersections and given in Table 4.3.2.

Table 4.3.3: Summary of Pedestrian Hazardous Index at different Locations on Different days on BRT Corridor

S. No.	Intersection Name and Code	Approach	Minimum	Maximum	Hazardous Index	Limit
1	Ambedkar Nagar Jn	Mool Chand	300	1148	192.0 E+08	2.00 E+08
2	Pushpa Bhavan Jn	Mool Chand	63	723	300.0 E+08	2.00 E+08
		Khanpur	129	375	104.0 E+08	2.00 E+08
3	Sheikh Sarai Jn	Mool Chand	43	187	824.0 E+08	2.00 E+08
		Khanpur	81	400	489.0 E+08	2.00 E+08
4	Chirag Delhi Jn	Mool Chand	76	318	119.0 E+08	2.00 E+08
		Khanpur	78	370	292.0 E+08	2.00 E+08
5	Siri Fort Jn	Mool Chand	30	260	165.0 E+08	2.00 E+08
		Khanpur	34	150	211.0 E+08	2.00 E+08
6	Gk-I Crossing Jn	Khanpur	9	249	116.0 E+08	2.00 E+08

From the Table 4.3.2, it can be clearly seen that all the locations have crossed the limit of hazardous index and need pedestrian facilities in terms of grade separated and exclusive signals etc.

4.4 Occupancy Survey

The occupancy of vehicle survey was conducted at different intersections during different timings of the day. The overall day average vehicle occupancy across different vehicles observed at different intersections is presented in Table 4.4.1.

Table 4.4.1: Overall Day Average Occupancy Survey across different Vehicle Types at Ambedkar Nagar Intersection

Vehicle Type	Direction	AN - PB	PB - SS	SS-CD	CD - SF	SF – GK I	Present Study Average	RITES Study 2011	DMRC Study, 2010	EMBARQ 2009
Bus	UP	33.16	39.69	35.24	41.80	38.76	*37.94*	31	39.6	37.88
	DOWN	33.62	38.50	38.78	40.01	39.85				
	Avg	***33.39***	***39.10***	***37.01***	***40.91***	***39.31***				
Mini Bus	UP	10.11	12.84	14.46	11.64	10.61	*13.00*	NA	10.6	
	DOWN	14.51	14.48	14.01	14.31	13.03				
	Avg	***12.31***	***13.66***	***14.24***	***12.98***	***11.82***				
Taxi	UP	2.35	2.36	1.80	1.88	2.04	*2.07*	NA	NA	NA
	DOWN	2.20	2.30	1.87	1.86	2.03				
	Avg	***2.27***	***2.33***	***1.84***	***1.87***	***2.04***				
Auto	UP	2.38	2.93	2.01	2.08	2.30	*2.46*	2.2	2.5	NA
	DOWN	2.31	2.71	2.62	2.87	2.42				
	Avg	***2.35***	***2.82***	***2.31***	***2.48***	***2.36***				
Two Wheeler	UP	1.55	1.55	1.37	1.03	1.38	*1.42*	1.4	1.4	NA
	DOWN	1.78	1.50	1.41	1.40	1.25				
	Avg	***1.67***	***1.52***	***1.39***	***1.21***	***1.32***				
Car	UP	2.24	2.71	2.07	2.29	1.94	*2.21*	2.2	2.4	NA
	DOWN	2.18	2.24	2.20	2.36	1.88				
	Avg	***2.21***	***2.48***	***2.14***	***2.33***	***1.91***				
Cycle	UP	1.16	1.35	1.18	1.03	1.03	*1.15*	NA	1.2	NA
	DOWN	1.13	1.32	1.08	1.08	1.09				
	Avg	***1.14***	***1.33***	***1.13***	***1.06***	***1.06***				
Cycle Rickshaw	UP	1.29	1.51	1.21	1.19	1.11	*1.24*	NA	1.1	NA
	DOWN	1.19	1.29	1.17	1.24	1.24				
	Avg	***1.24***	***1.40***	***1.19***	***1.21***	***1.17***				

Note: AN - Ambedkar Nagar Jn; PB - Pushpa Bhawan Jn; SS - Sheikh Sarai Jn; CD - Chirag Delhi Jn; SF - Siri Fort Jn; GK I - Greater Kailash Crossing Jn; NA - Not Available

From Table 4.4.1, the following inferences have been drawn on the observed occupancy levels on the study by comparing with the recent studies done for Delhi by various stakeholders:

- It was observed that the average occupancy of buses on the study corridor ranged from about 33 to 41 whereas the mini bus occupancy range varied from 12 to 14 across the different intersections. Interestingly, these values are much higher than what was reported in various recent studies like RITES Study *(2011)*, other studies *(DMRC Phase-III, 2010 conducted by CSIR-CRRI)* and EMBARQ *(2009)*. This scenario is obviously expected on the corridor as the bus frequency is now-a-days is high on the corridor prompting about 5 % modal shift towards bus from modes like cycle and two wheelers. This statistics can be corroborated with the user perception survey results reported in Section 4.11.

- At the same time, Car occupancy range is from 1.9 to 2.5 whereas in the case of two wheelers the ranged from 1.3 to 1.7. The average occupancy in the case of auto rickshaw hovering from 1.8 to 2.8 whereas the taxi occupancy ranged from 1.8 to 2.33. The maximum occupancy level in cycle rickshaw was 1.4 whereas cycle occupancy was varying from 1 to 1.33.

4.5 Speed and Delay Analysis of BRT and Non-BRT Corridor

By deploying the procedure outlined Section 3.2.4, the speed and delay was carried out across different vehicle types including cycles and cycle rickshaws during normal BRT operations on present study corridor from Ambedkar Nagar to Mool Chand. Further, these speed profiles were also calculated for adjoining non-BRT corridor namely Khel Gaon Marg. The analysed data is presented in the following section.

4.5.1 Speed and Delay of Buses during normal BRT Operations

Table 4.5.1 presents the speed and delay profile observed during the test runs conducted on buses by fitting the GPS encompassing weekday and week end operations. The salient observations drawn from this table during the various test runs are discussed below:

- The journey speeds of buses in upward direction on weekday during normal BRT operation ranges from 11.0 kmph *(9:26 AM)* to 27.8 kmph *(6:59 AM).*
- Maximum quantum of delay caused to the buses touches 746 seconds during morning time *(at 9:26 AM)* in upward direction on a weekday whereas the maximum delay reaches 655 seconds during evening time *(at 5:08 PM)* in upward direction on a weekend.
- On the contrary, the maximum quantum of delay caused to the buses during the test run touches 667 seconds during evening time *(at 8:03 PM)* in downward direction on a weekday whereas interestingly, the maximum delay reaches 733 seconds observed during evening time *(at 7:08 PM)* in downward direction on a weekend. This scenario is somewhat consistent and this phenomenon may be attributed to the delay caused by the large number of social and leisure commutes made by the private vehicle bound towards the malls, shopping complex, movie halls during the week-ends. Obviously, cars also encountered severe delays which were reflected in the car test run conducted during the same time for cars and the same is presented in Section 4.5.4.
- The minimum of overall delay of buses on the corridor is about 3.7 seconds observed during morning time *(at 6:59 AM)* in upward direction on a weekday whereas minimum total delay is about 60 seconds observed during afternoon time *(at 12:54 PM)* in downward direction on a weekday.

Table 4.5.1: Speed and Delay Characteristics of Buses during normal BRT operations

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
12-04-2012	6:59 AM	3.7	0.5	27.9	27.8	46.8
12-04-2012	9:26 AM	746.0	39.6	18.3	11.0	40.1
12-04-2012	12:26 PM	530.5	37.6	23.9	14.9	42.2
12-04-2012	7:33 PM	403.3	29.7	21.9	15.4	45.0
Weekend: Up Direction - **Ambedkar Nagar to Mool Chand**						
14-04-2012	6:38 AM	221.6	20.5	24.6	19.5	44.7
14-04-2012	7:44 AM	201.4	18.0	23.0	18.8	50.5
14-04-2012	11:57 AM	216.9	19.6	22.7	18.3	45.8
14-04-2012	12:54 PM	484.7	35.5	23.6	15.2	43.0
14-04-2012	5:08 PM	655.4	42.4	23.4	13.5	42.4
14-04-2012	6:38 PM	193.5	19.1	25.8	20.9	42.0
Weekday: Down Direction - **Mool Chand to Ambedkar Nagar**						
12-04-2012	7:16 AM	159.6	16.0	24.8	20.8	39.5
12-04-2012	10:14 AM	301.9	24.3	22.4	17.0	44.2
12-04-2012	12:54 PM	60.4	6.2	23.3	21.8	49.2
12-04-2012	1:28 PM	388.2	31.8	24.7	16.9	43.5
12-04-2012	2:19 PM	163.0	15.1	22.5	19.1	45.9
12-04-2012	8:03 PM	466.6	34.2	20.4	13.4	44.6
Weekend: Down Direction - **Mool Chand to Ambedkar Nagar**						
14-04-2012	7:09 AM	207.5	20.2	24.9	19.9	47.3
14-04-2012	8:07 AM	189.5	19.2	25.7	20.8	40.9
14-04-2012	12:26 PM	526.8	36.9	23.1	14.6	43.3
14-04-2012	1:22 PM	477.2	36.6	24.9	15.8	42.5
14-04-2012	5:56 PM	568.5	61.5	28.2	10.9	52.3
14-04-2012	7:08 PM	733.2	44.5	22.6	12.5	42.2

- At the same time, the minimum of total delay for buses on the corridor is about 193 seconds observed during evening time *(at 6:38 PM)* in upward direction on a weekend.
- The minimum of total delay of buses on the corridor is about 187 seconds observed during morning time *(at 8:07 AM)* in downward direction on a weekend.
- The journey speeds of buses in upward direction on weekend during normal BRT was ranging between 13.5 *(around 5:08 PM)* to 20.9 kmph *(around 6:38 PM)*.
- The journey speeds of buses in upward direction on weekday during BRT operation ranges from 13.4 *(8:03 PM)* to 21.8 kmph *(12:54 PM)*.

- The journey speeds of buses in upward direction on weekend during BRT ranges from 10.9 kmph *(around 5:56 PM)* to 20.8 kmph *(around 8:07 AM).*

4.5.2 Speed and Delay of Auto rickshaws during normal BRT Operations

Table 4.5.2 presents the speed and delay profile observed on autos on the study corridor encompassing weekday and week end operations. The salient observations drawn from this table across the various test runs are discussed below:

- The journey speeds of Autos in upward direction on weekdays during BRT operation ranges from 4.3 kmph *(9:24 AM)* to 18.8 kmph *(8:21 AM).*
- Maximum quantum of delay caused to the auto during the test run touches 1903 seconds in the morning time *(at 9:24 AM)* in upward direction on a weekday whereas the maximum delay reaches 258 seconds during morning time *(at 8:21 AM)* in upward direction on weekdays.
- The journey speeds of Autos in upward direction on Weekend during BRT operation ranges from 16.1 kmph *(at 2:22 PM)* to 37.5 kmph *(6:40 AM).*
- During afternoon time *(at 2:22 PM)* Maximum quantum of total delay caused to the Autos in upward direction is about 122 seconds on Weekends whereas the minimum amount of total delay caused to the is about 14 seconds observed during evening time *(at 9:05 PM)* in upward direction on Weekends.
- The journey speeds of Autos in downward direction on Weekend during BRT operation ranges from 8.9 kmph *(8.31 PM)* to 28.3 kmph *(6:50 AM).*
- Maximum amount of total delay caused to the Autos is about 781 seconds observed during evening time (at 8.03 *PM*) in downward direction on Weekend whereas the minimum quantum of total delay caused to the Autos is 71 seconds observed during morning time (at 6:50 AM) in downward direction on Weekends.

4.5.3 Speed and Delay of Two Wheelers during normal BRT Operations

Table 4.5.3 presents the speed and delay profile observed in the case of two wheelers on the study corridor encompassing weekday and week end operations. The salient inferences arrived based on the various test runs are discussed below:

- The journey speeds of Two Wheeler in upward direction on Weekdays during BRT operation ranges from 13.6 kmph *(5:10 PM)* to 30.6 kmph *(7:07 AM).*
- Maximum quantum of total delay encountered in the case of Two Wheelers during the test run is about 752 seconds observed in the evening time *(at 5:10 PM)* in upward direction on Weekdays whereas the minimum quantum total delay is about 15 seconds observed during morning time *(at 7:07 AM)* in upward direction on a weekday.
- The journey speeds of Two Wheeler in upward direction on weekends during BRT operation ranged from 16.8 kmph *(5.47 PM)* to 19 kmph *(6:50 PM).*

Table 4.5.2: Speed and Delay Characteristics of Autos during normal BRT operations

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
13-04-2012	8:21 AM	257.8	27.0	25.7	18.8	46.5
13-04-2012	9:24 AM	1903.4	55.4	9.7	4.3	36.0
13-04-2012	1:09 PM	762.0	45.7	22.2	12.1	45.0
13-04-2012	2:06 PM	691.1	38.6	12.5	7.7	42.9
13-04-2012	7:10 PM	1040.4	61.0	26.7	10.4	45.8
Weekend: Up Direction - **Ambedkar Nagar to Mool Chand**						
14-04-2012	6:40 AM	39.6	7.6	40.6	37.5	50.9
14-04-2012	7:47 AM	44.4	6.5	31.4	29.3	46.2
14-04-2012	2:22 PM	121.8	9.4	17.8	16.1	59.7
14-04-2012	9:05 PM	13.8	1.1	16.6	16.4	47.9
Weekday: Down Direction - **Mool Chand to Ambedkar Nagar**						
13-04-2012	8:39 AM	1405.5	59.3	18.1	7.4	51.1
13-04-2012	10:23 AM	1774.5	54.9	12.4	5.6	35.3
13-04-2012	1:38 PM	655.8	42.9	23.8	13.6	42.8
13-04-2012	2:38 PM	554.1	41.9	22.4	13.0	46.3
13-04-2012	6:35 PM	1018.0	54.3	20.4	9.3	40.8
Weekend: Down Direction - **Mool Chand to Ambedkar Nagar**						
14-04-2012	6:50 AM	70.9	10.0	31.5	28.3	46.99
14-04-2012	8:00 AM	121.1	11.9	22.6	20.0	44.2
14-04-2012	2:46 PM	392.9	29.5	21.0	14.8	42.8
14-04-2012	8:03 PM	780.9	48.3	18.0	9.3	54.65
14-04-2012	8:31 PM	117.1	7.5	9.6	8.9	56.0

- The maximum of total delay of Two Wheeler on the corridor is about 369 seconds observed during evening time *(at 5:47 PM)* in upward direction on Weekends whereas the minimum amount of total delay is about 144 seconds observed during evening time *(at 6:50 PM)* in upward direction on weekends. Since there were no test runs conducted during the week end on two wheelers during the morning time *(06:00 AM to 08:30 AM)*, no dataset is shown where the minimum delays could be substantially lower that presented in this report.
- The journey speeds of Two Wheelers in downward direction on weekdays during BRT ranges from 11.4 kmph *(12.37 PM)* to 27.3 kmph *(7:18 AM).*
- The maximum of total delay of Two Wheeler is about 964 seconds observed during afternoon time *(at 12:37 PM)* in downward direction on weekdays. On the

other hand, the minimum of total delay is about 91 seconds observed during morning time *(at 7:18 AM)* in downward direction on Weekdays.

Table 4.5.3: Speed and Delay Characteristics of Two Wheelers during BRT operations

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
13-04-2012	7:07 AM	15.2	2.2	31.3	30.6	59.4
13-04-2012	7:34 AM	117.3	14.9	30.7	26.1	56.7
13-04-2012	12:16 PM	442.6	35.9	26.4	16.9	53.3
13-04-2012	3:28 PM	338.5	30.5	26.3	18.3	59.3
13-04-2012	5:10 PM	751.6	49.8	27.2	13.6	57.7
Weekend: Up Direction - **Ambedkar Nagar to Mool Chand**						
14-04-2012	5:47 PM	368.5	29.7	23.8	16.8	58.2
14-04-2012	6:50 PM	143.9	13.6	22.0	19.0	48.2
Weekday: Down Direction - **Mool Chand to Ambedkar Nagar**						
13-04-2012	7:18 AM	91.1	12.3	31.1	27.3	59.8
13-04-2012	7:47 AM	222.7	25.4	31.5	23.5	59.1
13-04-2012	12:37 PM	963.9	53.0	24.2	11.4	57.3
13-04-2012	5:35 PM	422.6	33.7	24.8	16.5	59.9
Weekend: Down Direction - **Mool Chand to Ambedkar Nagar**						
14-04-2012	6:07 PM	217.9	20.5	23.5	18.7	60.5
14-04-2012	7:08 PM	320.0	26.8	23.0	16.8	56.1

- The journey speeds of two wheeler in downward direction on weekends during BRT operation ranges from 16.8 Kmph *(at 7:08 PM)* to 18.7 kmph *(at 6:07 PM)* due to the limited dataset collected during the evening timings only.
- The maximum of total delay encountered by the two wheelers during the test run on the corridor is about 320 seconds observed at evening times *(07:08 PM)* in downward direction on weekends. On the contrary, the minimum of total delay caused to the two wheeler during the test run is about 218 seconds observed during evening time *(at 6:07 PM)* in downward direction on weekends. Here again, no early morning dataset was collected for the down direction.

4.5.4 Speed and Delay of Cars during normal BRT Operations

Table 4.5.4 presents the speed and delay profile observed in the case of cars during the test run on the study corridor encompassing weekday and weekend operations. The salient inferences derived from this table during test run are discussed below:

Table 4.5.4: Speed and Delay Characteristics of Car during normal BRT operations

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
13-04-2012	7:23 AM	226.4	25.2	30.9	23.1	57.0
12-04-2012	8:00 AM	131.8	16.1	30.0	25.2	60.7
13-04-2012	8:21 AM	161.6	17.4	27.5	22.7	48.7
12-04-2012	8:36 AM	78.0	9.7	28.8	26.0	61.3
12-04-2012	12:10 PM	923.2	49.5	22.3	11.3	54.2
13-04-2012	1:11 PM	924.4	51.6	24.1	11.6	56.7
12-04-2012	1:18 PM	1588.4	64.7	24.2	8.5	53.2
13-04-2012	2:08 PM	1361.3	57.9	20.8	8.7	51.8
12-04-2012	5:31 PM	413.3	28.8	16.1	11.4	54.0
12-04-2012	6:25 PM	839.4	44.4	17.7	9.8	48.5
13-04-2012	6:39 PM	1191.4	59.9	26.0	10.4	60.4
13-04-2012	8:25 PM	965.5	56.1	27.9	12.2	61.5
Weekend: Up Direction - **Ambedkar Nagar to Mool Chand**						
14-04-2012	1:14 PM	841.1	52.6	27.5	13.1	58.9
14-04-2012	2:28 PM	459.4	39.6	30.1	18.2	62.4
14-04-2012	5:18 PM	984.9	55.3	27.6	12.3	70.1
14-04-2012	6:44 PM	869.5	58.5	34.6	14.4	69.4
Weekday: Down Direction - **Mool Chand to Ambedkar Nagar**						
13-04-2012	7:38 AM	518.3	44.3	32.2	17.9	56.5
12-04-2012	8:14 AM	588.5	44.8	28.4	15.7	60.8
13-04-2012	8:37 AM	941.7	52.0	24.0	11.5	64.4
12-04-2012	8:52 AM	449.5	38.3	28.6	17.6	68.2
12-04-2012	12:42 PM	1061.5	58.3	27.5	11.5	71.8
13-04-2012	1:41 PM	506.2	38.1	25.5	15.8	57.1
12-04-2012	1:59 PM	477.1	35.0	23.9	15.5	58.6
13-04-2012	2:48 PM	830.8	50.0	25.3	12.6	67.8
12-04-2012	5:57 PM	597.7	41.0	18.9	11.1	52.3
12-04-2012	6:58 PM	860.2	44.3	16.2	9.0	68.3
13-04-2012	7:13 PM	1101.8	52.0	20.6	9.9	52.4
Weekend: Down Direction - **Mool Chand to Ambedkar Nagar**						
14-04-2012	1:41 PM	686.5	48.4	28.5	14.7	64.3
14-04-2012	2:48 PM	573.5	43.0	27.4	15.6	63.8
14-04-2012	5:49 PM	633.3	40.3	22.9	13.7	56.5
14-04-2012	7:13 PM	732.6	49.0	28.2	14.3	72.0

- The journey speeds of test car in upward direction on weekdays during BRT operation ranged from 8.5 Kmph *(1:18 PM)* to 26 kmph *(08:36 AM)*.
- The maximum of total delay encountered by the test Car is about 1588 seconds observed during afternoon time *(1:18 PM)* in upward direction on a weekday whereas the minimum of total delay for the test car is about 78.0 seconds observed during morning time at *(8:36 AM)* in upward direction on a weekday.
- The journey speeds of Car in upward direction on Weekends during BRT operation ranged from 12.3 kmph *(5:18 PM)* to 18.2 kmph *(2:28 PM)*.
- The maximum of total delay of Car on the corridor is about 985 seconds observed during evening time *(5:18 PM)* upward direction on a weekend. The minimum of total delay for the test car is about 459 seconds observed during afternoon time *(2:28 PM)* in upward direction on a weekend.
- The journey speeds of test car in downward direction on weekdays during BRT operation ranged from 9.0 kmph *(6:58 PM)* to 17.9 kmph *(7:38 AM)*.
- The maximum of total delay caused to the test car is about 1102 seconds observed during evening time *(7:13 PM)* downward direction on a weekday whereas the minimum of total delay is about 477 seconds observed during morning time *(1:59 PM)* in downward direction on a weekday.
- The journey speeds of test car in downward direction on weekends during BRT operation ranged from 13.7 kmph *(5:49 PM)* to 15.6 kmph *(2:48 PM)*.
- The maximum of total delay to the test car is about 732 seconds observed during evening time (7:13 PM) downward direction on a weekend whereas the minimum of total delay is about 574 seconds observed during afternoon time (2:48 PM) in downward direction on a weekend.

4.5.5 Speed and Delay of Cycles during the normal BRT Operations

Table 4.5.5 presents the speed and delay profile observed in the case of cycles on the study corridor encompassing weekday and week end operations. The salient inferences arrived from this table based on the different test runs are discussed below:

- The journey speeds of Cycle during the test run in upward direction on weekdays ranged from 10.1 kmph *(12:15 PM)* to 14.4 kmph *(6:35 PM)*.
- The maximum of total delay caused to Cycle during the test run is about 145 seconds observed during evening time *(6:35 PM)* in upward direction on a weekday whereas the minimum of total delay is only 3 seconds observed during afternoon time *(at 2:47 PM)* in upward direction on a weekday. This phenomenon of good journey speeds coupled with occurrence of minimal delay at times due to the traffic signals illustrates the utility of providing exclusive lane for NMT traffic. Further, the provision of NMT lane enhances the safety for the pedestrians as well. Of course, this can be addressed effectively on this corridor only when strict enforcement is put in place by restraining the motorized two wheeler traffic from entering the NMT lane.

Table 4.5.5: Speed and Delay Characteristics of Cycle during normal BRT operations

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
12-04-2012	7:50 AM	21.0	1.4	13.5	13.3	23.7
12-04-2012	10:37 AM	44.8	2.9	12.3	12.0	20.0
12-04-2012	12:15 PM	86.0	4.5	10.6	10.1	23.3
12-04-2012	2:47 PM	2.9	0.3	14.2	14.2	21.8
12-04-2012	6:35 PM	144.9	10.4	16.1	14.4	27.7
Weekend: Up Direction - **Ambedkar Nagar to Mool Chand**						
14-04-2012	8:34 AM	4.2	0.3	15.6	15.5	24.5
14-04-2012	10:56 AM	7.5	0.7	18.2	18.1	31.3
14-04-2012	3:38 PM	232.8	14.9	15.5	13.2	27.3
Weekday: Down Direction - **Mool Chand to Ambedkar Nagar**						
12-04-2012	11:06 AM	59.8	3.8	13.1	12.6	26.0
12-04-2012	3:11 PM	301.7	18.0	11.4	9.3	23.5
12-04-2012	7:00 PM	34.1	2.4	14.1	13.8	27.4
12-04-2012	8:07 PM	372.9	25.7	15.0	11.1	34.8
Weekend: Down Direction - **Mool Chand to Ambedkar Nagar**						
14-04-2012	8:56 AM	4.6	0.4	15.6	15.5	30.0
14-04-2012	11:16 AM	215.7	14.1	14.7	12.6	35.0
14-04-2012	4:05 PM	70.4	5.4	16.2	15.3	33.1

- The journey speeds of Cycle during the test run in upward direction on weekends ranged from 13.2 kmph *(3:38 PM)* to 18.1 kmph *(10:56 AM)*. Interestingly, the maximum of total delay caused to the Cycle during the test run is about 233 seconds observed during evening time *(3:38 PM)* in upward direction on a weekend. On the other hand, the minimum of total delay of Cycle on the corridor is about 4.2 seconds observed during afternoon time at 8:34 AM in upward direction on a weekend.
- The journey speeds of Cycle during the test run in downward direction on weekdays ranged from 9.3 kmph *(3:11 PM)* to 13.8 kmph *(7:00 PM)*.
- The maximum of total delay encountered by the Cycle during the test run is about 373 seconds observed during evening time *(8:07 PM)* downward direction on a weekday whereas the minimum of total delay is about 34 seconds observed during morning time *(7:00 PM)* in downward direction on a weekday.
- The journey speeds of Cycle during the test run in downward direction on weekends ranged from 12.6 kmph *(11:16 AM)* to 15.5 kmph *(8:56 AM)*.
- The maximum of total delay faced by the Cycle during the test run is about 216 seconds observed during morning time *(11:16 AM)* in downward direction on a

weekend whereas the minimum of total delay of Cycle is 5 seconds observed during morning time *(8:56 AM)* in downward direction on a weekend.

4.5.6 *Speed and Delay of Cycle Rickshaws during the BRT Operations*

Table 4.5.6 illustrates the speed and delay profile observed in the case of cycle rickshaws during the test run on the study corridor encompassing weekday and week end operations. Due to paucity of time, it was not possible to carry out the test run using the Cycle Rickshaws during the weekends. Some of the salient inferences arrived from this table during test run is discussed below:

Table 4.5.6: Speed and Delay Characteristics of Cycle Rickshaws during BRT Operations

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay(in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
13-04-2012	8:36 AM	430.2	15.8	9.2	7.8	24.0
13-04-2012	12:03 PM	9.9	0.5	9.3	9.3	31.8
13-04-2012	1:41 PM	31.6	1.8	10.2	10.1	18.6
13-04-2012	5:11 PM	94.6	3.9	8.6	8.2	20.3
13-04-2012	6:37 PM	93.1	4.2	9.4	9.0	17.0
Weekday: Down Direction - **Mool Chand to Ambedkar Nagar**						
13-04-2012	9:36 AM	193.1	7.7	6.6	6.1	25.8
13-04-2012	12:53 PM	73.9	3.6	9.7	9.4	21.3
13-04-2012	2:42 PM	287.0	12.4	10.1	8.9	18.8
13-04-2012	6:02 PM	269.1	14.3	10.7	9.1	24.4
13-04-2012	7:54 PM	48.5	2.5	10.4	10.1	22.5

- The journey speeds of Cycle rickshaw during the test run in upward direction on weekdays ranged from 7.8 kmph *(8:36 AM)* to 10.1 kmph *(1:41 PM)*.
- The maximum of total delay caused to the Cycle rickshaw is about 430 seconds observed during morning time *(8:36 AM)* in upward direction on a weekday whereas the minimum of total delay of Cycle rickshaw is about 10 seconds observed during afternoon time *(12:03 PM)* in upward direction on a weekday.
- The journey speeds of Cycle rickshaw during the test run in downward direction on a weekday ranged from 6.1 kmph *(9:36 AM)* to 10.1 kmph *(7:54 PM)*.
- The maximum of total delay of Cycle rickshaw on the corridor is about 287.0 seconds observed during afternoon time *(2:42 PM)* downward direction on a weekday. At the same time, the minimum of total delay is 48 seconds observed during evening time *(at 7:54 PM)* in downward direction on a weekday.

4.5.7 Speed and Delay of Buses on Khel Gaon Marg (Non BRT Corridor)

Table 4.5.7 presents the speed and delay profile observed in the case of buses during the test run on the Khel Gaon Marg encompassing weekday operations. Some of the salient inferences arrived from this table across the different test runs are discussed below:

Table 4.5.7: Speed and Delay Characteristics of Buses on Khel Gaon Marg *(Non BRT Corridor)*

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction – **Panch Sheel to Andrews Ganj**						
24-04-2012	6:57 AM	15.8	2.9	22.6	21.9	44.2
24-04-2012	7:32 AM	20.0	4.8	24.6	23.4	44.15
24-04-2012	8:03 AM	50.7	8.1	17.5	16.1	46.5
24-04-2012	12:03 PM	114.1	15.8	19.3	16.3	40.7
24-04-2012	1:26 PM	61.3	7.7	16.1	14.9	41.7
24-04-2012	5:53 PM	124.4	24.1	29.7	22.5	55.2
24-04-2012	6:50 PM	237.0	26.9	17.8	13.0	36.9
Weekday: Down Direction - **Andrews Ganj to Panch Sheel**						
24-04-2012	7:20 AM	6.6	1.8	20.5	20.1	43.2
24-04-2012	7:50 AM	17.4	3.1	20.0	19.3	44.2
24-04-2012	11:48 AM	43.3	5.7	15.3	14.4	41.6
24-04-2012	1:04 PM	115.2	13.8	13.6	11.7	45.7
24-04-2012	7:25 PM	176.5	16.1	11.8	9.9	40.5

- Interestingly, the journey speeds of buses in upward direction on the Khel Gaon Marg ranges from 13.0 kmph *(6:50 PM)* to 23.4 Kmph *(7:32 AM)* which is comparatively higher than that of BRT corridor across the different time periods of the day. However, it has to be borne in mind that the traffic volumes handled on Khel Gaon Marg are comparatively less than that of BRT corridor.
- Consequently, the maximum of total delay encountered during the test run on this road is about 124.4 seconds observed during evening time *(5:53 PM)* in upward direction, whereas the minimum of total delay is only 16 seconds observed during morning time *(6:57 AM)* in upward direction on a weekday.
- The journey speeds of buses in downward direction on a weekday on Khel Gaon Marg ranged from 9.9 kmph *(7:25 PM)* to 20.1 kmph *(7:20 AM)*.
- The maximum of total delay of buses on the corridor is about 177 seconds observed during evening time *(7:25 PM)* in downward direction whereas the minimum of total delay of buses is about 7 seconds observed during morning time *(7:20 AM)* in downward direction on a weekday.

4.5.8 Speed and Delay of Two Wheelers on Khel Gaon Marg (Non BRT Corridor)

Table 4.5.8 presents the speed and delay profile observed in the case of two wheelers during the test run on the Khel Gaon Marg encompassing weekday operations. Some of the salient inferences arrived from this table based on the different test runs are discussed below:

- The journey speeds of two wheelers in upward direction on weekday ranged from 22.9 kmph *(12:34 PM)* to 30.3 Kmph *(08:50 AM).*
- The maximum of total delay of two wheelers on the corridor is about 114 seconds observed during evening time *(12:34 PM)* in upward direction on a weekday whereas the minimum of total delay is about 27 seconds observed during evening time *(4:33 PM)* in upward direction on a weekday.
- The journey speeds of two wheelers in downward direction on weekday ranged from 23.0 kmph *(12:25 PM)* to 33.4 kmph *(8:34 AM).*
- The maximum of total delay of two wheelers on the corridor is about 77.5 seconds observed during afternoon time *(12:25 PM)* in downward direction whereas the minimum of total delay of two wheelers on the corridor is only 5 seconds observed during morning time *(8:34 AM)* in downward direction on a weekday.

Table 4.5.8: Speed and Delay Characteristics of Two Wheeler on Khel Gaon Marg

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Panch Sheel to Andrews Ganj**						
24-04-2012	8:50 AM	45.1	12.0	34.4	30.3	58.2
24-04-2012	12:16 PM	82	16.1	27.6	23.2	62.6
24-04-2012	12:34 PM	113.9	22.3	29.5	22.9	59.4
24-04-2012	4:33 PM	26.9	6.5	29.2	27.3	60.1
Weekday: Down Direction - **Andrews Ganj to Panch Sheel**						
24-04-2012	8:34 AM	5	1.5	33.9	33.4	57.1
24-04-2012	8:56 AM	17.6	4.5	31.6	30.2	65.9
24-04-2012	12:25 PM	77.5	15.0	27.0	23.0	80.5
24-04-2012	12:43 PM	47.1	13.2	27.4	23.8	54.3
24-04-2012	4:42 PM	23.5	7.5	29.0	26.9	54.3

4.5.9 Speed and Delay of Cars on Khel Gaon Marg (Non BRT Corridor)

Table 4.5.9 presents the speed and delay profile observed in the case of two wheelers during the test run on the Khel Gaon Marg encompassing weekday operations. Some of the salient inferences arrived from this table during test run is discussed below:

- The journey speeds of car in upward direction on weekday ranges from 16.8 kmph *(5:02 PM)* to 27.7 kmph *(7:17 AM)*.
- The maximum of total delay of cars on the corridor is about 226 seconds observed during evening time at 5:02 PM in upward direction on a weekday whereas the minimum of total delay of cars on the corridor is about 32 seconds observed during morning time *(7:17 AM)* in upward direction on a weekday.
- The journey speeds of car in downward direction on weekday ranges from 18.0 kmph *(11:57 AM)* to 25.0 kmph *(8:05 AM)*.
- The maximum of total delay of cars on the corridor is about 195 seconds observed during evening time at 5:21 PM in downward direction whereas the minimum of total delay of cars on the corridor is about 59 seconds observed during morning time at 11:36 AM in downward direction on a weekday.

Table 4.5.9: Speed and Delay Characteristics of Car on Khel Gaon Marg

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Panch Sheel to Andrews Ganj**						
24-04-2012	7:17 AM	32.2	8.1	30.1	27.7	43.8
24-04-2012	7:57 AM	77.0	16.3	28.9	24.2	61.4
24-04-2012	11:26 AM	130.8	21.0	23.6	18.7	57.0
24-04-2012	11:48 AM	94.0	17.3	25.8	21.3	47.2
24-04-2012	4:34 PM	167.4	28.1	26.4	19.0	50.1
24-04-2012	5:02 PM	226.2	32.6	24.9	16.8	64.2
Weekday: Down Direction - **Andrews Ganj to Panch Sheel**						
24-04-2012	7:24 AM	106.7	21.8	30.5	23.9	64.8
24-04-2012	8:05 AM	71.2	15.0	29.4	25.0	56.0
24-04-2012	11:36 AM	58.6	11.8	25.3	22.3	60.6
24-04-2012	11:57 AM	189.1	29.8	25.3	17.8	55.6
24-04-2012	4:44 PM	102.4	20.7	30.3	24.0	72.4
24-04-2012	5:21 PM	195.1	30.1	26.1	18.3	57.4

4.5.10 Speed and Delay of Cycles on Khel Gaon Marg (Non BRT Corridor)

Table 4.5.10 presents the speed and delay profile observed in the case of cycles during the test run on the Khel Gaon Marg encompassing weekday operations. Some of the salient inferences drawn from this table during test run are discussed below:

- The journey speeds of cycle in upward direction on a typical weekday on the Khel Gaon Marg ranged from 12.0 kmph *(1:12 PM)* to 15.7 kmph *(5:04 PM)*.
- The maximum of total delay of cycles on the corridor is about 128 seconds observed during afternoon time *(1:12 PM)* in upward direction on a weekday. On

the other hand, the minimum of total delay is only 2 seconds observed during afternoon time *(5:04 PM)* in upward direction on a weekday.

- The journey speeds of cycle in downward direction on weekday ranged from 9.0 kmph *(4:30 PM)* to 16.2 kmph *(6:38 AM)*.
- The maximum of total delay caused to the cycle during the test run on the corridor is about 81 seconds observed during evening time *(4:30 PM)* in downward direction whereas the minimum of total delay for the test vehicle *(cycle)* is only 1 second observed during morning time *(8:11 AM)* in downward direction on a typical weekday despite the absence of exclusive NMT lane.

Table 4.5.10: Speed and Delay Characteristics of Cycle on Khel Gaon Marg

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Panch Sheel to Andrews Ganj**						
24-04-2012	6:25 AM	4.3	0.6	15.5	15.4	33.5
24-04-2012	6:58 AM	4.4	0.6	15.4	15.3	22.7
24-04-2012	1:12 PM	128.2	14.1	13.9	12.0	22.9
24-04-2012	2:05 PM	44.1	5.0	12.9	12.3	24.8
24-04-2012	5:04 PM	2.1	0.3	15.8	15.7	25.4
24-04-2012	5:32 PM	27.5	3.3	14.5	14.0	23.1
Weekday: Down Direction - **Andrews Ganj to Panch Sheel**						
24-04-2012	6:38 AM	1.4	0.2	16.2	16.2	24.4
24-04-2012	7:12 AM	1.9	0.3	14.6	14.6	22.5
24-04-2012	8:11 AM	1.3	0.2	14.1	14.1	25.0
24-04-2012	1:06 PM	8.3	2.5	12.7	12.4	22.9
24-04-2012	1:48 PM	67.3	7.0	13.0	12.1	23.7
24-04-2012	4:30 PM	80.8	23.6	11.7	9.0	22.4
24-04-2012	5:19 PM	16.6	2.2	15.3	15.0	26.0

4.5.11 Comparison of Journeys Speeds on BRT and Non-BRT Corridors

Having exhaustively analysed Speed Characteristics spread over BRT and adjoining Non-BRT Corridors in the vicinity a critical comparison of the lowest and highest of the Journey Speeds observed on the road sections is presented in Table 4.5.11. The following inferences have been drawn from the above table:

- Obviously, the highest journey speeds in the case of bus was experienced on the BRT corridor due to the exclusive lane provision. At the same time, despite the BRT lane, the lowest speed on BRT corridor is lesser than Mathura Road as this road is having less signalized intersection. This may be attributed to the higher proportion of buses on the BRT corridor reaching up to 5 % as compared to other corridors catering to less than 2 % coupled with the traffic volume on this road is substantially lower. At the same time, the speed of buses on BRT corridor is higher by 1 - 2 kmph as compared to Khel Gaon Marg and Aurobindo Marg as exclusive lane is provided for both directions of travel which enhances safety as well.

- At the same time, the lowest and highest speeds of Cars and Two Wheelers on the BRT Corridor *(i.e. on MV Lane)* is far less than the observed speeds on the adjoining corridors.
- The observed highest speeds in the case of cars *(27.8 kmph),* two wheelers *(30.6 kmph)* and autos *(37.5 kmph)* are fully acceptable on the BRT corridor, However, this phenomenon is experienced only during the early morning hour (i.e. maximum up to 08:30 am on the BRT corridor). Thereafter, journey speed profile changes drastically changes during the effective part of the day and sometimes touching the observed lowest of 8.5 kmph, 11.4 kmph and 4.3 kmph during the peak hours in the case of cars, two wheelers and autos respectively. On the contrary, the observed lowest speeds on other adjoining non-BRT corridor in case of cars *(ranging between 13.1 kmph to 21.9 kmph)* and two *wheelers (14.4 Kmph to 29.9 Kmph)* are far better. Here it is to be noted that the traffic volume on BRT corridor is about 27% higher than that of other Non-BRT corridors.
- Despite the fact that the proportion of Non-Motorized traffic touches 13 % on selected sections of the BRT corridor, the lowest speed of Cycle on BRT Corridor *(9.3 kmph)* is comparable with the observed speed of cycle *(9 kmph to 12 kmph)* on adjoining non-BRT corridors, This illustrates the utility of the exclusive NMT lane provided on the BRT corridor which enhances their safety as well.

Table 4.5.11: Comparison of the Lowest and Highest of the Journey Speeds Observed on BRT corridor and Adjoining Non-BRT Corridors in Delhi

Vehicle Type	Journey Speed on BRT Corridor *(kmph)* *Length 5.8 km*	Journey Speed on Adjoining Non-BRT Corridor *(kmph)*		
		Khel Gaon *(Panchsheel to Outer Ring Road)* Length 3.3km	Mathura Road *(Pragati Maidan to Mool Chand)* Length 6.1km	Aurobindo Marg *(Safdarjung to Hauz Khas)* Length 2.2km
		Lowest Speeds *(kmph)*		
Bus	10.9	9.9	14.8	9.0
Car	8.5	16.8	21.9	13.1
TW	11.4	22.9	29.9	14.4
Autos	4.3	Not Collected	Not Collected	Not Collected
Cycle	9.3	9.0	12.8	10.9
		Highest Speeds *(kmph)*		
Bus	27.8	23.4	25.5	22.5
Car	26.0	27.7	39.8	32.5
TW	30.6	33.4	43.3	41.7
Autos	37.5	Not Collected	Not Collected	Not Collected
Cycle	18.1	16.2	18.1	16.9

4.6 Passenger Flows

4.6.1 Passenger Flows on BRT Corridor

Based on the enumerated traffic volume presented in Section 4.1 and 4.2 and also the observed section-wise vehicle occupancy across different vehicle types presented in Section 4.4, section-wise passenger loads were worked out for both directions of travel covering different vehicle types and presented in Table 4.6.1. These results are depicted pictorially in Figures 4.6.1 to 4.6.4.

Table 4.6.1: Section-wise Passenger Flows observed on BRT Corridor (6:00 AM to 10:00 PM)

Name of the Section	Cars	Two Wheelers	Autos	Buses	SMVs	Total
Up Direction: Ambedkar Nagar to Mool Chand						
Ambedkar Nagar- Pushpa Bhawan	18858	14326	6005	65610	3150	1,07,949
Pushpa Bhawan - Sheikh Sarai	37774	30910	11453	74857	4208	1,59,202
Sheikh Sarai - Chirag Delhi	49420	32158	13291	90633	3851	1,89,352
Chirag Delhi - Siri Fort	42611	31373	8967	78420	3004	1,64,375
Siri Fort – GK I Crossing	32627	28776	9075	47728	2264	1,20,471
Down Direction: Mool Chand to Ambedkar Nagar						
Pushpa Bhawan -Ambedkar Nagar	28645	20889	5083	40879	2871	98,366
Sheikh Sarai -Pushpa Bhawan	32345	22200	10736	53271	5680	1,24,232
Chirag Delhi-Sheik Sarai	63679	35037	15439	84100	3571	2,01,825
Siri Fort-Chirag Delhi	41349	28628	13409	50901	2188	1,36,475
GK I Crossing-Siri Fort	31940	21911	10255	38156	1568	1,03,830

From the Table 4.6.1 and Figure 4.6.1, it can be observed that the passenger flows are varying from 1.2 Lakh to 1.9 Lakh in 16 hours in the direction of Ambedkar Nagar to Mool Chand. Out of total sections maximum passenger flows are observed at Sheikh Sarai to Chirag Delhi section followed by Chirag Delhi to Siri Fort (1,64,375 for 16 Hours) and Pushpa Bhawan to Sheik Sarai (1,59,202 for 16 Hours). The minimum passenger flows of 1,07,949 in 16 hours were observed at Ambedkar Nagar to Pusha Bhawan. Out of the total flows, bus passenger constitutes about 49 percent followed by cars of 24 percent, Two wheelers of 18 percent, Auto of 7percent and SMVs of 2 percent as shown in Figure 4.6.2.

Similarly the total passenger flows observed from Mool Chand to Ambedkar Nagar to (Downward direction) from 6:00 AM to 10:00 PM is given in Table 4.6.1 and Figure 4.6.3. In this direction, the passenger flows are varying from 0.98 Lakh to 2.01 Lakh in 16 hours. Out of total sections, maximum passenger flows 2,08,125 in 16 hours observed at Chirag Delhi to Sheikh Sarai section followed by Siri Fort to Chirag Delhi (1,36,475) and Sheik Sarai to Pushpa Bhawan (1,24,232) and the minimum passenger flows 98,366 in 16 hours were observed at Pushpa Bhawan to Ambedkar Nagar. Out of the total flows bus passenger constitute about 40 percent followed by cars of 30 percent, two wheelers of 20 percent, Auto of 8 percent and SMVs of 2 percent as shown in 4.6.4. The section-wise comparison of these 16 hour and peak hour passenger flows are given in in Figures 4.6.1 to 4.6.4 for both the directions.

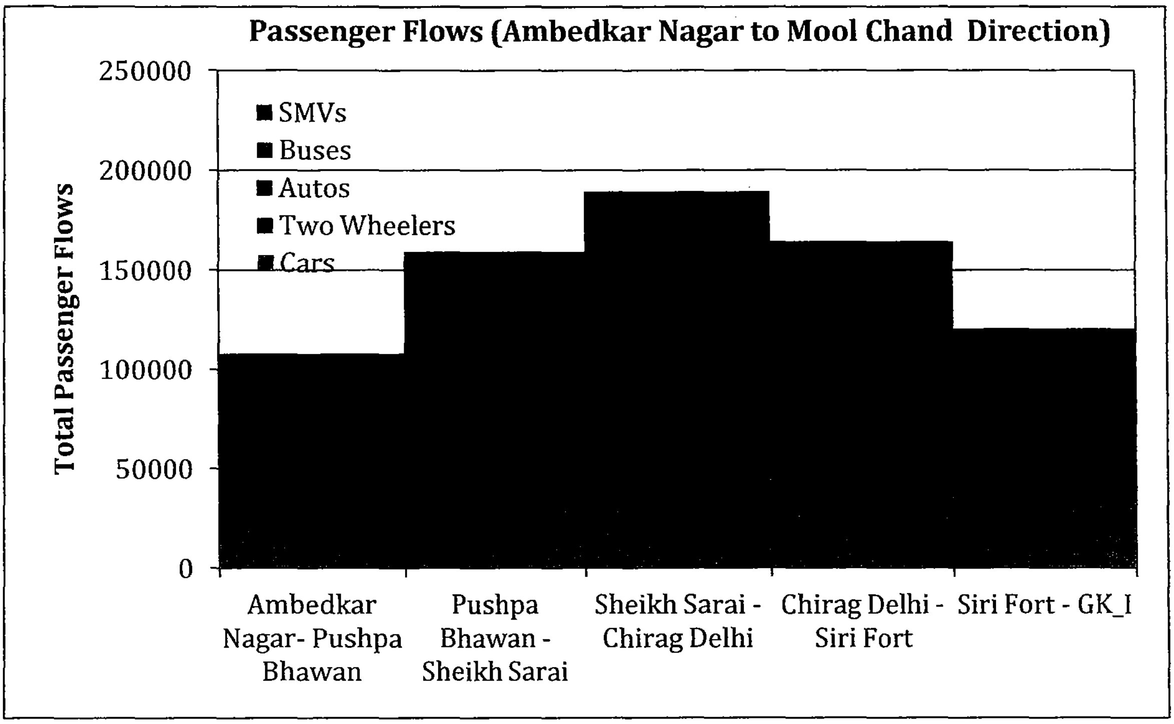


Figure 4.6.1: Observed Section-wise Passenger Flows on BRT Corridor (6 AM to 10 PM)

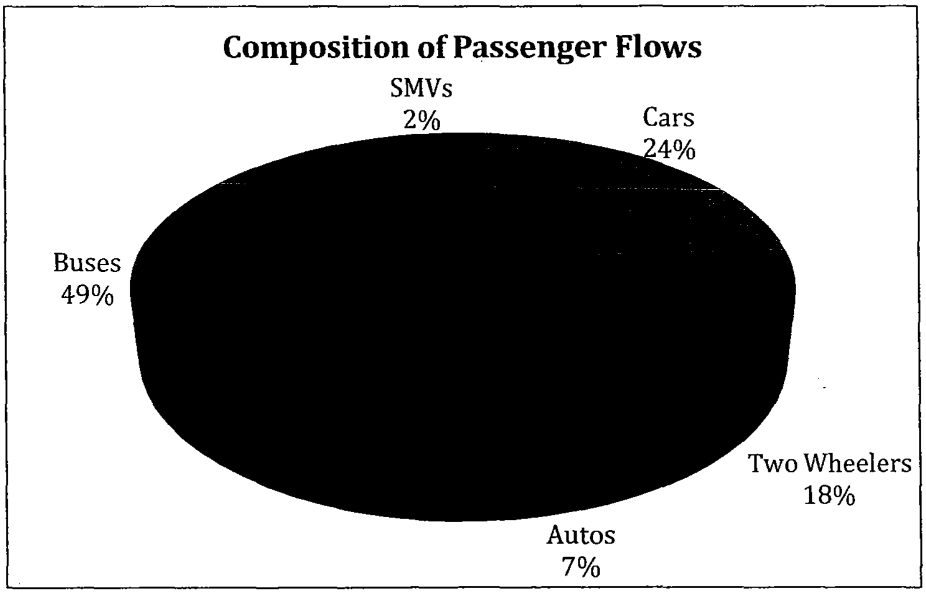


Figure 4.6.2: Composition of Total Passenger Flows observed from Ambedkar

Nagar to Mool Chand from 6 AM to 10 PM

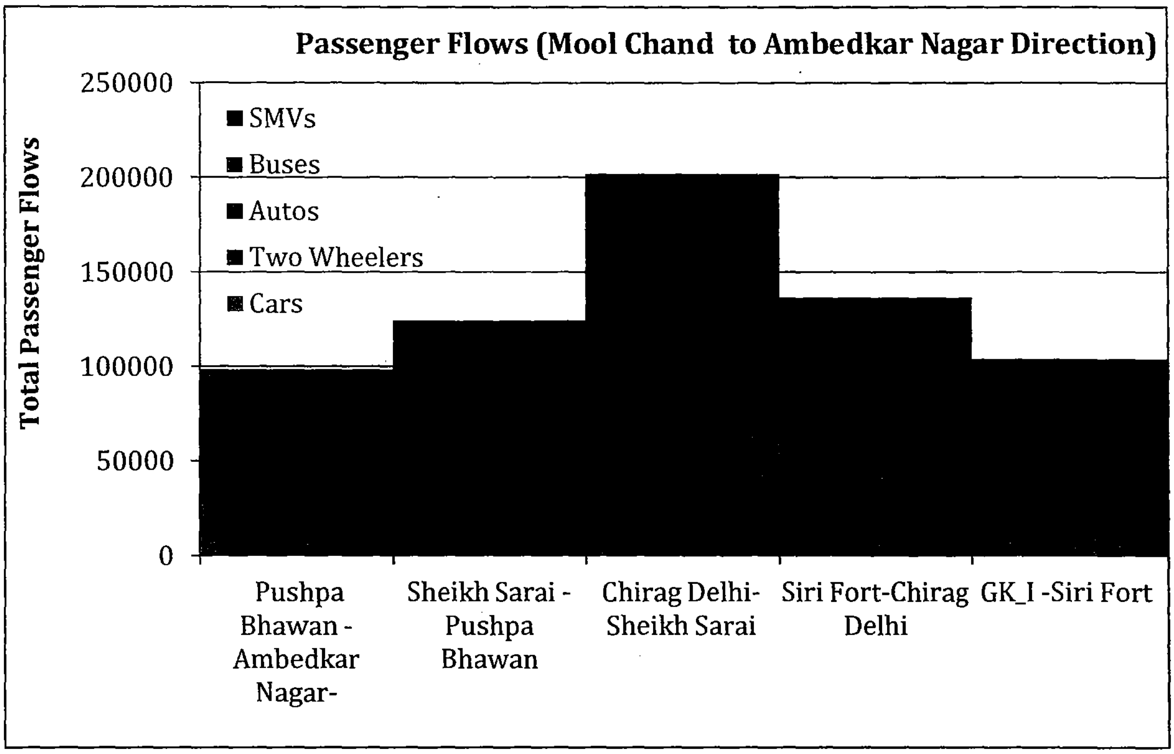


Figure 4.6.3: Total Passenger Flows observed from Mool Chand to Ambedkar Nagar from 6 AM to 10 PM

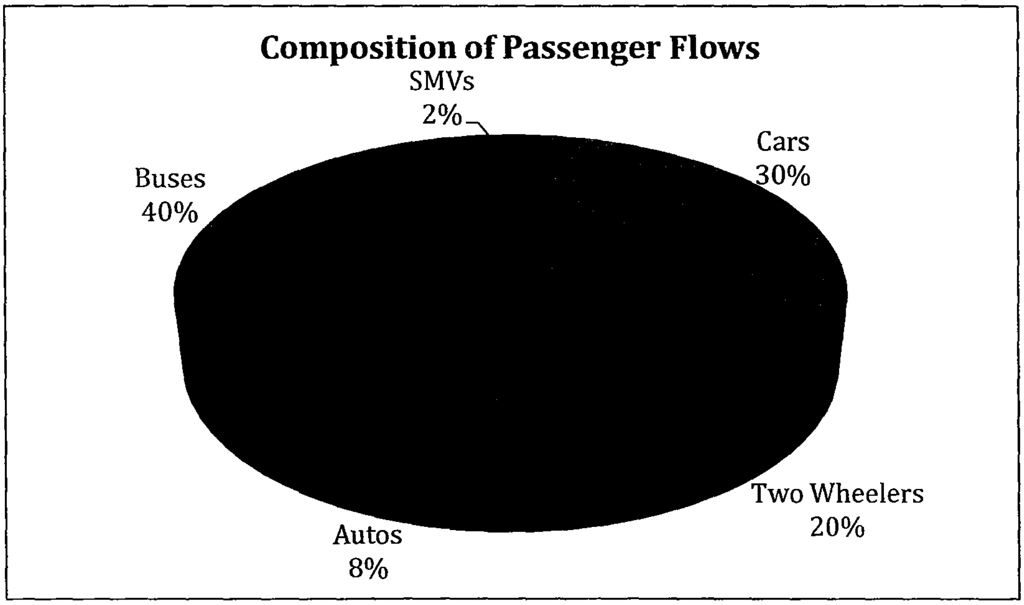


Figure 4.6.4: Composition of Total Passenger Flows observed from Mool Chand to Ambedkar Nagar from 6 AM to 10 PM

The Peak Hour passenger flows direction wise is given in Table 4.6.2 and shown in Figure 4.6.5 and 4.6.6. From the Table 4.6.3 and Figure 4.6.5 the maximum Peak hour Passenger Flows 21,784/hr were observed at Sheikh Sarai –Chirag Delhi section followed by Chirag Delhi to Siri Fort to (16,116) and Pushpa Bhawan to Sheikh Sarai

(15,692) , the minimum peak hour passenger flows 10,275/hr were observed at Ambedkar Nagar to Pushpa Bhawan.

Table 4.6.2: Peak hour Passenger flows from Ambedkar Nagar to Mool Chand

Name of the Section	Cars	Two Wheelers	Autos	Buses	SMVs	Total
Up Direction: Ambedkar Nagar to Mool Chand						
Ambedkar Nagar- Pushpa Bhawan	1688	910	383	7167	127	10,275
Pushpa Bhawan - Sheikh Sarai	3814	3089	1191	6632	966	15,692
Sheikh Sarai - Chirag Delhi	3876	3490	1035	12403	980	21,784
Chirag Delhi - Siri Fort	2970	3502	871	8122	651	16,116
Siri Fort – GK I Crossing	3912	2795	922	4531	245	12,405
Down Direction: Mool Chand to Ambedkar Nagar						
Pushpa Bhawan -Ambedkar Nagar	3259	2337	456	3137	274	9,463
Sheikh Sarai -Pushpa Bhawan	3144	2027	868	4522	532	11,092
Chirag Delhi-Sheik Sarai	5378	3348	1046	7348	467	17,587
Siri Fort-Chirag Delhi	3845	3029	985	4288	294	12,440
GK I Crossing-Siri Fort	2523	2286	679	2921	189	8,598

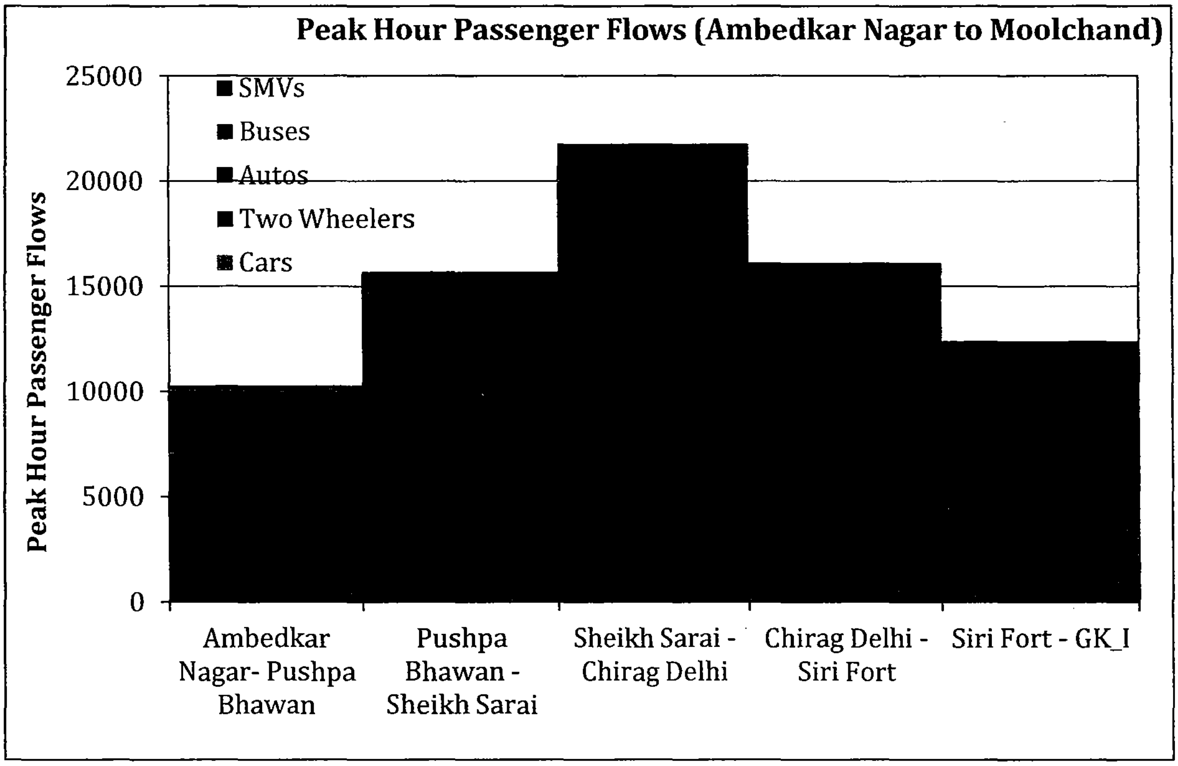


Figure 4.6.5: Peak hour Passenger Flows per direction observed from Ambedkar Nagar to Mool Chand

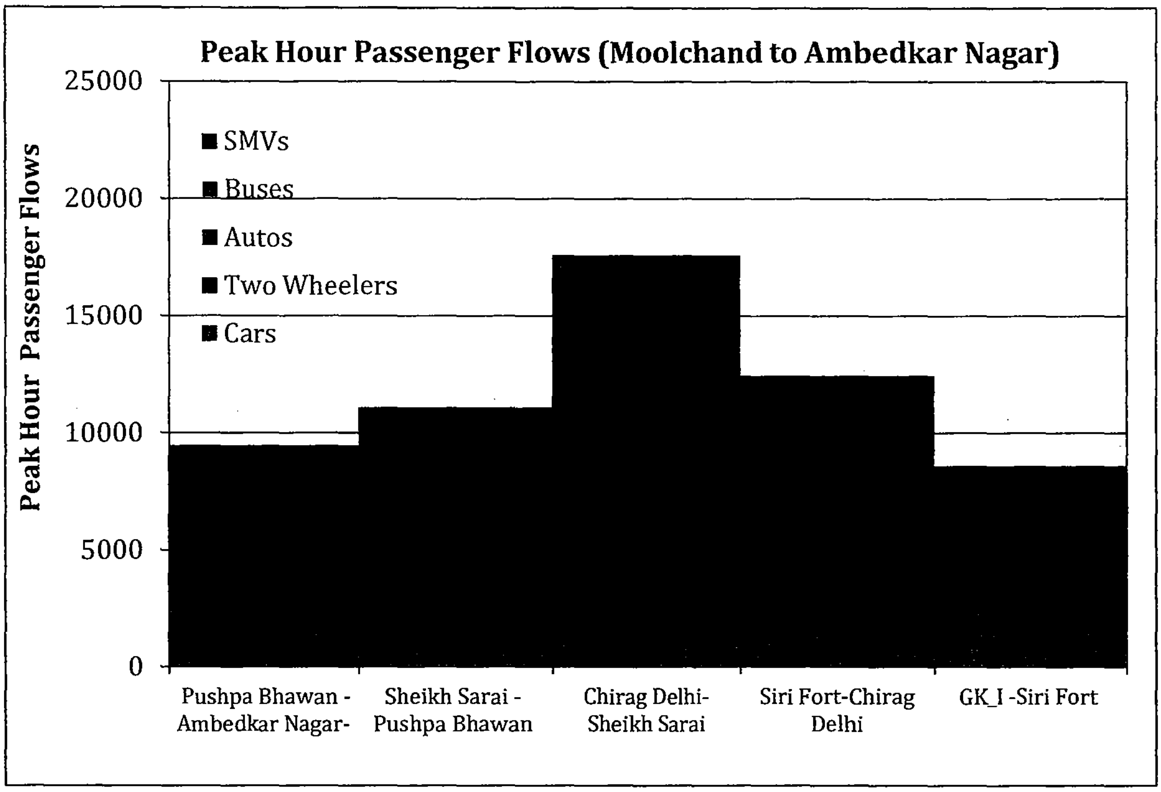


Figure 4.6.6: Peak hour Passenger Flows per direction observed from Mool Chand to Ambedkar Nagar

Similarly from the Table 4.6.2 and Figure 4.6.6 the Peak Hour passenger flows From Mool Chand to Ambedkar Nagar shows that the maximum Peak hour Passenger flows 17,587/hr were observed at Chirag Delhi - Sheikh Sarai section followed by Siri Fort - Chirag Delhi (12,440) and Sheik Sarai - Pushpa Bhawan (11,092) and the minimum peak hour passenger flows 8,598/hr were observed at Mool Chand – Siri Fort.

4.6.2 Passenger Flows on Non-BRT Corridors

The Passenger flows on selected Non - BRT corridor as mentioned in Section 4.2 has been worked out and the summary of total passenger flows are given in Table 4.6.3 and Figures 4.6.7 to 4.6.10.

Table 4.6.3: Total Passenger Flows observed at three Selected Non-BRT Mid Blocks Sections

Name of the Section	Cars	Two Wheelers	Autos	Buses	SMVs	Total
UP Direction						
Aurobindo Marg - AIIMS (near Yusuf Sarai)	48046	14684	11914	35280	470	1,10,393
Panch Sheel - South Extn (Near Panchsheel Park)	31590	1193	9258	11137	2250	55,429
Mool Chand - Pragati Maidan (near Sundar Nagar)	34001	20633	10449	28394	654	94,131
DOWN Direction						
AIIMS - Aurobindo Marg (near Yusuf Sarai)	42852	14017	13901	29883	443	1,01,096
South Extn - Panch Sheel (Near Panchsheel Park)	30054	674	13488	19931	1561	65,707
Pragati Maidan - Mool Chand (near Sundar Nagar)	30361	22095	13488	40826	283	1,07,052

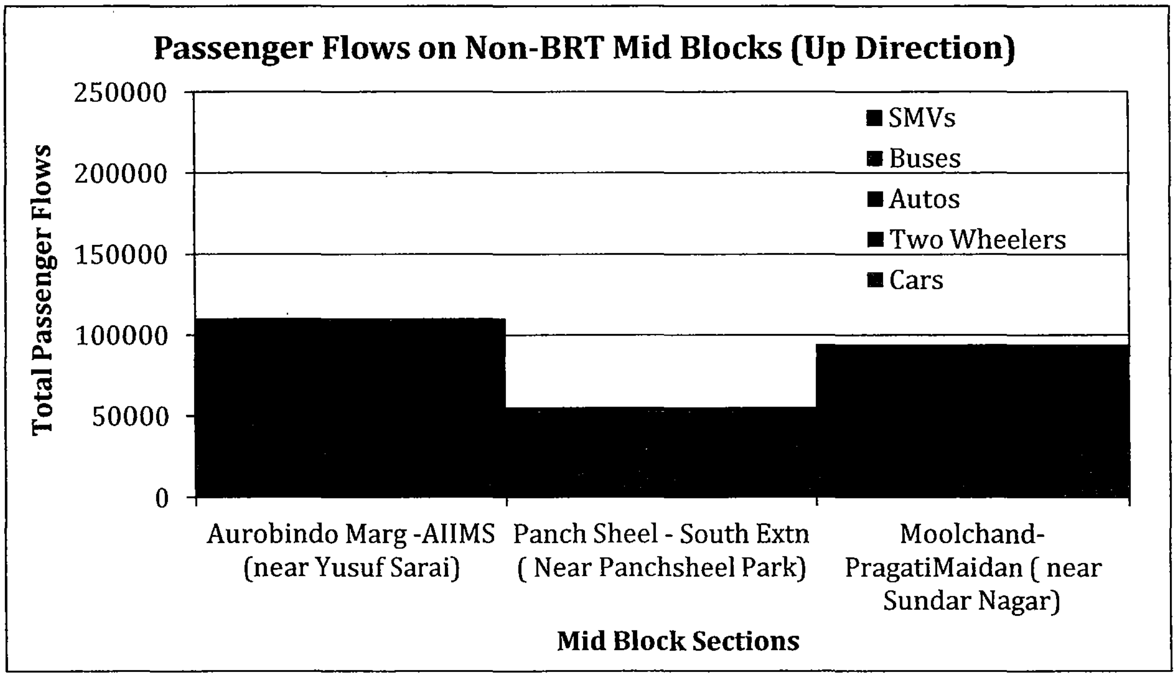


Figure 4.6.7: Total Passenger Flows at three Mid-Blocks Sections (UP Direction)

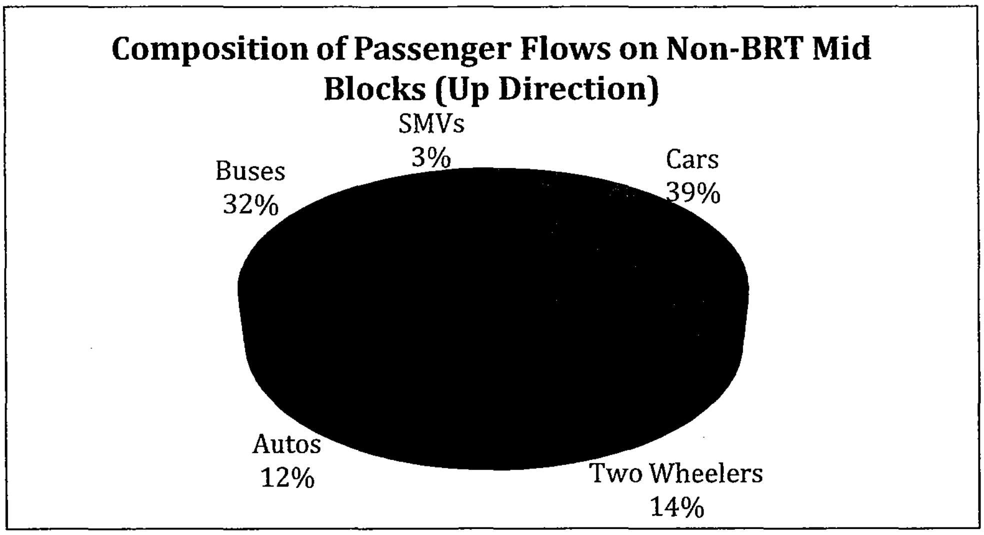


Figure 4.6.8: Composition of Total Passenger Flows observed three Mid-Blocks Sections (Upward Direction)

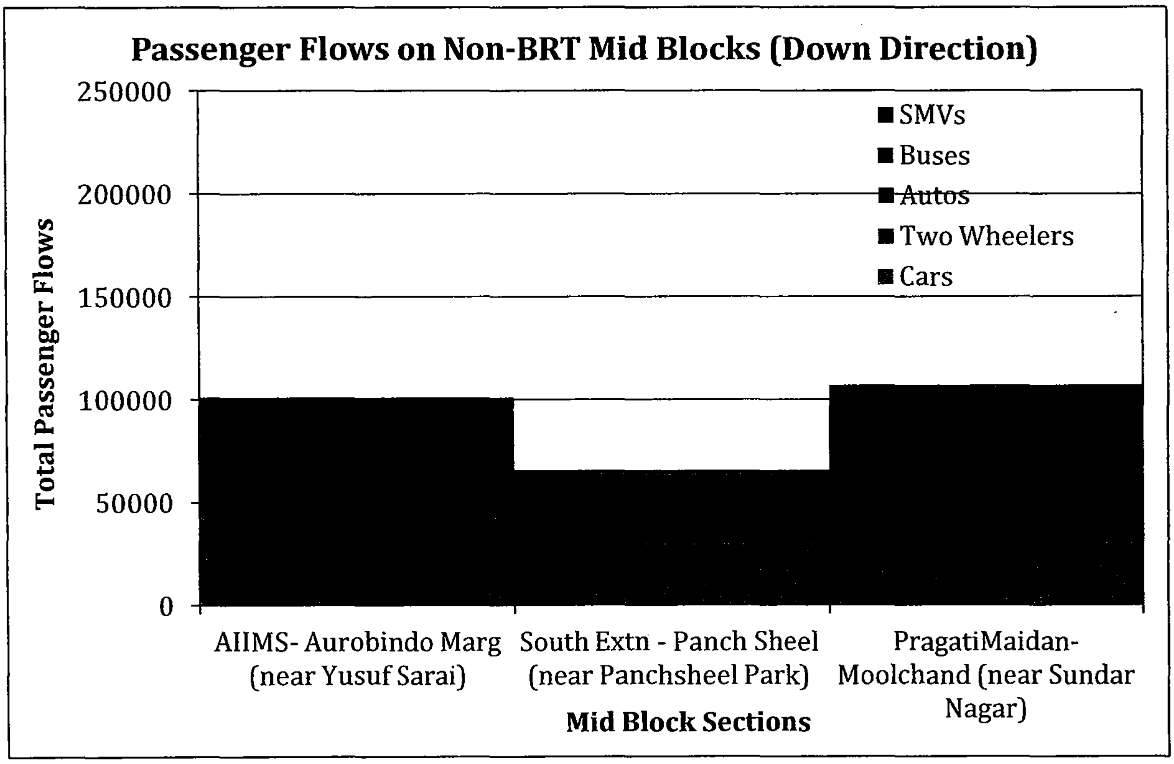


Figure 4.6.9: Total Passenger Flows at three Mid-Blocks Sections (Down Direction)

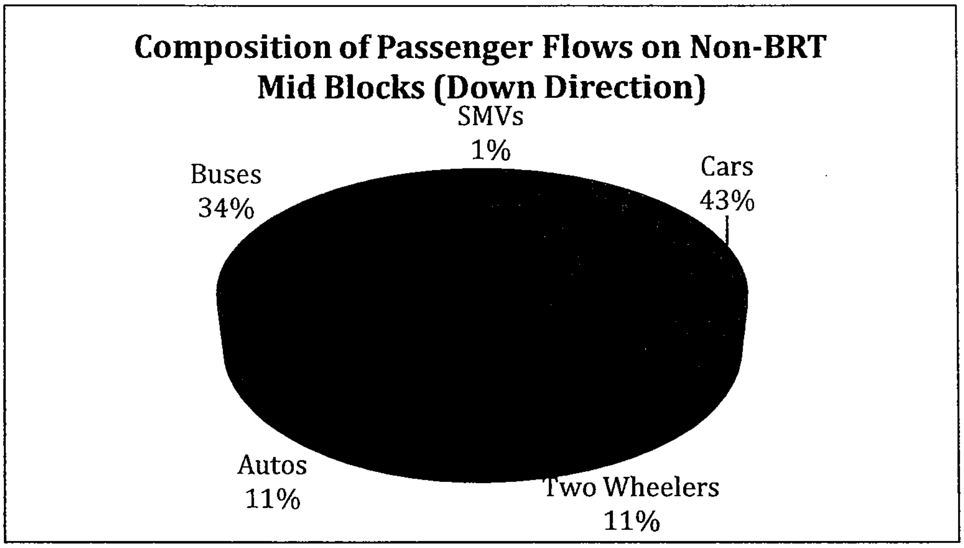


Figure 4.6.10: Composition of Total Passenger Flows observed three Mid-Blocks Sections (Downward Direction)

From the Table 4.6.3 and Figure 4.6.7 to 4.6.9, it can be observed that the maximum passenger flows were on Aurobindo Marg (1, 10,393) in upward direction and Mathura Road near Sunder Nagar. (1,07,052) downward direction. Out of the total flows bus passengers constitute about 32 percent (upward direction) 34 percent (downward direction) followed by cars 39 percent (upward direction) 43 percent (downward direction) , Two wheelers 14 percent (upward direction) 11 percent (downward direction), Auto 12 percent (upward direction) 11 percent (downward direction) and SMVs 3 percent (upward direction) 1 percent (downward direction).

The peak hour passenger flows upward direction as well downward directions are given in Table 4.6.4 and Figure 4.6.11 and 4.6.12.

Table 4.6.4: Peak hour Passenger flows at three Selected Non-BRT Mid Block Sections

Name of the Section	Peak Hour	Cars	Two Wheelers	Autos	Buses	SMVs	Total
UP Direction							
Aurobindo Marg - AIIMS (near Yusuf Sarai)	9.00-10.00	4416	1322	1088	4014	35	10,874
Panch Sheel - South Extn (Near Panchsheel Park)	10.00-11.00	2074	100	833	1443	424	4,875
Mool Chand - Pragati Maidan (near Sundar Nagar)	18.00-19.00	2838	2326	776	2586	33	8,558
DOWN Direction							
AIIMS - Aurobindo Marg (near Yusuf Sarai)	19.00-20.00	6515	1124	913	2488	16	11,056
South Extn - Panch Sheel (Near Panchsheel Park)	10.00-11.00	3067	69	1180	2590	211	7,118
Pragati Maidan - Mool Chand (near Sundar Nagar)	18.00-19.00	2697	2057	949	4336	26	10,064

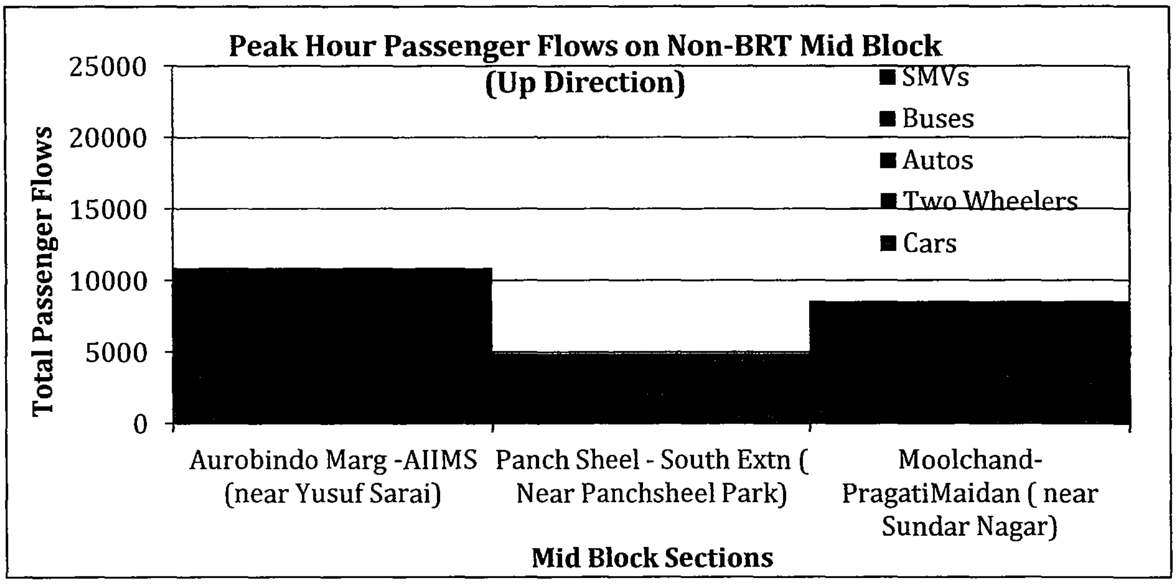


Figure 4.6.11: Peak Hour Passenger Flows observed at three Selected Non-BRT Mid Blocks Sections (Upward Direction)

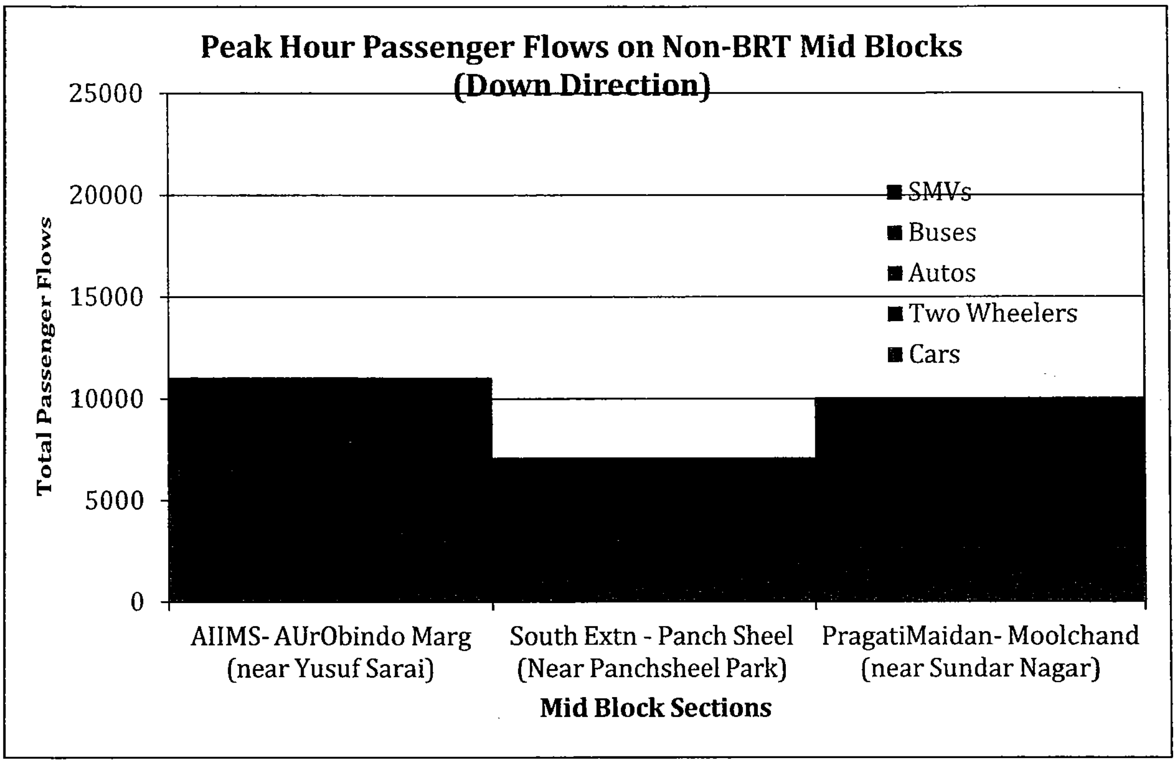


Figure 4.6.12: Peak hour Passenger Flows observed at three Non-BRT Mid-Blocks Sections (Downward Direction)

From the Table 4.6.4 and Figure 4.6.11, the maximum Peak hour Passenger Flows 10,874/hr (upward direction), 11,056/hr (downward direction) were observed Aurobindo Marg section followed by Sundar Nagar Section 8,558/hr (upward direction), 10,064/hr (downward direction).

4.7 Spot Speed Study

As mentioned in previous chapters, the spot speed survey was conducted at two locations. These locations were selected to assess the operating speeds of the traffic plying on BRT corridor. The collected spot speed data was analysed and the mean spot speeds were determined and presented in Table 4.7.1. From this table, it can be observed that the mean speed of cars and two wheelers are ranging between 38 to 42 kmph followed by auto rickshaws reported at 33 kmph. It is also observed that the average speed of buses / mini buses about 35 kmph whereas the mean speed of cycles is 14 kmph. Further, the 85th Percentile speeds on mid-blocks are presented in Table 4.7.2 From the Table 4.7.2 and referred annexure, it can be observed that the 85th Percentile speeds at mid blocks on the corridor cars ranges from 47 to 48 kmph followed by two wheelers 49 kmph, Autos 37 kmph, Buses from 38 to 42 kmph, Commercial Vehicles ranging between 36 kmph to 43 kmph and Cycles 15 kmph.

Table 4.7.1: Mean Spot Speeds on Typical Mid Block Sections of the BRT Corridor

Vehicle Type	Mean Speed (in kmph)				
	Krishi Vihar		Sheikh Sarai		Weighted Average
	DOWN*	UP#	DOWN*	UP#	
Small Car	35.3 (280)	40.7 (334)	40 (312)	36.6 (235)	38.4
Big Car	36.1 (156)	43.2 (255)	39.9 (135)	37.1 (194)	39.5
Two Wheeler	39.4 (185)	47.9 (276)	42.4 (282)	39.7 (496)	42.1
Auto	28.5 (115)	36.4 (237)	33.5 (284)	31.4 (170)	33.2
Bus	33 (230)	34.3 (170)	35 (232)	34.3 (259)	34.1
Mini Bus	35.3 (86)	37.7 (74)	33.7 (83)	38.9 (46)	36.0
LCV	28.6 (38)	33 (44)	30 (85)	31.7 (63)	30.8
HCV	24 (1)	33.5 (85)	30.5 (64)	36.2 (5)	32.3
Cycle	11.3 (89)	14.7 (141)	12.9 (104)	14.7 (136)	13.7

Note: Values given in parenthesis represents sample size, LCV- Light Commercial Vehicle; HCV- Heavy Commercial Vehicle; # Up is Mool Chand - Ambedkar Nagar direction of Travel;
** Down is Ambedkar Nagar - Mool Chand direction of Travel*

Table 4.7.2: 85th Percentile Spot Speeds on Typical Locations of the BRT Corridor

Vehicle Type	Mean Speed (in kmph)				
	Krishi Vihar		Sheik Sarai		Weighted Average
	DOWN*	UP#	DOWN*	UP#	
Small Car	42.28	49.65	48.92	46.04	46.9
Big Car	44.50	51.14	50.23	45.17	48.0
Two Wheeler	50.29	56.69	50.05	43.89	49.3
Auto	32.14	41.16	37.46	36.60	37.6
Bus	36.52	39.28	39.20	37.01	37.9
Mini Bus	43.05	43.00	37.81	47.60	42.3
LCV	34.86	40.90	34.24	37.34	36.5
HCV	37.00	48.25	36.20	38.75	42.9
Cycle	38.83	16.53	13.79	16.15	15.1

Note: Values given in parenthesis represents sample size, LCV- Light Commercial Vehicle; HCV- Heavy Commercial Vehicle; # Up is Mool Chand - Ambedkar Nagar direction of Travel;
** Down is Ambedkar Nagar - Mool Chand direction of Travel*

4.8 Queue Length and Saturation Flows

Queue length survey was conducted at all the six intersections falling on the study corridor. The measurement of the queues building on the different approach roads of the intersections was accomplished by ear marking 50 - 100 m section on the ground coupled with posting of enumerators at strategic locations on each of the arms of the intersections *(approach-wise)*. The above arrangement was employed on the study section spanning for a length of 500 m on the major approaches *(i.e. J.B. Tito Marg)* whereas in the case of minor approaches it was manned up to 200m. This study was conducted during the morning *(08:00 AM to 12:00 Noon)* and evening peak *(04:00 PM to 08:00 PM)* hours so as to assess the maximum and average queue length on each approach of the different intersections. This survey was conducted during the normal BRT operation as well during experimental trial run and the results of analysis of queue length observed from these experiments is discussed in the succeeding sections.

4.8.1 Results of Queue Length Surveys during normal BRT Operations

As mentioned above, the queue length survey was conducted during the normal BRT operations on the study corridors aimed at measuring the queue build-up *(as per procedure envisaged in Section 4.8)* on the BRT Lane and other Motor Vehicle *(MV)* separately. The queue length statistical summary in terms of minimum, maximum, mean and standard deviation (SD) on different approaches at all the intersections are presented in Table 4.8.1 to Table 4.8.6. Further, the observed queue build-up at the major intersections on the study corridor for both directions of travel is presented in Figure 4.8.1 and 4.8.2. The following inferences have been drawn from the above referred tables and figures:

- The queue build-up on the study corridor is primarily due to controlling of the signal on manual mode during morning and evening peak hours. Obviously, the major approach arms of the Chirag Delhi intersection and Sheikh Sarai intersection are heavily congested during the morning and evening peak hours and hence the long queues were witnessed due to over-saturated status of these intersections.
- Since the number of buses during the peak hours is ranging around 254, the maximum queue length build-up is witnessed only on the MV lane whereas on the BRT queue dissipation was noted during almost all the signal cycles.
- Out of all the six intersections, the maximum queue build-up was witnessed at Siri Fort Intersection on Mool Chand approach stretching up to 600 m. Similarly the average standard deviation of all approaches was observed to be quite high at Siri Fort junction (102 m) followed by Chirag Delhi junction (79 m).
- Queue length on all approaches of the Chirag Delhi intersection were very high with the maximum observed queue length was stretching up to 500m. Further, it was noted that even on the Nehru Place Approach and IIT approaches the maximum queue length observed was as high as 400 m with the average queue

building up to 176 m and 139 m respectively. This phenomenon may be attributed to the over saturated status of this intersection.

- The observed average maximum queue length at Siri Fort and Chirag Delhi intersections were 383 m and 367 m respectively whereas the average queue build-up on the Ambedkar Nagar Intersection, Pushpa Bhavan and Sheikh Sarai Intersection was 183 m, 150 m and 180 m respectively.

Table 4.8.1: Queue Length Statistics on Various Approaches at Ambedkar Nagar Intersection

Queue length Statistical Measures *(in meters)*	Mool Chand Approach *(MV Lane)*	Mool Chand Approach *(BRT Lane)*	Mehrauli Approach *(MV Lane)*	Mehrauli Approach *(BRT Lane)*	Badarpur Boarder Approach *(MV Lane)*	Badarpur Boarder Approach *(BRT Lane)*
Minimum	0.0	50.0	0.0	50.0	50.0	50.0
Maximum	150.0	100.0	250.0	250.0	250.0	100.0
Average	75.2	63.5	124.0	105.8	122.7	65.8
SD	25.9	22.3	58.2	59.5	52.7	23.3

Table 4.8.2: Queue Length Statistics on Various Approaches at Pushpa Bhawan Intersection

Queue length Statistical Measures *(in meters)*	Mool Chand Approach *(MV Lane)*	Mool Chand Approach *(BRT Lane)*	Dakshinpuri Approach *(MV Lane)*	Ambedkar Nagar Approach *(MV Lane)*	Ambedkar Nagar Approach *(BRT Lane)*	Saket Approach *(MV Lane)*
Minimum	50.0	50.0	0.0	0.0	50.0	50.0
Maximum	150.0	100.0	200.0	150.0	100.0	200.0
Average	71.7	53.9	106.9	76.9	51.3	64.2
SD	27.6	13.3	42.2	27.8	7.8	30.1

Table 4.8.3: Queue Length Statistics on Various Approaches at Sheikh Sarai Intersection

Queue length Statistical Measures *(in meters)*	Mool Chand Approach *(MV Lane)*	Mool Chand Approach *(BRT Lane)*	Ambedkar Nagar Approach *(MV Lane)*	Ambedkar Nagar Approach *(BRT Lane)*	Saket Approach *(MV Lane)*
Minimum	50.0	50.0	50.0	50.0	0.0
Maximum	250.0	100.0	250.0	150.0	150.0
Mean	154.2	51.5	132.7	57.1	83.5
SD	50.3	8.4	56.6	19.2	27.6

Table 4.8.4: Queue Length Statistics on Various Approaches at Chirag Delhi Intersection

Queue Length Statistical Measures *(in meters)*	Mool Chand Approach *(MV Lane)*	Mool Chand Approach *(BRT Lane)*	Nehru Place Approach	Ambedkar Nagar Approach *(MV Lane)*	Ambedkar Nagar Approach *(BRT Lane)*	IIT Approach
Minimum	100	100	0	0	100	30
Maximum	500	300	400	400	200	400
Average	425	114.6	176.3	273.8	111.7	138.5
SD	113.7	36.5	97.8	123.3	32.2	68.5

Table 4.8.5: Queue Length Statistics on Various Approaches at Siri Fort Junction

Queue Length Statistical Measures *(in meters)*	GK Approach	Siri Fort Approach	Mool Chand Approach	Chirag Delhi Approach
Minimum	0	0	0	0
Maximum	250	250	600	430
Average	64.3	73.98	169.21	137.45
SD	68.82	68.49	155.27	117.12

Table 4.8.6: Queue Length Statistics on Various Approaches at GK Crossing Junction

Queue Length Statistical Measures *(in meters)*	GK Approach	Siri Fort Approach
Minimum	0	0
Maximum	450	400
Average	151.5	38.1
SD	131.3	76.8

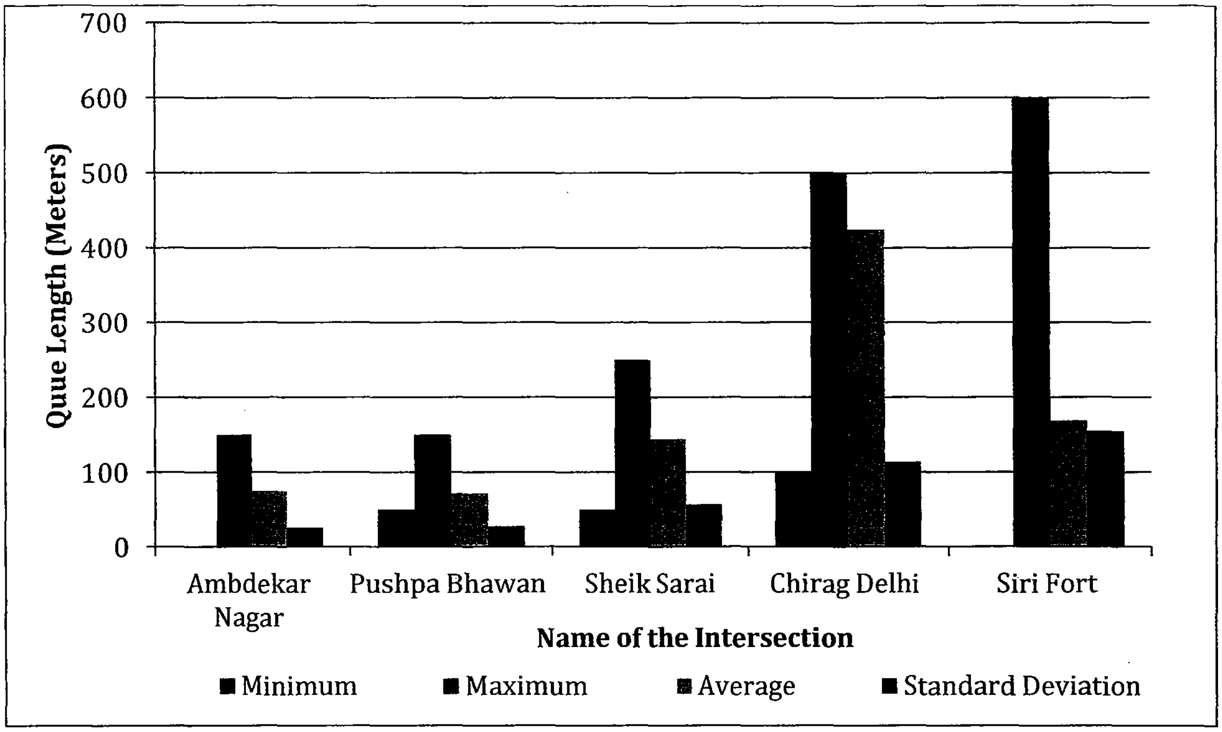


Figure 4.8.1: Queue Length at the Major Intersections on the Study Corridor from Mool Chand to Ambedkar Nagar Direction of Travel on MV Lane

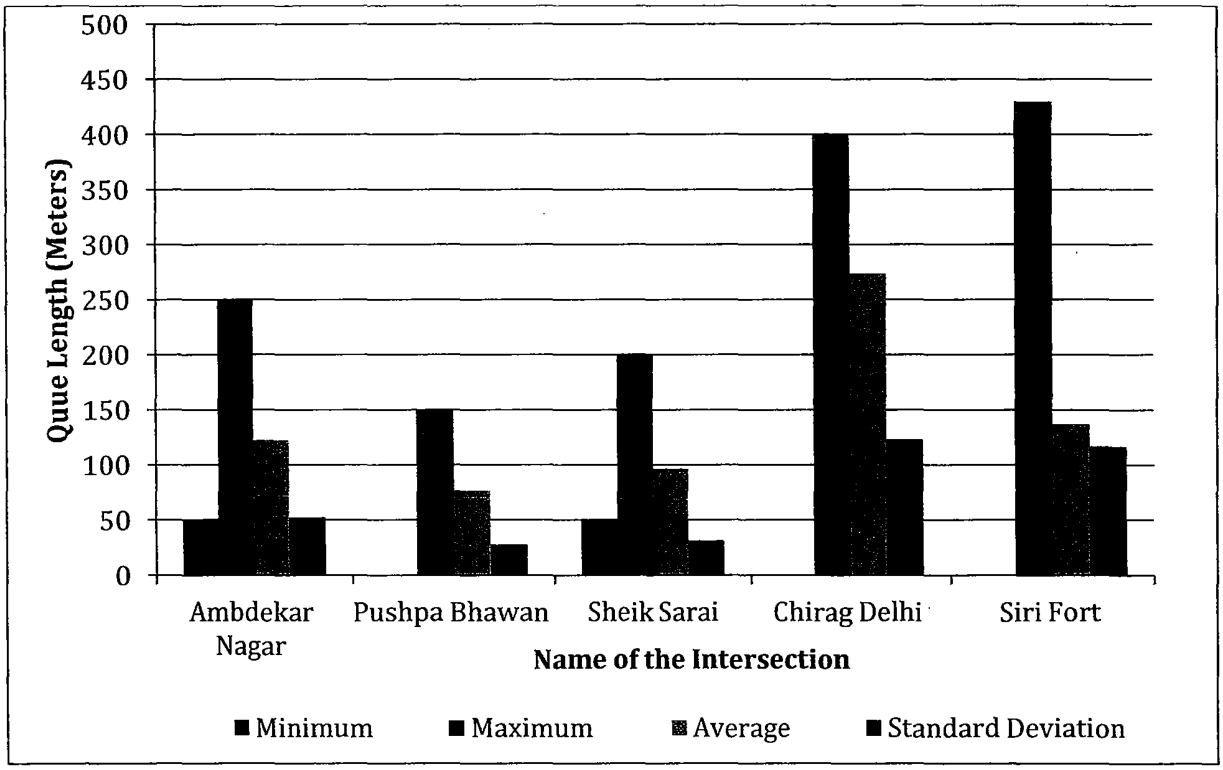


Figure 4.8.2: Queue Length at the Major Intersections on the Study Corridor from Ambedkar Nagar to Mool Chand Direction of Travel on MV Lane

4.8. *Results of Saturation Flow Analysis during normal BRT Operations*

Saturation flow survey was conducted at all the intersections on the study corridor covering effective part of the morning *(08:00 AM to 01:00 PM)* and evening peak hours *(04:00 PM to 08:00 PM)* coupled with inter peak period aimed at understanding the traffic discharge occurring at each of the intersections spread over different signal cycles. Saturation flow rate was estimated for each approach arm by enumerating the number of vehicles that would pass through the intersection during the green time for that approach. It was worked out separately for MV lane and BRT lane by estimating the number of intersections that can pass through the intersection during each hour under the prevailing traffic and roadway conditions. The saturation flow determined for all the intersections is presented in Figure 4.8.1 to Figure 4.8.4 by referring to Ambedkar Nagar side approach and Mool Chand side approach. All these figures represents that the saturation flow rate in PCU per hour. Further, it may be noted from the above that at some of the intersections, saturation flow data collection during the morning hours was conducted from 09:00 AM to 01:00 PM instead of 08:00 AM to 12:00 Noon and hence the 08:00 AM to 09:00 AM data column is left blank in some cases. The following inferences have been drawn from the above figures.

- During the morning hours, it is evident that the traffic discharge at the Greater Kailash-I *(GK-I)* intersection and Chirag Delhi intersection exhibits the maximum saturation flow rate accounting for about 6850 PCUs/hr and 6100 PCUs/hr on MV lane respectively whereas it is about 550 PCUs/hr and 500 PCUs/hr on BRT lane respectively on the Mool Chand bound approach *(Up Direction)*. Similarly, during the evening hours too, GK-I Intersection followed by Chirag Delhi accounts for the maximum saturation flow rate numbering around 4800 PCUs/hr and 4600 PCUs/hr on MV lane respectively whereas it is about 500 PCUs and 450 PCU/hr respectively on BRT lane.
- In the case of Siri Fort Intersection, it is evident that the saturation flow discharge rate is marginally higher during the evening hours (i.e. 4400 PCUs/hr) as compared to the morning hours *(i.e. 4200 PCUs/hr)* on Mool Chand bound approach *(Up Direction)*.
- The saturation flow rate at the remaining intersections like Ambedkar Nagar Intersection, Pushpa Bhavan Intersection and Sheikh Sarai Intersection is hovering between 1900 PCUs/hr to 4800 PCUs/hr on the MV lane during the different time periods of the day. The signal at Pushpa Bhavan is observed to remain under auto mode for the effective part of the day except during the evening peak wherein the maximum quantum of traffic discharges ranges around 1800 to 1900 PCUs/hour.

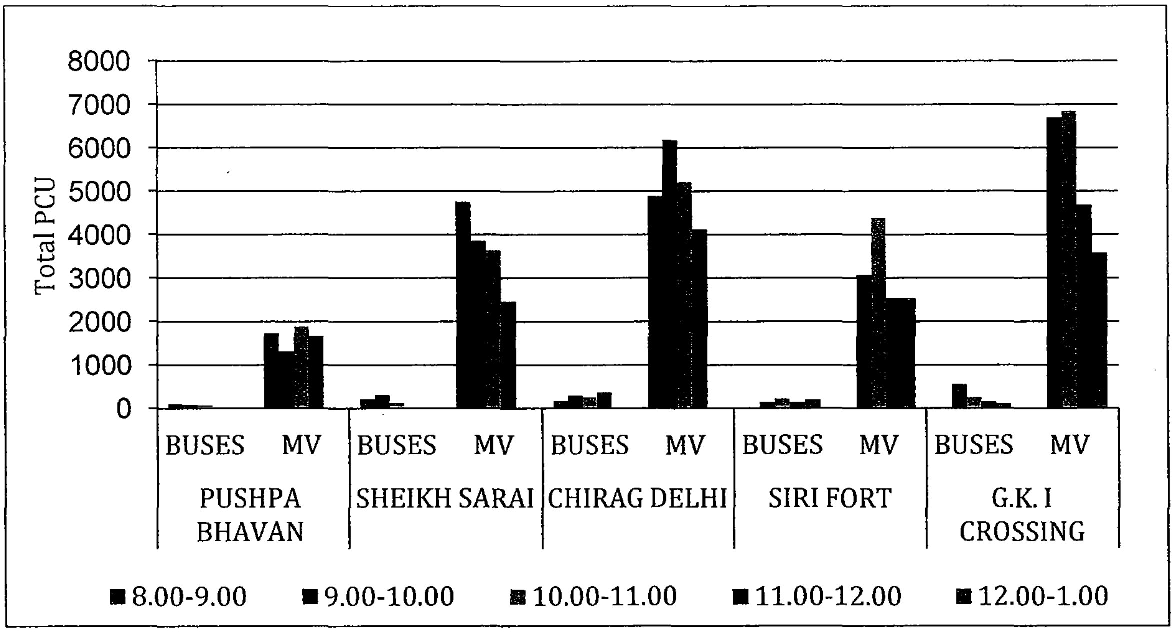


Figure 4.8.3: Saturation Flow Rate on Mool Chand Bound Approach (Up direction) during Morning Hours at Different Intersections

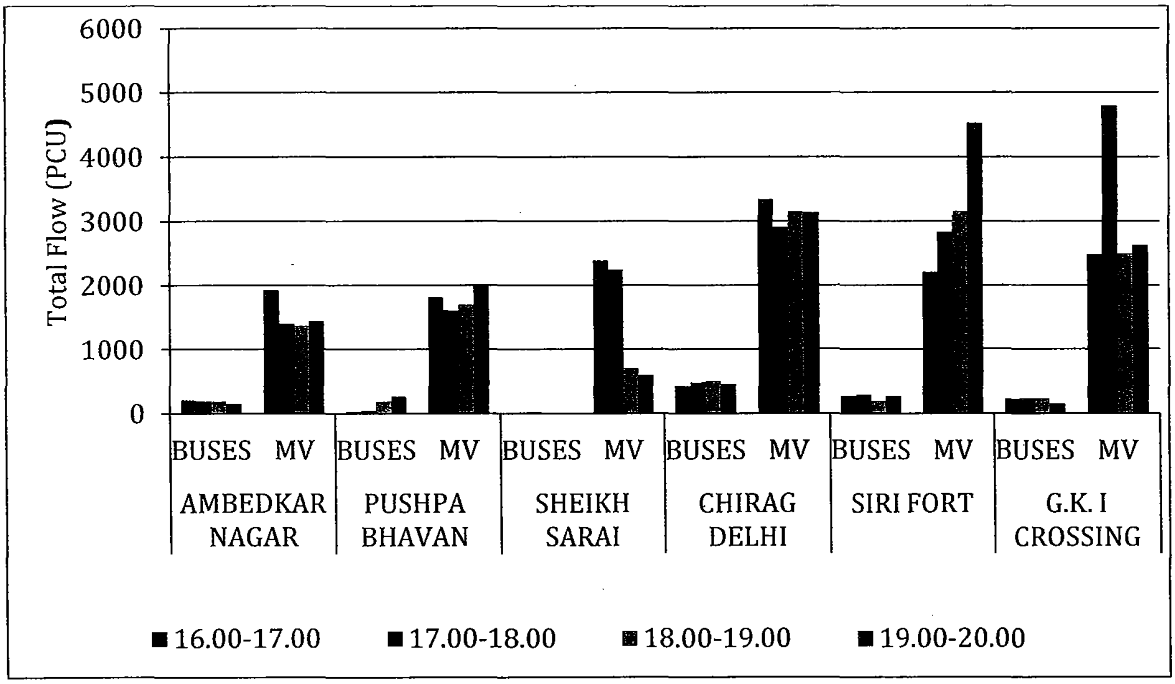


Figure 4.8.4: Saturation Flow Rate on Mool Chand Bound Approach (Up direction) during Evening Hours at Different Intersections

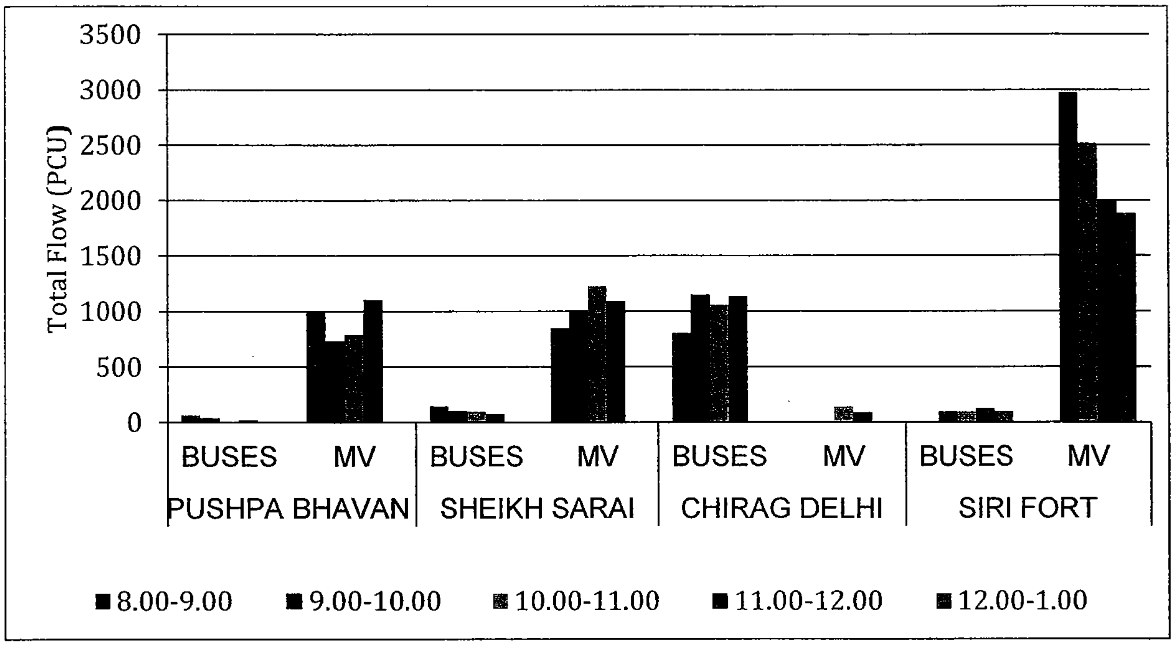


Figure 4.8.5: Saturation Flow Rate on Ambedkar Nagar Bound Approach (Down direction) during Morning Hours at Different Intersections

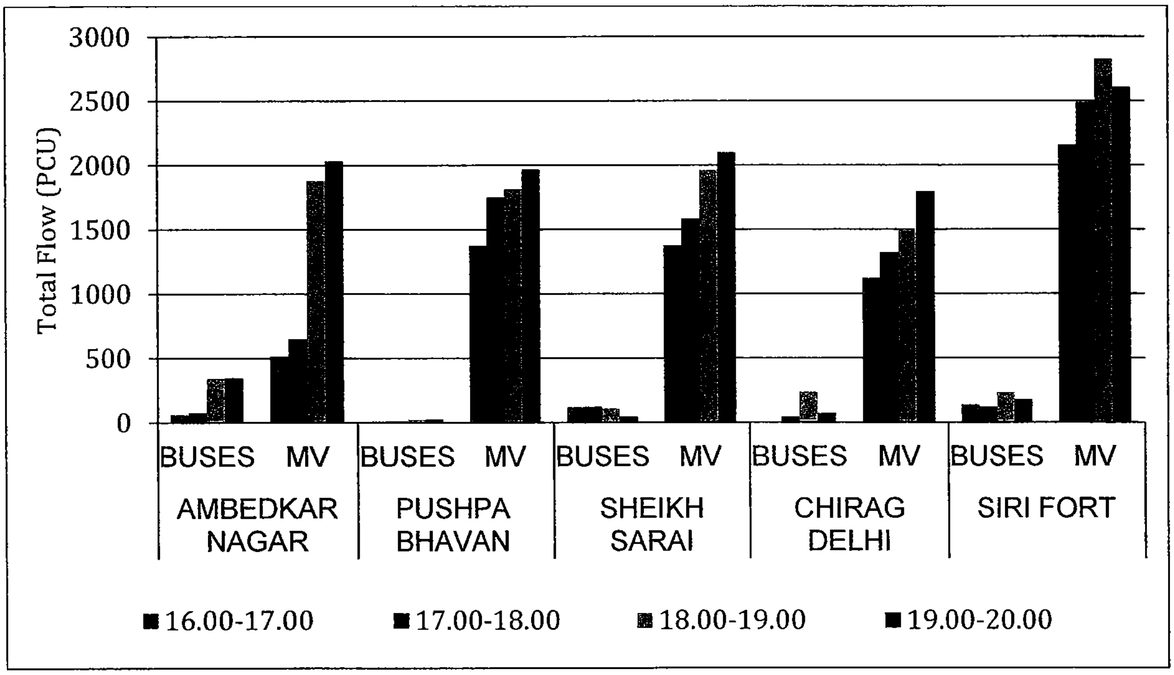


Figure 4.8.6: Saturation Flow Characteristics on Ambedkar Nagar Bound Approach *(Down direction)* during Evening Hours at Different Intersections

- Similarly, the Khanpur T- Intersection / Ambedkar Nagar Intersection tend to exhibit the same trend releasing around 2100 vehicles as that of Pushpa Bhavan both during and morning and evening peak periods under manual mode of operation.

- To summarize, the utility of the saturation flow results would be lost when the signal is operated under manual mode instead of automatic mode due to exigencies like over saturated conditions. *However, it was evident due to over saturated conditions prevalent at the major intersections located on this corridor, the signals were being operated under manual mode during the peak hours and hence no tangible outputs could be derived from the saturation flow study.*

4.9 Measurement of Fuel Consumption under normal BRT Operations

A total of 16 test runs by car were made spread over different time periods during normal BRT operations. A summary of the journey time and the associated delays during the test run for the petrol and diesel driven cars across different time periods of normal BRT operations is shown in Table 4.9.1 to 4.9.6. Subsequently, the fuel consumption during idling and cruising conditions observed presented in Table 4.9.7 to 4.9.12. The summary of the fuel consumption data comprising of ml/10m and ml/minute is presented in Table 4.9.13.

Table 4.9.1: Travel Time on the Study Stretch during the Morning Time (8:00 AM ~ 11:00 AM) for Petrol Driven Test Car under normal BRT operations

Road Stretch	Distance *(m)*	Delay Time*(Sec)*	Journey Time *(Min)*	Journey Speed *(kmph)*
		UP Direction		
Ambedkar Nagar to Pushpa Bhawan	1450	122 (36%)	5.44	15.19
Pushpa Bhawan to Sheikh Sarai	620	124 (56%)	3.40	10.17
Sheikh Sarai to Chirag Delhi	930	92 (44%)	3.29	16.01
Chirag Delhi to Siri Fort	1420	228 (59%)	6.26	13.23
Siri Fort to GK-I Crossing	800	0 (0%)	1.33	31.02
GK-I Crossing to Mool Chand	580	119 (61%)	3.17	10.61
TOTAL	**5800**	**685 (47%)**	**24.08**	**14.42**
		DOWN Direction		
Mool Chand to GK I Crossing	580	0 (0%)	1.23	25.24
GK-I Crossing to Siri Fort	800	153 (60%)	4.17	11.20
Siri Fort to Chirag Delhi	1420	239 (57%)	6.58	12.24
Chirag Delhi to Sheikh Sarai	930	36 (19%)	3.05	18.10
Sheikh Sarai to Pushpa Bhawan	620	86 (54%)	2.40	13.96
Pushpa Bhawan to Ambedkar Nagar	1450	87 (30%)	4.51	17.96
TOTAL	**5800**	**601 (43%)**	**23.13**	**14.99**

Note: Value in parenthesis shows the percentage of delay experienced out of the total travel time

Table 4.9.2: Travel Time on the Study Stretch during the Afternoon Time (12:00 noon ~ 4:00 PM) for Petrol Driven Test Car under normal BRT operations

Road Stretch	Distance *(m)*	Delay Time*(Sec)*	Journey Time *(Min)*	Journey Speed *(kmph)*
UP Direction				
Ambedkar Nagar to Pushpa Bhawan	1450	202 (51%)	6.39	13.07
Pushpa Bhawan to Sheikh Sarai	620	56 (42%)	2.12	16.90
Sheikh Sarai to Chirag Delhi	930	265 (68%)	6.29	8.60
Chirag Delhi to Siri Fort	1420	71 (29%)	4.04	20.95
Siri Fort to GK-I Crossing	800	2 (1%)	1.59	24.25
GK-I Crossing to Mool Chand	580	158 (66%)	3.58	8.76
TOTAL	**5800**	**754 (50%)**	**25.22**	**13.72**
DOWN Direction				
Mool Chand to GK I Crossing	580	0 (0%)	1.23	25.02
GK-I Crossing to Siri Fort	800	214 (65%)	5.29	8.76
Siri Fort to Chirag Delhi	1420	193 (50%)	6.25	13.28
Chirag Delhi to Sheikh Sarai	930	44 (23%)	3.09	17.76
Sheikh Sarai to Pushpa Bhawan	620	80 (53%)	2.30	14.83
Pushpa Bhawan to Ambedkar Nagar	1450	36 (17%)	3.33	24.52
TOTAL	**5800**	**567 (42%)**	**22.29**	**15.48**

Table 4.9.3: Travel Time on the Study Stretch during the Evening Time (4:00 PM ~ 8:00 PM) for Petrol Driven Test Car under normal BRT operations

Road Stretch	Distance *(m)*	Delay Time*(Sec)*	Journey Time *(Min)*	Journey Speed *(kmph)*
UP Direction				
Ambedkar Nagar to Pushpa Bhawan	1450	296 (56%)	8.43	9.98
Pushpa Bhawan to Sheikh Sarai	620	178 (66%)	4.30	8.28
Sheikh Sarai to Chirag Delhi	930	211 (63%)	5.32	9.93
Chirag Delhi to Siri Fort	1420	105 (39%)	4.26	19.21
Siri Fort to GK-I Crossing	800	6 (4%)	2.11	22.03
GK-I Crossing to Mool Chand	580	108 (53%)	3.24	10.25
TOTAL	**5800**	**903 (52%)**	**28.50**	**12.07**
DOWN Direction				
Mool Chand to GK I Crossing	580	0 (0%)	1.21	25.85
GK-I Crossing to Siri Fort	800	265 (61%)	7.14	6.64
Siri Fort to Chirag Delhi	1420	301 (58%)	8.40	9.84
Chirag Delhi to Sheikh Sarai	930	8 (5%)	2.53	19.32
Sheikh Sarai to Pushpa Bhawan	620	119 (56%)	3.31	10.56
Pushpa Bhawan to Ambedkar Nagar	1450	23 (9%)	4.05	21.33
TOTAL	**5800**	**715 (43%)**	**27.44**	**12.55**

Note: Value in parenthesis shows the percentage of delay experienced out of the total travel time

Table 4.9.4: Travel Time on the Study Stretch during the Morning Time (8:00 AM ~ 11:00 AM) for Diesel Driven Test Car under normal BRT operations

Road Stretch	Distance *(m)*	Delay *(Sec)*	Journey Time *(Min)*	Journey Speed *(kmph)*
UP Direction				
Ambedkar Nagar to Pushpa Bhawan	1450	164 (42%)	6.31	13.37
Pushpa Bhawan to Sheikh Sarai	620	96 (55%)	2.56	12.71
Sheikh Sarai to Chirag Delhi	930	83 (42%)	3.18	16.95
Chirag Delhi to Siri Fort	1420	62 (28%)	3.39	23.49
Siri Fort to GK-I Crossing	800	12 (9%)	2.06	22.91
GK-I Crossing to Mool Chand	580	59 (43%)	2.16	15.05
TOTAL	**5800**	**475 (38%)**	**20.45**	**16.77**
DOWN Direction				
Mool Chand to GK I Crossing	580	0 (0%)	1.01	33.61
GK-I Crossing to Siri Fort	800	79 (49%)	2.41	17.85
Siri Fort to Chirag Delhi	1420	147 (45%)	5.30	15.60
Chirag Delhi to Sheikh Sarai	930	77 (38%)	3.20	16.71
Sheikh Sarai to Pushpa Bhawan	620	84 (53%)	2.38	14.10
Pushpa Bhawan to Ambedkar Nagar	1450	43 (18%)	4.05	21.33
TOTAL	**5800**	**429 (37%)**	**19.16**	**18.07**

Note: Value in parenthesis shows the percentage of delay experienced out of the total travel time

Table 4.9.5: Travel Time on the Study Stretch during the Afternoon Time (12:00 noon ~ 4:00 PM) for Diesel Driven Car under normal BRT operations

Road Stretch	Distance *(m)*	Delay Time*(Sec)*	Journey Time *(Min)*	Journey Speed *(kmph)*
UP Direction				
Ambedkar Nagar to Pushpa Bhawan	1450	187 (49%)	6.25	13.57
Pushpa Bhawan to Sheikh Sarai	620	121 (57%)	3.32	10.52
Sheikh Sarai to Chirag Delhi	930	218 (64%)	5.39	9.89
Chirag Delhi to Siri Fort	1420	156 (47%)	5.28	15.68
Siri Fort to GK-I Crossing	800	7 (7%)	1.51	25.93
GK-I Crossing to Mool Chand	580	70 (46%)	2.33	13.45
TOTAL	**5800**	**759 (50%)**	**25.27**	**13.67**
DOWN Direction				
Mool Chand to GK I Crossing	580	0 (0%)	1.04	31.84
GK-I Crossing to Siri Fort	800	160 (44%)	5.05	9.43
Siri Fort to Chirag Delhi	1420	29 (16%)	6.08	13.99
Chirag Delhi to Sheikh Sarai	930	39 (34%)	3.00	18.65
Sheikh Sarai to Pushpa Bhawan	620	73 (26%)	1.54	19.59
Pushpa Bhawan to Ambedkar Nagar	1450	511 (39%)	4.47	18.22
TOTAL	**5800**	**567 (42%)**	**21.58**	**15.84**

Note: Value in parenthesis shows the percentage of delay experienced out of the total travel time

Table 4.9.6: Travel Time on the Study Stretch during the Evening Time (4:00 PM ~ 8:00 PM) for Diesel Driven Test Car under normal BRT operations

Road Stretch	Distance *(m)*	Delay Time *(Sec)*	Journey Time *(Min)*	Journey Speed *(kmph)*
UP Direction				
Ambedkar Nagar to Pushpa Bhawan	1450	263 (55%)	7.58	10.91
Pushpa Bhawan to Sheikh Sarai	620	133 (61%)	3.38	10.25
Sheikh Sarai to Chirag Delhi	930	325 (66%)	8.08	6.86
Chirag Delhi to Siri Fort	1420	344 (67%)	8.36	9.99
Siri Fort to GK-I Crossing	800	0 (0%)	1.26	33.61
GK-I Crossing to Mool Chand	580	150 (61%)	4.06	8.34
TOTAL	**5800**	**1213 (60%)**	**33.52**	**10.28**
DOWN Direction				
Mool Chand to GK I Crossing	580	0 (0%)	1.13	28.08
GK-I Crossing to Siri Fort	800	131 (51%)	4.13	11.36
Siri Fort to Chirag Delhi	1420	282 (54%)	8.38	9.94
Chirag Delhi to Sheikh Sarai	930	31 (16%)	3.11	17.56
Sheikh Sarai to Pushpa Bhawan	620	61 (39%)	2.35	14.41
Pushpa Bhawan to Ambedkar Nagar	1450	114 (30%)	6.17	13.83
TOTAL	**5800**	**618 (39%)**	**26.07**	**13.32**

Note: Value in parenthesis shows the percentage of delay experienced out of the total travel time

Table 4.9.7: Fuel Consumption on the Study Stretch during the Morning Time (8:00 AM ~ 11:00 AM) for Petrol Driven Test Car under normal BRT operations

Road Stretch	Distance (m)	Fuel Consumption (ml)	
		Idling	Total
UP Direction			
Ambedkar Nagar to Pushpa Bhawan	1450	19.1 (17%)	114.93
Pushpa Bhawan to Sheikh Sarai	620	17.6 (31%)	57.30
Sheikh Sarai to Chirag Delhi	930	12.9 (20%)	64.48
Chirag Delhi to Siri Fort	1420	31.2 (29%)	105.93
Siri Fort to GK-I Crossing	800	0 (0%)	40.30
GK-I Crossing to Mool Chand	580	17 (34%)	50.48
TOTAL	**5800**	**97.7 (23%)**	**433.41**
DOWN Direction			
Mool Chand to GK I Crossing	580	0 (0%)	45.85
GK-I Crossing to Siri Fort	800	22.1 (34%)	64.73
Siri Fort to Chirag Delhi	1420	33.6 (27%)	122.47
Chirag Delhi to Sheikh Sarai	930	5.4 (7%)	72.21
Sheikh Sarai to Pushpa Bhawan	620	13.2 (27%)	48.44
Pushpa Bhawan to Ambedkar Nagar	1450	13.1 (12%)	105.26
TOTAL	**5800**	**87.4 (19%)**	**458.96**

Note: Value in parenthesis shows the percentage of fuel consumption during idling time

Table 4.9.8: Fuel Consumption on the Study Stretch during the Afternoon Time (12:00 noon ~ 4:00 PM) for Petrol Driven Test Car under normal BRT operations

Road Stretch	Distance (m)	Fuel Consumption (ml)	
		Idling	Total
UP Direction			
Ambedkar Nagar to Pushpa Bhawan	1450	28.4 (23%)	120.75
Pushpa Bhawan to Sheikh Sarai	620	8.0 (18%)	44.98
Sheikh Sarai to Chirag Delhi	930	36.3 (39%)	93.30
Chirag Delhi to Siri Fort	1420	10.2 (11%)	94.20
Siri Fort to GK-I Crossing	800	0.3 (1%)	46.82
GK-I Crossing to Mool Chand	580	22.3 (39%)	57.35
TOTAL	**5800**	**105.4 (23%)**	**457.40**
DOWN Direction			
Mool Chand to GK I Crossing	580	0 (0%)	45.91
GK-I Crossing to Siri Fort	800	29.4 (38%)	76.52
Siri Fort to Chirag Delhi	1420	25.3 (21%)	119.94
Chirag Delhi to Sheikh Sarai	930	6.5 (9%)	73.27
Sheikh Sarai to Pushpa Bhawan	620	11.2 (24%)	46.58
Pushpa Bhawan to Ambedkar Nagar	1450	5.2 (6%)	92.02
TOTAL	**5800**	**77.5 (17%)**	**454.26**

Note: Value in parenthesis shows the percentage of fuel consumption during idling

Table 4.9.9: Fuel Consumption on the Study Stretch during the Evening Time (4:00 PM ~ 8:00 PM) for Petrol Driven Test Car under normal BRT operations

Road Stretch	Distance (m)	Fuel Consumption (ml)	
		Idling	Total
UP Direction			
Ambedkar Nagar to Pushpa Bhawan	1450	44.9 (33%)	134.47
Pushpa Bhawan to Sheikh Sarai	620	31.1 (45%)	68.57
Sheikh Sarai to Chirag Delhi	930	29.9 (35%)	84.37
Chirag Delhi to Siri Fort	1420	16.3 (16%)	101.69
Siri Fort to GK-I Crossing	800	1.1 (2%)	50.13
GK-I Crossing to Mool Chand	580	15.9 (31%)	52.10
TOTAL	**5800**	**139.1 (28%)**	**491.32**
DOWN Direction			
Mool Chand to GK I Crossing	580	0.0 (0%)	48.64
GK-I Crossing to Siri Fort	800	39 (50%)	78.59
Siri Fort to Chirag Delhi	1420	48.2 (34%)	141.95
Chirag Delhi to Sheikh Sarai	930	1.9 (2%)	74.20
Sheikh Sarai to Pushpa Bhawan	620	18.4 (31%)	59.73
Pushpa Bhawan to Ambedkar Nagar	1450	3.9 (4%)	96.39
TOTAL	**5800**	**111.3 (22%)**	**499.49**

Note: Value in parenthesis shows the percentage of fuel consumption during idling

Table 4.9.10: Fuel Consumption on the Study Stretch during the Morning Time (8:00 AM ~ 11:00 AM) for Diesel Driven Test Car under normal BRT operations

Road Stretch	Distance (m)	Fuel Consumption (ml)	
		Idling	Total
UP Direction			
Ambedkar Nagar to Pushpa Bhawan	1450	28.6 (17%)	167.51
Pushpa Bhawan to Sheikh Sarai	620	16.3 (23%)	71.13
Sheikh Sarai to Chirag Delhi	930	13.8 (17%)	79.81
Chirag Delhi to Siri Fort	1420	9.2 (7%)	126.04
Siri Fort to GK-I Crossing	800	1.5 (2%)	65.56
GK-I Crossing to Mool Chand	580	9.1 (17%)	55.28
TOTAL	**5800**	**78.5 (14%)**	**565.32**
DOWN Direction			
Mool Chand to GK I Crossing	580	0.0 (0%)	73.94
GK-I Crossing to Siri Fort	800	13.9 (21%)	65.64
Siri Fort to Chirag Delhi	1420	24.8 (16%)	153.78
Chirag Delhi to Sheikh Sarai	930	12.6 (13%)	100.72
Sheikh Sarai to Pushpa Bhawan	620	13.7 (19%)	72.42
Pushpa Bhawan to Ambedkar Nagar	1450	6.8 (6%)	117.72
TOTAL	**5800**	**71.7 (12%)**	**584.21**

Note: Value in parenthesis shows the percentage of fuel consumption during idling

Table 4.9.11: Fuel Consumption on the Study Stretch during the Afternoon Time (12:00 noon ~ 4:00 PM) for Diesel Driven Test Car under normal BRT operations

Road Stretch	Distance (m)	Fuel Consumption (ml)	
		Idling	Total
UP Direction			
Ambedkar Nagar to Pushpa Bhawan	1450	30.8 (20%)	150.40
Pushpa Bhawan to Sheikh Sarai	620	20.2 (28%)	71.95
Sheikh Sarai to Chirag Delhi	930	35.8 (32%)	111.42
Chirag Delhi to Siri Fort	1420	25.4 (19%)	134.59
Siri Fort to GK-I Crossing	800	1.2 (2%)	52.94
GK-I Crossing to Mool Chand	580	11.2 (19%)	59.49
TOTAL	**5800**	**124.7 (21%)**	**580.79**
DOWN Direction			
Mool Chand to GK I Crossing	580	0.0 (0%)	78.94
GK-I Crossing to Siri Fort	800	33.1 (36%)	92.30
Siri Fort to Chirag Delhi	1420	25.0 (17%)	147.52
Chirag Delhi to Sheikh Sarai	930	5.3 (5%)	100.02
Sheikh Sarai to Pushpa Bhawan	620	6.4 (12%)	53.87
Pushpa Bhawan to Ambedkar Nagar	1450	11.3 (9%)	130.63
TOTAL	**5800**	**81.1 (13%)**	**603.28**

Note: Value in parenthesis shows the percentage of fuel consumption during idling

Table 4.9.12: Fuel Consumption on the Study Stretch during the Evening Time (4:00 PM ~ 8:00 PM) for Diesel Driven Test Car under normal BRT operations

Road Stretch	Distance (m)	Fuel Consumption (ml) Idling	Fuel Consumption (ml) Total
UP Direction			
Ambedkar Nagar to Pushpa Bhawan	1450	46.7 (28%)	167.69
Pushpa Bhawan to Sheikh Sarai	620	25.9 (33%)	78.62
Sheikh Sarai to Chirag Delhi	930	57.1 (41%)	139.73
Chirag Delhi to Siri Fort	1420	61.3 (40%)	153.71
Siri Fort to GK-I Crossing	800	0 (0%)	47.86
GK-I Crossing to Mool Chand	580	25.7 (34%)	76.06
TOTAL	**5800**	**216.8 (33%)**	**663.66**
DOWN Direction			
Mool Chand to GK I Crossing	580	0 (0%)	57.77
GK-I Crossing to Siri Fort	800	22.4 (29%)	77.68
Siri Fort to Chirag Delhi	1420	49.2 (28%)	176.73
Chirag Delhi to Sheikh Sarai	930	5.5 (5%)	99.58
Sheikh Sarai to Pushpa Bhawan	620	10.7 (19%)	57.67
Pushpa Bhawan to Ambedkar Nagar	1450	20.5 (14%)	142.85
TOTAL	**5800**	**108.3 (18%)**	**612.26**

Note: Value in parenthesis shows the percentage of fuel consumption during idling

Table 4.9.13: Average Fuel Consumption from Petrol and Diesel Driven Probe Cars during normal BRT operations

Road Stretch	Fuel Consumption *(ml/10m)*	Fuel Consumption *(ml/minute)*
Petrol Driven Vehicle		
UP Direction: Ambedkar Nagar to Mool Chand	0.8	17.68
DOWN Direction: Mool Chand to Ambedkar Nagar	0.8	19.33
Diesel Driven Vehicle		
UP Direction: Ambedkar Nagar to Mool Chand	1.0	23.22
DOWN Direction: Mool Chand to Ambedkar Nagar	1.0	27.08

The salient observations drawn from Table 4.9.1 to 4.9.13 are presented below:

- The quantum of delay observed ranged from 7 - 20 minutes across different time periods of the day.
- The amount of fuel consumed due to idling at the intersections ranged from 78 ml to 139 ml in the case of petrol driven test car whereas in the case of diesel driven test car it is hovering between 72 ml to 217 ml across different time periods of the day. The maximum quantum of fuel was consumed on the section

between Sheikh Sarai to Chirag Delhi and similarly Chirag Delhi to Siri Fort due to the over saturated condition of the Chirag Delhi and Siri Fort intersections during the peak hours.

- The journey speed observed ranged from 10 kmph - 18 kmph across different time periods of the day.
- The amount of fuel wasted due to idling is ranging between 2 % to 45 %, with the maximum quantum wastage of fuel noted on the stretch between Sheikh Sarai to Chirag Delhi varying in the range of 17 per cent to 41 per cent across varying time periods of the day. Further, the time lost in idling varied from 37% to 60%.
- The fuel efficiency was low in diesel vehicle *(Tata Sumo)* and this may be attributed to the higher engine capacity of diesel vehicle *(2000 cc)* as compared with lower engine capacity *(800 cc)* of the petrol vehicle.

4.10 Parking Study

As given in earlier chapter, parking surveys were conducted at the selected locations on the BRT corridor where parking problems are clearly seen. Based on the reconnaissance visit, this survey has been conducted near Madangir spanning for 12 hours on a given working day starting from 8:00 AM to 8:00 PM. During the process of evaluation of the BRT corridor from Ambedkar Nagar to Mool Chand, the parking analysis derived include the parking accumulation and duration based on collected data A total of 4 locations as presented in Figure 4.10.1 mentioned earlier and the collected parking accumulation and duration data has been analysed. The results of parking study at the selected four locations are presented in Figure 4.10.2 to 4.10.5.

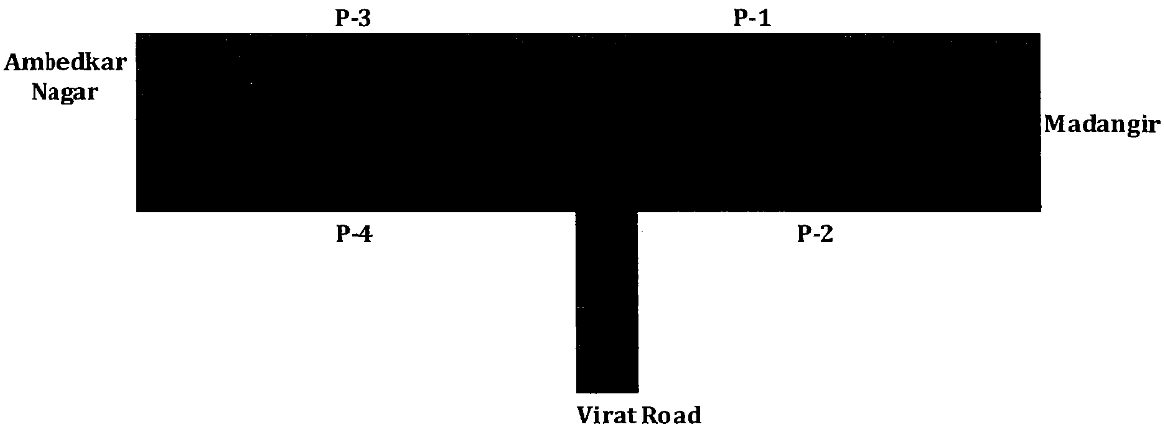
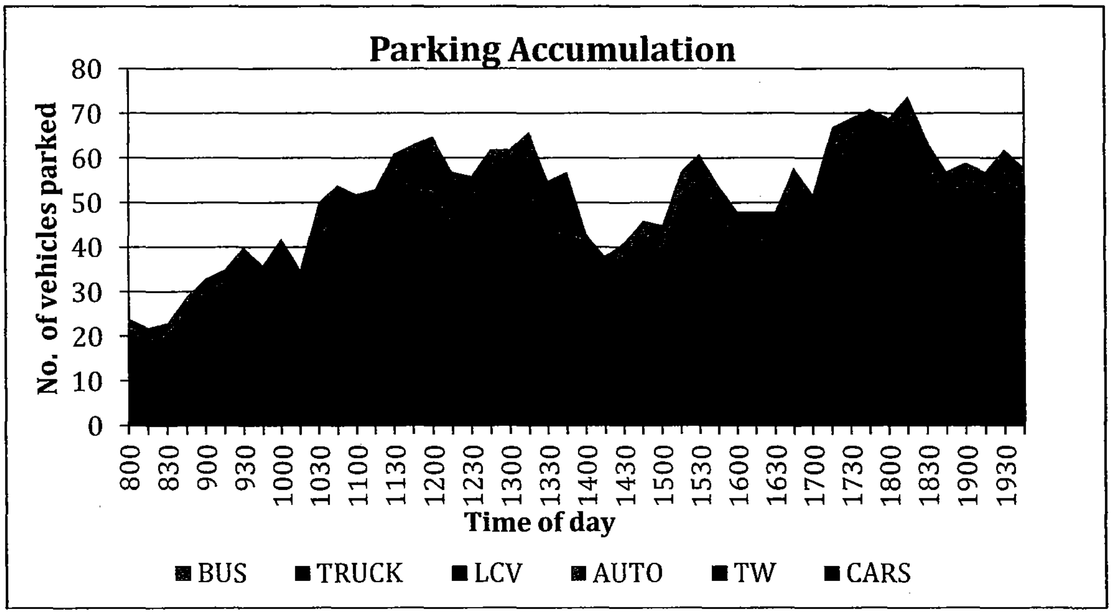


Figure 4.10.1: Locations of Parking Survey

From the Figure 4.10.1, it can be observed that the number of vehicles parked is high in the morning and evening time with a variation from about 40 to 70 vehicles in one hour. It can be further observed that more than 85 % of the parkers are cars and two wheelers. It can also be seen from the Figure 4.10.2 that 80% of the buses park for at least 3 hours, 80% of the cars for about one hour and 80% of the other vehicles park for less than an hour.

From the Figure 4.10.2, it can be observed that the number of vehicles parked is almost same throughout the day with a variation from about 10 to 20 vehicles in one hour. It can be further observed that only cars (62%) and two wheelers (38%) are parking at this location. It can also be seen from the Figure 4.10.3 that 90% of the cars park for one hour and 90% of the two wheelers between 30 min to 45 min.

From the Figure 4.10.4, it can be observed that the number of vehicles parked is high in the morning and evening time with a variation from about 100 to 120 vehicles in one hour. It can be further observed that about 75% of the parkers are cars, followed by two wheelers of 12%. and Autos of 10%. It can also be seen from the Figure 4.10.5 that 85% of the cars and two wheelers park for 30 min. whereas 85% of LCVs park for 4 hours and Trucks for 3 hours at this location.



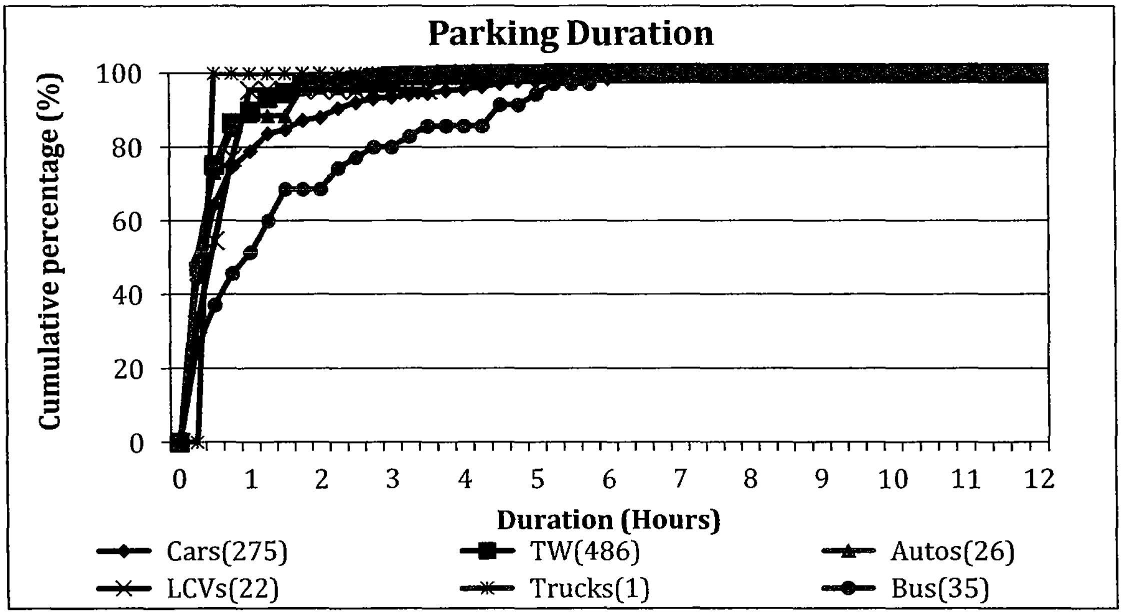
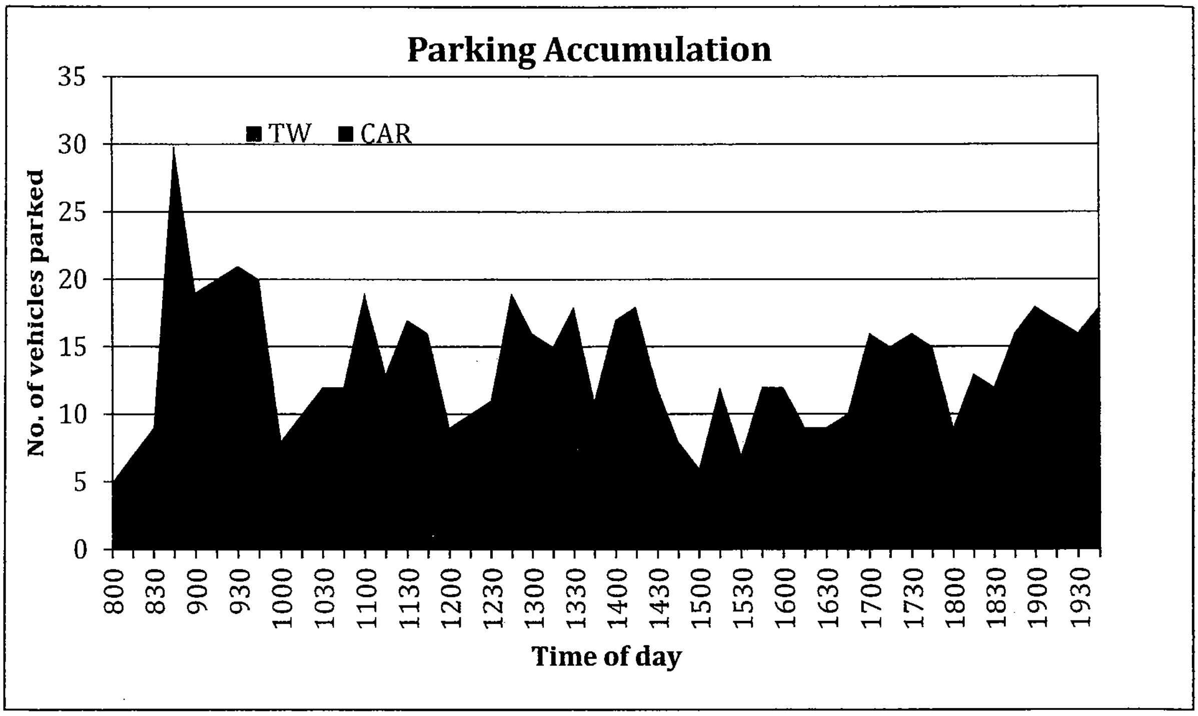


Figure 4.10.2: Parking Accumulation and Duration Survey Results at P1 Location



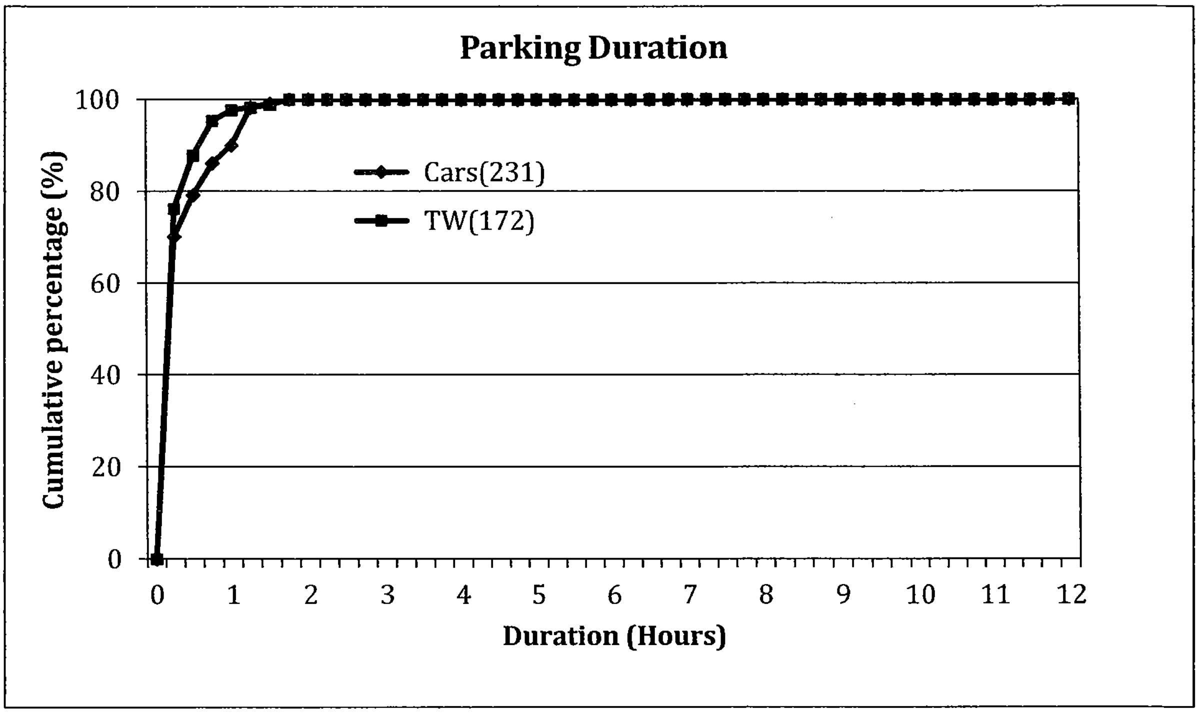
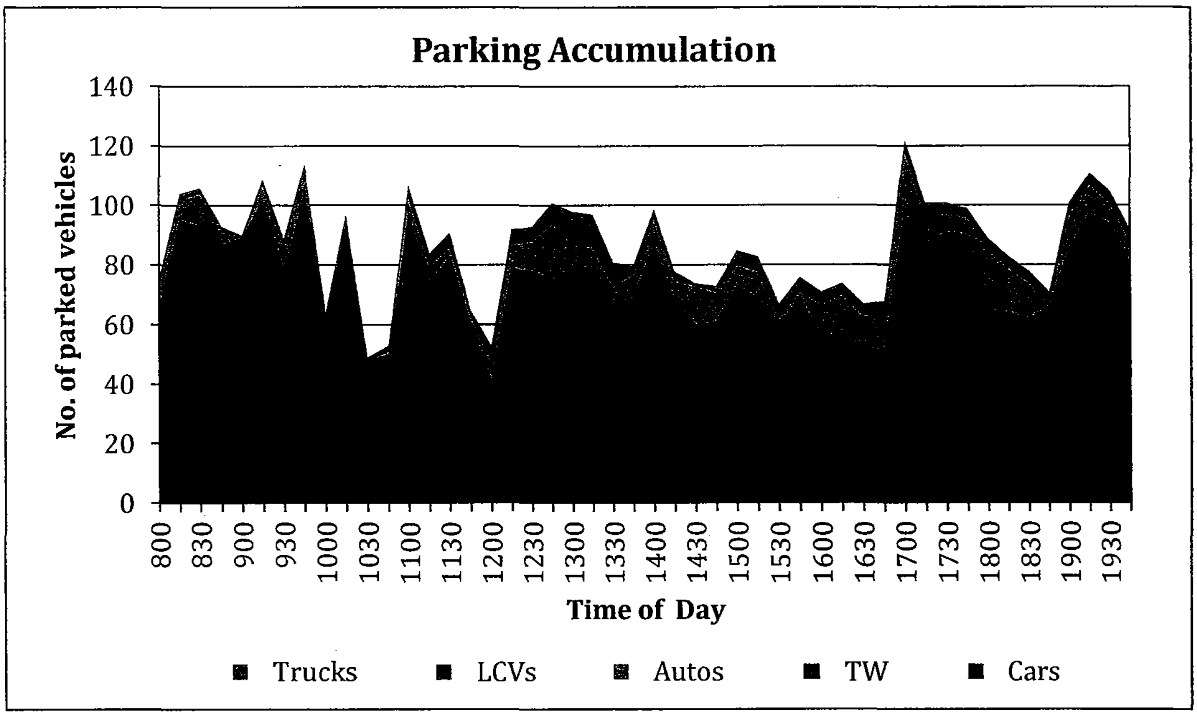


Figure 4.10.3: Parking Accumulation and Duration Survey Results at P2 Location



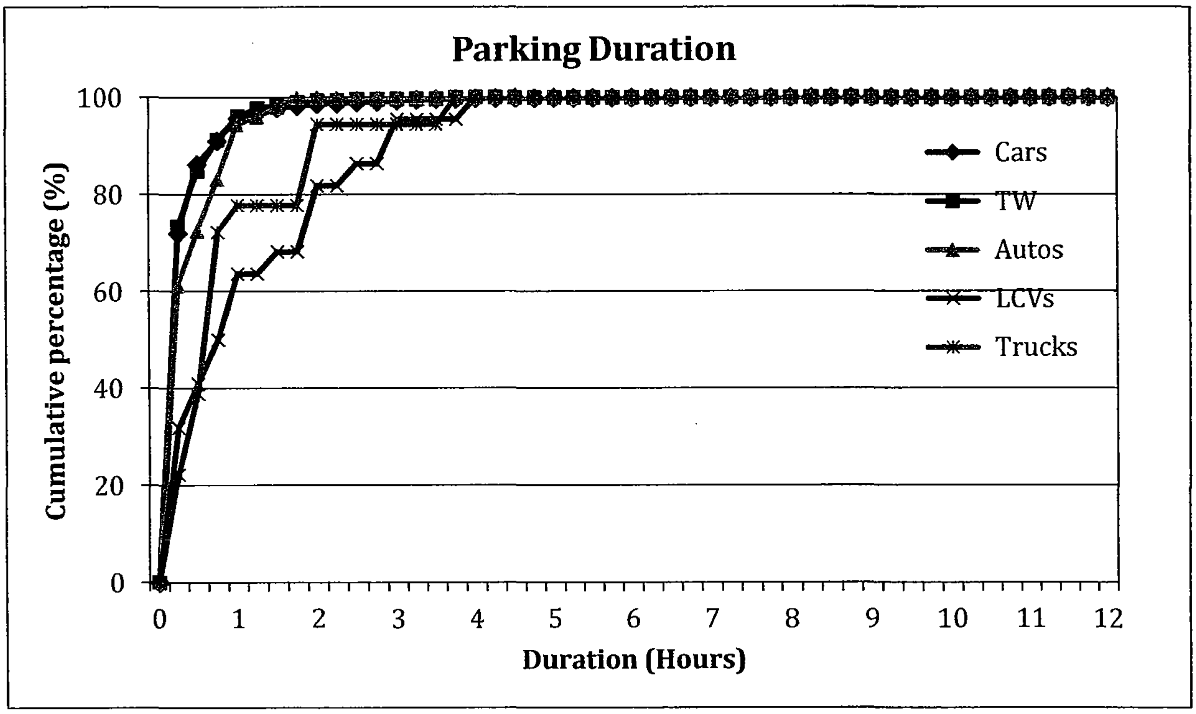
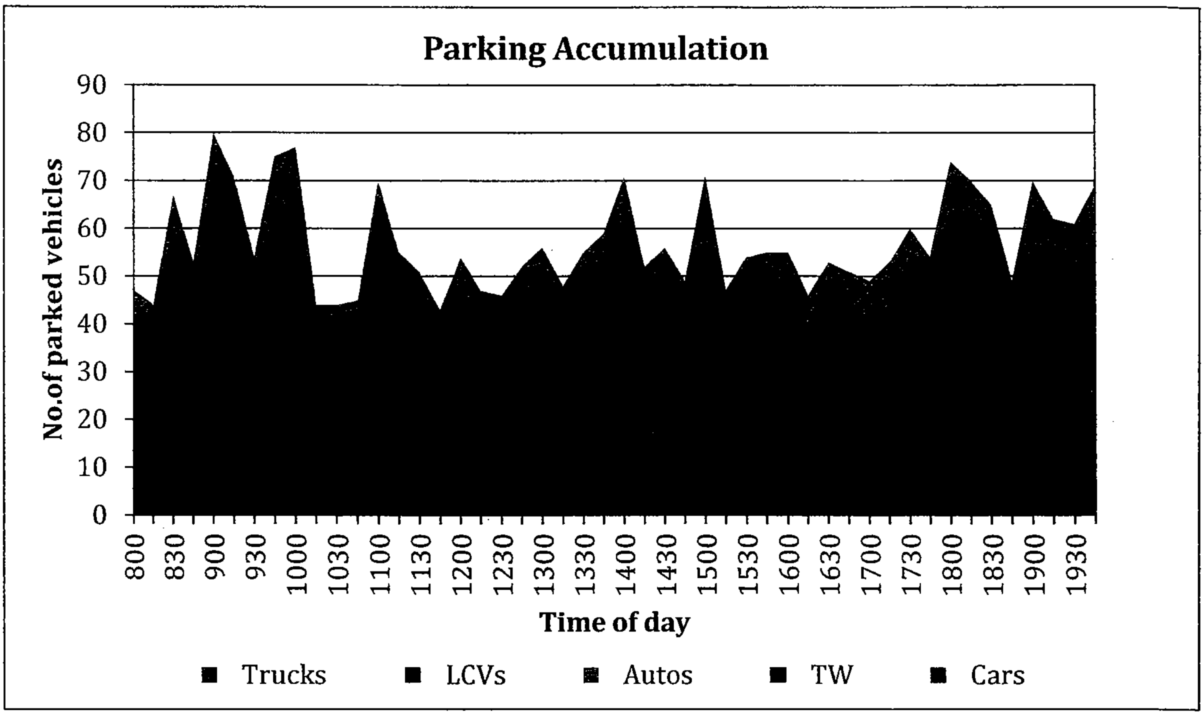


Figure 4.10.4: Parking Accumulation and Duration Survey Results at P3 Location



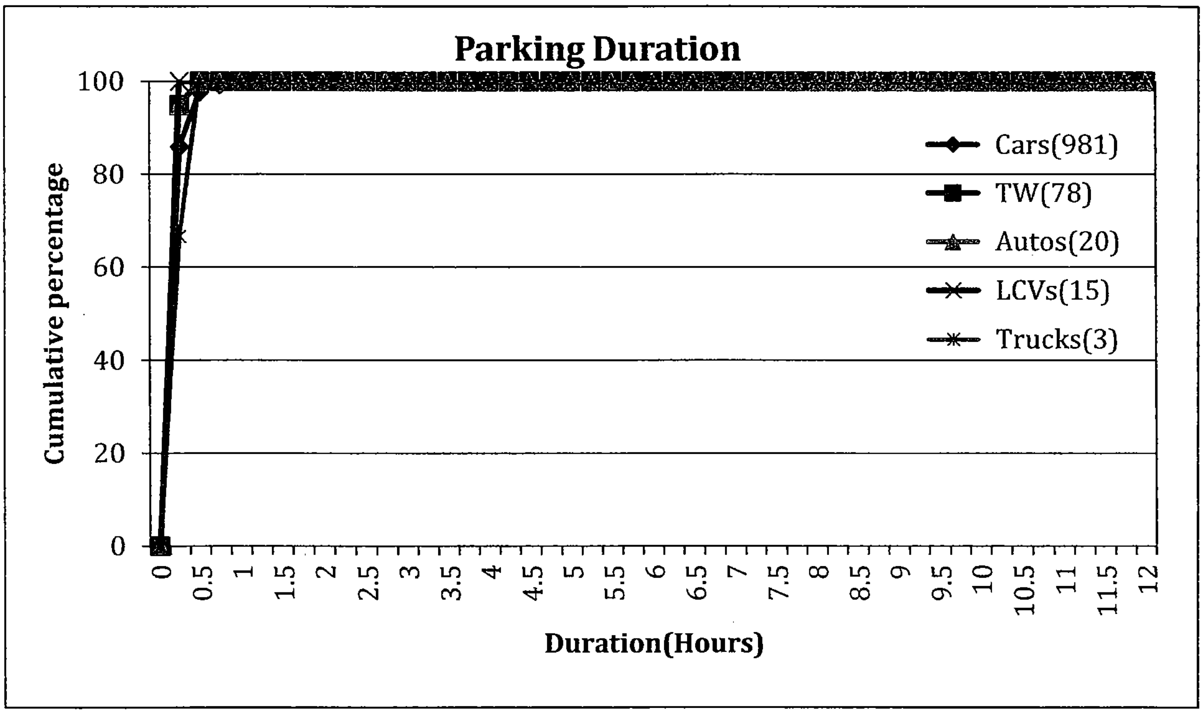


Figure 4.10.5: Parking Accumulation and Duration Survey Results at P4 Location

From the Figure 4.10.4, it can be observed that the number of vehicles parked is high in the morning and evening time with a variation from about 50 to 80 vehicles in one hour. It can be further observed that about 72% of the parkers are cars followed by two wheelers of 18% and Autos of 10%. It can also be seen from the Figure 4.10.4 that all the vehicles are quick parkers of less than 15 min except trucks park about 30 min.

From the parking analysis it can be observed that the on-street parking is common phenomenon on this corridor which is causing so much interference to the MV lane traffic on the BRT corridor. This on-street parking is also becoming menace to NMT users as they park on the cycle tracks and foot paths. From this, it can be recommended that these activities have to be fully controlled through by effective enforcement and provision of proper off-street parking facilities at Virat Area, Pushpa Bhawan etc.

4.11 User Opinion Survey Results

Basically a crisp interview was carried out to understand the satisfaction level of all types of commuters travelling on the study stretch which included a minimum of 5 per cent stratified random sample covering bus commuters, car travellers, two wheeler riders, auto rickshaw users, cyclists and pedestrians. The user opinion survey was carried out to understand the views of different road users who are travelling on this corridor as it is one of the important performance parameter for evaluation of BRT.

About 9,842 samples were collected which includes different vehicle users, both male and female. The sample collected for the study is given in Table 4.11.1. The respondents were chosen by deploying stratified random sampling procedure and the samples were collected by conducting a crisp interview of the road users / residents along the roadside, nearby malls, nearby RWAs *(some typical illustrations given in Figure 4.11.1 to 4.11.2)*, Schools, Offices and Business establishment by identifying the potential users of this corridor. Care was exercised by the survey team to collect the samples aimed at equal distribution cutting across all types of respondents mentioned above.

Photo 4.11.1: A Typical Meeting of CSIR-CRRI study team with Resident Welfare Associations along the BRT Corridor at Punchsheel Enclave

Photo 4.11.2: A Typical Meeting of CSIR-CRRI Study Team with various Resident Welfare Associations along the BRT Corridor at Sadiq Nagar

Table 4.11.1: Sample Distribution Based on Mode and Gender

Type of Vehicle Used	Female Respondents	Male Respondents	Total Sample Size
Bus	399	2020	2419
Taxi	20	90	110
Auto	60	283	343
Scooter	95	364	459
Two Stroke Motor Cycles	27	1113	1140
Four Stroke Motor Cycles	11	955	966
Small Car	182	1499	1681
Big Car	106	681	787
Cycle	24	1003	1027
Pedestrian	135	775	910
Total	**1059**	**8783**	**9842**

From Table 4.11.1, it can be noted that user perception surveys on the BRT corridor covered more than 9,800 road users with female respondents constituting about 11 %. Further out of the above, it can be inferred that about 27 percent are two wheeler riders followed by bus users accounting to 25 percent. The proportion of car users contacted comprised about 18 percent whereas the share of pedestrians included 9 %. The vehicle-wise trip purpose are shown in Table 4.11.2. and Figure 4.11.1

Table 4.11.2: Purpose of Trips on BRT Corridor across Vehicle Types

Type of Vehicle Used	Business	Education	Leisure	Social	Work
Bus	10.0%	9.0%	3.6%	2.3%	75.1%
Taxi	6.4%	2.7%	3.6%	2.7%	84.5%
Auto	3.5%	6.1%	4.7%	2.9%	82.7%
2W	12%	3%	2%	1%	81%
Car	21.3%	4.1%	2.0%	2.4%	70.3%
Cycle	4.8%	3.8%	1.8%	1.5%	88.2%

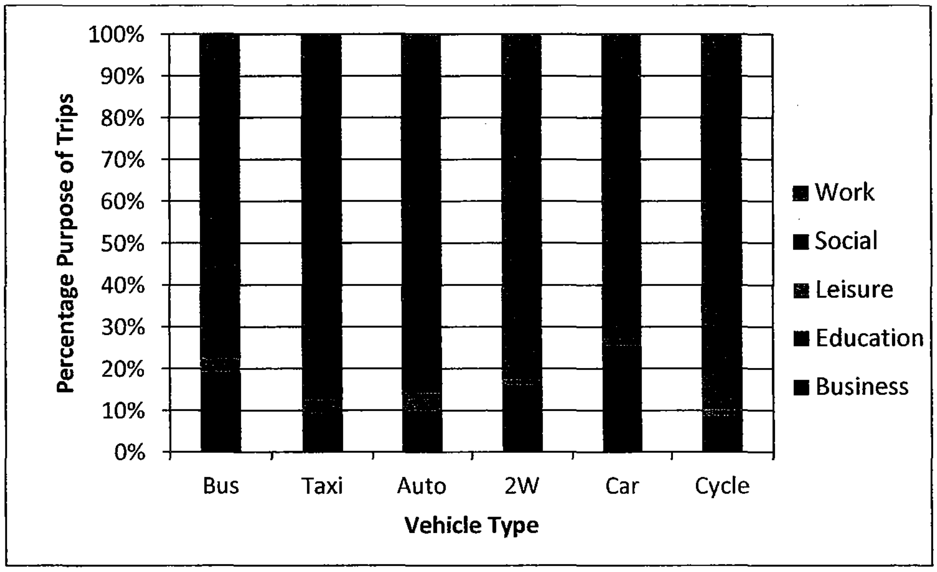


Figure 4.11.1: Purpose of Trips on BRT Corridor across Vehicle Types

From Table 4.11.2, the following salient findings were drawn:

- Work purpose trips contribute for the lion share of the trips on this corridor.
- It is interested to note that 83 percent auto trips are destined for work purpose.
- About 70 percent of car trips are for work purpose followed by 22% trips for Business purpose.
- Two wheeler trips for work purpose are around 80% followed by 12% for business purpose.
- Work trips made by Taxi accounts for about 85% followed by 6% business trips.
- Bus trips by work purpose are about 75% followed by 10% trips for business trips and 9% trips for education purpose.
- 88 % of cycle trips are made for work purpose.

The frequency of travel on the corridor is given in Table 4.11.3. From this table, it can be observed that overall 50% - 60% are daily trips followed by 10 - 25% trips are made 4 to 5 times a week. Occasional trips made by two wheelers accounting for about 23 % whereas weekly trips by Taxi and Auto are somewhat substantial. This may be attributed to the fact that most of the regular bus and two wheeler commuters *(for work)* might be inclined to use IPT for leisure / social trips during the week-ends.

Table 4.11.3: Frequency of Travel on BRT Corridor by Different Road Users

Type of Vehicle Used	Daily	4 to 5 times	3 times a week	Weekly	Occasional	Sample Size
Bus	61.5%	18.7%	8.9%	7.2%	3.7%	2416
Taxi	50.9%	22.7%	3.6%	18.2%	4.5%	110
Auto	63.0%	9.9%	4.7%	14.6%	7.9%	343
Scooter	64.0%	21.0%	4.8%	7.6%	2.6%	458
2-Stroke Motor Cycles	55.4%	22.9%	8.5%	8.3%	4.8%	1139
4-Stroke Motor Cycles	48.7%	14.6%	8.9%	9.6%	18.2%	964
Small Car	59.7%	24.8%	5.8%	4.3%	5.4%	1675
Big Car	64.5%	17.1%	4.6%	6.1%	7.8%	785
Cycle	58.2%	13.0%	2.9%	24.4%	1.5%	1027

The average monthly income reported by different vehicle users is given in Table 4.11.4. From this table it can be observed that the average monthly income is ranging from a minimum value of Rs. 8100 for cycles to Rs. 43000 in the case of the car commuters. Based on the above collected data, the value of time across different road users was worked by employing Wage Rate Approach which is ranging between Rs. 46 to Rs. 243 per hour across the different vehicle types. The average journey time of different vehicle users are furnished in Table 4.11.5. A close look at the data presented in this Table reveals that the average of the perceived percentage of travel time on BRT Corridor compared to total journey time for the entire trip across different vehicle types ranged from 39% - 54%.

Table 4.11.4: Average Monthly Income and Value of Time for different Vehicle Users

Vehicle Type Used	Avg. Monthly Income *(in Rs)*	Avg. Value of Time *(Rs/Hr)*
Bus	10738	61
Taxi	17619	100
Auto	12782	73
Scooters	11511	65
Two Stroke Motor Cycles	13154	75
Four Stroke Motor Cycles	21525	122
Small Cars	38446	218
Big Cars	42830	243
Cycles	8101	46

Table 4.11.5: Perceived Average Journey Time across Different Vehicle Users

Type of Vehicle Used	Average of Total Journey Time *(in min)*	Average of Journey time on BRT *(in min)*	Percentage of Travel Time on BRT	Sample Size
Bus	30.5	12.2	40%	2200
Taxi	36.8	16.2	44%	94
Auto	35.6	13.9	39%	306
Scooter	36.1	14.2	39%	399
2-Stroke Motor Cycles	33.6	15.4	46%	1016
4-Stroke Motor Cycles	34.6	17.5	50%	924
Small Car	36.9	20.1	54%	1548
Big Car	40.9	17.3	42%	755
Cycle	41.2	14.2	35%	956

The rating of different vehicle users for speed, safety, comfort and convenience and cost saving are given in Table 4.11.6 to Table 4.11.9. The users of vehicle types like cars and two wheelers perceived that their speeds have reduced after the introduction of BRT. The overall rating of the speed is 2.72 demonstrating drastic speed reduction perceived by the respondents across all the modes after the introduction of BRT.

Table 4.11.6: Overall Rating of Speeds on the Corridor by different Vehicle users

Type of Vehicle Used	Rating of Speed					Overall rating	Sample Size
	Very Bad (1)	Bad (2)	Average (3)	Good (4)	Very Good (5)		
Taxi	10.0%	3.6%	9.1%	77.3%	0.0%	3.54	110
Auto	12.0%	8.2%	11.7%	68.2%	0.0%	3.36	343
Scooter	26.4%	33.3%	11.5%	28.3%	0.4%	2.41	459
2-Stroke Motor Cycles	17.3%	22.0%	13.9%	45.2%	1.7%	2.84	1140
4-Stroke Motor Cycles	16.8%	31.0%	14.0%	37.1%	1.2%	2.69	966
Small Car	28.4%	36.8%	18.3%	15.9%	0.5%	2.21	1681
Big Car	34.1%	33.2%	15.6%	16.8%	0.3%	2.15	786
Cycle	15.3%	25.6%	12.3%	39.5%	7.3%	2.61	975
				Final Rating =		**2.72**	

Overall safety has been perceived to be bad compared to pre BRT situation *(refer Table 4.11.7)*. Taxi and auto rickshaws users felt the road safety parameter became 'very bad' after the introduction of BRT whereas other vehicle users like cars, cycle and two wheeler drivers also perceived that the situation became 'bad' after BRT and thereby the overall rating of the road safety during the BRT operations rated by the road user turned to be 2.03 falling under the 'bad category'. This may be attributed to the detoured alignment path at the intersection to accommodate for the bus stop location, pedestrian conflicts due to bus stop at centre and traffic violations due to long signal cycle. The overall rating for comfort and convenience of the present BRT corridor is given in Table 4.11.8. The majority of the users expressed their viewpoint that the Comfort and Convenience level is poor compared to the situation before BRT. Overall rating for cost saving after the BRT corridor is given in Table 4.11.9. Almost all users perceived that their cost of travel has increased after the introduction of BRT.

Table 4.11.7: Overall Rating of Safety on the Corridor by different Vehicle users

Type of Vehicle Used	Rating of Safety					Overall rating	Sample Size
	Very Bad (1)	Bad (2)	Average (3)	Good (4)	Very Good (5)		
Taxi	49.1%	41.8%	7.3%	1.8%	0.0%	1.62	110
Auto	47.8%	37.9%	9.9%	4.4%	0.0%	1.71	343
Scooter	28.8%	28.3%	21.6%	19.6%	1.7%	2.29	459
2-Stroke Motor Cycles	25.8%	28.6%	19.5%	19.9%	6.2%	2.21	1140
4-Stroke Motor Cycles	34.0%	24.9%	17.8%	20.2%	3.1%	2.18	966
Small Car	35.2%	34.7%	13.9%	15.4%	0.8%	2.08	1681
Big Car	34.1%	36.1%	12.3%	15.6%	1.8%	2.06	786
Cycle	20.1%	28.5%	17.5%	20.0%	13.9%	2.10	1016
				Final Rating =		**2.03**	

Table 4.11.8: Rating of Comfort/ Convenience Level by different Vehicle users

Type of Vehicle Used	Rating of Comfort/Convenience					Overall rating	Sample Size
	Very Bad (1)	Bad (2)	Average (3)	Good (4)	Very Good (5)		
Taxi	17.3%	44.5%	31.8%	6.4%	0.0%	2.27	110
Auto	14.3%	37.9%	35.0%	12.8%	0.0%	2.46	343
Scooter	19.2%	19.2%	33.1%	27.7%	0.9%	2.68	459
2-Stroke Motor Cycles	17.7%	20.7%	34.9%	24.2%	2.5%	2.61	1140
4-Stroke Motor Cycles	17.0%	25.9%	28.2%	26.7%	2.3%	2.60	966
Small Car	18.2%	16.0%	35.0%	29.9%	0.9%	2.75	1681
Big Car	19.4%	17.3%	33.9%	28.5%	0.9%	2.70	787
Cycle	22.4%	14.1%	29.4%	22.8%	11.3%	2.30	1018
				Final Rating =		**2.55**	

Table 4.11.9: Rating of Cost Saving Parameter by different Vehicle users

Type of Vehicle Used	Rating of Cost Saving Very Bad (1)	Bad (2)	Average (3)	Good (4)	Very Good (5)	Overall rating	Sample Size
Taxi	19.1%	16.4%	54.5%	10.0%	0.0%	2.55	110
Auto	22.2%	21.0%	44.3%	12.5%	0.0%	2.47	343
Scooter	21.4%	15.5%	35.5%	26.8%	0.9%	2.66	459
2-Stroke Motor Cycles	22.0%	14.9%	31.5%	28.9%	2.7%	2.62	1140
4-Stroke Motor Cycles	22.3%	16.1%	31.6%	25.6%	4.5%	2.52	966
Small Car	23.3%	16.8%	25.4%	34.1%	0.4%	2.70	1681
Big Car	21.9%	18.6%	24.8%	33.5%	1.3%	2.67	786
Cycle	19.6%	9.6%	22.7%	35.4%	12.6%	2.49	1016
				Final Rating =		**2.58**	

The overall rating of pedestrian facility on the corridor under 'before BRT' and 'after BRT' is given in Table 4.11.10 and the inferences are listed below:

- The pedestrians felt walking facility slightly deteriorated in spite of providing wider sidewalks. This may be because of unauthorised parking of vehicles obstructing smooth walking path for the pedestrians walking along the corridor.
- In the case of crossing facility available at the intersections too, it was felt that the need to cross the approach arms in parts by waiting at the island portion is prolonging their crossing time at the intersection. Perhaps, this issue can be addressed by keeping one exclusive 'All Red Pedestrian Phase' in each signal cycle. Further, wherever feasible, there is an urgent need to provide the grade separated crossing facility for the pedestrians at all the major intersections.

Table 4.11.10: Overall Rating of Pedestrians on the Corridor

Pedestrian Rating	Before BRT		After BRT	
	Percentage	Sample Size	Percentage	Sample Size
Very Bad (1)	3.2%	29	24.5%	223
Bad (2)	18.5%	168	15.5%	141
Average (3)	14.6%	133	8.7%	79
Good (4)	35.5%	323	34.4%	313
Very Good (5)	28.2%	256	16.9%	154
Overall Rating	3.67		3.04	

The quantum of trip length on the BRT corridor across different vehicle types is given in Table 4.11.11. From this table it can be seen that about 13 - 28 % of trips are made for the entire length of the corridor across different vehicle types.

Table 4.11.11: Percentage Trip Length of Travel on BRT Corridor

Type of Vehicle	Percentage of Trip Length of Travel on BRT Corridor												Total Sample
	Just Cross-ing	700m	900m	1300 m	1600 m	2000 m	2500 m	2900 m	3200 m	3800 m	4500 m	5800 m	
Bus	3.5%	2.0%	1.3%	13.3%	6.0%	10.0%	1.8%	19.8%	5.1%	2.4%	19.8%	15.1%	2419
Taxi	10.0%	1.8%	0.0%	13.6%	11.8%	2.7%	3.6%	8.2%	2.7%	0.0%	17.3%	28.2%	110
Auto	7.0%	2.0%	0.3%	19.8%	7.3%	5.0%	2.6%	9.6%	3.2%	1.5%	18.1%	23.6%	343
Scooter	4.4%	2.8%	0.7%	16.1%	6.8%	8.7%	2.8%	13.7%	5.0%	2.2%	17.9%	19.0%	459
2-Stroke Motor Cycles	3.9%	2.3%	1.8%	12.1%	5.9%	9.1%	1.6%	14.4%	3.7%	3.9%	20.7%	20.7%	1140
4-Stroke Motor Cycles	3.2%	4.2%	2.6%	12.6%	7.8%	10.4%	2.7%	11.6%	2.0%	8.5%	18.0%	16.5%	966
Small Car	2.7%	2.6%	1.2%	17.1%	8.9%	3.7%	3.2%	11.9%	6.2%	2.9%	25.0%	14.6%	1681
Big Car	2.0%	2.9%	1.1%	18.8%	12.2%	4.7%	2.7%	10.2%	5.3%	4.6%	22.1%	13.3%	787
Cycle	6.5%	3.4%	0.9%	20.6%	11.2%	9.7%	3.4%	13.0%	4.8%	1.4%	16.4%	8.7%	1027

The rating of the Corridor before and after the introduction of BRT is presented in Figure 4.11.2 and 4.11.3

The following salient feature can be drawn from these tables:

- Majority of motorized users perceived that the situation is bad as compared to without BRT earlier. On the contrary, Bus users felt the situation improved after the introduction of BRT.
- The overall rating before BRT was between average and Good (3.53). After the introduction of BRT, the rating has fallen between 'Bad' and 'Average' (2.54).

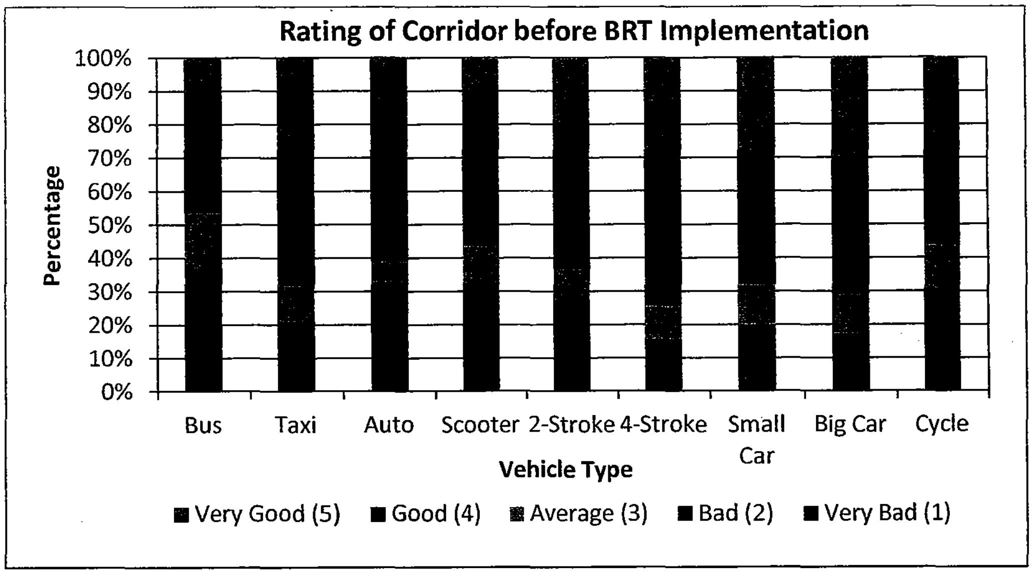


Figure 4.11.2: Overall Rating of Corridor before BRT by different Vehicle users

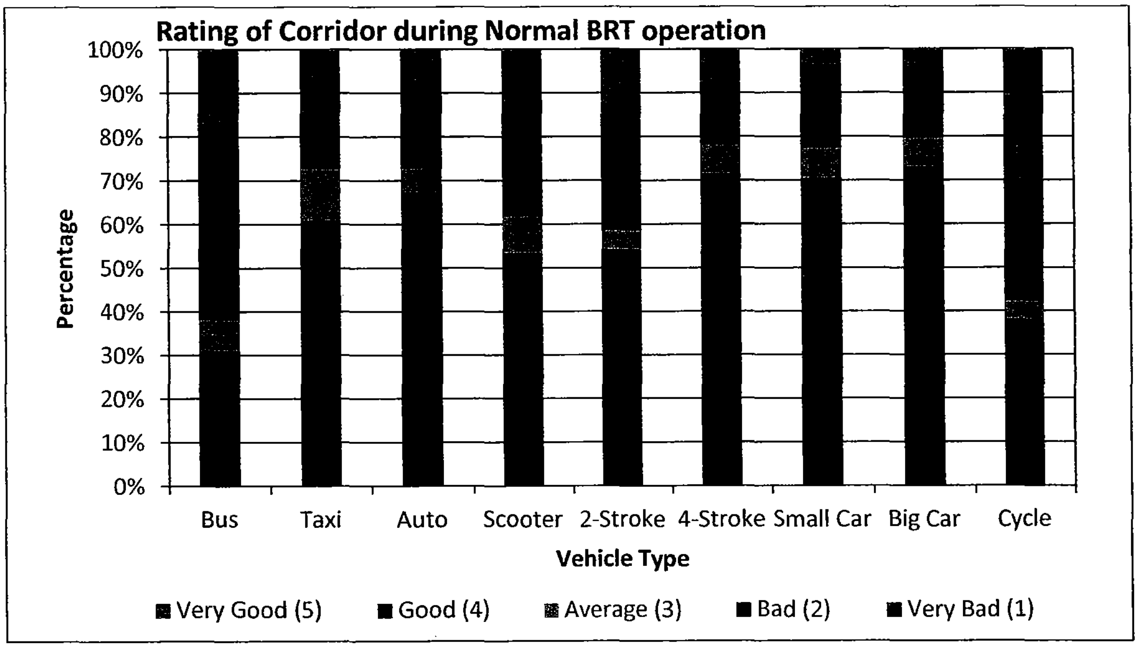


Figure 4.11.3: Overall Rating of Corridor after BRT by Different Vehicle users

The perceived increase in travel time perceived by different vehicle users varied from 13 to 17 minutes across different vehicle users after the introduction of BRT as given in Table 4.11.12. Similarly, the perceived value of time lost reported by vehicle users is presented in Table 4.11.13. Obviously, the perceived value of time loss reported by the car passenger is maximum amounting to Rs. 80 per trip on this corridor followed by two wheeler *(Rs. 43)*, taxi *(Rs. 30)* and autos *(Rs. 26)*. Interestingly, Cyclists also reported their time loss in spite of providing separate bicycle lanes and this may be attributed to the longer waiting time at signals. Of course their time loss valued by the cyclists is minimal at about Rs. 13 per trip.

Table 4.11.12: Average Increased Travel Time after BRT

Type of Vehicle User	Overall Average Increase in Journey Time in Minutes	Sample Size
Taxi	16.1	110
Auto	13.2	343
Scooter	17.6	432
2-Stroke Motor Cycles	16.4	940
4-Stroke Motor Cycles	15.6	828
Small Car	16.0	1559
Big Car	15.2	690
Overall Average =15.7		

Table 4.11.13: Average Value of Time Loss for different Vehicle Users

Vehicle Type Used	Avg. Value of Time Loss (Rs)	Sample Size
Taxi	29.8	110
Auto	26.2	343
Two Wheeler	42.6	2200
Cars	79.7	2249
Cycles	13.2	795

The mode used by the road users before the introduction of BRT was arrived from the user perception survey by interviewing the respondent on the type of mode used. The present mode was taken as the one which is presently used by the respondent. Eventually, the mode used by the respondents before and after the introduction of BRT was determined based on this user survey and presented in Table 4.11.14. Further, the reason for using the present mode of transport is given in the Table 4.11.15. The following inferences have been drawn from the above two tables:

- Obviously, the bus passengers has registered an increase of 6.7 % and at the same time, the proportion of car and two wheeler commuters also increased by 4.7 % and 3.1 % respectively after the introduction of BRT.
- On the contrary, the auto commuters have drastically reduced followed by Taxi. This may be attributed to the reluctance exhibited by the IPT drivers to travel on this corridor due to severe traffic congestion faced on the MV lane after the introduction of BRT as it is likely inflict heavy fuel consumption and time losses due to idling at intersections affecting their business.
- The minor reduction in cycle trips on the corridor may be attributed to the likelihood of increased income of cycle users and thereby migrating to other

modes like Bus and possibly to Two Wheelers as well in some cases which however is not enumerated in this study.

- About 20-30 percent of two wheeler riders are captive users and similarly about 36-40 percent of IPT modes are captive in nature. 45% of Buses users said that they do not have alternative to travel.

Table 4.11.14: Modal Split Before and After BRT

BRT Corridor	Bus	Cycle	Two Wheeler	Auto	Taxi	Car	Sample size
Before	20.3%	12.3%	24.0%	14.7%	4.2%	24.5%	8928
After	27.0%	11.5%	28.7%	3.8%	1.2%	27.6%	8928

Table 4.11.15: Reason for using the Present Mode of Transport

Vehicle Type	No Alternative	Captive User	Limited Coverage of BRT	Multi-Purpose Trips	Non Reliability of PT	Rising Fuel Price	Total
Bus	45.40%	36.30%	0.00%	13.90%	0.00%	4.40%	2226
Taxi	0.0%	40.0%	29.1%	15.5%	15.5%	0.0%	110
Auto	0.0%	36.4%	26.5%	14.6%	22.4%	0.0%	343
Scooters	29.9%	30.7%	15.2%	12.3%	11.9%	0.0%	479
Two Stroke Motor Cycles	29.1%	24.7%	17.5%	12.6%	16.1%	0.0%	1339
Four Stroke Motor Cycles	11.6%	22.6%	19.7%	13.2%	32.8%	0.0%	1145
Small Cars	12.9%	19.7%	14.1%	17.6%	35.7%	0.0%	1955
Big Cars	10.4%	15.0%	24.6%	20.1%	29.9%	0.0%	940
Cycles	19.9%	19.4%	22.6%	21.7%	16.4%	0.0%	1262
							9799

Lastly, one of the debated issues is about the present bus stop location and hence the opinion of bus commuters was also sought and the same is shown in Figure 4.11.4. From this table it can be seen that as far as BRT Bus stop location is concerned, 71% Bus passengers opined that the locating the bus stop on the Kerb Side as their preference. The various associated observations of the respondents on the location of bus stop and inferences drawn on the same are listed below:

- Perhaps this view has emerged since the bus commuters primarily felt that the bus stops located on the BRT stretch are like islands on the road with the persons desiring to access being required to cross the portion of the road meant for other vehicles and which not only leads to slowing down of the traffic but hazardous to the bus users.
- This viewpoint might have emerged due to poor traffic discipline exhibited by the road users including bus drivers which is prohibiting the bus commuters to cross the road with adequate safety even during green phase for pedestrians.

Interestingly, bus drivers resort to the traffic violations like jumping of signals when they were operating on the exclusive lanes during BRT operations hampering the safe crossing of the pedestrians.

- Further, the absence of grade separated crossing in the vicinity of most of the major intersections on the corridor is another deterrent which need to be addressed immediately. The provision of such facility is common in most of the Latin American cities wherein the bus patronage is very high on BRT corridors.
- Some of the commuters also expressed that one of the other safety hazards faced by them is whenever they need to catch any connecting bus route; they need to cross the road through the centre of the intersection. Of course this issue can be addressed to a large extent if the Transport Department, GNCTD can come with the proper route rationalisation policy in consultation with DTC / DIMTS on the corridor.

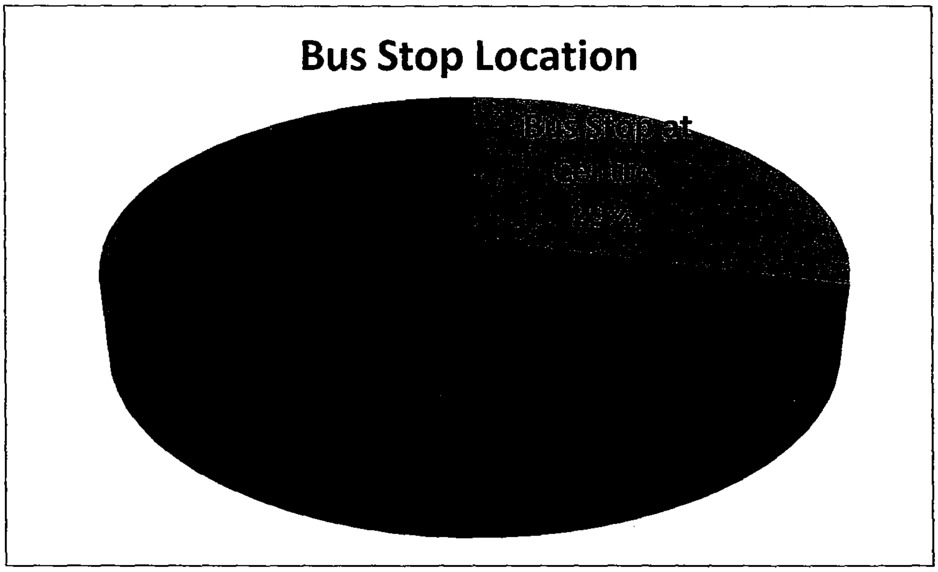


Figure 4.11.4: Opinion on Bus Stop Locations

5 EXPERIMENTAL TRIAL RUN ON BRT CORRIDOR

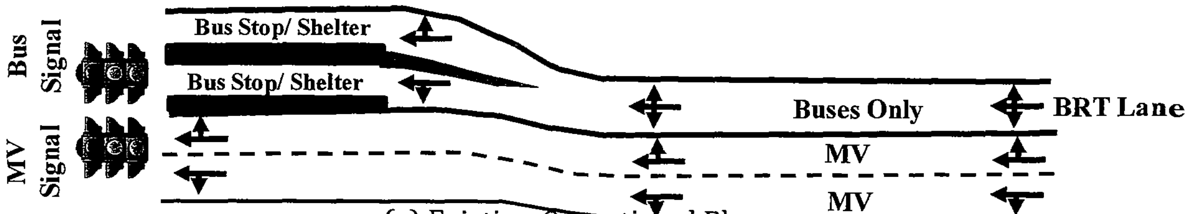
5.1 Background

The TOR received from the Transport Department, GNCTD and the copy of the Honourable Delhi High Court order vide WP (C) 380/2012 dated 15/3/2012 states "To conduct the experimental trial run on BRT corridor by the agency so appointed by the Transport Department, *(GNCTD)* shall during the course of the survey to regulate the vehicular movement on the aforesaid stretch as it may desire from time to time by allowing plying of vehicles other than buses on the reserved corridor exclusively for the buses". Complying with the above directions of Honourable Delhi High Court order, CSIR-CRRI study team conducted the experimental trial run.

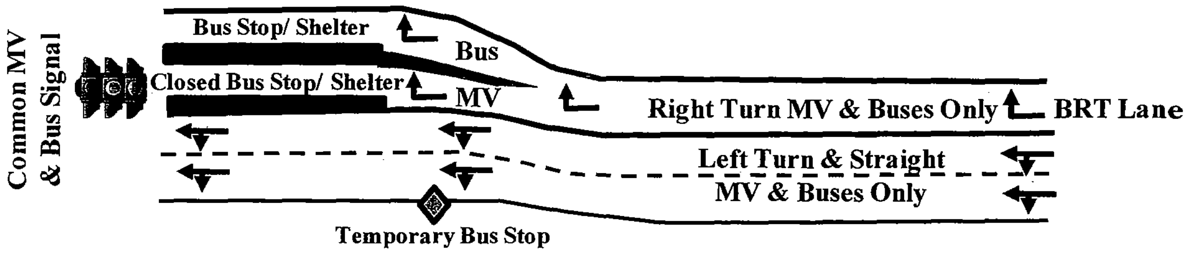
Before carrying out the experimental trial run, classified turning volume count data collected at all the six intersections *(namely Ambedkar Nagar, Pushpa Bhawan, Sheikh Sarai, Chirag Delhi, Siri Fort and GK-1 intersection)* were critically examined and the existing bus routes, existing traffic signalling phases / stages coupled with cycle time were also studied. Considering all these factors, a conceptual plan was devised and the same is presented in the succeeding sections.

5.2 Conceptualisation

At present, the existing BRT lane is in the middle of the corridor *(median side)* and other Motor Vehicles *(MV)* lane is in the left side of the corridor *(kerb side)*. In order to allow other vehicles on existing BRT lane in a systematic manner and achieve the safer vehicular movements at the intersection, the split of the vehicles based on turning movement type *(left, straight and right)* is very much essential. Considering this, it has been proposed that all the right turning vehicles need to use the existing BRT lane whereas all the straight and left turning vehicles could use the existing MV lane. The arrangement for experimental trial run has been shown schematically in Figure 5.2.1.



(a) Existing Operational Plan



(b) Proposed Operational Plan

Figure 5.2.1: Typical operation plan of Existing and Proposed Experimental Run on BRT Corridor

The salient aspects of the traffic operation implemented during the experimental run are presented in Figure 5.1.1.

a) **Left and straight bound buses** were directed to **ply on the left most carriageways only.** A temporary bus stop on kerb side *(within 100 m from the intersection)* was earmarked for left turning and straight bound buses at each intersection. The general straight bound and left traffic are plying on the adjacent lane.

b) The **right turning buses and also right turning general traffic** were directed to ply on the extreme right lane on both directions of travel i.e. existing BRT lane. Moreover, one out of the two bus shelters near the intersection was closed temporarily so that the right turning buses shall use the available bus stop whereas the other motorized vehicle were directed through the closed bus stop.

c) Wherever the right turn traffic was enumerated to be significant i.e. for instance at **Chirag Delhi intersection, one additional lane** was earmarked for right turning traffic from **Sheikh Sarai to Nehru Place.** Similarly, one **additional right turning traffic lane** was also provided at Sheikh Sarai intersection for right turning traffic from **Chirag Delhi to Saket.**

d) **Cyclists and other Non-Motorized Vehicles *(NMV)*** was requested to continue to use the existing NMV lane for all directions of travel.

e) There were two separate signals *(stages/ Phases)* for MV and buses and the same was combined for both MV and buses during the experimental trial run.

5.3 Implementation

After conceptualisation of the experimental run plan, a stakeholders meeting was organised at CSIR - CRRI on 20.4.2012. In this meeting, the officials from Transport Department, GNCTD, DIMTS Ltd., Delhi Traffic Police, Siemens Ltd., Public Works

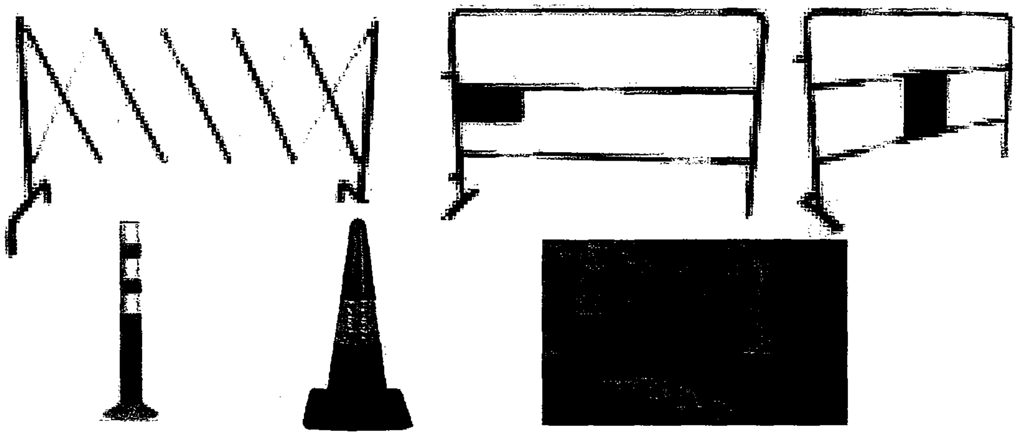
Department *(PWD)* and Municipal Corporation of Delhi *(MCD)* including the Petitioner were present. In that meeting, the operational plan conceived by the CSIR-CRRI study team was presented by the Team Leader and discussed at length inviting suggestions from the various stakeholders. Subsequently, a site visit was organised on 23.04.2012 to assess the practicability of the experimental trial plan. Discussions were also held with the Principal Secretary cum Commissioner of Transport and their officials requesting them for taking appropriate action towards the implementation of the operation plan by providing the Bill of Quantity *(BOQ)*. However, **a letter was received from Transport Department, GNCTD** *(vide letter no.3(49(/Tpt/Proj/2012 dated 02.05.2012)* stating that arrangement **for implementing the traffic operational plan shall be undertaken by CRRI itself** at its end and **additional expenditure incurred on the temporary installation of items, removal and re-fixing of removed items will be reimbursed by the Transport Department, GNCTD**. Based on the above communication, CSIR-CRRI study team estimated the requirements for implementation of the experimental run plan as given below:

- Metal Barricades tied with Traffic Cones using Ropes for segregation on the existing BRT lane so that it can be used for two way movement of the proposed right turning diversion
- Median Markers/ Reflectors on the existing dividers in BRT lane
- Posting of Traffic Signages *(informatory, regulatory, bus stop etc.)*
- Road Markings *(directional arrows)*
- Distribution of Traffic Advisories in the form of pamphlets as well as Traffic Advisory advertise in leading Newspapers
- Traffic Signals
- Segregation as well as the additional lane ear marked on the straight bound lane.

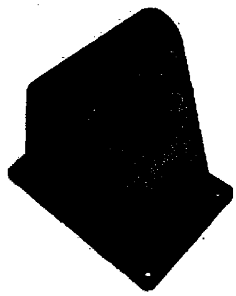
After assessing all the circumstances, the duration of the proposed experimental trial run was decided to be conducted spanning for 6 days i.e. starting from 12th to 17th May 2012.

5.3.1 Bollards or Dividers

As part of the above, procurement of the necessary items was accomplished and installed on the BRT corridor to carry out the experimental trial run. A typical view of bollard or dividers used for erection on the ground for segregation of the two-way traffic in BRT Lane is shown in Figure 5.3.1. The reflectors installed on the existing dividers in BRT Lane are also shown in Figure 5.3.1.



(a) Different Types of Bollards/ Dividers tied with rope to segregate two-way traffic in BRT Lane



(b) Median Reflectors on the existing dividers in BRT Lane

Figure 5.3.1: Different Types of Bollards/ Dividers tied with rope and Median Reflectors to segregate two-way traffic in BRT Lane

5.3.2 Road Signages

The road signages were designed scientifically keeping in view type of turning manoeuvre expected at the succeeding intersection catering to different types of road users. Based on this principle, the signages were designed and placed at all the approaches of the five intersections. Some typical illustrations of these road signages which were posted at the strategic locations on the study section are shown in Figure 5.3.2 to 5.3.7. It can be noted from the typical figures *(refer Figures 5.3.2 to 5.3.7)*, signages were designed conforming to different intersection requirements. Advance Direction Signs and Reassurance signs were also posted at the corridor at each of the approach arms of the intersections and a typical view of the same is presented in Figure 5.3.8.

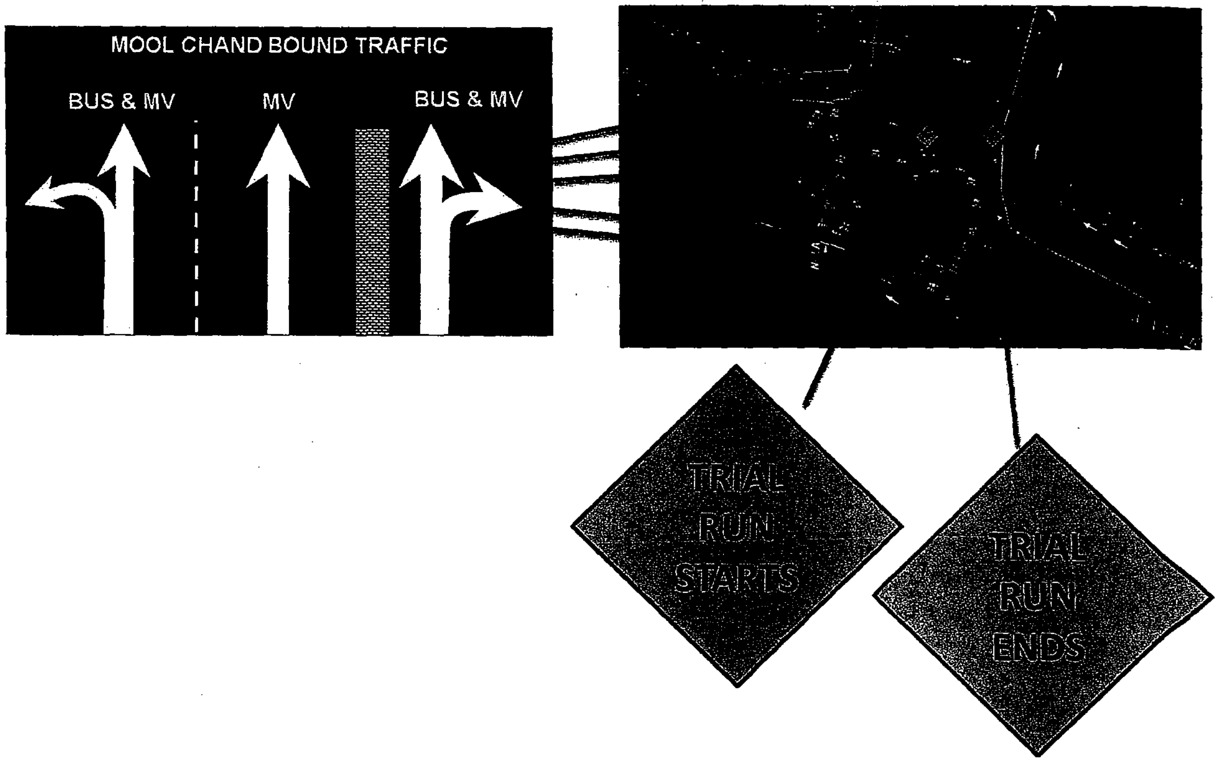


Figure 5.3.2: Road Signage Scheme Implemented at Ambedkar Nagar Intersection

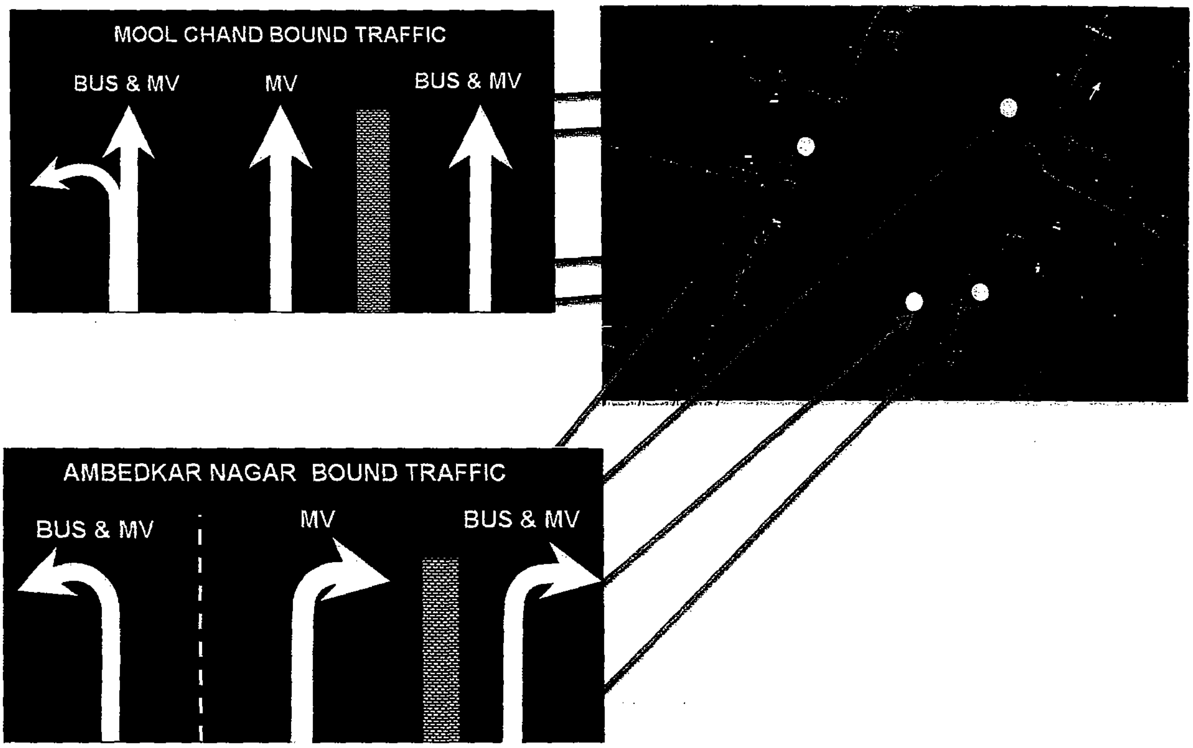


Figure 5.3.3: Overhead Road Signage Scheme Implemented at Pushpa Bhawan Intersection

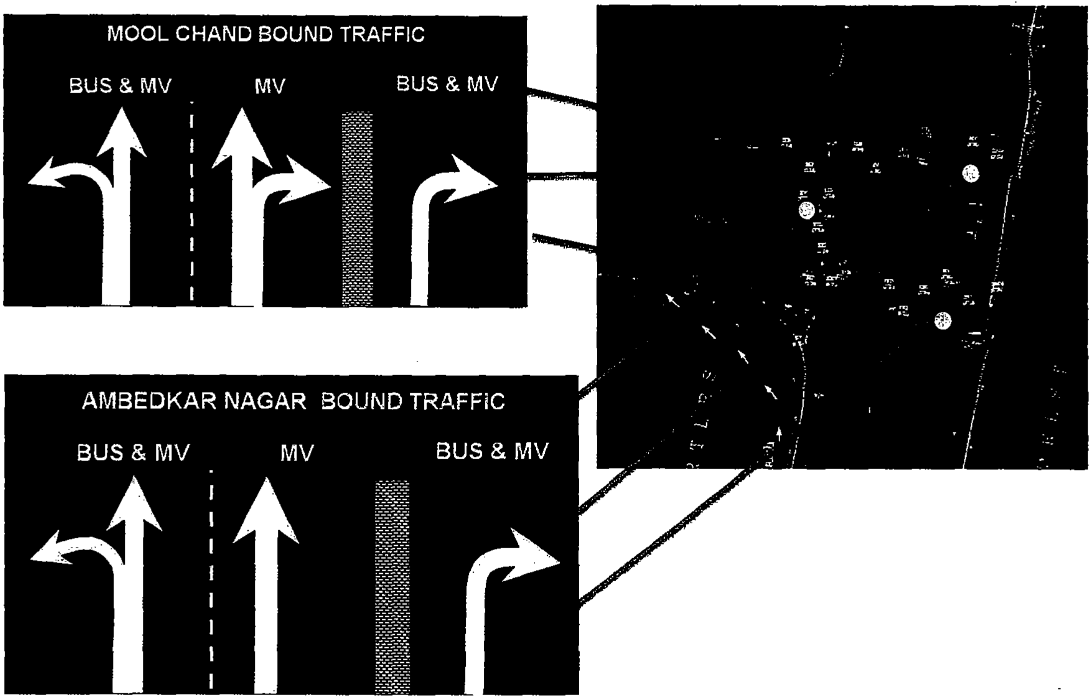


Figure 5.3.4: Overhead Road Signage Scheme Implemented at Sheikh Sarai Intersection

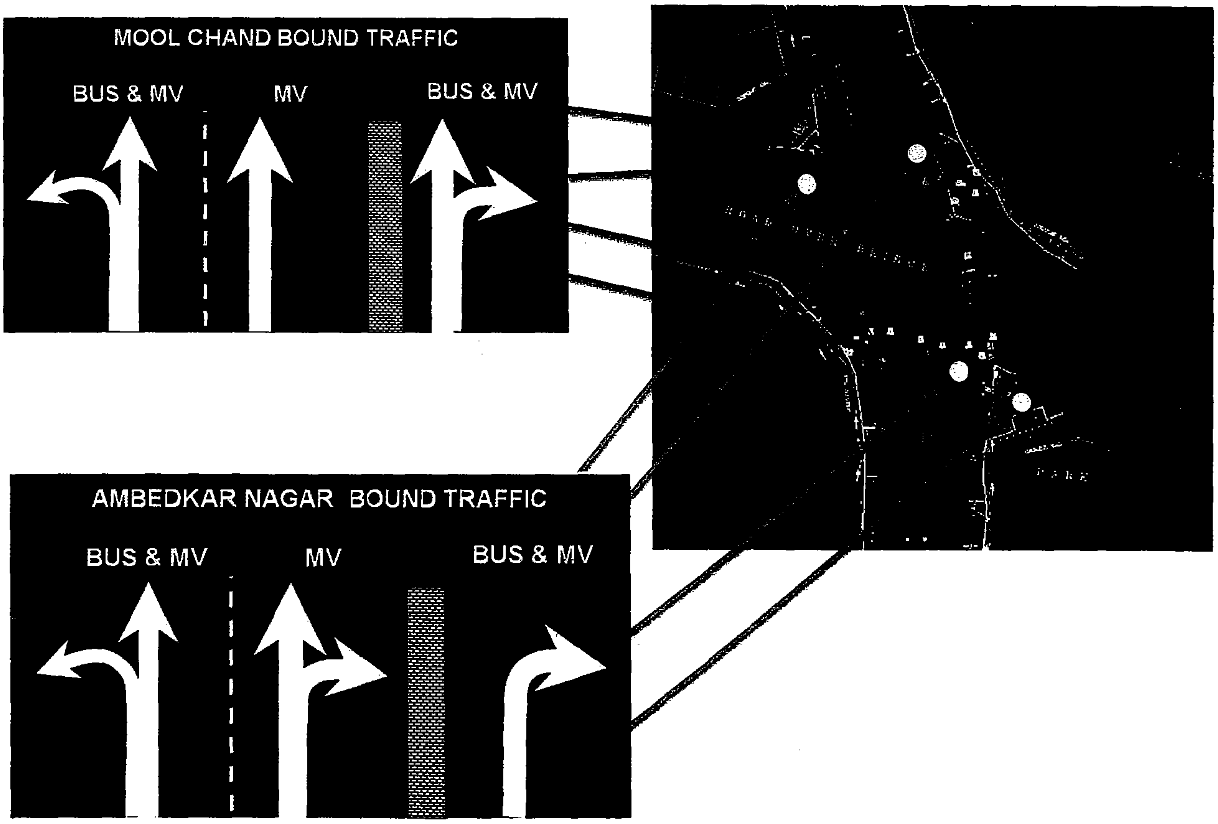


Figure 5.3.5: Overhead Road Signage Scheme Implemented at Chirag Delhi Intersection

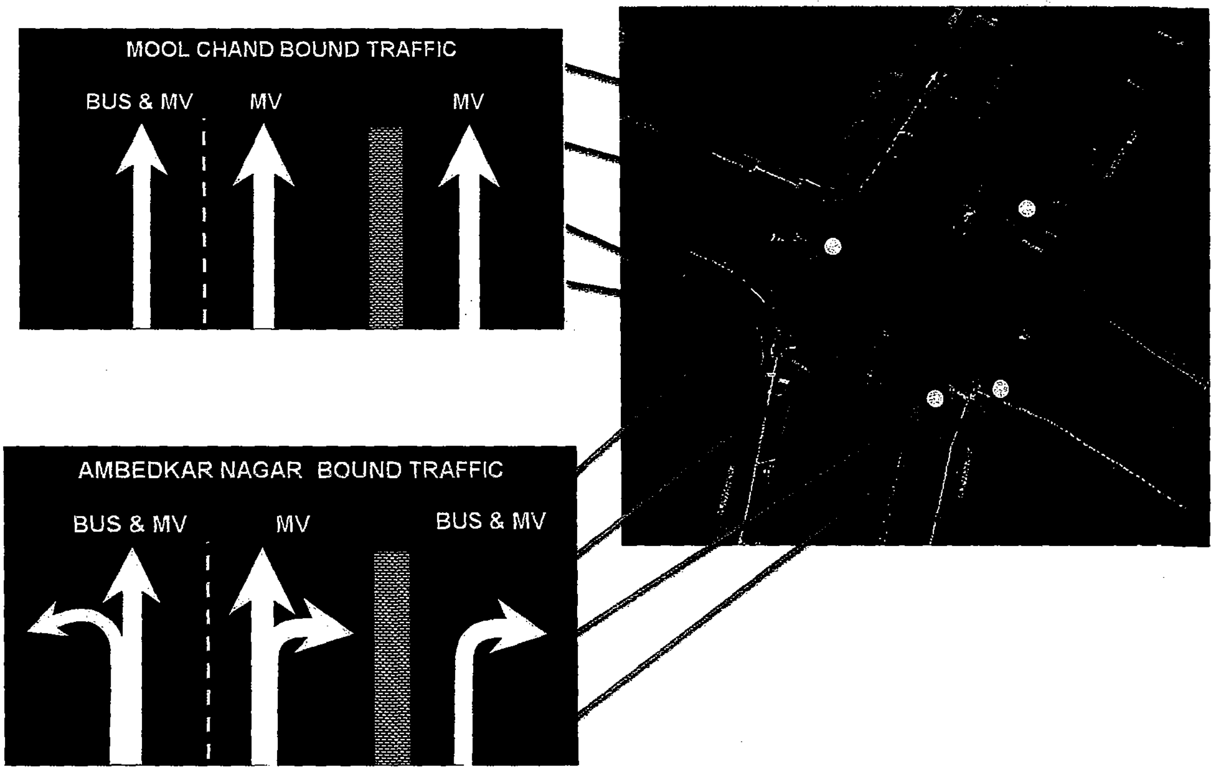


Figure 5.3.6: Overhead Road Signage Scheme Implemented at Siri Fort Intersection

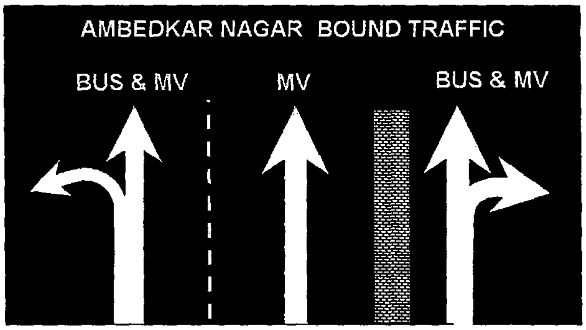


Figure 5.3.7: Overhead Road Signage Scheme Implemented between Siri Fort Intersection and GK Crossing Intersection at Chainage Km 4.920 (Median Side) and Chainage Km 4.880 (Kerb Side)

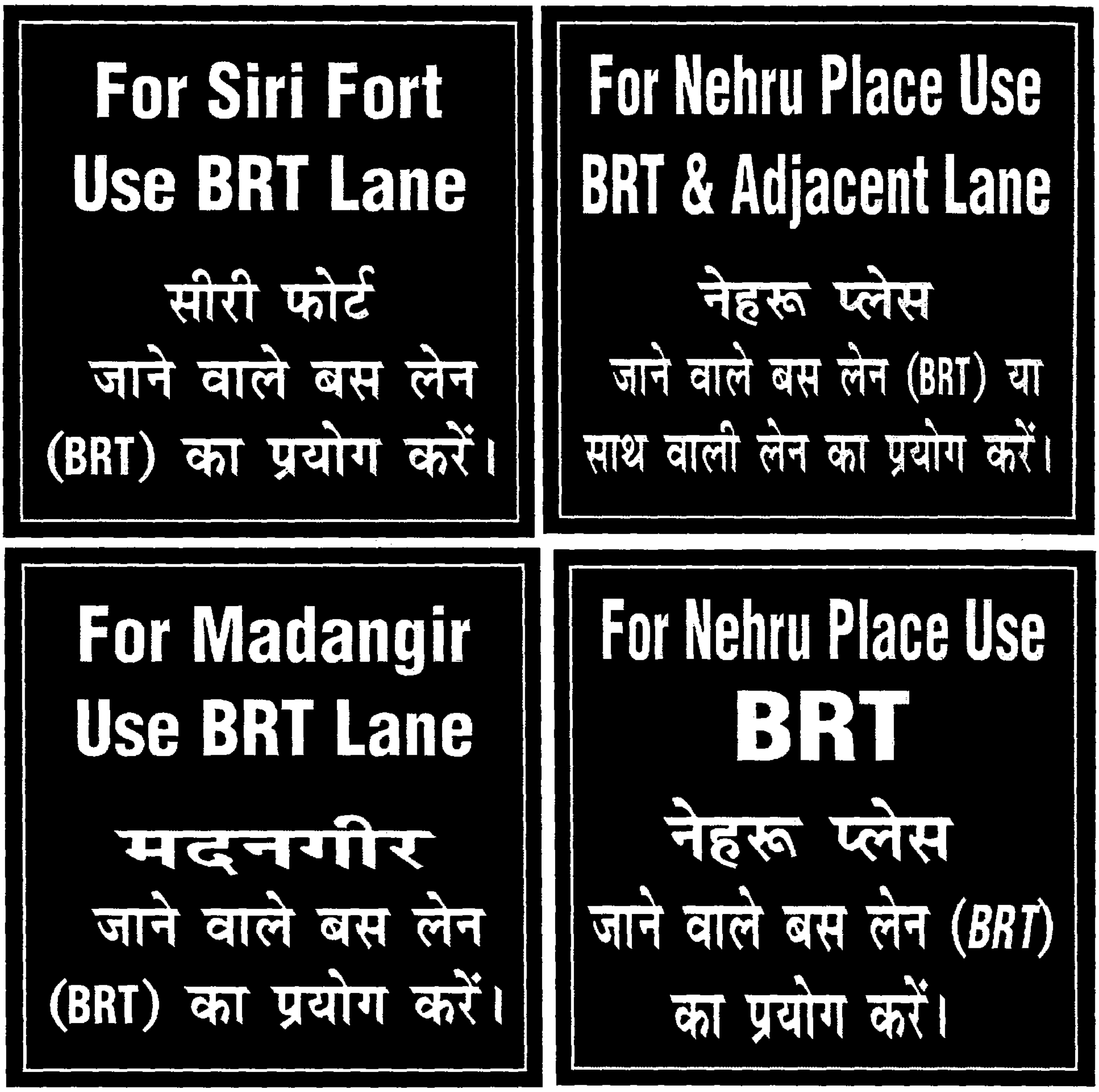
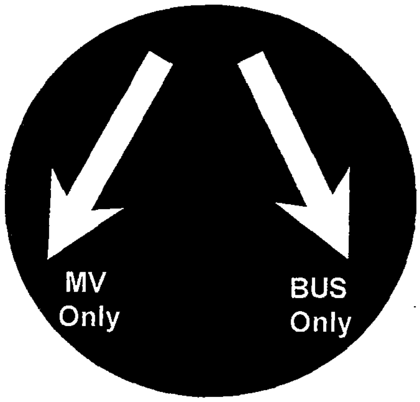


Figure 5.3.8: Typical Shoulder Mounted Informatory Sign on the Corridor

Further, regulatory signs such as 'Speed Limit' and 'Keep Left and 'Keep Right' signs were also placed at appropriate locations in the vicinity of all the existing bus shelters. The temporary bus stop signs were installed at the identified bus stop locations for the left turning and straight bound buses. Typical 'Speed Limit', 'Keep Left' and 'Keep Right' signs and 'Bus Stop' signs as per "IRC:67 *(2010)*: Code of Practice for Road Signs" were designed and installed on the ground before start of 'experimental trial run' *(refer Figure 5.3.9)*.

(a) Speed Limit Sign



(b) Keep Left and Right Sign

Figure 5.3.9: Speed limit, Keep Left and Right signs and Bus Stop Signs Posted on the Corridor during the Trial Run

5.3.3 Traffic Advisories

Apart from the posting of road signages and bollards/ dividers discussed above, the traffic advisory was designed and distributed to all types of road users starting from 09.05.2012 for three days prior experimental trial run. The purpose of issuance of traffic advisory is basically aimed at acclimatize road users on the experimental trial run plan in advance being implemented during the above mentioned dates. The traffic advisory was designed in both English and Hindi languages (as shown in *Annexure - XII).* A total of about 60,000 leaflets of traffic advisory were distributed on the BRT corridor spread over five intersection areas. These leaflets of traffic advisory were also distributed in the neighbourhoods and nearby commercial centres. In addition to this, the traffic advisory was advertised in all the leading news papers such as Indian Express, Jansatta, Times of India, etc. aimed at wide publicity about the experimental trial run. Apart from the print media, the details about the experimental trial run was also publicised by some of the television news channels on their own.

5.3.4 Design of Traffic Signal Stages

The traffic signals were redesigned and installed at all the five intersections by keeping separate phases for Motor Vehicles *(MV)* and buses. In order to have effective implementation of experimental trial run, these signal phases were appropriately combined so that the discharge of vehicles from MV and buses can be maintained smoothly. The signal phases/ stages which were in vogue during the normal BRT operation are presented in Table 5.3.1 along with cycle lengths and individual green phase timings implemented at the different intersections during the experimental trial run manned by CSIR-CRRI study team.

Table 5.3.1: Implemented Stages/ Phases and Cycle Length at different Intersections

S. No	Name of the Intersection	Number of Stages/ Phases		Cycle Length
		Existing	Proposed	
1	Ambedkar Nagar	6	4	180 Sec
2	Pushpa Bhavan	7	5	210 Sec
3	Sheikh Sarai	7	4	240 Sec
4	Chirag Delhi	9	5	240 Sec
5	Siri Fort	8	5	210 Sec

From above Table 5.3.1, it can be seen that the signal stages have been reduced to 4 ~ 5 and the cycle length is varying from 180 Sec ~ 240 sec. During the normal BRT operations, the pedestrian crossing has been incorporated in the signal phasing wherein they can cross part of the approach and reach up to Refuge Island during one particular phase and wait on the median / Refuge Island to get green phase to make the complete crossing of the approach from one end to other end. This is despite fact that Signal head is having the provision to provide exclusive 'All Red for Pedestrians' phase.

During the CRRI experimental trial plan implemented on the ground, it was ensured to maintain the above part approach crossing facility for pedestrians which was in vogue during the normal BRT operations. In addition, 'All Red for Pedestrians' phase was also provided for 20 seconds in which pedestrians can perform the crossing manoeuvre in all the desired directions. These signal phasing and green times are presented in Figure 5.3.10 to 5.3.15. The above signal timings were implemented on the ground as per the conceived plan of CSIR-CRRI study team with active co-operation from Transport Department *(GNCTD)*, Delhi Traffic Police and DIMTS. A glimpse of the traffic operations during the 'experimental trial run' is shown in Photo 5.3.1 to 5.3.9.

It is to be noted that since most of the intersections like Chirag Dill intersection, Sheikh Sarai Intersection, Siri Fort Road Intersection and Khanpur T- Intersection are in the state of over saturated condition, they were to be operated on manual mode during morning and evening peak period of traffic movement spanning for about 2 hours each.

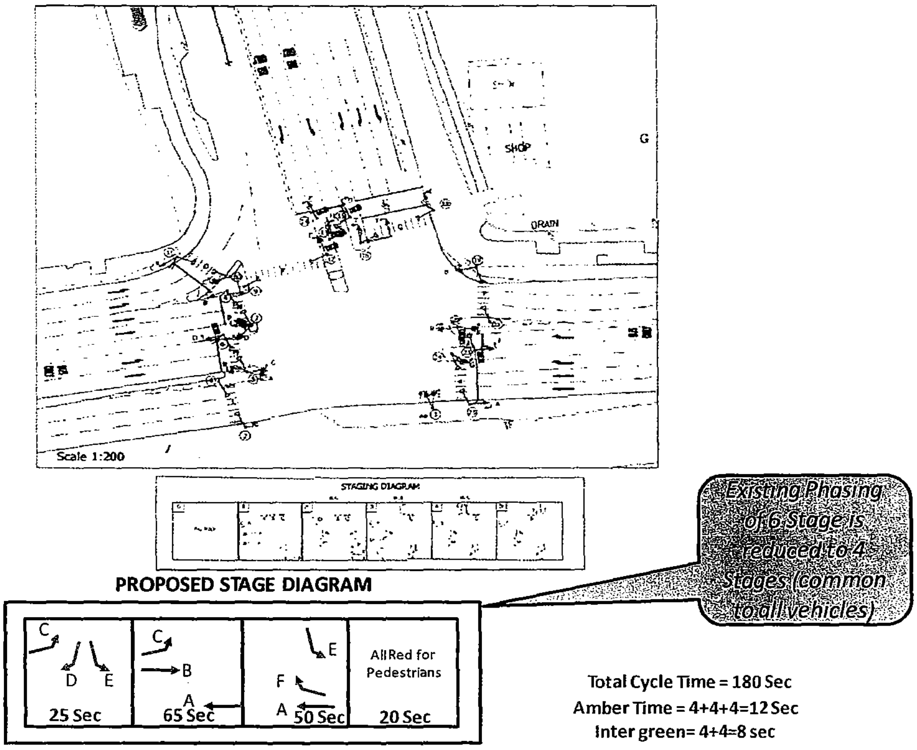


Figure 5.3.10: Traffic Signal Stages/ Phases and their Phase Timings at Ambedkar Nagar Intersection

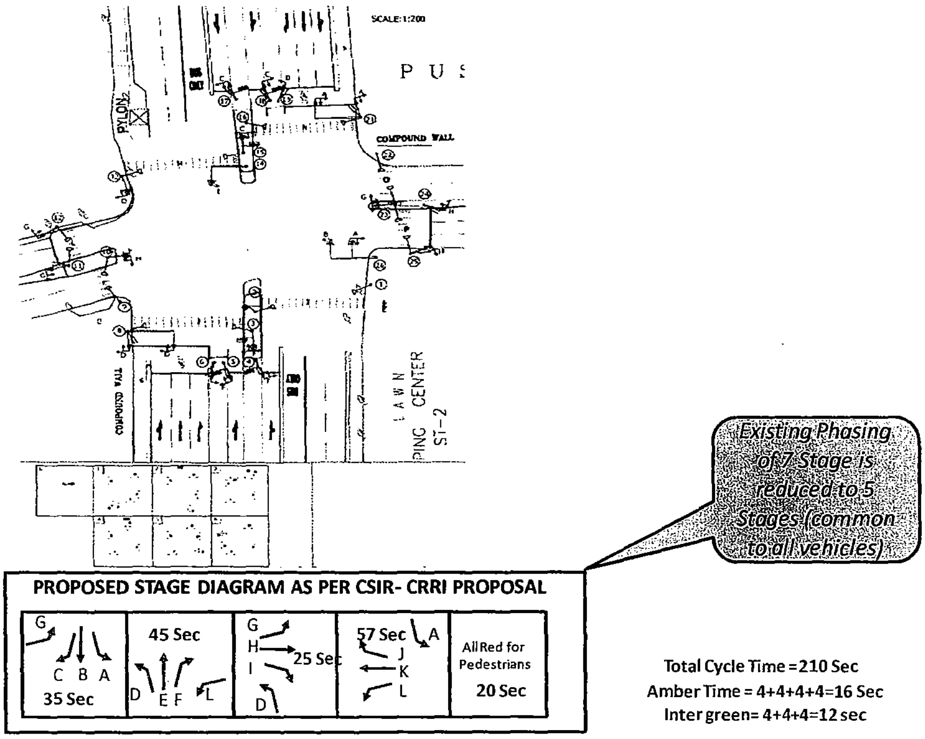


Figure 5.3.11: Traffic Signal Stages/ Phases and their Phase Timings at Pushpa Bhawan Intersection

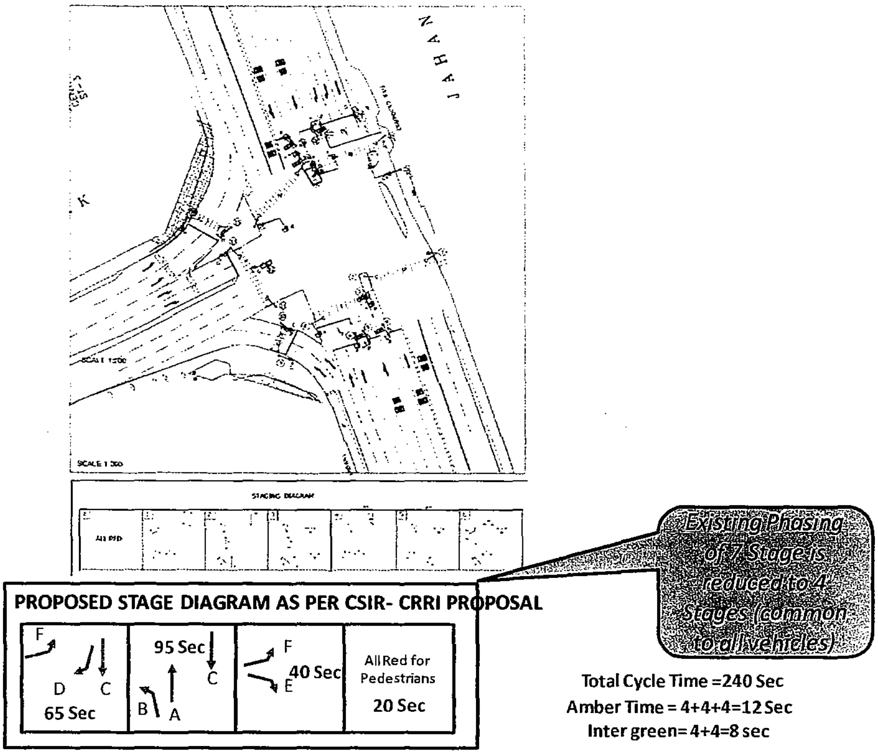


Figure 5.3.12: Traffic Signal Stages/ Phases and their Phase Timings implemented at Sheikh Sarai Intersection

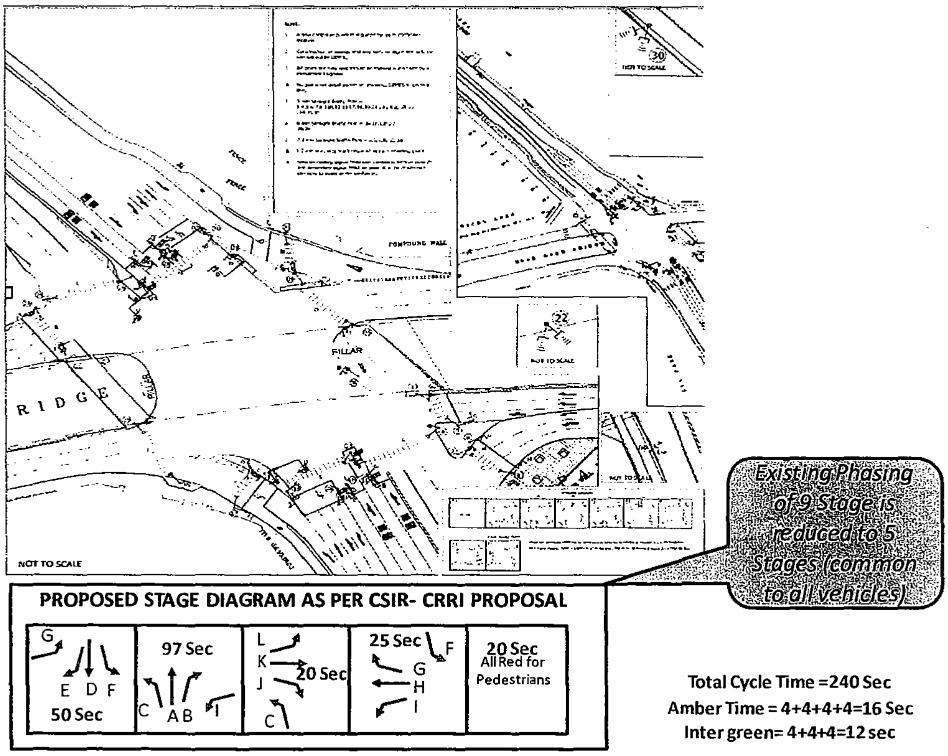


Figure 5.3.13: Traffic Signal Stages/ Phases and their Phase Timings implemented at Chirag Delhi Intersection

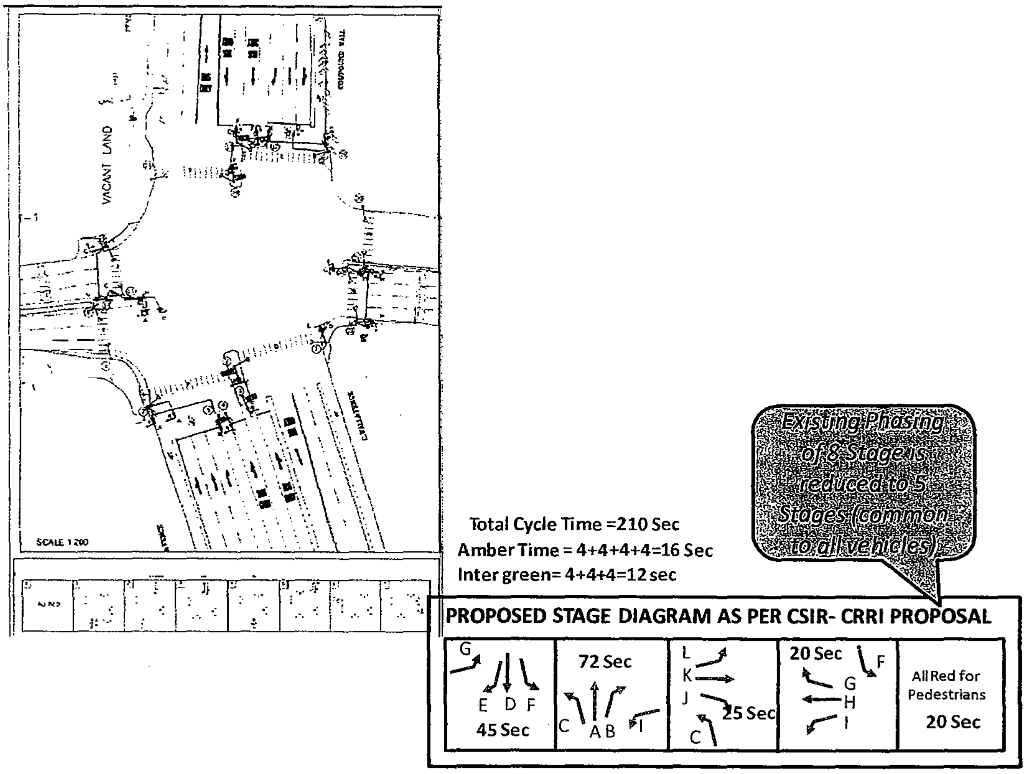


Figure 5.3.14: Traffic Signal Stages/ Phases and their Phase Timings implemented at Siri Fort Intersection

A glimpse of the implemented measures on BRT corridor under the experimental trial run is presented in Photo 5.1.1 to 5.1.9.

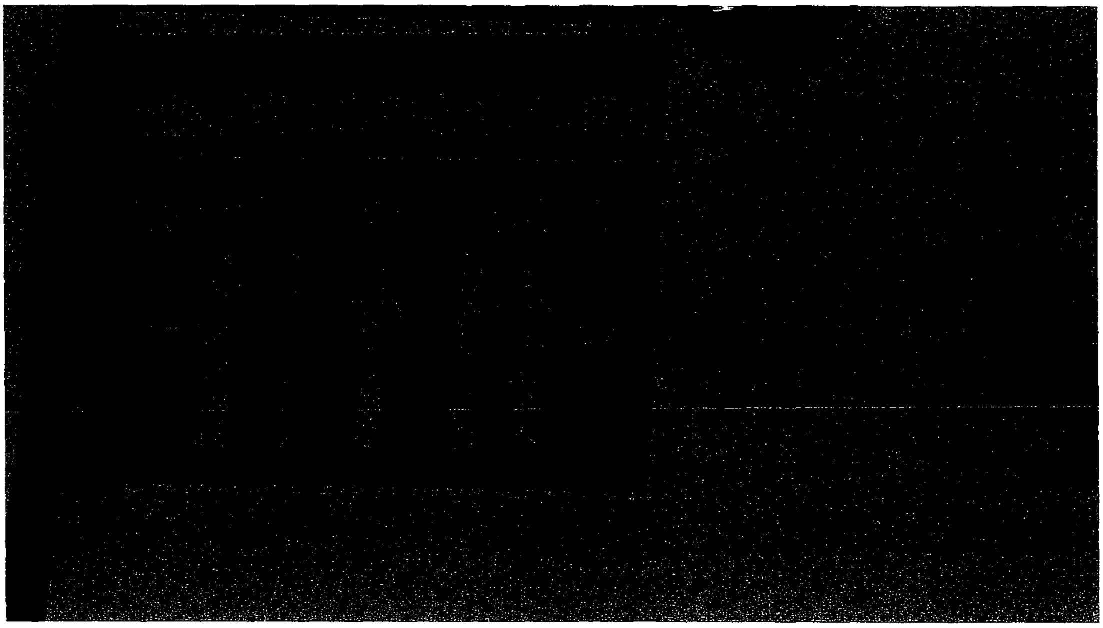


Photo 5.3.1: Temporary Overhead signage erected while conducting the Experimental Trial Run

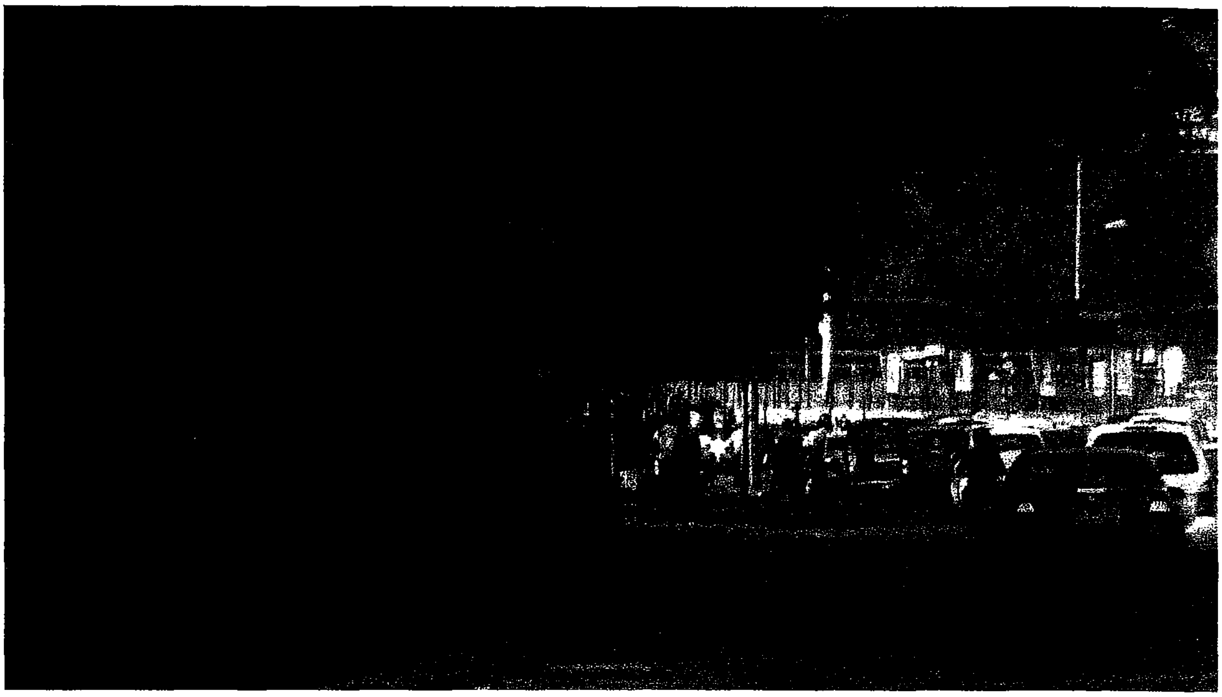


Photo 5.3.2: Temporary signage erected for conducting the experimental trial run

Photo 5.3.3: Temporary signage in bilingual language erected while conducting the experimental trial run

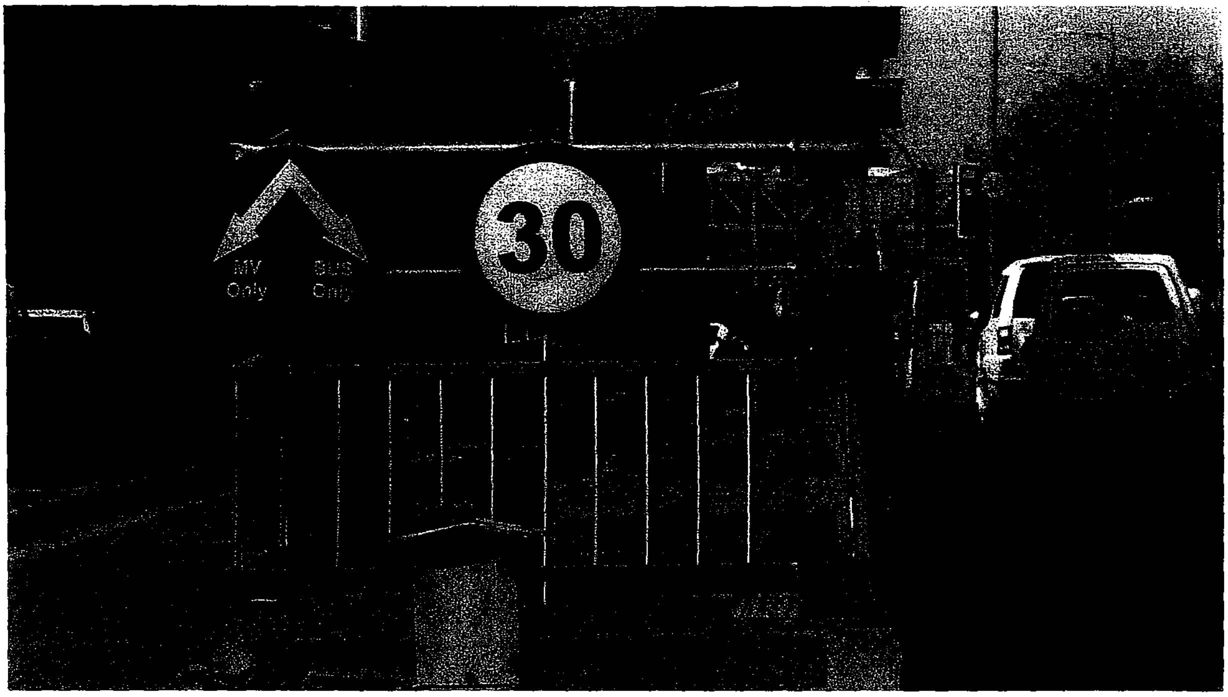


Photo 5.3.4: Temporary Regulatory Signage Erected for conducting the Experimental Trial Run

Photo 5.3.5: Flexible Bollard Placement in Progress for segregation of Opposing Traffic.

Photo 5.3.6: Effective Utilization of available Road Space during the Experimental Trial Run

Photo 5.3.7: Effective Utilization of available Road Space during the Experimental Trial Run

Photo 5.3.8: Effective Utilization of available Road Space during the Experimental Trial Run

Photo 5.3.9: Temporary barricading to control the traffic in Opposite Lanes during the Experimental Trial Run

5.4 Journey Speeds during Experimental Trial Run

As done during the normal BRT Operations, identical procedure *(vide Section 3.2.4)*, was followed for the collection of speed and delay data using GPS on the study corridor during 'experimental trial run' manned by CSIR-CRRI study team. During the course of the experimental trial run which was operational since 12th May, 2012 speed and delay studies were carried out starting from 13th to 19th May, 2012 so as to make a critical comparison with the observed speeds during weekdays and weekends across different vehicle types when the 'normal BRT operations. Further, a critical comparison of the speeds and delays observed across different vehicle types like cars, buses, two wheelers, auto rickshaws and cyclists during both scenarios has been made and presented in Chapter-6 of this report.

5.4.1 Speed and Delay Characteristics of Buses during normal BRT Operations

A summary of Speed and Delay survey carried out by installing GPS on the buses during experimental run on the study corridor is given in Table 5.4.1. The salient observations drawn from this table across the various test runs are discussed below:

- The journey speed of bus in upward direction on weekdays during trial run ranged from 14.0 Kmph *(6:14 AM)* to 19.1 Kmph (7:07AM)
- The maximum of total delay of buses caused to the test vehicle during the experimental trial run is about 713 seconds observed during evening time at 4:06 pm in upward direction on a weekday whereas the minimum of total delay of caused during the test run is about 98 seconds observed during morning time *(7:07 AM)* in upward direction on a weekday.
- The journey speeds of buses in upward direction on weekend during the trial run ranged from 14.6 Kmph *(8:21 AM)* to 26.5 Kmph *(7:36 AM)*.
- The maximum of total delay caused to the bus during the trial run is about 317 seconds observed during morning time *(9:35 AM)* in upward direction on weekends whereas the minimum of total delay caused to the bus is 39 seconds on week end during morning time *(7:36 AM)*.
- The journey speeds of buses in downward direction on weekdays during experimental trial ranged from 9.9 Kmph *(7:14 PM)* to 20.3 Kmph *(7:33 AM)*.
- The maximum of total delay of buses during the trial run is about 543 seconds observed during evening time at 4:34 PM in downward direction whereas the minimum of total delay of buses on the corridor is about 131 seconds observed during morning time at 7:33 AM in downward direction on a typical weekday.
- The journey speeds of buses in downward direction on weekends during experimental trial run ranged from 13.6 kmph *(5:25 PM)* to 22.8 kmph *(9:11 am)*. The maximum of total delay of buses on the corridor during the trial run is about 606 seconds observed during evening time *(5:25 PM)* in downward direction whereas the minimum of total delay of buses is about 90.0 seconds observed during morning time *(9:11 AM)* in downward direction on a typical weekend.

5.4.2 Speed and Delay Characteristics of Autos during normal BRT Operations

The summary of Speed and Delay survey conducted on Autos during the experimental trial run on the study corridor across the various test runs is given in Table 5.4.2. Due to paucity of time, no test runs were conducted during the weekends.

- The journey speeds of Autos in upward direction on weekdays during trial run on BRT ranged from 15.8 kmph *(6:33PM)* to 28.5 kmph *(7:31AM)*.

Table 5.4.1: Speed and Delay Characteristics of Bus during Experimental Trial Run on BRT

Date of Survey	Time of Start of Survey	Delay (Sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (Km)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
14-05-2012	7:07 AM	98.4	9.0	21.0	19.1	45.5
14-05-2012	7:55 AM	219.1	19.4	22.0	17.7	48.7
14-05-2012	12:10 PM	174.1	14.7	20.4	17.4	48.6
14-05-2012	1:34 PM	534.8	37.4	23.0	14.4	41.2
18-05-2012	4:06 PM	712.5	49.2	28.9	14.7	42.2
18-05-2012	5:07 PM	454.3	34.4	24.5	16.1	48.3
14-05-2012	5:07 PM	377.6	32.8	26.7	17.9	49.0
14-05-2012	6:14 PM	427.8	29.5	19.9	14.0	45.5
18-05-2012	6:40 PM	390.8	29.0	22.1	15.7	41.9
Weekend: Up Direction - **Ambedkar Nagar to Mool Chand**						
13-05-2012	7:36 AM	38.5	4.8	27.9	26.5	46.3
13-05-2012	8:21 AM	238.5	18.2	17.8	14.6	46.0
19-05-2012	8:31 AM	66.5	6.2	21.0	19.7	41.7
19-05-2012	9:35 AM	317.2	23.7	19.2	14.7	43.3
13-05-2012	12:06 PM	58.9	6.0	22.9	21.5	46.2
19-05-2012	12:10 PM	87.9	7.8	20.1	18.6	45.5
13-05-2012	12:54 PM	202.2	19.4	24.8	20.0	41.6
13-05-2012	4:53 PM	91.4	8.2	19.8	18.2	56.8
19-05-2012	5:01 PM	310.4	25.8	23.6	17.5	43.6
13-05-2012	5:50 PM	172.8	18.4	26.9	21.9	45.4
19-05-2012	6:03 PM	244.5	22.4	24.9	19.3	41.8
Weekday: Down Direction - **Mool Chand to Ambedkar Nagar**						
14-05-2012	7:33 AM	130.6	12.8	23.2	20.3	46.1
14-05-2012	8:21 AM	252.3	22.4	23.2	18.0	41.5
14-05-2012	12:39 PM	341.4	26.7	21.7	15.9	45.5
14-05-2012	2:04 PM	248.1	22.6	24.2	18.7	44.2
18-05-2012	4:34 PM	543.2	37.2	23.7	14.9	48.0
14-05-2012	5:32 PM	515.7	32.0	18.3	12.5	41.0
18-05-2012	5:47 PM	394.6	27.8	21.2	15.3	34.2
14-05-2012	6:54 PM	333.7	23.5	18.4	14.1	43.0
18-05-2012	7:14 PM	412.7	18.8	12.2	9.9	42.2
Weekend: Down Direction - **Mool Chand to Ambedkar Nagar**						
13-05-2012	7:52 AM	401.0	31.5	24.3	16.7	50.8
13-05-2012	9:11 AM	89.9	10.2	25.4	22.8	45.0
13-05-2012	12:32 PM	139.2	12.3	21.5	18.9	48.5
13-05-2012	1:18 PM	496.7	37.5	25.0	15.6	40.3
19-05-2012	1:46 PM	250.7	19.8	19.8	15.9	42.4
19-05-2012	5:25 PM	606.3	38.1	21.9	13.6	43.6
13-05-2012	6:10 PM	454.9	30.0	21.0	14.7	44.0
19-05-2012	6:34 PM	321.9	21.1	18.1	14.3	35.4

- The maximum of total delay of Autos on the corridor during the trial run is about 522 seconds observed during evening time at 6:33 PM in upward direction whereas the minimum of total delay of Autos is about 25 seconds observed during morning time at 7:31 AM in upward direction on a typical weekday.

- The journey speeds of Autos in downward direction on a typical weekday during the trial run hovered between 16.1 kmph *(1:24 PM)* to 25.2 Kmph *(7:44 AM)*.
- The maximum of total delay of autos encountered by the test vehicle during the trial run is about 443 seconds observed during afternoon time *(1:24 PM)* in downward direction whereas the minimum of total delay of Autos is about 200 seconds observed during morning time *(7:44 AM)* in downward direction on a weekday.

Table 5.4.2: Speed and Delay Characteristics of Autos during Experimental Trial Run on BRT

Date of Survey	Time of Start of Survey	Delay (sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
15-05-2012	7:31 AM	25.1	3.7	29.6	28.5	54.2
15-05-2012	8:14 AM	89.3	10.1	26.1	23.5	42.6
15-05-2012	12:12 PM	204.2	15.5	19.4	16.4	43.9
15-05-2012	1:00 PM	445.3	40.3	29.9	17.8	44.4
15-05-2012	5:50 PM	187.8	16.3	21.7	18.1	47.9
15-05-2012	6:33 PM	522.4	38.5	25.7	15.8	47.7
Weekday: Down Direction - **Mool Chand to Ambedkar Nagar**						
15-05-2012	7:44 AM	199.5	27.0	34.5	25.2	56.6
15-05-2012	12:36 PM	230.7	19.6	21.4	17.2	46.1
15-05-2012	1:24 PM	442.5	34.2	24.5	16.1	44.0

5.4.3 Speed and Delay Characteristics of Two Wheelers during Trial Run on BRT

The summary of Speed and Delay Survey of two wheelers during the experimental trial run on the study corridor spread over different test runs is given in Table 5.4.3.

- The journey speeds of Two wheelers in upward direction during the trial run on the study corridor ranged from 18.3 kmph *(5:18 PM)* to 24.6 kmph *(7:20 AM)* on a typical weekday.
- The maximum of total delay of two wheelers on the corridor is about 350 seconds observed during evening time *(6:30 PM)* in upward direction on a week day whereas the minimum of total delay of two wheelers is about 84 seconds observed during morning time *(1:37 PM)* in upward direction on a weekday.
- The journey speeds of Two wheelers in downward direction on a weekday during trial run ranged from 12.1 Kmph *(5:40 PM)* to 21.2 Kmph *(2:06 PM)*.
- The maximum of total delay of two wheelers on the study corridor during the trial run is about 383 seconds observed during afternoon time *(6:43 PM)* in downward direction whereas the minimum of total delay of two wheelers on the

corridor is about 110 seconds observed during morning time *(2:06 PM)* in downward direction on a typical weekday.

Table 5.4.3: Speed and Delay Characteristics of Two Wheeler during Experimental Trial Run on BRT

Date of Survey	Time of Start of Survey	Delay (sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
14-05-2012	7:20 AM	148.4	21.9	31.5	24.6	53.3
14-05-2012	8:23 AM	298.2	27.9	27.1	19.5	57.3
14-05-2012	12:21 PM	150.6	16.5	27.8	23.2	60.0
14-05-2012	1:37 PM	84	9.1	24.8	22.6	56.3
14-05-2012	5:18 PM	200.6	17.4	22.2	18.3	56.6
14-05-2012	6:18 PM	349.7	30.9	26.7	18.5	53.1
Weekend: Up Direction - **Ambedkar Nagar to Mool Chand**						
13-05-2012	7:59 AM	12.3	1.8	32.4	31.8	67.5
13-05-2012	8:48 AM	50.5	7.0	26.9	25.0	59.9
13-05-2012	12:12 PM	26.6	3.5	29.0	28.0	56.1
13-05-2012	12:51 PM	186.5	20.1	28.4	22.7	61.2
13-05-2012	5:01 PM	71.8	8.5	27.0	24.7	58.4
13-05-2012	5:57 PM	191.8	20.8	29.2	23.1	62.8
Weekday: Down Direction - **Mool Chand to Ambedkar Nagar**						
14-05-2012	7:33 AM	306	30.1	29.0	20.3	55.1
14-05-2012	8:46 AM	318.3	31.3	29.4	20.2	56.8
14-05-2012	12:41 PM	141.3	14.1	24.1	20.7	52.7
14-05-2012	2:06 PM	110.3	11.0	23.9	21.2	54.4
14-05-2012	5:40 PM	131.8	7.8	13.1	12.1	51.7
14-05-2012	6:43 PM	383	26.9	20.1	14.7	51.2
Weekend: Down Direction - **Mool Chand to Ambedkar Nagar**						
13-05-2012	8:11 AM	101.3	11.1	23.3	20.7	57.8
13-05-2012	9:01 AM	12.2	2.0	31.0	30.4	54.1
13-05-2012	12:24 PM	153.6	10.0	14.3	12.9	61.2
13-05-2012	1:07 PM	183.3	18.7	29.2	23.7	60.5
13-05-2012	5:16 PM	80.9	8.6	24.2	22.1	56.6
13-05-2012	6:14 PM	132.4	13.7	23.6	20.3	54.5

- The journey speeds of two wheelers in downward direction on Weekends during trial run ranges from 12.9 Kmph *(12:24 PM)* to 30.4 Kmph *(9:01 AM)*.
- The maximum of total delay of two wheelers encountered on the study corridor during the trial run is about 183 seconds observed during afternoon time *(1:07 PM)* in downward direction whereas the minimum of total delay of two wheelers

on the corridor is about 12 seconds observed during morning time at 9:01 AM in downward direction on a typical weekend.

5.4.4 *Speed and Delay Characteristics of Cars during Trial Run on BRT*

The summary of Speed and Delay Survey of Car during Experimental BRT operations spread over different test runs is given in Table 5.4.4.

- The journey speeds of Cars obtained from various test runs in upward direction on weekdays during the experimental trial run is between 12.8 Kmph *(6:13 PM)* to 26.8 Kmph *(7:50 PM)*.
- The maximum of total delay of Cars on the corridor during the trial run is about 699 seconds observed during evening time *(5:37 PM)* in upward direction whereas the minimum of total delay of Cars on the corridor is about 63 seconds observed during morning time *(7:50 AM)* in upward direction on a weekday.
- The journey speeds of Cars in upward direction on a weekend during trial run ranged from 17.5 kmph *(5:59 PM)* to 25.1 kmph *(1:01 PM)*.
- The maximum of total delay of Cars encountered by the test vehicle on the corridor during the trial run is about 612 seconds observed during evening time at 5:59 PM in upward direction whereas the minimum of total delay of Cars on the corridor is about 96 seconds observed during morning time at 8:22 am in upward direction on a typical weekend.
- The journey speeds of Cars in down direction on Weekdays during trial run ranged from 11.5 Kmph *(6:57 PM)* to 20.6 Kmph *(3:21 PM)*.
- The maximum of total delay of Cars encountered by the test car during the trial run on the corridor is about 760 seconds observed during evening time *(6:57 PM)* in down direction whereas the minimum of total delay caused to the test vehicle during the trial run is about 272 seconds observed during afternoon time *(3:21 PM)* in down direction on a weekday.
- The journey speeds of Cars in downward direction on weekends during trial run ranged from 14.2 kmph *(12:34 PM)* to 29.5 kmph *(8:20 am)*.
- The maximum of total delay of Cars encountered by the test vehicle during the experimental trial run is about 738 seconds observed during evening time *(12:34 PM)* in downward direction whereas the minimum of total delay of Cars on the corridor is about 23 seconds observed during morning time at 8:38 AM in downward direction on a weekend.

5.4.5 *Speed and Delay Characteristics of Cycles during Trial Run on BRT*

The summary of Speed and Delay survey of Cycles during the experimental trial run on the corridor spread over different test runs is given in Table 5.4.5.

- The journey speeds of Cycles in upward direction on a weekday during trial run ranged from 10.1 kmph *(4:38 pm)* to 14.7 kmph *(1:03 pm)*.

Table 5.4.4: Speed and Delay Characteristics of Car during Trial Run on BRT

Date of Survey	Time of Start of Survey	Delay (sec)	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
14-05-2012	7:21 AM	293.9	29.9	30.5	21.4	55.6
15-05-2012	7:50 AM	62.6	8.1	29.1	26.8	49.9
14-05-2012	8:26 AM	517.1	40.1	28.1	16.8	57.9
15-05-2012	9:01 AM	596.0	43.6	28.1	15.9	49.3
14-05-2012	12:21 PM	476.2	41.7	31.4	18.3	60.9
14-05-2012	1:40 PM	430.3	36.8	29.3	18.5	52.3
15-05-2012	2:05 PM	393.2	38.3	33.3	20.5	68.4
15-05-2012	2:58 PM	399.5	35.7	30.4	19.5	59.8
18-05-2012	3:58 PM	388.0	32.4	25.8	17.5	60.9
14-05-2012	5:37 PM	699.4	50.7	30.6	15.1	51.8
18-05-2012	5:53 PM	503.5	40.7	29.5	17.5	55.2
15-05-2012	6:13 PM	661.2	40.5	21.5	12.8	51.0
14-05-2012	6:33 PM	623.7	43.9	27.1	15.2	58.4
18-05-2012	6:44 PM	678.7	47.2	27.2	14.4	61.6
15-05-2012	7:10 PM	640.5	46.4	29.1	15.6	61.5
18-05-2012	7:38 PM	549.5	45.5	32.9	17.9	61.3
Weekend: Up Direction - **Ambedkar Nagar to Mool Chand**						
13-05-2012	8:01 AM	334.5	34.3	32.3	21.2	63.3
19-05-2012	8:22 AM	95.8	10.6	26.4	23.6	61.4
19-05-2012	8:56 AM	276.9	25.6	27.5	20.4	69.3
13-05-2012	8:58 AM	289.8	32.1	34.0	23.1	66.9
13-05-2012	9:53 AM	423.2	34.9	27.5	17.9	58.8
19-05-2012	12:15 PM	408.4	35.9	28.5	18.2	55.3
19-05-2012	1:00 PM	338.2	31.4	29.0	19.9	56.0
13-05-2012	1:01 PM	224.9	27.2	34.5	25.1	79.2
13-05-2012	2:06 PM	430.6	38.4	31.4	19.3	63.5
13-05-2012	5:06 PM	394.0	36.3	30.2	19.2	55.6
19-05-2012	5:59 PM	612.8	50.0	35.1	17.5	74.2
13-05-2012	6:29 PM	418.4	33.9	26.6	17.6	55.2
Week Day: Down Direction - **Mool Chand to Ambedkar Nagar**						
14-05-2012	7:38 AM	455.6	41.7	32.7	19.1	59.1
15-05-2012	8:06 AM	371.0	33.6	28.3	18.8	52.3
14-05-2012	8:48 AM	623.9	45.0	28.2	15.5	55.9
15-05-2012	9:24 AM	464.5	34.8	24.4	15.9	52.8
14-05-2012	12:40 PM	376.5	31.4	25.2	17.3	50.9
14-05-2012	2:01 PM	478.9	38.6	28.2	17.3	55.4
15-05-2012	2:26 PM	323.7	30.8	28.8	19.9	56.6

15-05-2012	3:21 PM	272.7	26.6	28.0	20.6	58.0
18-05-2012	4:18 PM	552.5	41.7	27.0	15.7	60.1
14-05-2012	6:01 PM	434.8	34.3	25.0	16.4	58.3
18-05-2012	6:15 PM	429.4	30.8	21.7	15.0	58.5
15-05-2012	6:42 PM	611.6	40.4	22.8	13.6	48.4
14-05-2012	6:57 PM	760.3	40.7	19.3	11.5	63.5
18-05-2012	7:09 PM	458.8	32.3	21.4	14.5	55.0
15-05-2012	7:34 PM	346.9	28.6	25.0	17.9	49.9
18-05-2012	7:59 PM	613.0	40.9	23.6	13.9	61.0
Week End: Down Direction - **Mool Chand to Ambedkar Nagar**						
13-05-2012	8:20 AM	189.6	27.1	40.4	29.5	75.7
19-05-2012	8:38 AM	23.9	3.1	27.2	26.4	68.9
13-05-2012	9:14 AM	424.8	42.0	35.3	20.5	60.4
19-05-2012	9:14 AM	392.5	36.8	31.5	19.9	71.5
13-05-2012	10:14 AM	401.4	37.4	32.0	20.1	78.0
19-05-2012	12:34 PM	737.5	51.4	29.1	14.2	72.4
19-05-2012	1:19 PM	542.3	44.7	31.2	17.2	65.9
13-05-2012	1:38 PM	358.2	33.2	28.9	19.3	60.6
13-05-2012	2:26 PM	311.4	32.4	32.1	21.7	57.2
13-05-2012	6:50 PM	386.9	33.9	28.5	18.8	52.9

- The maximum of total delay faced by the Cycles during the test run on the corridor is about 366 seconds observed during evening time *(4:38PM)* in upward direction whereas the minimum of total delay is about 78.5 seconds observed during afternoon time *(2:13PM)* in upward direction on a weekday.
- The journey speeds of Cycles in downward direction on a weekdays during trial run ranged from 8.3 kmph *(10:30AM)* to 16.1 Kmph *(1:26PM)*.
- The maximum of total delay encountered during the test run on the Cycle is about 454.8 seconds observed during afternoon time *(12:08PM)* in downward direction on a typical weekday whereas the minimum of total delay is about 35 seconds observed during evening time *(5:15PM)* in downward direction on a weekday.

5.5 Queue Length during Experimental Trial Run

As mentioned earlier, during trial run MV lane traffic was allowed to ply on the BRT lane for taking right turn at the intersections. Similarly Buses were allowed to ply on MV lane to take left turn at the intersections. To identify the behaviour of queue length at all the junctions queue length survey was conducted on the study Corridor. The queue length statistical summary such as minimum, maximum, mean and standard deviation of the queue lengths on different approaches at all the intersections are presented in Table 5.5.1 to Table 5.5.5.

Table 5.5.1: Speed and Delay Characteristics of Cycle during Experimental Trial Run

Date of Survey	Time of Start of Survey	Delay Sec	Delay (in % of Travel Time)	Avg. Running Speed (kmph)	Avg. Journey Speed (kmph)	Maximum Speed (kmph)
Weekday: Up Direction - **Ambedkar Nagar to Mool Chand**						
15-05-2012	9:50 AM	303.9	15.4	12.4	10.5	23.5
15-05-2012	11:40 AM	156.4	9.3	12.7	11.5	22.5
15-05-2012	1:03 PM	152.7	11.1	16.5	14.7	26.8
15-05-2012	2:13 PM	78.5	4.7	12.6	12.0	27.5
15-05-2012	4:38 PM	365.8	21.8	12.9	10.1	22.9
15-05-2012	5:56 PM	22.8	1.7	14.1	13.8	26.3
Weekday: Down Direction - **Mool Chand to Ambedkar Nagar**						
15-05-2012	10:30 AM	434.9	18.2	10.1	8.3	20.7
15-05-2012	12:08 PM	454.8	21.5	11.4	8.9	31.1
15-05-2012	1:26 PM	122.4	9.9	17.8	16.1	30.0
15-05-2012	2:46 PM	70.7	5.3	12.8	12.1	25.0
15-05-2012	5:15 PM	35.2	3.5	14.4	13.9	24.0
15-05-2012	6:23 PM	60.2	4.5	12.5	12.0	21.9

From the table it can be observed that the queue length is the maximum at Sheikh Sarai Intersection on Mool Chand approach and is about 250m. The maximum queue length at all other three intersections other than Ambedkar Nagar intersection is about 200m. The average maximum queue length at Siri Fort and Sheikh Sarai junction is 175m and 167 m respectively whereas this value for other three intersections is less than 150m. Similarly the high average standard deviation of all approaches was observed at Chirag Delhi junction (42m) followed by Siri Fort junction (32m).

Table 5.5.2: Summary of Queue length Statistical Measures on Various Approaches at Ambedkar Nagar Junction

Queue length Statistical Measures (in meters)	*Mool Chand Approach*	*Mehrauli Approach*	*Badarpur Border Approach*
Minimum	50	50	50
Maximum	100	100	150
Average	55.2	58.7	70.3
SD	15.3	19.1	26.3

Table 5.5.3: Summary of Queue length Statistical Measures on Various Approaches at Pushpa Bhawan Junction

Queue length Statistical Measures (in meters)	*Mool Chand Approach (MV Lane)*	*Dakshinpuri Approach (MV Lane)*	*Ambedkar Nagar Approach (MV Lane)*	*Saket Approach (MV Lane)*
Minimum	0	50	0	0
Maximum	200	100	150	100
Average	84.1	52.1	65.1	50
SD	38.6	10.0	27.9	4.6

Table 5.5.4: Summary of Queue length Statistical Measures on Various Approaches at Sheik Sarai Junction

Queue length Statistics (in Meters)	*Mool Chand Approach (MV Lane)*	*Ambedkar Nagar Approach (MV Lane)*	*Saket Approach (MV Lane)*
Minimum	50	0	50
Maximum	250	100	150
Mean	79.7	58.8	71.6
SD	35.2	19.6	34.4

Table 5.5.5: Summary of Queue length Statistical Measures on Various Approaches at Chirag Delhi Junction

Queue length Statistics (in Meters)	*Mool Chand Approach (MV Lane)*	*GK-II Approach*	*Ambedkar Nagar Approach (MV Lane)*	*IIT Approach (MV lane)*
Minimum	150	50	150	50
Maximum	200	50	100	50
Average	166.1	83.7	158.4	55
SD	43.3	42.3	66.7	15.1

Table 5.5.6: Summary of Queue length Statistical Measures on Various Approaches Siri Fort Junction

Queue length Statistics (in Meters)	*GK Approach*	*Siri Fort Approach*	*Mool Chand Approach*	*Chirag Delhi Approach*
Minimum	50	50	50	50
Maximum	150	150	200	200
Average	55.0	65.9	94.4	99.4
SD	17.0	29.3	40.7	40.1

5.6 Measurement of Fuel Consumption during Experimental Trial Run

The analysed journey time and associated delay during the experimental trial run for petrol and diesel driven cars across different time periods during experimental trial run BRT scenario is shown in Table 5.6.1 to 5.6.5. Subsequently, the fuel consumption during idling and cruising conditions is presented in Table 5.6.6 to 5.6.8 for petrol car only whereas for diesel vehicle, the loss of fuel in idling was calculated. The salient observations drawn from the data presented in Table 5.6.1 to 5.6.9 are presented below:

- The travel time of the study corridor is observed to vary between 16.2 to 21.2 minutes.
- The quantum of delay observed ranged from 4 - 9 minutes across different time periods of the day.
- The amount of fuel consumed due to idling at the intersections ranged from 50 ml to 80 ml in the case of petrol driven test car.
- The journey speed observed ranged from 16.3 kmph - 21.4kmph spread over various time periods of the day.
- The journey time was more in case of upward direction than in the case of downward direction.
- The delay experienced on the corridor during the probe vehicle run covering different time periods of the day was observed to hover between 12 to 43 %.

Table 5.6.1: Experimental Trial Run Travel Time on the Study Stretch during the Morning Time (8:00 AM ~ 11:00 AM) for Petrol Driven Car

Road Stretch	Distance (m)	Delay (Sec)	Average Journey Time (Min)	Average Journey Speed (kmph)
UP Direction				
Ambedkar Nagar to Pushpa Bhawan	1450	128(37%)	5.42	15.25
Pushpa Bhawan to Sheikh Sarai	620	34(28%)	2.01	18.38
Sheikh Sarai to Chirag Delhi	930	80(33%)	4.02	13.84
Chirag Delhi to Siri Fort	1420	76(33%)	3.53	21.93
Siri Fort to GK-I Crossing	800	2(2%)	1.34	30.68
GK-I Crossing to Mool Chand	580	62(46%)	2.15	15.47
TOTAL	**5800**	**383(33%)**	**19.28**	**17.88**
DOWN Direction				
Mool Chand to GK I Crossing	580	0(0%)	1.00	34.93
GK-I Crossing to Siri Fort	800	75(47%)	2.38	18.26
Siri Fort to Chirag Delhi	1420	105(38%)	4.36	18.49
Chirag Delhi to Sheikh Sarai	930	28(17%)	2.43	20.53
Sheikh Sarai to Pushpa Bhawan	620	84(52%)	2.41	13.90
Pushpa Bhawan to Ambedkar Nagar	1450	37(17%)	3.34	24.40
TOTAL	**5800**	**330(32%)**	**17.12**	**20.24**

Note: Value in parenthesis shows the percentage of Idling in total travel time

Table 5.6.2: Experimental Trial Run Travel Time on the Study Stretch during the Afternoon Time (12.00 noon ~ 4:00 PM) for Petrol Driven Car

Road Stretch	Distance (m)	Delay (Sec)	Average Journey Time (Min)	Average Journey Speed (kmph)
UP Direction				
Ambedkar Nagar to Pushpa Bhawan	1450	154 (42%)	6.06	14.27
Pushpa Bhawan to Sheikh Sarai	620	48 (39%)	2.03	18.12
Sheikh Sarai to Chirag Delhi	930	114 (47%)	4.01	13.90
Chirag Delhi to Siri Fort	1420	144 (45%)	5.19	16.01
Siri Fort to GK-I Crossing	800	0(0%)	1.25	33.93
GK-I Crossing to Mool Chand	580	60 (41%)	2.26	14.31
TOTAL	**5800**	**521 (41%)**	**21.20**	**16.31**
DOWN Direction				
Mool Chand to GK I Crossing	580	0 (0%)	0.57	36.87
GK-I Crossing to Siri Fort	800	100 (50%)	3.21	14.35
Siri Fort to Chirag Delhi	1420	136 (44%)	5.08	16.57
Chirag Delhi to Sheikh Sarai	930	13(10%)	2.01	27.56
Sheikh Sarai to Pushpa Bhawan	620	75 (44%)	2.50	13.15
Pushpa Bhawan to Ambedkar Nagar	1450	35 (14%)	4.02	21.54
TOTAL	**5800**	**358 (33%)**	**18.19**	**19.00**

Note: Value in parenthesis shows the percentage of Idling in total travel time

Table 5.6.3: Experimental Trial Run Travel Time on the Study Stretch during the Evening Time (4.00 PM ~ 8:00 PM) for Petrol Driven Car

Road Stretch	Distance (m)	Delay (Sec)	Average Journey Time (Min)	Average Journey Speed (kmph)
UP Direction				
Ambedkar Nagar to Pushpa Bhawan	1450	104(35%)	4.57	17.58
Pushpa Bhawan to Sheikh Sarai	620	34(33%)	1.41	22.12
Sheikh Sarai to Chirag Delhi	930	136 (50%)	4.30	12.41
Chirag Delhi to Siri Fort	1420	105 (41%)	4.14	20.16
Siri Fort to GK-I Crossing	800	1 (1%)	1.34	30.56
GK-I Crossing to Mool Chand	580	156(66%)	3.56	8.84
TOTAL	**5800**	**536(43%)**	**20.52**	**16.68**
DOWN Direction				
Mool Chand to GK I Crossing	580	0 (0%)	1.02	33.89
GK-I Crossing to Siri Fort	800	94(47%)	3.19	14.46
Siri Fort to Chirag Delhi	1420	121 (38%)	5.20	15.97
Chirag Delhi to Sheikh Sarai	930	3(2%)	2.03	27.22
Sheikh Sarai to Pushpa Bhawan	620	84(53%)	2.37	14.18
Pushpa Bhawan to Ambedkar Nagar	1450	40 (15%)	4.21	19.99
TOTAL	**5800**	**342(30%)**	**18.43**	**18.60**

Note: Value in parenthesis shows the percentage of Idling in total travel time

Table 5.6.4: Experimental Trial Run Travel Time on the Study Stretch during the Morning Time (8.00 AM ~ 11:00 AM) for Diesel Driven Car

Road Stretch	Distance (m)	Delay (Sec)	Average Journey Time (Min)	Average Journey speed (kmph)
UP Direction				
Ambedkar Nagar to Pushpa Bhawan	1450	131 (39%)	5.36	15.53
Pushpa Bhawan to Sheikh Sarai	620	52 (38%)	2.15	16.57
Sheikh Sarai to Chirag Delhi	930	94(39%)	4.02	13.82
Chirag Delhi to Siri Fort	1420	49 (25%)	3.18	25.82
Siri Fort to GK-I Crossing	800	1 (1%)	1.37	29.80
GK-I Crossing to Mool Chand	580	72 (52%)	2.20	14.90
TOTAL	**5800**	**399 (35%)**	**19.08**	**18.19**
DOWN Direction				
Mool Chand to GK I Crossing	580	0 (0%)	0.59	35.51
GK-I Crossing to Siri Fort	800	69 (46%)	2.30	19.16
Siri Fort to Chirag Delhi	1420	100 (38%)	4.20	19.65
Chirag Delhi to Sheikh Sarai	930	23 (16%)	2.24	23.31
Sheikh Sarai to Pushpa Bhawan	620	95 (58%)	2.43	16.66
Pushpa Bhawan to Ambedkar Nagar	1450	29 (15%)	3.19	26.19
TOTAL	**5800**	**316 (32%)**	**16.16**	**21.40**

Table 5.6.5: Experimental Trial Run Travel Time on the Study Stretch during the Evening Time (4:00 PM ~ 8:00 PM) for Diesel Driven Car

Road Stretch	Distance (m)	Delay (Sec)	Average Journey Time (Min)	Average Journey speed (kmph)
UP Direction				
Ambedkar Nagar to Pushpa Bhawan	1450	148(45%)	5.28	15.93
Pushpa Bhawan to Sheikh Sarai	620	34 (36%)	1.34	23.64
Sheikh Sarai to Chirag Delhi	930	91(43%)	3.31	15.89
Chirag Delhi to Siri Fort	1420	85 (37%)	3.53	21.90
Siri Fort to GK-I Crossing	800	0 (0%)	1.47	26.94
GK-I Crossing to Mool Chand	580	167 (66%)	4.11	8.31
TOTAL	**5800**	**524(43%)**	**20.24**	**17.05**
DOWN Direction				
Mool Chand to GK I Crossing	580	0 (0%)	0.59	35.21
GK-I Crossing to Siri Fort	800	55 (35%)	2.36	18.50
Siri Fort to Chirag Delhi	1420	81 (29%)	4.43	18.09
Chirag Delhi to Sheikh Sarai	930	0 (0%)	2.06	26.52
Sheikh Sarai to Pushpa Bhawan	620	94 (53%)	2.57	12.62
Pushpa Bhawan to Ambedkar Nagar	1450	13(6%)	3.41	23.67
TOTAL	**5800**	**243 (24%)**	**17.02**	**20.45**

Note: Value in parenthesis shows the percentage of Idling in total travel time

Table 5.6.6: Experimental Trial Run Fuel Consumption on the Study Stretch during the Morning Time (8.00 AM ~ 11:00 AM) for Petrol Driven Car

Road Stretch	Distance (m)	Average Fuel Consumption (ml)	
		Idling	Total
UP Direction			
Ambedkar Nagar to Pushpa Bhawan	1450	21.9(18%)	124.2
Pushpa Bhawan to Sheikh Sarai	620	5.3 (12%)	44.2
Sheikh Sarai to Chirag Delhi	930	11.8(15%)	76.9
Chirag Delhi to Siri Fort	1420	11.3 (12%)	90.6
Siri Fort to GK-I Crossing	800	0.3(0.65%)	43.7
GK-I Crossing to Mool Chand	580	9.2 (22%)	42.4
TOTAL	**5800**	**59.8 (14%)**	**422.0**
DOWN Direction			
Mool Chand to GK I Crossing	580	0 (0%)	45.0
GK-I Crossing to Siri Fort	800	11.4(23%)	50.6
Siri Fort to Chirag Delhi	1420	15.3 (14%)	107.9
Chirag Delhi to Sheikh Sarai	930	4.4 (6%)	72.6
Sheikh Sarai to Pushpa Bhawan	620	12.2(23%)	53.3
Pushpa Bhawan to Ambedkar Nagar	1450	6.6 (7%)	97.6
TOTAL	**5800**	**50.1 (12%)**	**427.0**

Note: Value in parenthesis shows the percentage of fuel consumption during idling

Table 5.6.7: Experimental Trial Run Fuel Consumption on the Study Stretch during the Afternoon Time (12:00 noon ~ 4:00 PM) for Petrol Driven Car

Road Stretch	Distance (m)	Average Fuel Consumption (ml)	
		Idling	Total
UP Direction			
Ambedkar Nagar to Pushpa Bhawan	1450	23.4 (18.42%)	127
Pushpa Bhawan to Sheikh Sarai	620	6.8 (13.48%)	50.2
Sheikh Sarai to Chirag Delhi	930	16.6 (21.69%)	76.7
Chirag Delhi to Siri Fort	1420	20.5(19.95%)	102.8
Siri Fort to GK-I Crossing	800	0.0 (0%)	40.4
GK-I Crossing to Mool Chand	580	8.8 (18.79%)	47
TOTAL	**5800**	**76.2 (17.15%)**	**444.1**
DOWN Direction			
Mool Chand to GK I Crossing	580	0.0 (0%)	45.7
GK-I Crossing to Siri Fort	800	14.9 (25.70%)	57.9
Siri Fort to Chirag Delhi	1420	23.6 (19.99%)	118.2
Chirag Delhi to Sheikh Sarai	930	2.1 (3.26%)	64.3
Sheikh Sarai to Pushpa Bhawan	620	10.9(19.91%)	54.9
Pushpa Bhawan to Ambedkar Nagar	1450	5.7 (5.64%)	101.3
TOTAL	**5800**	**57.3 (12.95%)**	**442.2**

Table 5.6.8: Experimental Trial Run Fuel Consumption on the Study Stretch during the Evening Time (4:00 PM ~ 8:00 PM) for Petrol Driven Car

Road Stretch	Distance (m)	Average Fuel Consumption (ml)	
		Idling	Total
UP Direction			
Ambedkar Nagar to Pushpa Bhawan	1450	16.5(14.72%)	112.1
Pushpa Bhawan to Sheikh Sarai	620	5.4(12.53%)	43.2
Sheikh Sarai to Chirag Delhi	930	20.1(24.97%)	80.5
Chirag Delhi to Siri Fort	1420	15.6(16.24%)	96.3
Siri Fort to GK-I Crossing	800	0.1 (0.35%)	42.1
GK-I Crossing to Mool Chand	580	22.2 (39.64%)	56
TOTAL	**5800**	**80 (18.60%)**	**430.1**
DOWN Direction			
Mool Chand to GK I Crossing	580	0 (0%)	46.9
GK-I Crossing to Siri Fort	800	14(24.48%)	57.2
Siri Fort to Chirag Delhi	1420	20.3 (17.38%)	116.8
Chirag Delhi to Sheikh Sarai	930	19.7 (32.63%)	60.4
Sheikh Sarai to Pushpa Bhawan	620	11.6 (22.55%)	51.6
Pushpa Bhawan to Ambedkar Nagar	1450	7.8 (8.21%)	95.6
TOTAL	**5800**	**73.5 (17.15%)**	**428.5**

Table 5.6.9: Summary of Fuel Consumption on Study Stretch during different Time Periods on Petrol Driven Car

Road Stretch	Fuel Consumption (ml/10m)	Fuel Consumption (ml/minute)
UP Direction: Ambedkar Nagar to Mool Chand	0.7	21.04
DOWN Direction: Mool Chand to Ambedkar Nagar	0.7	23.96

5.7 User Opinion Survey during Experimental Trial Run

In this study, the users were asked about the rating of the experimental trial run and total travel time variation compared to normal BRT operation. The perception (user rating) of the road users on the experimental run operation is given in Table 5.7.1. It was observed that the average ratings on the 'experimental trial run' registered an increase compared to 'normal BRT operation'. Bus passengers also rated better compared to BRT situation.

Table 5.7.1: Overall Rating of Corridor for the Experimental Trial Run on BRT by different Vehicle users

Type of Vehicle/ Road User	Rating of Trial Run					Overall rating	Sample Size
	Very Bad (1)	Bad (2)	Average (3)	Good (4)	Very Good (5)		
Auto	0.6%	2.7%	6.3%	53.4%	36.9%	4.23	1218
Bus Driver	14.3%	27.7%	12.7%	39.4%	6.0%	2.95	498
Bus Passenger	4.3%	13.7%	9.3%	62.7%	10.0%	3.60	963
Car	0.4%	1.9%	3.4%	48.0%	46.2%	4.38	6718
Cycle	1.6%	23.4%	22.8%	41.3%	10.9%	3.36	184
Goods Vehicle	11.8%	17.6%	11.8%	23.5%	35.3%	3.53	17
Pedestrian	4.7%	26.9%	16.7%	40.0%	11.6%	3.27	275
Taxi	0.4%	2.1%	4.0%	57.7%	35.8%	4.26	721
Two Wheeler	1.1%	3.6%	5.2%	61.2%	28.9%	4.13	4026
					Final Rating	**3.75**	

The overall time variation of the user's perception during experimental run is given in Table 5.7.2. Positive values in the table indicate savings during Experimental run compared to normal BRT operations. The inferences have been drawn by comparing the 'normal BRT operations' and the 'experimental trial run' scenarios:

- Autos reported loss of 13.2 minutes time during normal BRT operation have reported saving in time to the tune of about 14.1 minutes during the trial run.
- Similarly, Car passengers who have reported loss of 16 in normal BRT operation have felt that 16 minutes savings during the trial run.
- Bus passengers also reported savings to the tune of 6 minutes on the corridor during experimental trial run.
- Pedestrians also reported marginal gain of around 2 minutes and this may be attributed to the 'All Red for Pedestrians' phase included in the plan implemented during the Experimental run.
- Taxi passengers who have reported loss of 16 minutes during the normal BRT operation have perceived a savings of 14minutes during the experimental run.

Table 5.7.2: Overall Time Savings of different Vehicle users on BRT Corridor during the Experimental Trial Run

Type of Vehicle/ Road User	Direction	Average of Time Savings in Minutes	Sample Size
Auto	Up	13.9	450
Auto	Down	14.3	768
Auto	Both Directions	14.1	1218
Bus Driver	Up	-2.3	103
Bus Driver	Down	1.8	395
Bus Driver	Both Directions	1.0	498
Bus Passenger	Up	2.6	131
Bus Passenger	Down	6.8	832
Bus Passenger	Both Directions	6.2	963
Car	Up	15.3	3114
Car	Down	16.3	3604
Car	Both Directions	15.8	6718
Cycle	Up	2.8	56
Cycle	Down	4.3	128
Cycle	Both Directions	3.8	184
Pedestrian	Up	-0.7	115
Pedestrian	Down	3.5	160
Pedestrian	Both Directions	1.7	275
Taxi	Up	14.6	314
Taxi	Down	14.3	407
Taxi	Both Directions	14.4	721
Two Wheeler	Up	12.4	1575
Two Wheeler	Down	13.1	2451
Two Wheeler	Both Directions	12.8	4026

Note: *Up : Ambedkar Nagar to Mool Chand Direction; Down : Mool Chand to Ambedkar Nagar Direction ; Positive Values indicates Time Saving in Experimental Run; Negative Values indicates Time Loss in Experimental Run*

5.8 Limitations of the Experimental Trial Run

The above experimental trial run by the CSIR-CRRI study was implemented on the ground and in operation from 12th May - 19th May 2012 spanning for 8 days. However, there are still some limitations in this plan which needs to be addressed in the event of continuation of the above plan by Transport Department, GNCTD:

- The bus stops for left turning and straight bound buses have been temporarily shifted to the identified locations on the left side of the corridor *(kerb side)*. This is causing great discomfort to the bus commuters bound on these routes. In the event making this plan permanent, it is essential to construct and shift the dysfunctional bus shelter *(for the left turning and straight bound buses at each bus stop)* on to the temporary location ear marked on the ground by making minor changes in the alignment.

- This being an experimental run spanning for 8 days, the existing BRT lane has been segregated for facilitating two way movement of right turning traffic through temporary measure by using metal barricades connected with traffic cones. However, it is advisable to provide physical separation for segregating directional flows by leaving gap at an interval of every 200m. This proposed arrangement would enhance safety for the two directions of traffic coupled with provision for removing the stranded / breakdown vehicle.
- The u-turn traffic was not provided any separate signal phasing / stage and hence these turns are causing conflicts to the right turning bound vehicles during the signal phase. However, it is worthwhile to consider the provision of permitted U-Turning of vehicles by posting U-Turning mandatory signs on the lane reserved for right turning buses at the intersection.

5.9 Summary

As per the **Honorable High Court of Delhi Order (vide W.P.(C) 380/2012 dated 15.03.2012**, the experimental trial run needs to be carried out by allowing other vehicles to run on the existing BRT corridor. Accordingly, a scientific plan was devised and implemented by routing right turning vehicles on to the existing BRT lane and the remaining directions of movement *(i.e. left turning and straight bound traffic)* was routed to ply on the Motor Vehicle *(MV)* present on left side of the corridor on each direction of travel.

In order to implement the conceived experimental trial run on the ground, it was essential to effect physical changes on the ground in the form of installing the median markers / reflectors, installation of temporary traffic Signs, laying of flexible Bollards for providing segregated additional right turning lanes, provision of Road Directional Markings *(at selected locations)* and Placement of Metal Barricades, Iron Scissors and Traffic Cones by coupling them using Nylon Ropes for the segregation of right turning traffic on the BRT Corridor, etc. detailed in the preceding sections in this chapter. In addition, the traffic signal stages were re-designed in accordance with the signal stages and cycle times derived conforming to the traffic operational plan conceived by the CSIR-CRRI study team. Thereafter, the above conceived signal plan were implemented on each of the signal heads located at each of the intersections on the corridor by seeking the help of the DIMTS technical personnel for implementation of the above plan on the Signal head located on the ground. The basic premise behind the above plan is to decrease the number of stages as well as cycle time at each of the intersections falling on the corridor.

Moreover, the Traffic Advisory pamphlets were printed and distributed on the BRT Corridor to the various road users coupled with Issuance of Advertisement in Leading Newspapers at least 2 days in advance detailing the intended trial run which was carrying the name of **Transport Department, GNCTD and CSIR-CRRI** as shown in Annexure - XII Through this widespread publicity campaign it was aimed at communication about the new operational plan to the different road users of the corridor well in advance to avoid any traffic congestion and further helping them in getting acclimatized with the new traffic operational plan.

6 PERFORMANCE EVALUATION OF THE BRT CORRIDOR

6.1 Background

Having presented the detailed analysis results obtained from various traffic surveys (detailed in Chapter 4) including user perception survey and fuel consumption experiments, this chapter presents an exhaustive comparison of Passenger Flows, Passenger Hours, Vehicle Hours, Journeys Speeds and Delays, Fuel Consumption and Queue Length under the scenarios of 'normal BRT operations' and 'Experimental Trial Run'. This comparison has been carried out basically to make the performance evaluation of the BRT corridor which is functional since 20th April, 2008. Further, based on the data available from the Delhi Traffic Police records, a comparison of road crashes under the scenarios of 'before BRT' and 'after BRT' is also accomplished and presented in this chapter. Finally, a critical evaluation of the 'Delhi BRTS' and 'Ahmedabad BRTS' in terms of traffic flows and speed profile comparison is presented at the end of this chapter to understand the severity of the problems and issues on the present Delhi BRT corridor.

6.2 Traffic and Passenger Flows on BRT & Non BRT Corridor

6.2.1 Comparison of Traffic flows on BRT Versus on Non-BRT

A comparison of mid block section volumes comparing BRT and Non-BRT sections are depicted in Figure 6.2.1. From the Figure, it is obvious that the maximum traffic volume of 1,29,150 vehicles in 16 hours was observed on Shiekh Sarai to Chirag Delhi section whereas the minimum traffic flow of 55,205 vehicles on Ambedkar Nagar to Puspha Bhawan Section. In the case of adjoining non-BRT sections, the maximum traffic flow of 74,450 vehciles in 16 hours were obserbved at Aurobindo Marg near Yusuf Sarai. From these reuslts, it can be observed that the traffic flows on non-BRT sections carry somewhat comparable traffic flows.

6.2.2 Passenger Flows across 'BRTS' and Non-BRTS sections in Delhi

As mentuoned earlier, the Passenger flows were estimated on the BRT corridor as well as on the adjoining non-BRT corridors by considering the up and down directions of travel separately based on the classified traffic volume surveys results and emnumerated occupancy levels. Thereafter, the Passenger Per Hour Per Direction *(PPHPD)* values for the BRT corridor and the adjoining corridors were worked and presented in Figure 6.2.2 to 6.2.7.

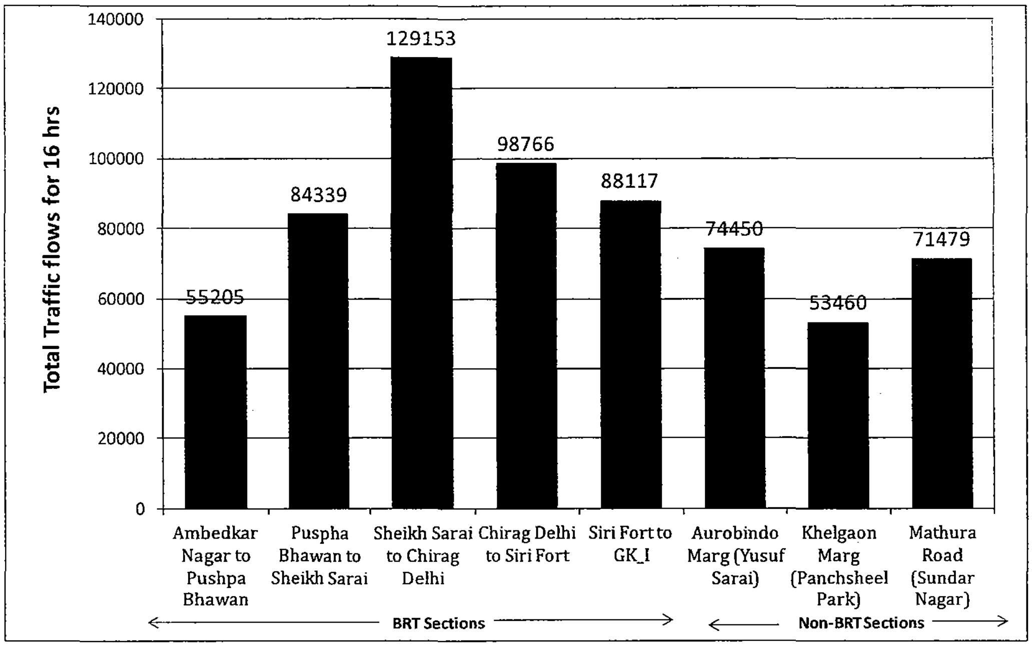


Figure 6.2.1: Comparison of Traffic Flows on BRT and Non-BRT sections

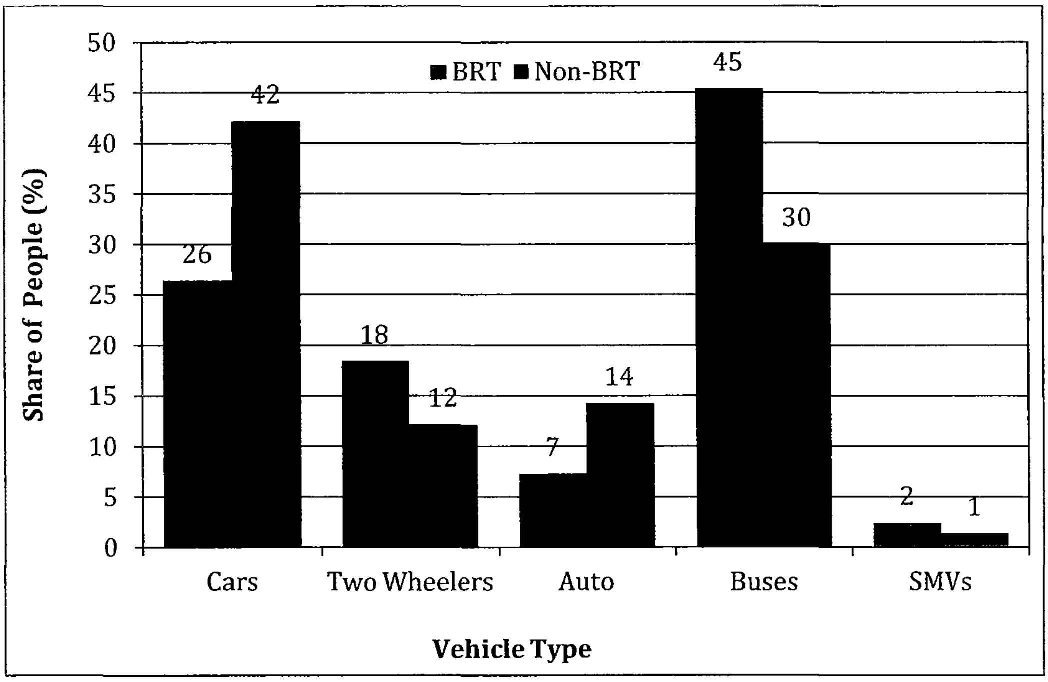


Figure 6.2.2: Comparison of Passenger Loads Share across BRT and Adjoining Typical Non-BRT Sections for different Vehicle Types

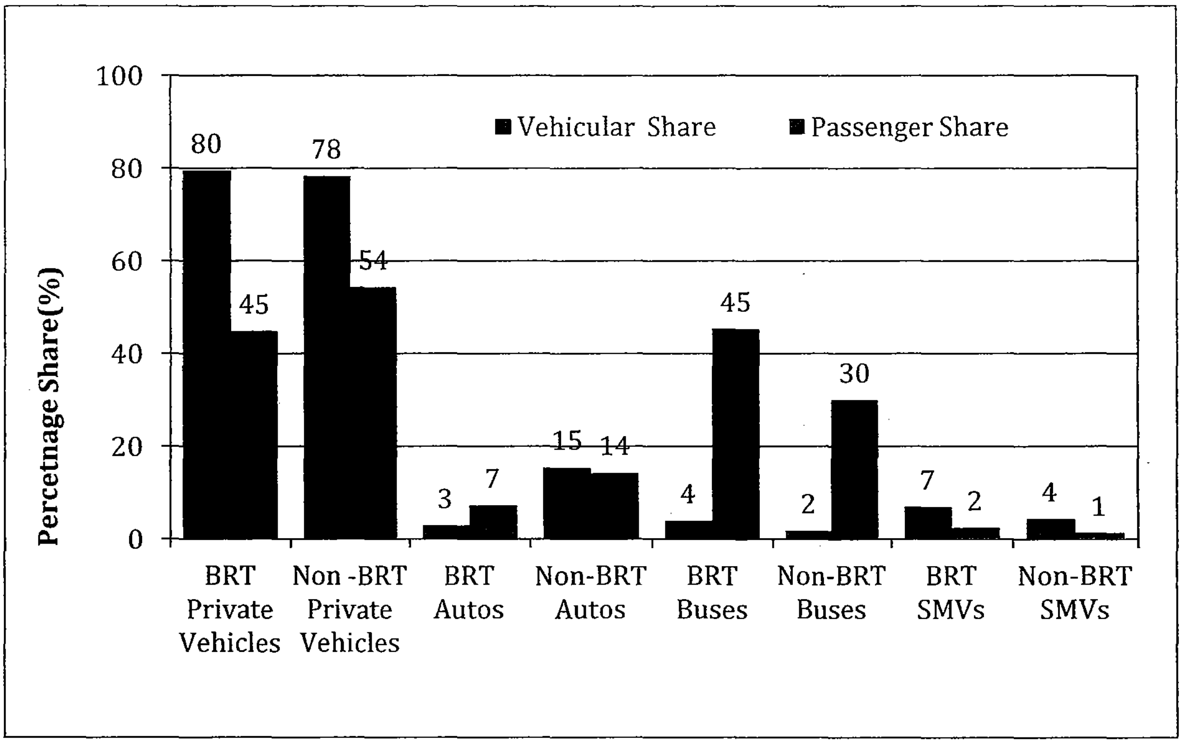


Figure 6.2.3: Comparison of Modal Split and Passenger Loads shares across BRT and Adjoining Typical Non-BRT Road sections in Delhi (UP+DOWN Direction)

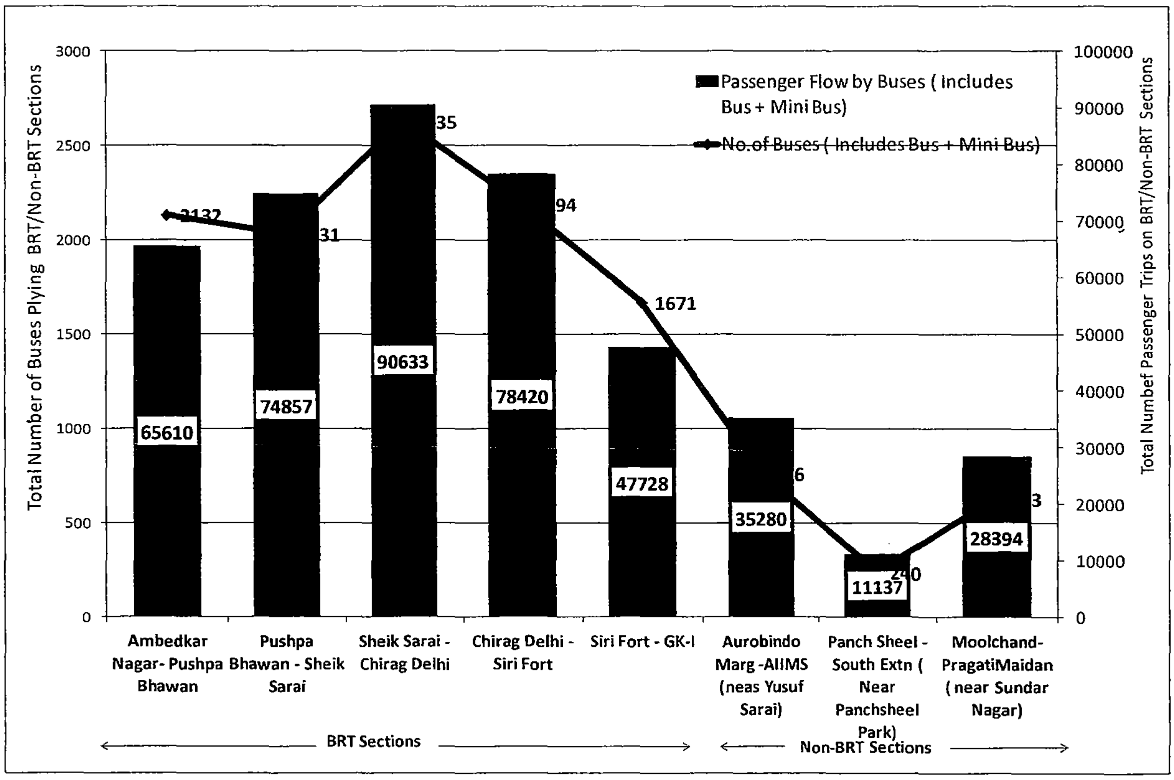


Figure 6.2.4: Total Passenger Trips by Buses *(Bus+ Mini Bus)* on BRT and Non-BRT Sections *(UP)*

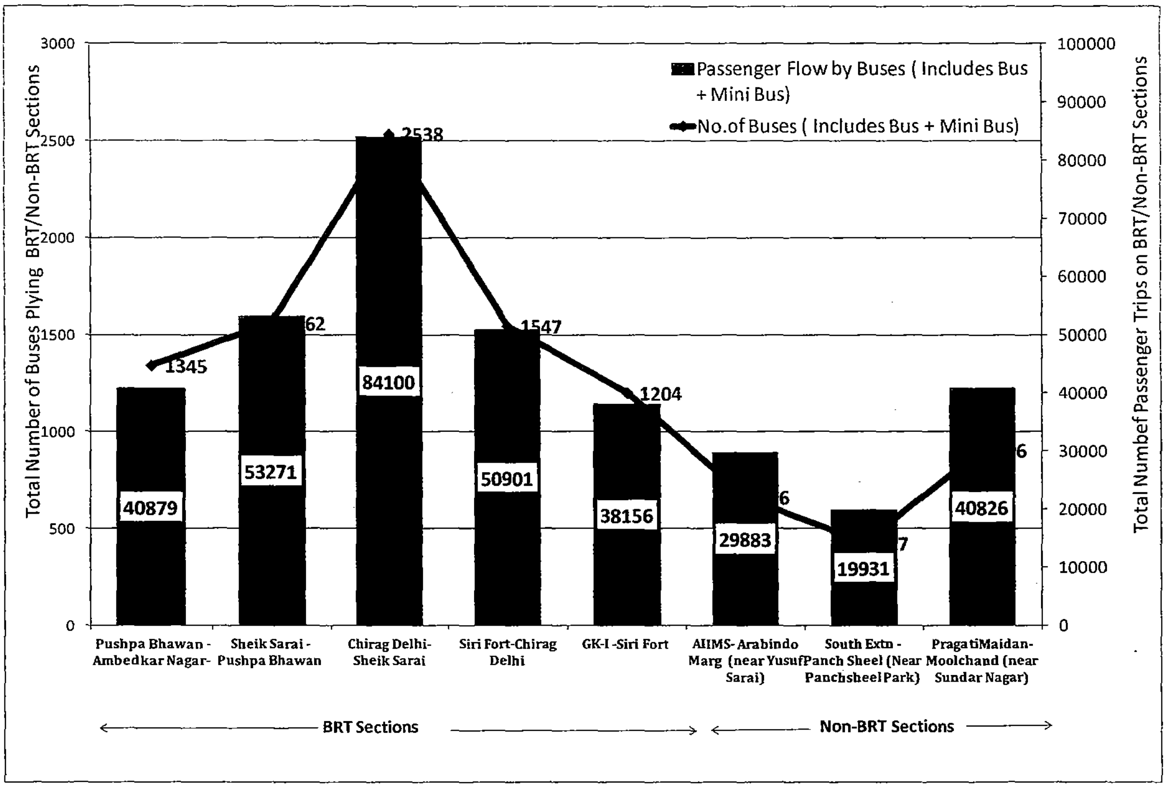


Figure 6.2.5: Total Passenger Trips by Buses (Bus+ Mini Bus) on BRT and Non-BRT Sections (Down)

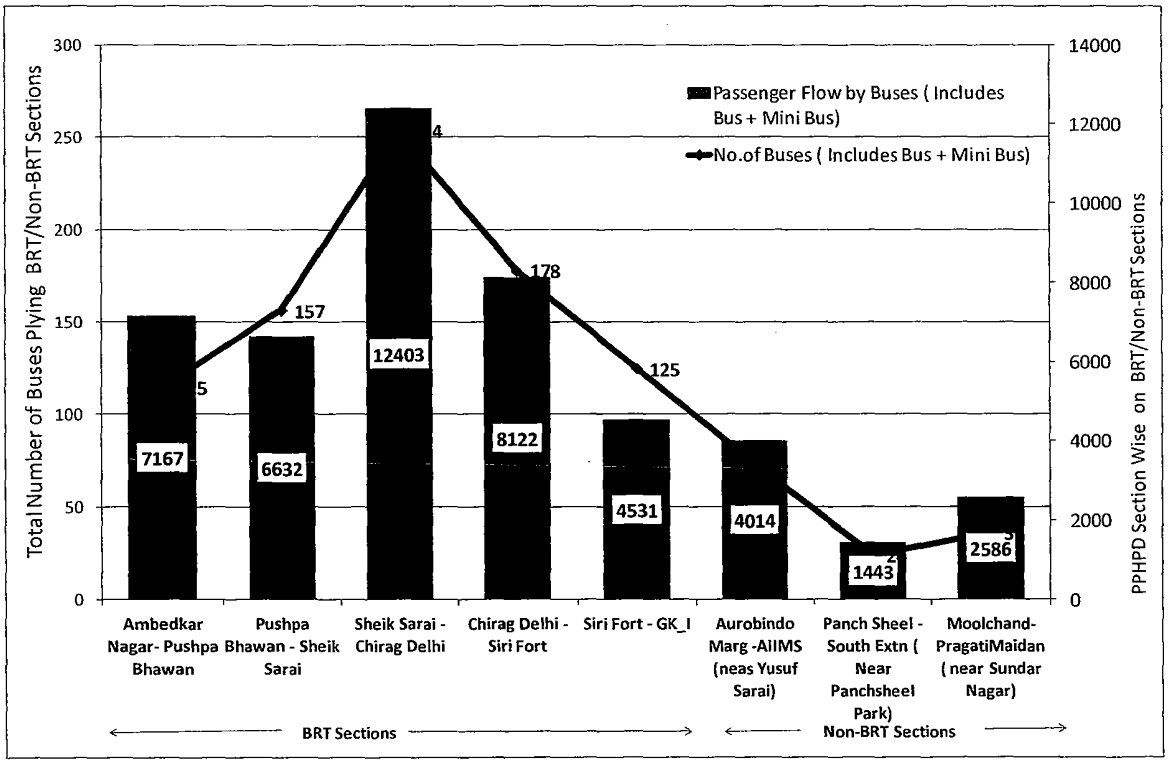


Figure 6.2.6: Peak Hour Passenger Trips by Buses (Bus+ Mini Bus) on BRT and Non-BRT Sections (UP)

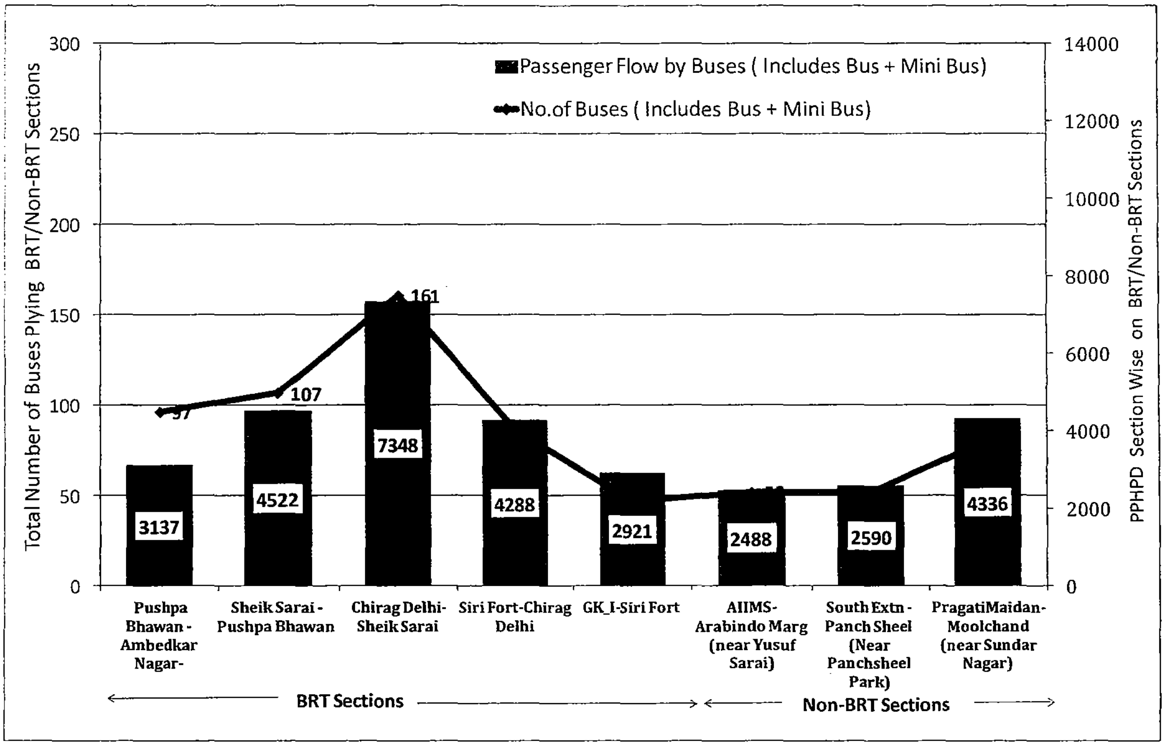


Figure 6.2.7: Peak Hour Passenger Trips by Buses (Bus+ Mini Bus) on BRT and Non-BRT Sections (Down)

The following inferences were drawn from the above referred figures.

- Quantum of bus passenger loads is expectedly higher on the BRT compared to the adjoining Non-BRT corridor. Further, it is interesting to note that PPHPD derived from this study is almost doubled from the value of 6500 PPHPD that reported in EMBARQ study *(2009)*. However, a close look at the above figure reveals that the bus volume of about 4% is catering to 45% of bus passenger loads on BRT whereas 2% share of buses on Non-BRT corridor is catering to 30% of bus passenger loads. It is evident that the total share of passengers carried by buses to a large extent dependent on the number buses supplied on a given corridor. Therefore, it can be inferred that higher the number of buses, higher the share of passengers trips by that.
- The share of private vehicle on BRT is about 80% and catering 45% of passenger share whereas about 78% of privates vehicels catering to 54% share of passengers on non BRT corridor, which cleraly indicates that even the lesser percentage share of private vehicles can cater more percetage share than BRTcorridor. Even under the mixed traffic conditions, the percentage share of passengers loads are better off on Non-BRT conditions.
- PPHPD determined based on the sectional loads across various links on the study corridor worked out be 12,403 passengers *(total of 254 buses constitutes 233 buses and 21 mini buses running during the peak hour observed during the traffic surveys given in Section 4.1)* on Sheikh Sarai – Chirag Delhi direction.

- Out of the three adjoining Non-BRT road sections considered in the study, PPHPD on Up Direction was observed to be maximum on Aurobindo Marg – AIIMS direction of travel i.e. 4014 PPHPD *(catered by 74 buses)* whereas in the case of down direction, PPHPD on Pragati Maidan to Mool Chand direction of travel is found to be maximum i.e. 4336 PPHPD *(catered by 81 buses)*

6.3 Speeds during 'normal BRT operation' and 'Experimental Trial Run' Operations

A critical comparison of average journey speeds observed over different time periods spread across different vehicle types were assessed to understand the variation under 'normal BRT operation' and 'Experimental trial run' operations. These comparisons were made for weekdays and weekends separately. The travel time savings were calculated considering the entire stretch length of 5.8 km. The comparison of journey speeds during 'normal BRT operation' and 'experimental trial run' on weekdays are given in Table 6.3.1. The inferences drawn on the above Table are presented below:

- It can be observed that overall average speeds registered an increase of 7.7 kmph (49.9%) for autos, 1.3 kmph (16.3%) for Two Wheelers and 2.9 kmph (27.7%) for Cars during the 'experimental trial run' compared to 'normal BRT operations'.
- The average speeds of buses and cycles considering the both directions of travel registered a marginal decline of about 0.4 kmph and 0.1 kmph respectively. But the average percentage was worked out considering the observed journey speeds from individual run spread across different time periods. This exhibited an average increase of about 3.0% due to the individual distribution of bus speeds in Ambedkar Nagar to Mool Chand direction is positive between 8 AM to 8 PM and their corresponding travel time savings outweighs the losses observed in some of the time periods.

Table 6.3.1: Comparison of Journey Speeds during BRT and Experimental Trial Run operation across different Vehicle Types during Weekday

Direction	Vehicle Type	Time Period	Avg. Journey Speed during BRT (Kmph)	Avg. Journey Speed during Experimental Run (Kmph)	Speed Variation (Kmph)	Travel Time Variation (Minutes)	Percentage Change in Speeds
Ambedkar Nagar to Mool Chand	Bus	6 AM to 8 AM	27.8	18.4	-9.4	-6.4	-33.8%
		8 AM to 12 PM	11.0	17.4	6.4	11.6	58.2%
		12 PM to 4 PM	14.9	15.5	0.6	0.9	4.0%
		4 PM to 8 PM	15.4	15.9	0.5	0.7	3.2%
Mool Chand to Ambedkar Nagar	Bus	6 AM to 8 AM	20.8	20.3	-0.5	-0.4	-2.4%
		8 AM to 12 PM	17.0	18.0	1.0	1.1	5.9%
		12 PM to 4 PM	19.3	17.3	-2.0	-2.1	-10.4%
		4 PM to 8 PM	13.4	13.3	-0.1	-0.2	-0.7%
Ambedkar Nagar to Mool Chand	Auto	8 AM to 12 PM	9.9	23.5	13.6	20.3	137.4%
		12 PM to 4 PM	9.9	17.1	7.2	14.8	72.7%
		4 PM to 8 PM	10.4	17.0	6.6	13.0	63.5%
Mool Chand to Ambedkar Nagar	Auto	12 PM to 4 PM	13.3	16.7	3.4	5.3	25.6%
Ambedkar Nagar to Mool Chand	Two Wheeler	6 AM to 8 AM	28.3	24.6	-3.7	-1.8	-13.1%
		12 PM to 4 PM	17.6	22.9	5.3	4.6	30.1%
		4 PM to 8 PM	13.6	18.4	4.8	6.7	35.3%
Mool Chand to Ambedkar Nagar	Two Wheeler	6 AM to 8 AM	25.4	20.3	-5.1	-3.4	-20.1%
		12 PM to 4 PM	11.4	21.0	9.6	14.0	84.2%
		4 PM to 8 PM	16.5	13.4	-3.1	-4.9	-18.8%
Ambedkar Nagar to Mool Chand	Car	6 AM to 8 AM	24.1	24.1	0.0	0.0	0.0%
		8 AM to 12 PM	20.0	16.3	-3.7	-3.9	-18.5%
		12 PM to 4 PM	9.6	18.9	9.3	17.8	96.9%
		4 PM to 8 PM	11.0	15.5	4.5	9.2	40.9%
Mool Chand to Ambedkar Nagar	Car	6 AM to 8 AM	17.9	19.1	1.2	1.2	6.7%
		8 AM to 12 PM	14.9	16.7	1.8	2.5	12.1%
		12 PM to 4 PM	13.9	18.8	4.9	6.5	35.3%
		4 PM to 8 PM	10.0	14.8	4.8	11.3	48.0%
Ambedkar Nagar to Mool Chand	Cycle	8 AM to 12 PM	12.0	11.0	-1.0	-2.6	-8.3%
		12 PM to 4 PM	12.1	13.3	1.2	2.6	9.9%
		4 PM to 8 PM	14.4	12.0	-2.4	-4.8	-16.7%
Mool Chand to Ambedkar Nagar	Cycle	8 AM to 12 PM	12.6	8.6	-4.0	-12.8	-31.7%
		12 PM to 4 PM	9.3	14.1	4.8	12.7	51.6%
		4 PM to 8 PM	12.5	12.9	0.4	0.9	3.2%

Positive values in difference indicates Gain during the Experimental Trial Run
Negative values in difference indicates Loss during the Experimental Trial Run

The comparison of journey speeds during normal BRT operations and experimental trial run for a typical weekend is given in Table 6.3.2. The following observations have been drawn from the above Table:

- The average speeds of buses spread across different time periods registered an increase of 1.9 kmph (12.0%) on weekends. Though it was observed that there is an increase in travel speeds of autos too during experimental run on weekdays, speed and delay surveys for autos and cycles could not be carried out during experimental run due to paucity of time.
- It can be observed that overall average of journey speeds registered an increase in the case of Two Wheelers by 4.7 kmph (26.3%) and Cars 4.9 kmph (24.1%). This gain in overall speeds during weekend is substantial compared to weekdays.

Table 6.3.2: Comparison of Journey Speeds during BRT operation and Experimental Trial operation across different Vehicle Types during Weekend

Direction	Vehicle Type	Time Period	Avg. Journey Speed during BRT kmph)	Avg. Journey Speed during Experimental Run (kmph)	Speed Variation (kmph)	Travel Time Variation (Minutes)	Percentage Change in Speeds
Ambedkar Nagar to Mool Chand	Bus	6 AM to 8 AM	19.2	26.5	7.3	5.0	38.0%
		8 AM to 12 PM	18.3	16.3	-2.0	-2.3	-10.9%
		12 PM to 4 PM	15.2	20.0	4.8	5.5	31.6%
		4 PM to 8 PM	17.2	19.2	2.0	2.1	11.6%
Mool Chand to Ambedkar Nagar	Bus	6 AM to 8 AM	19.9	16.7	-3.2	-3.4	-16.1%
		8 AM to 12 PM	20.8	22.8	2.0	1.5	9.6%
		12 PM to 4 PM	15.2	16.8	1.6	2.2	10.5%
		4 PM to 8 PM	11.7	14.2	2.5	5.2	21.4%
Ambedkar Nagar to Mool Chand	Two Wheeler	4 PM to 8 PM	17.9	23.9	6.0	4.9	33.5%
Mool Chand to Ambedkar Nagar	Two Wheeler	4 PM to 8 PM	17.8	21.2	3.4	3.1	19.1%
Ambedkar Nagar to Mool Chand	Car	12 PM to 4 PM	15.6	20.6	5.0	5.4	32.1%
		4 PM to 8 PM	13.3	18.1	4.8	6.9	36.1%
Mool Chand to Ambedkar Nagar	Car	12 PM to 4 PM	15.2	18.1	2.9	3.7	19.1%
		4 PM to 8 PM	14.0	15.3	1.3	2.1	9.3%

Positive values in difference indicates Gain during the Experimental Trial Run
Negative values in difference indicates Loss during the Experimental Trial Run

6.4 Study Corridor Ratings by the Road Users

A comparison of the ratings presented earlier (Section 4.11 and 5.7) covering 'before BRT implementation', during 'normal BRT operation' and during 'experimental trial run' accorded by the road users is compared and presented in Table 6.4.1 and Figure 6.4.1. Also travel time savings during 'experimental trial run' are depicted in Figure 6.4.2.

Table 6.4.1: Comparison of Overall Rating of Corridor by different Vehicle users

Type of Road User	User Opinion Survey on Corridor Rating				
	Before BRT Implementation Overall rating	During BRT Operation Overall rating	Sample Size	during Experimental Run Overall Rating	Sample Size
Auto	3.37	2.30	343	4.23	1218
Bus Passenger	3.14	3.32	2418	3.60	963
Car	3.77	2.08	2468	4.38	6718
Cycle	3.39	3.23	1027	3.36	184
Pedestrian	3.67	3.04	910	3.27	275
Taxi	3.58	2.33	110	4.26	721
Two Wheeler	3.57	2.51	2563	4.13	4026
Average	**3.53**	**2.54**	**9839**	**3.89**	**14105**

Note: 1: Very Bad, 2: Bad, 3: Average, 4: Good, 5: Very Good

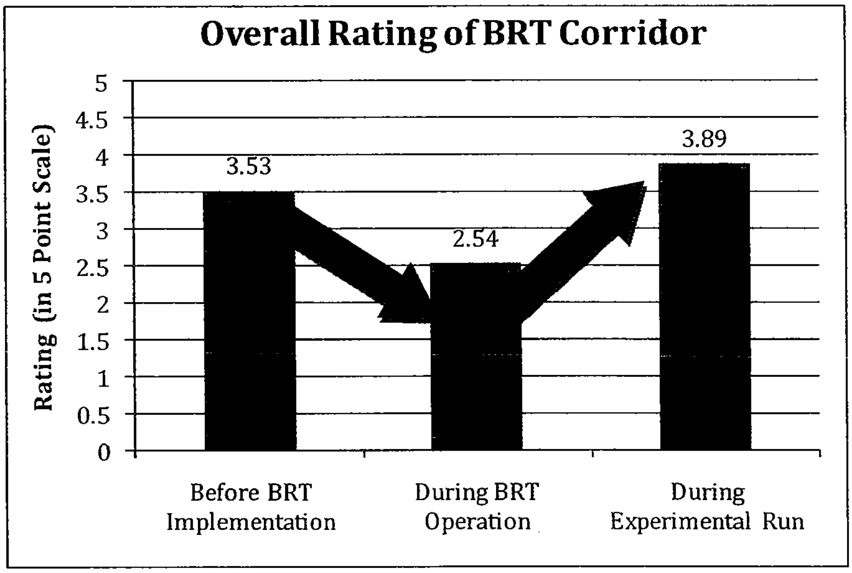


Figure 6.4.1: Overall Rating of BRT corridor under different operations

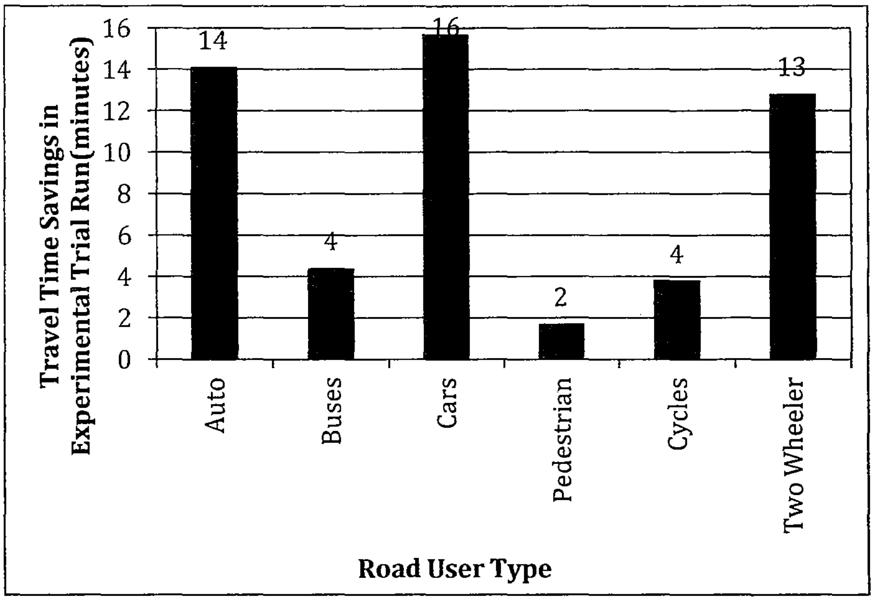


Figure 6.4.2: Travel Time Savings Perceived by Different Road User during Experimental Trial Run

The inferences from the Table and Figures are presented below:

- It can be noted that the on a five point scale, the overall user perception ratings accorded by different road users on the corridor dipped after BRT implementation to 2.54 during 'normal BRT operation' has gone up substantially higher securing a score of 3.89 during 'experimentaL trial run'. This implies that the corridor has been rated between 'average' to 'good' as compared to 'before BRT scenario' which was ranging between 'bad' to 'average'.
- The rating of the corridor by the bus passenger has registered a marginal increase from 3.32 (normal BRT operations) to 3.60 indicating accrual of minor perceived benefits in terms of time savings under the 'experimental trial run' scenario.
- The rating of corridor during 'experimental trial run' was obviously high in the case of car users (4.38) due to their time savings achieved and two wheeler riders rated at 4.13 as compared to 2.51 during 'normal BRT operations'
- In the case of auto and taxi passengers too, they rated the corridor very high ranging between 'good' to 'very good' (4.23 to 4.26)
- Pedestrians also rated the corridor marginally better during 'experimental trial run' as compared to 'normal BRT operations'.
- Private vehicle users particularly Cars have felt that they have gained about 15 minutes time savings during the 'experimental trial run' followed by two wheeler riders perceived their time savings in the order of 13 minutes.
- Even auto passengers have felt that their time savings is about 14 minutes as comapred to their time loss during the 'normal BRT operations'.

6.5 Queue Length Comparison during BRT and Experimental Trial Run Operations

As mentioned in Section 4.8 & Section 5.5 the queue length data collected both during the 'normal BRT operations' as well as 'experimental trial run' operations have been compared and presented in this section in the Table 6.5.1. From this table it is evident that the average of the maximum queue length and the average of the standard deviation (SD) of queue length witnessed at most of the intersections are much longer during the 'normal BRT operations' compared to 'trial run'. The queue length in the case of Chirag Delhi and Siri Fort intersections are obviously much longer.

However, it is kept in mind that the maximum length of the queue at Chirag Delhi and Siri Fort was as long as 350 m during the 'experimental trial run' at the morning and evening peak hour period. This phenomenon was noted during the 'normal BRT operations' as well wherein the maximum queue length was as high as 500 m queue and this is primarily due to manual mode of signal operations in force caused by the over-saturated status of these intersections.

Table 6.5.1: Comparison of Queue Length during normal BRT operations and 'Experimental Trial Run operations'

Queue Length Characteristics	Ambedkar Nagar		Pushpa Bhawan		Sheik Sarai		Chirag Delhi		Siri Fort	
	BRT	Trial Run	BRT	Trial Run	BRT	Trial Run	BRT	Trial Run	BRT	Trial Run
Avg. Maximum Queue Length	183	117	150	138	180	167	367	100	383	175
Average SD of Queue Length	40	20	25	20	32	30	79	42	102	32

6.6 Fuel Consumption during normal BRT and Experimental Trial Run

A comparison of the data for petrol and diesel driven vehicles for both scenarios of normal BRT operations and during experimental trial run BRT scenario is presented in Table 6.6.1 and 6.6.2. A close look at the above two Tables *(refer 6.6.1 and 6.6.2)* reveals the following:

- The journey time during experimental trial run scenario reduced by 26% as compared to the normal BRT operations.
- In the case of petrol driven probe vehicle, the fuel loss during idling reduced up to 32% during experimental trial run whereas in case of diesel driven probe vehicle the fuel loss in idling reduced substantially up to 46%.
- The total fuel consumption in case of petrol driven vehicle also showed declining trends by about 6% to 8% under the experimental trial run considering the both directions of travel.

Table 6.6.1: Comparison of Fuel Consumption from Petrol Driven Car across normal BRT Operations Vs. Experimental Trial Run

	Petrol Driven Vehicles						
Direction	Journey time (seconds)	Journey speed (kmph)	Time in idling (seconds)	Fuel loss in idling (ml)	Fuel loss in idling (%)	Time in idling (%)	Total fuel consumed (ml)
During normal BRT Operation							
Upward	1567	13.4	781	114	25	33	461
Downward	1469	14.3	627	92	19	30	471
During Experimental Run							
Upward	1233	17	480	72	17	28	432
Downward	1084	19.3	343	60	14	24	433

Table 6.6.2: Comparison of Fuel Consumption from Diesel Driven Car across normal BRT Operations Vs. Experimental Trial Run

	Diesel Driven Vehicles					
Direction	Journey time (seconds)	Journey speed (kmph)	Time in idling (seconds)	Fuel loss in idling (ml)	Fuel loss in idling (%)	Time in idling (%)
Upward	1601	13.6	816	140	23	34
Downward	1347	15.7	519	87	14	28
Upward	1186	17.6	461	77	12	28
Downward	998	20.9	279	47	7	22

Further the fuel loss especially during idle and cruising for the above vehicles (petrol and diesel driven cars) has been calculated using the above results of fuel consumption data by comparing both normal BRT operation and experimental trial run. This fuel loss per vehicle has been extended to entire population of vehicles on BRT corridor which was observed on traffic volume count surveys. Then the total fuel loss combining idle and cruising has been estimated for both the conditions (normal BRT operation and experimental trial run). The estimated total fuel consumption has been appropriately converted into monetary terms using fuel rate prevailed during the period of fuel consumption survey. The value of fuel loss due to BRT corridor was calculated by taking the difference between normal BRT operation and experimental trial run and this is around 2.48 crores per annum. This estimated monetary loss is referring to cars alone and considering the other vehicles, this loss would be much higher.

The Loss of fuel consumption across different vehicle data could not be evaluated due to the non availability of fuel consumption data for other vehicles such as buses, autos and two wheelers. The monetary evaluations of commercial vehicles are not considered due to non availability of survey data but it may also losses in normal BRT operation as the speeds in experimental run were improved. The losses due to emissions due to extra fuel consumed in normal BRT operation could not be evaluated due to non availability of speed-based emission factors for Indian conditions.

6.7 Passenger Hours and Vehicle Hours

6.7.1 Passenger Hours

Before attempting this exercise, it was felt essential to understand and consider total passenger hours and vehicle hours spent on both BRT operation and Experimental operation aimed at the performance evaluation of the BRT corridor. In this analysis, various field data and its analysis are used to arrive passenger hours and vehicle hours and its monetary evaluation. The average of all mid block passenger flows for the entire corridor covering different time periods and the associated corridor travel times (obtained from the Speed and delay surveys) for both upward and downward directions are used to calculate the passenger hours during normal BRT operation and Experimental trial run operation. The average hourly value of time obtained (in Rs) based on the User Perception survey results (refer Section 4.11) has been deployed to calculate Passenger hours. Traffic volumes on different mid block sections of the corridor, their corresponding average occupancies in different time periods and average speeds of the corridor have been appropriately considered in this regard. The same section-wise passenger flows for both the scenarios of 'normal BRT operations' and 'Experimental Trial Run' and the same is considered in conjunction with the observed journey speeds on the corridor during the above two scenarios. The weekday and weekend passenger hours spent on the corridor during both 'normal BRT operation' and 'experimental trial run' has been determined and shown in Figure 6.7.1 and 6.7.2. The observations drawn on the above figures are presented below:

- All types of road users are reaping marginal benefits in terms of passenger hours savings (3% in the case of buses) to substantial savings in the case of Cars users (51%).
- It can be seen that for 16 hour period on a typical weekday savings are more for cars accounting to 9424 passenger hours followed by autos achieving about 7292 passenger hours during experimental run compared to 'normal BRT operation' for the same vehicle passengers. The two wheeler passenger hours saved is of the order of 1397 passenger hours followed by buses too achieving 595 passenger hours.
- A close look at Figure 6.7.2 reveals that during the 16 hour period on a weekend, the savings are more for cars and two wheelers with a savings of 5062 passenger hours and 2829 passenger hour savings respectively during 'experimental trial run' compared to BRT operation for the same vehicle passengers. On the other

hand, the bus passenger hours saved in experimental run is about 3134 passenger hours compared to their passenger hours in BRT operation.

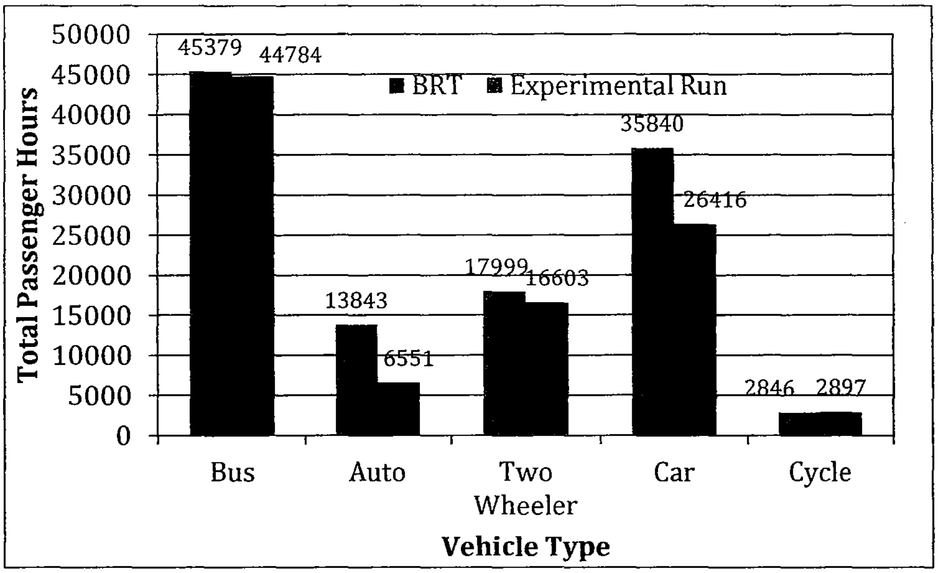


Figure 6.7.1: Comparison of Weekday Passenger Hours

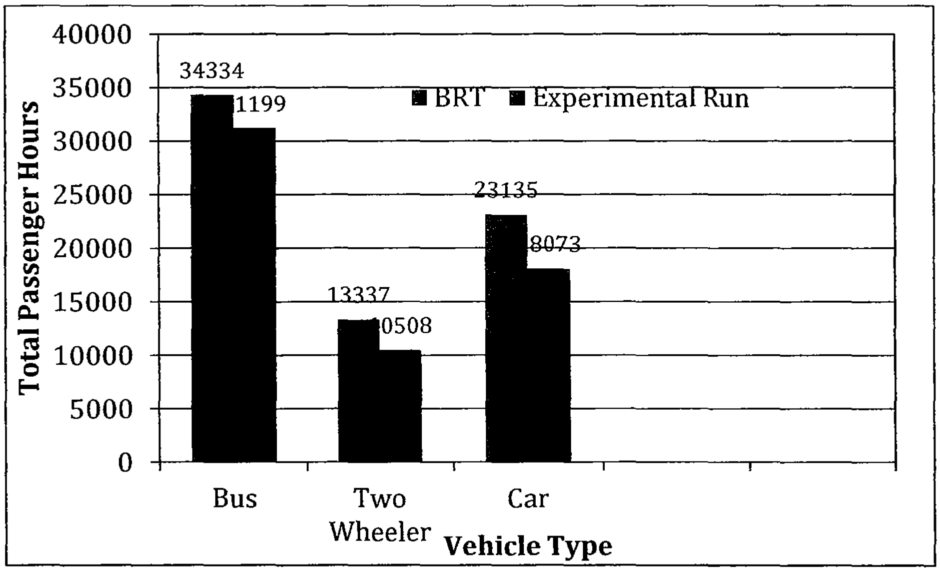


Figure 6.7.2: Comparison of Weekend Passenger Hours

The evaluation of weekday passenger hour loss under BRT operation by speed and delay survey is given in Table 6.7.1. From the Table 6.7.1, it can be seen that the total number of passenger hours savings during experimental run is in the order of 18,655 hours on a weekday for 16 hours duration. The maximum passenger hour savings amongst all vehicle passengers was observed for car passengers (50.5 %) followed by auto passenger (39.1%), two wheeler passengers (7.5%) and bus passengers (3.2%). Cyclists observed to be negligible loss due to their operation remained to be same in both situations. The total monetary savings / loss is calculated based on hourly income of different vehicle passenger and their passenger hours savings / loss by comparing the 'normal BRT operation' and Experimental run scenarios. The maximum monetary savings is observed in the case of car passengers (75.2%) followed by auto passenger (19.2%), two wheeler passengers (4.3%), and bus passengers (1.3%). Negligible loss observed for cyclists due to their operation remained to be same in both situations except signals. Adopting this analogy, the monetary value of time savings achieved due to experimental trial run for a typical normal working day spanning for 16 hours of traffic operation is estimated to be Rs. 27.57 lakhs which amounts to Rs. 71.67 crores for 260 weekdays in a year. For the remaining 105 weekends are evaluated separately below.

Table 6.7.1: Evaluation of Weekday Passenger Hours and Monetary Loss in BRT Operation by Speed and Delay Survey

Parameter	Passenger Mode					
	Bus	Auto	Two Wheeler	Car	Cycle	Total
Savings of Passenger Hours in Experimental Run by Mode for 16 hours duration of the day	595	7292	1397	9424	-51	18655
Percentage of Passenger Hours Saved in Experimental Run	3.2%	39.1%	7.5%	50.5%	-0.3%	100.0%
Avg. Hourly Income of Passenger by Mode (Rs)	61.0	72.6	85.3	220.1	46.0	
Monetary Value of Time Loss (Rs) on a Weekday Day	36275	529552	119060	2074100	-2364	2756623
Monetary Value of Time Loss (**Rs**) for 260 Weekdays in **Lakhs**	94.3	1376.8	309.6	5392.7	-6.1	7167.2
Percentage of Savings in rupees in Experimental Run	1.3%	19.2%	4.3%	75.2%	-0.1%	100.0%

The evaluation of weekend passenger hour loss during normal BRT operation by speed and delay survey is given in Table 6.7.2. The passenger flows on weekend are estimated from the weekend traffic volume data. The total number of passenger hours savings during experimental run is in the order of 11026 hours on a weekend for 16 hours duration. The maximum passenger hour savings amongst the cross section of all vehicle passengers are observed for car passengers (45.9%) followed by bus passengers (28.4%) and two wheeler passengers (25.7%). The maximum monetary savings is observed to be for car passengers (72%) followed by two wheeler passengers (15.6%) and bus passengers (12.4%). The monetary value of time savings during Experimental run on a weekend for 16 hours is about Rs. 15.46 lakhs which is amounting to Rs. 16.24 crore rupees spanning for 105 weekends in a year. Thus the total monetary loss including both weekdays and weekends per annum is about 87.91 crore rupees.

In the case of user perception survey, the average time savings/loss during experimental survey was directly elicited from the user and their average savings/loss in time, if any across each passenger mode was calculated. The same is multiplied by average of all section-wise passenger flows to arrive at the total savings in passenger hours in experimental survey. The annual monetary time loss is calculated for 260 weekdays and 105 weekends using respective passenger flows. The evaluation of weekday passenger hour loss in BRT operation by user perception survey is given in Table 6.7.3. The total number of passenger hours savings during experimental run by user perception survey is in the order of 39935 hours on a weekday for 16 hours duration. The maximum passenger hour savings by user perception survey is observed to be highest for car passengers (47.8%) followed by auto passenger (11.5%), two wheeler passengers (27.5%), bus passengers (12.4%) and cyclists observed to get negligible gain due to their operation remained to be same under both situations. The maximum monetary savings is observed to be for car passengers (72.6%) followed by two wheeler passengers (16.2%), auto passenger (5.8%), bus passengers (5.2%). Negligible gain observed for cyclists due to their operation remained to be the same in both situations except signal cycle. The monetary value of time savings during Experimental run by user perception survey on a normal working day for 16 hours is about 57.87 lakh rupees. This amounts to 197.25 crore rupees in a year.

Table 6.7.2: Evaluation of Weekend Passenger Hours and Monetary Loss in BRT Operation by Speed and Delay Survey

Parameter Considered	Passenger Mode			
	Bus	Two Wheeler	Car	Total
Savings of Passenger Hours in Experimental Run by Mode for 16 hours duration of the day	3134.88	2829.07	5062.79	11026.74
Percentage of Passenger Hours Saved in Experimental Run	28.4%	25.7%	45.9%	100.0%
Avg. Hourly Income of Passenger by Mode (Rs)	61.0	85.3	220.1	-
Monetary Value of Time Loss (Rs) on a Weekend	191260	241186	1114310	1546756
Monetary Value of Time Loss (**Rs**) for 105 Weekends in **Lakhs**	200.8	253.2	1170.0	1624.1
Percentage of Savings in Rs in Experimental Run	12.4%	15.6%	72.0%	100.0%

Note : Auto & Cycle speed survey not covered due to Paucity of time

Table 6.7.3: Evaluation of Passenger Hours and Monetary Loss in BRT Operation by User Perception Survey

Parameter Considered	Passenger Mode					
	Bus	Auto	Two Wheeler	Car	Cycle	Total
Savings of Passenger Hours in Experimental Run by Mode for 16 hours duration of the day	4969	4605	10968	19083	312	39935.93
Percentage of Passenger Hours Saved during Experimental Run	12.4%	11.5%	27.5%	47.8%	0.8%	100.0%
Avg. Hourly Income of Passenger by Mode (Rs)	61.0	72.6	85.3	220.1	46.0	
Monetary Value of Time Loss (Rs) on Weekday	303171	334411	935015	4200055	14359	5787011
Monetary Value of Time Loss (**Rs**) Per Year in **Lakhs**	1033.4	1139.8	3187.0	14315.9	48.9	19725.0
Percentage of Rupees Saved in Experimental Run	5.2%	5.8%	16.2%	72.6%	0.2%	100.0%

6.7.2 *Vehicle Hours*

The Weekday Vehicle hours spent on the corridor during both BRT operation and Experimental run is shown in Figure 6.7.3. From the figure, it can be seen that for 16 hour period savings on weekday is more in the case of cars accounting to 4264 hours followed by autos estimated at 2964 hours during 'Experimental Trial Run' compared to 'normal BRT operation' for the observed quantum of traffic volume and passenger flows (derived from occupancy survey). The two wheelers saved about 983 hours followed by marginally by buses about 16 hours for the same vehicle passengers. Accordingly their vehicle operating cost could be saved in Experimental Trial Run.

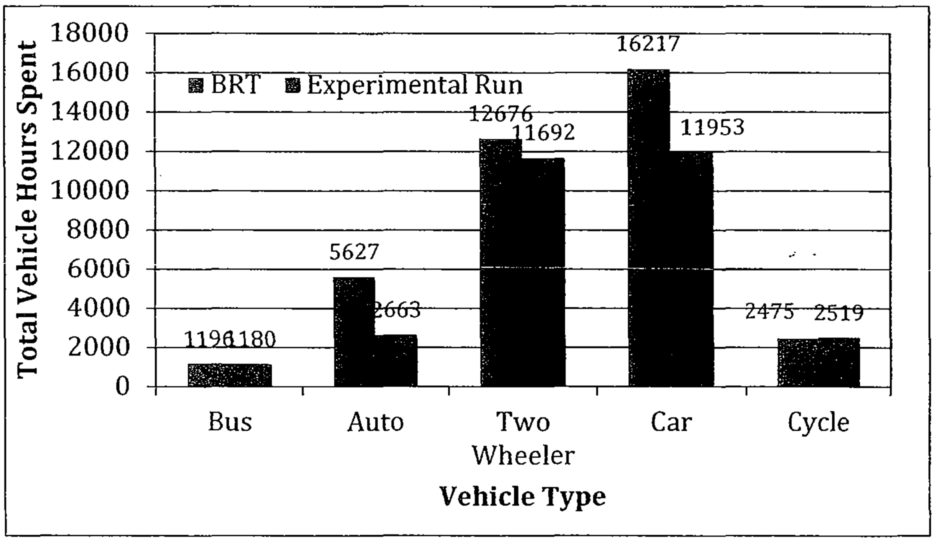


Figure 6.7.3: Comparison of Weekday Vehicle Hours spent on corridor

Weekend Vehicle hours spent on the corridor during 'normal BRT operation as well as 'Experimental Trial Run' is shown in Figure 6.7.4. From the figure, it can be noted that for 16 hour period savings on weekday is more in the case of cars accounting to 2291 hours followed by two wheelers estimated at 1992 hours during 'Experimental Trial Run' compared to 'normal BRT operation' for the observed quantum of traffic volume and passenger flows (derived from occupancy survey). The buses saved marginally by 83 hours for the same vehicle passengers. Accordingly their vehicle operating cost could be saved in Experimental Trial Run.

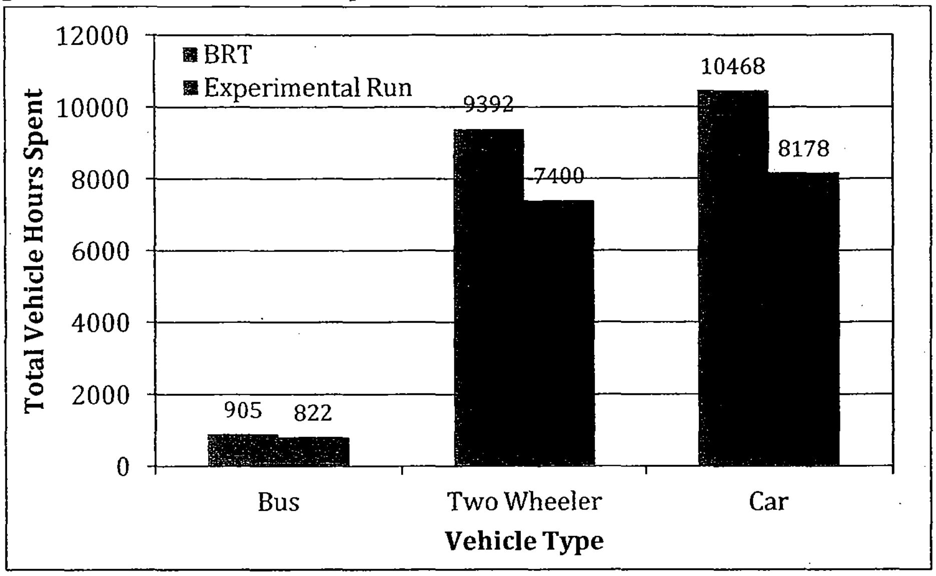


Figure 6.7.4: Comparison of Weekend Vehicle Hours spent on corridor

The evaluation of weekday vehicle hour loss during 'normal BRT operation' by speed and delay survey is given in Table 6.7.4. The maximum vehicle hour savings among all vehicles is observed to be for cars (52.1%) followed by autos (36.2%), two wheelers (12.2%), buses (0.2%). cycles (-0.5%) observed to be negligible loss due to their operation remained to be same in both situations.

Table 6.7.4: Evaluation of Weekday Vehicle Hours Loss in BRT Operation by Speed and Delay Survey

Parameter Considered	Passenger Mode					
	Bus	Auto	Two Wheeler	Car	Cycle	Total
Extra Time Travelled on normal BRT operation by each mode (Vehicle Hours for 16 hours of the day)	16	2964	983	4264	-45	8183
Percentage of Vehicle Hours Saved in Experimental Run	0.2%	36.2%	12.0%	52.1%	-0.5%	100.0%

The evaluation of weekend vehicle hours loss during BRT operation obtained from speed and delay survey is given in Table 6.7.5. The maximum vehicle hour savings amongst all vehicle types is observed in the case of Cars (52.5%) followed by Two wheelers (45.6%), Buses (1.9%). The survey for Auto & Cycle speed survey could not carried out due to short span of Experimental Trial Run.

Table 6.7.5: Evaluation of Weekend Vehicle Hours Loss in BRT Operation by Speed and Delay Survey

Parameter Considered	Passenger Mode			
	Bus	Two Wheeler	Car	Total
Extra Time Travelled on normal BRT operation by each mode (Vehicle Hours for 16 hours of the day)	83	1992	2291	4366
Percentage of Vehicle Hours Saved in Experimental Run	1.9%	45.6%	52.5%	100.0%

Note: Auto & Cycle speed survey could not be done due to short span of time

The evaluation of weekday vehicle hours loss in BRT operation obtained based on the user perception survey is given in Table 6.7.6. The maximum vehicle hour savings amongst all vehicles is observed to be maximum for cars (47.6%) followed by two wheelers (39.9%), autos (10.3%), buses (0.8%) and cycles (1.5%).

Table 6.7.6: Evaluation of Weekday Vehicle Hours Loss in BRT Operation by User Perception Survey

Parameter Considered	Passenger Mode					
	Bus	Auto	Two Wheeler	Car	Cycle	Total
Savings of Vehicle Hours in Experimental Run for 16 hours of the day	153	1911	7422	8850	275	18611.57
Percentage of Vehicle Hours Saved in Experimental Run	0.8%	10.3%	39.9%	47.6%	1.5%	100.0%

6.7.3 Summary

The monetary evaluation ideally should take all parameter variations such as User value of time (Passenger Hours), Vehicle operation costs (including fuel consumption), Vehicle emissions between both BRT operation and Experimental operation. In this section, monetary evaluation of user value of time i.e. passenger hours is presented and it shows that there is a loss of Rs. 87.91 crores in a year during normal BRT operation compared to Experimental run. On the other hand, based on the user perception survey estimates, the estimated monetary loss is Rs. 197.25 crore in a year.

The Loss of fuel consumption across different vehicle data could not be evaluated due to the non availability of fuel consumption data for other vehicles such as buses, autos and two wheelers. The monetary evaluations of commercial vehicles are not considered due to non availability of survey data but it may also losses in normal BRT operation as the speeds in experimental run were improved. The losses due to emissions due to extra fuel consumed in normal BRT operation could not be evaluated due to non availability of speed-based emission factors for Indian conditions.

6.8 Road Crash Scene on Study Corridor Before and After BRT

The road crash data available with the police records have been used to compare the road crash scene before and after the BRT. The data collected from Delhi Traffic police records are presented in Table 6.8.1 and the same is used to understand the trend of road crash occurrence before and after BRT. The observations drawn from the above table are presented below:

- During the last couple of years, contradicting reports appear about the trend of road crashes mentioning that the reduction in the fatal and serious injury crashes after the introduction of BRTS. But the data does not really depict that trend for any comparable number 3 years before and after BRT.
- At the same time no major inferences can be drawn in the absence of location of road crash on the above corridor.
- However, it was interesting to note that there is an increase of 40 per cent in the number of fatal road crashes coupled with 48 % increase in the number of fatalities. At the same time, the number of simple / injurious road crashes reported by the Traffic Police has registered an increase of 7 per cent.

Table 6.8.1: Time Series Data of Road Crashes data Before and After BRT

Year	Fatal Accidents	Person Killed	Simple / Injurious accidents
	Before BRT		
2005	6	6	43
2006	8	8	25
2007	3	3	21
2008	9	10	37
Total (Last 3 years)	20	21	83
	Post BRT		
2009	6	6	17
2010	16	19	31
2011	6	6	41
Total (Last 3 years)	28	31	89

Source: Delhi Traffic Police

6.9 Comparison of Delhi BRTS and Ahmadabad BRTS

A critical evaluation of the 'Delhi BRTS' and 'Ahmedabad BRTS' in terms of traffic flows and speed profile comparison is presented in this section.

6.9.1 Traffic Flows on Delhi BRT and Ahmadabad BRT

Before venturing in to this exercise, a brief description of the part corridor chosen on the Ahmadabad BRT is presented. Typical part of corridor on the Ahmadabad BRT corridor *(called as 120 Feet circular road from Dani Limda to Darpan Circle)*, spanning a length of 8.92 km stretch has been selected for comparison with Delhi BRT. The corridor has been selected strategically so as to include both BRT and Non BRT road sections for comparison. The section from Dani Limda to Nehru Nagar falls under BRT section spanning 5.72 Km long and catering to two major intersections namely Dani Limda and Anjali Char Rasta Junction. On the other hand, the non-BRT section starts from Nehru Nagar and ending at Darpan circle measuring about 3.2 km. This section too consists of two major intersections namely Panjarpole and Vijay Char Rasta. Figure 6.9.1 presents the typical BRT and Non BRT corridor in Ahmadabad city. The width of carriageway of Mixed Vehicle *(MV)* lane on BRT section is about 10 m whereas the width of the BRT section is approximately 9 m. It may be noted that in Ahmadabad there is no exclusive lane provided for NMT.

Classified Traffic Volume Count collected at three out of the above listed four intersections by CSIR-CRRI in their recent project titled, "Preparation of Junction Improvement Plan for Major Road Corridors of Ahmadabad" *(CRRI Study 2012)* has been used for comparison purpose in this study. Classified Traffic volume coupled with speed and delay data collected were carried out at Ahmadabad BRT and non-BRT sections during May 2012.

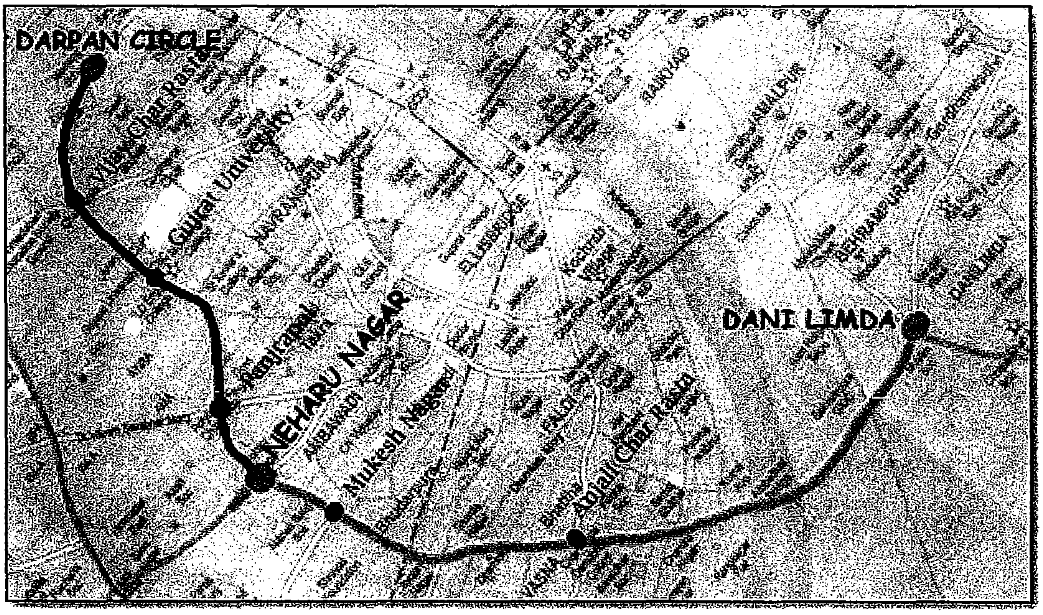


Figure 6.9.1: Typical BRT and Non BRT Corridor on Ahmadabad City

A summary of the 16 hour traffic flows observed at the three intersections are presented in Table 6.9.1. The collected traffic volume data was analyzed hourly and peak hour flows has been estimated both in terms of vehicles/hour and PCUs/hour. The observed peak hour traffic volume at the above four intersections are analyzed and presented in Table 6.9.2. Further, the average traffic composition on BRT Corridor and Non BRT corridors are estimated and presented in Figure 6.9.2. The following inferences have been drawn from the above Tables and Figure:

- It can be observed that the intersection located on BRT sections caters to around 90,000 PCUs whereas on Non BRT Section the traffic flow is around 1,00,000 PCUs.
- Peak hour traffic volume is about 9,400 PCUs on BRT section whereas in the case of Non-BRT section it is around 8,850 PCUs on Non BRT sections in Ahmadabad *(refer Table 6.9.2)*.

The average compositions of traffic on BRT and Non BRT sections are presented in Figure 6.9.2 and the following inferences are arrived:

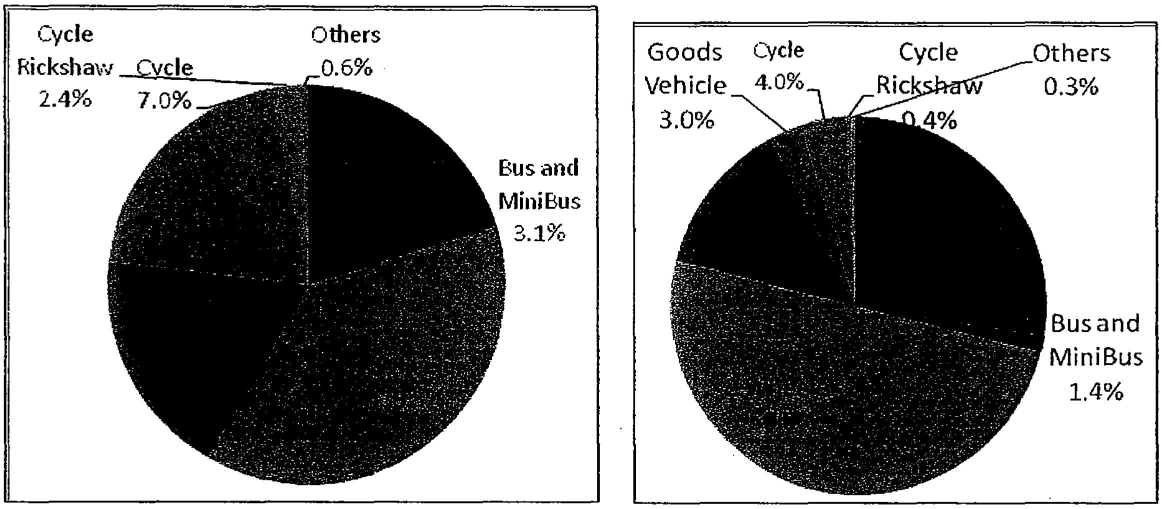
- Car composition is about 10% high on Ahmedabad Non-BRT sections as compared to Ahmedabad BRT section whereas the share of autos is about 6% high on BRT sections than Non-BRT section. This may be due to insufficient feeder system on BRT sections.
- Average Bus composition on Ahmedabad BRT section is about 3% and whereas Ahmedabad non BRT section the share is about 1.5%.
- Two wheeler is comparatively high on Ahmedabad Non BRT Sections, by about 10%.

Thereafter, the observed traffic flows of typical intersections on Delhi BRT section has been compared with typical four arm intersection on Ahmadabad BRT Section *(Refer Table 6.9.3)*. Average traffic composition observed on typical Delhi BRT and Ahmadabad BRT sections are compared and presented in Figure 6.9.3 and the following observations are drawn from the above tables:

- .It is observed that Dani Limda Intersection on BRT section of Ahmadabad handles comparatively less traffic loads than that of Chirag Delhi intersection and Pushpa Bhavan Intersections located on the Delhi BRT section.

Table 6.9.1 :Total Traffic Volume and Composition at Typical Intersections on BRT and Non BRT Section in Ahmadabad *(Ref: CRRI Study 2012)*

Name of the Intersection	Passenger Vehicle					Goods Vehicle				Non Motorised		Others	Total	
	Car	Mini Bus	Bus	2 Wheeler	3W Passenger	3W Goods	LCV	HCV	MAV	Cycle	Cycle Rickshaw		Vehicles	PCUs
Dani Limda -On BRT Section	12681	1183	1146	28324	13556	4358	3388	1337	678	5191	1755	415	74012	90177
	17.1%	1.6%	1.5%	38.3%	18.3%	5.9%	4.6%	1.8%	0.9%	7.0%	2.4%	0.6%	100.0%	
Vijay Char Rasta- On Non BRT Section	27638	364	1415	42287	12980	1824	682	356	309	4726	552	512	93645	99517
	29.5%	0.4%	1.5%	45.2%	13.9%	1.9%	0.7%	0.4%	0.3%	5.0%	0.6%	0.5%	100.0%	
Panjarpole-On Non BRT Section	26345	159	765	56648	13210	1710	775	115	67	3114	290	121	103319	104356
	25.5%	0.2%	0.7%	54.8%	12.8%	1.7%	0.8%	0.1%	0.1%	3.0%	0.3%	0.1%	100.0%	



(a) Composition On BRT Section *(b) Composition on Non-BRT Section*

Figure 6.9.2: Average Traffic composition on Typical BRT and Non-BRT Sections in Ahmadabad *(Ref: CRRI Study, May 2012)*

Table 6.9.2: Peak Hour Traffic Volume Characteristics at Intersection on Typical BRT and Non-BRT Roads Sections in Ahmadabad *(Ref: CRRI Study, May 2012)*

S.No	Name of the Intersection	Peak Hour Volume In Vehicles	Peak Hour Volume in PCUs
1	Dani Limda - On BRT Section	8132	9418
2	Panjarpole Char Rasta - on Non-BRT Section	8856	9032
3	Vijay Char Rasta - on Non BRT Section	8821	8915

- It can be observed that the proportion of car is almost 1.5 times on the MV lane of Delhi BRT. Obviously, this high composition of car traffic on Delhi BRT is contributing to lower journey speeds as the width of the available MV lane is only (7-8m) on either direction of travel. The above road width is obviously shared by other vehicle types including two wheelers accounting for about 35 % on Delhi BRT.
- The share of two wheelers is comparable on both the BRT corridors whereas proportion of autos is somewhat higher on Ahmadabad BRT. The argument in terms of auto riders showing reluctance to travel on Delhi BRT corridor observed during the user perception survey reported in Section 4.11 is corroborated here.
- The proportion of Slow Moving Vehicles is significantly higher *(7%)* on Delhi BRT section as compared to Ahmadabad BRT as the former serves the needs of large strata of Economically Weaker Section / Low Income Group of commuters emerging from Madangir and other adjoining localities. Hence the provision of exclusive NMT on the Delhi BRT is fully justified.

- Similarly, the share of goods vehicle is substantially high on the Ahmadabad BRT as it caters to some proportion of the goods traffic entering and exiting the city. In the case of Delhi BRT, limited proportion of goods traffic is only witnessed during the night hours and that too when the BRT operations are suspended between 11:00 pm to 05:00 am every day. During the remaining part of the day, the entry of goods traffic is obviously restricted in to the city.

Table 6.9.3: Peak Hour Traffic Volume on BRT sections in Delhi and Ahmadabad

S.No	Name of the Intersection	Total Volume In PCUs	Peak Hour Volume in PCUs
A	**Four arm Intersection on Delhi BRT Section**		
1	Pushpa Bhawan	120719	9639
2	Chirag Delhi	152358	12272
3	Siri Fort Junction	79866	7575
B	**Four Arm Intersections on Ahmadabad BRT Section**		
1	Dani Limda - on BRT Section	90177	9418

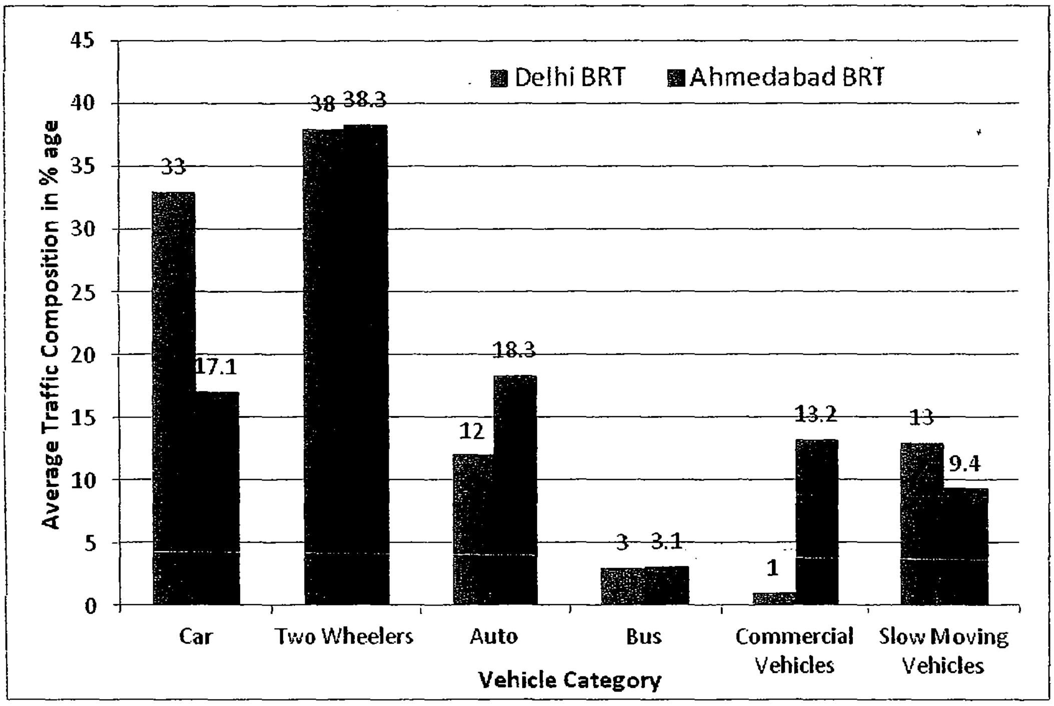


Figure 6.9.3: Average Traffic composition on Delhi BRT and Ahmadabad BRT Sections

6.9.2 Comparison of Speed and Delay on Delhi BRT versus Ahmedabad BRT

As mentioned earlier, Speed and delay survey was conducted on the study area corridor through Moving Car using V-BOX on normal working days covering morning and evening hours on the Ahmadabad BRT and Non-BRT sections as well. Various runs were carried out during the entire day on the study corridor for examining the speed characteristics on study corridors. Eventually, comparison of the speed and delay data collected for a typical day on BRT and Non-BRT sections were first estimated covering Ahmadabad BRT and Non-BRT sections and presented in Table 6.9.4.

- From the table it can be observed that difference in journey speeds on BRT section versus Non-BRT section in Ahmedabad is very insignificant.
- Also it was observed that there is not much variation in travel time during morning, afternoon and evening hours on BRT sections and average travel time per kilometre on BRT sections is about 2.1 minutes whereas average travel time per kilometre on Non BRT sections varies from 2 minutes to 3.3 minutes. This variation in travel time mainly due car composition on BRT *(18%)* and Non BRT Sections *(28%)*.

Table 6.9.4 : Speed and Delay on a Typical Part of the BRT and Non-BRT Corridor in Ahmadabad *(Ref: CRRI Study 2012)*

Time Period	Location	Travel time (min)	Delay (Sec)	Average Running Speed (kmph)	Average Journey speed (kmph)
	Test Car				
8:00 am - 9.00 am	BRT Section - 5.72km	12.23	120	35.6	33.5
	Non-BRT Section - 3.2 km	4.94	0	38.4	38.4
4:00 pm - 5:00 pm	BRT Section - 5.72km	11.15	11.2	33.4	33.0
	Non-BRT Section - 3.2 km	7.64	101.2	32.0	25.9
8:00 pm - 9:00 pm	BRT Section - 5.72km	11.89	68.6	28.8	26.0
	Non-BRT Section - 3.2 km	10.06	232.4	30.6	22.6

A critical comparison of Speed and Delay characteristics of Delhi BRT versus Ahmadabad BRT is presented across car and bus in Table 6.9.5 and 6.9.6.

- It can be observed that the length of BRT section in Delhi and Ahmadabad are almost comparable. However, on Delhi BRT, there is huge variation in journey time and the associated reduction in speeds through different time periods of the day. This increased journey time on the Delhi BRT corridor resulting in reduced speeds of buses *(despite the provision of exclusive lane in the form of BRT)* may be primarily attributed to the traffic congestion at the intersection because of the over saturated status at most of the intersections.

- The travel time of cars on MV lane on both the BRT corridors is almost the same during morning hours spanning only about 13 minutes whereas the average running speed *(30 kmph)* and journey speeds *(25 and 28 kmph)* are also comparable.
- However, during the evening hours, very high travel time was observed on Delhi BRT corridor extending up to 33.0 mins. This is to a large extent due to the insufficient road width available on MV Lane *(7-8 m) as against the 10 m width available for each direction of travel before BRT in April 2008)*, coupled with operation of the signal under manual mode during the peak hours due to the over saturated status.
- At the same time, there is insignificant variation in travel time on Ahmedabad BRT corridor during the entire day on the MV lane. From this observed data, it can be inferred that the travel time reliability is more on Ahmadabad BRT than the Delhi BRT section spread over different time periods of the day.
- Since the Ahmadabad BRTS is a closed system, the commercial travel speeds are much higher.
- The bus composition on BRT sections is about 3% of total traffic and the observed average speed of Buses on BRT section varies between 22 to 25 Kmph *(CEPT Ahmedabad)*. At the same time, the speed of buses on Ahmadabad BRTS is much higher than that of Delhi BRTS. This clearly highlights the fact that the Ahmadabad BRTS has deserved to get the silver rating in the recent ITDP study *(May, 2012)*.

Table 6.9.5 : Comparison of Speed and Delay for Test Car on Delhi BRT versus Ahmedabad BRT during Week Day

Time Period	Location	Travel Time (min)	Delay (Sec)	Average Running speed (kmph)	Average Journey speed (kmph)
8:00AM-9.00AM	Delhi BRT Section: 5.8km	13.60	131.80	30.0	25.20
	Ahmedabad BRT Section: 5.72Km	12.23	120.00	33.50	28.10
4:00PM-5:00PM	Delhi BRT Section: 5.8km	39.20	1361.00	20.80	8.70
	Ahmedabad BRT Section: 5.72Km	11.15	11.20	33.36	31.99
8:00PM-9:00PM	Delhi BRT Section: 5.8km	28.67	965.50	27.90	12.20
	Ahmedabad BRT Section: 5.72Km	11.89	68.60	30.84	28.55

Table 6.9.6: Comparison of BRT Bus Speed on Delhi BRT versus Ahmadabad BRT

Time Period	Location	Travel Time (min)	Delay (Sec)	Average Running speed (kmph)	Average Journey speed (kmph)
Typical Day	Delhi BRT Section: 5.8km	31.3	746	18.36	11.0
	Ahmedabad BRT Section: 5.72Km	NA	NA	NA	24.0*

*Reference CEPT Ahmedabad

7 Microscopic Traffic Simulation Model

7.1 Background

As mentioned in the earlier section, one of objectives of the present study of performance evaluation of BRT corridor is to perform the exercise of traffic simulation on this corridor to see the impact of various options of traffic operations on vehicular movements. In this direction, Microscopic Traffic Simulation (MTS) was applied in the present study as it analyzes individual vehicle behaviour more precisely and realistically than other methods (Barcelo and Casas, 2002). For this purpose, VISSIM 5.30 software was utilised as a tool for microscopic traffic simulation. VISSIM is the stochastic traffic simulator that uses the psycho-physical driver behaviour model developed by Widermann (PTV Vision, 2005). VISSIM combines a perceptual model of the driver with a vehicle model. VISSIM was selected for analysis due to its powerful multi-modal modeling capabilities that may include variety of modes such as cars, two wheelers, autos, trucks, buses etc.

The road network in VISSIM can be created using links and connectors and the simulator is capable of simulating up to ten times per second. Numerical output files are user-customized which include volume, speed, travel time, delay time, queue length, emissions, number of stops, number of lane changes with velocity and distance of respective vehicles, etc. The major inputs for the simulation model are roadway geometry, traffic composition and traffic control. The model output includes statistics at both the network level *(overall travel time, total travel distance, average speed, total delays etc.)* and link level *(traffic flows, queue lengths, delays, speeds, densities etc.)* or at specific location *(instantaneous detector information)*. In order to realistically estimate travel times, data collection and analysis plays an important role in the modeling process of microscopic traffic simulation. It is needless to mention that the prediction capability of the developed models highly depends on the accuracy of data. Considering the need to arrive at realistic values, the methodology has been devised for the development of microscopic traffic simulation model in VISSIM 5.30 software environment and the same is discussed in the succeeding sections.

7.2 Microscopic Simulation Modelling Methodology

The methodology developed for microscopic simulation and estimation of vehicular movements in VISSIM for the present study is shown in the form of flow chart in Figure 7.2.1. From Figure 7.2.1, it can be noted that first and foremost aspect is the need to have reliable database illustrating the analysis of vehicular flows especially turning flows at intersections and their vehicle composition. The next step is to prepare input parameters for the simulation model which includes Traffic Flows, Vehicle Speeds, Driver Characteristics, Vehicle Characteristics, Road Network details etc. After this, model development in VISSIM has been accomplished and the details are given in next section. Then the model has been appropriately calibrated and validated using the observed data namely journey speed data. Further this validated model has been considered for estimation of vehicular movements under different scenarios of traffic operations such as 'No BRT' and 'Provision of new link between Press Enclave and Outer Ring Road'.

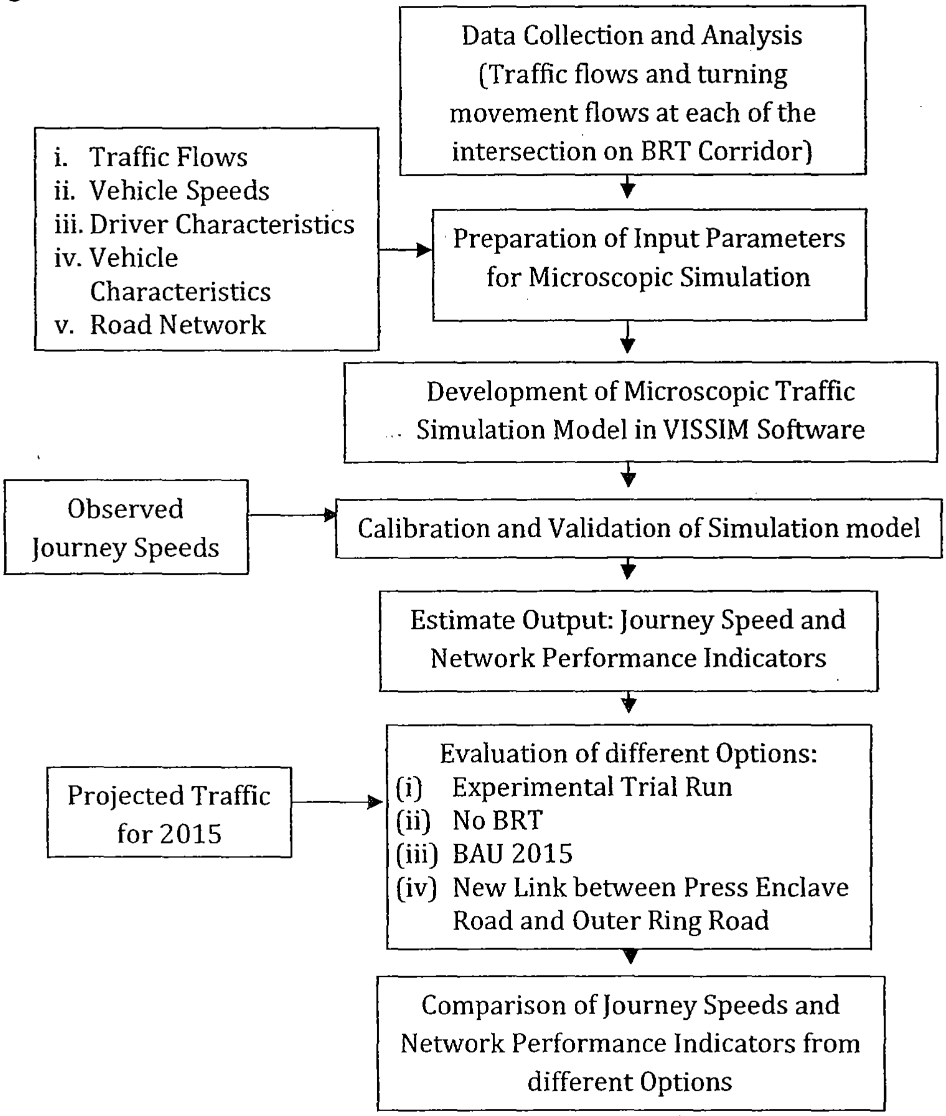


Figure 7.2.1: Methodology for Microscopic Simulation and Estimation of vehicular Movements in VISSIM

The performance indicators under these scenarios are used to measure the effectiveness of these options on the study area network i.e. from Ambedkar Nagar to Mool Chand. In the present study, the total network travel time and stopped delay time have been considered as performance evaluation indicators.

7.3 Model Development in VISSIM

A model which accurately represents the existing situation is known as the 'Base Model'. The base model development involves developing base network, defining model parameters, calibrating the network and validating the model which is described briefly in the next sections.

7.3.1 Development of Base Network

Development of a network that accurately determines the constraints of a road network is an important stage in the modeling process. The basic key network building components are links and connectors. Links are created by tracing the roadway over the AutoCAD drawing of BRT Corridor which served as a background. As mentioned earlier, the BRT corridor is a divided carriageway and out of these, two lanes are exclusively reserved for buses in the centre of the carriageway termed as BRT lanes in the simulation model. Remaining two lanes on each of the either side is being used by motor vehicles *(MV)*. Accordingly, the links are created in VISSIM for BRT lanes and MV lanes to replicate the observed conditions on the road section. The created road network for the entire BRT corridor from Ambedkar Nagar Junction to Mool Chand Junction is shown in Figure 7.3.1. From Figure 7.3.1, it can be seen that there are six junctions located on this corridor including Ambedkar Nagar Intersection, Pushpa Bhawan Intersection, Sheikh Sarai Intersection, Chirag Delhi Intersection, Siri Fort Intersection and GK-I Crossing Intersection. Since the BRT corridor is ending before Mool Chand Intersection, this junction was not considered in the simulation. Out of these six intersections, Ambedkar Nagar and Sheikh Sarai are three arm intersections.

7.3.2 Defining Model Parameters

(a) Vehicle Model

Vehicle model deals with dimensions of the each vehicle type that are considered for the simulation and the dimensions of the vehicle namely width and length are considered for the present simulation model as per the Indian conditions. However, other vehicle characteristics are considered as default values. In the present simulation model, vehicle types considered are car, two wheeler (motor cycle and scooter), auto rickshaw, LCV, HCV, MCV, bus and mini bus.

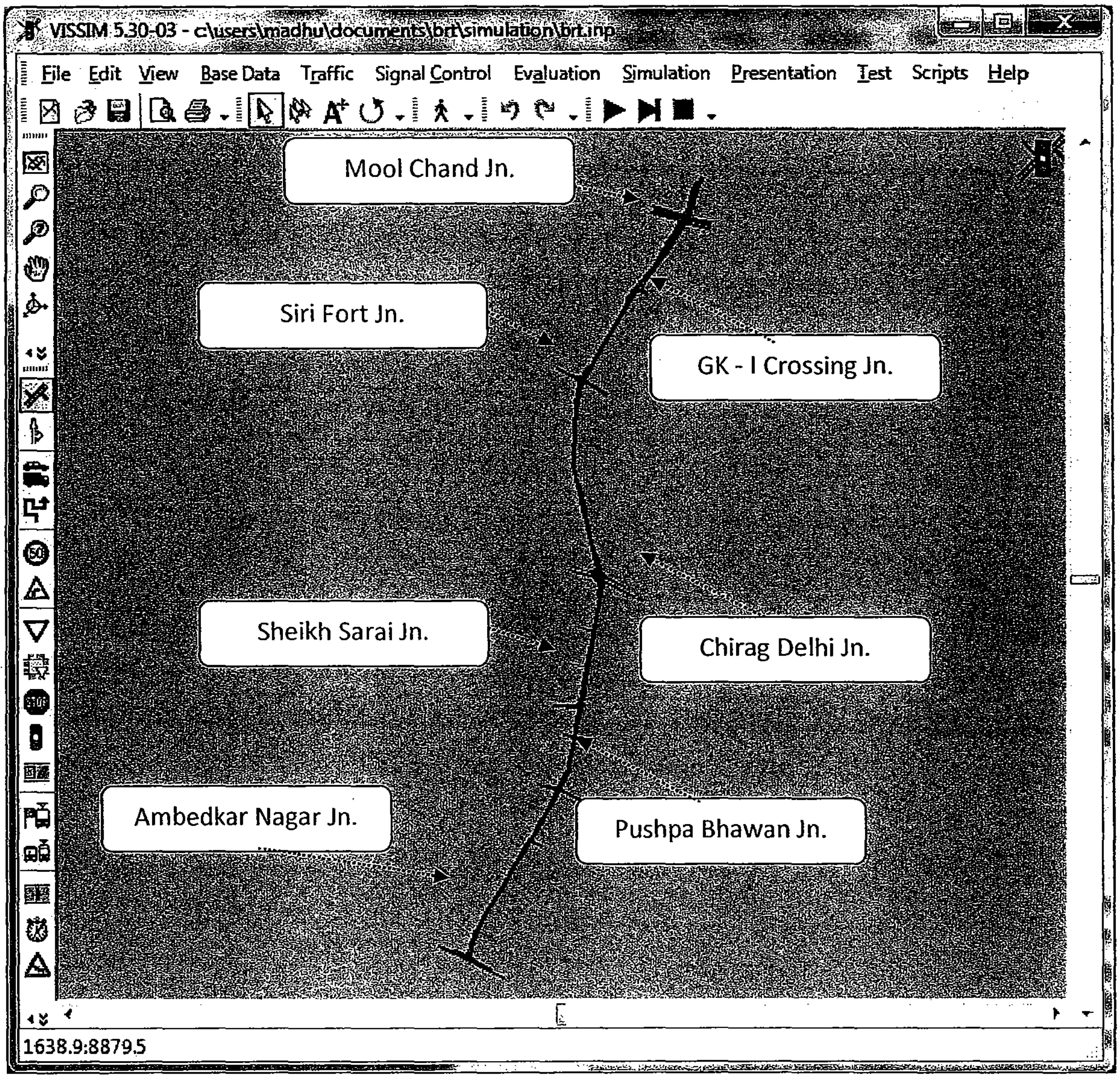


Figure 7.3.1: Development of Base Network for Microscopic Traffic Simulation in VISSIM

(b) Desired Speed Distribution

The desired speed distributions for each vehicle type have been given as input in VISSIM. The range of the values has to be given mentioning minimum, maximum and their distribution in between these. These values have been given based on the observed data to accurately represent field conditions through simulation model and thereby an attempt has been made to estimate the realistic output.

(c) Vehicle composition

Vehicle composition based on the observed data has been analysed as mentioned in the earlier section and given as input to simulation model encompassing different time interval and direction of travel.

(d) Vehicle Flow

Vehicle inflow is given as input based on the observed data encompassing different time intervals and different directions collected from the traffic volume count survey. Vehicles have been randomly generated following exponential distribution as per the observed volume and compositions given in the model input.

(e) Driving behavior characteristics

The driving behavior characteristics provided as inputs mainly includes: Widermann 99 Car-following, lane change and lateral model. Under this, the safety distance during standstill has been maintained. In lane change model too, minimum gap in the lane has been appropriately given based on the field conditions to perform the lane change during simulation. In the lateral model, the location of the vehicle on a lane, minimum lateral distance at different speeds etc. has been given as input.

(f) Signal Control

The existing signal phases and timings for all the above mentioned six intersections have been collected from the field during the normal BRT operations and furnished as input in the simulation model.

7.3.3 Calibration of the Simulation Model

Calibration is a process of adjusting the model parameters, network and vehicle demand to reflect and represent observed site conditions. This process involves adjusting following network, vehicle and driver characteristics:

- Desired speed distribution
- Maximum acceleration of vehicle
- Desired acceleration of vehicle
- Maximum deceleration of vehicle
- Desired deceleration of vehicle
- Weight of the vehicle
- Minimum Safety Distance
- Minimum Lateral Distance
- Minimum gap distance in the other lanes
- Observation of vehicles in same and other lanes

By giving the above parameters as an input, simulation runs has been carried out in order to estimate the output. In the present simulation model, the considered outputs are travel time of vehicles (journey speeds are calculated from this) since the observed data on this parameter has been collected in the field for validation of the developed simulation model. The comparison of estimated values with observed values has been carried out and error has been estimated. If the error is within the acceptable limits, the calibration process has been stopped; otherwise, the modification of the parameters has been carried out iteratively. This iterative simulation process is continued till the values are within reasonable degree of accuracy. This calibration process is shown in the form of Flow Chart in Figure 7.3.2.

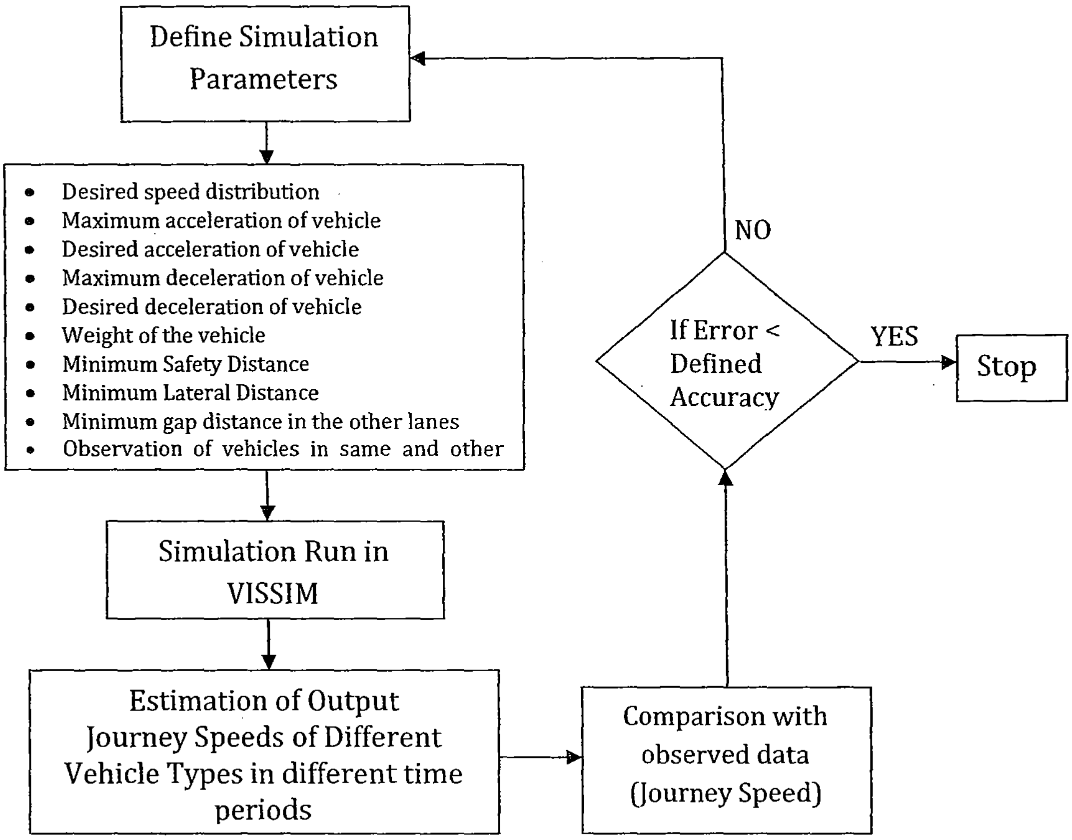


Figure 7.3.2: Calibration Procedure Adopted in Simulation Model in VISSIM

7.3.4 Validation of the Simulation Model

Using the validated parameters of simulation model outlined in Figure 7.3.2, the simulation model has been developed for existing BRT corridor from Ambedkar Nagar to Mool Chand. Initially the existing vehicle movements and traffic situation which is under normal BRT operations has been simulated for 3 hours (8:00 AM to 11:00 AM). Out of these 3 hours, first half an hour simulation has been considered as warm-up time. A typical birds' eye view of the vehicle movements at Chirag Delhi Intersection from the simulation exercise is shown in Figure 7.3.3.

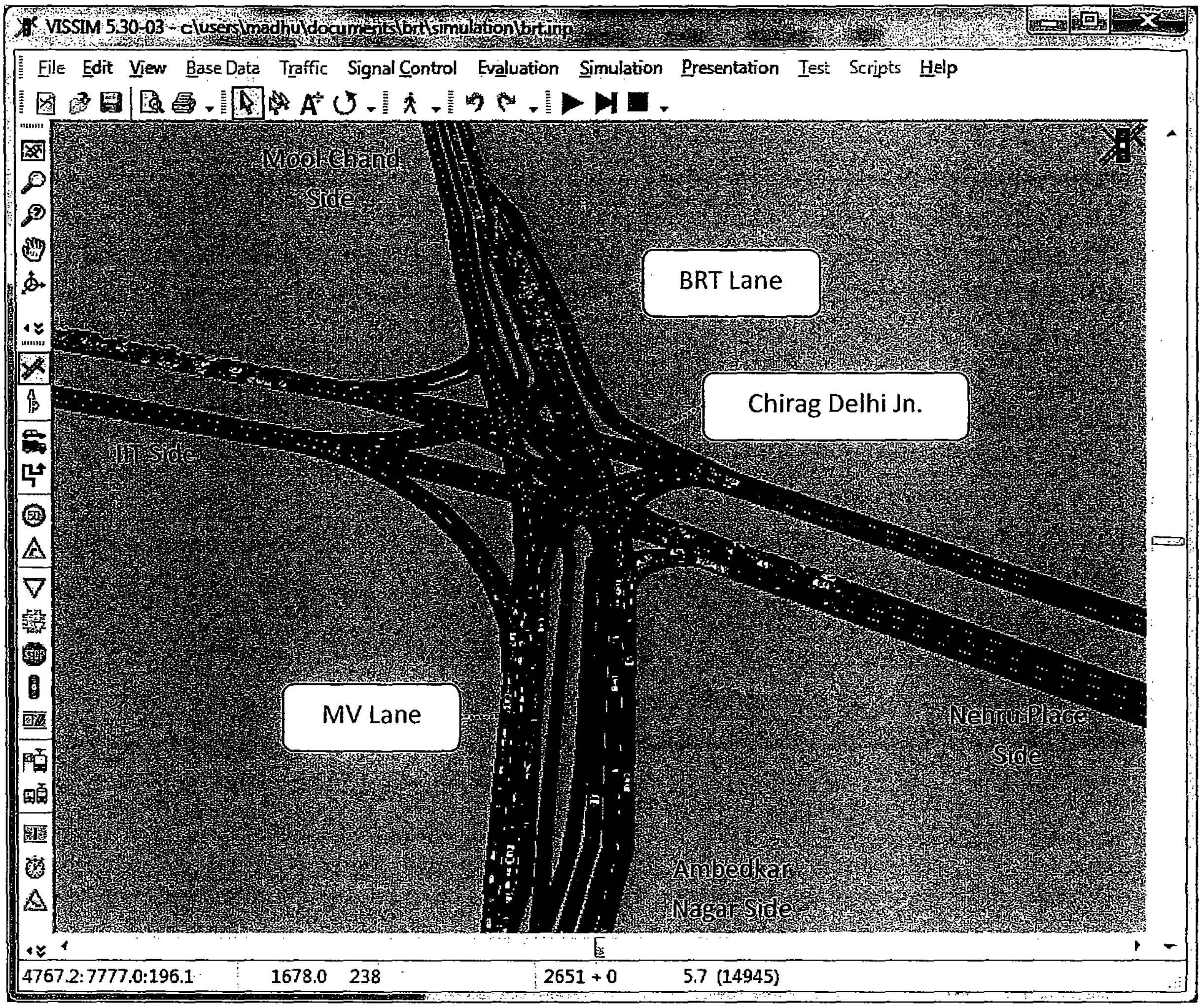


Figure 7.3.3: A Simulation View of Vehicular Movements at Chirag Delhi Intersection (Flyover is not shown)

From the Figure 7.3.3, it can be seen that the vehicles are travelling as per the BRT operational plan implemented on the ground. Buses are travelling on the BRT Lane and all other vehicles are travelling in MV lane. The traffic signal phasing has been created as per the observed signal timings and phases. At the intersection, BRT lane has been split into two lanes so as to make the provision for the straight bound and right turning buses as per their destination. The simulation exercise has been performed to simulate vehicles for 3 hours as mentioned before and the validation results of developed microscopic simulation model are shown in the Figure 7.3.4 and 7.3.5 for UP and DOWN directions respectively.

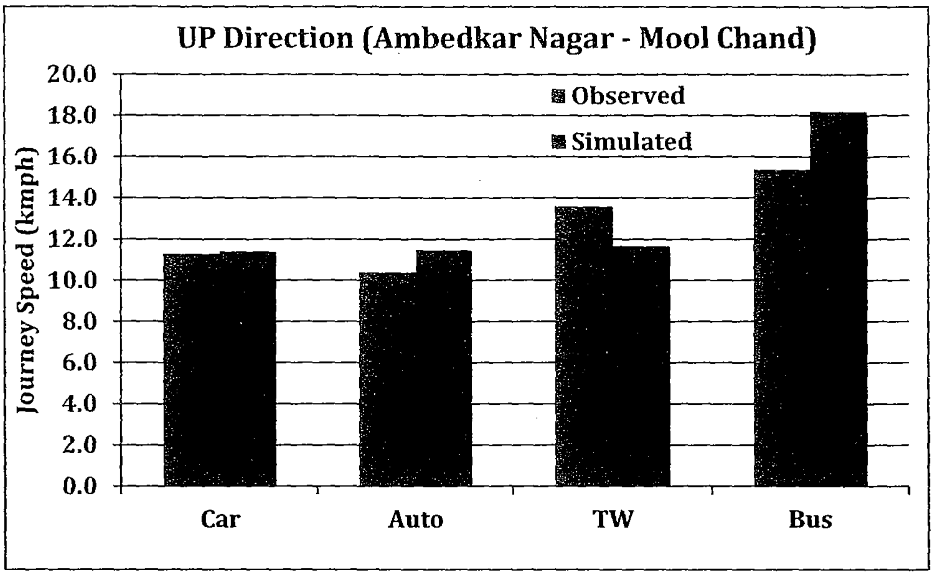


Figure 7.3.4: Comparison of Observed and Simulated Journey Speeds across different vehicles in UP Direction (Ambedkar Nagar - Mool Chand)

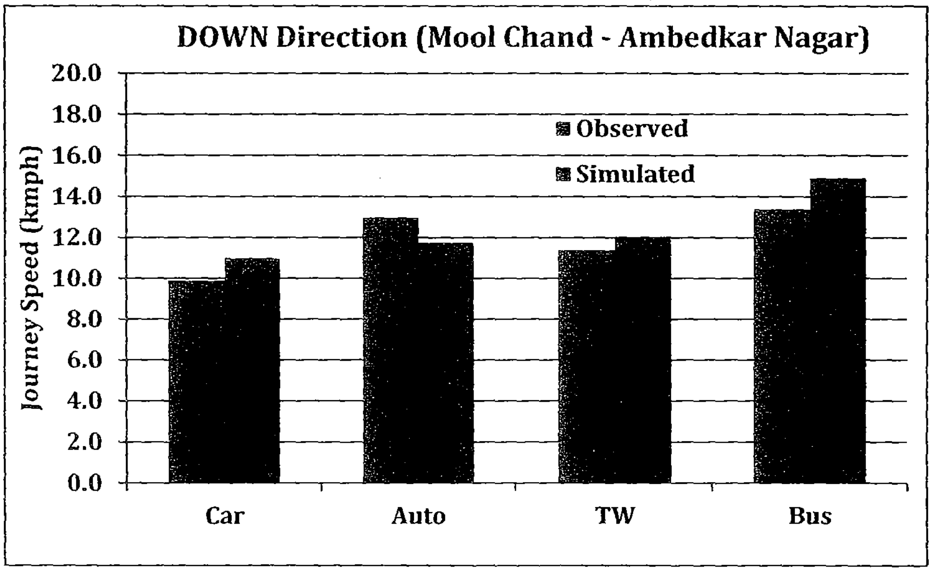


Figure 7.3.5: Comparison of Observed and Simulated Journey Speeds across different vehicles in DOWN Direction (Mool Chand - Ambedkar Nagar)

From the Figure 7.3.4 and 7.3.5, the following inferences have been drawn:

- Simulation model is able to predict the vehicular movements with fair degree of accuracy as the observed and simulated journey speeds of different vehicles are relatively close.
- The overall error is ranging from 9 to 11% in the case of journey speeds whereas in the case of individual vehicle type, the error is ranging from 1 to 18%.
- However, the error is more in the case of two wheelers as the observed speeds are somewhat more than the simulated speeds. This may be attributed to the two wheeler riders tend to exhibit zig-zag movement cutting across the traffic stream on our Indian urban roads aimed at reduction of travel time and thereby

increased speed. However, this phenomenon is difficult to explain in the simulation model.

- Further, in the case of buses, it was noticed that most of buses during the normal BRT operations tend to violate the signals and thereby their observed speeds during the BRT operations was relatively higher than the simulated bus speeds. Here again this abnormal phenomenon cannot be replicated in the simulated speeds of buses.
- Moreover, the present simulation model only adopted fixed time traffic signals at all the intersections. However, in reality, most of the intersections are mainly operated under manual mode of signal operations during the peak hours. This scenario is normally in vogue starting from around 09:30 AM. In spite of the above circumstances and operational issues on the study corridor, the developed simulation model is able to predict the vehicular movements with reasonable degree of accuracy.
- Given the above inherent limitations, the present microscopic simulation model can be reckoned to be realistic as it would be able to predict the vehicular movements with reasonable degree of accuracy.

7.4 Simulation of Experimental Trial Run

As per the TOR and mentioned objectives of the present study, an experiment trial run has to be conducted on the present BRT corridor by allowing other vehicles also to ply on BRT lanes. The conceptual plan devised implementation describing experimental trial run is already explained in Section 5.2. However, before the implementation of the experimental trial run, it was felt prudent to analyse the traffic movements under both existing and proposed plan using simulation. In order to implement this experimental trial run in the simulation model, the operational plan has been appropriately modified in terms of redesigning all the signals and the base road network to facilitate the desired movements of the vehicles in both BRT and MV lanes. The details of the experimental trial run can be seen in Section 5.3. After carrying out these modifications in the validated simulation model, it has been run to estimate the vehicle movements under the experimental trial run for 3 hours (8:00 AM to 11:00 AM). Out of these 3 hours, first half an hour simulation has been considered as warm up time as done earlier. A view of simulation of the vehicular movements under experimental trial run is shown in Figure 7.4.1. From this Figure 7.4.1, it can be seen that the other vehicles are also using the BRT lanes and straight bound buses are using MV lanes. Using this simulation model, the results have been estimated for study corridor which mainly included estimation of travel time and total stopped delays and presented in Figure 7.4.2 for the remaining 2 ½ hours excluding warm up period.

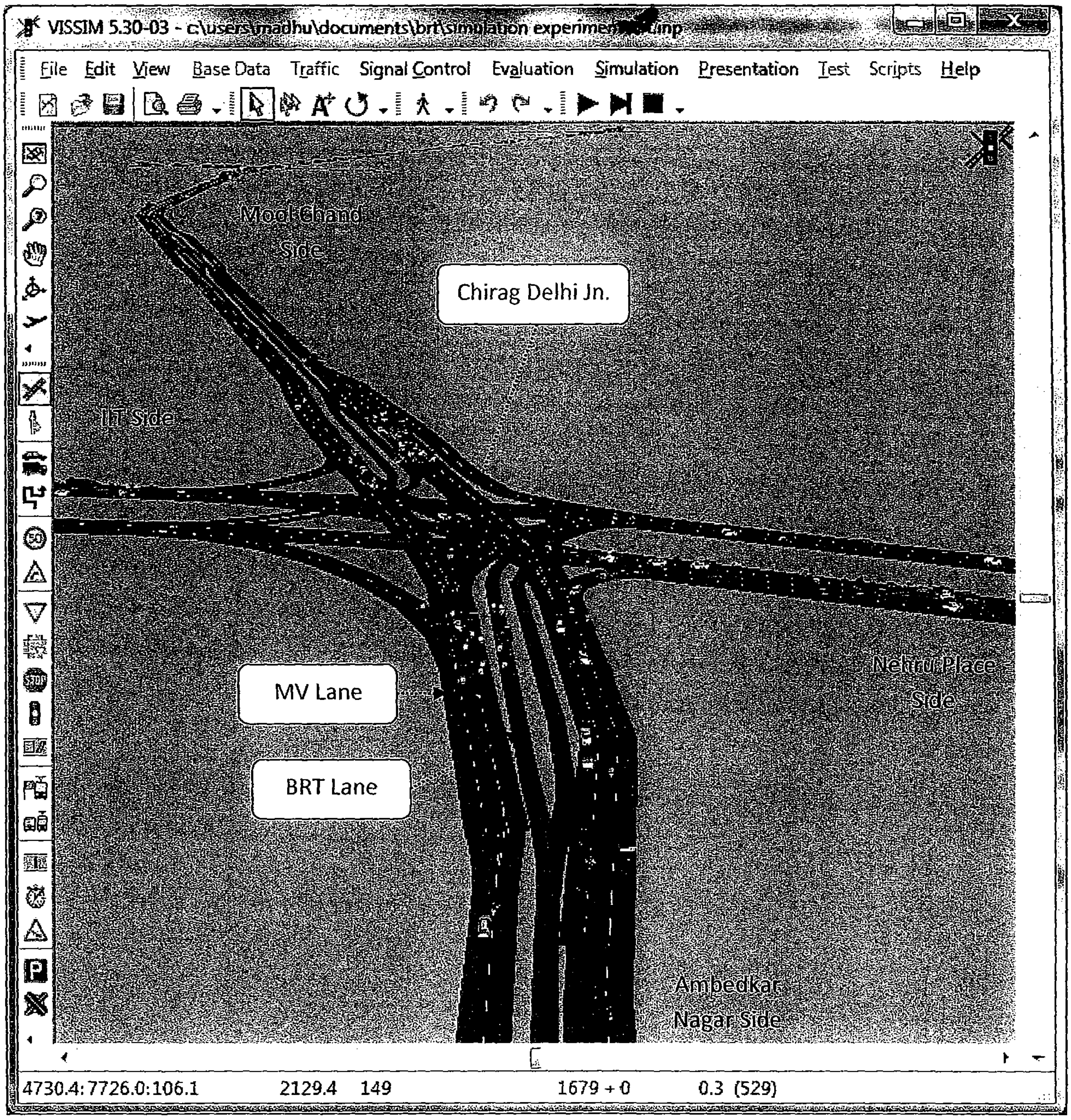


Figure 7.4.1: A Simulation View of Vehicular Movements at Chirag Delhi Intersection under Experimental Trial Run

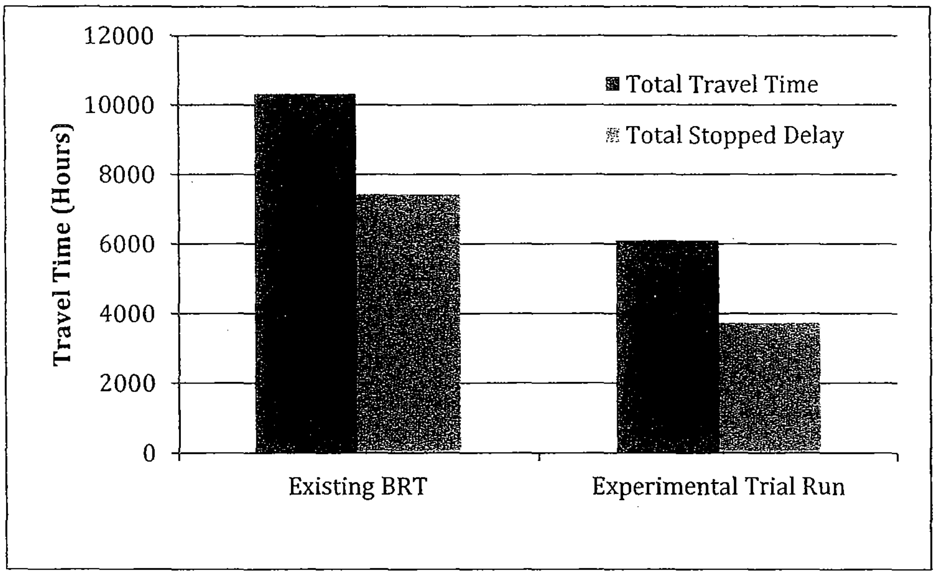


Figure 7.4.2: Comparison of Performance Indicators for normal BRT Operations and Experimental Trial Run for Study Corridor (from 8:30 AM to 11:00 AM)

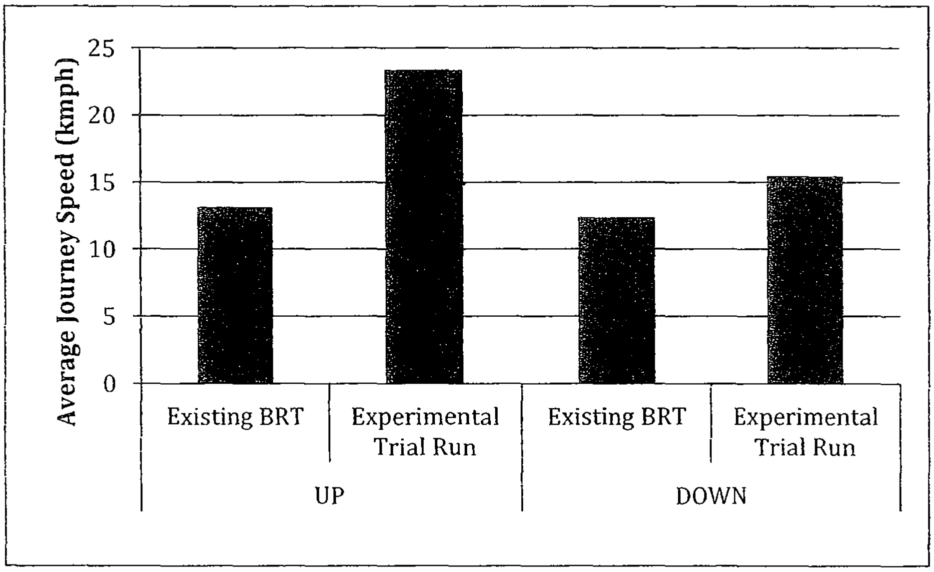


Figure 7.4.3: Comparison of Stream Speeds for normal BRT Operations and Experimental Trial Run for Study Corridor (from 8:30 AM to 11:00 AM)

From the Figure 7.4.2, it can be observed that the experimental trial run is able to reduce the total travel time and stopped delay by 41% and 50% respectively compared to existing BRT. Further, the stream journey speed has been estimated and compared with existing BRT as shown in Figure 7.4.3. From the Figure 7.4.3, it can be observed that the average stream journey speeds expected to register an increased speed in the order of 18 to 74% during the experimental trial run across different vehicle types. Based on the above results derived from the simulation result of experimental trial run, it was perceived that the experimental trial run would bring huge benefits in terms of reducing travel time on the BRT corridor. Largely, this simulation results instilled confidence to the CSIR-CRRI study team to go in for practical implementation of the experimental trial run on the study corridor and take up the challenge of management of the traffic during the trial run operations.

7.5 Simulation of Different Options

As per the objectives mentioned in the earlier section, one of the objectives is to evaluate the options of with BRT and without BRT along with any other improvement plans conceived by any stakeholders. Therefore, in the present study, it is proposed to evaluate these options by applying developed simulation model in VISSIM. In the recent past, UTTIPEC has conceived an option of providing new link between Press Enclave Marg and Outer Ring Road to decongest the existing BRT corridor especially between Chirag Delhi Intersection and Sheikh Sarai Intersection. Accordingly, it was felt worthwhile to evaluate the impact of the proposed link by applying the present simulation model. Since the new link is expected to take some amount of time for construction, hence it has been considered that it will be ready by year 2015 and accordingly traffic has been projected. To compare this option, existing BRT is also projected to year 2015 as BAU (Business As Usual).

The following options are considered to evaluate with developed simulation model:

- No BRT option
- Existing BRT - 2015 BAU
- New Link (between Press Enclave Marg and Outer Ring Road) - 2015

The simulation model has been appropriately modified in terms of road network to evaluate the 'No BRT scenario'. To accomplish the same, BRT lanes ear marked at the centre has been removed and all the lanes have been combined and segregated based on the direction of travel without disturbing the exclusive NMT provided during the normal BRT operations.

Further, in the case of existing BRT 2015 BAU option, the traffic has been projected by assuming an average growth rate of 7 % per annum and given input to simulation model. Whereas in the case of new link, the traffic has been appropriately distributed from entry points on the BRT corridor to the new link which include the following:

- Nehru Place approach and Siri Fort approach at Chirag Delhi Intersection and
- Saket approach and Pushpa Bhawan approach at Sheikh Sarai Intersection

All these three options are simulated and vehicular movements were estimated through the developed simulation model. The evaluation parameters for study corridor namely total travel time and total stopped delays are compared with each other and also with existing BRT case as shown in Figure 7.5.1. The following inferences have been drawn from the above figure.

- It can be observed that No BRT option is able to reduce the total travel time and stopped delay by 48% and 61% respectively compared to existing BRT.

- The existing BRT 2015 BAU case is increasing the total travel time and stopped delay by 13% and 15% respectively.
- On the other hand, the construction of the new link option (presumably ready by 2015) could bring about reduction in the total travel time and stopped delay by 20% and 22% respectively compared to existing BRT 2015 BAU case.

Further, the stream journey speed were also estimated and compared with existing BRT as shown in Figure 7.4.2 and the major observations drawn are summarized below:

- The existing BRT 2015 BAU case is reducing the stream journey speed in the order of 9 % to 22 %.
- It can be observed that the average stream journey speeds would increase in the order of 25 to 86% in case of No BRT scenario. On the other hand, the provision of new link by 2015 would bring about improvement in the stream journey speed in the order of 6 % and 13 %.
- Apart from this, another option is also tried using simulation by assuming the continuation of the implementation of the experimental trial run and thus the total travel time and stopped delay in the year 2015 have been estimated. A comparison of the scenario with the existing BRT 2015 BAU reveals that the trial run scenario in 2015 would reduce the total travel time and stopped delay in the year 2015 by 39 % and 48 % respectively.

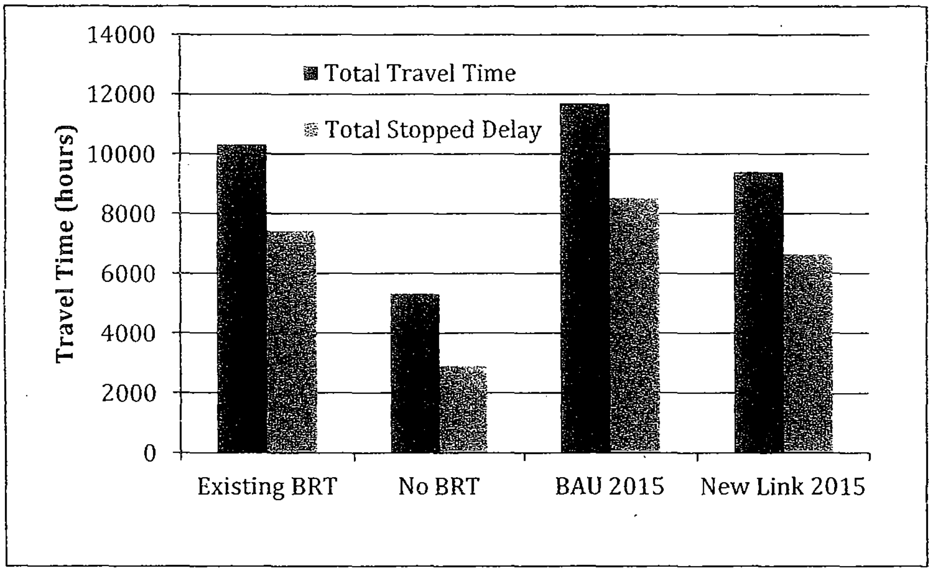


Figure 7.5.1: Comparison of Performance Indicators for Different Options on BRT Study Corridor (from 8:30 AM to 11:00 AM)

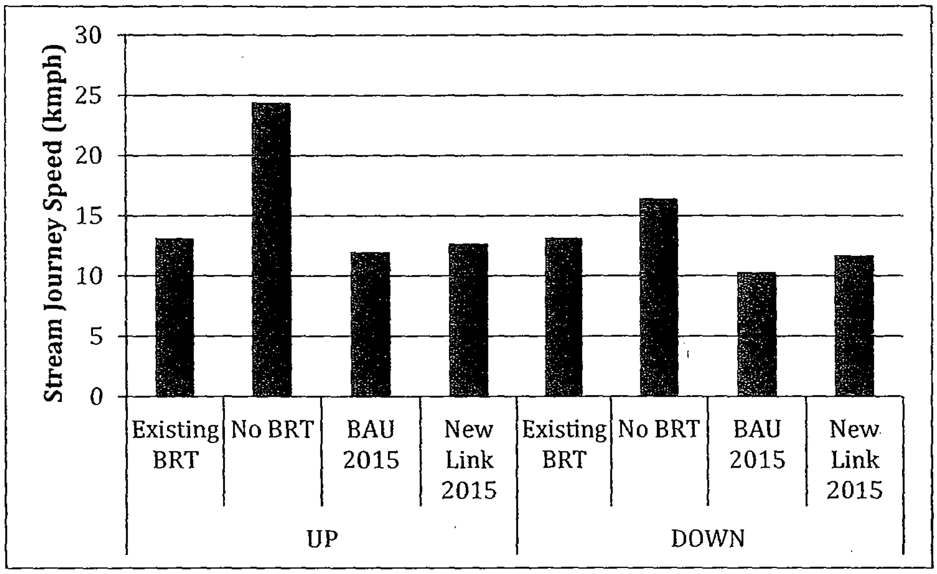


Figure 7.5.2: Comparison of Stream Speeds for Different Options on BRT Study Corridor (from 8:30 AM to 11:00 AM)

- To summarize, it can be said that simulation runs across varying scenarios have been accomplished with reasonable degree of accuracy.
- In a nutshell, it can be inferred that based on the various simulation experiments carried out in this study, given the fact that the study corridor is running under over saturated traffic conditions, the option of 'No BRT' would reap maximum benefits followed by 'experimental trial run continuation and the provision of 'new link between Press Enclave Marg and Outer Ring Road.

7.6 Limitation of the Simulation Runs

- During simulation, it is not possible to accurately replicate the behaviour of the different vehicle types, individual driver behaviour and hence the error is up to 20%. This is more so in the case of two wheeler rider as they tend to exhibit zig-zag movement cutting across the traffic stream on our Indian urban roads aimed at reduction of travel time. Due to this phenomenon, the observed speeds of two wheelers are somewhat higher than the simulated speeds in all the scenarios.
- The estimation of diverted traffic on to the proposed new link has been carried under the given constraints of absence of Origin - Destination (O-D) data at various entry points to the link.

8 SUMMARY OF FINDINGS AND RECOMMENDATIONS

8.1 Summary of Findings

Complying with the request of Transport Department, GNCTD and the Court order to evaluate BRT Corridor, CSIR-CRRI study team carried out an exhaustive list of studies on the BRT corridor and selected traffic studies on the adjoining Non-BRTS road sections in Delhi. The major inferences drawn from the results of the various traffic studies conducted like Intersection traffic volume counts, Mid block counts, Speed and delay studies, Spot Speed studies, Queue Length and Saturation Flow Studies, Pedestrian Volume counts at strategic locations, Parking studies, User's Perception on the BRTS operation as well as their perception on the 'experimental trial run' implemented by CSIR-CRRI, Fuel Consumption studies using probe vehicle and Bus Passenger Boarding / Alighting studies are presented in this section.

8.1.1 Salient Features from Traffic Volume Studies

- 16-hour traffic volume is varying from about 55,000 to 1,54,000 PCUs. The maximum traffic volume was observed at Chirag Delhi Intersection and minimum can be found at Siri Fort Intersection. The peak hour flow is varying from 12,272 PCU/hr at Chirag Delhi Intersection to 4,920 PCUs/hr at Siri Fort.
- On a working day, maximum peak hour flow is observed during the evening hours at Ambedkar Nagar, Pushpa Bhawan and Chirag Delhi whereas in the case of remaining intersections (Sheikh Sarai, Siri Fort and GK-I Crossing) peak hour is observed during the morning peak hour.
- The share of Bus is about 5 percent at Ambedkar Nagar Intersection whereas at the remaining intersections, it is ranging about 2 - 5 per cent.
- The share of car and two wheeler traffic is varying from about 77 to 82 percent at the three intersections namely Sheikh Sarai, Chirag Delhi and Siri Fort whereas in the case of Ambedkar Nagar and Pushpa Bhawan Intersections, the share of the same is about 60 percent.
- Auto Rickshaws composition is about 10 percent except at Pushpa Bhawan the share of autos is about 16 percent.
- Goods vehicles including Light Commercial Vehicles (LCV), Two Axle Heavy Commercial Vehicles (HCV) and Multi Axle Heavy Commercial Vehicles (MCV) constitute only about 1 to 3 percent as this is a typical urban corridor in the city wherein the entry of goods traffic is prohibited for effective part of the day.
- Traffic volume is varying from about 45,000 PCUs (on Khel Gaon Marg) to 63,000PCUs (on Aurobindo Marg) for 16-hour duration. The maximum peak hour flow in PCU/hr of about 6,000 observed on Aurobindo Marg.
- The fast moving vehicles (FMV) are observed to be varying from 90 to 98 percent of total traffic and slow moving vehicle (SMV) has very insignificant. The car

composition is very high and it is varying from about 40 to 55 percent followed by two wheelers accounting for about 15 to 40 percent.

- Auto rickshaws composition is also varying from 14 to 18 percent across different intersections. The commercial vehicles include LCV, HCV and MCV constitutes about 1 to 2 percent whereas buses account for a maximum percentage of 2 percent.

8.1.2 Salient Features from Pedestrian Studies

- Peak hour pedestrian volume is ranging from 130 to 2000 pedestrians at the different junctions on the BRT corridor. The highest pedestrian volume per hour can be found at the junctions Ambedkar Nagar followed by Pushpa Bhawan and Sheik Sarai. On the FOBs, peak hour pedestrian volume is ranging from 250 to 500 and highest can be found at Pushpa Bhawan FOB.
- All the mid block sections of the corridor have crossed the limit of hazardous index and need pedestrian facilities in terms of grade separated and exclusive signals etc.

8.1.3 Salient Features from Occupancy Studies

- The average occupancy of buses on the study corridor ranged from about 33 to 41 whereas the mini bus occupancy varied from 12 to 14 across the different intersections. Interestingly, these values are much higher than what was reported in various recent studies like RITES Study (2011), other studies (DMRC Phase-III, 2010 conducted by CSIR-CRRI) and EMBARQ (2009).
- Car occupancy range is from 1.9 to 2.5 whereas in the case of two wheelers it ranged from 1.3 to 1.7. The average occupancy in the case of auto rickshaw hovering from 1.8 to 2.8 whereas the taxi occupancy ranged from 1.8 to 2.33. The maximum occupancy level in cycle rickshaw is 1.4 whereas cycle occupancy was varying from 1 to 1.33.

8.1.4 Salient Features from Speed and Delay Studies

- The journey speed of buses ranges between 11-28 kmph, Autos ranges between 4-29 kmph, Two wheelers ranges between 11 to 30 kmph, Cars ranges between 9 to 26 kmph, Cycle ranges between 9 to 14 kmph and Cycle Rickshaw 6 to 10 kmph on BRT corridor.
- As compared to BRT corridor, the journey speed of buses on Non BRT Corridor ranges between 16 - 23 kmph, two wheelers ranges between 23 to 30 kmph, Cars ranges between 18 to 27 kmph and cycle between 9 to 13 kmph. At the same time, it is to be kept in mind that the traffic flow on Khel Gaon Marg during the 16 hour period of survey on a normal working day is only 53,560 vehicles (45,000 PCUs)

8.1.5 Passenger Flows on BRT and Non-BRT Corridors

- The passenger flows are varying from 0.98 Lakh to 2.08 Lakh in 16 on BRT corridor. Out of total sections maximum passenger flows are observed at Sheikh Sarai to Chirag Delhi section followed by Chirag Delhi to Siri Fort and Pushpa Bhawan to Sheik Sarai. Out of the total flows, bus passenger constitutes ranging from 40 to 49 percent followed by cars ranging from 24 to 30 percent, Two wheelers from 18 -20 percent, Auto of 7 to 8 percent and SMVs of 2 percent.
- The Peak Hour passenger flows from Mool Chand to Ambedkar Nagar shows that the maximum Peak hour Passenger flows are about 17,600 /hr were observed at Chirag Delhi - Sheikh Sarai section followed by Siri Fort - Chirag Delhi (12,440) and Sheik Sarai - Pushpa Bhawan (11,092) and the minimum peak hour passenger flows 8,598/hr were observed at Mool Chand – Siri Fort.
- The maximum Peak hour Passenger Flows 21,784/hr were observed at Sheikh Sarai –Chirag Delhi section followed by Chirag Delhi to Siri Fort to (16,116) and Pushpa Bhawan to Sheikh Sarai (15,692) , the minimum peak hour passenger flows 10,275/hr were observed at Ambedkar Nagar to Pushpa Bhawan.
- PPHPD determined based on the sectional loads across various links on the study corridor worked out be **12,403 PPHPD** *(total of 254 buses constitutes 233 buses and 21 mini buses running during the peak hour observed during the traffic surveys given in Section 4.1)* on Sheikh Sarai – Chirag Delhi *(UP)* direction of travel. Further, it may be noted that PPHPD has almost doubled from the reported PPHPD value of 6500 in the EMBARQ study *(2009)*. This is followed by Chirag Delhi - Sheikh Sarai direction of travel *(DOWN)* accounting for 7348 PPHPD catered to by 161 buses. Here it may be that the section-wise PPHPD loads in the remaining sections of the corridor is comparatibvely less on both directions of travel. This reiterates the fact that the maximum quantum of public transport passenger loads is on this section *(i.e. Sheikh Sarai - Chirag Delhi and vice versa direction as well)* of the corridor.
- Out of the three adjoining Non-BRT road sections considered in the study, PPHPD on Up Direction was observed to be maximum on Aurobindo Marg - AIIMS direction of travel i.e. 4014 PPHPD *(catered by 74 buses)* whereas in the case of down direction, PPHPD on Pragati Maidan to Mool Chand direction of travel is found to be maximum i.e. 4336 PPHPD *(catered by 81 buses)*.

8.1.6 Salient Observations from Pedestrians Studies

- Based on the Pedestrian Flow studies conducted, it was noted that the peak hour pedestrian volume is ranging from 130 to 2000 at the different junctions (namely Ambedkar Nagar, Pushpa Bhawan, Sheikh Sarai, Chirag Delhi, Siri Fort and GK-I intersection) on the BRT corridor. The highest pedestrian crossing volume per hour was observed at the junctions Ambedkar Nagar followed by

Pushpa Bhawan and Sheikh Sarai. On the FOBs, peak hour pedestrian volume was ranging from 250 to 500 and highest was found at Pushpa Bhawan FOB.

8.1.7 *Salient Aspects from Spot Speed Studies*

- It can be observed that the mean speed of cars and two wheelers are ranging between 38 to 42 kmph followed by auto rickshaws reported at 33 kmph. It is also observed that the average speed of buses / mini buses about 35 kmph whereas the mean speed of cycles is 14 kmph. At the same time, 85th Percentile Spot speeds at mid blocks on the corridor in the case of cars ranges from 47 to 48 kmph followed by two wheelers 49 kmph, Autos 37 kmph, Buses from 38 to 42 kmph, Commercial Vehicles ranging between 36 kmph to 43 kmph and Cycles 15 kmph.

8.1.8 *Salient Findings from Queue Length Studies*

- The maximum queue build-up was witnessed at Siri Fort Intersection on Mool Chand approach stretching up to 600 m. Similarly the average standard deviation of all approaches was observed to be quite high at Siri Fort junction (102 m) followed by Chirag Delhi junction (79 m).
- Queue length on all approaches of the Chirag Delhi intersection were very high with the maximum observed queue length was stretching up to 500m. Further, it was noted that even on the Nehru Place Approach and IIT approaches the maximum queue length observed was as high as 400 m with the average queue building up to 176 m and 139 m respectively. This phenomenon may be attributed to the over saturated status of this intersection.
- The observed average maximum queue length at Siri Fort and Chirag Delhi intersections were 383 m and 367 m respectively whereas the average queue build-up on the Ambedkar Nagar Intersection, Pushpa Bhavan and Sheikh Sarai Intersection was 183 m, 150 m and 180 m respectively.

8.1.9 *Salient Findings from Saturation Flow Studies*

- During the morning hours, the traffic discharge at the GK-I Crossing intersection and Chirag Delhi intersection exhibits the maximum saturation flow rate accounting for about 6850 PCUs/hr and 6100 PCUs/hr for two lanes on MV lane respectively whereas it is about 550 PCUs/hr/lane and 500 PCUs/hr/lane on BRT lane respectively on the Mool Chand bound approach (Up Direction).
- Similarly, during the evening hours too, GK-I Intersection followed by Chirag Delhi accounts for the maximum saturation flow rate numbering around 4800 PCUs/hr and 4600 PCUs/hr for two lane on MV lane respectively whereas it is about 500 PCUs/hr/lane and 450 PCU/hr/lane respectively on BRT lane. However, the utility of the saturation flow results would be lost when the signal

is operated under manual mode instead of automatic mode due to exigencies like over saturated conditions. Due to over saturated conditions prevalent at all the major intersections located on this corridor, the signals were being operated under manual mode during the peak hours and hence no tangible outputs could be derived from the saturation flow study.

8.1.10 Salient Aspects of Parking Studies

- Based on the parking surveys carried out at the selected locations between Ambedkar Nagar - Madangir section, it was observed that on-street parking is a common phenomenon typically witnessed on the road stretch which is causing so much interference to the traffic on the MV lane on both directions of travel. This on-street parking is also becoming problematic to NMT users and pedestrians as well as the parkers tend to park their vehicles obstructing the cycle tracks and foot paths. This is more of an enforcement issue which need to be tackled through strict enforcement mechanism and possible provision of proper off-street parking facilities at Virat / Pushpa Bhawan area.

8.1.11 Salient Aspects of Fuel Consumption Studies

- A total of 16 test runs by deploying probe car method spread over different time periods during normal BRT operations. The quantum of delay observed ranged from 7 - 20 minutes across different time periods of the day. The amount of fuel consumed due to idling at the intersections ranged from 78 ml to 139 ml in the case of petrol driven test car whereas in the case of diesel driven test car it is hovering between 72 ml to 217 ml across different time periods of the day. The maximum quantum of fuel was consumed on the section between Sheikh Sarai to Chirag Delhi and similarly Chirag Delhi to Siri Fort due to the over saturated condition of the Chirag Delhi and Siri Fort intersections during the peak hours. The amount of fuel wasted due to idling is ranging between 2 % to 45 %, with the maximum quantum wastage of fuel noted on the stretch between Sheikh Sarai to Chirag Delhi varying in the range of 17 per cent to 41 per cent across varying time periods of the day. Further, the time lost in idling varied from 37% to 60%.

8.1.12 Highlights of User Perception Survey

- Overall 50% - 60% of trips are made daily followed by 10 - 25% trips are made 4 to 5 times a week. Occasional trips are maximum by two wheelers accounting for about 23%. Weekly trips are maximum by Taxi, Auto and Cycles.
- The average monthly income of the road users across different vehicle types is ranging from Rs. 8100 for cycles to Rs. 43000 for Cars and accordingly, the value of time across different road users is ranging between Rs. 46 to Rs. 243 per hour.

- The perceived average increased journey time after the BRT on the corridor is ranging between 13 to 16 minutes for all the vehicles as per the user perception.
- Majority of motorized users felt the situation is bad as compared to without BRT earlier. On the other hand, Bus users felt their situation improved after the introduction of BRT.
- The overall rating before BRT was between Average and Good. After the introduction of BRT, the rating has fallen between Bad and Average. Experimental trial run rating was between average and good.
- The overall increase of bus trips is 6.7% and the two wheeler and Car trips also increased by 4.7% and 3.1% respectively. The trips by Auto have drastically reduced followed by Taxi. This may be because of IPT modes reluctant to travel on this corridor due to more travel time compared to before BRT and the IPT owners got reduced their savings.
- The minor reduction in cycle trips on the BRT Corridor may be because increase income of cycle users and there by migrating to other modes like Bus, Two Wheelers.
- One of the debated issues is about the present bus stop location and hence the opinion of bus commuters was also sought and it was noted 71% Bus passengers opined that the locating the bus stop on the Kerb Side as their preference.

8.1.13 Highlights of the 'Experimental Trial Run' of CSIR-CRRI

- Based on the results derived from the above-mentioned surveys, the efficacy analysis of allowing other vehicles to ply on the BRT lane on experimental basis was accomplished as per the Court order which was outlined in the TOR as well. Accordingly, a suitable plan was conceived in terms of allowing right turn vehicles in the existing BRT lane and all other vehicles (left turning and straight) on left lanes of the corridor. In order to implement the conceived experimental trial run plan, the required physical elements were installed which include Bollards or Dividers to segregate two-way traffic in BRT Lane, Rope to tie two adjacent Bollards or Dividers, Reflectors on the existing dividers in BRT Lane, Traffic Signages (informatory, regulatory, bus stop etc.), Road Markings (directional arrows), Dividers to earmark the extra lane for right turn vehicles, Traffic Advisories and Traffic Signals. The traffic signages were designed as per the requirement of the intersection (allowed turns for each lane) and appropriately placed on each of the approach. The traffic signal stages were re-designed by decreasing the number of stages as well as cycle time.

8.1.14 Speed Comparison 'normal BRT operations' Vs. Experimental Trial Run

- During the course of the experimental trial run which was operational since 12th May, 2012 speed and delay studies were carried out starting from 13th to 19th May, 2012 so as to make a critical comparison with the observed speeds during weekdays and weekends across different vehicle types when the 'normal BRT operations. Further, a critical comparison of the speeds and delays observed across different vehicle types like cars, buses, two wheelers, auto rickshaws and cyclists during both scenarios has been made.
- The overall average speeds on weekday registered an increase of 7.7 kmph (49.9%) for autos, 1.3 kmph (16.3%) for Two Wheelers and 2.9 kmph (27.7%) for Cars during the 'experimental trial run' compared to 'normal BRT operations'. In case of buses, marginal increase of about 3.0% was found.
- The average speeds of buses spread across different time periods registered an increase of 1.9 kmph (12.0%) on weekends. Though it was observed that there is an increase in travel speeds of autos too during experimental run on weekdays, speed and delay surveys for autos and cycles could not be carried out during experimental run due to paucity of time.
- The overall average of journey speeds registered an increase in the case of Two Wheelers by 4.7 kmph (26.3%) and Cars 4.9 kmph (24.1%). This gain in overall speeds during weekend is substantial compared to weekdays.

8.1.15 Fuel Consumption Comparison 'normal BRT Vs 'experimental trial run'

- The journey time during experimental trial run scenario reduced by 26% as compared to the normal BRT operations.
- In the case of petrol driven probe vehicle, the fuel loss during idling reduced up to 32% during experimental trial run whereas in case of diesel driven probe vehicle the fuel loss in idling reduced substantially up to 46%.
- The total fuel consumption in case of petrol driven vehicle also showed declining trends by about 6% to 8% under the experimental trial run considering the both directions of travel.
- The value of fuel loss due to BRT corridor was calculated by taking the difference between normal BRT operation and experimental trial run and this is around 2.48 crores per annum. This estimated monetary loss is referring to cars alone and considering the other vehicles, this loss would be much higher.

8.1.16 Passenger Hours 'normal BRT Vs. 'experimental trial run'

- The total number of passenger hours savings during experimental run is in the order of 18,655 hours on a weekday and 11026 on weekend for 16 hours duration.

- The evaluation of passenger hours in terms of monetary values shows that there is a loss of Rs. 87.91 crores in a year during normal BRT operation compared to Experimental run.
- The total number of vehicle hours savings during experimental run is in the order of 8,183 hours on a weekday and 4,366 on weekend for 16 hours duration.

8.1.17 Users Perception Survey Comparison 'normal BRT vs 'experimental trial run'

- The user's perception on the overall time variation, if any due to the 'experimental trial plan' was assessed by collecting samples across different vehicle types. Autos reported loss of 13.2 minutes time during normal BRT operation have reported saving in time to the tune of about 14.1 minutes during the trial run. Similarly, Car passengers who have reported loss of 16 minutes in normal BRT operation have felt that 16 minutes savings during the trial run. The rating of corridor during 'experimental trial run' was obviously high in the case of car users (4.38) due to their time savings achieved and two wheeler riders rated at 4.13 as compared to 2.51 during 'normal BRT operations'. The rating of the corridor by the bus passenger has registered a marginal increase from 3.32 (normal BRT operations) to 3.60 indicating accrual of minor perceived benefits in terms of time savings under the 'experimental trial run' scenario.
- Bus passengers also reported savings to the tune of 6 minutes on the corridor during experimental trial run. Pedestrians also reported marginal gain of around 2 minutes and this may be attributed to the 'All Red for Pedestrians' phase included in the plan implemented during the 'experimental trial run'.

8.1.18 Limitations of the Experimental Trial Run

The experimental trial run by the CSIR-CRRI study was implemented on the ground and in operation from 12th May - 19th May 2012 spanning for 8 days. However, there are still some limitations in this plan which needs to be addressed in the event of continuation of the above plan by Transport Department, GNCTD:

- The bus stops for left turning and straight bound buses have been temporarily shifted to the identified locations on the left side of the corridor (kerb side). This is causing great discomfort to the bus commuters bound on these routes. In the event making this plan permanent, it is essential to construct and shift the dysfunctional bus shelter (for the left turning and straight bound buses at each bus stop) on to the temporary location ear marked on the ground by making minor changes in the alignment.
- This being an experimental run spanning for 8 days, the existing BRT lane has been segregated for facilitating two way movement of right turning traffic through temporary measure by using metal barricades connected with traffic cones. However, it is advisable to provide physical separation for segregating directional flows by leaving gap at an interval of every 200m. This proposed

arrangement would enhance safety for the two directions of traffic coupled with provision for removing the stranded / breakdown vehicle.

- The u-turn traffic was not provided any separate signal phasing / stage and hence these turns are causing conflicts to the right turning bound vehicles during the signal phase. However, it is worthwhile to consider the provision of permitted U-Turning of vehicles by posting U-Turning mandatory signs on the lane reserved for right turning buses at the intersection.

8.1.19 Road Crash Data; Before and After BRT

The road crash data available with the police records were used to compare the road crash scene before and after the BRT.

- During the last couple of years, contradicting reports appear about the trend of road crashes mentioning that the reduction in the fatal and serious injury crashes after the introduction of BRTS. But the data does not really depict that trend for any comparable number 3 years before and after BRT.
- At the same time no major inferences can be drawn in the absence of location of road crash, time of crash, vehicles involved and weather at the time on the above corridor.
- A comparison of the available road crash data indicates that there is an increase of 40 per cent in the number of fatal road crashes coupled with 48 % increase in the number of fatalities. At the same time, the number of simple / injurious road crashes reported by the Traffic Police has registered an increase of 7 per cent.

8.1.20 Traffic Flows on Delhi BRT and Ahmadabad BRT

A comparison of the traffic flows on the Delhi BRTS and Ahmadabad BRTS has been presented.

- It can be observed that the proportion of car is almost 1.5 times on the MV lane of Delhi BRT. Obviously, this high composition of car traffic on Delhi BRT is contributing to lower journey speeds as the width of the available MV lane is only (7–8m) on either direction of travel. The above road width is obviously shared by other vehicle types including two wheelers accounting for about 35 % on Delhi BRT.
- The share of two wheelers is comparable on both the BRT corridors whereas proportion of autos is somewhat higher on Ahmadabad BRT. The argument in terms of auto riders showing reluctance to travel on Delhi BRT corridor observed during the user perception survey reported in Section 4.11 is corroborated here.
- The proportion of Slow Moving Vehicles is significantly higher *(7%)* on Delhi BRT section as compared to Ahmadabad BRT as the former serves the needs of large strata of Economically Weaker Section (EWS) / Low Income Group (LIG) of cyclists emerging from Madangir and other adjoining localities. Hence, the provision of exclusive NMT on the Delhi BRT is fully justified.

8.1.21 *Comparison of Speed and Delay on Delhi BRT versus Ahmedabad BRT*

- The travel time of cars on MV lane on both the BRT corridors is almost the same during morning hours spanning only about 13 minutes whereas the average running speed *(30 kmph)* and journey speeds *(25 and 28 kmph)* are also comparable. However, during the evening hours, very high travel time was observed on Delhi BRT corridor extending up to 33.0 mins. This is to a large extent due to the insufficient road width available on MV Lane *(7-8 m) as against the 10 m width available for each direction of travel before BRT in April 2008)*, coupled with operation of the signal under manual mode during the peak hours due to the over saturated status.
- Since the Ahmadabad BRTS is a closed system, the commercial travel speeds are much higher. The bus composition is about 3% of total traffic in both the cases, the observed average speed of Buses on Ahmadabad BRT section varies between 22 to 25 Kmph *(CEPT Ahmedabad)* which is much higher than that of Delhi BRTS (13-15 kmph)

8.1.22 *Microscopic Simulation Modelling*

- A microscopic simulation model in VISSIM is developed to estimated vehicular movements on BRT corridor. The developed model is able to predict the vehicular movements with fair degree of accuracy as the observed and simulated journey speeds of different vehicles are relatively close.
- The overall error is ranging from 9 to 11% in the case of journey speeds whereas in the case of individual vehicle type, the error is ranging from 1 to 18%.
- However, the error is more in the case of two wheelers as the observed speeds are somewhat more than the simulated speeds. This may be attributed to the two wheeler riders tend to exhibit zig-zag movement cutting across the traffic stream on our Indian urban roads aimed at reduction of travel time and thereby increased speed. However, this phenomenon is difficult to explain in the simulation model.
- Further, in the case of buses, it was noticed that most of buses during the normal BRT operations tend to violate the signals and thereby their observed speeds during the BRT operations was relatively higher than the simulated bus speeds. Here again this abnormal phenomenon cannot be replicated in the simulated speeds of buses.
- Moreover, the present simulation model only adopted fixed time traffic signals at all the intersections. However, in reality, most of the intersections are mainly operated under manual mode of signal operations during the peak hours. This scenario is normally in vogue starting from around 09:30 AM. In spite of the above circumstances and operational issues on the study corridor, the developed simulation model is able to predict the vehicular movements with reasonable degree of accuracy.

- Given the above inherent limitations, the present microscopic simulation model can be reckoned to be realistic as it would be able to predict the vehicular movements with reasonable degree of accuracy.
- The experimental trial run is able to reduce the total travel time and stopped delay by 41% and 50% respectively compared to existing BRT. The average stream journey speeds expected to register an increased speed in the order of 18 to 74% during the experimental trial run across different vehicle types. Based on the above results derived from the simulation result of experimental trial run, it was perceived that the experimental trial run would bring huge benefits in terms of reducing travel time on the BRT corridor. Largely, this simulation results instilled confidence to the CSIR-CRRI study team to go in for practical implementation of the experimental trial run on the study corridor and take up the challenge of management of the traffic during the trial run operations.

8.2 Recommendations

8.2.2 Scenario Evaluation

The following options are considered to evaluate with developed simulation model:

- No BRT option
- Existing BRT - 2015 BAU
- New Link (between Press Enclave Marg and Outer Ring Road) - 2015

The results are given in Table 8.2.1

Table 8.2.1: Comparison of Various Scenarios from Microscopic Traffic Simulation

S. No	Scenario	Journey Speed	Total Travel Time	Total Stopped Delay
1	Base Case (With BRT)	12.5 kmph	10326 Hours (morning 2 ½ Hours duration)	7428 Hours (morning 2 ½ Hours duration)
2	No BRT*	increase of 25 to 86%	Decrease of 48%	Decrease of 61%
3	Existing BRT 2015 BAU*	decrease of 9 to 22%	Increase of 13%	Increase of 15%
4	New Link Case 2015**	increase of 6 to 13%	Decrease of 20%	Decrease of 22%

** Compared with Base Case (with BRT)* *** Compared with Existing BRT 2015 BAU*

- Comparison of the scenario with the existing BRT 2015 BAU reveals that the trial run scenario in 2015 would reduce the total travel time and stopped delay in the year 2015 by 39 % and 48 % respectively.

- Out of the above scenarios presented in Table 8.2.1, the No BRT option yields better benefits for this corridor with the given traffic conditions.
- Moreover, the results of the experimental trial run conducted on the above corridor reiterated the fact that the allowing of other vehicles to ply on the earmarked lane for buses yielded better benefits for all the road users compared to BRT situation.

8.2.2 Other Improvement Measures

Appropriate improvement measures in the form of Traffic Engineering and Pedestrians Facilities like Signal Provision, Subway / FOB requirements as well as route rationalization measures have been recommended aimed at providing relief to all types of road users and thus enhance the safety, irrespective of the corridor. Considering the available carriageway width on the corridor coupled with the operation of BRTS in vogue various improvement measures are suggested. However some of the measures are applicable even under 'without' BRT scenarios as applicable for any other corridor in Delhi. Considering the above, various improvement measures recommended are described:

A. Redesign of Signalling Phase

- During the course of the study by CSIR-CRRI team, it was noted all the 4 armed intersections are provided 6 phases on the entire BRT corridor which includes 2 exclusive phases for BRT lane Buses. However, it was noted that this is causing too much delay to the vehicles on the MV lane. This is more so during the manual mode operations of the 6 stage signal.
- However, this issue can be efficiently addressed by providing the green phase for BRT lane (Straight) and MV lane (Straight) simultaneously on both directions of travel. This shall be followed by opening of the green phase for the BRT lane right and MV lane right directions simultaneously. The present U-Turning maneuver occurring at each of the approaches from the MV lane need to be accommodated appropriately in the phasing by making permitted U-Turns.
- The remaining two phases from the crossing approaches shall be handled in two separates phases.
- At the end of each cycle, it is essential to provide 'All Red for Pedestrians' which is very essential considering the pedestrians flows occurring at the junction. Even in the experimental trial run' conducted by CSIR-CRRI study team, this phase was in vogue. This is one of the essential facility need to be on the ground in the absence of grade separated facility not provided on this BRTS wherein the bus stop is located close to the intersection.
- Other simple measures which need to be installed on the ground are the 'Count down Timer' on each of the approach arms at strategic locations. This is

essentially required urgently on the ground as the road users will have the comfort of knowing the opening of green phase / stage during the auto mode operation of the signals.

B. Pedestrian Facilities

- Since all the six intersections *(namely Ambedkar Nagar, Pushpa Bhawan, Sheikh Sarai, Chirag Delhi, Siri Fort and GK-I intersection)* located on the study corridor exhibit huge quantum of pedestrian flows and hence they have crossed the limit of hazardous index. Considering the above, it is essential to provide at least to start with the facility for exclusive signal phasing at the intersections ('All Red for Pedestrians' Phase). This measure is not implemented on the ground despite the Signal Head (named as Intelligent Signalling System ISS one of the best instrumentation in the world) is having this simple provision. Secondly, wherever feasible, grade separated facility in the form of Foot Over Bridge / Subway need to be constructed. Of course in case of intersections like Chirag Delhi Intersection, the topology of the intersections itself makes the provision of grade separated facility a difficult task.

C. Parking Regulation

- It was observed that on-street parking is a common phenomenon typically witnessed on the road stretch which is causing so much interference traffic on the MV lane on both directions of travel. Incidentally parking study results reveal that 90 % of the parkers are short term parkers and they park their vehicles on main carriageway itself and thereby encroaching the main carriageway. Since this is more of an enforcement issue, it can be strictly controlled through law enforcement.
- This on-street parking is also becoming problematic to NMT users and pedestrians as well as the parkers tend to park their vehicles obstructing the cycle tracks and foot paths. This is more of an enforcement issue which need to be tackled through strict enforcement mechanism and possible provision of proper off-street parking facilities at Virat / Pushpa Bhawan area.

D. Provision of Extra Lane between Sheikh Sarai to Chirag Delhi

- To explore the possibility of capacity augmentation on the MV lane on either side starting from Sheikh Sarai – Chirag Delhi- Siri Fort which would help in relieving the traffic congestion due to the over saturated status of this section during the peak hour. However, this may require acquisition of Green / Forest Land on either side up to Chirag Delhi.

E. Provision of Service Lane near Madangir

To address the local needs of the Virat Road bound traffic, it is proposed to provide service lane on the RHS of the BRT corridor starting from Virat Road T Junction to Pushpa Bhawan.

F. Provision of Continuous NMT Lanes and Rationalization of NMT lane widths

- NMT lanes are not continuous due to the obstruction of trees, and other religious structures proper relocation of these structures can be made thereby the NMT lanes can be made continuous. Further considering the heavy traffic on MV lanes rationalization of the reducing the width of the NMT lanes is recommended.

G. Signs and Road Markings

- Sings and Road Markings are main guiding factors for the road users which is essentially required to be adequate and placed at appropriate places on the road.
- It is unfortunate to note the Road Signs is rather inadequate on the entire corridor and ones existing on the ground are in deplorable condition.
- Road Markings provided is fully in dilapidated condition.
- Hence it is immediate requirement to install the sign boards and markings on this stretch.

H. Route Rationalization and Scheduling

- The maximum quantum of public transport passenger loads on the study corridor is observed on the section between Sheikh Sarai - Chirag Delhi and vice versa direction as well of the corridor. This is to a large extent contributed by the Route Number 534 and 534-A entering the study corridor at Sheikh Sarai and exiting at Chirag Delhi. On the other hand, based on the 16 hour survey conducted *(on a typical week day)* aimed at understanding the number of passenger alighting / boarding at all the 22 bus stops located on the study corridor, it is evident that the average number of passengers boarding / alighting from the above two bus routes is only 4 - 5 passengers per bus. It may be noted here a minimum of 25 % sample of buses was covered in each route during this survey spread over the entire day *(06:00 am to 10:00 pm).*
- On the contrary, the observed passenger occupancy on the above two routes is noted to be falling under the 'Full' load *(60 passenger per bus).* Moreover, the frquency during the peak hours in both the buses is found to be around 5 minutes coupled with at least 2 buses of the same route travelling one behind the other *(clustering phenomenon due to poor scheduling).* **This aspect is obviously boosting the PPHPD drastically and thus presenting an exaggerated figure.** This scenario calls for **proper rationalization and scheduling of the routes on the entire study corridor.** This is very much required in the case of **534 and**

534-A routes by re-routing them away from the BRT corridor as the bus route is always noted to be overloaded due to its long route *(Anand Vihar ISBT - IGI Airport/ Ambedkar Nagar)* and more importantly, the average number of passengers boarding and alighting is only 4 - 5 passengers per bus on both these routes (as reported above) and it is traversing a length less than 1 km on the entire corrdor. It is expected that the above proposed route rationalization and scheudling of the routes *(even in the case of Route No. 419 clustering phenomenon was witnessed)* will bring about great relief to all types of road users on the study corridor as the journey speeds is expected to register increase. However, it is worthwhile for Transport Department, GNCTD to conduct a detailed study in consulatation with DTC / DIMTS in this regard and make a comprehensive route rationalisation for the study corridor.

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Annexures

ANNEXURES

ANNEXURE-I: TRAFFIC VOLUME COUNT PROFORMA

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Proforma V (1)

Classified Traffic Volume Count Survey (Mid-Block / Intersection)

Road/ Intersection Name: ______________________ Name of the Location ______________________

Date: __________ Time Period: From ______________ To ______________

Direction: From ______________________ To ______________________ Weather: __________

Name of the Enumerator: ______________________

Time of the Day	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)
___: 00 to ___: 15						
___: 15 to ___: 30						
___: 30 to ___: 45						
___: 45 to ___: 00						

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Proforma V (2)

Classified Traffic Volume Count Survey (Mid-Block/ Intersection)

Road/ Intersection Name: ______________________ Name of the Location ______________________

Date: ____________ Time Period: From ______________ To ______________

Direction: From ______________________ To ______________________ Weather: ____________

Name of the Enumerator: ______________________

Time of the Day	Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Autos (A)	Buses (B)	Mini Buses (MB)
___: 00 to ___: 15					
___: 15 to ___: 30					
___: 30 to ___: 45					
___: 45 to ___: 00					

** - Maruti 800, Omni, Zen, Wagon R, Alto, Santro, i-10, i-20, Indica, Fiat Palio, Matiz, Spark etc (up to 1400 cc)*

*** - Ambassador, Maruti Esteem, Hyundai Ascent, Ford Ikon, Toyota, Mitsubishi Lancer, Logan, Tata Indigo, Honda City, BMW, Mercedes Benz etc.*

 # - Sports Utility Vehicle (SUV) like Mahindra Jeep, Standard/ Matador Van, Sumo, Safari, Tavera, Qualis, Scorpio etc.

ANNEXURE-II: OCCUPANCY SURVEY PROFORMA

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Proforma V (1)

Occupancy

Occupancy Count Survey (Mid-Block / Intersection)

Road/ Intersection Name: ______________________ Name of the Location ______________________

Date: __________ Time Period: From ____________ To ____________

Approach/arm Name : ______________________ Weather: ____________

Name of the Enumerator: ______________________

Time of the Day	Motor Cycles		Cycle-Rickshaws and Other (CY-SMV)
	2-Stroke*	4-Stroke#	
:00 to :05			
:05 to :10			
:10 to :15			
:15 to :20			
:20 to :25			
:25 to 30			
:30 to :35			
:35 to :40			
:40 to :45			
:45 to :50			
:50 to :55			
:55 to :60			

* 2-Stroke = Yamaha, TVS-Suzuki, Suzuki Samurai, Suzuki Shogun, Enfield Bullet, Yezdi

\# 4-Stroke = Hero Honda, Kawasaki Bajaj, LML Energy, Suzuki Fiero,, SMV = Slow Moving Vehicles

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Proforma V (2)

Occupancy

Occupancy Count Survey (Mid-Block / Intersection)

Road/ Intersection Name: ____________________ Name of the Location ____________________

Date: __________ Time Period: From __________ To __________

Approach/arm Name : ____________________ Weather: __________

Name of the Enumerator: ____________________

Time of the Day	Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis
:00 to :05			
:05 to :10			
:10 to :15			
:15 to :20			
:20 to :25			
:25 to 30			
:30 to :35			
:35 to :40			
:40 to :45			
:45 to :50			
:50 to :55			
:55 to :60			

* - Maruti 800, Omni, Zen, Wagon R, Alto, Santro, i-10, i-20, Indica, Fiat Palio, Matiz, Spark etc (up to 1400 cc)

** - Ambassador, Maruti Esteem, Hyundai Ascent, Ford Ikon, Toyota, Mitsubishi Lancer, Logan, Tata Indigo, Honda City, BMW, Mercedes Benz etc.# - Sports Utility Vehicle (SUV) like Mahindra Jeep, Standard/ Matador Van, Sumo, Safari, Tavera, Qualis, Scorpio etc.

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Occupancy Count Survey (Mid-Block / Intersection)

Proforma V (3)

Occupancy

Road/ Intersection Name: ____________________ Name of the Location ____________________

Date: __________ Time Period: From __________ To __________

Approach/arm Name : ____________________ Weather: __________

Name of the Enumerator: ____________________

Time of the Day	Scooters	Autos (A)	Cycles (CYC)
:00 to :05			
:05 to :10			
:10 to :15			
:15 to :20			
:20 to :25			
:25 to 30			
:30 to :35			
:35 to :40			
:40 to :45			
:45 to :50			
:50 to :55			
:55 to :60			

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Proforma V (4)
Occupancy

Occupancy Count Survey (Mid-Block / Intersection)

Road/ Intersection Name: ______________________ Name of the Location ______________________
Date: ____________ Time Period: From ____________ To ____________
Approach/arm Name : ______________________ Weather: ____________
Name of the Enumerator: ______________________

Time of the Day	Buses (B)	Mini Buses (MB)
:00 to :05		
:05 to :10		
:10 to :15		
:15 to :20		
:20 to :25		
:25 to 30		
:30 to :35		
:35 to :40		
:40 to :45		
:45 to :50		
:50 to :55		
:55 to :60		

ANNEXURE-III: SPEED AND DELAY SURVEY PROFORMA

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"Evaluating Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Moolchand, Delhi"

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Speed and Delay Survey

Proforma S&D

Road Name: ____________________ No. of Run __________

Date: __________ Time Period: From __________ To __________

Direction: From __________ To __________ Weather: __________

Name of the Enumerator: ____________________

Chainage/ Distance	Land Mark/ Control Point	Start Time	Delay Duration	Cause of Delay/ Remarks

** Codes for Delay: 1 - Signal; 2 - Traffic Jam/ Congestion; 3 - Road Repair/ Construction; 4 - Signal Failure; 5 - Accident; 6 - VIP Movement/ Other Processions; 7 - Vehicle Breakdown; 8 - Unsignalized Intersection*

ANNEXURE-IV: SPOT SPEED SURVEY PROFORMA

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Spot Speed Survey

Proforma SP

Road Name: ____________________ Name of the Location ____________________

Date: ____________ Time Period: From ______________ To ______________

Direction: From ______________ To ______________ Weather: ______

Name of the Enumerator: ______________________________

Vehicle Type*	Observed Speed**	Vehicle Type*	Observed Speed**	Vehicle Type*	Observed Speed**

Codes for Vehicle Types:* *Small Cars (<1400 cc)* - **CS; Big Cars/ SUV - **CB**; Motor Cycles - **MC**; Scooters - **SC**; Autos - **A**; Cycles - **CY**; Cycle Rickshaws & Other Slow Veh. - **OT**; Buses - **B**; Mini Buses - **MB**; Tractors and Tractor Trailers - **TT**; Light Commercial Vehicles - **LT**; Two Axle Trucks - **HT**; Multi Axle Trucks - **MT**;*

***All speed measurements are in Kmph*

ANNEXURE-V: PARKING SURVEY PROFORMA

CSIR - CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI

"Evaluating Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Moolchand, Delhi"

Sponsored by

Transport Department, GNCTD

Proforma PRK

Parking Survey

Road Name: ____________________ Name of the Location ____________________

Date: __________ Time Period: From __________ To __________ Weather: __________

Name of the Enumerator: ____________________

Time of the Day	Registration Number of Different Vehicle Types				
	Cars	Two Wheelers	Autos	LCVs	Two Axle and Multi-Axle Trucks
___:___ to ___:___					
___:___ to ___:___					
___:___ to ___:___					
___:___ to ___:___					

ANNEXURE-VI: PEDESTRIAN VOLUME COUNT PROFORMA

CSIR - CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI

"Evaluating Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Moolchand, Delhi"

Sponsored by

Transport Department, GNCTD

Proforma PED

Pedestrian Volume Count Survey

Road/ Intersection Name: ______________________ Name of the Location ______________________

Date: __________ Time Period: From ____________ To ____________

Direction: From ______________________ To ______________________ Weather: __________

Name of the Enumerator: ______________________

Time of the Day	**Along the Road** *(Direction: ____________ To ____________)*	**Across the Road** *(Direction: ____________ To ____________)*
___: 00 to ___: 15		
___: 15 to ___: 30		
___: 30 to ___: 45		
___: 45 to ___: 00		

ANNEXURE-VII: SATURATION FLOW SURVEY

CSIR - CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI

Evaluating Bus Rapid Transit *(BRT)* Corridor Performance from Ambedkar Nagar to Moolchand, Delhi

CSIR CRRI

Saturation Flow Survey (Intersection)

Sponsored by

Transport Department, Government of NCT of Delhi.

Proforma V (1)

Road/ Intersection Name: ______________________ Name of the Location ______________________

Date: ____________ Time Period: From ______________ To ______________

Arm of the intersection ______________________ Weather: ______________

Name of the Enumerator: ______________________

Time of the	Green time (Sec)	Motor Cycles		Taxis	Light Commercial Vehicles (LCV)	Two Axle Trucks (HCV)	Multi Axle Trucks (MAV)	Cycle-Rickshaws and Other (CY-SMV)
		2-Stroke*	4-Stroke#					

* 2-Stroke = Yamaha, TVS-Suzuki, Suzuki Samurai, Suzuki Shogun, Enfield Bullet, Yezdi

\# 4-Stroke = Hero Honda, Kawasaki Bajaj, LML Energy, Suzuki Fiero,, SMV = Slow Moving Vehicles

CSIR - CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI

Evaluating Bus Rapid Transit *(BRT)* Corridor Performance from Ambedkar Nagar to Moolchand, Delhi

Saturation Flow Survey (Intersection)

Sponsored by

Transport Department, Government of NCT of Delhi.

Proforma V (2)

Road/ Intersection Name: ____________________ Name of the Location ______________________________

Date: __________ Time Period: From __________ To __________

Arm of the intersection: ______________________________ Weather: __________

Name of the Enumerator: ______________________________

Time of the Day	Green Time (Sec)	Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Buses (B)	Mini Buses (MB)

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Evaluating Bus Rapid Transit *(BRT)* Corridor Performance from Ambedkar Nagar to Moolchand, Delhi

CSIR सीआरआरआई

Saturation Flow Survey (Intersection)

Sponsored by

Transport Department, Government of NCT of Delhi.

Proforma V (2)

Road/ Intersection Name: ____________________ Name of the Location ____________________

Date: __________ Time Period: From ____________ To ____________

Arm of the intersection: ____________________ Weather: ____________

Name of the Enumerator: ____________________

Time of the Day	Green time (Sec)	Scooters	Autos (A)	Cycles (CYC)

ANNEXURE-VIII: QUEUE LENGTH SURVEY

CSIR - CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI

Evaluating Bus Rapid Transit *(BRT)* Corridor Performance from Ambedkar Nagar to Moolchand, Delhi

CSIR

Queue Length Survey

Proforma Queue length

Sponsored by

Transport Department, Government of NCT of Delhi.

Road/ Intersection Name: ______________________________Name of the Location ____

Date: ______________ Time Period: From __________________ To ___________________

Arm of the intersection: ____Weather: ________________

Name of the Enumerator: ____

Hour of the Day	Minute of the hour and Queue length (m)																			
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59

ANNEXURE-IX: USER PERCEPTION SURVEY PROFORMA

CSIR - CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI

सीएसआईआर - केंद्रीय सड़क अनुसंधान संस्थान, नई दिल्ली

Evaluating Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Moolchand, Delhi

बस रैपिड ट्रांजिट (बी.आर.टी.) अंबेडकरनगर से मूलचंद कॉरिडोर, दिल्ली का प्रदर्शन का मूल्यांकन

CSIR सीआरआरआई

Sponsored by Transport Department, Government of NCT of Delhi
परिवहन विभाग, राष्ट्रीय राजधानी क्षेत्रकी दिल्ली सरकारद्वारा प्रायोजित

Car
कार

User Perception Survey - Car Passengers

उपयोगकर्ता की धारणा का सर्वेक्षण- कार यात्री

नमूना संख्या Sample No.

Name of the Location on J.B. Tito Marg जे.बी. टीटो मार्ग पर स्थान का नाम: ____________________

Date दिनांक: ____________

Time of Survey with respondent प्रतिवादी के साथ सर्वेक्षण का समय:_____hrs घंटा ______mins मिनट

Direction of Travel यात्रा की दिशा: From आरंभसे ________________ To तक ________________

Name of the Enumerator गणनाकार का नाम: ____________________

1. a. Vehicle Type वाहन प्रकार (*Pl. tick* कृपया टिक करें): **Small Car (< 1400cc)** छोटा कार (<1400 सीसी) **/ Big Car** बड़ी कार

   b. Make (model year) of the vehicle वाहन निर्माण का साल :________

2. Gender लिंग: **Male** पुरुष / **Female** स्त्री

   b. Age of the Respondent: प्रतिवादी की आयु: __________ **years वर्ष**

3. Monthly Income Range of the passenger (in Rs.) मासिक आय सीमा (रुपए में): *(Pl. tick the appropriate only: कृपया उचित पर टिक करें)* **1) < 5,000 2) 5,001 - 15,000 3) 15,001 - 30,000 4) 30,001 - 50,000 5) 50,001 - 75,000 6) 75,001 - 1 Lakh लाख 7) 1 - 1.5 Lakh लाख 8) > 1.5 Lakh लाख**

4. Purpose of Trip यात्रा का उद्देश्य: **Work कार्य / Business व्यवसाय / Education शिक्षा / Social सामाजिक / Leisure आराम**

5. a. Total Journey Time for your entire trip आपके यात्रा पूरी करने के लिए कुल यात्रा समय: _____ **mins** मिनट.

   b. Time taken on the BRT Corridor बी.आर.टी.कॉरिडोर पर लिया गया यात्रा समय: _____ **mins** मिनट.

6. Place of Entry and Intended Place of Exit on the BRT Corridor *(Pl. tick the given Junctions)*
   बी.आर.टी.कॉरिडोर पर अपने वाहन के प्रवेश स्थान / निकास स्थान (*कृपया दिया हुआ चौराहा / जंकशन पर टिक करें*)

Ambedkar Nagar	**Pushpa Bhavan**	**Press Enclave**	**Chirag Delhi**	**Siri Fort**	**Mool Chand**
अम्बेडकर नगर	**पुष्पा भवन**	**प्रेस एन्क्लेव**	**चिराग दिल्ली**	**सिरी फोर्ट**	**मूलचंद**
(Khanpur Jn.)	***(Birla School Jn.)***	***(Sheikh Sarai)***			
(खानपुर जं.)	(बिरला स्कूल)	**(शेख सराय)**			

7. Frequency of Travel by present mode on BRT corridor बी.आर.टी. गलियारे पर साधन द्वारा यात्रा की साप्ताहिक आवृत्ति *(Pl. Tick the appropriate only* कृपया उचित पर टिक करें):
   Daily दैनिक / 4-5 times a week हफ्ते में 4 से 5 बार / Thrice a week हफ्ते में 3 बार / Weekly साप्ताहिक / Occasional आकस्मिक

8. Before the introduction of BRT, what was your mode of commute बी.आर.टी.के प्रारंभ से पहले, आपके आने के साधन क्या था? *(Pl. tick the appropriate only* कृपया उचित पर टिक करें):
   Bus बस / Cycle साइकिल / Two Wheeler दो व्हीलर / Auto Rickshaw ऑटोरिक्शा / Taxis टैक्सी / Car कार

9. a. Have you ever travelled on the BRT Corridor by Bus? क्या आपने कभी BRT कॉरिडोर पर बस से यात्रा की है?

(Pl. tick the appropriate only कृपया उचित पर टिक करें): **Yes हां / No नहीं**

b. What are the reaso*n(s)* for continuing to use car for your trip? इस जे.बी.टीटो मार्ग पर यात्रा करने के लिए अपने कार का उपयोग जारी रखने के कारण(ओं) क्या हैं? *(Pl. tick the appropriate one[s]* कृपया उचित पर टिक करें):

No alternative route / Captive User / Limited coverage of BRT / Multi-Purpose Trips / Non Reliability of PT
कोई वैकल्पिक मार्ग नहीं/ बंदी उपयोगकर्ता/बी.आर.टी. की सीमित लंबाई / बहु उद्देश्यीय यात्रा के लिए / सार्वजनिक परिवहन की गैर विश्वसनीयता

c. If BRT if extended up to Delhi Gate, would you be inclined to shift? यदि बी.आर.टी. अगर दिल्ली गेट तक बढ़ाया, आप
यात्रा में बदलाव करने केलिए इच्छुक कहोंगे? *((Pl. tick the appropriate only* कृपया उचित पर टिक करें): **Yes हां / No नहीं**

(P.T.O)

10. Is there a variation in your journey time by car since the introduction of BRT? / इस सड़क पर बी.आर.टी.की शुरूआत के
बाद से अपने कार साधन द्वारा यात्रा समय में बदलाव है? **Yes हां / No नहीं**
If Yes, quantum of increase in Journey Time due to delays यदि हाँ, देरी की वजह से यात्रा के समय में वृद्धि की मात्रा:
_______***(mins*** मिनट में)

11. How much value do you attach to the Time Loss indicated by you in question No.10
प्रश्न No.10 में आप द्वारा संकेत समय की हानि की कितना मूल्य हैं? : Rs. रु._________

12. How do you rate this road stretch in terms of the following parameters for travel on present mode?
आप निम्नलिखित मानकों के संदर्भ में बी.आर.टी.गलियारे का मूल्यांकन कैसे करेंगे ?

Speed (गति)		Safety (सुरक्षा)		Comfort / Convenience आराम और सुविधा		Cost Saving लागत बचत	

Note: Very Bad बहुत बुरा - 1; Bad बुरा - 2; Average औसत - 3; Good अच्छा - 4; Very Good बहुत अच्छा - 5

13. How do you rate the overall traffic situation on this corridor before BRT (pre April 2008) and after BRT? कुल मिलाकर, आप इस गलियारे पर पूरे यातायात की स्थिति का बी.आर.टी के **पहले** / बी.आर.टी के **बाद** कैसे मूल्यांकन करेंगे? *(Pl. tick the appropriate only* कृपया उचित पर टिक करें*)*

<u>a. Before BRT (pre April 2008)</u> <u>बी.आर.टी के **पहले**</u>

Very Bad बहुत बुरा / Bad बुरा /Average औसत*/Good अच्छा / Very Good बहुत अच्छा

<u>b. After BRT</u> <u>बी.आर.टी के **बाद**</u>

Very Bad बहुत बुरा / Bad बुरा / Same as before यानी पहले की तरह ही / Good अच्छा / Very Good बहुत अच्छा

14. Any other Remarks कोई भी अन्य टिप्पणी

Checked by

CSIR - CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI

सीएसआईआर - केंद्रीय सड़क अनुसंधान संस्थान, नई दिल्ली

Evaluating Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Moolchand, Delhi

बस रैपिड ट्रांजिट (बी.आर.टी.) अंबेडकरनगर से मूलचंद कॉरिडोर, दिल्ली का प्रदर्शन का मूल्यांकन

Sponsored by Transport Department, Government of NCT of Delhi

परिवहन विभाग, राष्ट्रीय राजधानी क्षेत्रकी दिल्ली सरकारद्वारा प्रायोजित

TW
दो व्हीलर

User Perception Survey - Two Wheeler Passengers

उपयोगकर्ता की धारणा का सर्वेक्षण- दो व्हीलर यात्री

संख्या Sample No.

Name of the Location on J.B. Tito Marg जे.बी. टीटो मार्ग पर स्थान का नाम: ____________________

Date दिनांक: ____________

Time of Survey with respondent प्रतिवादी के साथ सर्वेक्षण का समय: _____hrs घंटा ______mins मिनट

Direction of Travel यात्रा की दिशा: From आरंभसे ____________________ To तक ________________

Name of the Enumerator गणनाकार का नाम: ____________________

1. a. Vehicle Type वाहन प्रकार (*Pl. tick* कृपया टिक करें):
   Scooter स्कूटर / **Two Stroke Motor Cycle (MC)** दोस्ट्रोक मोटर साइकिल (एमसी) / **Four Stroke MC** चार स्ट्रोक एम सी

   b. Make (model year) of the vehicle वाहन निर्माण का साल :________

2. Gender लिंग: **Male** पुरुष / **Female** स्त्री
   b. Age of the Respondent: प्रतिवादी की आयु: __________ **years वर्ष**
3. Monthly Income Range of the passenger (in Rs.) मासिक आय सीमा (रुपए में): (*Pl. tick the appropriate only:* *कृपया उचित पर टिक करें*) **1) < 5,000 2) 5,001 - 15,000 3) 15,001 - 30,000 4) 30,001 - 50,000 5) 50,001 - 75,000 6) 75,001 - 1 Lakh लाख 7) 1 - 1.5 Lakh लाख 8) > 1.5 Lakh लाख**
4. Purpose of Trip यात्रा का उद्देश्य: **Work कार्य / Business व्यवसाय / Education शिक्षा / Social सामाजिक / Leisure आराम**
5. a. Total Journey Time for your entire trip आपके यात्रा पूरी करने के लिए कुल यात्रा समय: _____ **mins** मिनट.
   b. Time taken on the BRT Corridor बी.आर.टी.कॉरिडोर पर लिया गया यात्रा समय: _____ **mins** मिनट.
6. Place of Entry and Intended Place of Exit on the BRT Corridor (*Pl. tick the given Junctions*) बी.आर.टी.कॉरिडोर पर अपने वाहन के प्रवेश स्थान / निकास स्थान (*कृपया दिया हुआ चौराहा / जंकशन पर टिक करें*)

Ambedkar Nagar	Pushpa Bhavan	Press Enclave	Chirag Delhi	Siri Fort	Mool Chand
अम्बेडकर नगर	पुष्पा भवन	प्रेस एन्क्लेव	चिराग दिल्ली	सिरी फोर्ट	मूलचंद
(Khanpur Jn.) (खानपुर जं.)	(Birla School Jn.) (बिरला स्कूल)	(Sheikh Sarai) (शेख सराय)			

7. Frequency of Travel by present mode on BRT corridor बी.आर.टी. गलियारे पर साधन द्वारा यात्रा की साप्ताहिक आवृत्ति (*Pl. Tick the appropriate only* कृपया उचित पर टिक करें):
   Daily दैनिक / 4-5 times a week हफ्ते में 4 से 5 बार / Thrice a week हफ्ते में 3 बार / Weekly साप्ताहिक / Occasional आकस्मिक
8. Before the introduction of BRT, what was your mode of commute बी.आर.टी.के प्रारंभ से पहले, आपके आने के साधन क्या था? (*Pl. tick the appropriate only* कृपया उचित पर टिक करें):
   Bus बस / Cycle साइकिल / Two Wheeler दो व्हीलर / Auto Rickshaw ऑटोरिक्शा / Taxis टैक्सी / Car कार

9. a. Have you ever travelled on the BRT Corridor by Bus? क्या आपने कभी BRT कॉरिडोर पर बस से यात्रा की है?
   (Pl. tick the appropriate only कृपया उचित पर टिक करें): **Yes हां / No नहीं**

   b. What are the reaso*n(s)* for continuing to use car for your trip*?* इस जे.बी.टीटो मार्ग पर यात्रा करने के लिए अपने कार का उपयोग जारी रखने के कारण(ओं) क्या हैं? *(Pl. tick the appropriate one[s]* कृपया उचित पर टिक करें):

   No alternative route / Captive User / Limited coverage of BRT / Multi-Purpose Trips / Non Reliability of PT कोई वैकल्पिक मार्ग नहीं/ बंदी उपयोगकर्ता/बी.आर.टी. की सीमित लंबाई / बहु उद्देश्यीय यात्रा के लिए / सार्वजनिक परिवहन की गैर विश्वसनीयता

   c. If BRT if extended up to Delhi Gate, would you be inclined to shift? यदि बी.आर.टी. अगर दिल्ली गेट तक बढ़ाया, आप यात्रा में बदलाव करने केलिए इच्छु कहोंगे? *((Pl. tick the appropriate only* कृपया उचित पर टिक करें):**Yes हां / No नहीं**

(P.T.O)

10. Is there a variation in your journey time by two wheeler since the introduction of BRT? / इस सड़क पर बी.आर.टी.की शुरूआत के बाद से अपने दो व्हीलर साधन द्वारा यात्रा समय में बदलाव है? **Yes हां / No नहीं**

    If Yes, quantum of increase in Journey Time due to delays यदि हाँ, देरी की वजह से यात्रा के समय में वृद्धि की मात्रा: ________*(mins* मिनट में)

11. How much value do you attach to the Time Loss indicated by you in question No.10 प्रश्न No.10 में आप द्वारा संकेत समय की हानि की कितना मूल्य हैं? : Rs. रु.________

12. How do you rate this road stretch in terms of the following parameters for travel on present mode? आप निम्नलिखित मानकों के संदर्भ में बी.आर.टी.गलियारे का मूल्यांकन कैसे करेंगे ?

Speed (गति)		**Safety (सुरक्षा)**		**Comfort / Convenience आराम और सुविधा**		**Cost Saving लागत बचत**	

Note: Very Bad बहुत बुरा - 1; Bad बुरा - 2; Average औसत - 3; Good अच्छा - 4; Very Good बहुत अच्छा - 5

13. How do you rate the overall traffic situation on this corridor **'before' and 'after'** the experimental run of opening the BRT Corridor for other vehicles? कुल मिलाकर, आप इस गलियारे पर पूरे यातायात की स्थिति का प्रयोगात्मक रन से **'पहले' और 'के बाद'** (अन्य वाहनों के लिए बी.आर.टी. कॉरिडोर खोलने पर) कैसे मूल्यांकन करेंगे? *(Pl. tick the appropriate only* कृपया उचित पर टिक करें*)*

    a. Before the Experimental Run प्रयोगात्मक रन से पहले'

    Very Bad बहुत बुरा / Bad बुरा /Average औसत*/Good अच्छा / Very Good बहुत अच्छा

    b. After the start of Experimental Run प्रयोगात्मक रन 'के बाद'

    Very Bad बहुत बुरा / Bad बुरा / Same as before यानी पहले की तरह ही */Good अच्छा / Very Good बहुत अच्छा

15. Any other Remarks कोई भी अन्य टिप्पणी

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सीएसआईआर - केंद्रीय सड़क अनुसंधान संस्थान, नई दिल्ली

Evaluating Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Moolchand, Delhi

बस रैपिड ट्रांजिट (बी.आर.टी.) अंबेडकरनगर से मूलचंद कॉरिडोर, दिल्ली का प्रदर्शन का मूल्यांकन

CSIR सीआरआरआई

Sponsored by Transport Department, Government of NCT of Delhi
परिवहन विभाग, राष्ट्रीय राजधानी क्षेत्रकी दिल्ली सरकारद्वारा प्रायोजित

IPT Mode
ऑटोरिक्शा / टैक्सी

User Perception Survey - Auto / Taxi Passengers

उपयोगकर्ता की धारणा का सर्वेक्षण- ऑटोरिक्शा / टैक्सी यात्री

नमूना संख्या Sample No.

Name of the Location on J.B. Tito Marg जे.बी. टीटो मार्ग पर - स्थान का नाम: ______________________

Date दिनांक: ______________

Time of Survey with respondent प्रतिवादी के साथ सर्वेक्षण का समय: _____hrs घंटा ______mins मिनट

Direction of Travel यात्रा की दिशा: From आरंभसे ____________________ To तक ____________________

Name of the Enumerator गणनाकार का नाम: ______________________

1. a. Vehicle Type वाहन प्रकार (*Pl. tick* कृपया टिक करें): **Auto Rickshaw** ऑटो रिक्शा / **Taxi** टैक्सी
   b. Make (model year) of the vehicle वाहन निर्माण का साल *(only for Taxi* केवल टैक्सी के लिए*)*:________
2. Gender लिंग: **Male** पुरुष / **Female** स्त्री
   b. Age of the Respondent: प्रतिवादी की आयु: __________ **years वर्ष**
3. Monthly Income Range of the passenger (in Rs.) मासिक आय सीमा (रुपए में): *(Pl. tick the appropriate only: कृपया उचित पर टिक करें)*. **1) < 5,000 2) 5,001 - 15,000 3) 15,001 - 30,000 4) 30,001 - 50,000 5) 50,001 - 75,000 6) 75,001 - 1 Lakh लाख 7) 1 - 1.5 Lakh लाख 8) > 1.5 Lakh लाख**
4. Purpose of Trip यात्रा का उद्देश्य: **Work कार्य / Business व्यवसाय / Education शिक्षा / Social सामाजिक / Leisure आराम**
5. a. Total Journey Time for your entire trip आपके यात्रा पूरी करने के लिए कुल यात्रा समय: ______ **mins मिनट.**
   b. Time taken on the BRT Corridor बी.आर.टी.कॉरिडोर पर लिया गया यात्रा समय: _____ **mins मिनट.**
6. Place of Entry and Intended Place of Exit on the BRT Corridor *(Pl. tick the given Junctions)*
   बी.आर.टी.कॉरिडोर पर अपने वाहन के प्रवेश स्थान / निकास स्थान (*कृपया दिया हुआ चौराहा / जंकशन पर टिक करें*)

Ambedkar Nagar	Pushpa Bhavan	Press Enclave	Chirag Delhi	Siri Fort	Mool Chand
अम्बेडकर नगर	**पुष्पा भवन**	**प्रेस एन्क्लेव**	**चिराग दिल्ली**	**सिरी फोर्ट**	**मूलचंद**
(Khanpur Jn.)	***(Birla School Jn.)***	***(Sheikh Sarai)***			
(खानपुर जं.)	**(बिरला स्कूल)**	**(शेख सराय)**			

7. Frequency of Travel by present mode on BRT corridor बी.आर.टी. गलियारे पर साधन द्वारा यात्रा की साप्ताहिक आवृत्ति *(Pl. Tick the appropriate only* कृपया उचित पर टिक करें):
   Daily दैनिक / 4-5 times a week हफ्ते में 4 से 5 बार / Thrice a week हफ्ते में 3 बार / Weekly साप्ताहिक / Occasional आकस्मिक
8. Before the introduction of BRT, what was your mode of commute बी.आर.टी.के प्रारंभ से पहले, आपके आने के साधन क्या था? *(Pl. tick the appropriate only* कृपया उचित पर टिक करें):
   Bus बस / Cycle साइकिल / Two Wheeler दो व्हीलर / Auto Rickshaw ऑटोरिक्शा / Taxis टैक्सी / Car कार
9. What are the reason*(s)* for continuing to use Auto / Taxi for your trip? *(Pl. tick the appropriate one[s])*
   इस जे.बी.टीटो मार्ग पर यात्रा करने के लिए अपने **ऑटोरिक्शा / टैक्सी** का उपयोग जारी रखने के कारण(ओं) क्या हैं? (कृपया उचित पर टिक करें):

No alternative route / Captive User / Limited coverage of BRT / Multi-Purpose Trips / Non Reliability of PT
कोई वैकल्पिक मार्ग नहीं/ बंदी उपयोगकर्ता/बी.आर.टी. की सीमित लंबाई / बहु उद्देश्यीय यात्रा के लिए / सार्वजनिक परिवहन की गैर विश्वसनीयता

10. Is there a variation in your journey time by Auto / Taxi since the introduction of BRT? / इस सड़क पर बी.आर.टी.की शुरूआत के बाद से अपने **ऑटोरिक्शा / टैक्सी** साधन द्वारा यात्रा समय में बदलाव है? **Yes हां / No नहीं**

If Yes, quantum of increase in Journey Time due to delays यदि हाँ, देरी की वजह से यात्रा के समय में वृद्धि की मात्रा:
________***(mins** मिनट में**)***

11. How much value do you attach to the Time Loss indicated by you in question No.10
प्रश्न No.10 में आप द्वारा संकेत समय की हानि की कितना मूल्य हैं? : Rs. रु.________

(P.T.O)

12. How do you rate this road stretch in terms of the following parameters for travel on present mode?
आप निम्नलिखित मानकों के संदर्भ में बी.आर.टी.गलियारे का मूल्यांकन कैसे करेंगे ?

Speed (गति)		**Safety (सुरक्षा)**		**Comfort / Convenience आराम और सुविधा**		**Cost Saving लागत बचत**	

Note: Very Bad बहुत बुरा - 1; Bad बुरा - 2; Average औसत - 3; Good अच्छा - 4; Very Good बहुत अच्छा - 5

13. How do you rate the overall traffic situation on this corridor before BRT (pre April 2008) and after BRT? कुल मिलाकर, आप इस गलियारे पर पूरे यातायात की स्थिति का बी.आर.टी के **पहले** / बी.आर.टी के **बाद** कैसे मूल्यांकन करेंगे? *(Pl. tick the appropriate only* कृपया उचित पर टिक करें*)*

<u>a. Before BRT (pre April 2008)</u> <u>बी.आर.टी के पहले</u>

Very Bad बहुत बुरा / Bad बुरा /Average औसत*/Good अच्छा / Very Good बहुत अच्छा

<u>b. After BRT</u> <u>बी.आर.टी के बाद</u>

Very Bad बहुत बुरा / Bad बुरा / Same as before यानी पहले की तरह ही / Good अच्छा / Very Good बहुत अच्छा

14. Any other Remarks कोई भी अन्य टिप्पणी

15.

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सीएसआईआर - केंद्रीय सड़क अनुसंधान संस्थान, नई दिल्ली
Evaluating Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Moolchand, Delhi
बस रैपिड ट्रांजिट (बी.आर.टी.) अंबेडकरनगर से मूलचंद कॉरिडोर, दिल्ली का प्रदर्शन का मूल्यांकन

CSIR सीआरआरआई

Sponsored by Transport Department, Government of NCT of Delhi
परिवहन विभाग, राष्ट्रीय राजधानी क्षेत्रकी दिल्ली सरकारद्वारा प्रायोजित

Bus
बस

User Perception Survey - Bus Passengers
उपयोगकर्ता की धारणा का सर्वेक्षण- बस यात्री

ooooo संख्या Sample No.

Name of the Location on J.B. Tito Marg जे.बी. टीटो मार्ग पर स्थान का नाम: ____________________

Date दिनांक: ______________

Time of Survey with respondent प्रतिवादी के साथ सर्वेक्षण का समय: _____hrs घंटा ______mins मिनट

Direction of Travel यात्रा की दिशा: From आरंभसे ____________________ To तक ____________________

Name of the Enumerator गणनाकार का नाम: ____________________

1. Bus Route No: बस मार्ग संख्या: ________
2. Gender लिंग: **Male** पुरुष / **Female** स्त्री
   b. Age of the Respondent: प्रतिवादी की आयु: __________ **years वर्ष**
3. Monthly Income Range of the passenger (in Rs.) मासिक आय सीमा (रुपए में): *(Pl. tick the appropriate only: कृपया उचित पर टिक करें)* **1) < 5,000 2) 5,001 - 15,000 3) 15,001 - 30,000 4) 30,001 - 50,000 5) 50,001 - 75,000 6) 75,001 - 1 Lakh लाख 7) 1 - 1.5 Lakh लाख 8) > 1.5 Lakh लाख**
4. Purpose of Trip यात्रा का उद्देश्य: **Work कार्य / Business व्यवसाय / Education शिक्षा / Social सामाजिक / Leisure आराम**
5. a. Total Journey Time for your entire trip आपके यात्रा पूरी करने के लिए कुल यात्रा समय: _____ **mins** मिनट.
   b. Time taken on the BRT Corridor बी.आर.टी.कॉरिडोर पर लिया गया यात्रा समय: _____ **mins** मिनट.
6. Place of Entry and Intended Place of Exit on the BRT Corridor *(Pl. tick the given Junctions)* बी.आर.टी.कॉरिडोर पर अपने वाहन के प्रवेश स्थान / निकास स्थान *(कृपया दिया हुआ चौराहा / जंकशन पर टिक करें)*

Ambedkar Nagar	Pushpa Bhavan	Press Enclave	Chirag Delhi	Siri Fort	Mool Chand
अम्बेडकर नगर	पुष्पा भवन	प्रेस एन्क्लेव	चिराग दिल्ली	सिरी फोर्ट	मूलचंद
(Khanpur Jn.)	*(Birla School Jn.)*	*(Sheikh Sarai)*			
(खानपुर जं.)	(बिरला स्कूल)	(शेख सराय)			

7. Frequency of Travel by present mode on BRT corridor बी.आर.टी. गलियारे पर साधन द्वारा यात्रा की साप्ताहिक आवृत्ति *(Pl. Tick the appropriate only कृपया उचित पर टिक करें)*:
   Daily दैनिक / 4-5 times a week हफ्ते में 4 से 5 बार / Thrice a week हफ्ते में 3 बार / Weekly साप्ताहिक / Occasional आकस्मिक
8. Before the introduction of BRT, what was your mode of commute बी.आर.टी.के प्रारंभ से पहले, आपके आने के साधन क्या था? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*:
   Bus बस / Cycle साइकिल / Two Wheeler दो व्हीलर / Auto Rickshaw ऑटोरिक्शा / Taxis टैक्सी / Car कार
9. a. How do you access/ catch the BRT Bus? आप बी.आर.टी. गलियारे पर बस कैसे पकड़ते हैं? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*

Walk चलताहुआ / Cycle साइकिल / Bus बस / Two Wheeler दोव्हीलर / Car कार / Others *(pl specify)* अन्य *(कृपया निर्दिष्ट करें)*

b. What is your mode to reach the destination after alighting the Bus? बस उतर ने के बाद गंतव्य तक पहुंच ने के लिए आपके साधन क्या है? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*

Walk चलताहुआ / Cycle साइकिल / Bus बस / Two Wheeler दोव्हीलर / Car कार / Others अन्य *(pl specify कृपया निर्दिष्ट करें)*

10. What are the reason(s) for using theBRT bus? बस का उपयोग करने के लिए कारण (ओं) क्या हैं? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*

Proximity / Frequency in Schedule / Affordability Issues / Traffic Congestion / Safety / Rising Fuel Prices
निकटता / अनुसूची में आवृत्ति / किफायती / यातायात जमाव / सुरक्षा / वर्धितई धन की कीमत

(P.T.O)

11. a. Has the commute on BRT benefited during your travel on this corridor? क्या बी.आर.टी. गलियारे पर नियमित यात्रा के दौरान आपको लाभान्वित किया है? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*: **Yes हां / No नहीं**

b. If Yes, is it in terms of यदि हां, इसेके संदर्भ में है *(please tick the appropriate one[s] उपयुक्त एक टिककरें)*

Time Savings / Cost Savings / Enhanced Safety / Comfort / Reliability
समय बचत / लागत बचत / बढ़ी सुरक्षा / सुविधा / विश्वसनीयता

c. If No, is it in terms of यदि नहीं, इसेके संदर्भ में है *(please tick the appropriate one[s] उपयुक्त एक टिककरें)*

Increased Cost / Increased Tra. Time / Deterioration in Safety / Deterioration in Comfort / Poor Reliability
बढ़ती लागत / यात्रा समय में वृद्धि / सुरक्षा में गिरावट / सुविधा में गिरावट / विश्वसनीयता मेंगिरावट

12. What configuration of Bus Stop location is safer from your usage perspective? आपके उपयोग के नजरिए से कौनसा बस स्टॉप स्थान के व्यवस्था का प्रारूप सुरक्षित है? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*:

Kerbside (left side) फुटपाथ दिशा (बाईंओर)/ Centre of the road सड़क के केंद्र

13. Are you a user of the Bike / Bicycle Rental facility provided on the corridor? क्या आप गलियारे में किराया पर बाइक/ साइकिल प्रदान की सुविधा के उपयोगकर्ता हैं? **Yes हां / No नहीं**

14. How do you rate the overall traffic situation on this corridor before BRT (pre April 2008) and after BRT? कुल मिलाकर, आप इस गलियारे पर पूरे यातायात की स्थिति का बी.आर.टी के **पहले** / बी.आर.टी के **बाद** कैसे मूल्यांकन करेंगे? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*

a. Before BRT (pre April 2008) बी.आर.टी के **पहले**

Very Bad बहुत बुरा / Bad बुरा /Average औसत*/Good अच्छा / Very Good बहुत अच्छा

b. After BRT बी.आर.टी के **बाद**

Very Bad बहुत बुरा / Bad बुरा / Same as before यानी पहले की तरह ही / Good अच्छा / Very Good बहुत अच्छा

15. Any other Remarks कोई भी अन्य टिप्पणी

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सीएसआईआर - केंद्रीय सड़क अनुसंधान संस्थान, नई दिल्ली
Evaluating Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Moolchand, Delhi
बस रैपिड ट्रांजिट (बी.आर.टी.) अंबेडकरनगर से मूलचंद कॉरिडोर, दिल्ली का प्रदर्शन का मूल्यांकन

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Cycle
साइकिल

User Perception Survey - Cycle Passengers
उपयोगकर्ता की धारणा का सर्वेक्षण- साइकिल यात्री

संख्या
Sample No.

Name of the Location on J.B. Tito Marg जे.बी. टीटो मार्ग पर स्थान का नाम: ________________________

Date दिनांक: ______________

Time of Survey with respondent प्रतिवादी के साथ सर्वेक्षण का समय:_____hrs घंटा ______mins मिनट

Direction of Travel यात्रा की दिशा: From आरंभसे ______________________ To तक ____________________

Name of the Enumerator गणनाकार का नाम: ____

1. a. Gender लिंग: **Male** पुरुष / **Female** स्त्री
   b. Age of the Respondent: प्रतिवादी की आयु: __________ **years वर्ष**

2. Monthly Income Range of the passenger (in Rs.) मासिक आय सीमा (रुपए में): *(Pl. tick the appropriate only: कृपया उचित पर टिक करें)*. **1) < 5,000 2) 5,001 - 15,000 3) 15,001 - 30,000 4) 30,001 - 50,000 5) 50,001 - 75,000 6) 75,001 - 1 Lakh लाख 7) 1 - 1.5 Lakh लाख 8) > 1.5 Lakh लाख**

3. Purpose of Trip यात्रा का उद्देश्य: **Work कार्य / Business व्यवसाय / Education शिक्षा / Social सामाजिक / Leisure आराम**

4. a. Total Journey Time for your entire trip आपके यात्रा पूरी करने के लिए कुल यात्रा समय: _____ **mins** मिनट.
   b. Time taken on the BRT Corridor बी.आर.टी.कॉरिडोर पर लिया गया यात्रा समय: _____ **mins** मिनट.

5. Place of Entry and Intended Place of Exit on the BRT Corridor *(Pl. tick the given Junctions)*
   बी.आर.टी.कॉरिडोर पर अपने वाहन के प्रवेश स्थान / निकास स्थान *(कृपया दिया हुआ चौराहा / जंकशन पर टिक करें)*

Ambedkar Nagar	Pushpa Bhavan	Press Enclave	Chirag Delhi	Siri Fort	Mool Chand
अम्बेडकर नगर	पुष्पा भवन	प्रेस एन्क्लेव	चिराग दिल्ली	सिरी फोर्ट	मूलचंद
(Khanpur Jn.)	*(Birla School Jn.)*	*(Sheikh Sarai)*			
(खानपुर जं.)	(बिरला स्कूल)	(शेख सराय)			

6. Frequency of Travel by present mode on BRT corridor बी.आर.टी. गलियारे पर साधन द्वारा यात्रा की साप्ताहिक आवृत्ति *(Pl. Tick the appropriate only कृपया उचित पर टिक करें)*:
   Daily दैनिक / 4-5 times a week हफ्ते में 4 से 5 बार / Thrice a week हफ्ते में 3 बार / Weekly साप्ताहिक / Occasional आकस्मिक

7. Before the introduction of BRT, what was your mode of commute बी.आर.टी.के प्रारंभ से पहले, आपके आने के साधन क्या था? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*:
   Bus बस / Cycle साइकिल / Two Wheeler दो व्हीलर / Auto Rickshaw ऑटोरिक्शा / Taxis टैक्सी / Car कार

8. a. Have you ever travelled on the BRT Corridor by Bus? क्या आपने कभी BRT कॉरिडोर पर बस से यात्रा की है? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*: **Yes हां / No नहीं**
   b. What are the reason*(s)* for continuing to use Cycle for your trip? इस जे.बी.टीटो मार्ग पर यात्रा करने के लिए अपने साइकिल का उपयोग जारी रखने के कारण(ओं) क्या हैं? *(Pl. tick the appropriate one[s] कृपया उचित पर टिक करें)*:

No alternative route / Captive User / Limited coverage of BRT / Multi-Purpose Trips / Non Reliability of PT
कोई वैकल्पिक मार्ग नहीं/ बंदी उपयोगकर्ता/बी.आर.टी. की सीमित लंबाई / बहु उद्देश्यीय यात्रा के लिए / सार्वजनिक परिवहन की गैर विश्वसनीयता

c. If BRT if extended up to Delhi Gate, would you be inclined to shift? यदि बी.आर.टी. अगर दिल्ली गेट तक बढ़ाया, आप यात्रा में बदलाव करने केलिए इच्छु कहोंगे? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*: **Yes हां / No नहीं**

(P.T.O)

9. Is there a variation in your journey time by Cycle since the introduction of BRT? / इस सड़क पर बी.आर.टी.की शुरूआत के बाद से अपने साइकिल साधन द्वारा यात्रा समय में बदलाव है? **Yes हां / No नहीं**

If Yes, quantum of increase in Journey Time due to delays यदि हाँ, देरी की वजह से यात्रा के समय में वृद्धि की मात्रा: ________*(mins मिनट में)*

10. How much value do you attach to the Time Loss indicated by you in question No.10 प्रश्न No.10 में आप द्वारा संकेत समय की हानि की कितना मूल्य हैं? : Rs. रु.________

11. How do you rate this road stretch in terms of the following parameters for travel on present mode? आप निम्नलिखित मानकों के संदर्भ में बी.आर.टी.गलियारे का मूल्यांकन कैसे करेंगे ?

Speed (गति)		Safety (सुरक्षा)		Comfort / Convenience आराम और सुविधा		Cost Saving लागत बचत	

Note: Very Bad बहुत बुरा - 1; Bad बुरा - 2; Average औसत - 3; Good अच्छा - 4; Very Good बहुत अच्छा - 5

12. How do you rate the overall traffic situation on this corridor before BRT (pre April 2008) and after BRT? कुल मिलाकर, आप इस गलियारे पर पूरे यातायात की स्थिति का बी.आर.टी के **पहले** / बी.आर.टी के **बाद** कैसे मूल्यांकन करेंगे? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*

a. Before BRT (pre April 2008) बी.आर.टी के पहले

Very Bad बहुत बुरा / Bad बुरा /Average औसत*/Good अच्छा / Very Good बहुत अच्छा

b. After BRT बी.आर.टी के बाद

Very Bad बहुत बुरा / Bad बुरा / Same as before यानी पहले की तरह ही / Good अच्छा / Very Good बहुत अच्छा

13. Any other Remarks कोई भी अन्य टिप्पणी

Checked by

CSIR - CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI
सीएसआईआर - केंद्रीय सड़क अनुसंधान संस्थान, नई दिल्ली
Evaluating Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Moolchand, Delhi
बस रैपिड ट्रांजिट (बी.आर.टी.) अंबेडकरनगर से मूलचंद कॉरिडोर, दिल्ली का प्रदर्शन का मूल्यांकन

CSIR Sponsored by Transport Department, Government of NCT of Delhi
परिवहन विभाग, राष्ट्रीय राजधानी क्षेत्रकी दिल्ली सरकारद्वारा प्रायोजित

Pedestrian
पैदल यात्री

User Perception Survey - **Pedestrians**
उपयोगकर्ता की धारणा का सर्वेक्षण- पैदल यात्री

संख्या Sample No.

Name of the Location on J.B. Tito Marg जे.बी. टीटो मार्ग पर स्थान का नाम: ______

Date दिनांक: ______

Time of Survey with respondent प्रतिवादी के साथ सर्वेक्षण का समय: _____hrs घंटा _____mins मिनट

Direction of Travel यात्रा की दिशा: From आरंभसे ______ To तक ______

Name of the Enumerator गणनाकार का नाम: ______

1. a. Gender लिंग: **Male** पुरुष / **Female** स्त्री
   b. Age of the Respondent: प्रतिवादी की आयु: ______ **years वर्ष**
2. Purpose of Walking on the Foot path फुट पथ पर चलना के उद्देश्य:
   Catchthe bus बस पकड़ना / **Work कार्य / Business व्यवसाय / Education शिक्षा / Social सामाजिक / Leisure** आराम
3. Location of Crossing the BRT Corridor .बी.आर.टी. कॉरिडोर पर प्रवेश स्थान *(Pl. tick the given Junction कृपया दिया हुआ चौराहा / जंकशन पर टिक करें)*

Ambedkar Nagar अम्बेडकर नगर ***(Khanpur Jn.)*** **(खानपुर जं.)** — **Pushpa Bhavan** पुष्पा भवन ***(Birla School Jn.)*** (बिरला स्कूल) — **Press Enclave** प्रेस एन्क्लेव ***(Sheikh Sarai)*** **(शेख सराय)** — **Chirag Delhi** चिराग दिल्ली — **Siri Fort** सिरी फोर्ट — **Mool Chand** मूलचंद

4. Are you satisfied with the adequacy of the Pedestrain Facility on the BRT corridor? क्या आप बी.आर.टी. गलियारे पर पैदल चलनेवालों की सुविधा की पर्याप्तता से संतुष्ट हैं? *(Pl. Tick the appropriate only):*
   a. Along the Road रोड के साथ: Very Bad बहुत बुरा / Bad बुरा /Average औसत*/Good अच्छा / Very Good बहुत अच्छा
   b. Across the Road रोडकेआर - पार: Very Bad बहुत बुरा / Bad बुरा /Average औसत*/Good अच्छा / Very Good बहुत अच्छा
5. How do you rate the BRT corridor in terms of the following parameters from Pedestrain Viewpoint?
   कुल मिला कर आप इस बी.आर.टी. गलियारे पर पैदल चलनेवालों की दृष्टि कोण को कैसे रेट करेंगे?

Safety (सुरक्षा)		Comfort / Convenience आराम और सुविधा	

Note: Very Bad बहुत बुरा - 1; Bad बुरा - 2; Average औसत - 3; Good अच्छा - 4; Very Good बहुत अच्छा - 5

6. What configuration of Bus Stop location is safer from your usage perspective? आपके उपयोग के नजरिए से कौनसा बस स्टॉप स्थान के व्यवस्था का प्रारूप सुरक्षित है? *(Pl. tick the appropriate only कृपया उचित पर टिक करें):*
   Kerbside (left side) फुटपाथ दिशा (बाईंओर)/ Centre of the road सड़क के केंद्र

7. a. Are you aware of the Bicycle Rental facility available on the BRT corridor? क्या आप बी.आर.टी. गलियारे पर उपलब्ध सुविधा किराए की साइकल के बारे में जानते हैं? *(Pl. tick the appropriate only* कृपया उचित पर टिक करें): **Yes हां / No नहीं**

   b. If yes, have you ever used the facility provided on the corridor? यदि **हां** आपने कभी गलियारे पर प्रदान की सुविधा का इस्तेमाल किया *(Pl. tick the appropriate only* कृपया उचित पर टिक करें): **Yes हां / No नहीं**

(P.T.O)

8. How do you rate the overall traffic situation on this corridor before BRT (pre April 2008) and after BRT? कुल मिलाकर, आप इस गलियारे पर पूरे यातायात की स्थिति का बी.आर.टी के **पहले** / बी.आर.टी के **बाद** कैसे मूल्यांकन करेंगे? *(Pl. tick the appropriate only कृपया उचित पर टिक करें)*

   <u>a. Before BRT (pre April 2008)</u> <u>बी.आर.टी के **पहले**</u>

   Very Bad बहुत बुरा / Bad बुरा /Average औसत*/Good अच्छा / Very Good बहुत अच्छा

   <u>b. After BRT</u> <u>बी.आर.टी के **बाद**</u>

   Very Bad बहुत बुरा / Bad बुरा / Same as before यानी पहले की तरह ही / Good अच्छा / Very Good बहुत अच्छा

9. Any other Remarks कोई भी अन्य टिप्पणी

Checked by

CSIR - CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI
Evaluating Bus Rapid Transit *(BRT)* Corridor Performance from Ambedkar Nagar to Moolchand, Delhi
Sponsored by
Transport Department, Government of NCT of Delhi.

User Perception Survey

User Perception Survey – Experimental Trial run as per the Court Order

Name of the Location on J.B. Tito Marg: ____________________
Date: ______________
Name of the Enumerator: ____

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1. Direction of Travel: Up / Down
   (Up: Ambedkar Nagar - Mool Chand Direction); Down: Ambedkar Nagar - Mool Chand Direction)
2. Vehicle Type *(Pl Tick)*: Car /Taxi/Two Wheeler/Auto/Bus Passenger/Bus Driver/Cycle/Pedestrians/Goods Vehicle
3. How do you feel about the Experimental Trial Run? **Very Good / Good /Same as before / Bad / Very Bad**
4. In Experimental trial run, how much change in your journey time after allowing right turning vehicles on BRT

   (Please tick the appropriate and mention time)

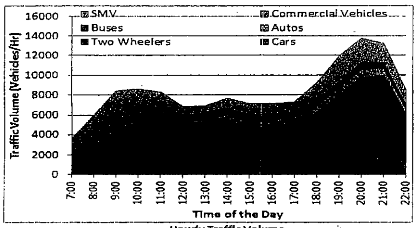
   Travel Time Saved *(.....................min)* / No Change / Travel Time Loss *(...................min)*

ANNEXURE-X: TRAFFIC VOLUME COUNT DATA AT INTERSECTIONS AND MID BLOCKS

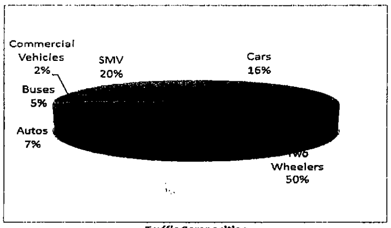
Classified Traffic Volume at Ambedkar Nagar Intersection (08.04.2012)

Road/ Intersection Name:	Ambedkar Nagar Junction			Intersection Code:	I-01
Date: 8.4.2012	Time Period:	From	06:00	To	22:00

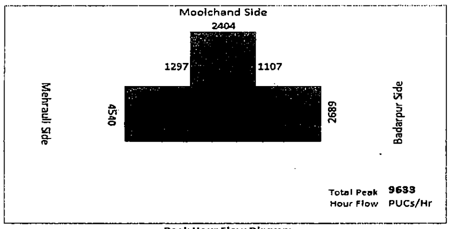
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-...)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	243	114	31	188	209	15	1535	39	30	0	1142	115	2404	1257	3661	2848
7:00	8:00	454	149	60	251	264	5	2294	103	64	12	2072	316	3656	2388	6044	4804
8:00	9:00	581	223	63	536	424	17	3384	95	71	3	2607	438	5396	3045	8441	6672
9:00	10:00	667	189	91	590	366	7	4023	89	50	3	2138	419	6075	2557	8632	6566
10:00	11:00	924	274	74	620	361	4	4590	107	69	20	930	345	7043	1275	8318	6579
11:00	12:00	1024	311	45	609	377	3	3351	86	61	2	703	286	5869	989	6858	5740
12:00	13:00	1072	331	42	611	389	2	3655	109	52	22	439	218	6286	657	6943	5823
13:00	14:00	1321	483	61	613	428	1	3577	129	45	19	729	286	6677	1015	7691	6596
14:00	15:00	1119	397	33	596	484	6	3133	144	48	21	974	196	5980	1170	7150	6207
15:00	16:00	1185	395	45	631	482	5	3252	99	51	11	831	181	6156	1012	7168	6149
16:00	17:00	1137	373	62	638	338	4	3660	78	60	12	703	238	6362	941	7303	5920
17:00	18:00	1072	471	62	736	359	5	4611	107	51	13	1384	381	7487	1765	9252	7189
18:00	19:00	1123	456	57	751	463	5	6319	71	42	11	2541	85	9298	2626	11924	8290
19:00	20:00	1304	540	65	841	541	7	7840	82	52	24	2380	87	11295	2467	13762	9633
20:00	21:00	1426	507	52	757	371	2	8021	86	38	14	1911	63	11273	1974	13247	8877
21:00	22:00	990	345	42	615	222	0	4700	52	17	8	1479	31	6991	1510	8501	5667
Total		15640	5559	885	9583	6078	88	67944	1476	801	195	22961	3685	108250	26646	134896	103560
															Peak Hour	13761.84	9633
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



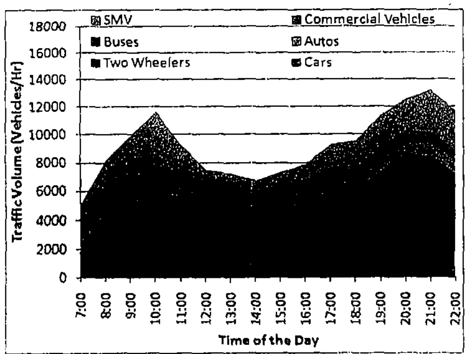
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Ambedkar Nagar Intersection (08.04.2012)

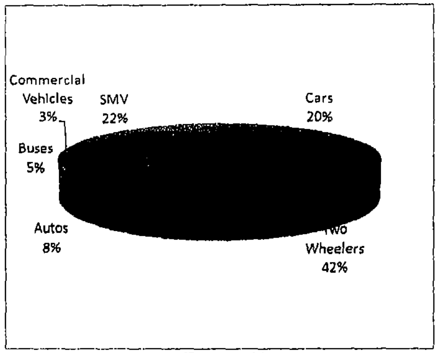
Classified Traffic Volume at Ambedkar Nagar Intersection (09.04.2012)

Road/ Intersection Name: Ambedkar Nagar Junction   Intersection Code: I-01
Date: 9.4.2012   Time Period: From 06:00 To 22:00

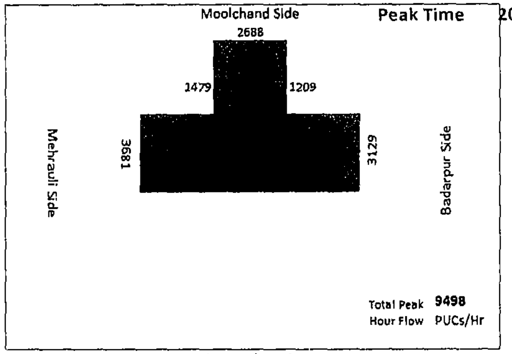
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV" (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Comme-rcial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	377	219	95	424	372	55	1750	72	52	15	1552	73	3431	1625	5056	4230
7:00	8:00	709	489	145	664	511	76	2784	176	64	3	2456	94	5621	2550	8172	6600
8:00	9:00	1031	639	127	868	525	43	3197	206	62	14	3152	51	6712	3203	9915	7705
9:00	10:00	1236	743	198	929	447	44	3921	251	80	21	3709	46	7870	3755	11624	8666
10:00	11:00	1077	617	201	805	463	63	3612	275	78	24	1940	66	7214	2006	9220	7443
11:00	12:00	1097	648	109	719	421	61	3309	194	72	11	791	38	6641	829	7470	6250
12:00	13:00	1025	606	223	561	363	24	3284	214	82	25	740	32	6406	772	7178	6015
13:00	14:00	906	461	153	517	261	25	3332	251	92	16	644	34	6013	678	6692	5379
14:00	15:00	958	604	117	719	317	30	3218	190	87	30	977	43	6270	1020	7291	5900
15:00	16:00	1018	625	149	784	347	23	3293	172	136	22	1190	43	6569	1233	7802	6352
16:00	17:00	962	725	203	838	341	39	4130	234	104	23	1593	74	7598	1667	9265	7166
17:00	18:00	1088	665	195	782	335	41	4079	177	70	15	1973	87	7447	2060	9507	7149
18:00	19:00	1307	966	203	921	405	43	4901	152	77	6	2270	89	8980	2359	11339	8465
19:00	20:00	1326	988	188	965	447	29	6064	143	59	19	2219	51	10229	2270	12499	9090
20:00	21:00	1558	936	216	1063	439	19	5691	153	56	13	2998	55	10145	3053	13198	9498
21:00	22:00	1285	781	210	999	346	7	4950	135	57	14	2812	36	8784	2848	11632	8213
Total		16959	10711	2732	12559	6340	622	61515	2995	1228	271	31015	912	115932	31927	147860	114121
															Peak Hour	13198	9498
															Peak Time	20:00	21:00



Hourly Traffic Volume



Traffic Composition



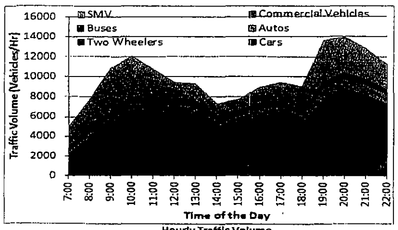
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Ambedkar Nagar Intersection (09.04.2012)

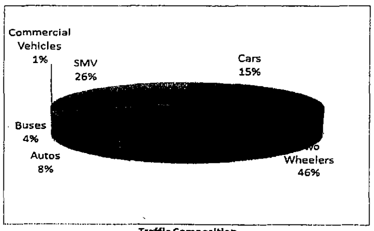
Classified Traffic Volume at Ambedkar Nagar Intersection (10-04-2012)

Road/ Intersection Name: Ambedkar Nagar Junction | Intersection Code: I-01
Date: 10.4.2012 | Time Period: From 06:00 To 22:00

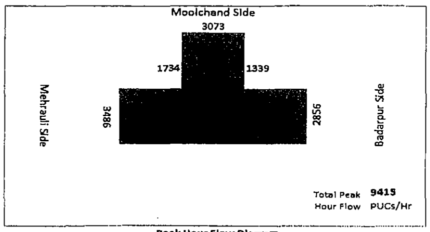
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	322	332	18	332	248	71	1543	60	39	7	2039	10	2972	2049	5021	3738
7:00	8:00	598	515	68	576	416	89	2651	129	34	5	2724	16	5081	2740	7821	5888
8:00	9:00	753	471	61	855	229	47	4017	112	14	0	4324	16	6559	4340	10898	6882
9:00	10:00	774	421	79	824	248	54	5400	206	9	2	4031	46	8018	4077	12094	7664
10:00	11:00	885	547	40	663	342	53	5019	148	9	0	3031	16	7706	3047	10753	7215
11:00	12:00	801	596	44	840	274	33	5000	134	20	0	1695	19	7741	1714	9455	6378
12:00	13:00	1053	759	67	841	303	38	4425	128	25	7	1651	37	7646	1688	9334	6676
13:00	14:00	903	639	65	563	229	48	3514	110	28	11	1175	32	6111	1207	7318	5355
14:00	15:00	844	645	65	708	369	39	3903	115	36	4	1036	23	6727	1059	7786	5887
15:00	16:00	939	665	38	960	330	24	4299	125	34	6	1538	17	7419	1555	8973	6416
16:00	17:00	943	662	58	953	347	21	4534	72	42	2	1772	30	7633	1802	9435	6667
17:00	18:00	927	587	48	898	235	26	3780	56	57	0	2405	14	6614	2419	9034	6131
18:00	19:00	1143	721	66	1150	424	21	5893	89	35	1	4034	45	9543	4079	13622	9105
19:00	20:00	1160	720	67	969	509	18	6890	96	15	0	3496	24	10444	3520	13964	9415
20:00	21:00	1070	639	61	1030	461	15	6433	59	6	3	3013	21	9777	3034	12811	8575
21:00	22:00	962	641	60	1066	385	5	5639	43	14	3	2464	13	8817	2477	11294	7555
Total		14075	9562	905	13226	5349	602	72939	1682	417	51	40428	379	118808	40807	159615	109547
															Peak Hour	13964	9415
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



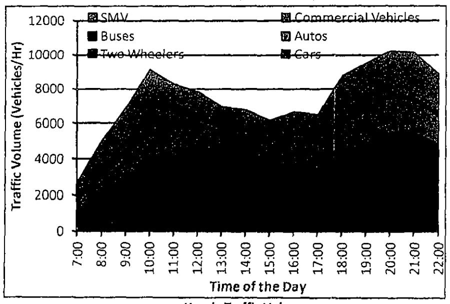
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Ambedkar Nagar Intersection (10-04-2012)

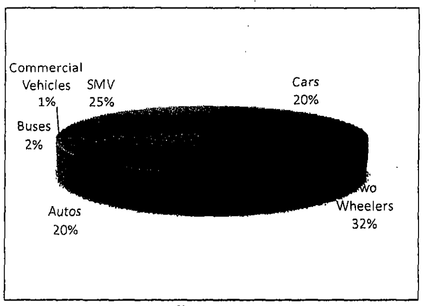
Classified Traffic Volume at Pushpa Bhawan Intersection (08.04.2012)

Road/ Intersection Name: Pushpa Bhawan Jn   Intersection Code: I-02
Date: 8.4.2012   Time Period: From 06:00 To 22:00

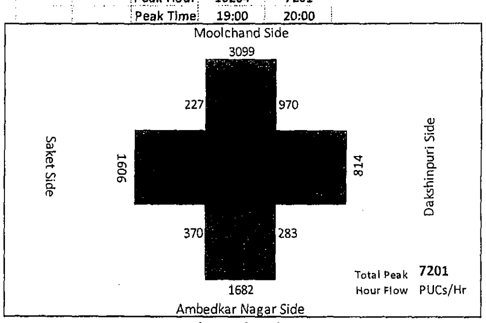
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	371	178	83	496	96	18	605	58	16	0	713	156	1921	869	2790	2301
7:00	8:00	592	259	82	899	162	20	1170	56	24	2	1548	218	3266	1766	5032	3858
8:00	9:00	710	399	98	1207	186	42	1848	38	4	1	2066	297	4533	2363	6896	5056
9:00	10:00	733	351	101	1359	183	30	2840	29	4	0	3298	192	5630	3490	9119	5967
10:00	11:00	971	477	79	1558	154	24	2608	40	5	0	2282	94	5916	2376	8292	5512
11:00	12:00	984	545	103	1670	160	15	2977	38	10	0	1220	112	6502	1332	7835	5379
12:00	13:00	1022	499	87	1645	138	22	2473	37	4	0	918	113	5927	1031	6958	4867
13:00	14:00	974	459	73	1435	111	18	2732	36	3	1	824	118	5842	942	6784	4665
14:00	15:00	924	390	59	1302	108	25	2343	31	4	0	860	134	5186	994	6180	4313
15:00	16:00	997	486	56	1674	110	10	2212	30	3	1	932	153	5579	1085	6664	4658
16:00	17:00	1030	508	42	1790	107	13	1896	31	2	0	947	137	5419	1084	6503	4563
17:00	18:00	1055	499	67	1908	122	14	2495	26	2	3	2218	366	6191	2584	8774	6109
18:00	19:00	1241	546	99	2056	119	3	2774	40	3	0	2236	412	6881	2648	9528	6673
19:00	20:00	1416	651	133	2006	156	19	3331	14	3	1	2178	356	7730	2534	10264	7201
20:00	21:00	1473	603	118	1854	113	18	3298	25	5	1	2297	363	7508	2660	10168	7068
21:00	22:00	1305	518	93	1621	83	9	2923	13	2	0	1994	311	6567	2305	8872	6095
Total		15798	7368	1373	24478	2108	300	38525	542	94	10	26532	3532	90596	30064	120660	84285
															Peak Hour	10264	7201
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



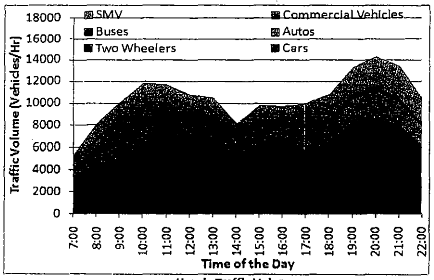
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Pushpa Bhawan Intersection(08.04.2012)

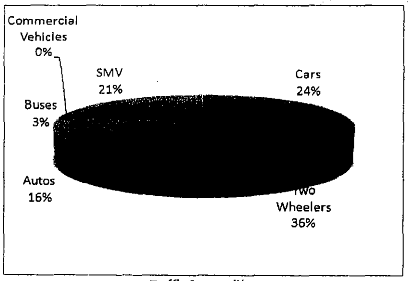
Classified Traffic Volume at Pushpa Bhawan Intersection (09.04.2012)

Road/ Intersection Name: Pushpa Bhawan Jn — Intersection Code: I-02
Date: 9.4.2012 — Time Period: From 06:00 To 22:00

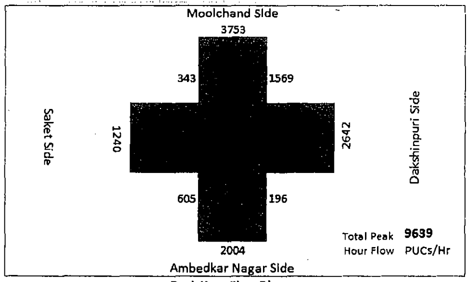
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	1085	403	173	507	174	84	1752	68	2	0	893	244	4248	1137	5385	4481
7:00	8:00	1240	483	198	973	299	140	2593	67	3	0	1926	332	5996	2258	8254	6547
8:00	9:00	1461	503	217	1326	199	78	2858	51	5	2	3071	361	6700	3432	10132	7345
9:00	10:00	1937	567	205	1404	174	42	3731	67	2	1	3380	398	8130	3778	11909	8459
10:00	11:00	1941	614	211	1550	198	48	4477	44	1	6	2300	304	9090	2604	11695	8300
11:00	12:00	1895	716	136	1554	311	32	4027	77	6	7	1879	159	8761	2038	10799	7941
12:00	13:00	1863	623	182	1993	320	40	3923	34	10	4	1332	177	8992	1509	10501	7765
13:00	14:00	1379	505	142	1376	250	33	3227	23	1	2	1116	147	6938	1263	8201	6025
14:00	15:00	1911	679	177	1619	308	68	3683	51	5	3	1156	175	8504	1331	9834	7477
15:00	16:00	1834	663	141	1602	241	42	3782	40	5	3	1228	137	8353	1365	9717	7092
16:00	17:00	1688	527	105	2031	211	37	3475	50	9	8	1768	108	8141	1876	10017	6999
17:00	18:00	1738	594	143	1974	161	50	3859	34	3	8	2160	86	8564	2246	10810	7298
18:00	19:00	2260	1006	211	2113	275	37	4898	27	3	10	2430	62	10840	2492	13332	9296
19:00	20:00	2410	798	185	2510	205	48	5310	34	4	11	2761	78	11515	2839	14354	9639
20:00	21:00	2155	697	273	2196	206	41	4849	33	4	6	2909	113	10460	3022	13482	9096
21:00	22:00	1701	478	206	1794	149	18	3810	29	8	2	2142	75	8195	2217	10412	6958
Total		28498	9856	2905	26522	3681	838	60254	729	71	73	32450	2956	133427	35406	168834	120718
															Peak Hour	14354	9639
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



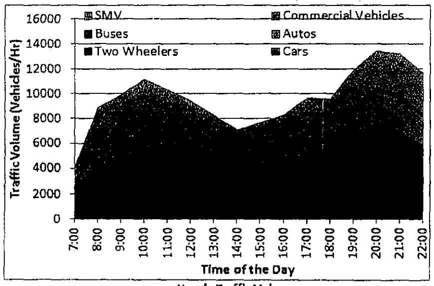
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Pushpa Bhawan Intersection (09.04.2012)

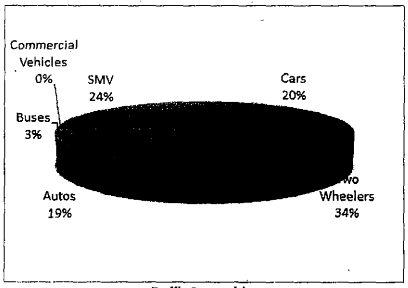
Classified Traffic Volume at Pushpa Bhawan Intersection(10-04-2012)

Road/ Intersection Name: Pushpa Bhawan Jn   Intersection Code: I-02
Date: 10.4.2012   Time Period: From 06:00 To 22:00

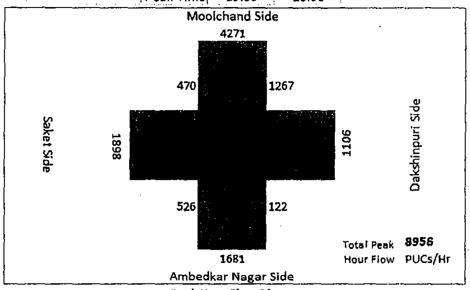
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	608	258	74	599	141	51	1018	52	7	2	1246	55	2810	1301	4110	3089
7:00	8:00	1299	516	118	1444	271	87	2284	38	5	3	2776	46	6065	2822	8887	6306
8:00	9:00	1291	586	68	1598	245	55	2780	43	3	3	3211	70	6672	3281	9953	6784
9:00	10:00	1366	516	53	1773	196	55	3798	38	0	0	3316	81	7795	3397	11191	7268
10:00	11:00	1155	520	51	1889	186	56	3647	21	2	0	2725	78	7527	2803	10330	6692
11:00	12:00	1490	579	58	1805	189	47	3406	11	1	3	1793	57	7589	1850	9439	6413
12:00	13:00	1331	521	84	1718	194	49	3093	9	1	0	1224	35	7000	1259	8259	5695
13:00	14:00	1173	472	47	1450	206	37	2496	16	2	1	1163	34	5900	1197	7097	5022
14:00	15:00	1191	457	21	1773	214	61	2780	16	5	3	1148	38	6521	1186	7707	5382
15:00	16:00	1135	425	36	1862	171	53	3014	19	12	4	1501	52	6731	1553	8284	5564
16:00	17:00	1351	439	26	2187	223	58	3334	44	10	7	1915	92	7679	2007	9686	6602
17:00	18:00	1337	466	12	2048	149	39	3500	11	5	0	1966	62	7567	2028	9595	6233
18:00	19:00	1503	625	57	2514	205	61	4120	13	4	0	2714	89	9102	2803	11905	7775
19:00	20:00	1689	864	87	2434	246	96	5114	18	2	0	2768	121	10550	2889	13439	8955
20:00	21:00	1863	867	70	2673	232	48	4222	12	0	0	3125	75	9987	3200	13187	8746
21:00	22:00	1620	776	36	2284	197	43	3446	5	0	0	3222	63	8407	3285	11692	7697
Total		21402	8887	898	30049	3265	896	52052	366	59	26	35813	1048	117900	36861	154760	104223
															Peak Hour	13439	8955
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



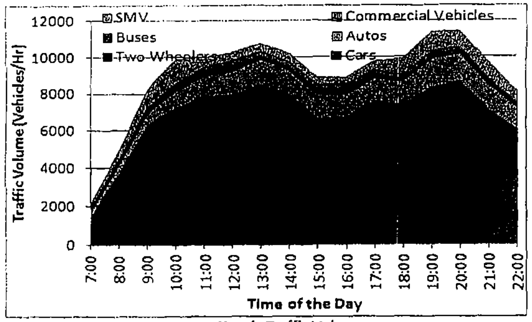
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Pushpa Bhawan Intersection(10-04-2012)

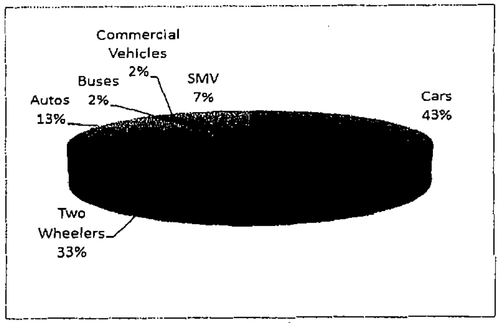
Classified Traffic Volume at Sheik Sarai Intersection (08-04-2012)

Road/ Intersection Name: Sheik Sarai Junction   Intersection Code: I-03
Date: 8.4.2012   Time Period: From 06:00 To 22:00

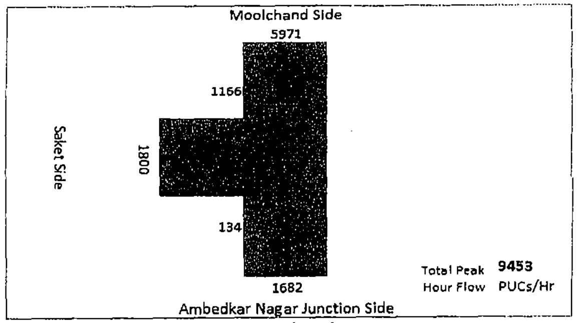
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV*(CE)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	296	194	37	225	48	12	374	42	9	3	74	55	1240	129	1369	1239
7:00	8:00	589	267	102	377	72	13	1504	58	12	6	245	69	3000	314	3314	2545
8:00	9:00	1065	589	200	466	114	9	1948	64	12	6	534	220	4473	754	5227	4283
9:00	10:00	1207	616	221	689	115	11	2479	66	14	0	681	185	5418	866	6284	4841
10:00	11:00	1489	746	141	834	151	16	2613	83	12	0	238	205	6085	443	6528	5266
11:00	12:00	1610	903	178	950	117	12	2455	154	41	1	161	212	6421	373	6794	5626
12:00	13:00	1794	958	125	983	92	13	2736	111	32	2	177	188	6846	365	7211	5768
13:00	14:00	1963	994	188	999	62	20	2215	151	24	3	167	210	6619	377	6996	5784
14:00	15:00	1648	823	153	974	106	28	2126	177	15	1	122	216	6051	338	6389	5342
15:00	16:00	1608	824	191	966	141	18	2140	133	13	0	144	182	6034	326	6360	5301
16:00	17:00	1895	1236	267	939	76	24	1904	142	12	0	148	277	6495	425	6920	5961
17:00	18:00	1798	1125	253	974	53	14	1970	117	8	4	547	341	6316	888	7204	6001
18:00	19:00	1889	1061	385	1177	65	14	2502	136	9	0	663	355	7238	1018	8256	6663
19:00	20:00	2060	1167	337	1100	83	28	2305	71	10	0	580	268	7161	848	8009	6520
20:00	21:00	1822	1142	156	1088	81	27	1796	41	12	0	640	242	6165	882	7047	5747
21:00	22:00	1547	990	126	884	57	18	1479	33	7	0	456	175	5141	631	5772	4691
Total		24280	13635	3060	13625	1433	277	32546	1579	242	26	5577	3400	90703	8977	99680	81578
															Peak Hour	8256	6663
															Peak Time	18:00	19:00



Hourly Traffic Volume



Traffic Composition



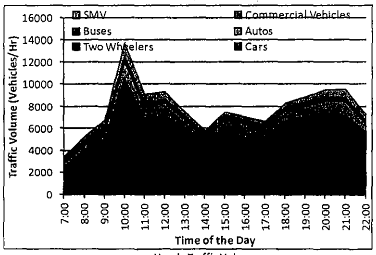
Peak Hour Flow Diagram

Classified Traffic Volume at Sheik Sarai Intersection (09-04-2012)

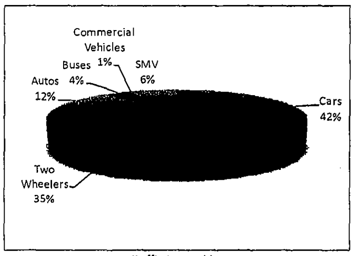
Road/ Intersection Name: Sheik Sarai Junction | Intersection Code: I-03

Date: 9.4.2012 | Time Period: From 06:00 To 22:00

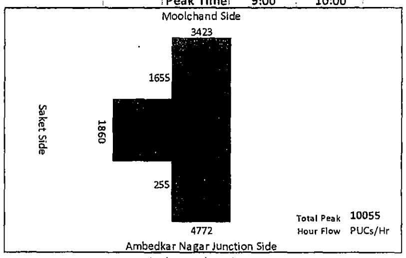
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	708	567	177	339	188	74	1117	57	12	2	203	23	3241	226	3467	3133
7:00	8:00	1256	1083	267	551	243	98	1335	63	7	3	329	39	4906	368	5274	4797
8:00	9:00	1489	1190	255	671	240	53	2140	41	19	3	597	34	6101	631	6732	5638
9:00	10:00	2007	1637	439	1521	374	83	6384	66	0	0	1218	32	12511	1250	13761	10054
10:00	11:00	1670	1265	158	1045	255	75	3844	22	3	0	779	24	8337	803	9140	6895
11:00	12:00	1801	1386	130	1218	187	45	3848	37	9	4	630	34	8665	664	9329	6962
12:00	13:00	1821	1340	120	753	219	62	2808	62	7	0	320	23	7192	343	7535	6132
13:00	14:00	1370	1044	85	721	200	53	1874	47	3	1	366	23	5398	389	5787	4789
14:00	15:00	2011	1424	143	1021	234	54	2255	66	3	1	273	22	7212	295	7507	6292
15:00	16:00	1710	1124	128	1178	198	50	2249	63	9	2	316	35	6711	351	7062	5703
16:00	17:00	1710	1215	105	812	179	42	2197	64	12	1	247	26	6337	273	6610	5447
17:00	18:00	2277	1638	182	964	196	50	2620	47	2	0	289	76	7976	365	8341	6925
18:00	19:00	2272	1791	195	945	248	72	2845	46	2	0	348	83	8416	431	8847	7420
19:00	20:00	2626	1703	161	1094	228	80	2962	40	5	0	520	70	8899	590	9489	7797
20:00	21:00	2410	1451	184	1239	197	47	3147	57	4	0	686	96	8736	782	9518	7532
21:00	22:00	1922	1149	170	810	173	47	2422	44	10	1	480	57	6748	537	7285	5901
Total		29060	21007	2899	14882	3559	985	44047	822	107	18	7601	697	117386	8298	125684	101417
															Peak Hour	13761	10054
															Peak Time	9:00	10:00



Hourly Traffic Volume



Traffic Composition



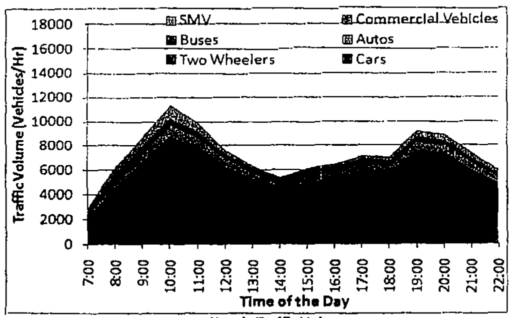
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Sheik Sarai Intersection(09.04.2012)

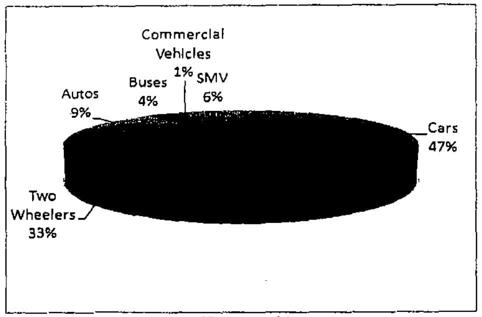
Classified Traffic Volume at Sheik Sarai Intersection (10.04.2012)

Road/ Intersection Name: Sheik Sarai Junction Intersection Code: I-03
Date: 10.4.2012 Time Period: From 06:00 To 22:00

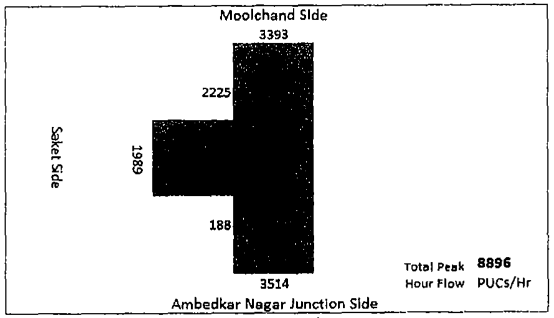
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Comme-rcial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	637	379	97	257	193	64	1205	32	12	0	175	14	2876	189	3065	2719
7:00	8:00	1283	1097	179	586	454	124	1899	76	18	2	546	29	5718	575	6293	5858
8:00	9:00	1983	1742	180	720	396	126	2816	57	8	1	698	23	8029	721	8750	7559
9:00	10:00	2382	2026	147	1056	297	65	4246	52	6	2	1088	26	10279	1114	11393	8896
10:00	11:00	2311	1673	139	847	309	48	3805	30	4	0	737	25	9166	762	9928	7924
11:00	12:00	2156	1515	132	749	166	51	2463	49	17	0	329	18	7298	347	7645	6309
12:00	13:00	1876	1278	135	645	172	45	1949	57	16	0	145	21	6173	166	6339	5418
13:00	14:00	1590	1113	128	557	149	50	1573	69	25	0	106	17	5254	123	5377	4684
14:00	15:00	1958	1293	127	647	253	61	1546	71	38	2	117	33	5996	150	6146	5679
15:00	16:00	2095	1412	130	627	264	44	1646	53	22	1	151	53	6294	204	6498	5963
16:00	17:00	2166	1413	152	706	224	44	2158	49	12	2	193	43	6926	236	7162	6202
17:00	18:00	2130	1271	185	569	221	37	2248	48	20	2	321	35	6731	356	7087	6085
18:00	19:00	2632	1649	177	854	215	58	3068	36	4	0	460	40	8693	500	9193	7527
19:00	20:00	2555	1487	184	751	161	48	3167	46	5	0	506	30	8404	536	8940	7137
20:00	21:00	1725	1121	153	743	165	14	2955	48	17	5	403	57	6946	460	7406	5825
21:00	22:00	1362	950	120	625	103	6	2433	46	15	0	263	34	5660	297	5957	4593
Total		30841	21419	2365	10939	3742	885	39177	819	239	17	6238	498	110443	6736	117179	98378
															Peak Hour	11393	8896
															Peak Time	9:00*	10:00



Hourly Traffic Volume



Traffic Composition



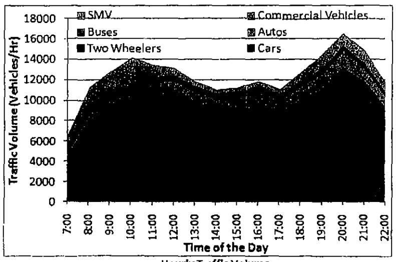
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Sheik Sarai Intersection(10.04.2012)

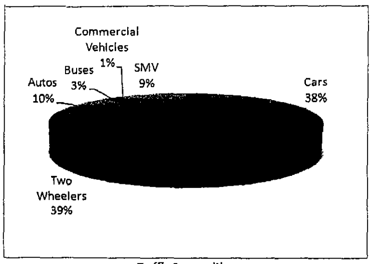
Classified Traffic Volume at Chirag Delhi Intersection (12.04.2012)

Road/ Intersection Name: **Chirag Delhi Jn** Intersection Code: **I-04**
Date: **12.4.2012** Time Period: From **06:00** To **22:00**

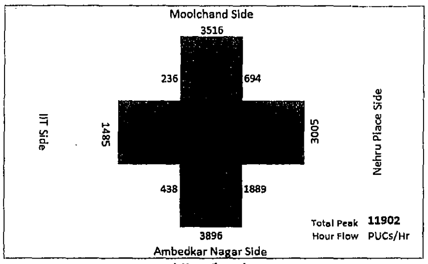
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Comme-rcial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	1539	706	290	457	374	114	2070	116	52	8	811	114	5726	925	6651	6092
7:00	8:00	2545	1464	423	754	546	123	3628	147	80	10	1382	136	9721	1518	11239	9916
8:00	9:00	2775	1421	329	1200	316	64	4297	96	38	2	2150	73	10538	2223	12761	9806
9:00	10:00	2692	1578	364	1277	326	41	5169	65	32	4	2538	47	11548	2585	14133	10472
10:00	11:00	3209	1788	451	1457	193	46	4873	110	29	0	1258	41	12156	1299	13455	10224
11:00	12:00	3224	1945	342	1215	236	25	5311	102	35	6	630	71	12441	701	13142	10261
12:00	13:00	2709	1807	340	1217	213	46	4774	117	54	8	414	88	11285	502	11788	9316
13:00	14:00	2602	1479	372	1124	257	48	4652	84	37	6	304	47	10661	351	11012	8693
14:00	15:00	2395	1522	375	1306	304	81	4640	80	44	7	387	47	10754	434	11188	8869
15:00	16:00	2590	1754	314	1419	297	49	4830	94	61	7	330	61	11415	391	11805	9388
16:00	17:00	2471	1518	317	1384	246	47	4406	91	54	9	442	49	10543	491	11033	8666
17:00	18:00	2823	1863	359	1397	208	53	4996	44	24	4	859	57	11771	916	12687	9644
18:00	19:00	2819	1730	371	1546	278	68	6181	38	23	2	1325	46	13056	1371	14427	10610
19:00	20:00	3179	2203	428	1681	212	42	7380	61	26	2	1211	39	15214	1250	16465	11902
20:00	21:00	3134	2248	378	1421	216	35	6018	63	22	1	1208	70	13536	1278	14814	11089
21:00	22:00	2586	1852	308	1133	174	12	4552	52	23	1	896	61	10693	957	11650	8851
Total		43292	26878	5761	19988	4397	894	77777	1360	634	77	16146	1047	181058	17193	198251	153799
															Peak Hour	16465	11902
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



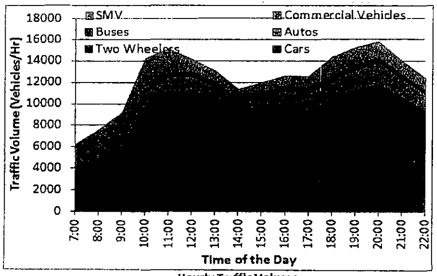
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Chirag Delhi Intersection(12.04.2012)

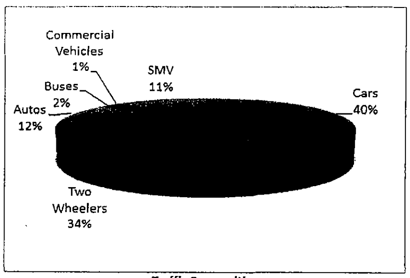
Classified Traffic Volume at Chirag Delhi Intersection (13-04-2012)

Road/ Intersection Name: Chirag Delhi Jn | Intersection Code: I-04
Date: 13.4.2012 | Time Period: From 06:00 To 22:00

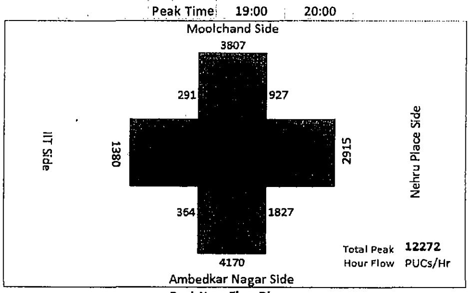
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	1268	788	109	661	73	14	1928	9	2	0	1304	54	4852	1358	6210	4479
7:00	8:00	1519	955	156	804	100	26	2319	20	7	0	1576	76	5906	1652	7558	5521
8:00	9:00	1812	1148	212	972	138	50	2782	43	16	2	1899	106	7174	2005	9179	6819
9:00	10:00	2408	1729	409	1264	142	55	5290	47	11	1	2757	122	11357	2879	14235	10063
10:00	11:00	3345	2047	364	1323	192	48	5452	40	18	3	2184	75	12832	2259	15091	11161
11:00	12:00	3734	2215	342	1688	181	37	4543	125	54	17	1120	84	12936	1204	14140	11158
12:00	13:00	3138	2227	296	1636	146	38	4334	162	53	15	941	64	12045	1005	13050	10208
13:00	14:00	2756	1868	286	1336	108	38	3869	125	38	11	870	38	10435	908	11343	8755
14:00	15:00	3002	1817	332	1369	265	70	4062	151	22	11	829	48	11101	877	11978	9619
15:00	16:00	3082	1857	353	1577	198	41	4361	166	42	12	854	57	11689	911	12601	9888
16:00	17:00	2780	1678	325	1614	222	70	4606	146	38	9	981	65	11488	1046	12534	9657
17:00	18:00	3078	1985	330	1799	242	83	5019	105	31	7	1618	54	12680	1672	14351	10853
18:00	19:00	3404	2173	361	1874	270	67	5396	75	18	4	1523	67	13642	1590	15232	11563
19:00	20:00	3827	2561	311	2073	314	59	5135	37	12	2	1416	64	14332	1480	15812	12272
20:00	21:00	3425	2286	255	1843	272	42	4579	23	4	0	1234	43	12729	1277	14005	10805
21:00	22:00	3060	2037	207	1639	236	31	4077	13	1	0	1082	27	11301	1109	12410	9534
Total		45638	29371	4648	23472	3098	770	67752	1287	367	94	22187	1044	176497	23231	199728	152355
															Peak Hour	15812	12272
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



Peak Hour Flow Diagram

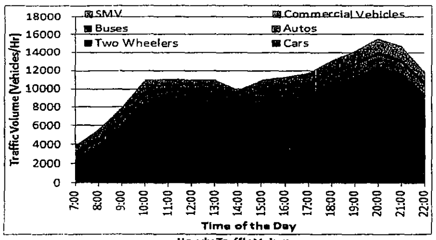
Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Chirag Delhi Intersection (13.04.2012)

Classified Traffic Volume at Chirag Delhi Intersection (14-04-2012)

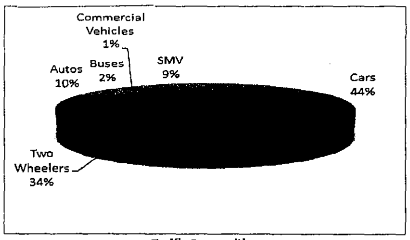
Road/ Intersection Name: Chirag Delhi Jn — Intersection Code: I-04

Date: 14.4.2012 — Time Period: From 06:00 To 22:00

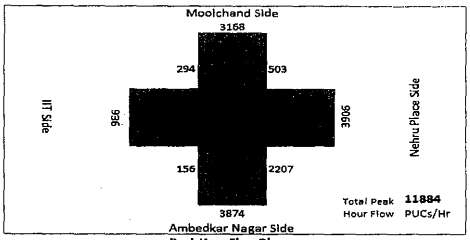
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	776	670	154	438	118	30	961	102	24	8	526	27	3281	553	3834	3276
7:00	8:00	910	834	221	509	137	24	1855	161	25	8	835	44	4684	879	5563	4452
8:00	9:00	1628	1246	261	697	189	34	2693	84	18	1	990	55	6851	1045	7897	6238
9:00	10:00	2062	1472	266	921	224	59	4611	64	21	2	1222	34	9702	1256	10959	8174
10:00	11:00	2498	1596	290	1065	188	29	4399	56	8	0	907	27	10129	934	11063	8339
11:00	12:00	2687	1886	224	1167	177	31	3821	95	25	6	826	45	10119	871	10990	8616
12:00	13:00	2767	1623	289	1251	160	33	3897	94	13	0	829	53	10127	882	11009	8483
13:00	14:00	2500	1420	294	1198	144	38	3433	70	9	0	685	15	9106	700	9806	7524
14:00	15:00	2744	1901	284	1274	150	23	3424	145	25	3	912	56	9973	968	10941	8636
15:00	16:00	2813	2003	255	1303	144	21	3789	103	19	2	778	56	10452	834	11285	8802
16:00	17:00	3012	2338	322	1426	151	13	3359	131	11	0	848	53	10763	901	11664	9297
17:00	18:00	3146	2787	351	1362	158	16	4117	96	40	0	939	56	12073	995	13068	10366
18:00	19:00	3259	2678	389	1321	122	9	4936	65	11	1	1291	54	12790	1345	14136	10721
19:00	20:00	3700	2995	439	1394	148	14	5297	69	21	0	1366	45	14077	1411	15488	11884
20:00	21:00	3701	2562	413	1277	149	13	4958	77	19	1	1472	41	13170	1513	14683	11254
21:00	22:00	3268	2524	239	1063	128	13	3390	96	79	11	984	32	10811	1016	11827	9647
Total		41471	30535	4691	17666	2485	400	58940	1508	368	43	15411	693	158107	16104	174211	135709
															Peak Hour	15488	11884
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



Peak Hour Flow Diagram

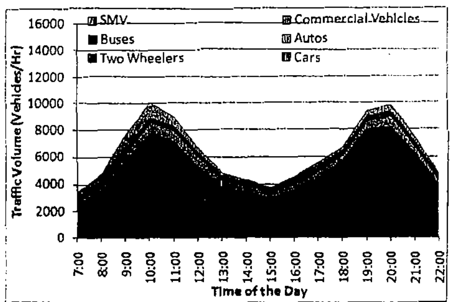
Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Chirag Delhi Intersection (14.04.2012)

Classified Traffic Volume at Siri Fort Intersection (12.04.2012)

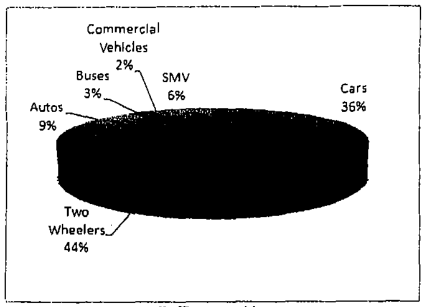
Road/ Intersection Name: Siri Fort Jn   Intersection Code: I-05

Date: 12.4.2012   Time Period: From 06:00 To 22:00

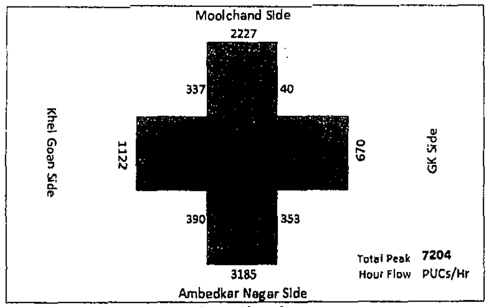
Time of the Day		Small Cars (<1400 cc)* (CS), Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Comme-rcial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	1352	88	242	138	72	1106	87	13	8	329	30	3106	359	3465	3066
7:00	8:00	1622	196	336	194	111	1731	85	21	6	508	39	4301	547	4848	4148
8:00	9:00	2197	294	658	171	70	3227	84	13	2	954	93	6716	1047	7763	5888
9:00	10:00	2733	291	890	185	73	4739	24	6	3	1137	32	8945	1169	10114	7204
10:00	11:00	2381	288	874	141	107	4503	24	5	0	621	50	8323	671	8994	6403
11:00	12:00	1904	238	840	142	71	3101	54	10	1	306	51	6362	357	6718	5016
12:00	13:00	1519	135	640	117	60	2056	71	5	1	166	49	4604	215	4819	3751
13:00	14:00	1371	69	558	117	41	1950	91	3	2	116	29	4201	145	4347	3376
14:00	15:00	1439	76	458	104	35	1386	137	15	0	60	21	3650	81	3731	3125
15:00	16:00	1569	59	555	144	45	1944	176	12	0	70	32	4504	102	4606	3776
16:00	17:00	2083	89	549	161	38	2288	147	18	0	147	60	5372	207	5579	4598
17:00	18:00	2592	215	446	150	32	2916	128	7	1	201	53	6487	254	6741	5411
18:00	19:00	3550	166	672	151	76	4337	58	6	0	317	77	9016	394	9409	7205
19:00	20:00	3521	146	866	144	100	4532	84	17	0	366	134	9410	500	9909	7575
20:00	21:00	2709	127	598	131	56	3403	93	15	0	271	53	7133	324	7457	5741
21:00	22:00	1586	80	531	77	22	2121	66	29	2	138	29	4514	167	4681	3578
Total		34126	2557	9712	2269	1008	45340	1409	195	26	5708	832	96643	6540	103183	79861
														Peak Hour	10114	7575



Hourly Traffic Volume



Traffic Composition



Peak Hour Flow Diagram

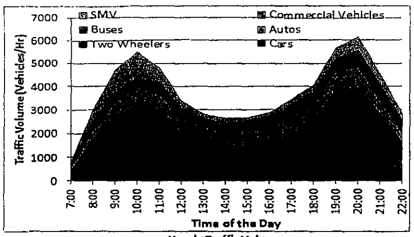
Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Siri Fort Intersection(12.04.2012)

Classified Traffic Volume at Siri Fort Intersection (13-04-2012)

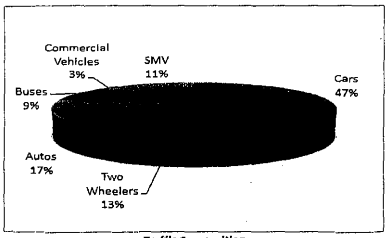
Road/ Intersection Name: Siri Fort Intersection | Intersection Code: I-01

Date: 13.4.2012 | Time Period: From 06:00 To 22:00

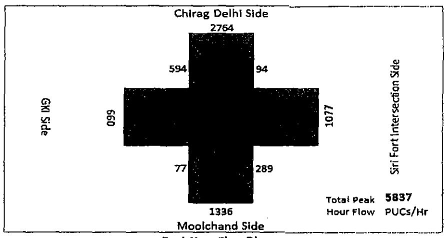
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	272	0	46	147	45	40	76	51	4	2	80	13	681	93	775	787
7:00	8:00	1297	0	132	385	127	122	338	90	17	2	397	71	2511	468	2979	2891
8:00	9:00	1900	0	194	635	135	217	617	55	6	0	869	71	3759	940	4699	4129
9:00	10:00	2088	0	194	786	114	228	902	36	8	1	1038	98	4356	1136	5492	4607
10:00	11:00	1835	0	204	839	117	297	811	47	18	2	599	36	4170	635	4805	4167
11:00	12:00	1447	0	152	653	110	217	401	59	31	2	302	21	3073	323	3396	3166
12:00	13:00	1156	0	126	667	114	153	320	62	32	2	161	23	2633	184	2817	2671
13:00	14:00	1057	0	125	603	89	147	284	97	43	1	167	30	2445	197	2642	2534
14:00	15:00	1056	0	151	645	104	147	279	139	23	3	87	34	2547	121	2669	2606
15:00	16:00	1142	0	158	714	206	136	241	134	12	4	91	38	2746	129	2875	2974
16:00	17:00	1389	0	155	778	169	175	392	126	17	2	204	43	3203	247	3449	3334
17:00	18:00	1778	0	200	737	184	191	580	77	15	6	236	65	3767	301	4069	3909
18:00	19:00	2591	0	260	842	232	258	984	59	2	0	359	83	5228	442	5670	5288
19:00	20:00	2769	0	249	908	253	317	925	124	6	0	492	109	5551	601	6151	5837
20:00	21:00	2050	0	225	633	266	212	535	114	4	0	346	119	4039	465	4504	4569
21:00	22:00	1191	0	134	391	257	136	311	86	25	4	270	27	2535	297	2832	3061
Total		25458	0	2731	10432	2534	3000	8087	1372	290	31	5767	892	53933	6659	60592	57283
															Peak Hour	6151	5837
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



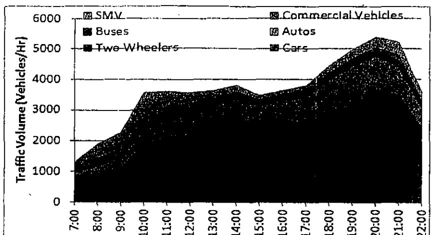
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Siri Fort Intersection (13-04-2012)

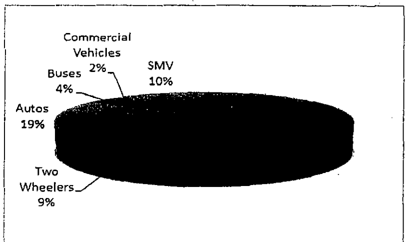
Classified Traffic Volume at Siri Fort Intersection (14-04-2012)

Road/ Intersection Name: Siri Fort Intersection   Intersection Code: I-01
Date: 14.4.2012   Time Period: From 06:00 To 22:00

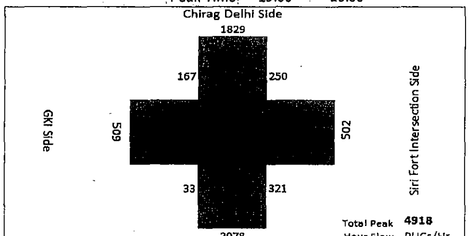
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV#(CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-...	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	767	0	48	120	40	9	59	39	48	14	98	72	1145	170	1315	1496
7:00	8:00	788	0	42	237	95	31	113	65	68	11	350	107	1449	457	1906	2074
8:00	9:00	898	0	91	383	98	21	134	51	49	8	426	115	1733	541	2275	2276
9:00	10:00	1467	0	88	488	177	30	314	71	31	10	725	160	2676	885	3561	3459
10:00	11:00	1712	0	77	598	144	35	324	49	34	13	471	142	2986	613	3599	3488
11:00	12:00	1540	0	64	636	189	21	557	43	27	17	308	153	3094	461	3554	3480
12:00	13:00	2010	0	48	564	155	18	482	32	35	6	145	124	3350	269	3619	3573
13:00	14:00	2295	0	51	645	136	20	405	23	7	5	161	51	3587	212	3799	3569
14:00	15:00	2064	0	46	630	94	19	399	47	21	10	111	25	3329	136	3465	3217
15:00	16:00	2323	0	66	646	92	13	300	35	25	8	99	18	3507	117	3624	3405
16:00	17:00	2227	0	35	878	111	12	281	66	21	5	133	13	3635	146	3782	3468
17:00	18:00	2594	0	47	987	109	13	358	55	16	14	220	20	4192	240	4432	4002
18:00	19:00	2695	0	46	1330	131	22	380	34	25	9	254	38	4672	292	4964	4392
19:00	20:00	3093	0	68	1117	150	32	490	40	17	28	325	28	5035	353	5388	4919
20:00	21:00	2883	0	107	947	169	21	486	84	20	53	421	20	4770	441	5210	4920
21:00	22:00	1989	0	51	684	85	16	359	56	24	11	257	21	3275	278	3553	3216
Total		31345	0	974	10891	1974	330	5440	790	468	222	4503	1107	52434	5610	58044	54954
															Peak Hour	5388	4920
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



Peak Hour Flow Diagram

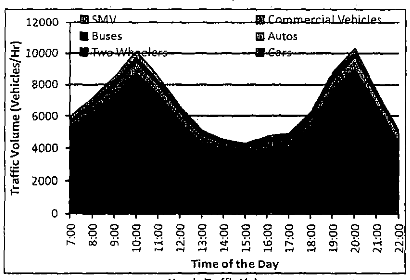
Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at Siri Fort Intersection (14.04.2012)

Classified Traffic Volume at GK-I Intersection (12-04-2012)

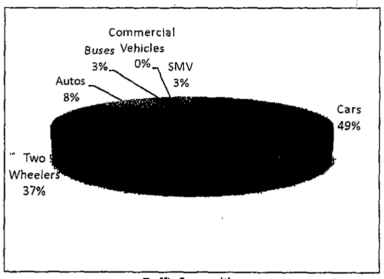
Road/ Intersection Name: GK-I Jn   Intersection Code: I-06

Date: 12.4.2012   Time Period: From 06:00 To 22:00

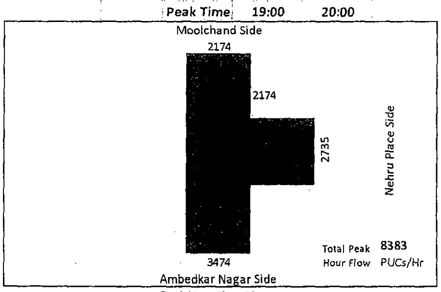
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	2488	0	234	432	88	22	2480	5	1	0	231	48	5750	279	6029	4697
7:00	8:00	2939	0	283	519	113	29	2937	9	2	0	277	62	6831	339	7170	5615
8:00	9:00	3470	0	340	619	139	41	3473	13	5	0	332	78	8100	410	8510	6691
9:00	10:00	4034	0	379	719	162	57	4334	9	3	4	360	74	9701	434	10135	7880
10:00	11:00	3756	0	355	608	158	77	3273	6	2	0	204	67	8235	271	8506	6892
11:00	12:00	2659	0	285	606	138	61	2686	14	4	4	118	33	6457	151	6608	5272
12:00	13:00	2527	0	174	495	149	52	1624	26	1	0	66	22	5048	88	5136	4405
13:00	14:00	2420	0	113	382	101	29	1415	49	1	2	24	19	4512	43	4555	3914
14:00	15:00	2337	0	125	396	110	27	1221	42	2	0	40	17	4260	57	4317	3764
15:00	16:00	2536	0	146	412	163	37	1330	78	6	1	41	31	4709	72	4781	4320
16:00	17:00	2641	0	81	449	173	23	1403	68	13	1	61	42	4852	103	4955	4462
17:00	18:00	2956	0	256	566	197	24	2171	41	4	0	48	42	6215	90	6305	5389
18:00	19:00	4123	0	329	645	206	57	3273	32	1	0	90	67	8666	157	8823	7345
19:00	20:00	4852	0	162	764	170	87	3977	59	8	0	122	92	10079	214	10293	8383
20:00	21:00	3837	0	144	513	111	55	2696	46	17	0	69	67	7419	136	7555	6290
21:00	22:00	2531	0	97	485	87	30	1789	43	28	3	52	24	5093	76	5169	4307
Total		50106	0	3503	8610	2265	708	40082	540	98	15	2135	785	105927	2920	108847	89626
															Peak Hour	10293	8383
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



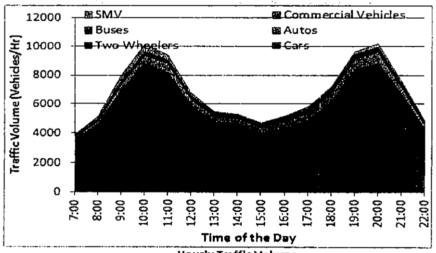
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at GK-I Intersection (12-04-2012)

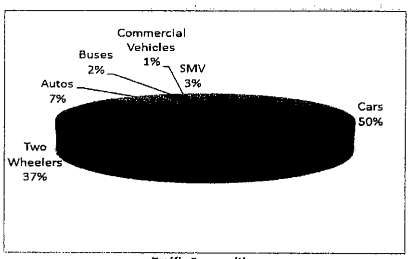
Classified Traffic Volume at GK-I Intersection (13-04-2012)

Road/ Intersection Name: GK-I Jn   Intersection Code: I-06
Date: 13.4.2012   Time Period: From 06:00 To 22:00

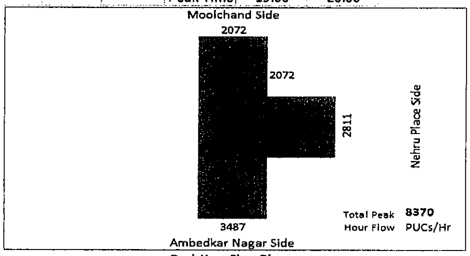
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	1871	0	175	215	28	20	1474	10	2	1	91	16	3796	107	3903	3108
7:00	8:00	2398	0	240	272	57	32	1970	20	6	0	136	25	4995	161	5156	4144
8:00	9:00	3532	0	310	464	123	43	3088	13	1	0	380	51	7574	431	8005	6366
9:00	10:00	4230	0	339	568	140	60	4255	12	0	1	432	80	9605	512	10117	7889
10:00	11:00	3829	0	322	668	138	69	4027	18	8	0	256	48	9079	304	9383	7291
11:00	12:00	2902	0	235	506	118	61	2733	26	14	3	156	24	6598	180	6778	5423
12:00	13:00	2576	0	172	407	132	57	2000	28	18	0	78	6	5390	84	5474	4580
13:00	14:00	2341	0	169	330	113	27	2191	46	26	0	57	14	5243	71	5314	4354
14:00	15:00	2301	0	183	452	114	22	1491	59	14	4	46	22	4640	68	4708	4046
15:00	16:00	2486	0	191	485	143	45	1666	80	7	6	28	40	5109	68	5177	4511
16:00	17:00	2880	0	182	521	161	27	1822	51	17	2	83	51	5663	134	5797	5037
17:00	18:00	3469	0	264	678	178	31	2391	38	13	6	73	50	7068	123	7191	6108
18:00	19:00	4319	0	394	780	182	71	3651	29	1	1	108	70	9428	178	9606	7826
19:00	20:00	4678	0	340	768	176	102	3819	69	0	1	124	103	9953	227	10180	8369
20:00	21:00	3841	0	261	520	124	55	2603	53	1	1	73	96	7459	169	7628	6434
21:00	22:00	2548	0	177	357	77	25	1593	34	20	4	40	24	4835	64	4899	4166
Total		50201	0	3954	7991	2004	747	40774	586	148	30	2161	720	106435	2881	109316	89652
															Peak Hour	10180	8369
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



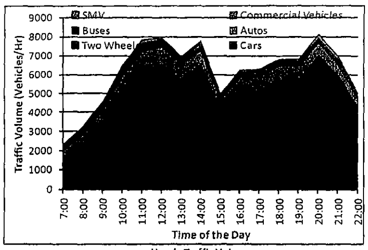
Peak Hour Flow Diagram

Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at GK-I Intersection (13-04-2012)

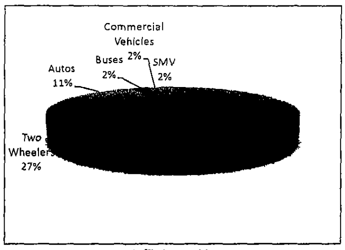
Classified Traffic Volume at GK-I Intersection (14-04-2012)

Road/ Intersection Name: GK-I Jn | Intersection Code: I-06
Date: 14.4.2012 | Time Period: From 06:00 To 22:00

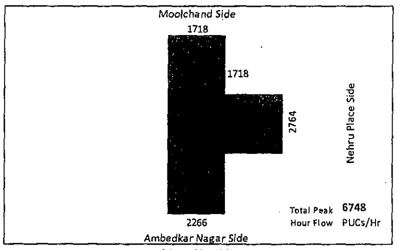
Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Commercial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	872	0	180	346	44	5	653	91	29	1	75	24	2221	99	2320	2005
7:00	8:00	1314	0	161	539	115	8	848	113	31	0	114	32	3129	146	3275	2909
8:00	9:00	1731	0	224	618	121	9	1577	85	14	0	124	34	4379	158	4537	3729
9:00	10:00	2744	0	304	655	295	11	2246	79	3	0	103	30	6337	133	6470	5639
10:00	11:00	3554	0	425	989	310	16	2290	17	32	0	159	28	7633	187	7820	6830
11:00	12:00	4164	0	371	911	285	10	2029	49	38	0	79	18	7857	97	7954	7138
12:00	13:00	3735	0	246	877	171	8	1742	56	37	0	45	27	6872	72	6944	6087
13:00	14:00	4601	0	327	721	169	11	1645	142	58	0	70	19	7674	89	7763	7095
14:00	15:00	2735	0	125	618	43	12	1243	92	10	8	43	14	4886	57	4943	4191
15:00	16:00	3595	0	121	800	89	6	1362	126	21	10	70	37	6130	107	6237	5479
16:00	17:00	3673	0	105	761	107	5	1372	162	21	10	55	16	6216	71	6287	5584
17:00	18:00	3992	0	107	755	95	12	1645	84	16	9	57	32	6715	89	6804	5909
18:00	19:00	3253	0	187	768	122	10	2283	72	10	0	63	38	6705	101	6806	5592
19:00	20:00	4308	0	168	682	123	10	2557	58	6	0	159	42	7912	201	8113	6748
20:00	21:00	4225	0	171	608	82	12	1550	98	15	0	161	32	6761	193	6954	6076
21:00	22:00	3046	0	162	477	56	7	1093	92	25	11	51	23	4969	74	5043	4506
Total		51542	0	3384	11125	2227	152	26135	1416	366	49	1428	446	96396	1874	98270	85517
															Peak Hour	8113	7138
															Peak Time	19:00	20:00



Hourly Traffic Volume



Traffic Composition



Peak Hour Flow Diagram

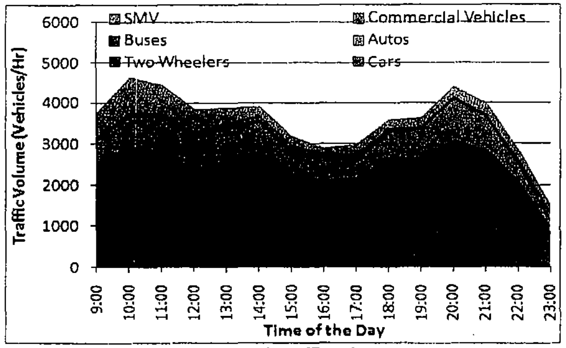
Hourly Traffic Variation, Traffic Composition and Peak Hour Flow Diagram at GK-I Intersection (14-04-2012)

Classified Traffic Volume on Khel Gaon Marg

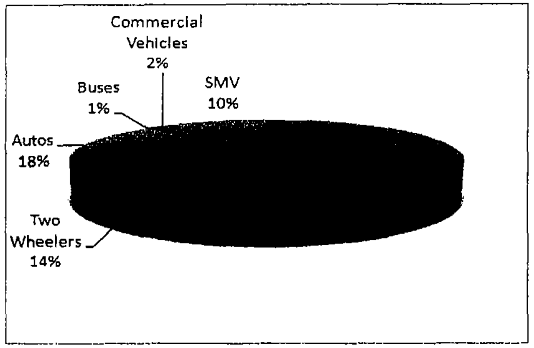
Road/ Intersection Name: **Khelgaon Marg** Intersection Code: **MB-01**
Date: **16.4.2012** Time Period: From **08:00** To **23:00**

Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Comme-rcial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
8:00	9:00	2096	0	117	540	42	9	370	3	9	0	574	13	3185	587	3773	3151
9:00	10:00	2181	0	245	732	70	6	517	19	5	0	853	8	3775	861	4636	3756
10:00	11:00	2113	0	219	809	75	2	522	4	3	0	680	14	3747	694	4441	3609
11:00	12:00	1766	0	182	761	51	0	434	60	24	1	530	27	3279	557	3836	3184
12:00	13:00	2092	0	127	750	46	2	410	85	11	0	307	36	3523	343	3866	3326
13:00	14:00	1970	0	147	699	44	10	712	77	11	2	210	25	3672	235	3907	3282
14:00	15:00	1598	0	136	481	86	4	556	100	25	0	150	50	2986	200	3187	2918
15:00	16:00	1382	0	156	540	27	3	583	71	7	0	109	16	2769	125	2894	2400
16:00	17:00	1267	0	136	415	34	3	797	98	12	0	184	44	2763	228	2991	2480
17:00	18:00	1897	0	191	641	26	2	567	41	9	0	176	22	3374	198	3572	2993
18:00	19:00	1902	0	228	691	35	2	539	8	4	0	198	11	3410	209	3619	2999
19:00	20:00	2157	0	234	993	21	0	714	27	8	0	213	39	4154	252	4406	3556
20:00	21:00	2173	0	164	795	28	0	534	15	4	0	243	30	3713	273	3986	3302
21:00	22:00	1742	0	110	395	18	1	248	63	35	0	194	44	2612	238	2850	2614
22:00	23:00	720	0	58	161	18	0	176	94	86	0	160	24	1313	184	1497	1529
Total		27056	0	2450	9409	622	45	7679	765	253	3	4781	403	48276	5184	53460	45099

ak Hour	4636	3756
ak Time	9:00	10:00



Hourly Traffic Volume



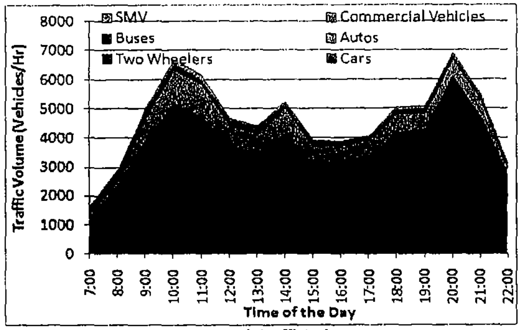
Traffic Composition

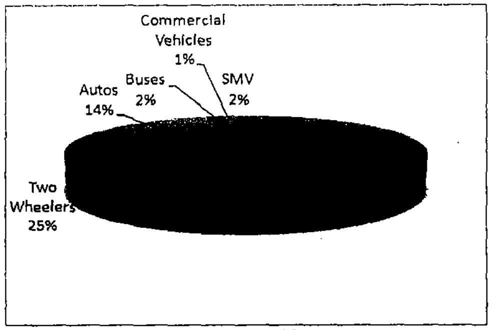
Hourly Traffic Variation and Traffic Composition on Khel Gaon Marg

Classified Traffic Volume on Aurobindo Marg (Near Yusuf Sarai)

Road/ Intersection Name: **Aurabindo Marg** Intersection Code: **MB-02**
Date: **17.4.2012** Time Period: From *06:00* To *22:00*

Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Comme-rcial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	467	261	294	243	66	13	225	51	10	1	56	0	1630	56	1686	1611
7:00	8:00	897	542	444	302	107	20	504	54	11	0	48	2	2881	50	2931	2780
8:00	9:00	1570	987	446	827	125	13	951	17	3	0	107	5	4939	112	5051	4384
9:00	10:00	1897	865	644	1155	138	22	1797	15	3	0	138	1	6536	139	6675	5431
10:00	11:00	1870	912	283	1141	92	11	1670	16	6	0	149	7	6001	156	6157	4894
11:00	12:00	1463	845	190	787	74	6	1207	51	5	0	64	6	4629	70	4699	3863
12:00	13:00	1202	774	257	678	84	3	1274	94	9	0	40	6	4375	46	4421	3666
13:00	14:00	1516	921	249	905	64	10	1468	44	4	2	56	19	5183	75	5258	4233
14:00	15:00	1062	791	220	664	71	3	1007	65	7	0	30	10	3890	40	3931	3281
15:00	16:00	983	744	293	546	49	2	1204	37	3	0	21	11	3861	32	3893	3142
16:00	17:00	1140	823	283	589	65	5	1126	22	4	0	27	7	4057	34	4091	3378
17:00	18:00	1532	881	251	636	81	6	1547	31	5	0	75	14	4970	89	5059	4135
18:00	19:00	1554	945	361	571	84	8	1446	18	12	1	82	15	5000	97	5097	4271
19:00	20:00	2434	1766	291	608	87	9	1607	17	3	0	61	18	6822	79	6901	5974
20:00	21:00	1935	1254	295	645	64	3	1252	13	7	0	27	15	5468	42	5510	4713
21:00	22:00	1041	740	164	274	44	2	745	8	5	0	66	2	3023	68	3090	2653
Total		22563	14051	4965	10571	1294	138	19030	553	97	4	1046	138	73266	1184	74450	62409
															Peak Hour	6901	5974
															Peak Time	19:00	20:00



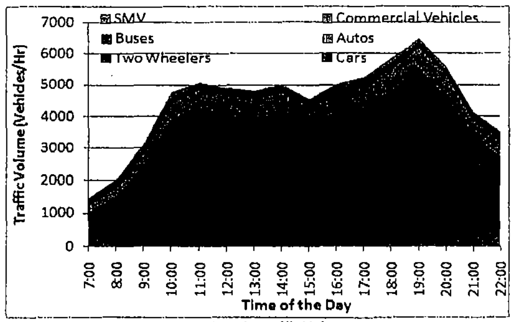


Hourly Traffic Variation and Traffic Composition on Aurobindo Marg (Near Yusuf Sarai)

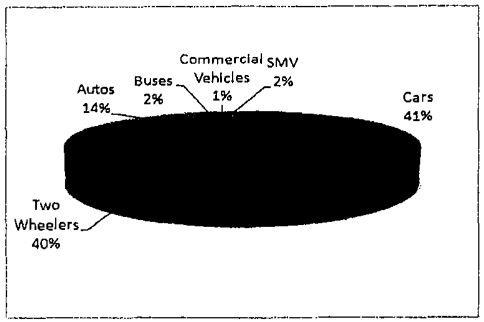
Classified Traffic Volume on Mathura Road (Near Sundar Nagar)

Road/ Intersection Name: Mathura Road Intersection Code: MB-03
Date: 16.4.2012 Time Period: From 06:00 To 22:00

Time of the Day		Small Cars (<1400 cc)* (CS)	Big Cars** / SUV# (CB)	Taxis (T)	Autos (A)	Buses (B)	Mini Buses (MB)	Two Wheelers (TW)	Light Comme-rcial Vehicles (LT)	Two Axle Trucks (HT)	Multi Axle Trucks (MT)	Cycles (CYC)	Cycle Rickshaws and Other (CY-SMV)	Total FMV	Total SMV	Grand Total (Vehicle)	Grand Total (PCU)
6:00	7:00	303	171	75	283	95	6	470	28	0	0	51	1	1431	52	1483	1289
7:00	8:00	519	252	98	290	102	11	668	36	3	0	69	10	1980	79	2058	1789
8:00	9:00	771	307	55	424	89	14	1355	8	1	0	126	10	3024	136	3161	2409
9:00	10:00	1442	581	75	574	127	22	1807	1	2	0	130	0	4632	130	4761	3776
10:00	11:00	1358	630	71	626	91	10	2198	8	2	0	70	0	4995	70	5065	3813
11:00	12:00	1384	583	78	655	98	7	1995	30	2	0	50	5	4833	55	4887	3762
12:00	13:00	1202	804	99	801	87	3	1701	49	8	0	35	6	4754	41	4796	3750
13:00	14:00	1233	711	114	644	80	8	2088	50	2	0	64	5	4930	69	4999	3799
14:00	15:00	646	633	110	664	68	9	2306	51	2	1	38	3	4490	41	4531	3203
15:00	16:00	1305	800	66	696	49	3	1947	65	4	0	66	8	4935	74	5009	3802
16:00	17:00	1165	762	106	735	67	10	2226	72	8	2	75	2	5153	77	5230	3912
17:00	18:00	1319	805	113	787	83	14	2554	56	5	0	122	3	5737	125	5861	4345
18:00	19:00	1483	945	118	715	122	17	2956	21	4	0	77	6	6381	83	6464	4868
19:00	20:00	1293	977	48	800	87	4	2236	1	1	0	109	4	5447	113	5560	4171
20:00	21:00	1187	856	56	544	69	2	1269	58	2	0	69	2	4043	71	4114	3347
21:00	22:00	936	764	44	607	78	4	930	76	8	2	48	3	3449	51	3500	2928
Total		17546	10581	1326	9845	1394	146	28706	610	54	5	1198	68	70212	1266	71479	54963
															Peak Hour	6464	4868
															Peak Time	18:00	19:00



Hourly Traffic Volume



Traffic Composition

Hourly Traffic Variation and Traffic Composition on Mathura Road (Near Sundar Nagar)

ANNEXURE-XI: PEDESTRIAN COUNT SURVEY DATA

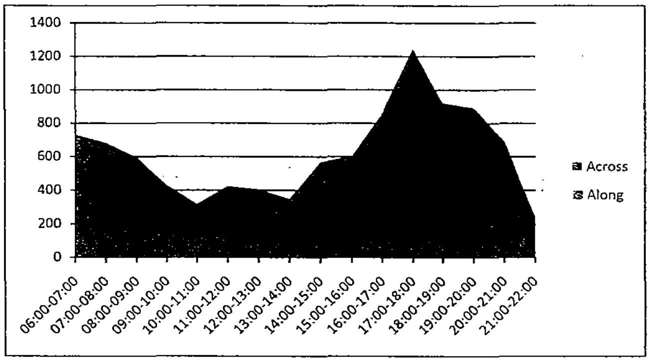
Location Name: Ambedkar Chowk Date: 08-04-2012
Direction: Towards Moolchand Day: Sunday

Peak hour volume 1244

Peak hour 17:00-18:00 Hrs

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	348	383	731
07:00-08:00	324	361	685
08:00-09:00	229	369	598
09:00-10:00	167	265	432
10:00-11:00	143	177	320
11:00-12:00	172	255	427
12:00-13:00	87	320	407
13:00-14:00	61	290	351
14:00-15:00	100	470	570
15:00-16:00	110	494	604
16:00-17:00	115	749	864
17:00-18:00	264	980	1244
18:00-19:00	139	781	920
19:00-20:00	171	723	894
20:00-21:00	195	495	690
21:00-22:00	82	162	244
TOTAL	2707	7274	9981



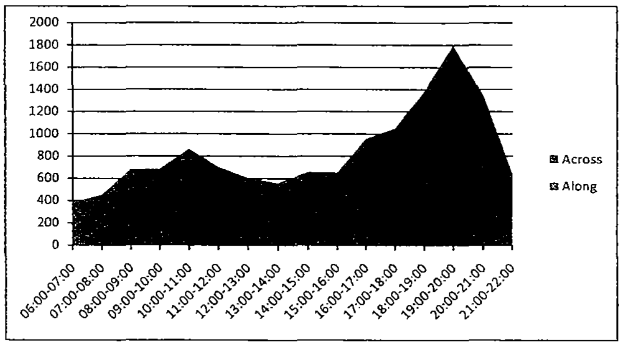
Location Name: Ambedkar Chowk Date:08-04-2012
Direction: Towards Khanpur Day:Sunday

Peak hour volume 1796

Peak hour 19:00-20:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	214	172	386
07:00-08:00	254	204	458
08:00-09:00	310	373	683
09:00-10:00	356	332	688
10:00-11:00	496	371	867
11:00-12:00	397	306	703
12:00-13:00	345	264	609
13:00-14:00	338	223	561
14:00-15:00	415	245	660
15:00-16:00	398	257	655
16:00-17:00	627	332	959
17:00-18:00	707	345	1052
18:00-19:00	902	481	1383
19:00-20:00	1279	517	1796
20:00-21:00	852	499	1351
21:00-22:00	355	290	645
TOTAL	8245	5211	13456



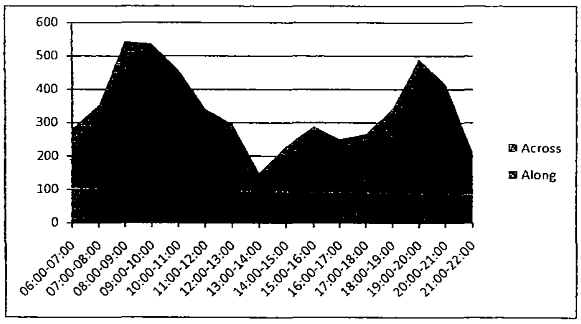
Location Name: Ambedkar Chowk Date:08-04-2012
Direction: Towards Mahrauli Day:Sunday

Peak hour volume 544

Peak hour 08:00-09:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	165	117	282
07:00-08:00	195	159	354
08:00-09:00	255	289	544
09:00-10:00	263	275	538
10:00-11:00	209	252	461
11:00-12:00	163	179	342
12:00-13:00	143	155	298
13:00-14:00	81	70	151
14:00-15:00	133	97	230
15:00-16:00	148	142	290
16:00-17:00	145	107	252
17:00-18:00	148	120	268
18:00-19:00	203	140	343
19:00-20:00	303	188	491
20:00-21:00	255	161	416
21:00-22:00	123	90	213
TOTAL	2932	2541	5473

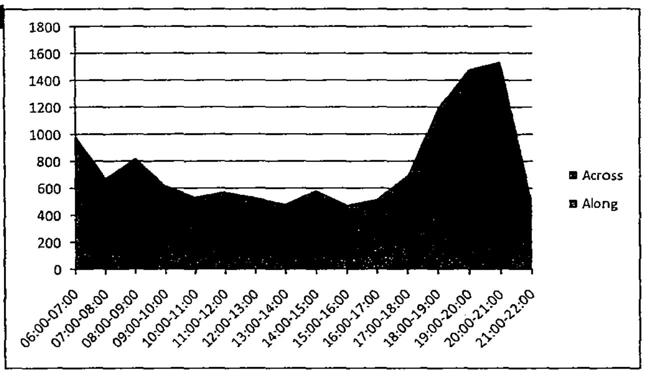


Location Name: Ambedkar Chowk **Date:** 09-04-2012
Direction: Towards Moolchand **Day:** Monday

Peak hour volume 1539
Peak hour 20:00-21:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	437	560	997
07:00-08:00	174	505	679
08:00-09:00	342	485	827
09:00-10:00	223	399	622
10:00-11:00	199	339	538
11:00-12:00	262	313	575
12:00-13:00	189	344	533
13:00-14:00	186	300	486
14:00-15:00	152	435	587
15:00-16:00	68	411	479
16:00-17:00	147	372	519
17:00-18:00	239	457	696
18:00-19:00	388	806	1194
19:00-20:00	470	1014	1484
20:00-21:00	391	1148	1539
21:00-22:00	148	364	512
TOTAL	4015	8252	12267

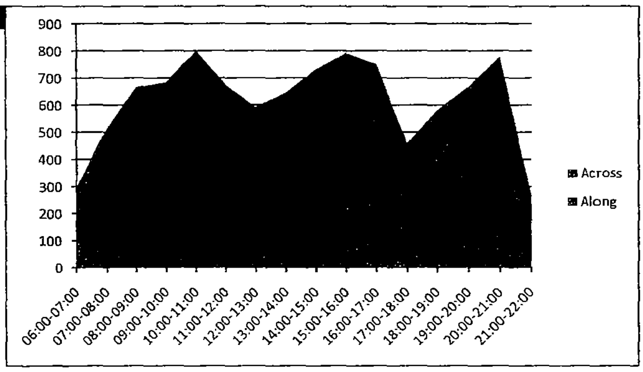


Location Name: Ambedkar Chowk **Date:**09-04-2012
Direction: Towards Khanpur **Day:**Monday

Peak hour volume 801
Peak hour 10:00-11:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	167	129	296
07:00-08:00	283	231	514
08:00-09:00	244	423	667
09:00-10:00	291	395	686
10:00-11:00	344	457	801
11:00-12:00	362	314	676
12:00-13:00	375	217	592
13:00-14:00	382	266	648
14:00-15:00	474	259	733
15:00-16:00	473	319	792
16:00-17:00	551	201	752
17:00-18:00	321	139	460
18:00-19:00	447	135	582
19:00-20:00	471	198	669
20:00-21:00	629	150	779
21:00-22:00	215	54	269
TOTAL	6029	3887	9916

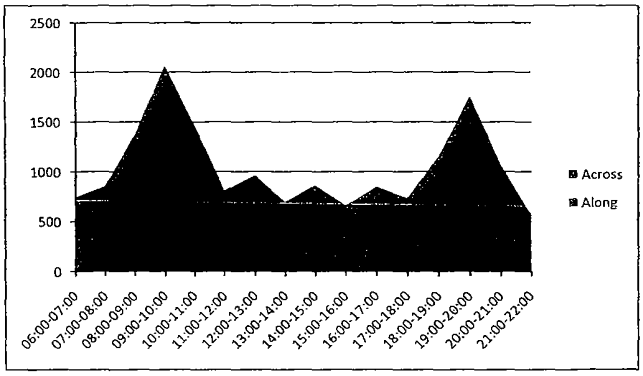


Location Name: Ambedkar Chowk **Date:**09-04-2012
Direction: Towards Mahrauli **Day:**Monday

Peak hour volume 2066
Peak hour 09:00-10:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	317	429	746
07:00-08:00	331	524	855
08:00-09:00	588	786	1374
09:00-10:00	993	1073	2066
10:00-11:00	749	718	1467
11:00-12:00	368	442	810
12:00-13:00	488	480	968
13:00-14:00	366	334	700
14:00-15:00	475	394	869
15:00-16:00	356	304	660
16:00-17:00	413	439	852
17:00-18:00	385	354	739
18:00-19:00	562	590	1152
19:00-20:00	645	1111	1756
20:00-21:00	598	465	1063
21:00-22:00	199	374	573
TOTAL	7833	8817	16650

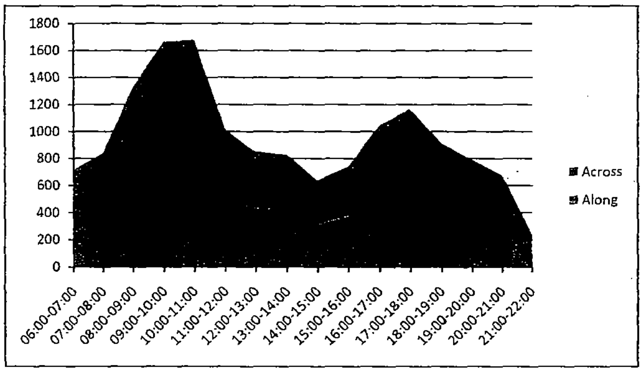


Location Name: Ambedkar Chowk Date: 10-04-2012
Direction: Towards Moolchand Day: Tuesday

Peak hour volume 1679
Peak hour 10:00-11:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	357	355	712
07:00-08:00	431	409	840
08:00-09:00	655	672	1327
09:00-10:00	775	890	1665
10:00-11:00	840	839	1679
11:00-12:00	509	508	1017
12:00-13:00	430	422	852
13:00-14:00	424	407	831
14:00-15:00	315	325	640
15:00-16:00	375	367	742
16:00-17:00	524	521	1045
17:00-18:00	597	569	1166
18:00-19:00	495	420	915
19:00-20:00	388	404	792
20:00-21:00	340	339	679
21:00-22:00	107	130	237
TOTAL	7562	7577	15139

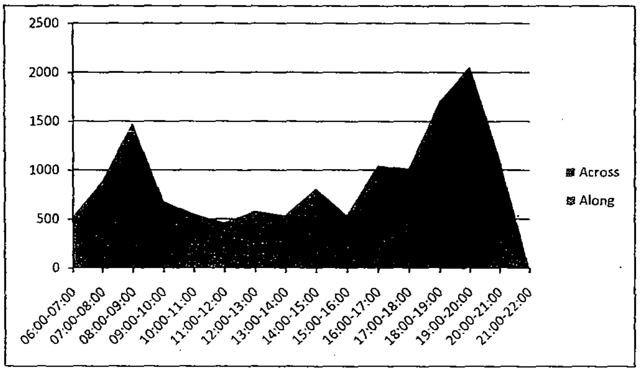


Location Name: Ambedkar Chowk Date:10-04-2012
Direction: Towards Khanpur Day:Tuesday

Peak hour volume 2059
Peak hour 19:00-20:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	241	278	519
07:00-08:00	356	537	893
08:00-09:00	269	1218	1487
09:00-10:00	164	524	688
10:00-11:00	253	305	558
11:00-12:00	213	252	465
12:00-13:00	246	341	587
13:00-14:00	281	260	541
14:00-15:00	270	549	819
15:00-16:00	148	394	542
16:00-17:00	248	803	1051
17:00-18:00	394	624	1018
18:00-19:00	501	1204	1705
19:00-20:00	418	1641	2059
20:00-21:00	350	769	1119
21:00-22:00	0	0	0
TOTAL	4352	9699	14051

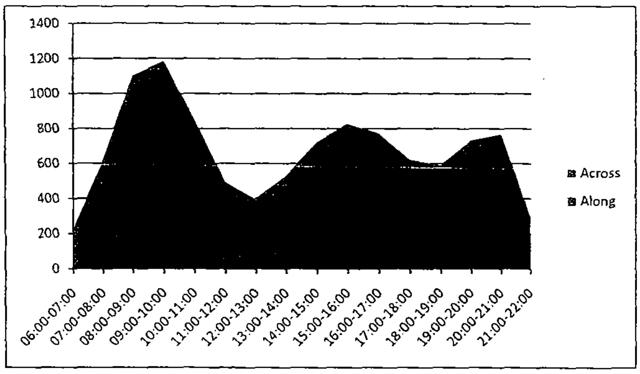


Location Name: Ambedkar Chowk Date:10-04-2012
Direction: Towards Mahrauli Day:Tuesday

Peak hour volume 1186
Peak hour 09:00-10:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	128	98	226
07:00-08:00	323	294	617
08:00-09:00	583	519	1102
09:00-10:00	584	602	1186
10:00-11:00	484	372	856
11:00-12:00	258	239	497
12:00-13:00	203	199	402
13:00-14:00	283	249	532
14:00-15:00	411	311	722
15:00-16:00	474	355	829
16:00-17:00	431	342	773
17:00-18:00	339	286	625
18:00-19:00	311	280	591
19:00-20:00	426	306	732
20:00-21:00	394	374	768
21:00-22:00	148	147	295
TOTAL	5780	4973	10753

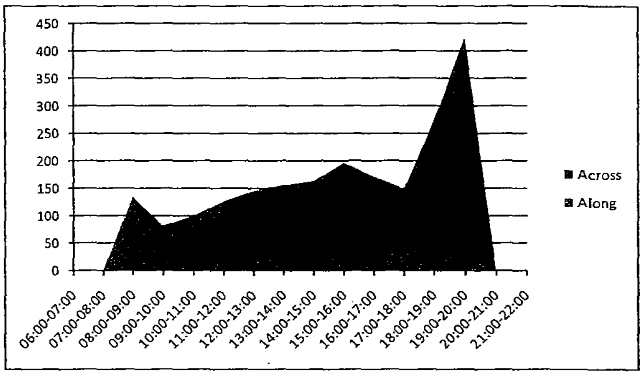


Location Name: Khanpur (Foot Over Bridge) Date:18/04/2012
Direction: Both Day: Wednesday

Peak hour volume 423
Peak hour 19:00-20:00

HOURLY VOLUME COUNT

TIME	Along	Across	Toal
06:00-07:00	0	0	0
07:00-08:00	0	0	0
08:00-09:00	0	134	134
09:00-10:00	0	81	81
10:00-11:00	0	100	100
11:00-12:00	0	126	126
12:00-13:00	0	145	145
13:00-14:00	0	156	156
14:00-15:00	0	163	163
15:00-16:00	0	196	196
16:00-17:00	0	171	171
17:00-18:00	0	149	149
18:00-19:00	0	273	273
19:00-20:00	0	423	423
20:00-21:00	0	0	0
21:00-22:00	0	0	0
TOTAL	0	2117	2117

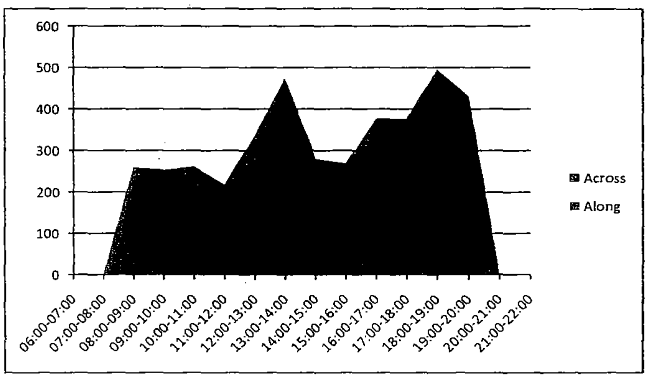


Location Name: Pushpa Bhawan(Foot Over Bridge) Date:18/04/2012
Direction: Both Day: Wednesday

Peak hour volume 496
Peak hour 18:00-19:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	0	0	0
07:00-08:00	0	0	0
08:00-09:00	0	260	260
09:00-10:00	0	254	254
10:00-11:00	0	262	262
11:00-12:00	0	218	218
12:00-13:00	0	337	337
13:00-14:00	0	475	475
14:00-15:00	0	281	281
15:00-16:00	0	269	269
16:00-17:00	0	377	377
17:00-18:00	0	377	377
18:00-19:00	0	496	496
19:00-20:00	0	432	432
20:00-21:00	0	0	0
21:00-22:00	0	0	0
TOTAL	0	4038	4038

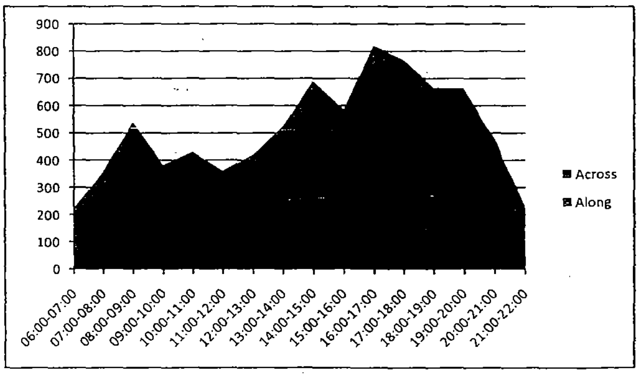


Location Name: Pushpa Bhawan Chowk Date: 08-04-2012
Direction: Towards Moolchand Day:Sunday

Peak hour volume 820
Peak hour 16:00-17:00

HOURLY VOLUME COUNT

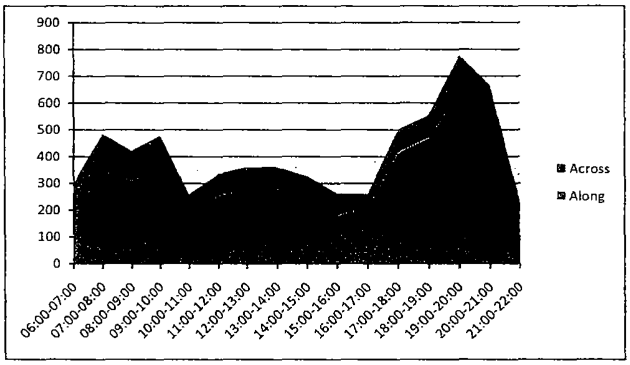
TIME	Along	Across	Total
06:00-07:00	145	78	223
07:00-08:00	214	143	357
08:00-09:00	265	275	540
09:00-10:00	175	208	383
10:00-11:00	192	239	431
11:00-12:00	174	187	361
12:00-13:00	140	279	419
13:00-14:00	254	270	524
14:00-15:00	261	430	691
15:00-16:00	265	321	586
16:00-17:00	341	479	820
17:00-18:00	272	496	768
18:00-19:00	269	398	667
19:00-20:00	211	453	664
20:00-21:00	118	358	476
21:00-22:00	81	150	231
TOTAL	3377	4764	8141



Location Name: Pushpa Bhawan Chowk **Date:** 08-04-2012 Peak hour volume 777
Direction: Towards Dakshinpuri **Day:** Sunday Peak hour 19:00-20:00

HOURLY VOLUME COUNT

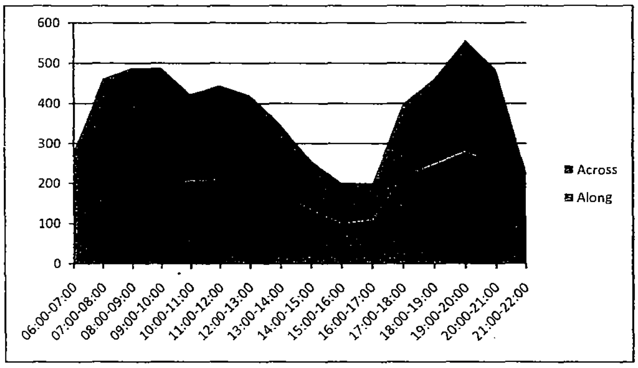
TIME	Along	Across	Total
06:00-07:00	186	113	299
07:00-08:00	346	138	484
08:00-09:00	310	113	423
09:00-10:00	354	125	479
10:00-11:00	195	64	259
11:00-12:00	255	80	335
12:00-13:00	273	87	360
13:00-14:00	243	119	362
14:00-15:00	232	94	326
15:00-16:00	180	82	262
16:00-17:00	210	51	261
17:00-18:00	413	87	500
18:00-19:00	470	84	554
19:00-20:00	637	140	777
20:00-21:00	571	97	668
21:00-22:00	172	59	231
TOTAL	5047	1533	6580



Location Name: Pushpa Bhawan Chowk **Date:** 08-04-2012 Peak hour volume 557
Direction: Towards Khanpur **Day:** Sunday Peak hour 19:00-20:00

HOURLY VOLUME COUNT

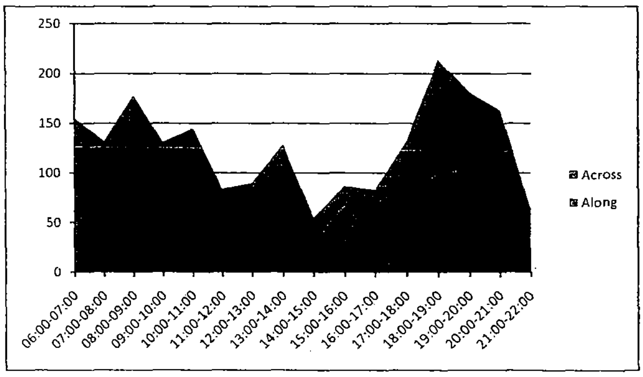
TIME	Along	Across	Total
06:00-07:00	116	163	279
07:00-08:00	160	301	461
08:00-09:00	191	298	489
09:00-10:00	191	298	489
10:00-11:00	208	216	424
11:00-12:00	210	235	445
12:00-13:00	226	195	421
13:00-14:00	177	171	348
14:00-15:00	135	123	258
15:00-16:00	100	102	202
16:00-17:00	110	90	200
17:00-18:00	219	180	399
18:00-19:00	250	210	460
19:00-20:00	280	277	557
20:00-21:00	250	236	486
21:00-22:00	117	114	231
TOTAL	2940	3209	6149



Location Name: Pushpa Bhawan Chowk **Date:** 08-04-2012 Peak hour volume 214
Direction: Towards Saket **Day:**Sunday Peak hour 18:00-19:00

HOURLY VOLUME COUNT

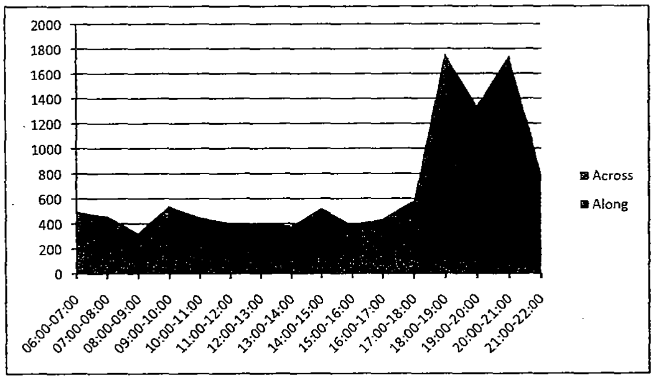
TIME	Along	Across	Total
06:00-07:00	80	76	156
07:00-08:00	75	57	132
08:00-09:00	110	68	178
09:00-10:00	70	61	131
10:00-11:00	82	63	145
11:00-12:00	53	31	84
12:00-13:00	63	27	90
13:00-14:00	69	60	129
14:00-15:00	33	22	55
15:00-16:00	67	20	87
16:00-17:00	42	41	83
17:00-18:00	82	50	132
18:00-19:00	99	115	214
19:00-20:00	103	78	181
20:00-21:00	67	96	163
21:00-22:00	34	30	64
TOTAL	1129	895	2024



Location Name: Pushpa Bhawan Chowk Date:09-04-2012 Peak hour volume 1760
Direction: Towards Moolchand Day:Monday Peak hour 18:00-19:00

HOURLY VOLUME COUNT

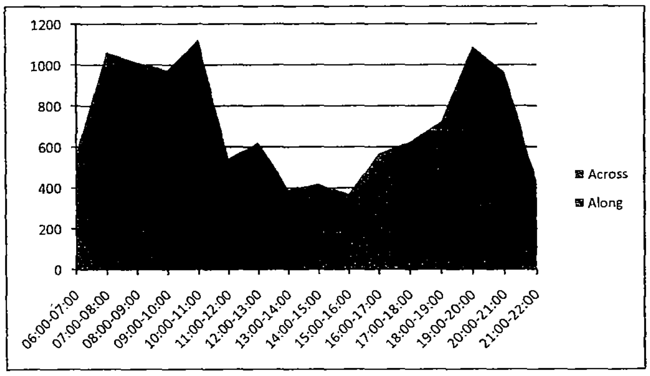
TIME	Along	Across	Total
06:00-07:00	279	218	497
07:00-08:00	295	168	463
08:00-09:00	217	111	328
09:00-10:00	366	177	543
10:00-11:00	279	171	450
11:00-12:00	309	98	407
12:00-13:00	295	112	407
13:00-14:00	230	152	382
14:00-15:00	422	103	525
15:00-16:00	328	63	391
16:00-17:00	352	89	441
17:00-18:00	491	92	583
18:00-19:00	1225	535	1760
19:00-20:00	791	550	1341
20:00-21:00	1025	723	1748
21:00-22:00	614	189	803
TOTAL	7518	3551	11069



Location Name: Pushpa Bhawan Chowk Date:09-04-2012 Peak hour volume 1124
Direction: Towards Dakshinpuri Day:Monday Peak hour 10:00-11:00

HOURLY VOLUME COUNT

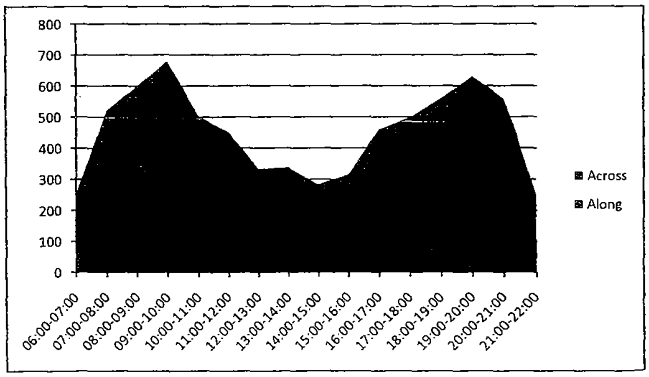
TIME	Along	Across	Total
06:00-07:00	221	340	561
07:00-08:00	348	715	1063
08:00-09:00	409	606	1015
09:00-10:00	419	557	976
10:00-11:00	425	699	1124
11:00-12:00	216	327	543
12:00-13:00	298	325	623
13:00-14:00	195	197	392
14:00-15:00	181	239	420
15:00-16:00	186	185	371
16:00-17:00	383	186	569
17:00-18:00	424	201	625
18:00-19:00	499	225	724
19:00-20:00	721	369	1090
20:00-21:00	678	290	968
21:00-22:00	286	150	436
TOTAL	5889	5611	11500



Location Name: Pushpa Bhawan Chowk Date:09-04-2012 Peak hour volume 680
Direction: Towards Khanpur Day:Monday Peak hour 09:00-10:00

HOURLY VOLUME COUNT

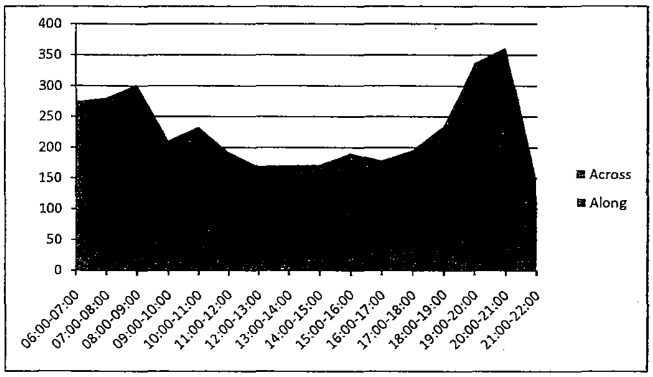
TIME	Along	Across	Total
06:00-07:00	124	127	251
07:00-08:00	302	219	521
08:00-09:00	323	278	601
09:00-10:00	354	326	680
10:00-11:00	275	229	504
11:00-12:00	234	217	451
12:00-13:00	175	159	334
13:00-14:00	182	157	339
14:00-15:00	142	142	284
15:00-16:00	162	155	317
16:00-17:00	217	243	460
17:00-18:00	236	263	499
18:00-19:00	291	269	560
19:00-20:00	306	325	631
20:00-21:00	290	269	559
21:00-22:00	107	145	252
TOTAL	3720	3523	7243



Location Name: Pushpa Bhawan Chowk   Date:09-04-2012   Peak hour volume 362
Direction: Towards Saket   Day:Monday   Peak hour 20:00-21:00

HOURLY VOLUME COUNT

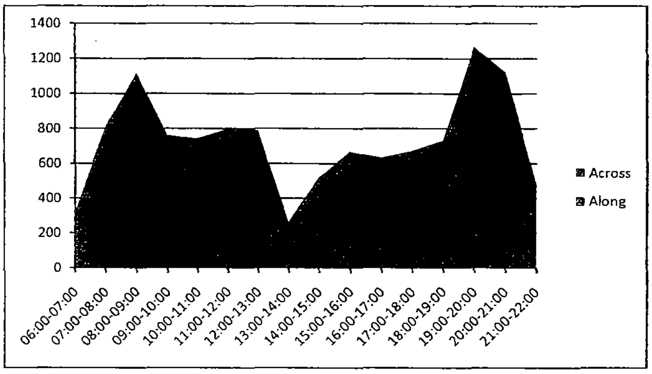
TIME	Along	Across	Total
06:00-07:00	145	130	275
07:00-08:00	146	135	281
08:00-09:00	197	106	303
09:00-10:00	171	40	211
10:00-11:00	169	65	234
11:00-12:00	105	88	193
12:00-13:00	112	58	170
13:00-14:00	107	64	171
14:00-15:00	106	66	172
15:00-16:00	122	69	191
16:00-17:00	109	70	179
17:00-18:00	124	72	196
18:00-19:00	137	98	235
19:00-20:00	234	103	337
20:00-21:00	222	140	362
21:00-22:00	96	52	148
TOTAL	2302	1356	3658



Location Name: Pushpa Bhawan Chowk   Date:10-04-2012   Peak hour volume 1267
Direction: Towards Moolchand   Day:Sunday   Peak hour 19:00-20:00

HOURLY VOLUME COUNT

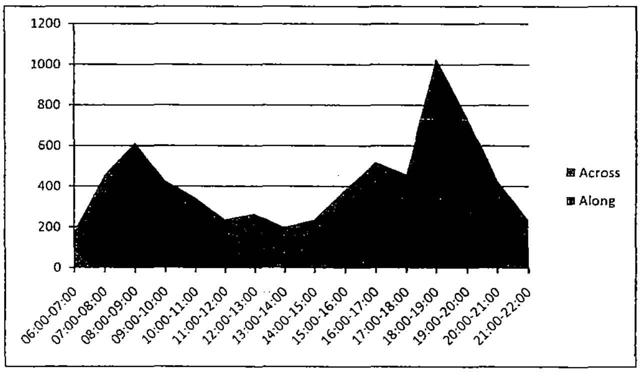
TIME	Along	Across	Total
06:00-07:00	198	117	315
07:00-08:00	534	282	816
08:00-09:00	821	298	1119
09:00-10:00	533	229	762
10:00-11:00	464	281	745
11:00-12:00	438	363	801
12:00-13:00	372	420	792
13:00-14:00	180	85	265
14:00-15:00	318	206	524
15:00-16:00	331	338	669
16:00-17:00	365	271	636
17:00-18:00	407	266	673
18:00-19:00	434	300	734
19:00-20:00	675	592	1267
20:00-21:00	579	545	1124
21:00-22:00	278	205	483
TOTAL	6927	4798	11725



Location Name: Pushpa Bhawan Chowk   Date:10-04-2012   Peak hour volume 1030
Direction: Towards Dakshinpuri   Day:Tuesday   Peak hour 18:00-19:00

HOURLY VOLUME COUNT

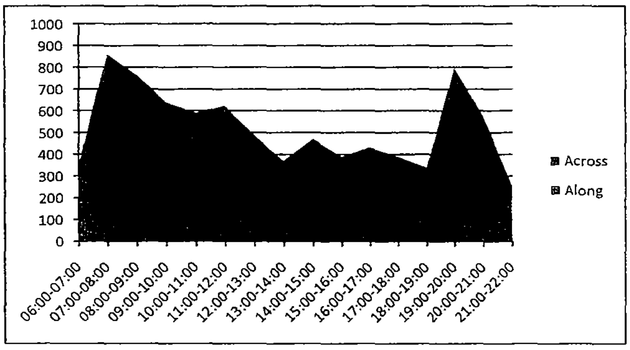
TIME	Along	Across	Total
06:00-07:00	106	70	176
07:00-08:00	345	110	455
08:00-09:00	524	93	617
09:00-10:00	336	92	428
10:00-11:00	261	84	345
11:00-12:00	175	65	240
12:00-13:00	197	71	268
13:00-14:00	126	75	201
14:00-15:00	167	72	239
15:00-16:00	251	134	385
16:00-17:00	393	128	521
17:00-18:00	315	146	461
18:00-19:00	790	240	1030
19:00-20:00	580	164	744
20:00-21:00	342	90	432
21:00-22:00	195	44	239
TOTAL	5103	1678	6781



Location Name: Pushpa Bhawan Chowk Date:10-04-2012 Peak hour volume 861
Direction: Towards Khanpur Day:Tuesday Peak hour 07:00-08:00

HOURLY VOLUME COUNT

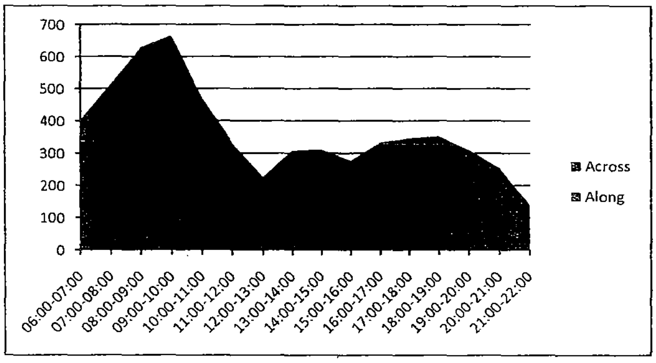
TIME	Along	Across	Total
06:00-07:00	200	146	346
07:00-08:00	529	332	861
08:00-09:00	395	368	763
09:00-10:00	299	341	640
10:00-11:00	329	261	590
11:00-12:00	342	282	624
12:00-13:00	250	237	487
13:00-14:00	213	158	371
14:00-15:00	259	213	472
15:00-16:00	218	171	389
16:00-17:00	270	163	433
17:00-18:00	222	167	389
18:00-19:00	185	154	339
19:00-20:00	420	375	795
20:00-21:00	302	273	575
21:00-22:00	125	129	254
TOTAL	4558	3770	8328



Location Name: Pushpa Bhawan Chowk Date:10-4-2012 Peak hour volume 665
Direction: Towards Saket Day:Tuesday Peak hour 09:00-10:00

HOURLY VOLUME COUNT

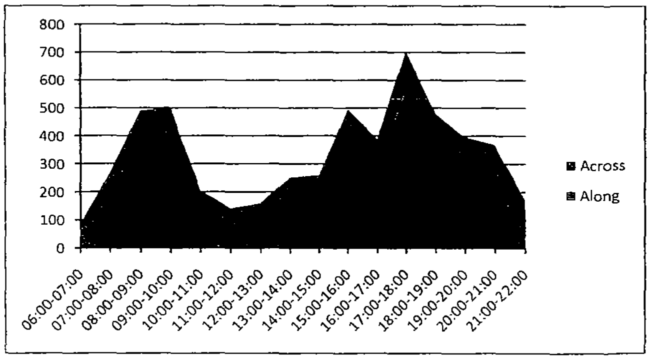
TIME	Along	Across	Total
06:00-07:00	323	79	402
07:00-08:00	422	92	514
08:00-09:00	495	134	629
09:00-10:00	533	132	665
10:00-11:00	389	84	473
11:00-12:00	285	48	333
12:00-13:00	159	67	226
13:00-14:00	200	109	309
14:00-15:00	221	90	311
15:00-16:00	213	64	277
16:00-17:00	270	63	333
17:00-18:00	260	87	347
18:00-19:00	276	77	353
19:00-20:00	230	81	311
20:00-21:00	191	64	255
21:00-22:00	95	49	144
TOTAL	4562	1320	5882



Location Name: Sheikh Sarai Chowk Date: 08-04-2012 Peak hour volume 703
Direction: Towards Moolchand Day: Sunday Peak hour 17:00-18:00

HOURLY VOLUME COUNT

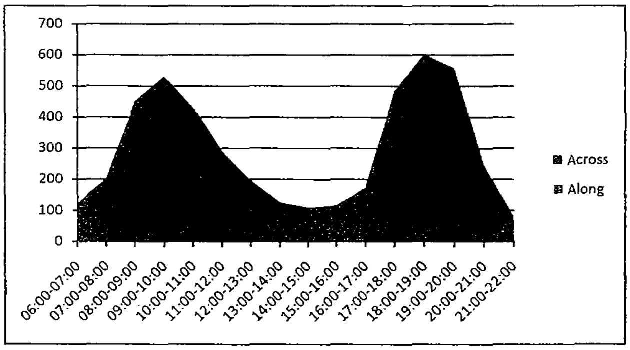
TIME	Along	Across	Total
06:00-07:00	49	37	86
07:00-08:00	198	73	271
08:00-09:00	398	93	491
09:00-10:00	447	56	503
10:00-11:00	175	31	206
11:00-12:00	96	46	142
12:00-13:00	120	40	160
13:00-14:00	138	114	252
14:00-15:00	161	100	261
15:00-16:00	233	263	496
16:00-17:00	290	98	388
17:00-18:00	564	139	703
18:00-19:00	345	135	480
19:00-20:00	280	118	398
20:00-21:00	301	68	369
21:00-22:00	140	33	173
TOTAL	3935	1444	5379



Location Name: Sheikh Sarai Chowk Date: 08-04-2012 Peak hour volume 602
Direction: Towards Khanpur Day: Sunday Peak hour 18:00-19:00

HOURLY VOLUME COUNT

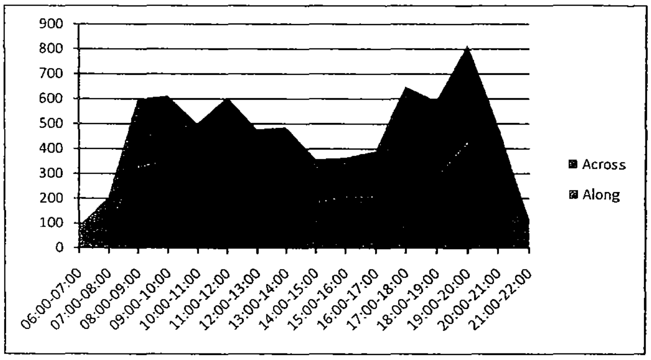
TIME	Along	Across	Total
06:00-07:00	60	63	123
07:00-08:00	121	80	201
08:00-09:00	359	92	451
09:00-10:00	425	107	532
10:00-11:00	260	173	433
11:00-12:00	197	95	292
12:00-13:00	128	70	198
13:00-14:00	77	49	126
14:00-15:00	63	47	110
15:00-16:00	77	40	117
16:00-17:00	99	75	174
17:00-18:00	410	75	485
18:00-19:00	505	97	602
19:00-20:00	493	65	558
20:00-21:00	169	79	248
21:00-22:00	54	27	81
TOTAL	3497	1234	4731



Location Name: Sheikh Sarai Chowk Date: 08-04-2012 Peak hour volume 819
Direction: Towards Qutub Minar Day: Sunday Peak hour 19:00-20:00

HOURLY VOLUME COUNT

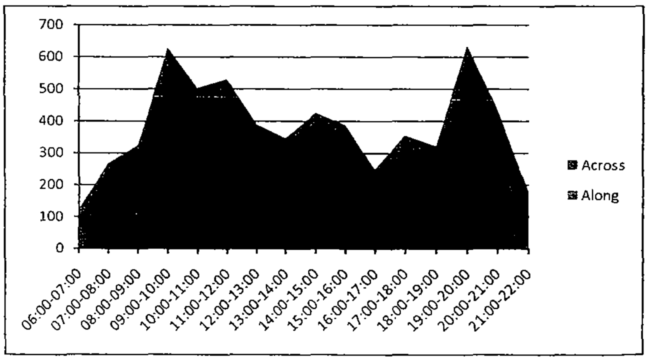
TIME	Along	Across	Total
06:00-07:00	43	45	88
07:00-08:00	90	115	205
08:00-09:00	328	272	600
09:00-10:00	350	264	614
10:00-11:00	329	172	501
11:00-12:00	379	230	609
12:00-13:00	276	203	479
13:00-14:00	270	218	488
14:00-15:00	185	174	359
15:00-16:00	207	158	365
16:00-17:00	207	184	391
17:00-18:00	345	305	650
18:00-19:00	287	307	594
19:00-20:00	427	392	819
20:00-21:00	287	209	496
21:00-22:00	61	57	118
TOTAL	4071	3305	7376



Location Name: Sheikh Sarai Chowk Date: 09-04-2012 Peak hour volume 637
Direction: Towards Moolchand Day: Monday Peak hour 19:00-20:00

HOURLY VOLUME COUNT

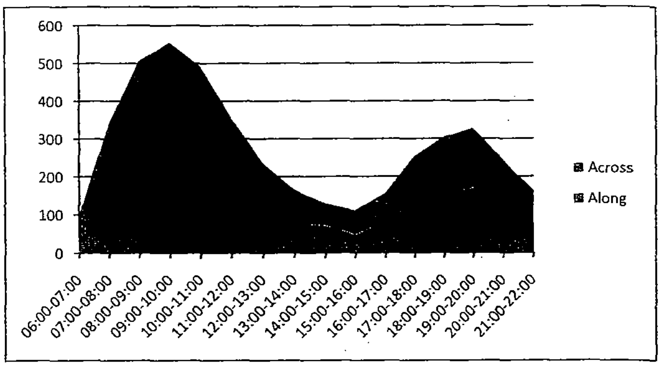
TIME	Along	Across	Total
06:00-07:00	68	56	124
07:00-08:00	106	162	268
08:00-09:00	146	178	324
09:00-10:00	255	375	630
10:00-11:00	204	300	504
11:00-12:00	260	273	533
12:00-13:00	170	219	389
13:00-14:00	152	196	348
14:00-15:00	224	202	426
15:00-16:00	184	204	388
16:00-17:00	124	126	250
17:00-18:00	207	148	355
18:00-19:00	195	127	322
19:00-20:00	373	264	637
20:00-21:00	259	174	433
21:00-22:00	118	62	180
TOTAL	3045	3066	6111



Location Name: Sheikh Sarai Chowk   Date:09-04-12   Peak hour volume 555
Direction: Towards Khanpur   Day: Monday   Peak hour 09:00-10:00

HOURLY VOLUME COUNT

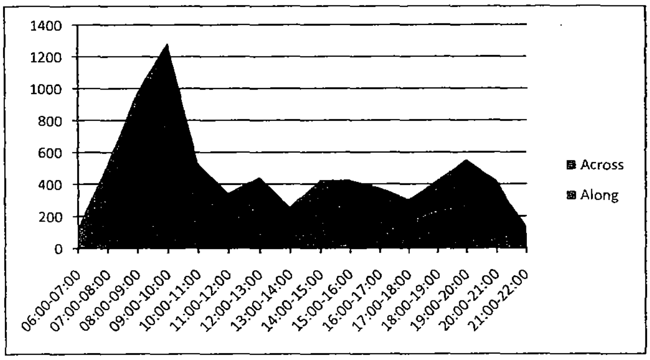
TIME	Along	Across	Total
06:00-07:00	47	51	98
07:00-08:00	195	145	340
08:00-09:00	270	235	505
09:00-10:00	295	260	555
10:00-11:00	260	233	493
11:00-12:00	181	175	356
12:00-13:00	110	126	236
13:00-14:00	79	87	166
14:00-15:00	71	59	130
15:00-16:00	48	64	112
16:00-17:00	83	74	157
17:00-18:00	130	125	255
18:00-19:00	155	150	305
19:00-20:00	170	158	328
20:00-21:00	135	110	245
21:00-22:00	80	85	165
TOTAL	2309	2137	4446



Location Name: Sheikh Sarai Chowk   Date: 09-04-2012   Peak hour volume 1289
Direction: Towards Qutub Minar   Day: Monday   Peak hour 09:00-10:00

HOURLY VOLUME COUNT

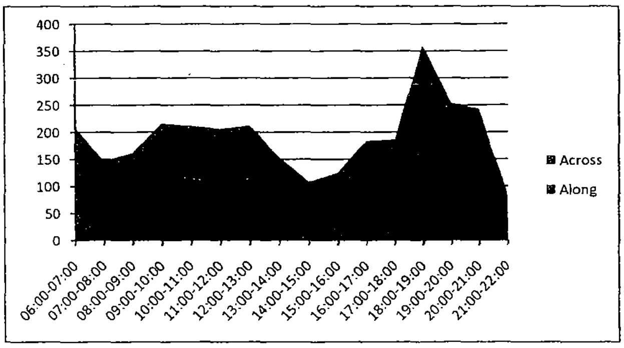
TIME	Along	Across	Total
06:00-07:00	65	60	125
07:00-08:00	309	220	529
08:00-09:00	540	441	981
09:00-10:00	730	559	1289
10:00-11:00	253	279	532
11:00-12:00	161	185	346
12:00-13:00	267	181	448
13:00-14:00	148	112	260
14:00-15:00	215	213	428
15:00-16:00	287	141	428
16:00-17:00	214	166	380
17:00-18:00	167	141	308
18:00-19:00	232	197	429
19:00-20:00	264	292	556
20:00-21:00	209	213	422
21:00-22:00	75	63	138
TOTAL	4136	3463	7599



Location Name: Sheikh Sarai Chowk   Date: 10-04-2012   Peak hour volume 360
Direction: Towards Moolchand   Day:Tuesday   Peak hour 18:00-19:00

HOURLY VOLUME COUNT

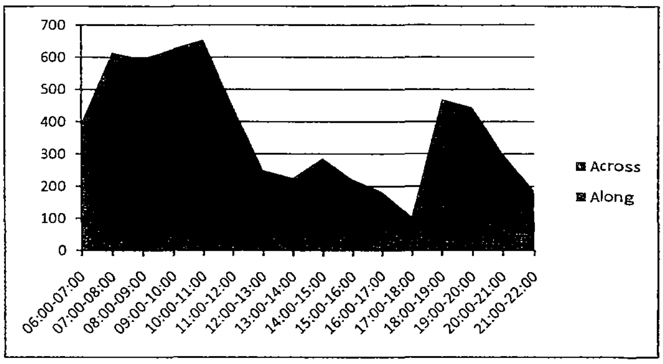
TIME	Along	Across	Total
06:00-07:00	98	111	209
07:00-08:00	86	62	148
08:00-09:00	96	66	162
09:00-10:00	122	95	217
10:00-11:00	114	98	212
11:00-12:00	108	99	207
12:00-13:00	114	99	213
13:00-14:00	83	71	154
14:00-15:00	61	48	109
15:00-16:00	67	59	126
16:00-17:00	96	89	185
17:00-18:00	96	91	187
18:00-19:00	173	187	360
19:00-20:00	127	127	254
20:00-21:00	124	120	244
21:00-22:00	39	43	82
TOTAL	1604	1465	3069



Direction: Towards Khanpur Day:Tuesday Peak hour 10:00-11:00

HOURLY VOLUME COUNT

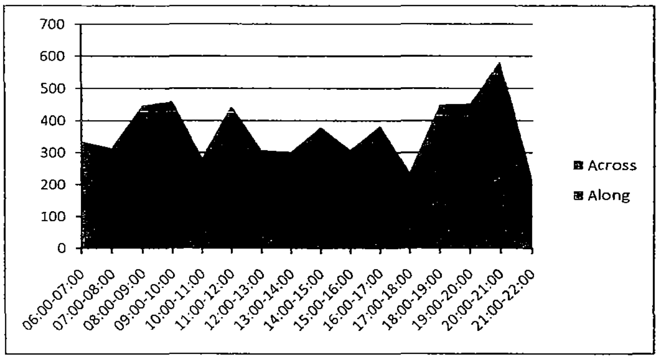
TIME	Along	Across	Total
06:00-07:00	149	246	395
07:00-08:00	215	400	615
08:00-09:00	197	399	596
09:00-10:00	274	353	627
10:00-11:00	323	331	654
11:00-12:00	181	268	449
12:00-13:00	91	159	250
13:00-14:00	57	169	226
14:00-15:00	63	224	287
15:00-16:00	48	174	222
16:00-17:00	63	120	183
17:00-18:00	25	81	106
18:00-19:00	135	335	470
19:00-20:00	162	283	445
20:00-21:00	73	230	303
21:00-22:00	60	125	185
TOTAL	2116	3897	6013



Location Name: Sheikh Sarai Chowk Date: 10-04-2012 Peak hour volume 585
Direction: Towards Qutub Minar Day:Tuesday Peak hour 20:00-21:00

HOURLY VOLUME COUNT

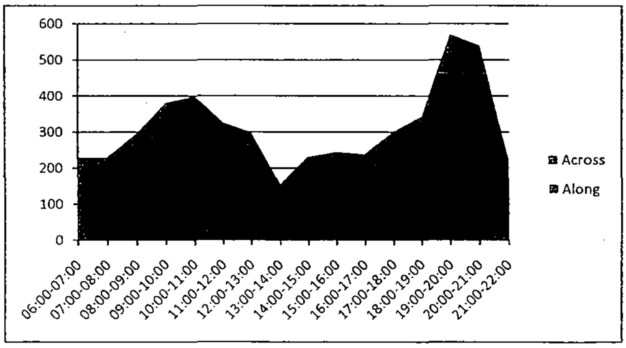
TIME	Along	Across	Total
06:00-07:00	143	193	336
07:00-08:00	132	183	315
08:00-09:00	187	261	448
09:00-10:00	137	324	461
10:00-11:00	90	194	284
11:00-12:00	154	291	445
12:00-13:00	85	223	308
13:00-14:00	109	194	303
14:00-15:00	123	257	380
15:00-16:00	156	154	310
16:00-17:00	184	200	384
17:00-18:00	105	134	239
18:00-19:00	147	303	450
19:00-20:00	162	291	453
20:00-21:00	223	362	585
21:00-22:00	83	136	219
TOTAL	2220	3700	5920



Location Name: Chirag Delhi Date: 12-04-2012 Peak hour volume 571
Direction: Towards Moolchand Day: Thursday Peak hour 19:00-20:00

HOURLY VOLUME COUNT

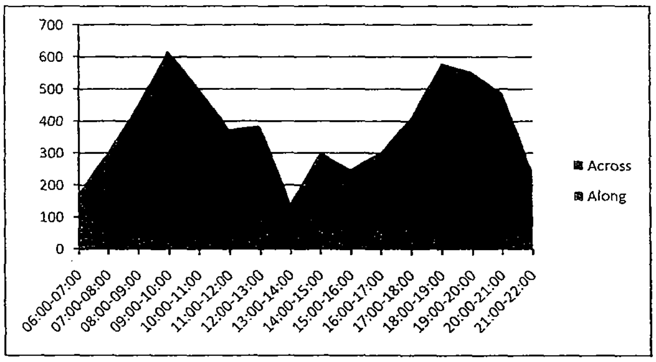
TIME	Along	Across	Total
06:00-07:00	118	112	230
07:00-08:00	128	102	230
08:00-09:00	194	103	297
09:00-10:00	235	146	381
10:00-11:00	238	161	399
11:00-12:00	175	152	327
12:00-13:00	156	143	299
13:00-14:00	80	76	156
14:00-15:00	126	105	231
15:00-16:00	110	135	245
16:00-17:00	128	111	239
17:00-18:00	149	152	301
18:00-19:00	180	163	343
19:00-20:00	255	316	571
20:00-21:00	288	253	541
21:00-22:00	121	103	224
TOTAL	2681	2333	5014



Location Name: Chirag Delhi   Date: 12-04-2012   Peak hour volume 621
Direction: Towards GK-II   Day:Thursday   Peak hour 09:00-10:00

HOURLY VOLUME COUNT

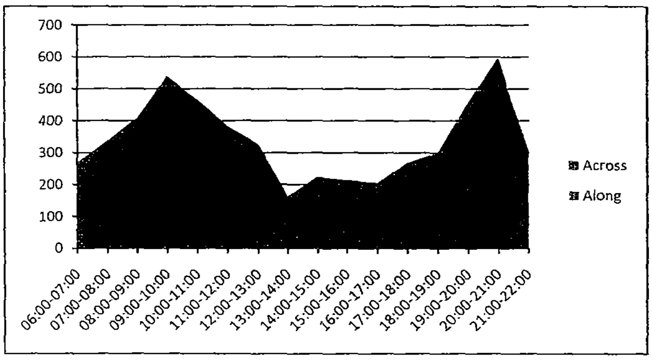
TIME	Along	Across	Total
06:00-07:00	87	90	177
07:00-08:00	224	80	304
08:00-09:00	333	119	452
09:00-10:00	446	175	621
10:00-11:00	375	130	505
11:00-12:00	247	129	376
12:00-13:00	248	137	385
13:00-14:00	97	47	144
14:00-15:00	209	95	304
15:00-16:00	179	71	250
16:00-17:00	192	112	304
17:00-18:00	267	146	413
18:00-19:00	369	212	581
19:00-20:00	317	236	553
20:00-21:00	269	220	489
21:00-22:00	159	88	247
TOTAL	4018	2087	6105



Location Name: Chirag Delhi   Date: 12-04-2012   Peak hour volume 597
Direction: Towards Khanpur   Day:Thursday   Peak hour 20:00-21:00

HOURLY VOLUME COUNT

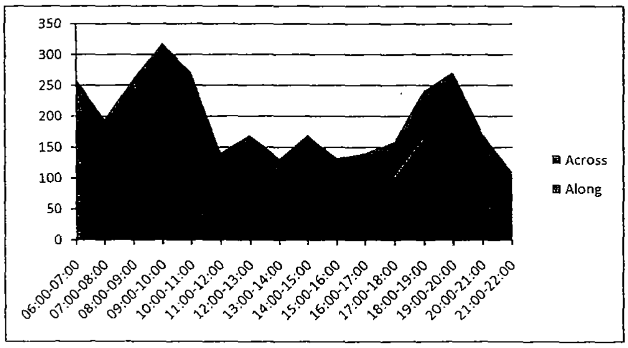
TIME	Along	Across	Total
06:00-07:00	104	165	269
07:00-08:00	192	146	338
08:00-09:00	220	188	408
09:00-10:00	303	237	540
10:00-11:00	240	227	467
11:00-12:00	190	194	384
12:00-13:00	146	182	328
13:00-14:00	86	78	164
14:00-15:00	113	112	225
15:00-16:00	107	108	215
16:00-17:00	101	105	206
17:00-18:00	118	151	269
18:00-19:00	135	166	301
19:00-20:00	189	270	459
20:00-21:00	227	370	597
21:00-22:00	143	162	305
TOTAL	2614	2861	5475



Location Name: Chirag Delhi   Date: 12-04-2012   Peak hour volume 319
Direction: Towards Airport   Day:Thursday   Peak hour 09:00-10:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	167	94	261
07:00-08:00	121	75	196
08:00-09:00	174	88	262
09:00-10:00	210	109	319
10:00-11:00	182	89	271
11:00-12:00	89	52	141
12:00-13:00	106	64	170
13:00-14:00	61	71	132
14:00-15:00	116	54	170
15:00-16:00	82	51	133
16:00-17:00	96	45	141
17:00-18:00	102	57	159
18:00-19:00	165	77	242
19:00-20:00	171	101	272
20:00-21:00	111	61	172
21:00-22:00	73	38	111
TOTAL	2026	1126	3152



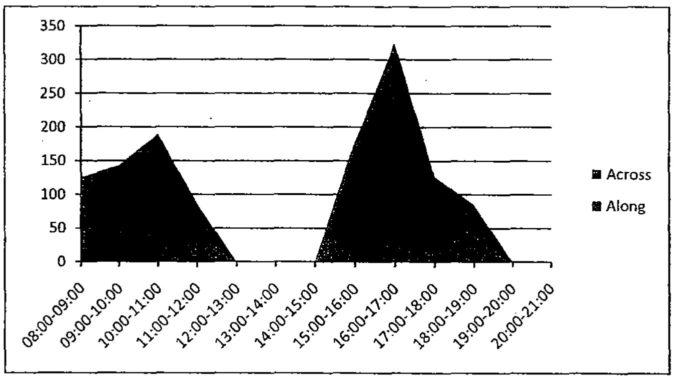
Road/ Intersection Name: Siri fort Intersection
Date: 13.04.2012
Direction: From : To: Moolchand

SUMMARY

Peak hour volume	325
Peak hour	16:00-17:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	95	30	125
09:00-10:00	81	62	143
10:00-11:00	135	55	190
11:00-12:00	55	32	87
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	63	115	178
16:00-17:00	65	260	325
17:00-18:00	53	73	126
18:00-19:00	43	42	85
19:00-20:00	0	0	0
20:00-21:00	0	0	0
TOTAL	590	669	1259



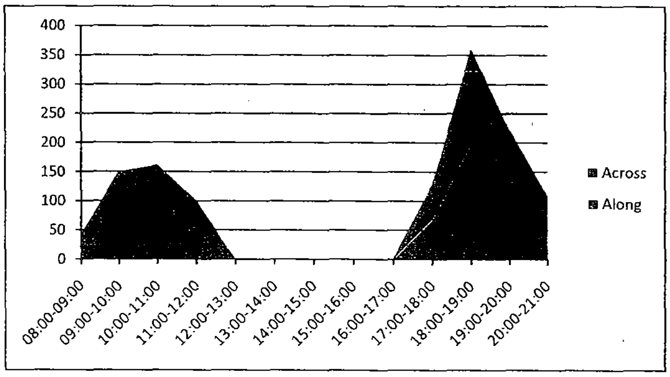
Road/ Intersection Name: Siri fort Intersection
Date: 13.04.2012
Direction: From : To: GK I

SUMMARY

Peak hour volume	360
Peak hour	18:00-19:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	32	11	43
09:00-10:00	103	47	150
10:00-11:00	120	42	162
11:00-12:00	69	32	101
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	0	0	0
17:00-18:00	67	61	128
18:00-19:00	197	163	360
19:00-20:00	157	65	222
20:00-21:00	74	35	109
TOTAL	819	456	1275



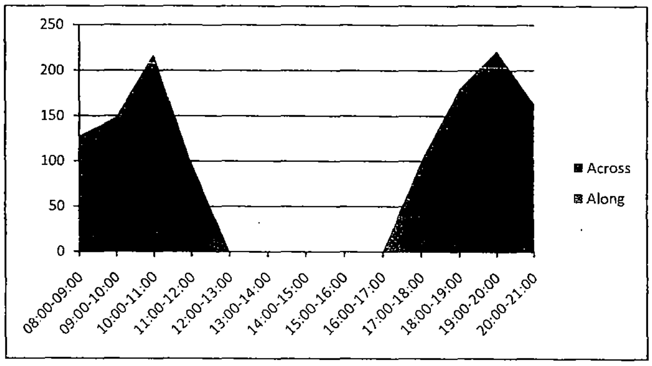
Road/ Intersection Name: Siri fort Intersection
Date: 13.04.2012
Direction: From : To: Chirag delhi

SUMMARY

Peak hour volume	222
Peak hour	19:00-20:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	94	34	128
09:00-10:00	93	56	149
10:00-11:00	157	61	218
11:00-12:00	64	34	98
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	0	0	0
17:00-18:00	41	59	100
18:00-19:00	75	105	180
19:00-20:00	72	150	222
20:00-21:00	54	110	164
TOTAL	650	609	1259



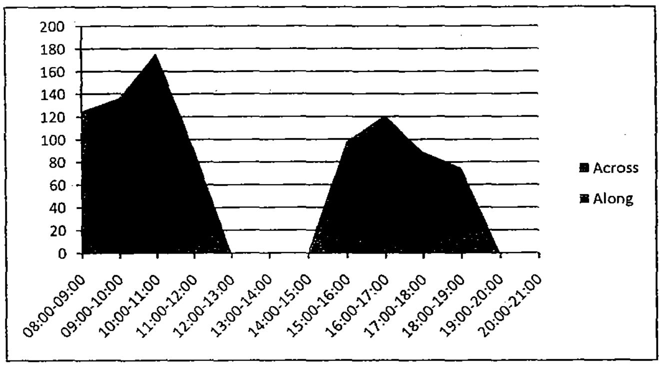
Road/ Intersection Name: Siri fort Intersection
Date: 13.04.2012
Direction: From : To: Siri fort

SUMMARY

Peak hour volume 176
Peak hour 10:00-11:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	95	30	125
09:00-10:00	81	55	136
10:00-11:00	135	41	176
11:00-12:00	55	38	93
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	57	41	98
16:00-17:00	65	56	121
17:00-18:00	53	36	89
18:00-19:00	43	32	75
19:00-20:00	0	0	0
20:00-21:00	0	0	0
TOTAL	584	329	913



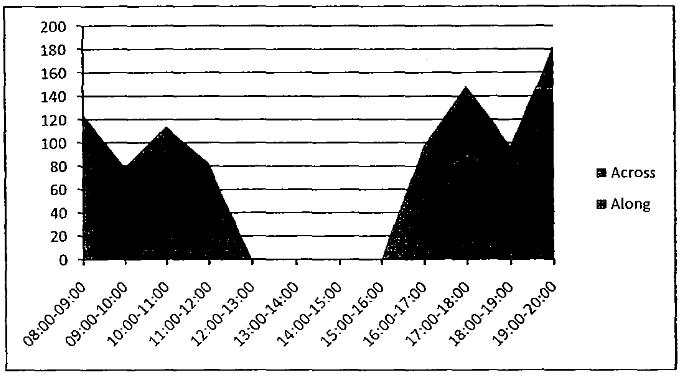
Road/ Intersection Name: Moolchand Intersection
Date: 14.04.2012
Direction: From : To: Moolchand

SUMMARY

Peak hour volume 183
Peak hour 19:00-20:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	81	44	125
09:00-10:00	69	10	79
10:00-11:00	71	43	114
11:00-12:00	57	26	83
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	67	30	97
17:00-18:00	89	60	149
18:00-19:00	72	25	97
19:00-20:00	136	47	183
TOTAL	364	162	927



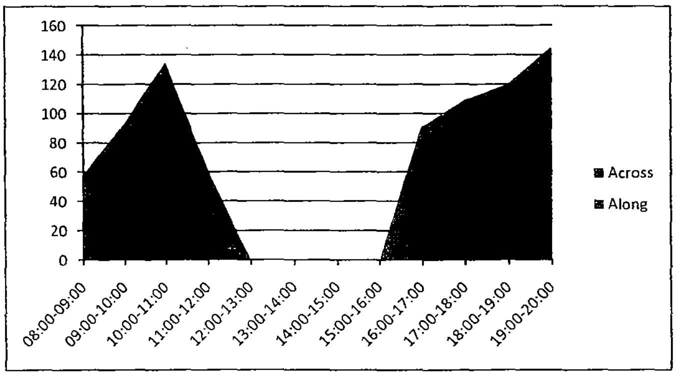
Road/ Intersection Name: Moolchand Intersection
Date: 14.04.2012
Direction: From To GK1

SUMMARY

Peak hour volume 145
Peak hour 19:00-20:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	52	6	58
09:00-10:00	72	21	93
10:00-11:00	113	22	135
11:00-12:00	46	16	62
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0		0
15:00-16:00	0	0	0
16:00-17:00	72	19	91
17:00-18:00	82	27	109
18:00-19:00	91	29	120
19:00-20:00	125	20	145
TOTAL	653	95	813



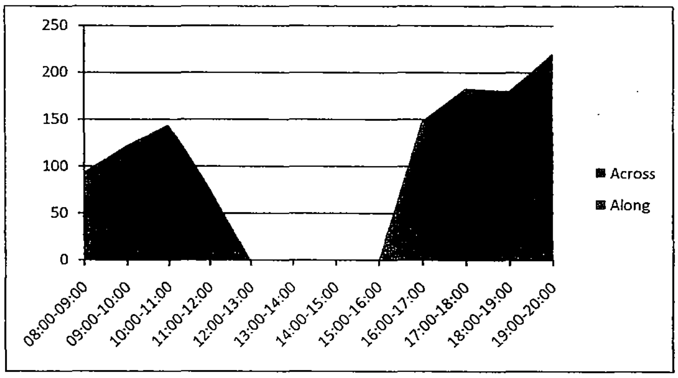
Road/ Intersection Name: Moolchand Intersection
Date: 14.04.2012
Direction: From To Chirag Delhi

SUMMARY

Peak hour volume 221
Peak hour 19:00-20:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	50	44	94
09:00-10:00	72	51	123
10:00-11:00	113	32	145
11:00-12:00	46	31	77
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	79	69	148
17:00-18:00	82	101	183
18:00-19:00	91	90	181
19:00-20:00	125	96	221
TOTAL	658	514	1172



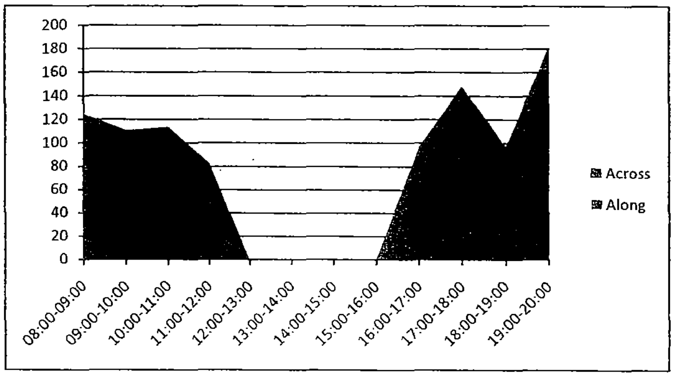
Road/ Intersection Name: Moolchand Intersection
Date: 14.04.2012
Direction: From To Siri Fort

SUMMARY

Peak hour volume 183
Peak hour 19:00-20:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	81	44	125
09:00-10:00	69	42	111
10:00-11:00	71	43	114
11:00-12:00	57	26	83
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	67	30	97
17:00-18:00	89	60	149
18:00-19:00	72	25	97
19:00-20:00	136	47	183
TOTAL	642	317	959



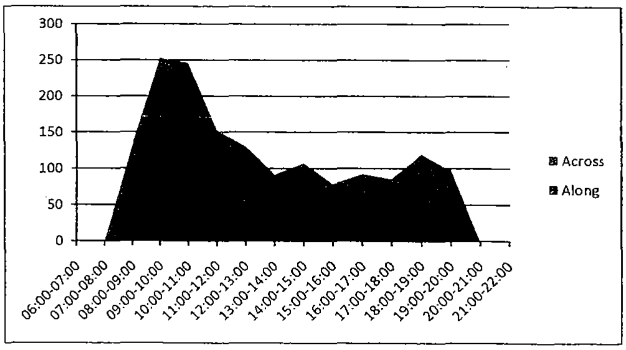
Location Name: **Krishi Vihar Near Indian Gas Agency**
Direction: Across the Road

Date: 23-04-2012
Day: Monday

Peak hour volume 253
Peak hour 09:00-10:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
06:00-07:00	0	0	0
07:00-08:00	0	0	0
08:00-09:00	0	133	133
09:00-10:00	0	253	253
10:00-11:00	0	246	246
11:00-12:00	0	154	154
12:00-13:00	0	131	131
13:00-14:00	0	92	92
14:00-15:00	0	108	108
15:00-16:00	0	79	79
16:00-17:00	0	93	93
17:00-18:00	0	86	86
18:00-19:00	0	120	120
19:00-20:00	0	98	98
20:00-21:00	0	0	0
21:00-22:00	0	0	0
TOTAL	0	1593	1593



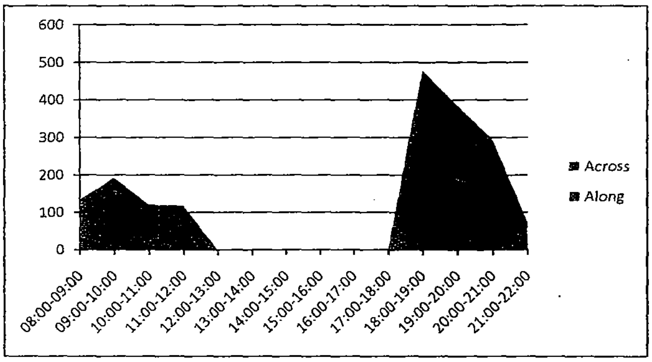
Road/ Intersection Name: N GK Crossing
Date: 13.04.2012
Direction: From : To: Moolchand

SUMMARY

Peak hour volume 478
Peak hour 18:00-19:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	97	36	133
09:00-10:00	158	35	193
10:00-11:00	112	9	121
11:00-12:00	107	11	118
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	0	0	0
17:00-18:00	0	0	0
18:00-19:00	241	237	478
19:00-20:00	188	197	385
20:00-21:00	160	134	294
21:00-22:00	43	30	73
TOTAL	1106	689	1795



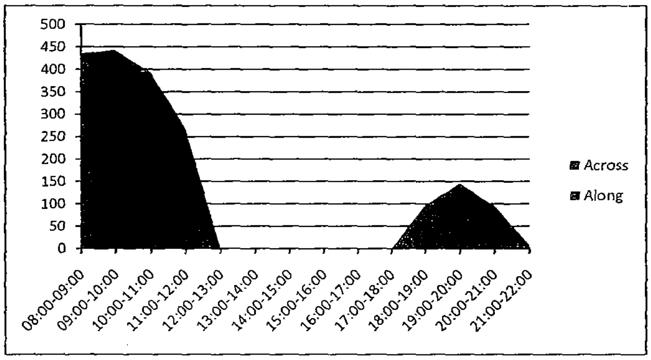
Road/ Intersection Name: GK Crossing
Date: 13.04.2012
Direction: From To Nehru Place

SUMMARY

Peak hour volume 443
Peak hour 09:00-10:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	275	160	435
09:00-10:00	290	153	443
10:00-11:00	217	176	393
11:00-12:00	181	86	267
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	0	0	0
17:00-18:00	0	0	0
18:00-19:00	53	43	96
19:00-20:00	103	43	146
20:00-21:00	50	47	97
21:00-22:00	5	4	9
TOTAL	1174	712	1886



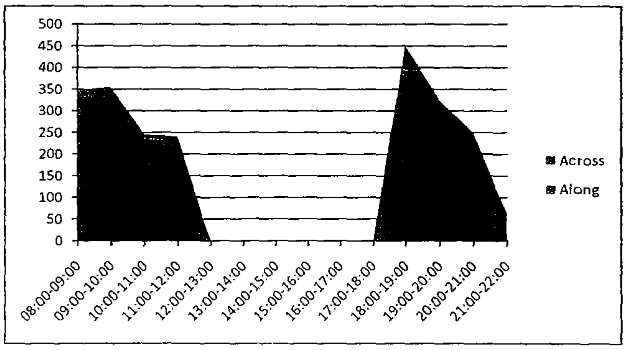
Road/ Intersection Name: I GK Crossing
Date: 13.04.2012
Direction: From To Chirag Delhi/ Siri Fort

SUMMARY

Peak hour volume 451
Peak hour 18:00-19:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	312	36	348
09:00-10:00	320	35	355
10:00-11:00	237	9	246
11:00-12:00	230	11	241
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	0	0	0
17:00-18:00	0	0	0
18:00-19:00	202	249	451
19:00-20:00	125	200	325
20:00-21:00	122	128	250
21:00-22:00	38	25	63
TOTAL	1586	693	2279



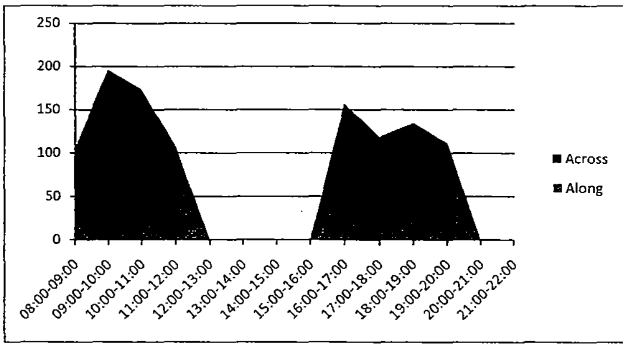
Road/ Intersection Name: GK Crossing
Date: 14.04.2012
Direction: From : To: Moolchand

SUMMARY

Peak hour volume 196
Peak hour 09:00-10:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	73	32	105
09:00-10:00	134	62	196
10:00-11:00	134	40	174
11:00-12:00	78	29	107
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	125	32	157
17:00-18:00	101	18	119
18:00-19:00	111	24	135
19:00-20:00	96	16	112
20:00-21:00	0	0	0
21:00-22:00	0	0	0
TOTAL	852	253	1105



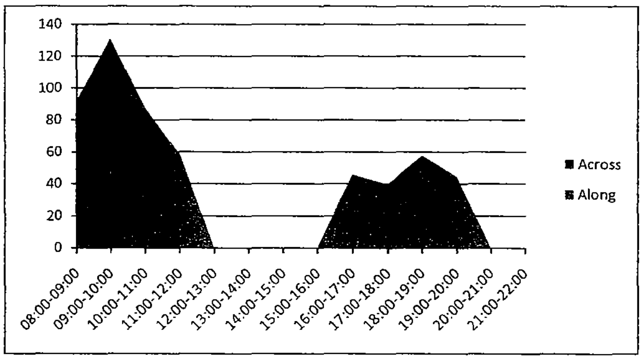
Road/ Intersection Name: N GK Crossing
Date: 14.04.2012
Direction: From To Nehru Place

SUMMARY

Peak hour volume 131
Peak hour 09:00-10:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	66	26	92
09:00-10:00	97	34	131
10:00-11:00	65	23	88
11:00-12:00	47	12	59
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	34	12	46
17:00-18:00	32	8	40
18:00-19:00	36	22	58
19:00-20:00	30	15	45
20:00-21:00	0	0	0
21:00-22:00	0	0	0
TOTAL	407	152	559



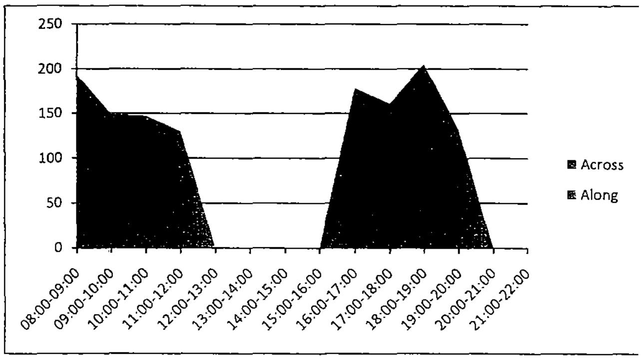
Road/ Intersection Name: GK Crossing
Date: 14.04.2012
Direction: From To Chirag Delhi/ Siri Fort

SUMMARY

Peak hour volume 205
Peak hour 18:00-19:00

HOURLY VOLUME COUNT

TIME	Along	Across	Total
08:00-09:00	143	51	194
09:00-10:00	119	31	150
10:00-11:00	115	33	148
11:00-12:00	101	30	131
12:00-13:00	0	0	0
13:00-14:00	0	0	0
14:00-15:00	0	0	0
15:00-16:00	0	0	0
16:00-17:00	105	74	179
17:00-18:00	91	71	162
18:00-19:00	93	112	205
19:00-20:00	80	52	132
20:00-21:00	0	0	0
21:00-22:00	0	0	0
TOTAL	847	454	1301



ANNEXURE-XII: TRAFFIC ADVISORY

IMPORTANT TRAFFIC ADVISORY

CSIR CRRI

Trial Run for Evaluation of Bus Rapid Transit (BRT) Corridor Performance from Ambedkar Nagar to Mool Chand, Delhi starting from 12th to 17th May, 2012

In compliance with the directions of Hon'ble Delhi High Court order vide WP *(C)* 380/2012 dated 15/3/2012, Transport Department, Govt. of NCT, Delhi *(GNCTD)* appointed CSIR - Central Road Research Institute *(CRRI)*, New Delhi for the conduct of the study on evaluation of BRT Corridor. Exhaustive scientific traffic studies have been carried out by CSIR-CRRI and based on the same, the following traffic movement plan would be on trial starting at **Ambedkar Nagar Khanpur 'T' Point and up to Siri Fort Intersection only beginning from 12/05/2012 to 17/05/2012 from 6 am to 10 pm as shown in the Schematic Diagram overleaf:**

a) **Left and straight bound buses** would **ply on left carriageway only and locations for bus stops indicated**. The general straight bound and left traffic would ply on the adjacent lane.

b) The **right turning buses and also right turning general traffic** would ply on the extreme right lane on both directions of travel i.e. existing BRT lane.

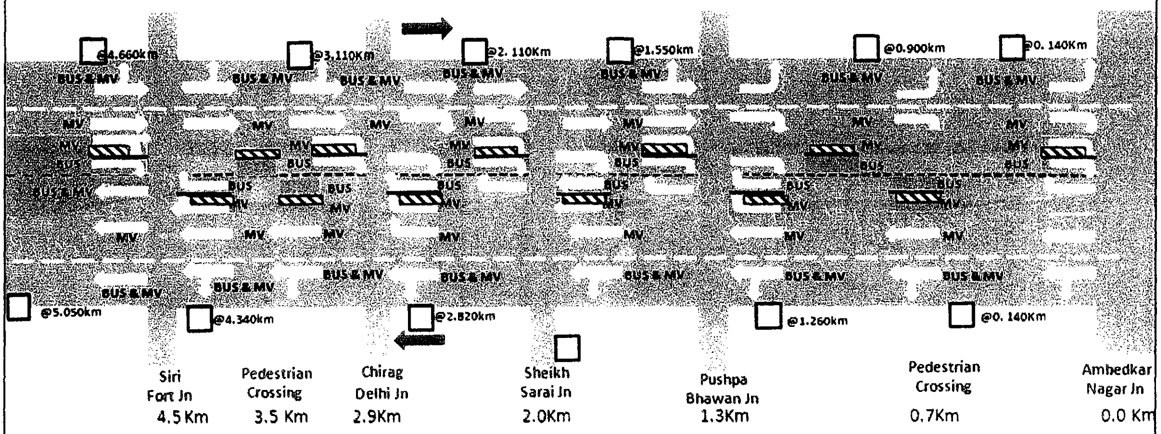
c) At **Chirag Delhi intersection, one additional lane** has been earmarked for right turning traffic from **Sheikh Sarai to Nehru Place.**

d) Similarly, one **additional right turning traffic lane** has also been provided at Sheikh Sarai intersection for right turning traffic from **Chirag Delhi to Saket.**

e) **Cyclists and other Non-Motorized Vehicles** ***(NMV)*** will continue to use the existing NMV lane for all directions of travel.

This traffic advisory has been issued in public interest by Transport Department, GNCTD, and CSIR - CRRI with an aim to achieve smooth flow of traffic during the experimental trial run and therefore all the road users are strongly advised to adhere to the above traffic advisory plan. Further all the road users are requested to follow the posted road signage, road markings, directions of the Delhi Traffic Police and Marshalls deployed during experimental trial run.

Transport Department, GNCTD and
CSIR - Central Road Research Institute, New Delhi
P.T.O.



Legend:
Bus stop Location for Left & Straight Buses, MV: Motor Vehicle (Car, Two Wheeler, Auto, Taxi and Goods Vehicle)
Existing Bus Shelter temporarily closed; Open for MV traffic
Existing Bus Shelter
BRT lane open for Bus and MV

Schematic Diagram of Movement during the Experimental Trial Run from Khanpur 'T' point to Siri Fort Intersection

ANNEXURE-XIII: OPINION COMMENTS

Auto Users: Students travelled by auto and van rated bad due to their long waiting timing at signals, Their other compliant is BRT bus drivers do not follow signal during the 'normal BRT operations'.

Car Users: Air and Noise pollution in front of schools and hospital, Cause of accidents, wastage of money and time, BRT total failure and nuisance by Siri Fort residents, delays by 20-25 min. every day, BRT bus drivers don,t follow signal, long signal cycle, More accidents, BRT in every road of the delhi town will be good, safer for bikers, remove signals and keep bus stops at left of the road, need of road widening for MV lanes, Make the grade separation at intersections or replace the BRT, Close the BRT, BRT are called killer buses, consuming lot of fuel, making difficult to make on time for schools and offices, Pollution increased because of congestion, signal violations due to short green phases, BRT become big bottle neck and problem area, morning difficult to cross for school children so changed mode to car from school bus, Most of the siri fort residents are late by 15-20 minutes after BRT implementation, BRT buses enters BRT at high speeds, it made life hell. Increase the number of lanes, Drive BRT buses with care, Bus stop should be at left side, Must increase road width for smooth journey, Metro should be there instead of BRT.

Bus Users:
Negative comments: Remove BRT, more traffic and time loss, Traffic was smooth before BRT implementation, BRT not comfortable due to bus stop at centre, not safe and accident prone area, long signal cycle, and short green phase, Jumping of red light by buses, poor schedule and frequency, Fully crowded buses, problems during evening school times, problem of road crossing, less security for ladies,
Positive comments: • It is good &profitable,It is good in the long run, It is comfortable for the people, Many people are happy due to the comforts in BRT, Bus seats are comfortable, good looking, No more accidents after implementing BRT, BRT is safe, Saves time, Many people want to extend the BRT to Delhi gate

Two wheeler users: Negative : It is a very bad service provided by govt. Change this service, Wastage of time, fuel & public money, Not comfortable, Close BRT & open for general public as soon as possible, Traffic jams are caused due to BRT, More number of accidents caused, more time in travelling, Students get late to schools, Delay caused in reaching office, Red light problem is there, road was flexible before BRT, Not good for long roads, It is dangerous, Should extend toward Delhi gate,Special security checking at stand, Separate road for bikers,Remove red signal, Red signal's time should be upto 3 minutes,Bus stand left hand side,Underpass at Chirag Delhi, Do not extend BRT to Delhi Gate, Should be constructed properly

Positive: It is a very good service provided by the govt., Good experience, extend all over Delhi, General public will be profited, BRT is useful, Saves time, Less time in travel due to BRT,BRT is safer, Lesser accidents, Good for small routes.

Cycles: BRT service is very bad,Remove BRT,Traffic jams, BRT buses cause accidents, Risky for cycle passenger, Car and motor cycle passengers are coming on cycle track which is wrong, Causes delay in reaching office, Heavy traffic caused due to traffic red light, BRT buses are good, Should be constructed all over delhi, Less time, No accidents, It is good that there are different lanes for bus and cycle. Because of the separate lane, there is no possibility of accident in cycle lanes, It is good for cyclists, BRT is good and convenient for pedestrians, No other vehicle should be allowed in cycle track, Bikers should not be allowed on cycle track, Flyover should be there, Toilet is required, There should be the arrangement for water at the stand, Everyone should obey their lane.

CSIR
CRRI
CSIR-Central Road Research Institute
(An ISO 9001-2008 Institution)
Mathura Road, New Delhi
110 025
http://www.crridom.gov.in/