A STUDY ON PARA-TRANSIT SYSTEM IN INDORE CITY

EMBARQ
The WRI Center for Sustainable Transport

TARU

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ABBREVIATIONS

BRTS:	Bus Rapid Transit System
CBD:	Central Business District
CNG:	Compressed Natural Gas
CTTPI:	Comprehensive Traffic and Transportation Plan for Indore
EMI:	Equated Monthly Installments
GIS:	Geographic Information System
GPS:	Global Positioning System
ICTSL	Indore City Transport Service Limited
IMC:	Indore Municipal Corporation
IPTS:	Intermediate Public Transport System
IRC:	Indian Road Congress
JNNURM:	Jawaharlal Nehru National Urban Renewal Mission
LPG:	Liquid Petroleum Gas
LRTS:	Light Rail Transit System
MIG:	Middle Income Group
NH:	National Highway
PTS:	Paratransit System
PCU:	Passenger Car Unit
RTO:	Regional Transport Office
SEC:	Socio Economic Class
SH:	State Highway
SMS:	Short Message Service
ULB :	Urban Local Bodies

Introduction

1 INTRODUCTION

In India, the percentage of urban population with respect to the total population has been increasing over last three decades at an average rate of 40% per decade. The population growth was relatively high between 1991 to 2001 (increase of over 48%). After post reforms, the population growth was also supported by urban economic growth catering to increased livelihood options for urban dwellers.

The urban population growth forced the cities to spread and expand into the peri-urban areas. This expansion of the cities has resulted in an increased need for mobility. Also, the increase in affordability index due to economic growth has led to higher aspiration amongst people (especially a need for increased comfort). Unfortunately, in most of the Indian cities, the public transportation system has not been able to keep pace with city's growth and its developmental needs. This lack of public transportation, growing need for connectivity and comfort, has led to increased usage of private transportation.

The increased use of private transportation has led to unexpected pressure on the transportation infrastructure. For example, cities centres are usually comprised of high building density but their roads are designed for low traffic density. This existing situation reduces the scope for expansion of the road widths. Further, encroachment on carriageway by informal traders and unorganized vehicle parking especially in the business areas reduces the effective road width.

In this prevailing scenario, achieving an acceptable standard of current and future mobility within the cities is a complicated task. One of the ways is to reduce the number of vehicles on road and improve the transportation infrastructure. However, the reduction in the vehicles, especially private vehicles that constitute the majority, will not be possible unless public is provided with an option for accessible, affordable, convenient and quality public transport. In recent years, the growing necessity for public transportation and incapacity of the administration to invest has lead to the emergence of paratransit systems (PTS).

The PTS nowadays has become an indispensable mode of transportation across urban India. Auto-rickshaws, Maruti Omni, Minibuses, and Taxis have become imperative part of paratransit system (PTS). The service flexibility of PTS makes it a vital transport system to fill the gap within the organized public transport system.

PTS generally emerge out as lifeline support system to serve growing transport needs among Indian cities. Lack of infrastructure, inefficient operational controls, insufficient training, irregular monitoring, etc. does make PTS unsafe but crucial. Further, the lack of regulatory mechanisms within these systems may cripple working of the cities. Therefore, linkages of the public transportation system with a reliable and passenger friendly para-transit will be essential to reduce the traffic congestion, travel times and reliance on private transport. An integrated approach including all stakeholders is necessary to make the system safe. This would need a sound understanding of the current transportation system.

Indore City Transportation Infrastructure

2 INDORE CITY TRANSPORTATION INFRASTRUCTURE

The population of Indore is over 1.6 Million (Census 2001) with an average decadal growth rate of 40%. The Indore metropolitan area is spread over 504.87 km^2 and includes the Indore Municipal Corporation (IMC), 4 towns and 90 villages. The population density of Indore city ranges from 100 persons/ha in peripheral areas to 1,028 persons/ha in core areas.

Migration is one of the contributors to the population growth of Indore city. Being a major urban centre in the Western Madhya Pradesh, Indore serves as educational, medical industrial and trade hub. The city currently caters to a large floating population. According to Census 2001, registered work force within Indore city is around 30%. Within this work force, 63.4% and 33.4% of people employed in tertiary sectors and secondary sectors respectively. The projected population for the Indore planning area in year 2011 is 2.53 million (55% decadal growth) and in year 2021 is 3.67 million (IMC, 2006[1]).

The rapid development coupled with increase in population has contributed to increased vehicle traffic on the city roads. The increasing traffic has resulted in the manifestation of number of problems including congestion, delays, accidents, pollution etc. Public transport system in the Indore city comprises of organized standard bus service operations and metro taxi by Indore City Transport Service Limited (ICTSL) complemented by un-organized/ paratransit systems.

2.1 Road Network

The total length of road network in Indore is nearly 1710 km. The main roads cover a length of 234 km, while intermediate roads and city roads cover a length of 211 km and 936 km respectively. The National Highway (NH) and State Highway (SH) accounts for more than 50% of the incoming and outgoing traffic in the city. These roads carry majority of traffic but have insufficient carriageway width. Essential road facilities such as medians, footpaths etc. are also non-existent on most roads. The railway track virtually divides the city into two parts acting as one of the constraint to the mobility of vehicles in the city. The expansion of the city has been taking place without providing for sufficient interconnectivity. The mobility of the traffic is also retarded by many junctions with high traffic density especially during peak hours.

The salient characteristics about the city transportation network are listed below (TARU, 2010):

- 70% of the city's primary network has right-of-way of up to 30 m. About only 30% of road network can be developed in to 4-lane carriageway or more.
- 40% of the city's primary network has two-lane carriageway, 4% has single-lane carriageway while 20% of road length has intermediate lane width. Less than 20% road network has four lanes or above configuration compared to the potential of about 30%.
- 82 % of the road length in the city has undivided carriageway and from capacity and safety consideration needs attention to prevent possible head on collisions.
- Nearly 90% of the road network has bituminous pavement. Road length with Concrete pavement accounted for 7%.

[1] Indore Municipal Corporation 2006, Indore City Development Plan under JNNURM

- In 90% of the road network, there are no provision for service lane, which causes the traffic to use the principal network for all its local movement needs. This inter-mixing of local traffic with the long distance traffic severely affects the level of service on the network.
- On-street parking results in loss of carrying capacity of the road network. 57% of the road network has on-street parking thereby reducing the carriageway width for traffic movement.
- General qualities of pavements are fair and on major corridors, the incidence of pavement deterioration is low.
- Nearly 78% of the road length does not have roadside drainage facility. About 15% of road length has drainage on one side only.
- Nearly 92% of the road length does not have footpaths, thereby forcing the pedestrian to walk on the carriageway, which in turn reduces the available width for vehicular movement. About 4% of road length has footpath on one side only. Even the major corridors of traffic movement have no pedestrian facilities.
- Inventory of availability of street light facility indicates that about two third of the identified network has streetlight on one side. Nearly 17% of the network does not have any street lighting facility endangering the safety of road users at night.
- Almost all the Roads Except MR-10 and Rong Road have Existing Right of Way less than the IDP ROW due to encroachments and proliferation of Commercial activities on the Right of Way
- There are about 400 Kms of missing links as per the Draft Indore Development Plan 2025. This problem of missing links are planned to be addressed within future Projects.

2.2 Vehicle Population

In Indore, the annual growth of vehicles is about 8.8%. The city has an average of 0.98 vehicles per household. Private vehicles perform more than half the trips. Two wheelers account for nearly half the vehicle km covered. The details of registered vehicles in Indore in presented in Table 2-1. Central Business District (CBD) has narrow roads and has no place for parking. Usually carriage ways are utilized for parking; this reduces the carrying capacity of road and ultimately increases traffic congestion. Bus terminals which are also located in the densely built areas add to this traffic congestion. With the growing vehicle growth and increasing stress on the existing transportation infrastructure, the scope to widen the existing roads (including construction of extra lane) is not feasible due to the lack of available space.

Table 2-1: Number of Registered Vehicles (1991-2010)

Sl. No.	Type of Vehicle	Nos.	% of Total	% of PTS	Capacity Persons (Approx)
1	Bus (Govt. & Private)	3,420	0.3%	-	171,000
2	Mini Bus (PTS)*	28,994	2.6%	64%	869,820
3	Motor Cab/Metro Taxi (PTS)	3,534	0.3%	8%	14,136

4	Tempo (Goods)	211	0.0%	-	1,266
5	Maruti City Van & Tata Magic (PTS)	792	0.1%	2%	4,752
6	Auto Rickshaw (PTS)	11,876	1.1%	26%	35,628
7	2 Wheelers (Private)	845,528	77.0%	-	845,528
8	4 Wheelers (Private)	131,893	12.0%	-	407,674
9	Heavy Trucks (for transporting goods)	60,624	5.5%		
10	Others	11,320	1.0%	-	
Total		**1,098,192**	**100.0%**	**100%**	2,349,804

Source: Regional Transport Office, Indore

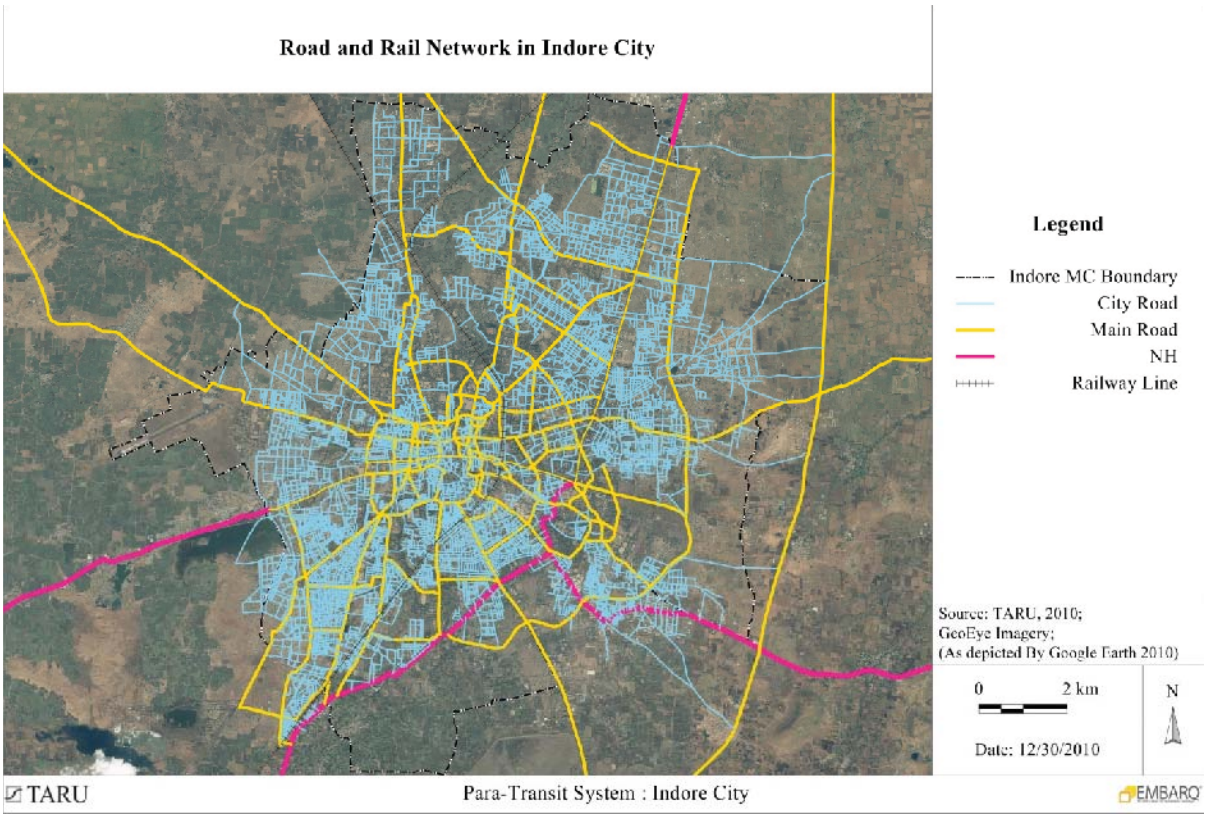
Note:

*This number of registered vehicles is very high and probably most of them are operate outside the city limits. Since Indore is a commercial hub, vehicles which are bought/registered within Indore may be operating in other parts of the state. People prefer to register their vehicles in Indore due to several reasons for example better resale value.

2.3 Public Transport System

The road and rail networks of the Indore City is shown in the Figure 2-1**Error! Reference source not found.**. The Public Transport System in the city comprises of organized and un-organized public transport system. The organized systems include standard bus services and Metro Taxi by ICTSL. There are also bus (Star Buses, TATA) owned by private operators which are operated on 24 different routes. The operation of these buses is monitored and controlled by ICTSL (special purpose vehicle to provide public transport services in Indore).

Figure 2-1: Road and Rail Network in Indore City



A Comprehensive Traffic and Transportation Plan for Indore (CTTPI) was prepared in 2004. The CTTPI has estimated the travel demand to be 5.5 million person trips per day by 2025. The CTTPI has proposed development of an extensive road network system of radial and ring corridors, development and operation of Light Rail Transit System (LRTS) of 44.75 km, development and operation of bus system, development of passenger and goods terminals, a parking policy, traffic management particularly in the CBD and establishment of metropolitan transport authority.

The Indore Municipal Corporation (IMC) has started Indore City Transport Services Ltd (ICTSL) to facilitate public transport system. ICTSL operates 120 low floor air-conditioned buses, on 24 different routes. Fleet of 100 Metro Taxis is also operating in Indore. The current operational characteristics of ICTSL bus operations is presented in **Table 2-2**

Table 2-2: Operational Characteristics of ICTSL Bus Operations

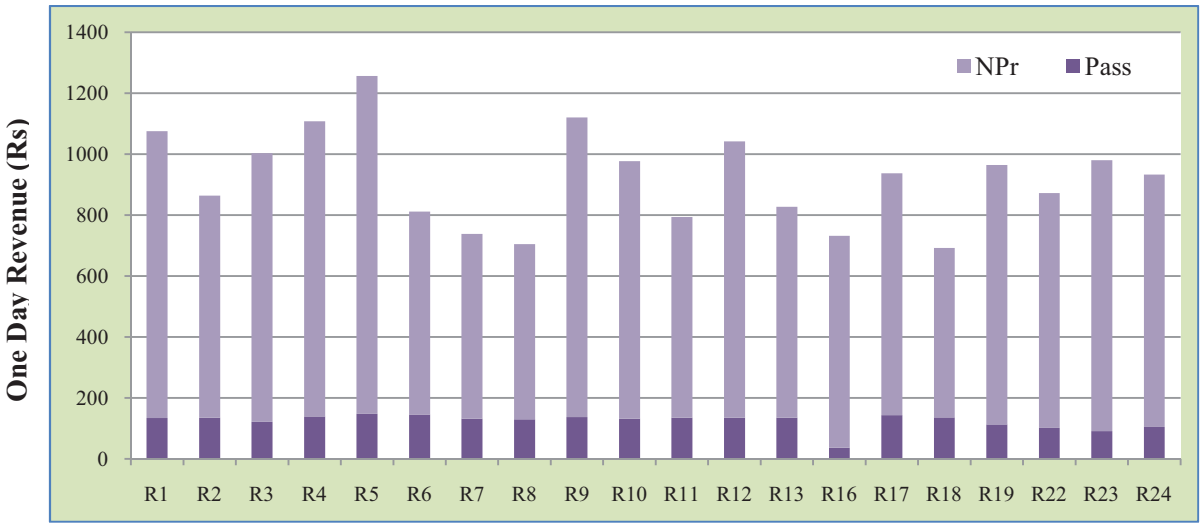
Characteristics	Details
Maximum Operational Time (hrs)	20
Average Duration of service (hrs)	16
Average km/day	230
Maximum Trips/day	16
Average Trips/day	10
Average Trip length (km)	15
Average Passengers carried/day	1,300
Dead km/day (km)	5
Passenger km/day	11,500
Source: Bus Rapid Transit System Report,2006	

The State Government (notification dated 09th December, 2004) has prescribed fare for city buses in the Municipal Corporation limit area for sitting capacity exceeding 12 (excluding driver). Fare structure of ICTSL vehicles is presented in Table 2-3.

Table 2-3: ICTSL Fare Structure

Sl. No.	KM	Fare Rate (Rs.)
1	Up to 3 K.M	5.00
2	Up to 7 K.M.	7.00
3	Up to 10 K.M.	9.00
4	Up to 13 K.M.	12.00
5	Up to 16 K.M.	14.00
6	Up to 19 K.M.	16.00
Source: http://www.citybusindore.com/busfare.aspx		

Figure 2-2: Revenue from City Buses in May-2010 (One Day)



Source: ICTSL, 2010

2.4 Paratransit System

The paratransit system comprises of about 500 Mini buses, 550 Maruti vans and 10,300[2] plus Auto-rickshaws. There are also few horse drawn carts (Tonga), an artifact of the old system. Until recently paratransit system also included three wheelers (Vikram), Minibuses and other vehicles. The city administration has scraped those polluting vehicles and replaced them with Maruti Van, TATA Magic and CNG/LPG run Auto-rickshaws. This has reportedly reduced the pollution levels, but overcrowding is still a setback. These vehicles require temporary or annual permits for their operation and their permits are allotted by the RTO. The RTO has restricted issuance of new permits, which has reportedly created an informal demand for permits. The Maruti Van and Tata Magic vehicles have specific route permits, while autos and taxis permitted to operate in any route within the city. In addition to these city permits, the RTO also issues rural permits to paratransit vehicles to run between the neighboring villages and along the outskirts of the city.

Operational characteristics of Mini buses, Maruti vans and Auto-rickshaws is presented in the Table 2-4.

Table 2-4: Paratransit Operational Characteristics (Indore City)

Characteristics	Mini Buses	Maruti Vans	Auto
Maximum Operational Time (hrs)	18	18	15
Average Duration of service (hrs)	13	13	12
Average km/day	133	105	79
Maximum Trips/day	7	12	15
Average Trips/day	8	8	12
Average Trip length (km)	13	6.5	3.3

[2] The number of licensed auto rickshaws is 10,300, but the number of unlicensed auto rickshaws is unknown.

Average Passengers carried/day	293	145	20
Dead km/day (km)	13.5	23	29
Passenger km/day	3,809	943	66
Source: CTTS Report Consulting Engineering Services (CES),2004			

While the city of Indore is making considerable investments towards a rational and efficient public transport system, it is essential to improve the performance of the PTS to serve the city safely, efficiently with environment friendly manner. Since the existing land use is becoming a constraint for expansion of BRTS, the paratransit will continue to play a vital role in ensuring connectivity.

2.5 PTS Vehicle Specifications

The Table 2-5 shows the fuel tank capacity of the different type of public transportation vehicles.

Table 2-5 PTS Vehicle Characteristics

Sl. No.	Vehicle	Fuel Type (CNG/ LPG/ Diesel)	Fuel Tank Capacity	Manufacturer	Remarks
1	Taxi-Maruti	CNG	10 kg	Maruti-SX4 (Metro Taxi)	Metro Taxi-CNG fuel tank-10 Kg & Diesel fuel tank - 40 kg
	Taxi-Tata	Diesel	40 lit	Indica DNA / Vista	-
2	Tata Magic	CNG	12 / 14 kg	-	-
3	Maruti Van	LPG	50/ 60 lit	-	-
		CNG	10 kg	-	-
4	Auto	LPG	15/ 25 / 35 lit	Bajaj	-
		CNG	4.5 / 8.5 kg	Piagio	8.5 kg fuel tank only in Piagio Auto
		Petrol	9.5 lit	Bajaj	-
Note: LPG= Rs. 32.38/litre., CNG= Rs. 36/kg, Petrol= Rs. 55.22/litre., Petrol power= Rs. 57.15/litre., Diesel = Rs. 41.42/litre., Diesel power = Rs. 43.23/litre. Source: TARU Field Survey, 2010					

The Table 2-6 shows the fuel type, engine type and seating capacity of the selected public transportation vehicles.

Sl. No.	Vehicle Type	Fuel	Engine	Seating Capacity + Driver	Remarks
1	**Maruti Van**	LPG or Petrol	4-stroke	7 + 1	Replaced by Tempo
2	**Maruti Van**	LPG or Petrol	4-stroke	7 + 1	Replaced by Nagar Sava
3	**TATA Magic**	CNG	4-stroke	7 + 1	Replaced by Nagar Sava
4	**Auto Rickshaw**	Petrol or LPG	4-stroke	4 +1	-
5	**Auto Rickshaw**	CNG	4-stroke	3+1	-

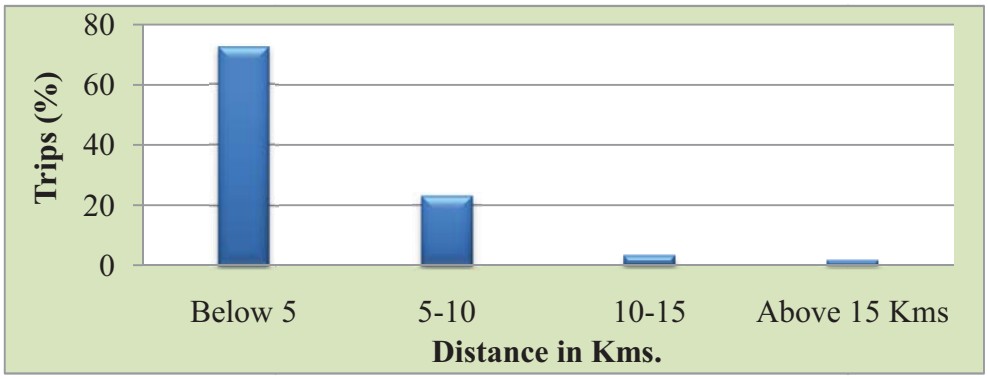
Sl. No.	Vehicle Type	Fuel	Engine	Seating Capacity + Driver	Remarks
6	**City Bus**	Diesel	-	44+10	-
7	**Nagar Seva**	Diesel	-	12+1 or 30+1	-
8	**Tonga**	NA	NA	7+1	-

2.6 Passenger Travel Characteristics[3]

In 2004, the average vehicle ownership was 0.98 vehicles per household. The distribution of households by vehicle ownership did show that about 95 % households own at least one vehicle. The per capita trip rate was 1.09 and the average trip length was 4.4 kms (excluding walk). Figure 2-3 shows the trip length distribution.

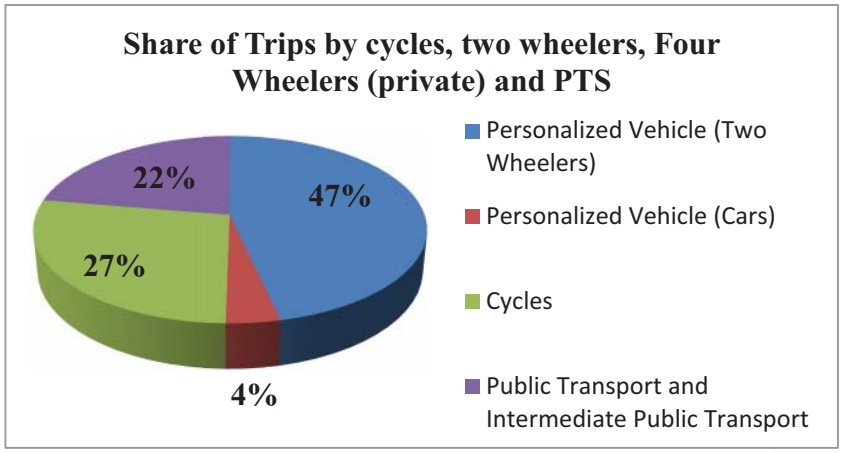
[3] The information provided within this section are based on Urban Transportation Sector Study which was commissioned under Asian City Climate Change Resilience Network, 2010

Figure 2-3: Trip Length Distribution



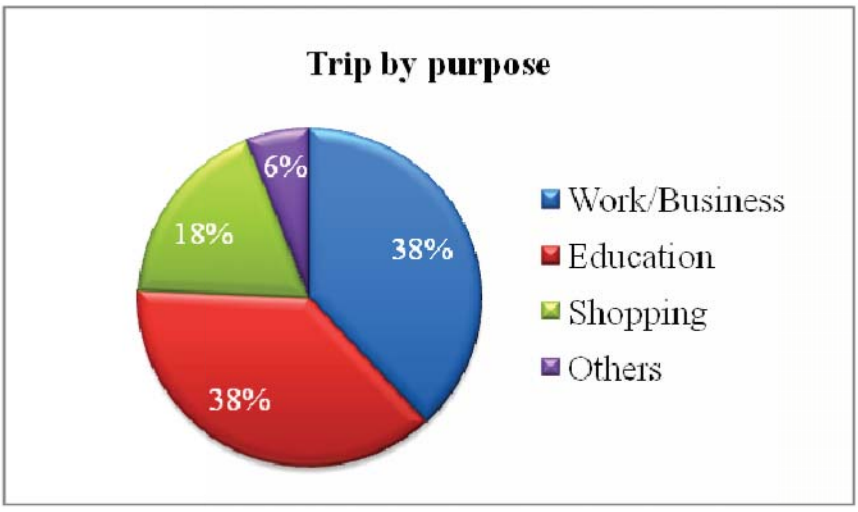
From the report, it was evident that there exists low car ownership in comparison with two wheelers and cycles. Nearly 50% of the trips were performed by personalized vehicles i.e. cars and two wheelers. The following is the distribution of the Trips by various modes. Figure 2-4 illustrates the share of trips by four modes of transportation.

Figure 2-4: Share of Trips by Different Mode of Transport



The Figure 2-5 illustrates the distribution of the trips by various purpose. It is evident from Figure 2-5 that nearly 75% of the trips in the city are scheduled trips like work and education.

Figure 2-5: Details of Trips by Purpose

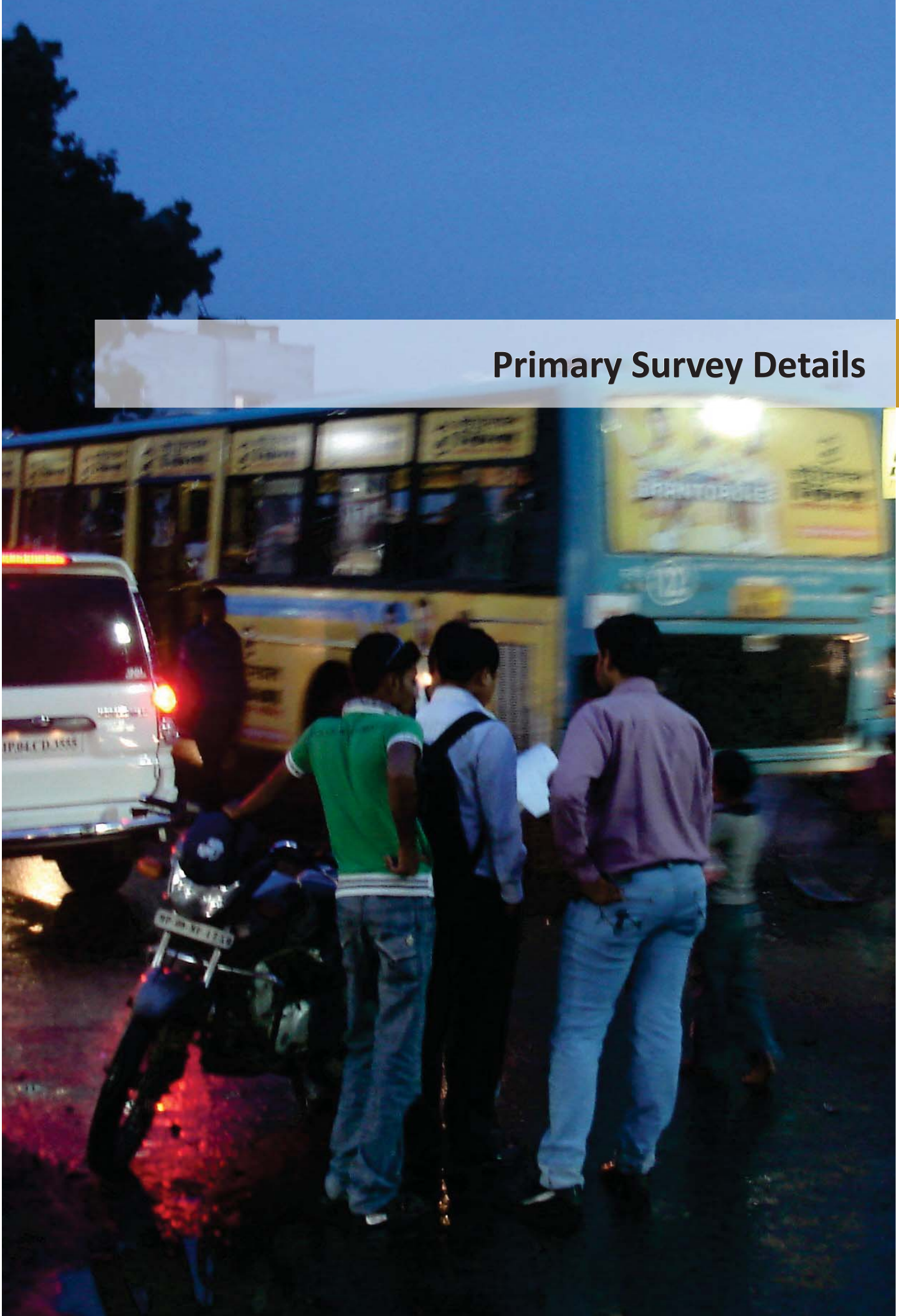


Objectives

3 OBJECTIVES

The key objective of this assignment was to study the Para-transit operations in Indore city. The subsidiary objectives include;

- Classification of Para-transit types and their universe estimates
- Determine physical characteristics of PTS and detail-out the PTS operational framework
- Assess the transport service coverage gap and levels of access
- Understand the current and the growth pattern of PTS
- Identify problems and issues of PTS
- Suggest a set of recommendations relating to improvements of operational performance, coordination mechanism of PTS and future model of management for PTS.



Primary Survey Details

4 PRIMARY SURVEY DETAILS

Survey was carried out to understand various aspects of paratransit system in Indore. The details of the different survey and their sample size are provided in the Table 4-1.

Table 4-1: Type of Survey including Sample Size and Other Details

Sl. No.	Survey	Sample Size	Details
1	Volume Count	15	Major road junctions
2	Auto Stand Survey	150	
3	GPS Survey	93	
	Tata Magic	30	
	Mini Bus	1	
	Tonga	1	
	Maruti Van	30	
	Auto	19	
	Taxi	10	Star Cab-4, Metro-3, Taxi-3
4	Fuel Station	10	
5	Passenger	200	
6	HH	100	
7	Driver	42	Auto -15, MV-10, TM-10, Taxi-7
8	Operator	18	Auto-5, MV-5, TM-5, Taxi-3
9	Stake holder	20	
	RTO	5	
	Traffic Police	5	
	Union	10	

In addition to vehicles with city/route permits, Auto-rickshaws are given either temporary (4 months) or long term (5 years) permit. The renewal process of permits takes about 45-60 days, with intermediation by unions and agents. The RTO fixes the maximum number of permits from time to time and had stopped issuing fresh auto permits after 2006.

TATA Magic and Maruti vans dominate the route based paratransit system due to replacement of Mini bus and Tempo. Auto-rickshaw dominates the city wide paratransit system. Route based paratransit options, such as TATA Magic or Maruti van are most preferred by people since charge per passenger is less.

The universal estimate of the number of PTS vehicles along with the capacity per vehicle is presented in the Table 4-2.

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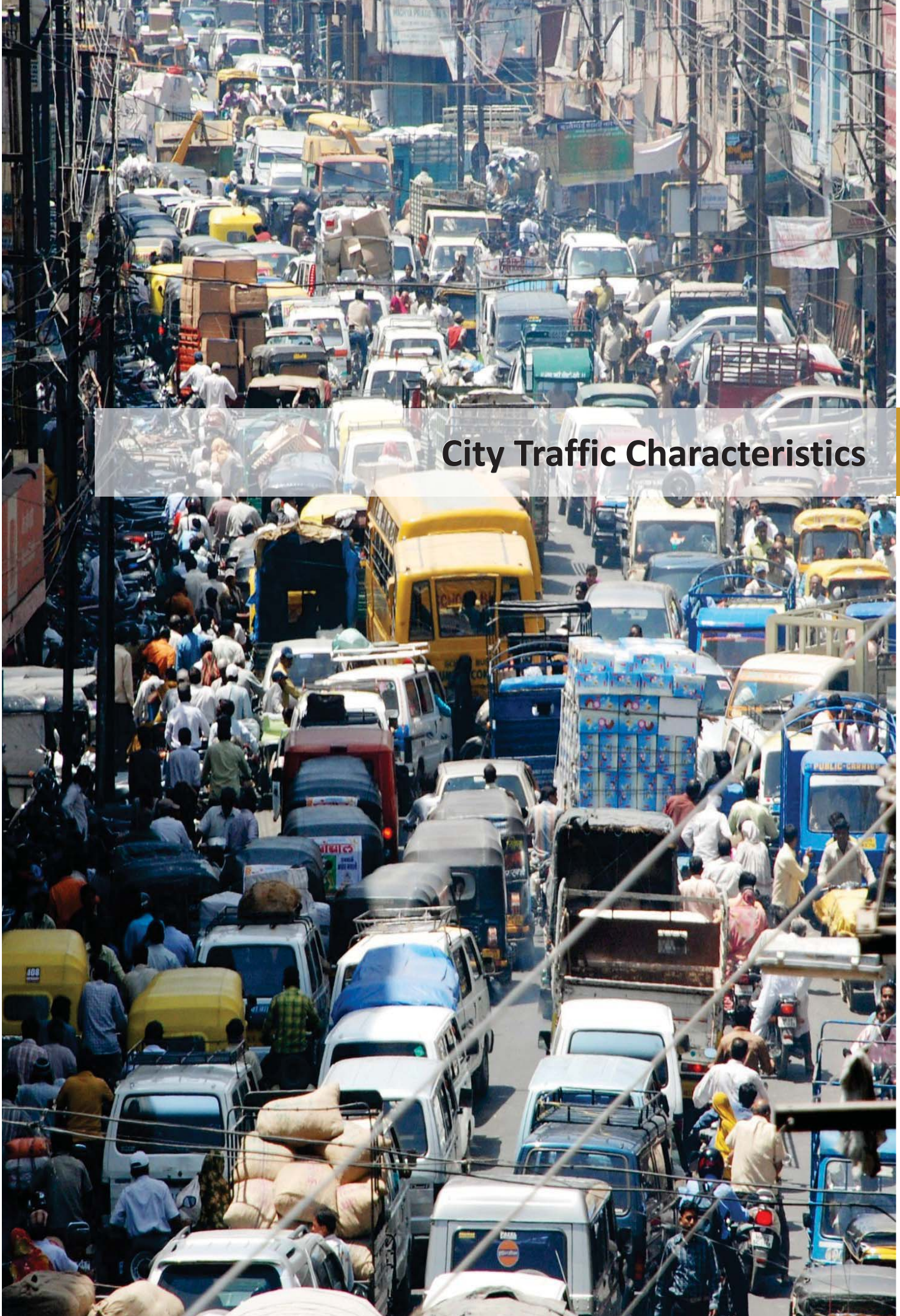
Table 4-2: Numbers of PTS Vehicle & their Capacity

Type of Vehicle	Numbers	Remarks	Capacity Excluding Driver	Max Overloaded Capacity Observed
Auto-rickshaw	10300 +	LPG 1500, CNG 3000, Rest petrol	3	7 (up to 9 children)
Tata Magic	300	-	7 Urban, 6 Rural	19
Maruti Van	550	(Tempo permits 525, replaced by Maruti Van) (450 city & 100 route permits)	6	12
Mini Buses	196	(496 route permits issued, replaced by Tata Magic)	12 , 30	30, 50
Metro Taxi and Star Cab	200	100 each for Metro and Star cabs	-	-
Source: RTO, Unions. The numbers are approximate.				



City Traffic Characteristics

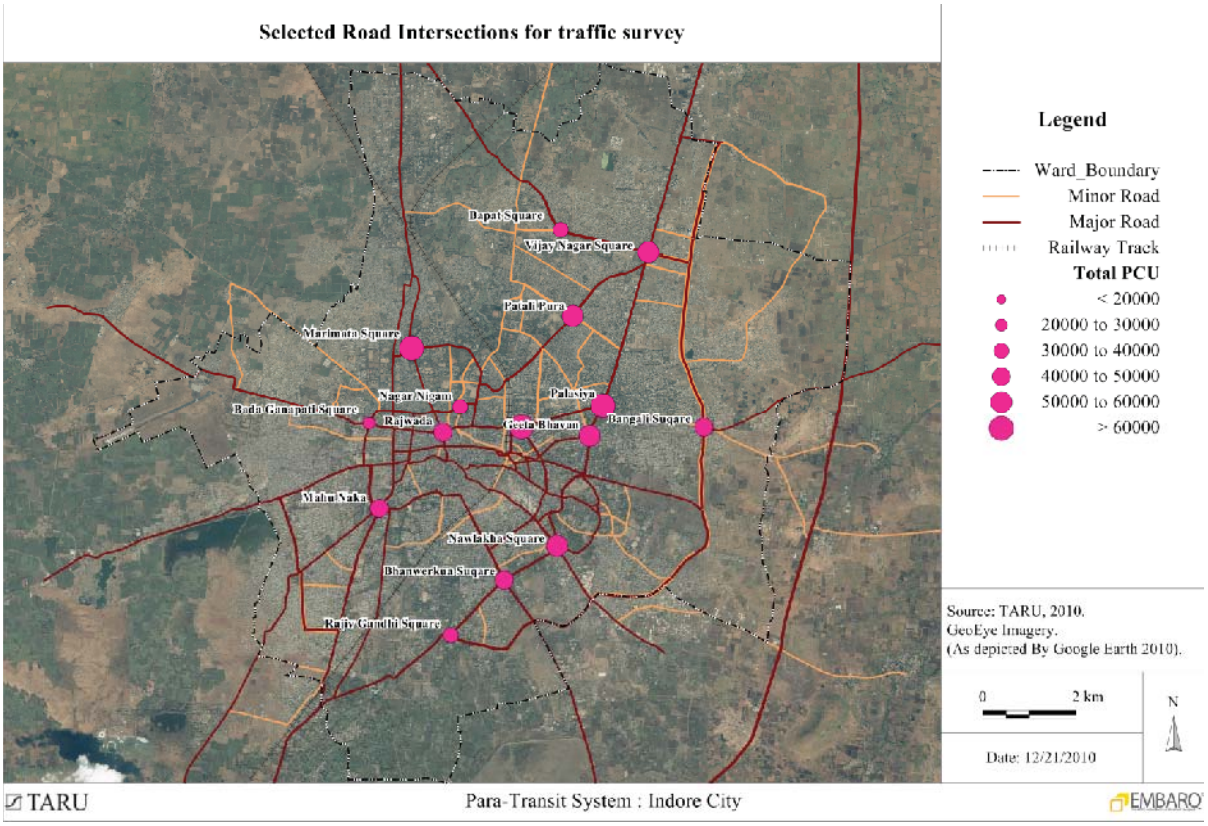
5 CITY TRAFFIC CHARACTERITICS

To understand the prevailing pattern of traffic and vehicle composition, a classified volume survey was carried out at 15 major road junctions across the Indore City. These were identified in consultation with EMBARQ.

The traffic volume survey was conducted to analyze the incoming and outgoing traffic at road junctions. The survey was carried out for a period of 14 hours per junctions with 15 minute intervals (i.e. once every half an hour).

The traffic count covered bicycle, two wheeler, private cars, PTS (Auto-rickshaw, Tata Magic, Maruti van and Mini bus), city buses and transport vehicles such as trucks. The location of the surveyed traffic junctions with PCU counts is presented in the Figure 5-1.

Figure 5-1: Traffic Volume Count at Road Junctions



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This survey aided in identifying the percentage composition of the PTS traffic to the total traffic. The findings from the traffic volume survey are presented in Table 5-1.

Table 5-1: Traffic Volume Count at Selected Locations*

Sl. No.	Junction Name	Bicycle	Two wheeler	Car	PTS	Bus	Others	Total Vehicle
1	Bada Ganapati Square	8,714	21,501	1,719	3,601	350	1,130	37,015
2	Bangali Square	5,453	25,590	8,548	2,189	1,470	5,092	48,342
3	Bapat Square	4,329	19,724	5,003	1,512	634	2,472	33,674
4	Bhawerkuan Square	5,995	30,816	8,486	3,874	1,288	2,683	53,142
5	Geeta Bhavan Square	8,313	40,826	12,356	5,518	1,006	1,804	69,823
6	Mari mata Square	9,444	42,355	8,425	7,067	1,169	2,634	71,094
7	Mhownaka Square	14,739	27,017	3,265	2,792	405	3,263	51,481
8	Nagar Nigam Bus Depot	7,457	27,972	2,346	4,769	305	970	43,819
9	Navlakha Square	7,772	27,053	8,622	4,969	1,775	5,375	55,566
10	Nehru Square	22,746	1,06,688	24,100	19,031	3,231	3,913	1,79,709
11	Palasiya Sqaure	7,965	47,938	13,953	6,332	869	1,322	78,379
12	Patlipura Square	15,988	41,404	5,124	5,521	701	2,084	70,822
13	Rajiv Gandhi Square	2,955	15,812	5,314	995	1,122	4,852	31,050
14	Rajwada Square	8,733	35,835	2,692	4,842	339	438	52,879
15	Vijay Nagar Square	5,811	34,272	11,983	3,680	1,770	2,935	60,451
Total		**1,36,414**	**5,44,803**	**1,21,936**	**76,692**	**16,434**	**40,967**	**9,37,246**
% of Total		**15%**	**58%**	**13%**	**8%**	**2%**	**4%**	**100%**

Source: Volume Count Survey, 2010;
TARU Analysis, 2010
Survey Dates: 15th to 17thJuly and 19th to 22nd July, 2010.
*Incoming without interpolation

Key findings of the traffic volume survey (in terms of vehicle count) are following:

- Two-wheelers contribute to an average of 58% of the total traffic volume.
- Bicycle contributes to around 15 % of the total traffic volume.
- Public transport vehicles' including paratransit and bus contributes 10% to the total volume in which PTS contribution is of around 8%.

Passenger Car Units (PCU) was derived from the survey data by using Indian Road Congress (IRC) conversion rates. The passenger car units are presented in Table 5.2.

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Table 5-2: Passenger Car Units at Selected Locations

(Alternate 15 Minutes Count)

Sl. No.	Junction Name	Parameter	Bicycle	Two wheeler	Car	PTS	Bus	Others	Total
1	Bada Ganapati Square	PCU Volume	3,486	16,126	1,719	4,081	770	2,486	28,668
		%	*12%*	*56%*	*6%*	*14%*	*3%*	*9%*	*100%*
2	Bangali Square	PCU Volume	2,181	19,193	8,548	2,461	3,234	11,202	46,820
		%	*5%*	*41%*	*18%*	*5%*	*7%*	*24%*	*100%*
3	Bapat Square	PCU Volume	1,732	14,793	5,003	1,691	1,395	5,438	30,051
		%	*6%*	*49%*	*17%*	*6%*	*5%*	*18%*	*100%*
4	Bhawerkuan Square	PCU Volume	2,398	23,112	8,486	4,346	2,834	5,903	47,078
		%	*5%*	*49%*	*18%*	*9%*	*6%*	*13%*	*100%*
5	GeetaBhavan Square	PCU Volume	3,325	30,620	12,356	6,281	2,213	3,969	58,764
		%	*6%*	*52%*	*21%*	*11%*	*4%*	*7%*	*100%*
6	Marimata Square	PCU Volume	3,778	31,766	8,425	7,973	2,572	5,795	60,309
		%	*6%*	*53%*	*14%*	*13%*	*4%*	*10%*	*100%*
7	Mhownaka Square	PCU Volume	5,896	20,263	3,265	3,183	891	7,179	40,676
		%	*14%*	*50%*	*8%*	*8%*	*2%*	*18%*	*100%*
8	Nagar Nigam Bus Depot	PCU Volume	2,983	20,979	2,346	5,362	671	2,134	34,475
		%	*9%*	*61%*	*7%*	*16%*	*2%*	*6%*	*100%*
9	Navlakha Square	PCU Volume	3,109	20,290	8,622	5,597	3,905	11,825	53,348
		%	*6%*	*38%*	*16%*	*10%*	*7%*	*22%*	*100%*
10	Nehru Square	PCU Volume	9,098	80,016	24,100	22,049	7,108	8,609	1,50,980
		%	*6%*	*53%*	*16%*	*15%*	*5%*	*6%*	*100%*
11	Palasiya Sqaure	PCU Volume	3,186	35,954	13,953	7,132	1,912	2,908	65,045
		%	*5%*	*55%*	*21%*	*11%*	*3%*	*4%*	*100%*
12	Patlipura Square	PCU Volume	6,395	31,053	5,124	6,249	1,542	4,585	54,948
		%	*12%*	*57%*	*9%*	*11%*	*3%*	*8%*	*100%*
13	Rajiv Gandhi Square	PCU Volume	1,182	11,859	5,314	1,113	2,468	10,674	32,611
		%	*4%*	*36%*	*16%*	*3%*	*8%*	*33%*	*100%*
14	Rajwada Square	PCU Volume	3,493	26,876	2,692	5,778	746	964	40,549
		%	*9%*	*66%*	*7%*	*14%*	*2%*	*2%*	*100%*
15	Vijay Nagar Square	PCU Volume	2,324	25,704	11,983	4,114	3,894	6,457	54,477
		%	*4%*	*47%*	*22%*	*8%*	*7%*	*12%*	28,668
Total		PCU Volume	54,566	4,08,604	1,21,936	87,410	36,155	90,128	7,98,799
		%	7%	51%	15%	11%	5%	11%	100%

Equivalent PCU factors (sourceIRC:106-1990)
Two wheeler cycle and Scooter=0.75;Passenger Car, pick-up van=1.0;Auto-rickshaw=1.2; Light Commercial vehicle=1.4; Truck or Bus=2.2; Agricultural tractor Trailer=4.0,Cycle=0.4

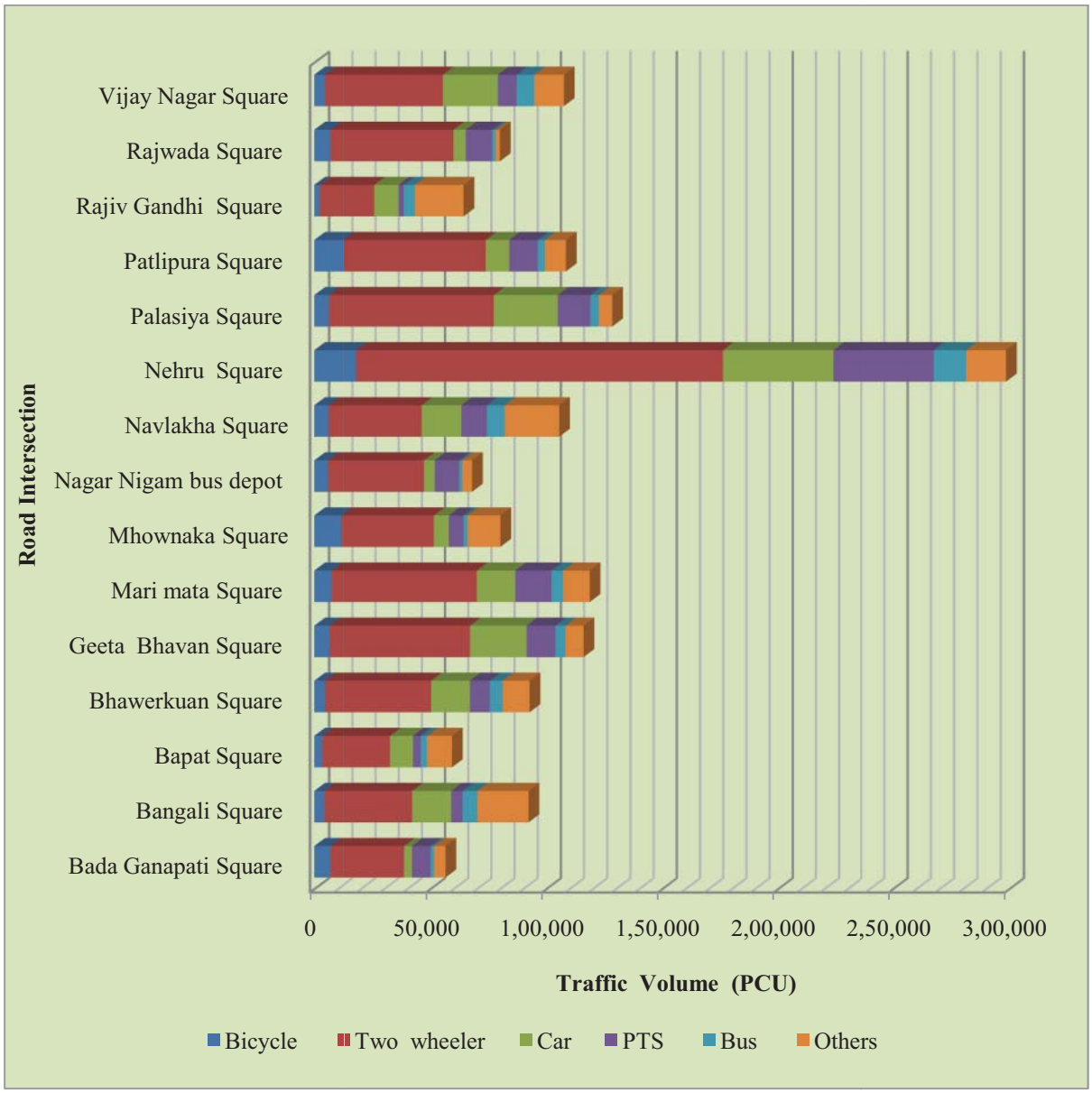
The findings of PCU calculation indicate that:

- Maximum traffic flow was observed at Nehru Square,
- Two wheelers contributes 51% of total traffic across the surveyed junctions, and
- PTS contributes 16% of the total traffic.

The comparative graphical representation of traffic volume at the surveyed junctions is presented in Figure 5-2.

Figure 5-2: Traffic Volume (in PCU) at Surveyed Junctions

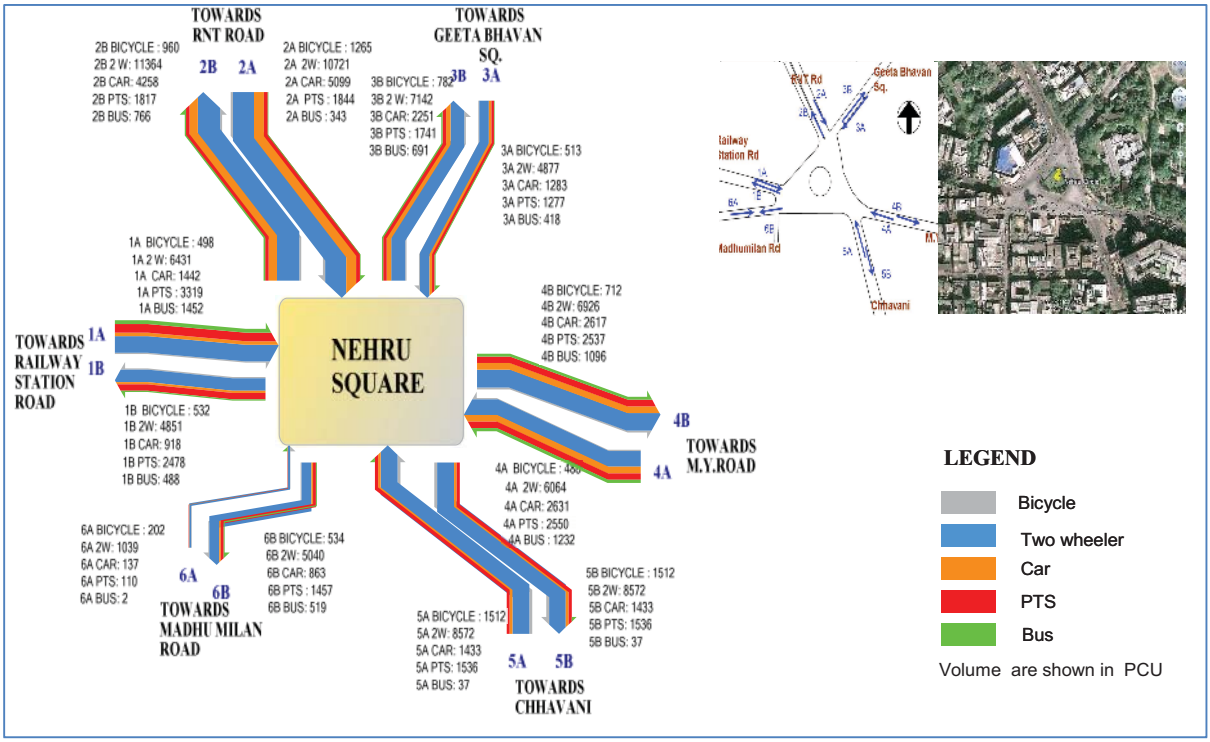
(Full 14 Hours based on Interpolation)



Source: TARU, 2010

Sankey diagrams were prepared to represent the movement of traffic at various junctions. Width of the arrows in Sankey diagrams are proportional to the traffic flow. The traffic volume diagram of Nehru Square is presented in Figure 5-3. The Sankey diagrams of remaining junctions are presented in Annex C.

Figure 5-3: Traffic Volume Diagram: Nehru Square



5.1 PTS Vehicle Composition

PTS vehicles include Auto-rickshaws, Maruti vans, Tata Magic and Mini buses. Percentage share for each PTS vehicle type at survey junctions are shown in the Table 5-3.

Table 5-3: PTS Composition (%) at Surveyed Junctions

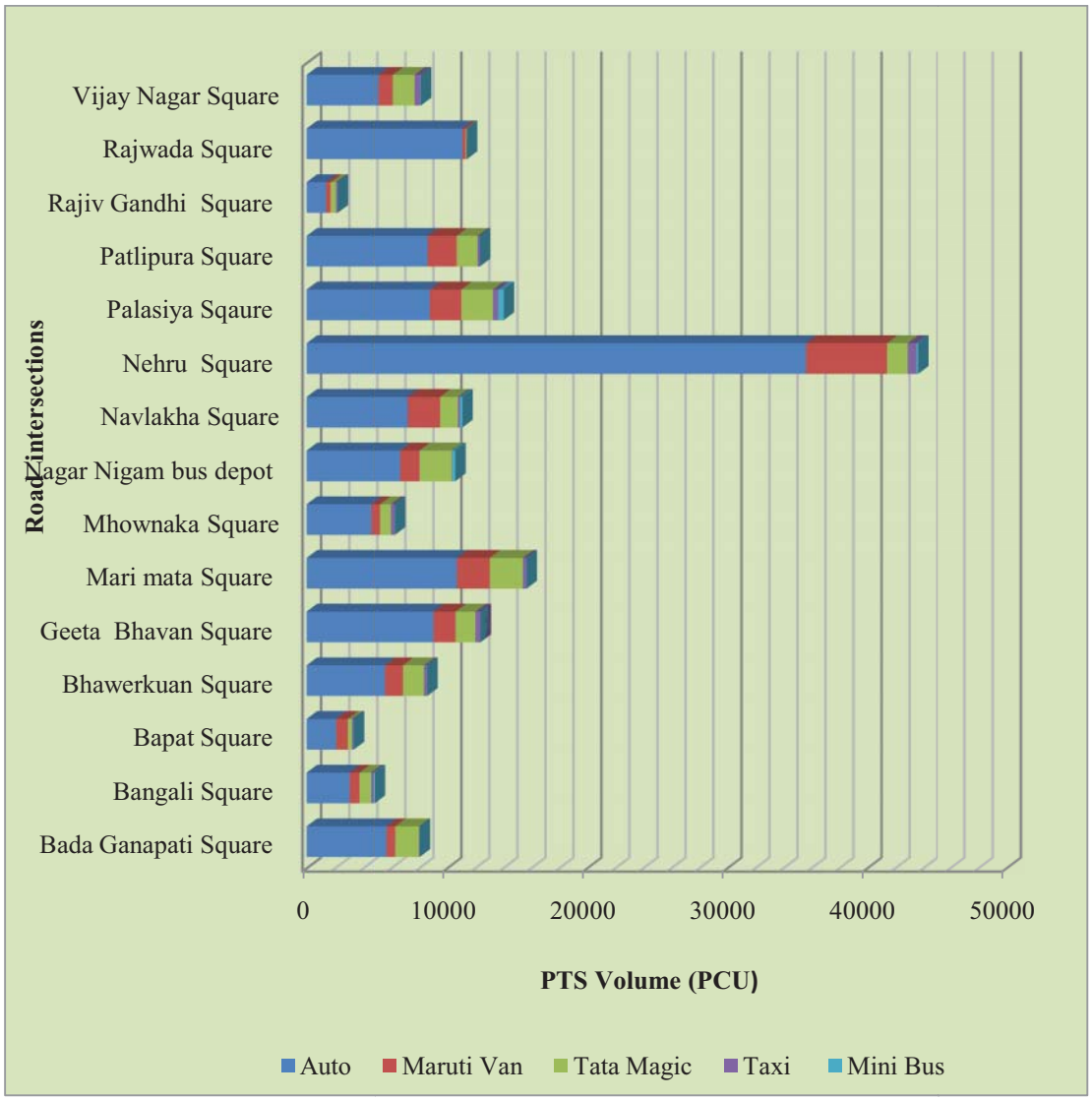
Sl No	Junction	Percentage Composition of Various PTS					
		Auto-rickshaws	Maruti Van	Tata Magic	Taxi	Mini Bus	Total PTS
1	Bada Ganapati Square	71%	8%	21%	1%	0%	4,081
2	Bangali Square	63%	14%	17%	4%	2%	2,461
3	Bapat Square	63%	25%	9%	3%	0%	1,691
4	Bhawerkuan Square	65%	15%	17%	2%	0%	4,346
5	Geeta Bhavan Square	73%	13%	11%	3%	0%	6,281
6	Mari mata Square	68%	15%	15%	2%	0%	7,973
7	Mhownaka Square	73%	10%	12%	4%	0%	3,183
8	Nagar Nigam bus depot	63%	13%	22%	0%	2%	5,362
9	Navlakha Square	65%	21%	11%	1%	1%	5,597
10	Nehru Square	82%	13%	3%	1%	0%	22,049
11	Palasiya Sqaure	63%	16%	16%	3%	3%	7,132
12	Patlipura Square	70%	17%	12%	1%	0%	6,249
13	Rajiv Gandhi Square	63%	14%	17%	5%	1%	1,113
14	Rajwada Square	97%	2%	1%	0%	0%	5,778
15	Vijay Nagar Square	63%	13%	19%	5%	0%	4,114

Source: TARU Field Study, 2010

Table 5-3 illustrates that Auto-rickshaws have major share (69%) amongst all PTS vehicle count followed by Tata Magic (14%) and Maruti van (14%). Nehru circle has the highest number of PTS vehicle count amongst all surveyed junctions.

Figure 5-4: PTS Vehicle Composition at Surveyed Junctions

(7: 15 am to 8:45 pm)



5.2 PTS Traffic

Observed traffic pattern of PTS vehicles between 7:15 am to 8:45 pm is presented in the Figure **5-5** to **Figure 5-8**.

Figure 5-5: Traffic Pattern of Auto-rickshaws (14 hours)

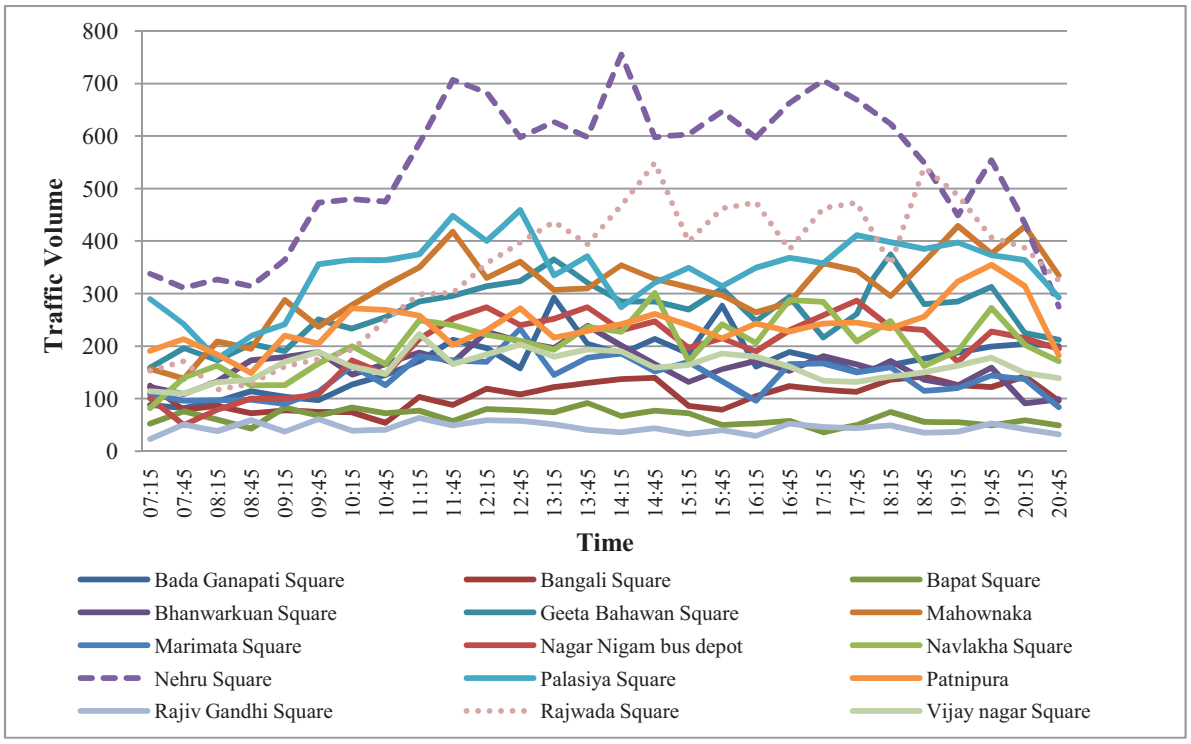
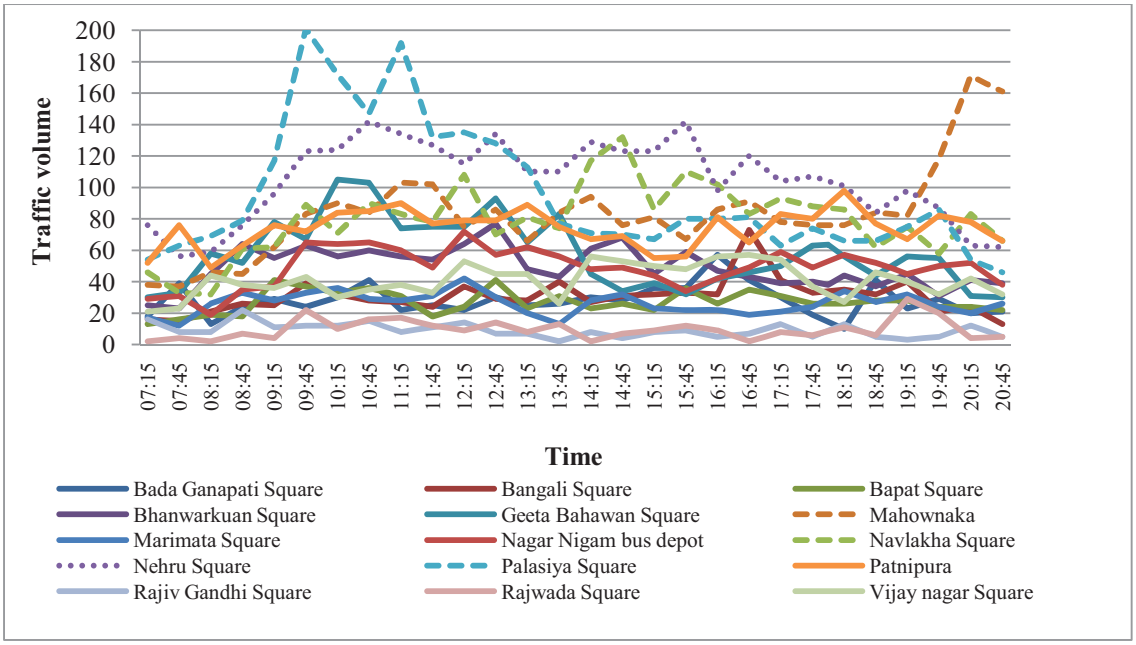


Figure 5-5 represents Auto-rickshaw traffic pattern. Maximum numbers of Auto-rickshaws were observed at Nehru Square located near Central Business District (CBD) during peak hours. The Rajwada and Palasia junctions are two other busy junctions, accounting for significant proportion of the Auto-rickshaw traffic.

Figure 5-6: Traffic Pattern of Maruti Van (14 hours)



The traffic pattern shows a high vehicle density at Mhow Naka. This is one of the densely populated areas, with mainly low socio-economic settlements.

Figure 5-7: Traffic Pattern of Tata Magic (14 hours)

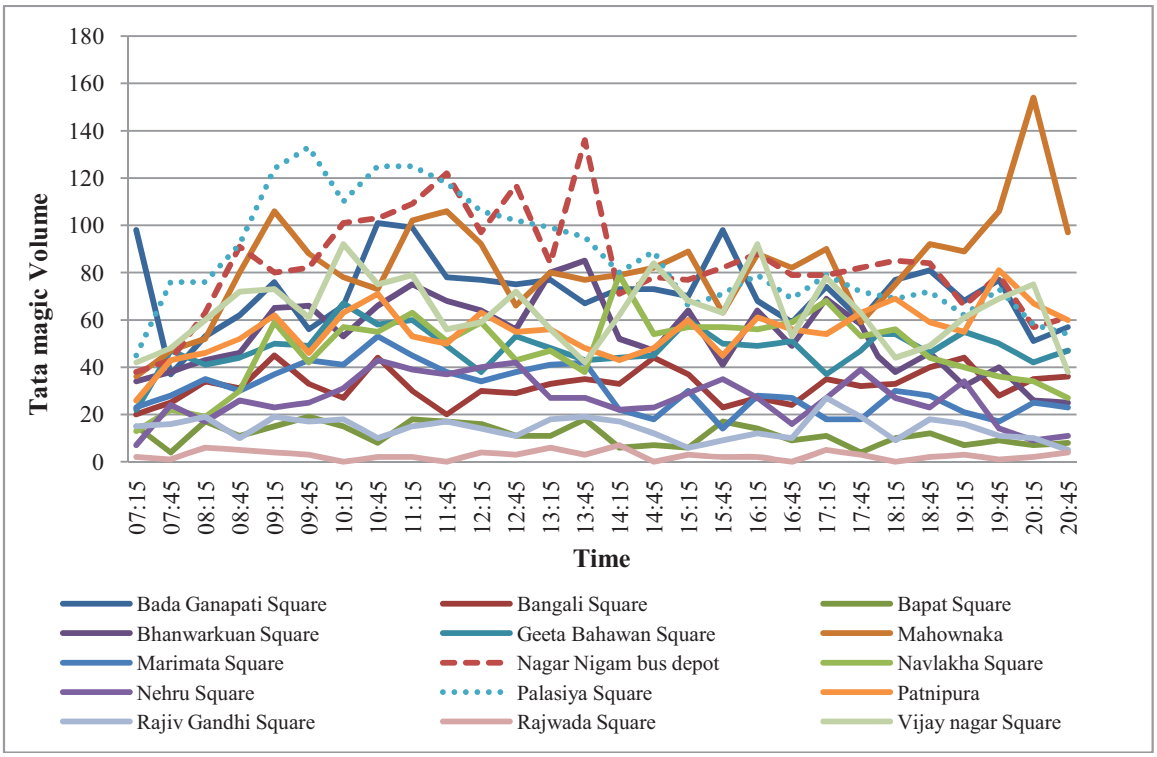
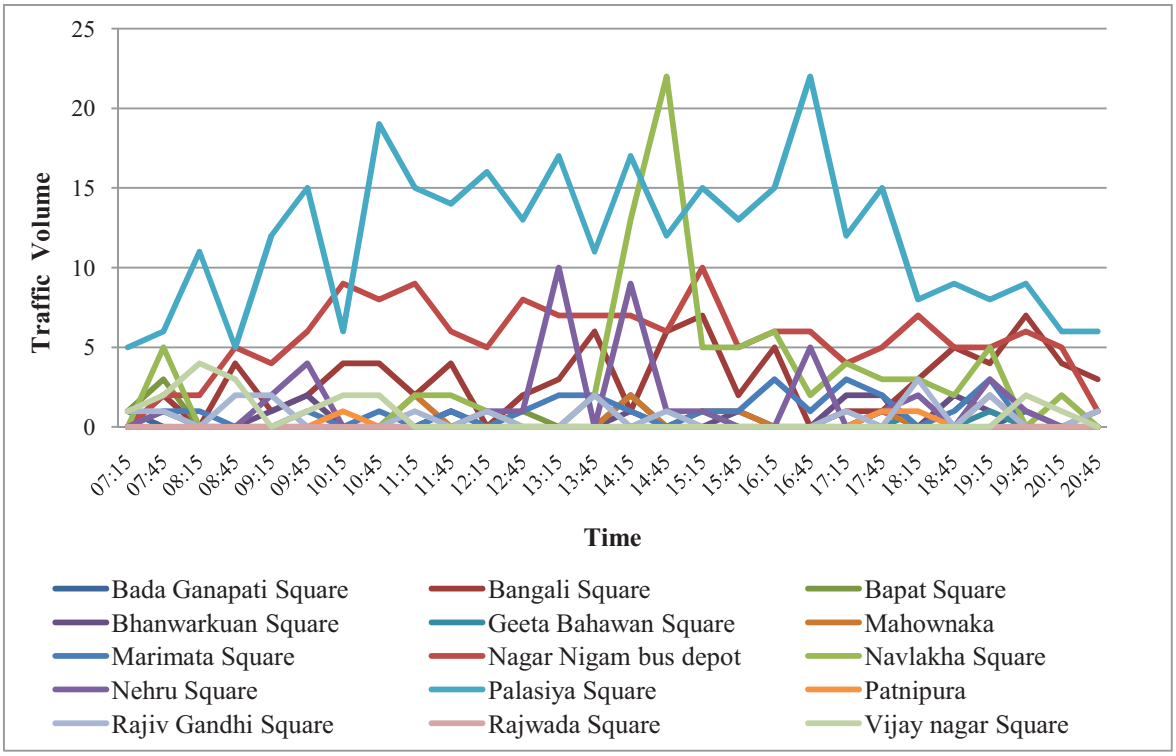


Figure 5-8: Traffic Pattern of Mini Bus (14 hours)



Mini Bus traffic is high on the Palasiya Square & Nehru Square especially between 09:15 to 11:45 am. The lack of sufficient traffic control adds to the congestion in these areas.

5.3 Congestion and Bottlenecks

The high proportion of two wheelers and lack of efficient traffic control combined with the poor adherence of traffic rules add to the congestion. This situation is further worsened due to insufficient traffic monitoring and control at the junctions.

Figure 5-9: Traffic Volume (PCU) at Bada Ganapati Square

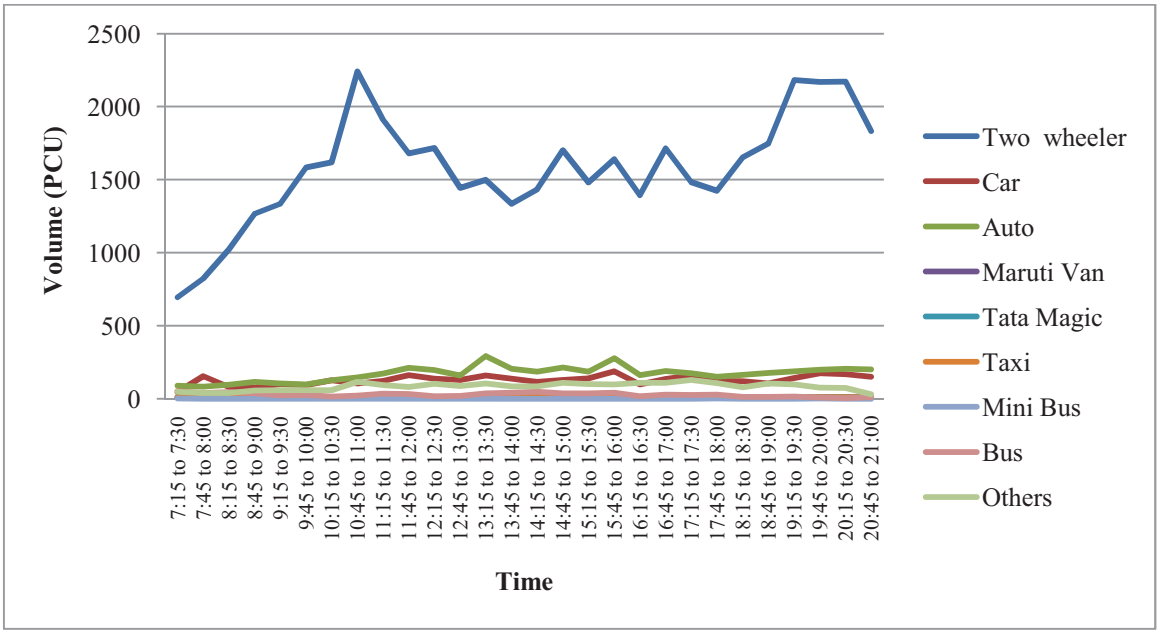


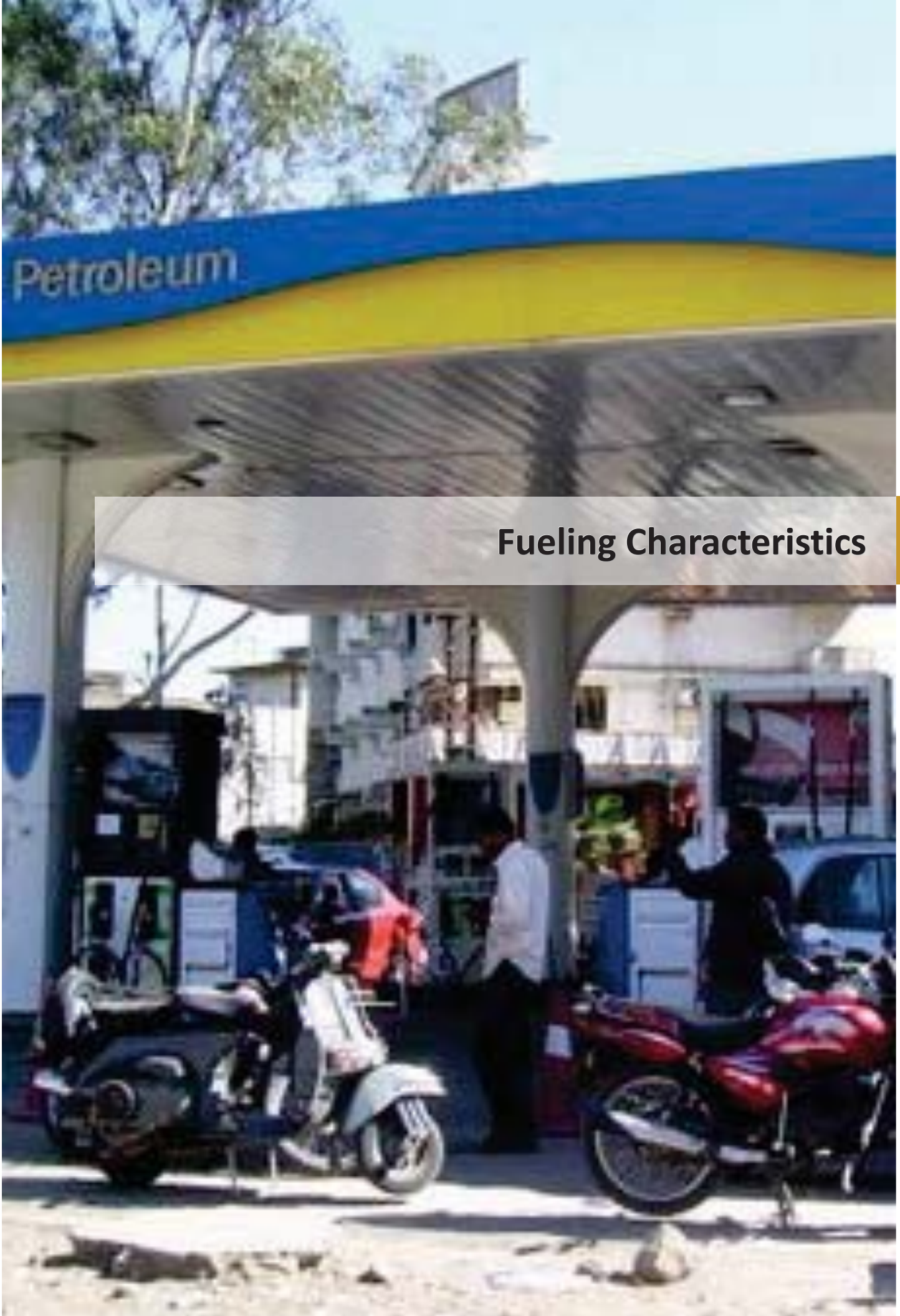
Figure 5-9 shows the traffic pattern at Bada Ganpati Square. Two wheelers dominate the total traffic composition. Cumulatively at these junctions, two wheeler exceed 2000 PCU between 10:00-11:00 hrs and 19:00-20:30 hrs. The number of Auto-rickshaws is observed to be high during afternoon. Traffic volumes for other squares are presented in Annexure-A. The priority of vehicles at the junctions (traffic circles) is often not respected resulting in logjams. Weaving habit of smaller vehicles further constrains the traffic flow.

From the survey, it was identified that the peak traffic lasts between 09:00 to 11:00 hrs. No such peak traffic conditions were evident in the evening. This is mainly due to the overlap of travel timing between people from walks of life commuting during the morning hours. For example, government employees, business personnel, retail employees, etc). While most offices close around 6 pm the retail business extends till around 8 pm, thereby reducing such congestions during the evening hours. Among all surveyed junctions, Palasia Junction followed by Bengali Square and Patnipura experiences high congestion during most times of the day.

Figure 5-10: Traffic Congestion during Peak Hours

Location: Jahawar Marg

Location: Nandlalpura Area



Fueling Characteristics

6 FUELING CHARACTERISTICS

In this study, 10 fuel stations were surveyed for 14 hours, between 07:00 hrs to 21:00 hours. The variables covered included the type of paratransit vehicle, type of fuel filled and the amount of fuel filled. The type of fuel used by various paratransit vehicles is presented in the Table 6-1.

Table 6-1: Classification of PTS Vehicle Count by Fuel Type

Vehicle Type	Fuel Type (Number of Vehicles)			
	CNG	LPG	Petrol	Sample Total
Auto Rickshaw	2,454	1,008	87	3,549
Tata Magic	723	-	-	723
Maruti City Van	165	9	-	174
Total	3,342	1,017	87	4,446
Source: Fuel Station Survey, 2010; TARU Field Study, 2010				

The city RTO provides the registration number series for paratransit vehicles to commute within Indore city. The Table 6-2 presents the registration number series for paratransit vehicles as approved by the RTO. Interviews with officials and the operators gave an insight into the volume of non-permit PTS vehicles operating within the city. Most of these vehicles are from nearby districts/rural areas. Auto-rickshaw registration numbers were noted as a part of the petrol/gas station survey to estimate the number of vehicles without proper permits.

Table 6-2: Vehicle Registration Allotted by RTO for PTS

Auto & Taxi Car				
Sl. No.	**Numbers**	**From**	**To**	**Remarks**
1	MP 09 T	1001	3999	
2	MP 09 T	5001	5999	New
3	MP 09 T	7001	9999	
4	MP 09 TA	101	3000	CNG Auto-rickshaws
Metro Taxi				
1	MP 09 T	6001	6100	Only 100 no. has been allotted and 400 no. of this series (6101 to 6499) is remaining for New Metro Taxis.
Maruti Van				
1	MP 09 T	4201	4600	Urban Permit (7+1 passenger capacity)
Tata Magic				
1	MP 09 T	4601	5000	Urban Permit (7+1 passenger capacity)
2	MP 09 T	6801	7000	Urban Permit (7+1 passenger capacity)
3	MP 09 T	6501	6800	Rural Permit (6+1 passenger capacity)

Detail of series not allotted by RTO for paratransit Auto rickshaws in Indore, but were noticed during the survey are presented in the Table 6-3.

Table 6-3: Unauthorized Auto-rickshaw Registration Numbers

Vehicle Series 1	Non CNG Vehicles (Black)											CNG Vehicles (Green)					Total
	No Num	C	CA	D	GJ	K	KA	KB	KC	KD	RC	K	KC	R	RC	TN	
Grand Total	5	1	1	2	1	12	28	18	92	1	1	2	5	2	1	3	175
Source: Petrol Station Survey, TARU 2010																	

From the surveyed sample of 3,538 Auto-rickshaws, 175 vehicles were found without appropriate registration numbers (numbers as per RTO paratransit regulations). If we consider this as a representative sample, then in total there may be around 500 Auto-rickshaws without permits operating within the city. The union representatives estimate the unauthorized Auto-rickshaws numbers to be over 3000. This is a major problem, but the regulatory authorities are not able to either track or prevent/restrict the unauthorized operators.

6.1.1 Refuelling Time

A total of 10 fuel stations were surveyed to analyse time taken for fuelling and to estimate the informal Auto rickshaw population. A total of 4,183 paratransit vehicle were surveyed. The time taken for refuelling is presented in the Table 6-4.

Table 6-4: Average Time Taken for Refuelling (in minutes)

Name of the Fuel station	Fuel Type	05:00 to 8:00	8:00 to 12:00	12:00 to 16:00:00	16:00 to 20:00	20:00 to 23:00	No of Samples
Aavantik Gas	CNG	5	7	7	11	5	486
Fazal P Khan	LPG	2	4	2	4	2	396
	Petrol		5		5	2	13
Gopi Kishan	CNG	52	27	74	9	46	678
Kashyap Petrol Pump	CNG	67	62	122	22	74	814
	Petrol				25		1
Malviya Filling Station	LPG	10	9	2		2	109
P C Auto Center	CNG	114	93	140	25	122	692
Police Welfare felling station	LPG	8	21	2	37	4	231
Sukhmani Petrol Pump	Petrol	5	2	2	2	3	69
Usha Raj Petrol Pump	LPG	4	8	5	2	5	272
	Petrol	5				5	3
Supreme	CNG	105	54	120	9	96	661

CNG vehicles consume the maximum time for refuelling. There are also complaints among the CNG vehicle users that they often do not get sufficient fuel due to insufficient pressure at the gas station. On the other hand, petrol and LPG vehicles consume relatively less refuelling time. Due to time constraints, the paratransit drivers prefer to buy LPG vehicles especially Auto-rickshaws. The average recorded fuel consumption per vehicle is presented in the Table 6-5.

Table 6-5: Average Fuel Consumption by Vehicle Type

Fuel Type	Auto (kg/litre)	Magic (kg)	Van (kg/litre)
CNG	3	10	9
LPG	4	-	8
Petrol	3	-	-
Filling Frequency/week	11.7	13.6	14.8

The results indicate that the TATA Magic and Maruti Van fill on an average of 10 and 9 kg of fuel respectively. This will allow them to operate for around 130-140 km only before requiring refuelling. Most of the operators need to commute more than 120 km per day to break even with their investments. Therefore, limited fuel capacity leads to frequent refuelling i.e. nearly twice daily. Long waiting periods at the fuel stations disrupts their schedule. Average trip lengths per day and fuel consumption patterns are presented in the Table 6-6

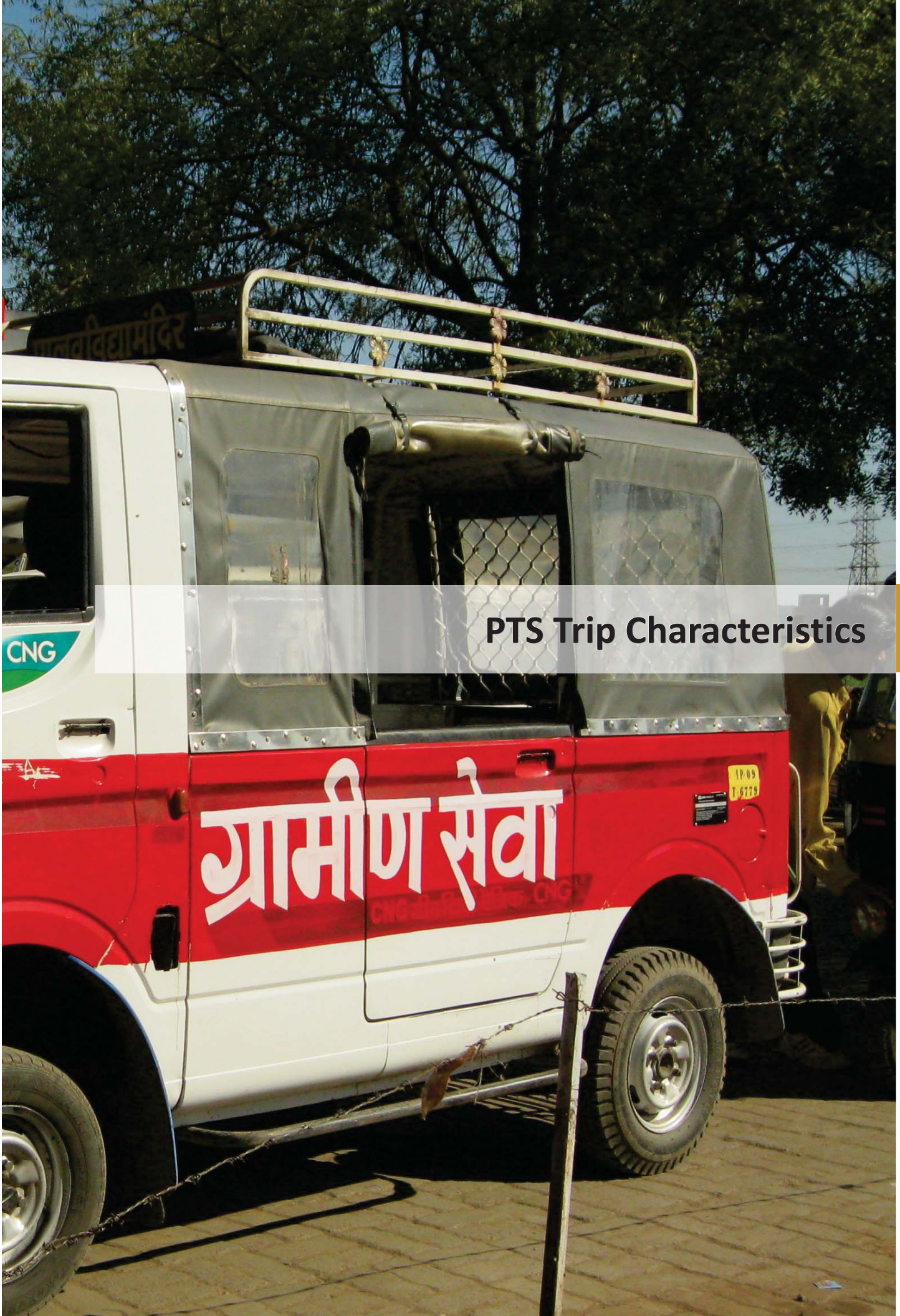
Table 6-6: Trip Length and Fuel Consumption

Vehicle Type	Fuel Type	Average Trip Length per day (km)	Average of Daily Fuel (Kg/litre)	Mileage km/ (kg or litre)
Auto	CNG	102	6.3	16.2
	LPG	81	5.7	14.2
	Petrol	82	5.6	14.6
Magic	CNG	177	19.6	9.1
Van	CNG	152	18.0	8.4
	LPG	126	12.89	9.74
Source: Fuel Station Survey, TARU 2010. (sample size: 4183 paratransit vehicles)				

The mileage reported by the drivers at the fuel stations are lesser than estimated from the GPS Survey. The GPS Survey estimates are provided in the Table 6-7.

Table 6-7: Fuel Efficiency of Paratransit Vehicles

Vehicle	Fuel	Mileage (km/unit)	Rate Rs/unit	Fuel Cost/km
Maruti	CNG (Kg)	14.36	36	2.51
Maruti	LPG (Litre)	9.22	32.37	3.51
Tata Magic	CNG (Kg)	13.60	36	2.65



PTS Trip Characteristics

7 PTS TRIP CHARACTERISTICS

In this study, 91 paratransit vehicles were selected and their per day trip characteristics were monitored using GPS device. In most cases, a surveyor travelled along with the operator (Tata Magic and Maruti van), to record the passenger details. In case of Auto-rickshaws and Taxis, passenger details were recorded by the respective vehicle drivers. Summary of this survey is presented in Table 7-2.

Table 7-1: Number of Survey Samples per Vehicle Type

Type of vehicle	No. of Samples
Auto Rickshaw	19
Maruti Van	30
Tata Magic	30
Metro Taxi	3
Private Taxi	3
Star Cab	4
Minibus	1
Tonga	1
Total	91

Table 7-2 outlines the age wise distribution of paratransit vehicles from the survey. Majority of the vehicles were found to be less than five years old. This is due to replacement of old vehicles with CNG/LPG vehicles. The analysis shows that there are considerable numbers of Auto-rickshaws (1 in every 6 Auto-rickshaws) which are old and still run on petrol (often with mix of kerosene).

Table 7-2: Age of Vehicles

Type	< 1 year	1-5 year	5-10 year	>10 year	Sample Total
Auto Rickshaw	43%	43%		14%	14
Tata Magic	25%	75%			16
Maruti Van		100%			13
Taxi	43%	43%	14%		7
Source: TARU Field Study, 2010					

7.1 Operational details

7.1.1 Maruti Van

The GPS survey provided information on the total length travelled, number of passengers and revenue collected. The summary of findings from the survey for Maruti Vans is presented in the Table 7-3.

Table 7-3: Maruti Van Survey Results

Route	Total fare collected Rs.	Paid Dist. km	Rate/ km	Trips	Break Dist. km	Paid Passengers	Rate/ Passenger	Km/ trip
M Y to Chandan Nagar	1,718	88.41	19.43	19	10.94	294	5.8	4.7
Rajmohalla to Patel Brige	1,314	84.91	15.48	23	8.60	201	6.5	3.7
Kalani Nagar to Kalani Nagar	1,302	147.02	8.86	10	0.00	210	6.2	14.7
Fhooti to Rajwada	1,258	133.54	9.42	19	5.33	225	5.6	7.0
Bhawarkua to Bombay Hospital	1,199	145.92	8.22	14	0.00	222	5.4	10.4
Bhawarkua to Badaganpati	1,128	108.76	10.37	21	9.87	223	5.1	5.2
Rajwada to Rajendra Nagar	1,081	129.24	8.36	20	2.60	212	5.1	6.5
Vijay Nagar to Bhawarkua	1,066	50.87	20.96	12	1.85	192	5.6	4.2
Nagar Nigam to Tilak nagar	1,060	112.69	9.41	26	2.40	212	5.0	4.3
Rajwada to Bhwarkua	1,053	113.12	9.31	16	4.18	191	5.5	7.1
Mushakhedi to Chandannagar	1,005	95.39	10.54	13	2.63	171	5.9	7.3
Nagar nigam to LIG	1,000	99.38	10.06	23	4.62	204	4.9	4.3
M Y to Chandan nagar	999	89.16	11.20	14	1.38	198	5.0	6.4
Hawa bangla to Rajwada	980	99.33	9.87	19	22.18	189	5.2	5.2
Bhwarkua to Vijay nagar	948	105.05	9.02	14	2.58	178	5.3	7.5
Vijay Nagar to Arvindo	928	110.78	8.38	13	0.90	171	5.4	8.5
Foothi khoti to Bhwarkua	908	88.80	10.22	14	3.98	153	5.9	6.3
Bombay hospital to Bhawarkua	901	168.65	5.34	16	4.67	170	5.3	10.5
Pardeshipura to MR 10	885	69.59	12.72	27	6.31	181	4.9	2.6
Rajwada to Rajendra nagar	882	101.33	8.70	17	7.59	169	5.2	6.0
Nagar nigam to Sch. No. 51	874	83.50	10.47	14	2.58	168	5.2	6.0
Station to Deepmala	810	72.31	11.20	13	3.24	95	8.5	5.6
Choithram to Rajwada	792	85.19	9.30	21	4.91	189	4.2	4.1
Nagar nigam to Indogerman	790	88.19	8.96	13	0.00	141	5.6	6.8
Bhwarkua to Tejaji Nagar	721	106.92	6.74	14	21.47	126	5.7	7.6
Pardeshipura to MR 10	720	48.61	14.81	18	4.65	144	5.0	2.7
Bhawarkua to Bhawarkua	707	90.61	7.80	8	1.61	123	5.7	11.3
Station to Patnipura	670	61.07	10.97	16	1.13	133	5.0	3.8
Rajwada to Choithram	640	53.22	12.03	13	7.17	128	5.0	4.1
Nagar Nigam to Vijay Nagar	634	89.50	7.08	12	9.00	130	4.9	7.5
Average	**966**	**97.4**	**10.5**	**16**	**5.3**	**178.1**	**5.5**	**6.4**
Maximum	**1,718**	**168.7**	**21.0**	**27**	**22.2**	**294.0**	**8.5**	**14.7**
Minimum	**634**	**48.6**	**5.3**	**8**	**0**	**95**	**4.19**	**2.58**

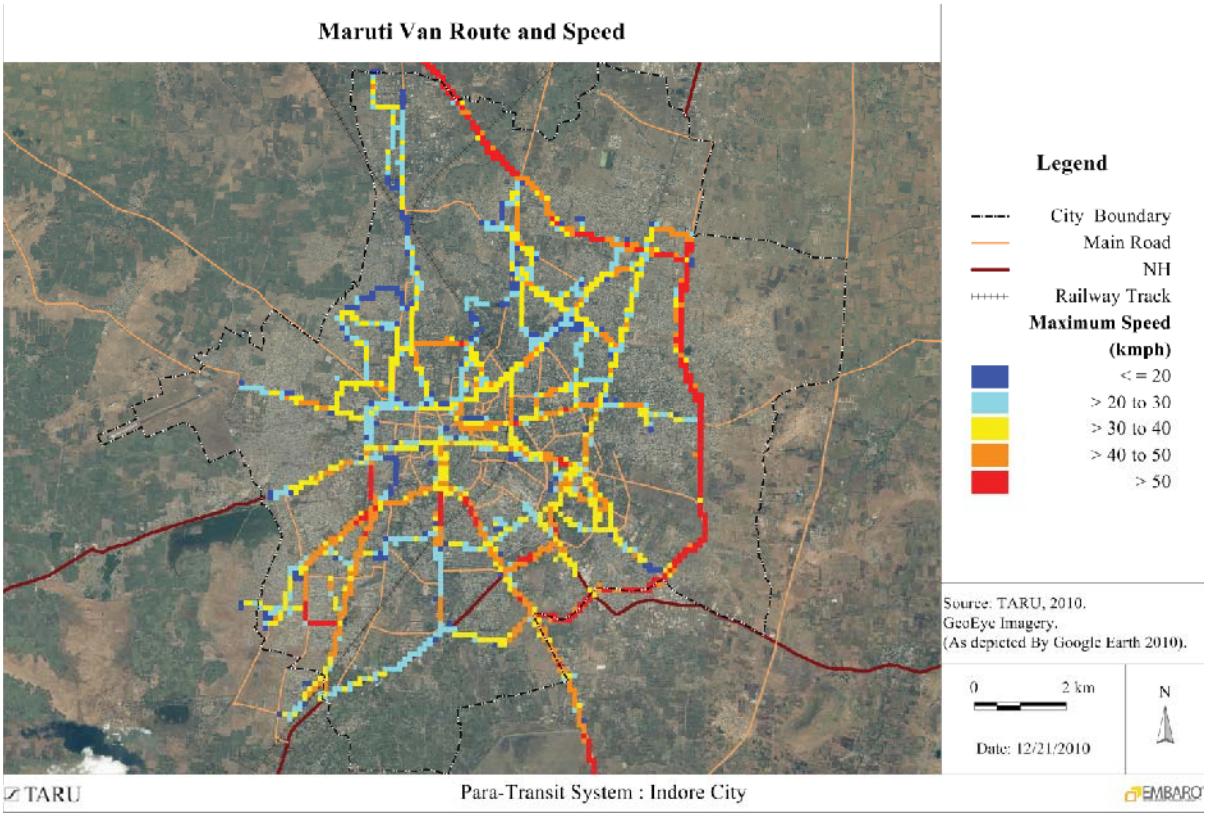
Source: GPS Survey TARU 2010

Within the surveyed samples, Maruti vans commute an average of 16 trips and a maximum of 27 trips. The operators (drivers) of the vehicles earn an average of Rs 966 per day and a

maximum of Rs 1,718 per day. The maximum revenue generating route is between Vijayanagar to Bhawar Kua. The average distance covered within a single trip is around 6.4 km. Out of the total distance travelled within a day, around 95% of the trips are for commuting the passengers (paid trips). The revenue generated per trip ranges between Rs 60 to Rs. 170.

Only 100 Maruti vans have route permits, rest can travel throughout the city and this is an advantage. The operators of Marti van has to cover a minimum of 100 km per day to break even with their investment and earn a profit. In order to maximize their profit for any given day, the operators tend to overload the passengers increase the profit per trip or over speed to increase the number of trips per day. The maximum speed of Maruti vans at various locations tracked during the survey are presented in the Figure 7-1**Error! Reference source not found.**. From the figure it is evident that most of vehicles travel at an average speed of 30 to 40 kmph within the city and over 50 kmph along the periphery. From the figure, it is also evident that there are certain stretches within the city where the Maruti vans travel between 40 to 50 kmph and some over 50 kmph.

Figure 7-1: Maruti Van Routes and Speed

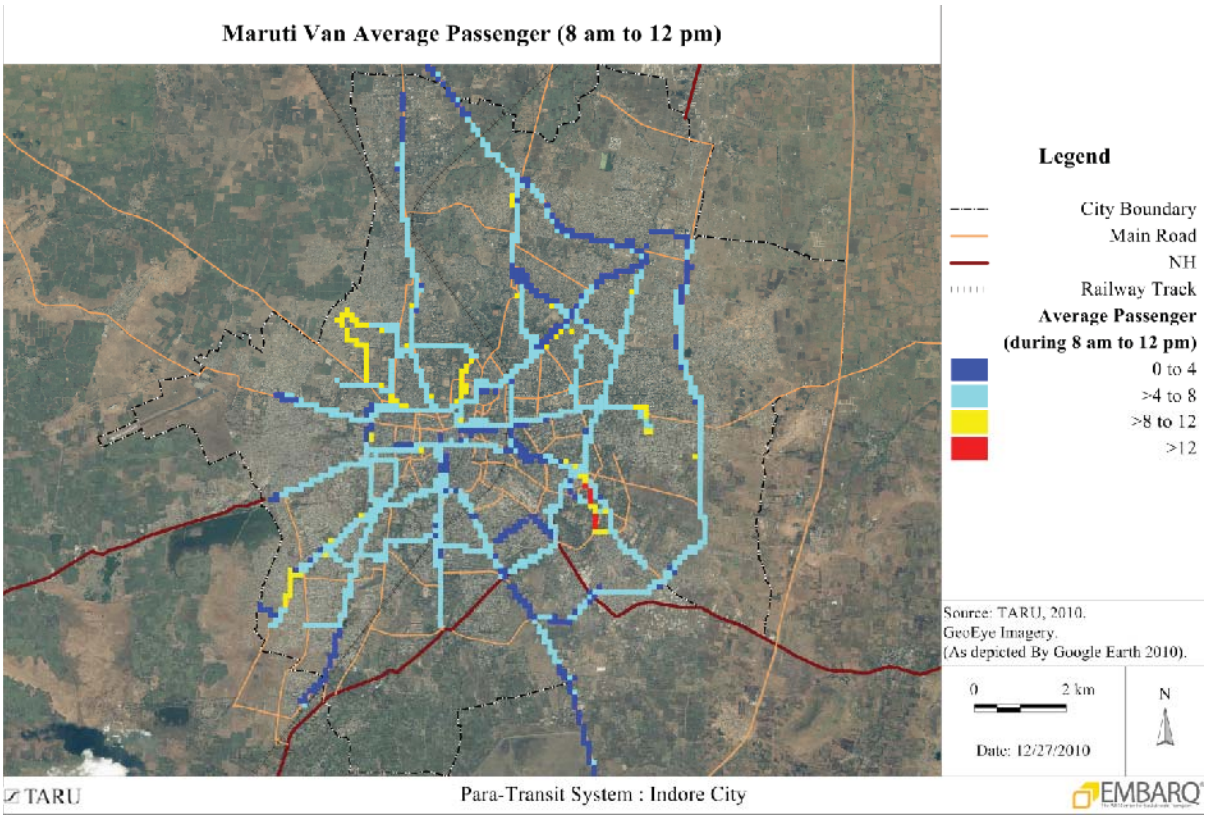


The numbers of passengers who embark and disembark the vehicles were recorded during the survey. The average number of passengers (per trip) commuting by Maruti van between 08:00 am to 12:00 pm is presented in the Figure 7-2. Average passenger density for other time durations of the day are presented in the Annexure D. From the figure, it is evident that during peak hours, average number of passengers range between 4 to 7. In spite of the vehicle's design capacity, there are also instances of overloading (along important sections of the city) i.e. more than 7 to over 13 passengers.

On further analysis, it was evident that average number of passengers commuting by Maruti vans is low along the routes of Nagar Seva bus service. But, overcrowding takes place in routes close to the Nagar Seva. From this we can deduce that Maruti van operators are filling

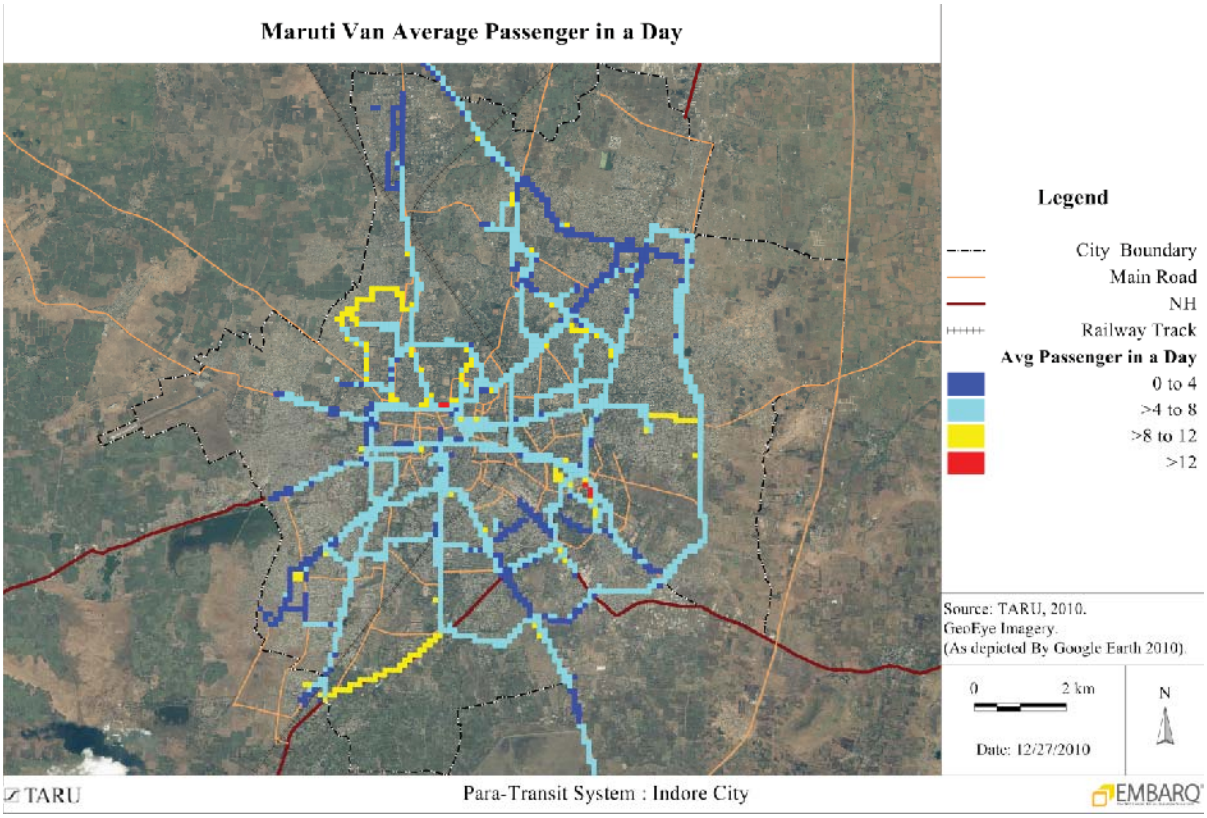
the demand gap in areas where public transportation is not available. That is, the distance between the bus stops and surrounding places of interest to the passengers are catered by the paratransit operators. Nagar Seva has relatively more passenger carrying capacity in comparison with Maruti vans. The disembarking passenger's from Nagar Sewa are left with little or no option but to agree to the van operator's idea of squeezing into their already crowded vehicles.

Figure 7-2: Average Passengers per Trip (8 am to 12 pm)



The average passengers per trip commuting by Maruti vans between 8:00 am to 8:00 pm are presented in the Figure 7-3. From the figure it is evident that passenger densities across most routes do not vary drastically. One reason for this uniformity might be that, the operators of the vans do not agree to move their vehicles unless their minimum requirements, usually 4 to 7 numbers, of passengers occupy their vehicles before starting the trip. This is usually to ensure that they break even with their minimum operating cost/investment at the end of the day. Nevertheless, there are also certain locations/areas where, the van operators are forced to move without sufficient passengers occupying their vehicles before the commencement of the trip. This is mainly due to pressure from other operators (including mafia) along a route.

Figure 7-3: Average Passengers per Trip Commuting by Maruti Van (8 am to 8 pm)



7.1.2 Tata Magic:

The travel details of TATA Magic derived from the surveyed samples are presented in the Table 7-4. On an average Tata Magic operators earn around Rs 1215 per day. The maximum earning recorded was Rs 370. From the survey, it was evident that the earnings of the operators are highly dependent on their routes. Some of the routes, especially in around the CBD, seem to be highly profitable while some of the rural routes seem less profitable. The operators also tend to schedule/reschedule their trips along the section of the routes to maximize their earnings. On an average, most operators manage to earn around Rs 12 per km. This amount is more than what most taxis or cab charge per km of travel.

In spite of a fairly decent revenue, Tata Magic operators have to cover more than 120 km to break even with their investment an earn a profit. This is due to the high hiring cost of the vehicles. The owners of Tata Magic rent the vehicles to the operators at an average rate of Rs 700-800 per day. Apart from this high hiring charge, the operators have to bear the cost of fuel and salaries of drivers/conductors (usually more than one to streamline the operations). These pressures usually lead operators in speeding along the road or looking for more profitable junctions away from their designated routes. This often results in inconvenience to the passengers.

Table 7-4 Travel Characteristics of TATA Magic (Based on Survey)

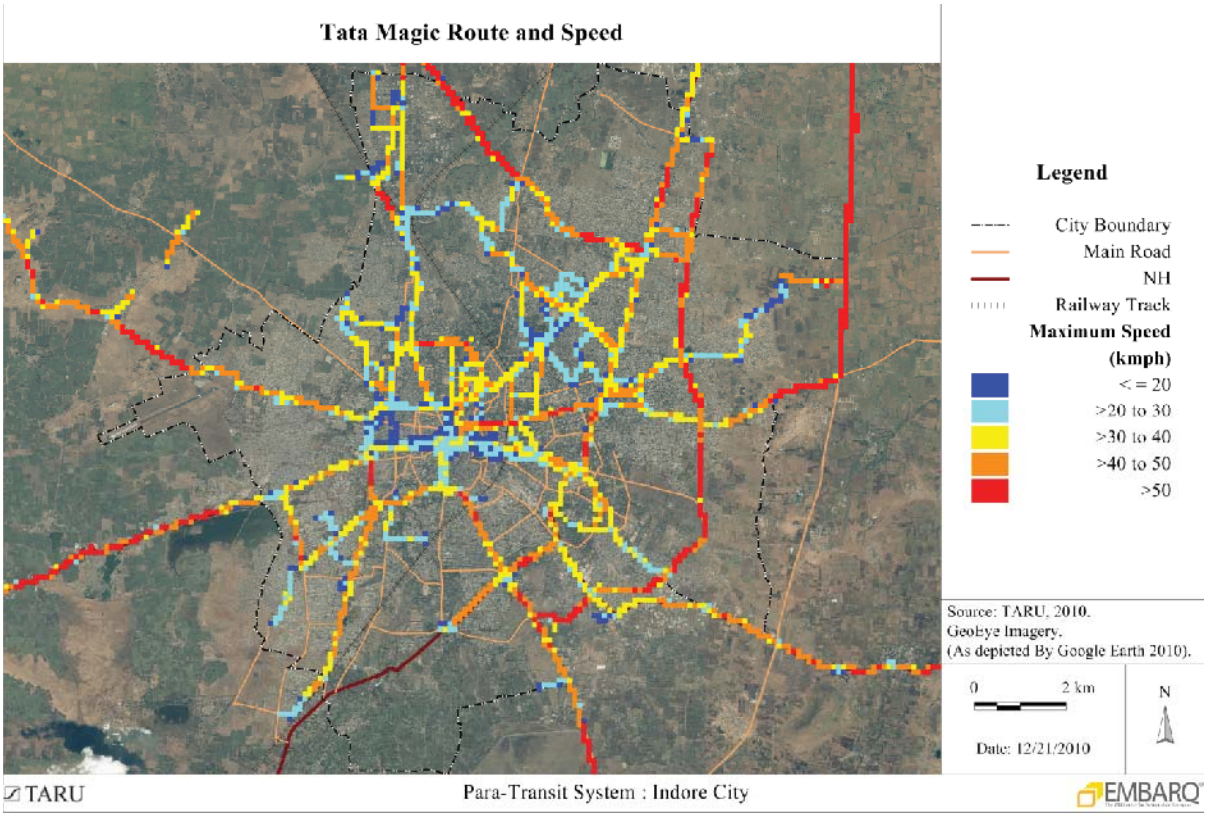
Route	Total fare Rs.	Paid Dist. km	Rate Rs/km	Trips	Break Dist.km	Paid Passengers	Rate(Rs)/ Passenger	Km/ Trip
Rajwada to Rajendra nagar	2,416	123.30	19.59	10	1.1	338	7.15	12.3
Nagarnigam to Sanchar nagar	1,964	154.44	12.71	19	21.0	395	4.97	8.1
Sirpur to Mushakedi	1,701	#	#	11	#	358	4.75	
Badaganti to Gomat giri	1,602	155.47	10.30	10	2.8	275	5.83	15.5
Gangwal to Tekri	1,537	102.69	14.96	17	6.5	257	5.98	6.0
Patnipura to Norani nagar	1,455	107.51	13.53	12	43.1	217	6.71	9.0
Bhwarkua to Arvindo	1,429	111.89	12.77	19	4.3	335	4.27	5.9
Bhwarkua to Pardeshipura	1,423	124.00	11.47	16	0.1	208	6.84	7.7
Norani nagar to Pardeshipura	1,403	100.04	14.02	11	18.4	239	5.87	9.1
Railwa staion to Ghandhi nagar	1,384	118.82	11.64	18	1.6	251	5.51	6.6
Nagar nigam to Deep mala	1,258	107.86	11.66	14	0.7	196	6.42	7.7
Gangwal to Kalariya	1,255	92.83	13.51	18	0.2	236	5.32	5.2
Khajrana to Norani nagar	1,236	93.59	13.20	13	7.5	214	5.78	7.2
Shukliya to Choithram	1,223	116.57	10.49	14	1.0	230	5.32	8.3
Norani nagar to Pardeshipura-B	1,218	33.44	36.42	9	1.8	263	4.63	3.7
Khajrana to Nagar nigam	1,216	94.12	12.920	14	16.9	191	6.37	6.7
Pardeshipura to Bhwarkua	1,195	#	#	18	#	233	5.13	
Bhawarkua to Bhawarkua	1,189	117.62	10.10	12	13.5	202	5.89	9.8
Navlakha to Khudel	1,128	113.85	9.90	17	37.8	238	4.74	6.7
Nagar nigam to Sch. No. 51	1,128	122.54	9.20	9	1.8	206	5.48	13.6
Bhawarkua to Simrol	1,125	104.36	10.78	8	16.2	190	5.92	13.0
Station to Niranjarpur	1,116	134.23	8.31	14	1.3	215	5.19	9.6
Bhawarkua to Noorani nagar	1,095	86.96	12.59	8	17.0	191	5.73	10.9
Hawa banglo to Vijay nagar	1,086	152.51	7.12	10	3.9	202	5.38	15.3
Khajrana to Nagar nigam-B	854	97.84	8.72	7	7.4	171	4.99	14.0
Patnipura to Shipra	820	100.34	8.17	10	0.3	147	5.58	10.0
Malwa mill to Sabji mandi	646	77.56	8.32	18	9.1	190	3.40	4.3

Route	Total fare Rs.	Paid Dist. km	Rate Rs/km	Trips	Break Dist.km	Paid Passengers	Rate(Rs)/ Passenger	Km/ Trip
Mushakhedi to Sch. No. 51	567	95.60	5.93	7	17.2	100	5.67	13.7
Rajwada to Vindraban	404	48.98	8.24	4	0.1	84	4.81	12.2
Norani nagar to Nagar nigam	370	#	#	13	#	74	5.00	
Average	**1,215**	**107.0**	**12.1**	**13**	**9.4**	**222**	**5.5**	**9.3**
Max	**2,416**	**155.47**	**36.42**	**19**	**43.1**	**395**	**7.1**	**15.5**
Min	**370**	**33.4**	**5.9**	**4**	**0.1**	**74**	**3.4**	**3.7**

GPS data incomplete
Source: GPS Survey TARU 2010

The maximum travel speed of the surveyed Tata Magic vehicles is presented in Figure 7-4. From the figure, it is evident that the drivers do tend to cross the permissible speed limits along some of the areas within CBD. This is especially during non-peak hours.

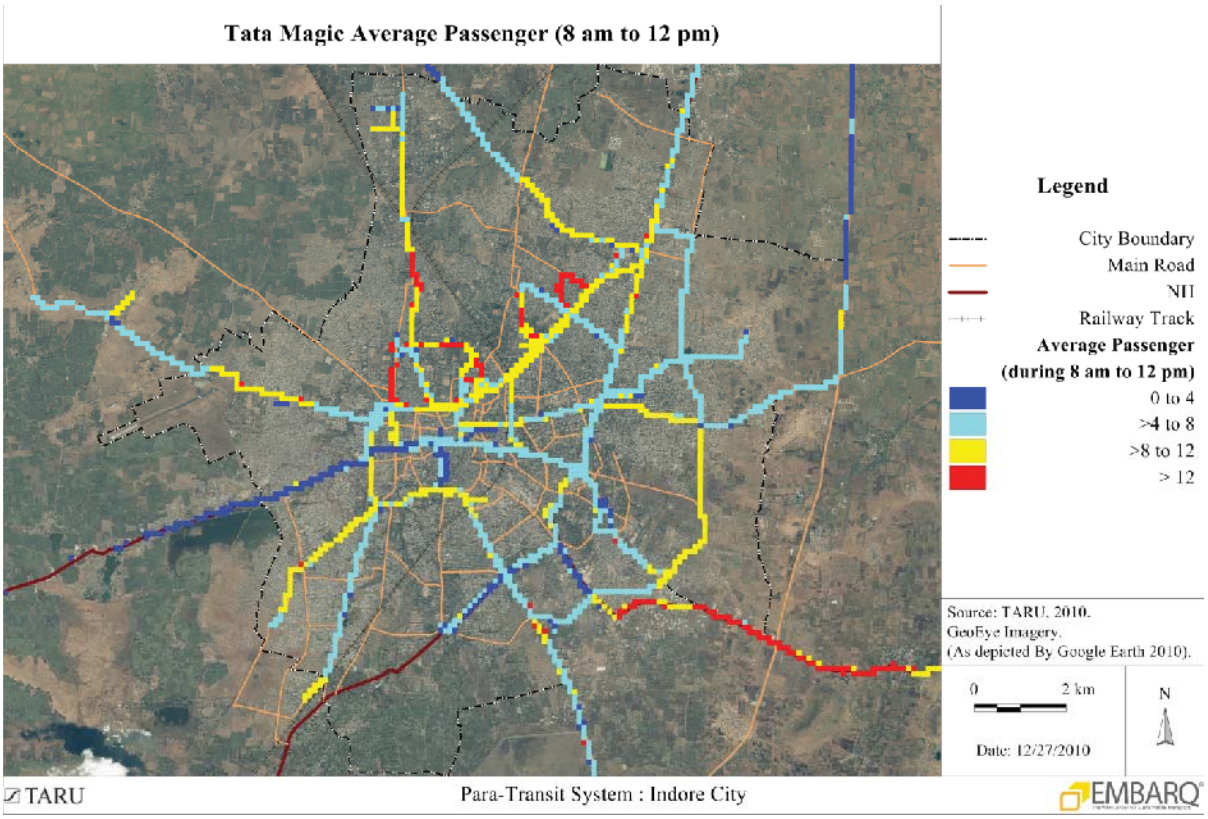
Figure 7-4: Tata Magic Routes and Maximum Speed



The average passengers per trip commuting by Tata Magic across different routes between 08:00 am -12:00 pm are presented in the Figure 7-5 During the peak hours, certain sections of routes are highly unprofitable due to low passenger density whereas certain sections of the routes are highly profitable. In order to maximize their earnings, wherever possible the vehicle operators tend to squeeze more passengers (more than design capacity) into their

vehicles. During the peak hours, such actions are more prominent amongst vehicles which operate from rural areas, since much of the labour population tend to come from the peri-urban and rural areas. Further, lack of public transportation across these regions creates a situation of no alternatives for these passengers. Average passengers densities per trip during other times of the day are presented in the Annex E.

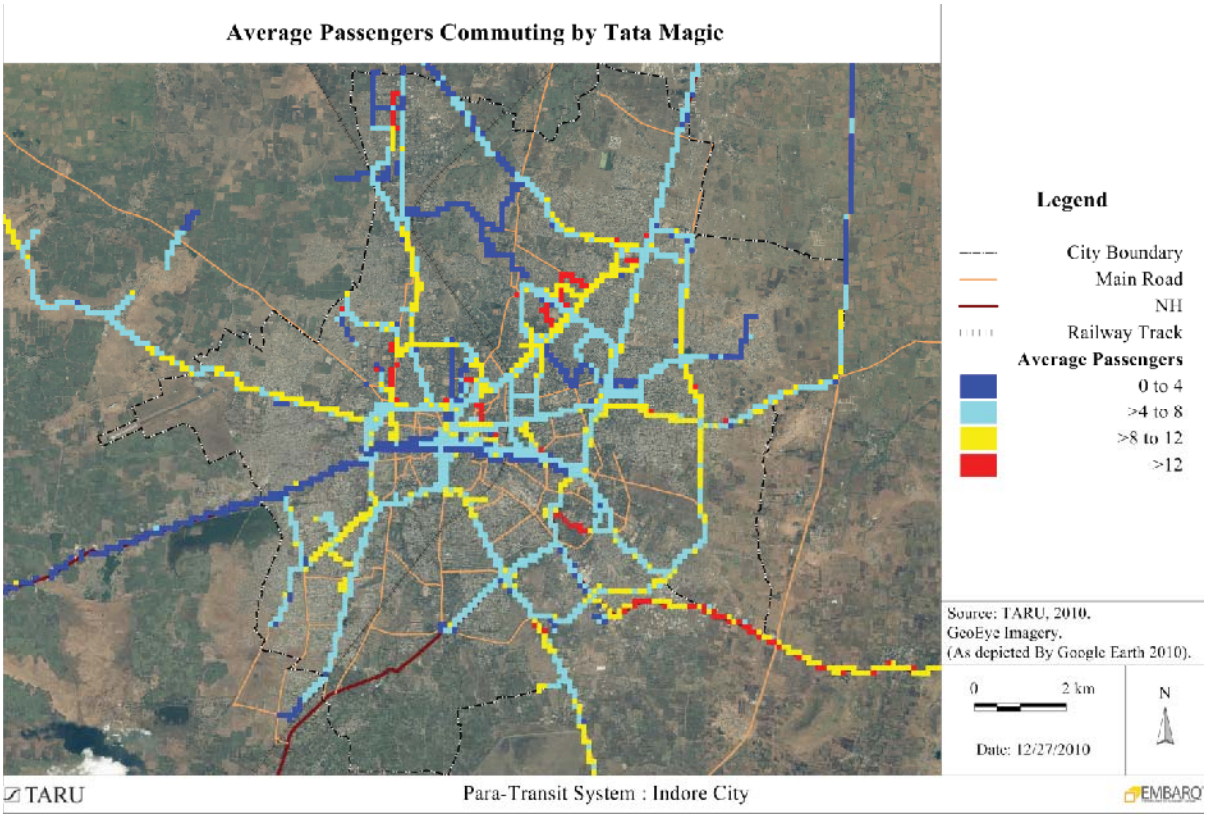
Figure 7-5: Tata Magic Average Passengers (8 am to 12 pm)



The average passenger per trip across the sampling period is presented in Figure 7-6. Maximum passengers are accommodated in PTS vehicles that operate along the southern periphery (usually consist of labourers who travel from rural to urban areas for work) and north central area (CBD) of the city. These are also the areas where maximum poaching of routes take place.

The average commuter per trip of all samples is shown in the Figure 7-6.

Figure 7-6: Average Passengers Commuting by Tata Magic



7.1.3 Nagar Seva

A sample of Nagar Seva minibus was surveyed during the study. The route details and passenger loads are presented in the Annexure-G. The Nagar Seva minibuses are currently being replaced by Tata Magic and Maruti Vans which are smaller vehicles, less polluting and managed by private operators.

7.1.4 Auto-rickshaw

The sample travel characteristics of Auto-rickshaw is presented in the Table 7-5**Error! Reference source not found.**. The average distance travelled by Auto-rickshaw per day accounts to over 70 km with an average of about 23 trips. Even though set metering mechanism is recommended by the RTO, the travel tariff is usually negotiated between the drivers and passengers. The official rate per km stipulated by the RTO is around Rs 7 per km. The drivers often do not follow this stipulated rate. Further, the drivers also prefer short trips where the rate of earning per km is high. The revenue generated by drivers range between Rs 115 to 615, with average of Rs 305.

Table 7-5: Characteristics of Auto-rickshaw: Travel and Operations

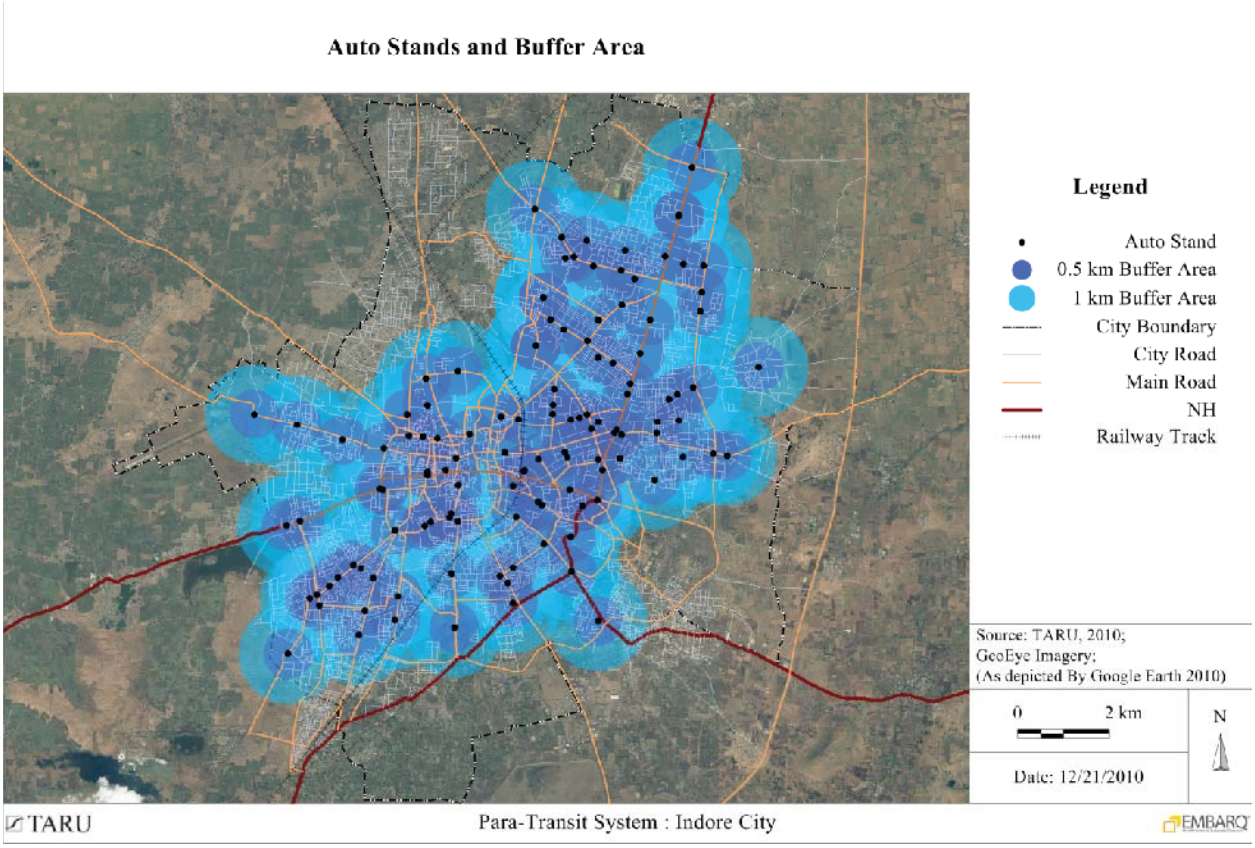
Survey No.	Total fare Rs.	Paid Distance km	Rate / km	Trips	Break Distance	Paid Passengers	Rate / Passenger	Km / Trip
AA-40387	245	35.05	6.99	13	11.3	15	16.3	2.7
AA-40388	615	51.04	12.05	16	23.7	25	24.6	3.2
AA-40389	440	76.24	5.77	21	10.7	12	36.7	3.6
AA-40390	445	86.84	5.12	20	23.9	24	18.5	4.3

Survey No.	Total fare Rs.	Paid Distance km	Rate / km	Trips	Break Distance	Paid Passengers	Rate / Passenger	Km / Trip
AA-40392	145	38.41	3.78	9	26.2	9	16.1	4.3
AA-40393	210	27.78	7.56	9	36.3	13	16.2	3.1
AA-40399	115	24.60	4.67	7	68.2	4	28.8	3.5
BB-40389	240	56.68	4.23	10	9.2	8	30.0	5.7
BB-40391	365	42.78	8.53	11	22.1	25	14.6	3.9
BB-40392	150	51.52	2.91	19	9.0	14	10.7	2.7
BB-40393	250	57.06	4.38	8	14.0	10	25.0	7.1
CC-40387	380	54.07	7.03	19	29.4	37	10.3	2.8
CC-40390	490	64.90	7.55	15	23.2	23	21.3	4.3
CC-40392	230	58.43	3.94	11	1.3	14	16.4	5.3
CC-40393	190	33.20	5.72	8	22.1	6	31.7	4.2
DD-40388	320	16.65	19.22	10	32.1	17	18.8	1.7
DD-40390	360	28.58	12.60	13	34.7	20	18.0	2.2
Average	**305**	**47.28**	**7.18**	**12.9**	**23.4**	**16**	**20.8**	**3.8**
Maximum	**615**	**86.84**	**19.22**	**21**	**68.2**	**37**	**36.7**	**7.1**
Minimum	**115**	**16.65**	**2.91**	**7**	**1.3**	**4**	**10.3**	**1.7**

The Auto-rickshaw stand distribution across the city and buffers of 0.5 km and 1 km are presented in.

Figure 7-7.

Figure 7-7: Indore Auto Stands and Buffer Area

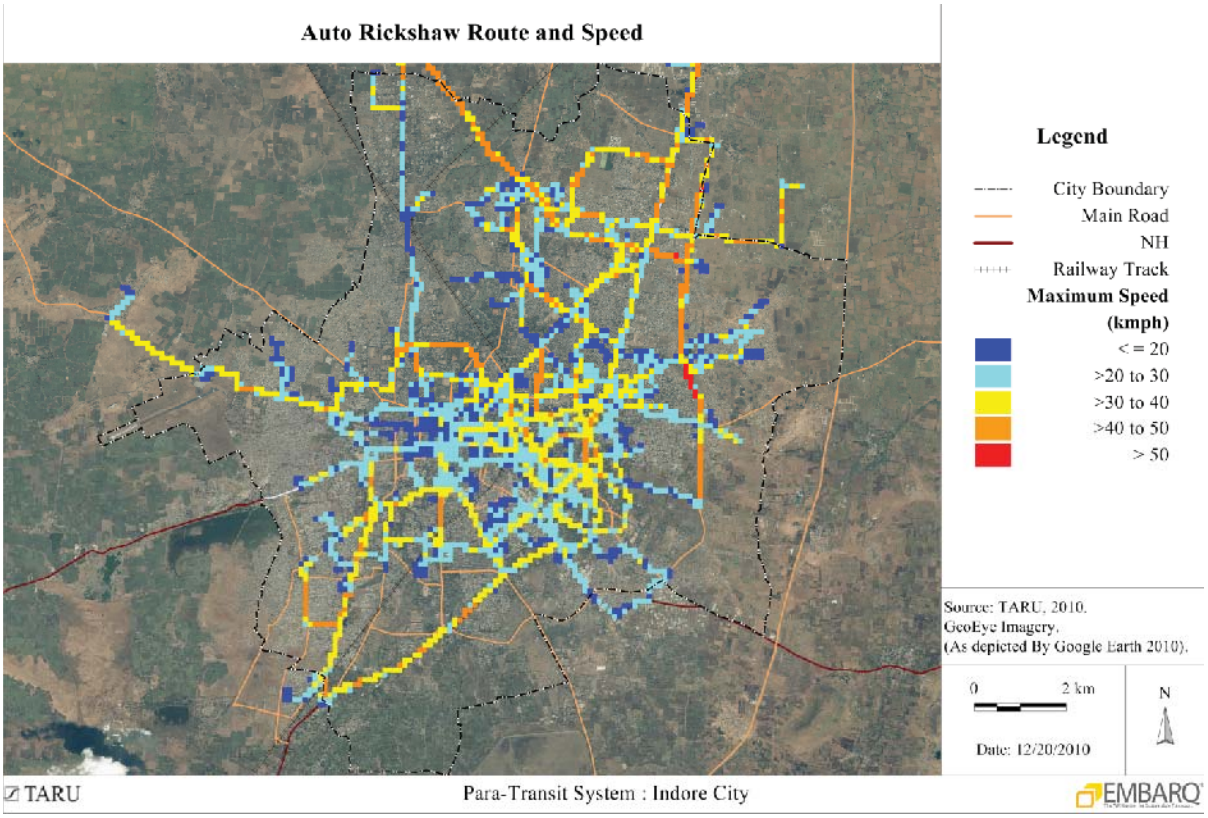


The .

Figure 7-7 shows that most areas within the city have Auto-rickshaw stands within 1 km (i.e. about 15 minutes of walking time).

The travel coverage and maximum travel speeds are presented in the Figure 7-8.

Figure 7-8: Auto Rickshaw: Recorded Maximum Speed



Most of the travel was performed in the core city area within permissible speeds (may be due to congestion). Most Auto rickshaws crossed the mandated speed limits in and around the peri-urban areas.

7.1.5 Metro Taxi

Single day travel characteristics of surveyed taxis are presented in the Table 7-6. The sample size is too small to get sufficient results. This was due to reluctance of Star Cab operators to provide information related to operating timings and fare details. Four taxis (Metro Taxis) were surveyed but only two drivers managed to provide us with necessary information.

Table 7-6: Travel Characteristics of Metro Taxi (Single Day)

Metro No	Total Fare Rs.	Paid Distance km	Rate / km	Trips	Break Distance	Paid Passengers	Rate / Passenger	Km / Trip
AA-40411	653	87.5	7.5	5	20.9	7	93	17.5
BB-40411	940	54.9	17.1	16	26.2	9	104	3.4
Average	**797**	**71.2**	**12.3**	**10.5**	**23.6**	**8**	**99**	**10.5**

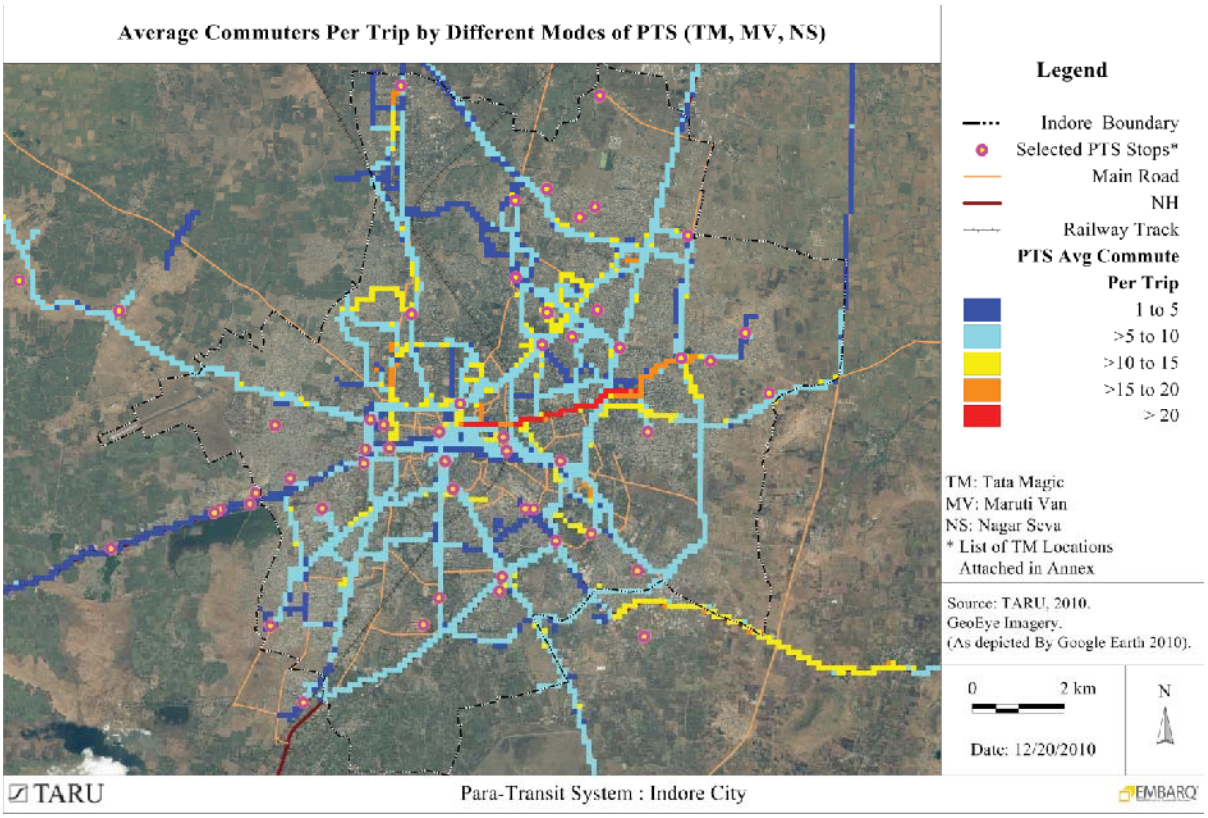
The results indicate that taxis collect an average revenue of around Rs 800 per day. The taxis travel an average of 10.5 km per trip. Average revenue is Rs 12.3 per km of travel. The

official rate for Metro cabs is Rs 15 for every km travelled (if it is a one-way trip) or Rs 7.5 for every km travelled if it is a return trip.

7.2 Earning

The survey results indicate that Tata Magic operators commute around 222 persons while the Maruti Vans commute around 178 persons. The average fare per passenger ranged between Rs. 4.2 to 8.5 for Maruti Van with an average of Rs 5.5 per passenger trip. Figure 7-9 highlights the average commuter density by different modes of PTS.

Figure 7-9: Average Commuter Density per Section (By different modes of PTS including all samples)



7.3 Coverage

The coverage of the route based paratransit across the city is presented in the Figure 7-10. Inner city is fairly covered by PTS operators and also provides services across certain peri-urban/rural areas. There are many overlaps between the BRTS routes and the paratransit routes as shown in Figure 7-11.

In spite of the overlap in routes between different modes of public transport, the profile of the passengers who commute by paratransit and people who prefer BRTS are often different. If the quality (e.g. overcrowding) of paratransit is improved and their routes realigned, it could aid in creating an efficient city wide transportation network. This would benefit the people (easy access to transportation), paratransit and BRTS operators.

Advance timing announcements and signage at key locations within 0.25 km from any point in the city may be very useful in integration. Such integrated transport system can benefit the BRTS since most of the stops have insufficient parking spaces and further expansion of BRTS; especially in inner city is constrained by current land use.

Figure 7-10: RTO Approved Tata Magic Routes and Selected Stops

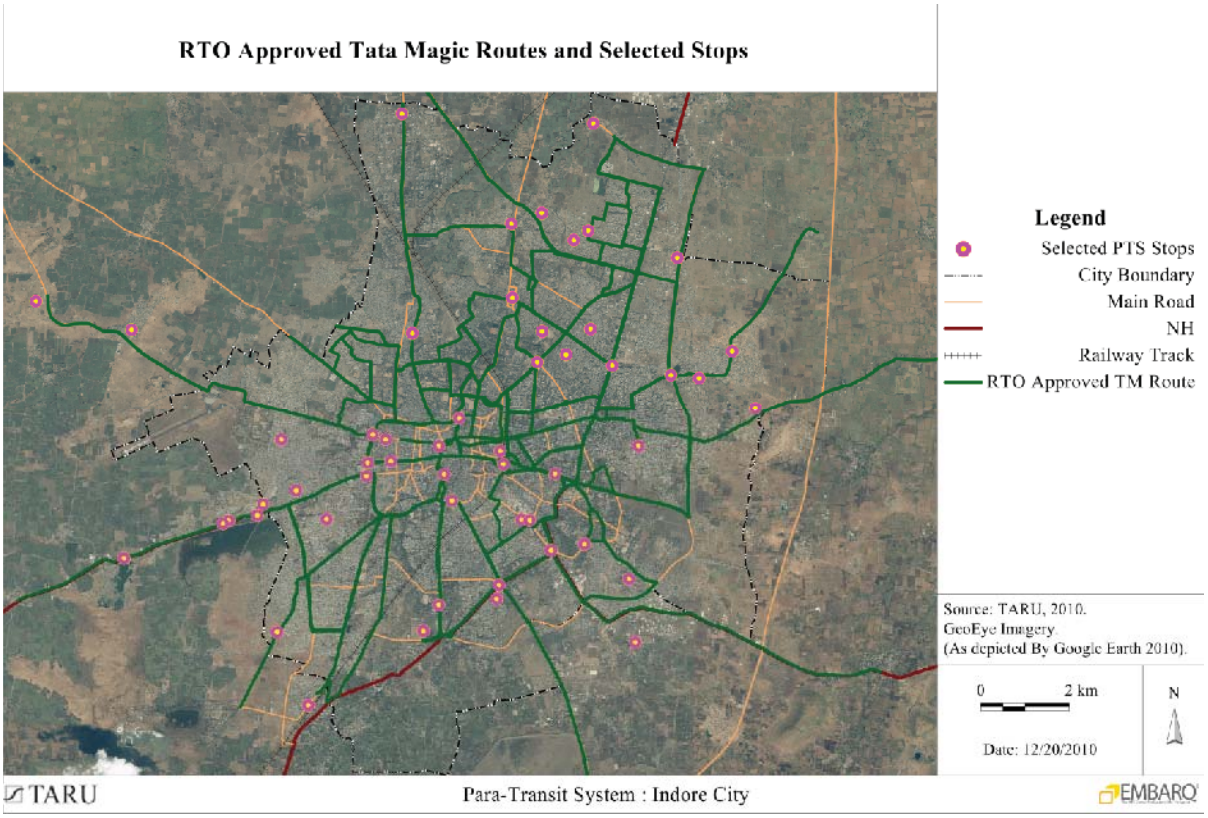
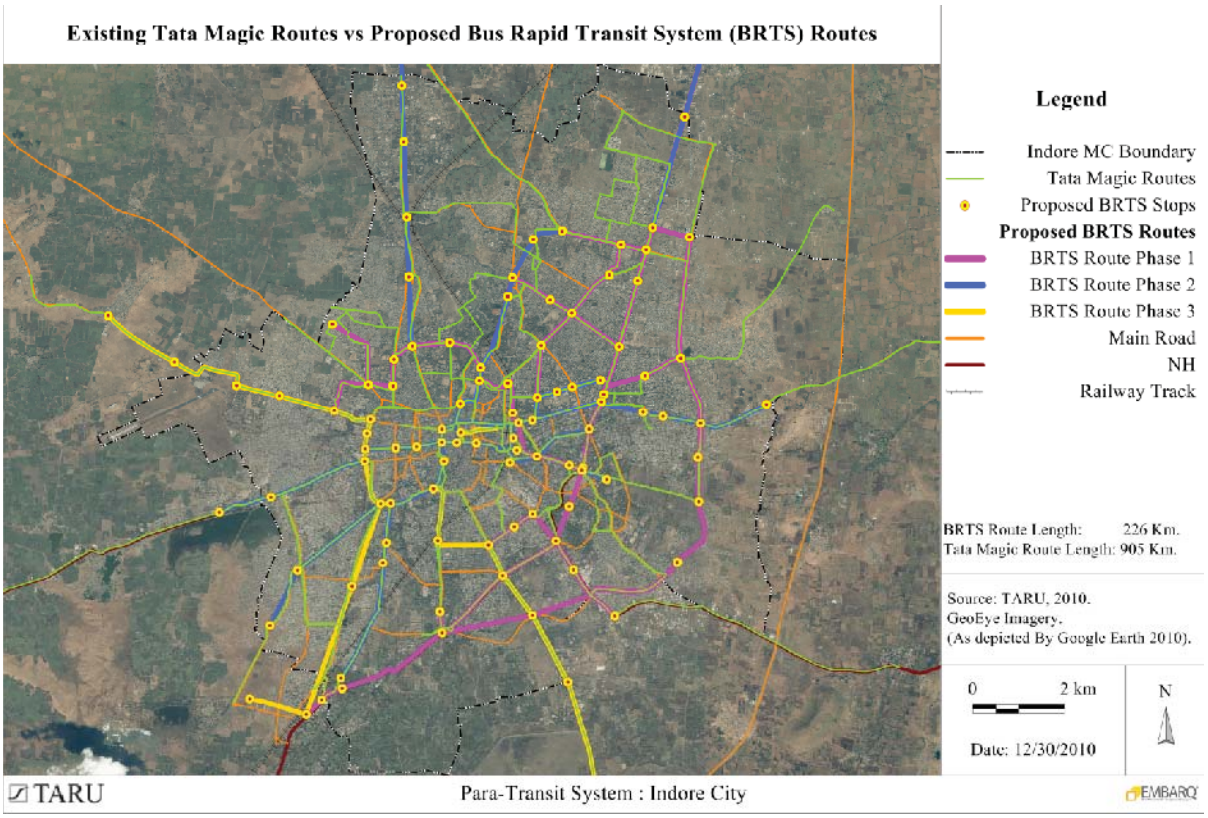
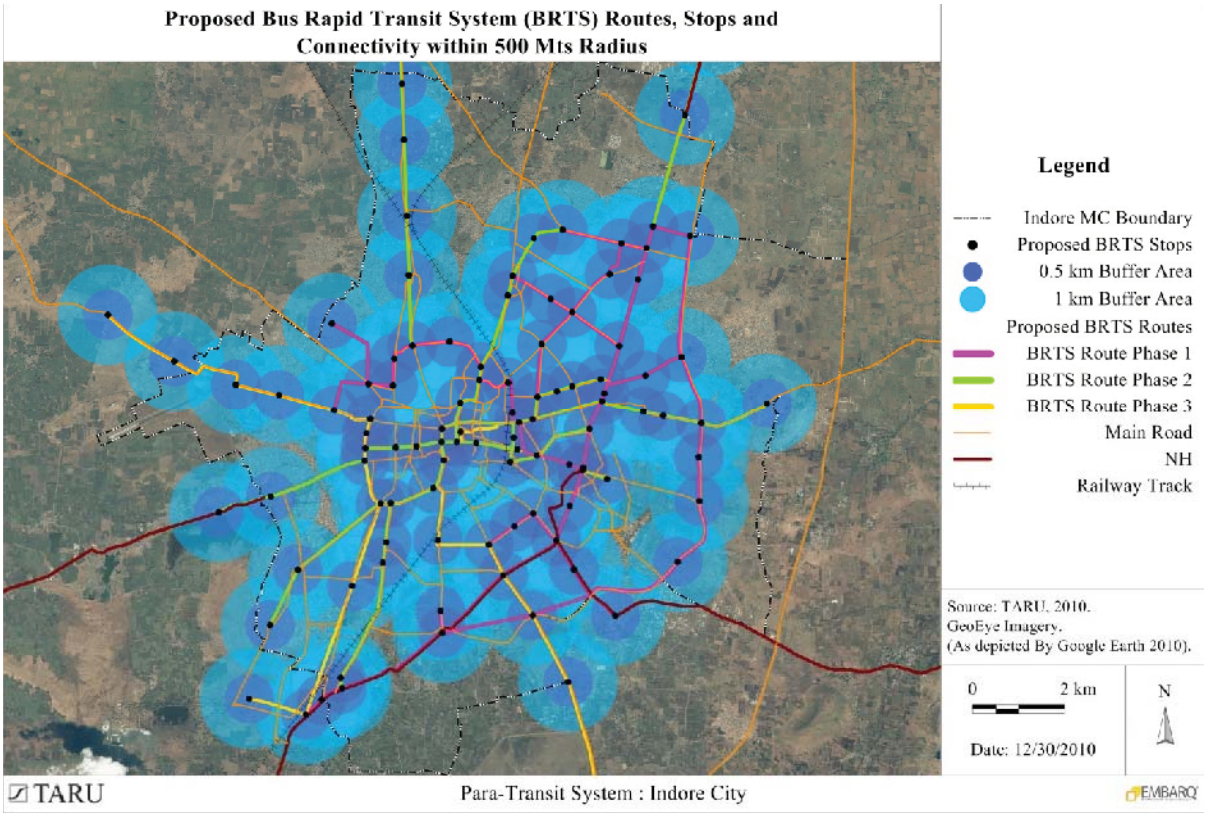


Figure 7-11: Existing Tata Magic Route Vs BRTS Routes



This issue is shown in the with 500 m and 1 km buffer of all BRTS points. BRTS stop buffer image Figure 7-12

Figure 7-12: BRTS Routes, stops and Connectivity



7.4 Deviation from Routes

The coverage of vehicles was done to understand the adherence of routes by the Tata Magic and Maruti Vans. The study indicated that cream skimming of high passenger routes is common. The urban route based paratransit vehicles deviate from their designated/alloted routes. The violation of routes across survey samples (rural Tata Magic vehicles) is shown in Figure 7-13. Similar maps illustrating the deviation in routes (different allocated routes vs actual travel) are shown in the Annex F. The cumulative travel pattern of all survey Tata Magic samples i.e. approved routes and deviations from approved routes is illustrated in the Figure 7-14.

The figures illustrate that significant proportion of paratransit operations does not take place along the RTO approved/designated routes. There are also instances of Tata Magic and Maruti van operators poaching upon each other's routes. This practice is widespread, and it leads to attempt of cream skimming by all operators. Such practices create uncertainties in travel timings and in some cases overcrowding.

Figure 7-13: Tata Magic with Rural Permits: On Route and Off Route

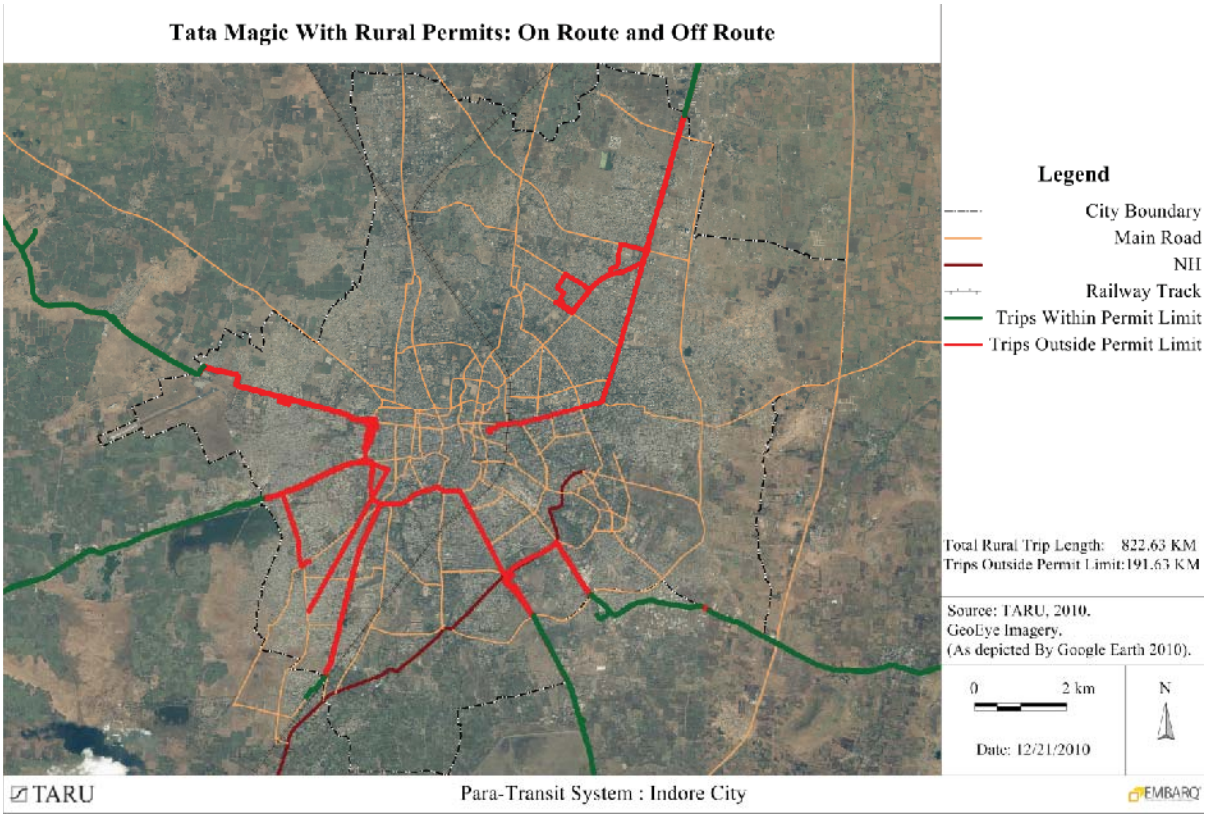
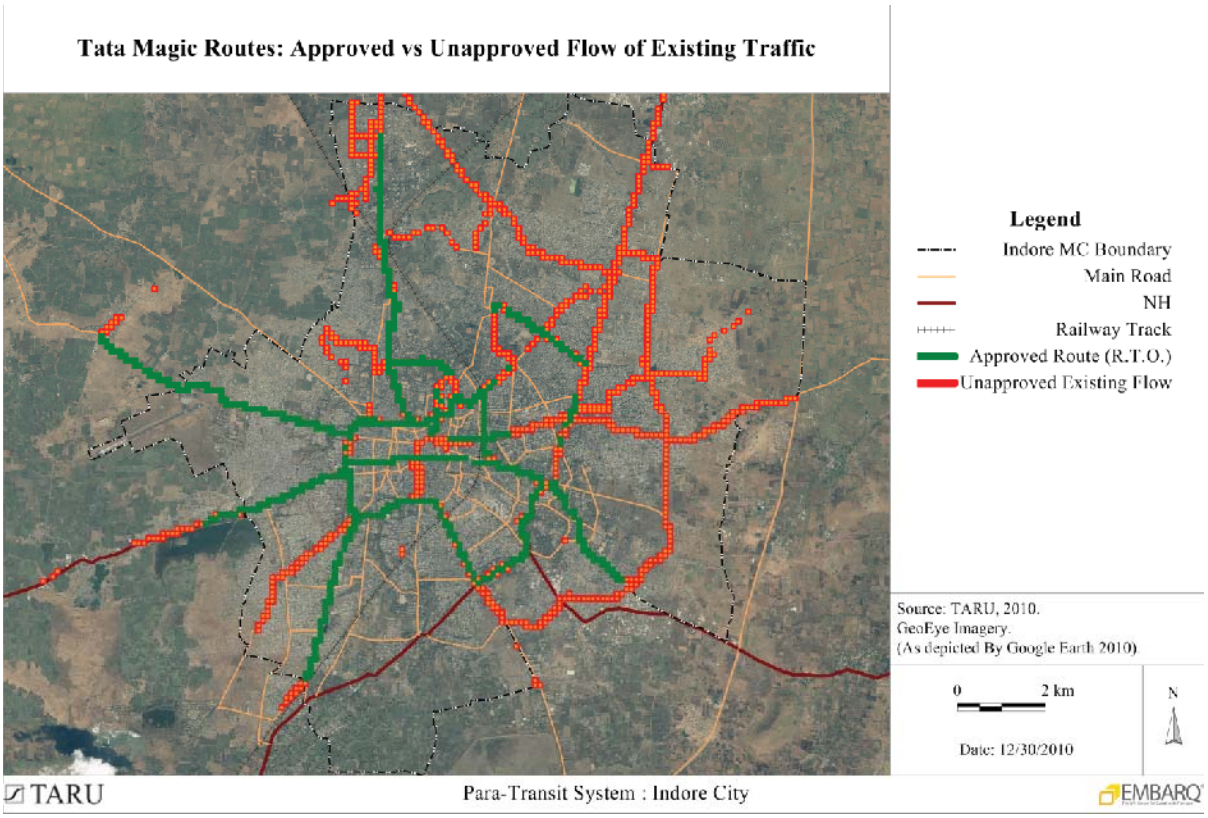


Figure 7-14: Tata Magic Routes: Approved Vs. Unapproved



7.5 Working and Break Periods

All paratransit drivers except for the Metro taxi drivers work more than 10 hours per day. The route permit holders as well as shared taxi operators (City permit Maruti vans operating on routes) try to serve passengers during morning as well as evening peaks hours in order to earn enough to break even with their daily investment and increase their earning.

While the route permit holders have to approach the passengers along their travel path, the city permit vehicles enjoy the convenience of passengers approaching them either to the parking stands or through phone.

The results on the average number of breaks and the average time spent on the breaks is presented in the Table 7-7. From the table it is evident that the taxis take less breaks in comparison with the vans but spend considerable time on each breaks.

Table 7-7: Break Times and Total Working Time Across Sample Paratransit Vehicles

Vehicle type	Average No. of breaks	Average break time/day (min.)	Average working time/day (min.)
Auto rickshaw	8	309	636
Metro Taxi	6	240	437
Private taxi	4	403	695
Maruti Van	10	96	667
Tata Magic	7	86	666
Source: GPS Survey, TARU 2010.			

Private taxis and Auto-rickshaws experiences idle time during their work hours that lasts longer in comparison with route permit vehicles. Maruti van and Tata Magic operators cannot take long breaks because they have to accomplish a minimum of 10 trips during the day to break even with their investment. Further, due to other problems such as route skimming the competition amongst these operators are also very high.

7.6 Facilities at Terminals

The information about facilities at or near the PTS terminals which includes water, covered areas, furniture, toilets was analyzed. The results are presented in the Table 7-8.

Table 7-8: Availability of Basic Facilities (%)

Facility at Terminal	Yes	Total Sample
Covered Area	25%	89
Drinking Water	28%	89
Seating	22%	89
Toilet	20%	89
Source: GPS Survey, TARU 2010		

Most facilities are often available only in petrol pumps or other transportation nodes. The facilities in these locations are further not designed for the convenience of PTS passengers.

While the route terminals have some basic facilities Auto-rickshaw stands mostly do not have any facilities. Such lack of basic facilities is a matter of concern, which also indicates the de-facto informal status of the terminals.

In few of the Auto-rickshaw stands have informal drinking water facilities, but the water is stored in earthen pots and may not be safe. Figure 7-15 shows examples of Auto-rickshaw stands without basic amenities

Figure 7-15: Auto Stands without Basic Amenities

Source: A.B. Road location; TARU Field Study, 2010

Driver Survey

8 DRIVER SURVEY

8.1 Driver Profiles

8.1.1 Education

Educational background & training of the drivers is one of the primary indicators which was used to assess the knowledge of safety (including passenger safety) amongst drivers. The Table 8-1 shows the educational qualification of drivers in PTS. This indicator was also stressed by the RTO officials and traffic police. According to them, low literacy levels among drivers are one of the major issues in creating awareness programs and to improving safety. Poor adherence of traffic rules leads to traffic jams and accidents in the city.

Table 8-1: Qualification of PTS Drivers (Based on Surveyed Samples)

Education Level	Auto-rickshaw	Magic	Taxi	Van	Sample Total
Illiterate	1	-	-	-	1
Primary	8	10	-	6	24
Secondary	3	6	4	4	17
Higher Secondary	1	-	1	3	5
Graduate & Above	1	-	2	-	3
Total	14	16	7	13	50
Source: Sample Size 50; TARU Analysis, 2010					

In most cases, the drivers are educated, except for 2% who are illiterate. Out of 50 drivers interviewed, 24 drivers have primary education (up to 5th standard) and 17 have secondary education (up to 10th standard). Basic qualification for new drivers is a minimum of secondary school education (10th standard or above).

8.1.2 Experience

The drivers come with different years of driving experience. The level of education in comparison with year of driving experience is presented in the Table 8-2

Table 8-2 Education and Driving Experience

Year of Operation	Illiterate	Up to 5th Std	Up to 10th Std	Up to 12th Std	Graduate & Above	Total Sample
1-2 Yrs	-	9	1	1	-	11
3-4 Yrs	-	3	-	1	1	5
5-10 Yrs	-	6	10	-	1	17
>10 Yrs	1	6	6	3	1	17
Source: Sample Size 50; TARU Analysis 2010						

8.1.3 Age of the PTS Drivers

Maximum drivers are in the age group of 25 to 40 years. Auto-rickshaw drivers (relatively low proportion) seem to be the oldest, i.e. above 50 years in age.

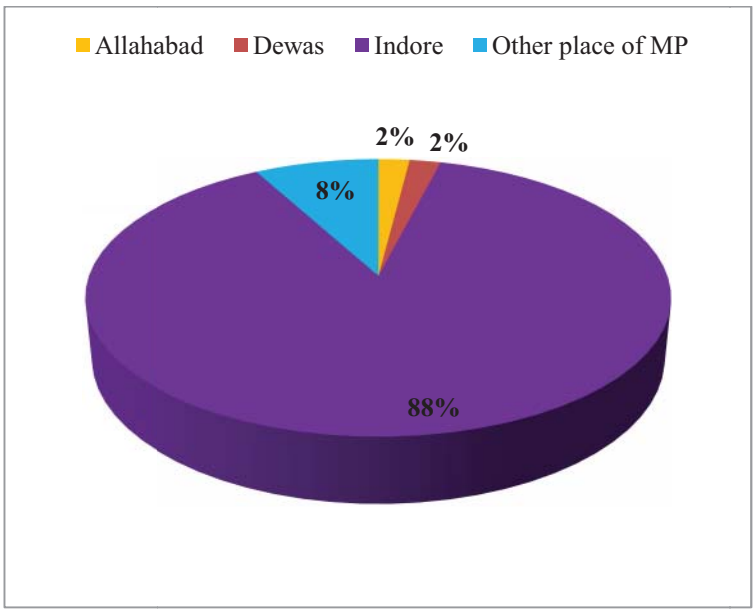
Table 8-3: Age Group of PTS Drivers

PTS Type	Age Group (in year)				Sample Total
	< 25	25 to 40	40 to 55	> 55	
Auto Rickshaw	14%	50%	21%	14%	14
Tata Magic	13%	63%	25%		16
Taxi	14%	71%	14%		7
Maruti City Van	8%	77%	8%	8%	13

8.1.4 State of Origin

Most of the drivers are old residents of the city while there are a few immigrants (around 12 percent). Figure 8-1 shows state wise proportion of drivers in Indore city.

Figure 8-1: State of Origin of Drivers

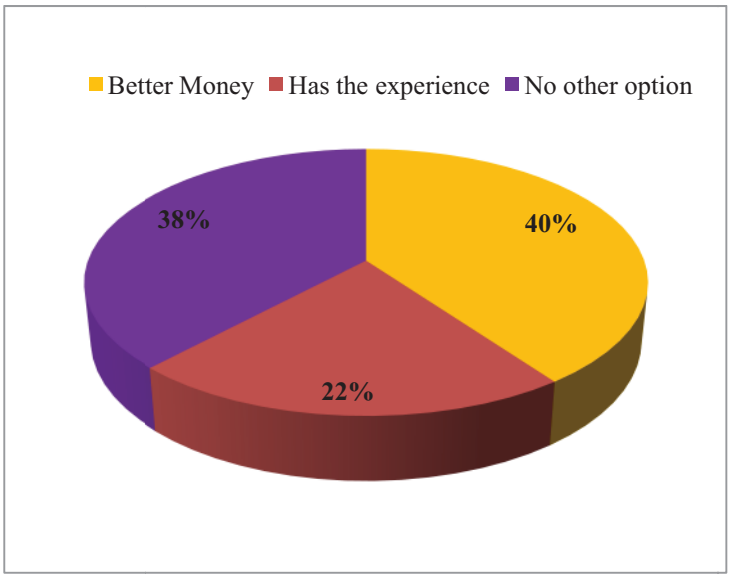


Source: Sample Size 50; TARU Analysis 2010

8.1.5 Reason of Driving

PTS drivers gave different reasons for choosing their current occupation. The results are presented in the Figure 8-2. Most people (40%) drive because this professions guarantees them better income. About 38% of the people are in this occupation because they do not have an alternate employment opportunity.

Figure 8-2: Reasons for Driving Paratransit Vehicle



Source: Sample Size 50; TARU Analysis 2010

8.2 Routes

The PTS vehicles are provided with separate permits to travel within or outside the city. Many of the paratransit drivers especially Auto-rickshaw drivers prefer to commute passengers from specific areas, which provide them steady incomes. Also some of the Auto-rickshaw drivers prefer steady income generation options such as commuting children to schools.

The Tata Magic routes are controlled by the associations and are therefore function in a more organized manner (relatively). In the case of Maruti van operators, only 20% have route permits, while the rest have city permits. This gives the city permit holders the liberty of plying on high paying routes which are assigned to other operators (cream skimming). Due to the nature of the problem, neither traffic police nor RTO officials are able to control the paratransit travel patterns. In most cases, in spite of the cream skimming, operators avoid complaining to the concerned officials. One of the main reasons is the political support which some of the unions/persons enjoy. This prevents the operators from raising the issue and creating inter-personal conflicts. The driver survey findings regarding this issue is presented in Table 8-4.

Table 8-4: Reason for Selection of Route

PTS Type	Fixed by Association	Maximum Revenue	Sample Total
TATA Magic	69%	31%	16
Maruti Van	23%	77%	13
Source: Sample Size 50; TARU Analysis 2010			

The driver survey provided a synoptic picture of the length of daily routes operated formally and informally by various paratransit vehicles as shown in the Table 8-5.

Table 8-5: Proportion of Trip Lengths Operated by Drivers

Type	<5km	5-10	10-20	20-50	50-75	>75	Grand Total
Auto-rickshaw	43%	21%	7%	14%	14%		14
TATA Magic		38%	38%	19%	6%		16
Taxi	14%	29%	14%		14%	29%	7
Maruti Van	8%	31%	38%	23%			13
Grand Total	**16%**	**30%**	**26%**	**16%**	**8%**	**4%**	**50**
Source: Sample Size 50; TARU Analysis 2010							

8.3 Fare Fixing Methods

Surveys were undertaken to understand the method of fare fixing methods in the PTS. The results from the survey are presented in Table 8-6.

Table 8-6: Fare Fixing Methods

PTS Type	Metered	Own	Union	Sample Total
Auto-rickshaw	29%	64%	7%	14
TATA Magic	-	63%	38%	16
Taxi	100%	-	-	7
Maruti Van	-	69%	31%	13
Total	4	35	11	50
Source: Sample Size 50; TARU Analysis 2010				

Three type of fare fixing methods are currently prevalent.

1. **Fixed Rates:**

   This is practiced by vehicles which operate on designated routes. The operators of these vehicles usually follow the rules setup by the authorities.

2. **Variable Rates:**

   This method is used when the passengers have less or no option for alternate means of transportation. The operators of these vehicles are usually to deviate/operate from their designated routes. They also tend deviate from the rules/laws in terms of overcrowding and over pricing. In these cases the passengers usually end up paying more than the designated fare.

3. **Rates decided by the Unions:**

   PTS Unions help avoid conflicts between drivers/operators usually when the frequency and number of PTS vehicles operating across a single route is high. Unions also try to minimize the competition between the operators.

Apart from the above methods, in important places like railway station and bus terminus, the drivers have mutually decided fixed rates based on destinations. Night time charges are also variable. The passengers feel that one of the disadvantages of PTS is high tariff.

8.4 Fine and Penalties

Fines are generally levied for breaking traffic rules and the incidences of such fines were elicited and presented in the Table 8-7. Overloading is the main reason for fines paid by the drivers. Both Tata Magic and Maruti vans operators overload regularly, but the driver survey shows a very different picture.

Table 8-7: Main Causes of Fines

PTS Type	Overloading	Parking	Not Wearing Uniform	No Fines	Total
Auto Rickshaw	29%	-	14%	57 %	14
Tata Magic	37%	-	-	62%	16
Maruti Van	62%	7%	-	31%	13
Source: Sample Size 50; TARU Analysis 2010					

8.5 Revenue

Average revenue per month generated by different paratransit vehicles are presented in the Table 8-8. The results indicate that proportionally the revenue generated from Tata Magic is higher than Maruti van which is also indicated by the higher daily hiring rates.

Table 8-8: Average Revenue Generated per Month (Rs.)

PTS Type	<5000	5,000 to 10,000	10,000 to 25,000	>25,000	Total
Auto-rickshaw	7	6	1	-	14
Tata Magic	-	1	6	9	16
Taxi	-	-	5	2	7
Maruti van	-	4	4	5	13
Source: Sample Size 50; TARU Analysis 2010					

8.6 Vehicle Maintenance

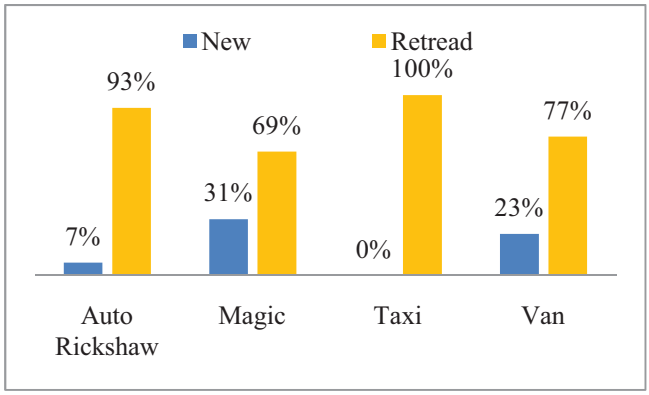
Table 8-9: Vehicle Service Frequency

PTS Type	1 Month	2 Month	3 Month	4 Month	As per need / Breakdown	Total
Auto-rickshaw	-	-	-	7%	93%	14
Tata Magic	19%	69%	13%	-	-	16
Taxi	29%	-	-	-	71%	7
Maruti Van	31%	62%	8%	-	-	13
Source: Sample Size 50; TARU Analysis 2010						

The frequency of servicing (vehicles) carried out by the vehicle operators are presented in the Table 8-9. Maruti van and Tata Magic were launched recently in Indore for paratransit. These vehicles are therefore less than 5 year old and many of them are under manufacturer's

warranty/service schemes. Tire retreading is found to be widely practiced by all paratransit vehicles. Retreaded tyre usage in the overloaded paratransit vehicles is unsafe. The retreading practices currently followed by various operators are presented in the Figure 8-3.

Figure 8-3: Tyre Retreading



Source: Sample Size 50; TARU Analysis 2010

Operator Survey

9 OPERATOR SURVEY

A total of 18 operators were interviewed. They included 6 Maruti van, 6 Auto-rickshaw, 4 Tata Magic and 2 Private Taxi operators. The results from the interviews indicate that only four out of 18 operators (less than 25%) were driving their own vehicles. The rest were operating vehicles on a rented basis. In case of rented vehicles, the driver pays for fuel, lubricants and traffic fines (if any). The vehicle owners are responsible for the vehicle maintenance, repairs and replacement of tyres.

The Auto-rickshaws are rented at the rates ranging between Rs. 250 to 300 per day, while TATA Magic vehicles are rented at rates ranging between Rs. 750-800 per day. Maruti vans are rented at rates ranging between Rs. 650-750. The variation in the rental rates among the same vehicles usually depend upon the route permits.

9.1 Fixed Maintenance Costs

The average fixed and maintenance costs for various paratransit vehicles are presented in the Table 9-1.

Table 9-1: Fixed and Average Maintenance Costs of PTS Vehicles

PTS Type	Vehicle Price	Permit Fees	Maintenance (Rs/Month)	Lubricant (Rs/Month	Cost of Fuel (Rs/Day)	Driver Salary (Rs./Month)	Conductor's Salary (Rs/Month
Auto	118,500	1,133	633	200	126	3,600	
Magic	380,000	7,450	2,875	900	303	6,600	4,067
Van	190,000	7,000	2,500	300	330	5,000	4,500
Taxi	205,000	40,000	6,000	1,250	1,100	4,750	

The table indicates that the owner needs to spend about 2-3 days of his rent collected from the driver for maintenance. The operator also has to pay back the Easy Monthly Installments (EMI) of the vehicle if he has bought the vehicle on loan, as is the case of most Maruti vans and Tata Magic. These vehicles were bought during the last 2-3 years. The operators reported net earnings of about Rs 10,000 to 15,000 per month in case of Tata Magic and about Rs 3000-5000 per month in case of Auto rickshaws.

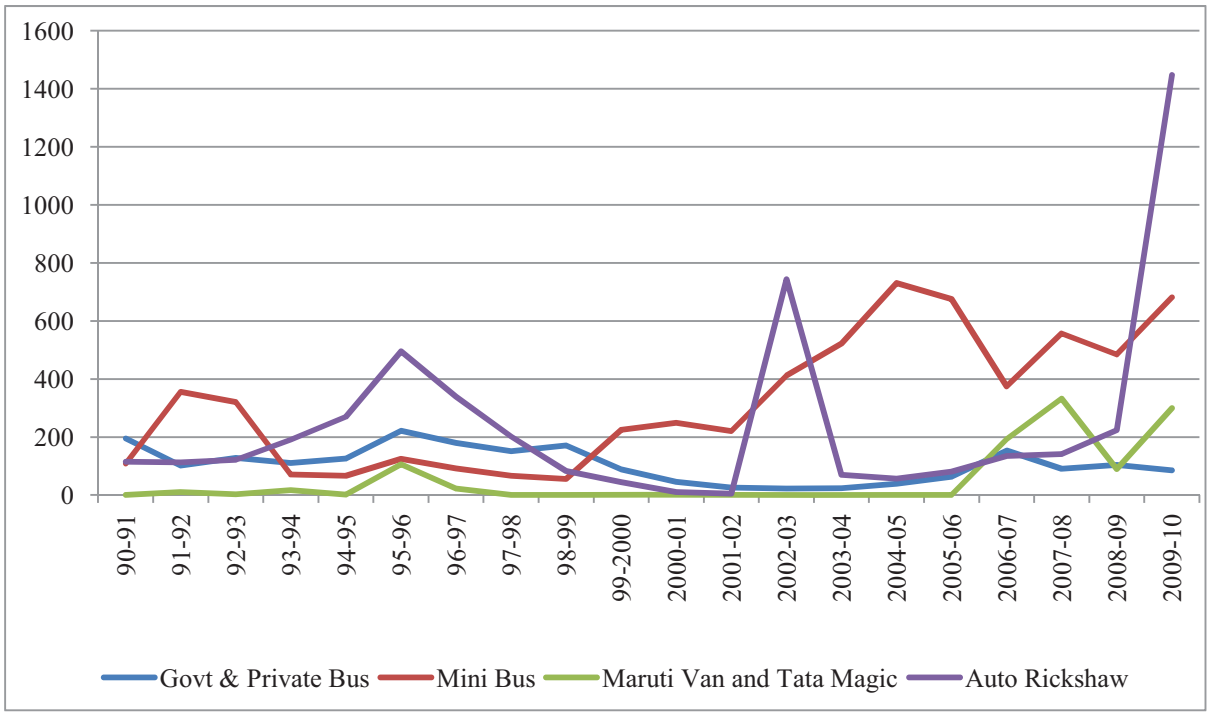
9.2 Permit Procedures

There are two types of permits. i.e. temporary and permanent. The temporary permits are usually issued for up to four month. Permanent permits are for commuting public on a regular basis. These permanent permits require renewal once every 5 years. The current application fee for new permit is Rs. 750 and transfer of permit from an old vehicle to a new vehicle is Rs.1,000. Presently, even though new applications are being accepted, the RTO has temporarily stopped issuing new permits.

Due to the temporary halt in new permit issuance, in city with growing population, has opened up possibilities for perverse incentives, unfair competition and incidences of illegal paratransit vehicles. The permits are also traded informally at premium prices- for example the Auto rickshaw permits are reportedly being traded at Rs 125,000. Similar issues in Maruti vans and Tata Magic are reported by the union representatives and operators.

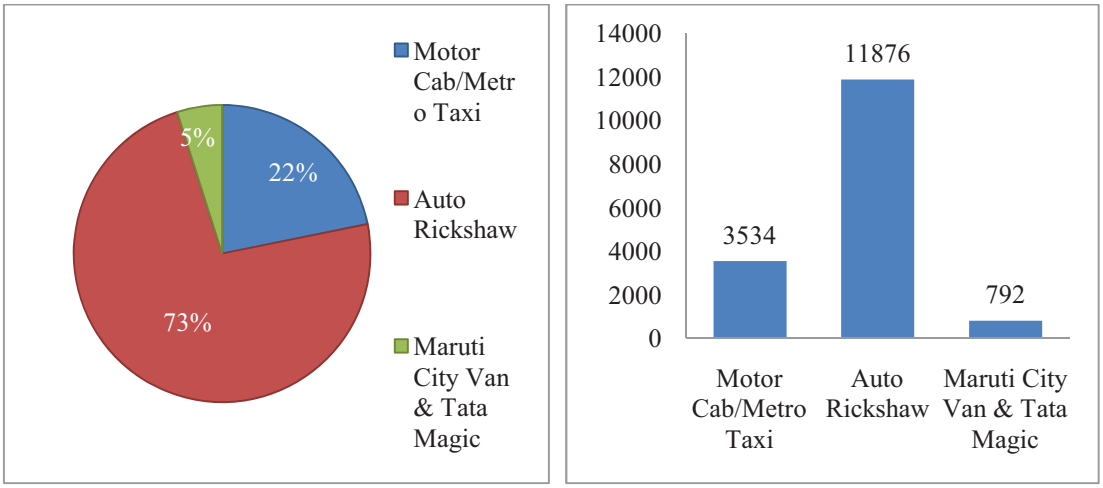
Number of registered vehicles show an increase, but it is not clear how they are able to operate these vehicles, especially Auto-rickshaws which are solely used as paratransit vehicles (refer Figure 9-1).

Figure 9-1: Registered Vehicles (up to March 2010)



Old Auto-rickshaws permit are being replaced by new Auto-rickshaws with CNG or LPG. It is common to find both factory-installed, as well as retrofitted LPG Auto-rickshaws in Indore.

Figure 9-2: Details of Registered PTS Vehicle



Out of total PTS vehicle registered (up to 2010), share of Motor Cab/Metro Taxi is around 22% (3,534 Nos.), Maruti Van & Tata Magic is 5% (792 Nos.) and Auto-rickshaw is 75% (11,876). Details related to registered PTS vehicles are presented in the Annexure-B.

XXXVIII—5
Labour

फार्म "सी" रेग्युलेशन क्रमांक ६ के अनुसार

व्यावसायिक संघ के राजेष्टीकरण का

प्रमाण-पत्र

राजेष्टीकरण क्रमांक 5727

व्यावसायिक संघ का नाम इन्दौर रेलवे स्टेशन टेक्सी कार यूनियन इन्दौर

कार्यालय रजिस्ट्रार व्यावसायिक संघ

मध्य-प्रदेश शासन

यह प्रमाणित किया जाता है कि इन्दौर रेलवे स्टेशन टेक्सी कार यूनियन, इन्दौर संघ को व्यावसायिक संघ विधान, सन् १९२६ (विधान क्रमांक १६, सन् १९२६) के अधीन आज दिनांक 14 मास दिसंबर सन् १९ 2000 को राजेष्टीकृत किया गया।

(एल. के. पाण्डेय)
रजिस्ट्रार
व्यावसायिक संघ, मध्यप्रदेश

10 INTERVIEWS

A total of 10 union representatives, 5 RTO officials and 5 traffic police officials were interviewed about their views on the Indore paratransit system.

10.1 Union Representatives

There are 7 major paratransit unions in Indore the details are provided in the following Table 10-1.

Table 10-1: Paratransit Unions in Indore

Sl. No.	Union Name	Vehicle Type	No. of Registered Members	Growth of membership over years (data table) last five years	No. of Vehicles
1	Indore Tempo Union	Maruti Van	300	300 members fixed.	550
2	Auto-rickshaw Union	Auto	15,000	Every year on an average 1,000 new members join the union.	5,000
3	M.P. Rickshaw Chalak sena	Auto	150	2006 = 50; 2007 = 60; 2008 = 80; 2009 = 100; 2010 = 150	150
4	Auto-rickshaw Panchayat	Auto	15,000	2006= 10,000; 2007 = 12,000; 2008 = 13,000; 2009 = 14,000; 2010 = 15,000	15,000
5	Indore Shahar Auto-rikshaw Chalak association	Auto	1,200	2005 = 900; 2006 = 980; 2007 = 1,030; 2008 = 1,150; 2010 = 1,200	1,200
6	Devi Ahilya Tempo Union	Maruti Van	530	1998 = 125; 1999 = 145; 2005 = 155; 2004 = 270; 2010 = 530	150
7	Indore Shahar Nagar Seva	Tata Magic	496	2000 = 130; 2002 = 145; 2004 = 165; 2006 = 195; 2010 = 496	496
Source: TARU Field Survey, 2010					

The Auto-rickshaw union is the largest with over 15,000 members, while there are only 10,300 Auto-rickshaws in the city. The difference in the figure is because both drivers as well as owners are eligible for the membership. The unions support the members in dealing with official matters including renewal of the permit, getting loans sanctioned for new vehicles and act as mediators in case of disputes. The unions also provide legal support to their members.

Union officials indicated the presence of non-permit (not registered) paratransit vehicles. Their estimates in Auto-rickshaw ranged between 1,500 and 5,000. Similarly, in the route-based paratransit e.g. Maruti van and Tata Magic there may be around 100 informal vehicles plying the city routes. Two major concerns of the union representatives are a) multiple unions undermine their capacity to bargain and b) lack of responses by the government officials to address their grievances.

10.2 RTO Officials

The RTO officials informed that no new permits (temporary or permanent) are currently issued and only existing permits are renewed. They cite the problem of congestion for limiting the issuance of permits to the paratransit vehicles. On the other hand, they are continuing to register new private vehicles in large numbers (e.g. cars, two wheelers, etc) which is one of the main reasons of increasing congestion.

Driving of paratransit vehicles by person without license to drive public vehicles is a major safety issue for the passengers. Further, as per the rules, all paratransit vehicles have to be examined and should possess RTO issued fitness certificate. This practice is not adhered strictly resulting in unsafe PTS plying Indore City. Other issues include the lack of safety equipments like first aid box and fire extinguishers within the vehicle.

The RTO conducts regular training programs trough unions to promote awareness about safe driving. However, low literacy levels inhibit the effectiveness of such programs. The RTO officials informed that despite repeated training, the drivers do not change their driving habits. From the drivers' perspective, the pressure of earning, long working hours (often more than 10 hours), pressure of passengers to reach on time amidst high traffic density and congestions limit the possibility of the drivers to adhere to the safety norms. The RTO officials suggested that short but regular training programs are the best way to emphasis safety rules. However, unless all drivers (private and public) change their driving habits the safety situation is unlikely to improve.

Some of the other improvements suggested by RTO officials are as follows:

- Only registered/licensed drivers should be allowed to drive the PTS,
- Condition of roads of the city should be improved,
- Non permitted vehicles should be strictly banned,
- There should be proper stops for each vehicle according to location, and
- Training of drivers should be practiced.

10.3 Traffic Police

According to the traffic police, safe driving is a major issue in city. The traffic police reported that nearly one third of all registered offences (booked) are done by paratransit vehicles. The offences of paratransit operators include overloading, rash driving, breaking traffic rules (especially driving over one ways and jumping traffic lights). Further, bad road conditions during the monsoon seasons reportedly increase the traffic accidents.

In order to curb the above problems, efforts taken by the traffic police include checking of vehicles (which is currently being performed irregularly due to shortage of staff). The suggestions from traffic police includes; use of double-decker buses, construction of more flyovers to overcome the traffic congestion, building a organization for addressing traffic issues in partnership with the citizens and increase the frequency of train service between Indore and Dewas.

Passenger Characteristics

11 PASSENGER CHARACTERISTICS

Majority of the people use PTS for commuting to their work place or educational institutions. Table 11-1 shows the distribution of survey sample, i.e. PTS usage by people under different age classification.

Table 11-1 : Classification of PTS Passenger by Age

Passenger Age Group in Years	Reported PTS Usage Period				Sample Total
	6 Month	6 Month to 1 Year	1-2 Years	>2 Years	
<25	10%	27%	32%	31%	81
25 to 40	14%	9%	17%	60%	87
40 to 55	33%	11%	22%	33%	18
>55	7%	21%	14%	57%	14
Source: TARU Analysis, 2010; Sample size: 200					

11.1 Passenger Trip Details

The average length of trips and number of responses for each paratransit trip were analyzed from the surveyed samples. The results are presented in Table 11-2 and Table 11-3.

Table 11-2 Classification of PTS Passengers by Purpose and Mode of Travel

Purpose of Travel	Auto	Tata Magic	Taxi	Maruti Van	Nos. of Respondents
Business	46%	31%	8%	15%	**13**
Education	50%	24%	2%	24%	**50**
Connecting with Bus/ Train stations & Airport	67%	33%			**3**
Health	83%	17%			**6**
Shopping	55%	25%		20%	**20**
Social Visits	38%	38%		25%	**8**
Work	44%	19%	7%	30%	**90**
Others	80%	20%			**10**
Total	**50%**	**23%**	**4%**	**24%**	**200**
Source: TARU Analysis, 2010; Sample size: 200					

From the Table 11-2, it is evident that most people commute (using PTS) for work followed by education. The results also indicate that Auto-rickshaws are the most preferred (50%) mode of transportation while taxis are least preferred (4%). Since Tata Magic and Maruti van usually operate over different routes, in general, commuter's preferences are mostly divided between route based transportation system (Maruti van or Tata Magic) or meter based transportation system (Auto-rickshaws).

The average lengths of the trips undertaken for different purposes are presented in the Table 11-3. From the table, it is evident that the average travel lengths for range of purposes do not vary drastically. Nevertheless, the results indicate that the passengers travel the most for social visits (family) and shopping, in the same order. Taxi is the least preferred mode of transportation and commuters use taxis for official and educational purposes only.

Table 11-3 Average Length of Trips Travelled by the Passengers

Purpose of Trip	Auto	Tata Magic	Taxi	Van	Average (by Purpose)
	(Trip Length in km)				
Business	3.8	8.0	2.0	8.5	5.7
Education	4.2	8.8	6.0	6.4	5.9
Connecting with Bus/Train Stations & Airport	7.0	5.0			6.3
Health	5.2	2.0			4.7
Shopping	6.0	7.0		8.5	6.8
Social Visits	6.0	8.7		7.5	7.4
Work	4.1	7.0	7.0	6.8	5.6
Others	4.3	5.0			4.5
Average (by mode of transport)	**4.5**	**7.6**	**6.1**	**6.9**	**5.8**
Source: TARU Analysis, 2010; Sample size: 200					

The classification of the trips by distance and mode of transportation particular is presented in Table 11-4. The results indicate that Tata Magic and Maruti Van (route based operators) are more preferred for longer distance travel. Auto-rickshaws are more preferred for short distance travel.

Table 11-4: Classification of Travel Trip Length based on Vehicle Type (%)

PTS Type	Trip Length (in km)				Nos. of Sample
	< 0.25	>0.25 to 5	>5 to 10	> 10	
Auto Rickshaw	16%	62%	20%	2%	100
Tata Magic	4%	31%	47%	18%	45
Taxi	13%	38%	25%	25%	8
Maruti Van	4%	28%	62%	6%	47
Source: TARU Analysis, 2010; Sample size: 200					

11.2 Vehicle Availability

Table 11-5 shows the availability of PTS vehicles during the day and night time in Indore. It shows that City bus frequency at night is very less. Auto-rickshaw is only transport option in the night-time. Passengers can easily get the auto rickshaw within <0.5km, while during the night-time passengers can avail this facility within 0.5 to 1 km.

Table 11-5: PTS Vehicle Availability During Day and Night Time

Distance (km)	Auto-rickshaw		Tata Magic		Maruti City Van		City Bus	
	Day	Night	Day	Night	Day	Night	Day	Night
<0.5	48	18	42	10	44	8	44	7
0.5 to 1	38	49	38	14	35	15	35	12
1 to 2	6	13	11	3	10	3	7	3
>2	3	5	2	2	3	1	1	1
Source: TARU Analysis, 2010; Sample size: 200								

11.3 Weekly Travel Statistics

The weekly travel patterns of the passengers were analyzed to estimate the percentage usage of PTS and private vehicles. The results are presented in the Table 11-6.

Table 11-6: Weekly Travel Characteristics of Passengers (km)

Purpose	Auto-rickshaw	Magic	Private 2W	Private 4W	Taxi	Van	Bus	Total
Business	505	305	1,070		144	90		**2,114**
Education	710	1,297	1,915		120	953	451	**5,446**
Health	30	5	200					**235**
Bus/Train Stations & Airport			105	620		50	55	**830**
Shopping	189	180	4,318		16	69	313	**5,085**
Social	56	6	5,745	50		16	100	**5,973**
Work	1,351	1,522	14,650	294	105	2,197	614	**20,733**
Other	43	10	1,121				30	**1,204**
Total	**2,882**	**3,325**	**29,124**	**964**	**385**	**3,375**	**1,563**	**41,618**
Source: TARU Analysis, 2010; Sample size: 200								

The results indicate that private two wheelers are most preferred means of transportation. Two wheelers accounts for 70% of all weekly travel. Route based (Tata Magic and Maruti Van) and meter based (Auto-rickshaws) paratransit account for 8% and 7% respectively. The frequency of usage is presented in the Table 11-7.

Table 11-7: Classification of the Passengers based on their Frequency of Travel

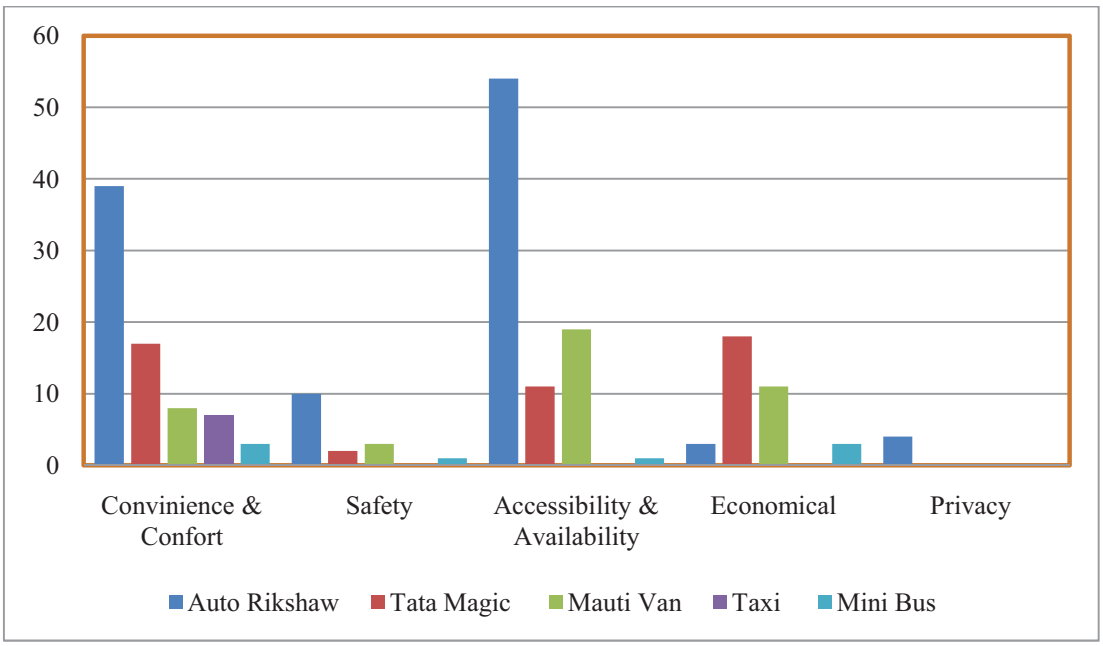
Purpose of travel	Auto	Tata Magic	Private 2 Wheeler	Private Car	Taxi	Maruti Van	Bus	Total
Business	10	11	8		12	6		47
Education	8	8	10		4	8	6	44
Health	1	1	20					22
Bus/Train Stations & Airport			7	4		2	2	15
Shopping	3	2	6		2	2	5	20

Purpose of travel	Auto	Tata Magic	Private 2 Wheeler	Private Car	Taxi	Maruti Van	Bus	Total
Social	3	1	9	2		1	5	21
Work	7	10	13	7	3	11	8	59
Other	1	1	10				3	15
Average trips by mode of transport	**33**	**34**	**83**	**13**	**21**	**30**	**29**	**243**
Source: TARU Analysis, 2010; Sample size: 200								

11.4 Advantages and Disadvantages of PTS

The passenger response on the advantages and disadvantages of PTS is presented in the Figure 11-1 to Figure 11-3.

Figure 11-1: Advantages of PTS



Source: Passenger Survey, TARU

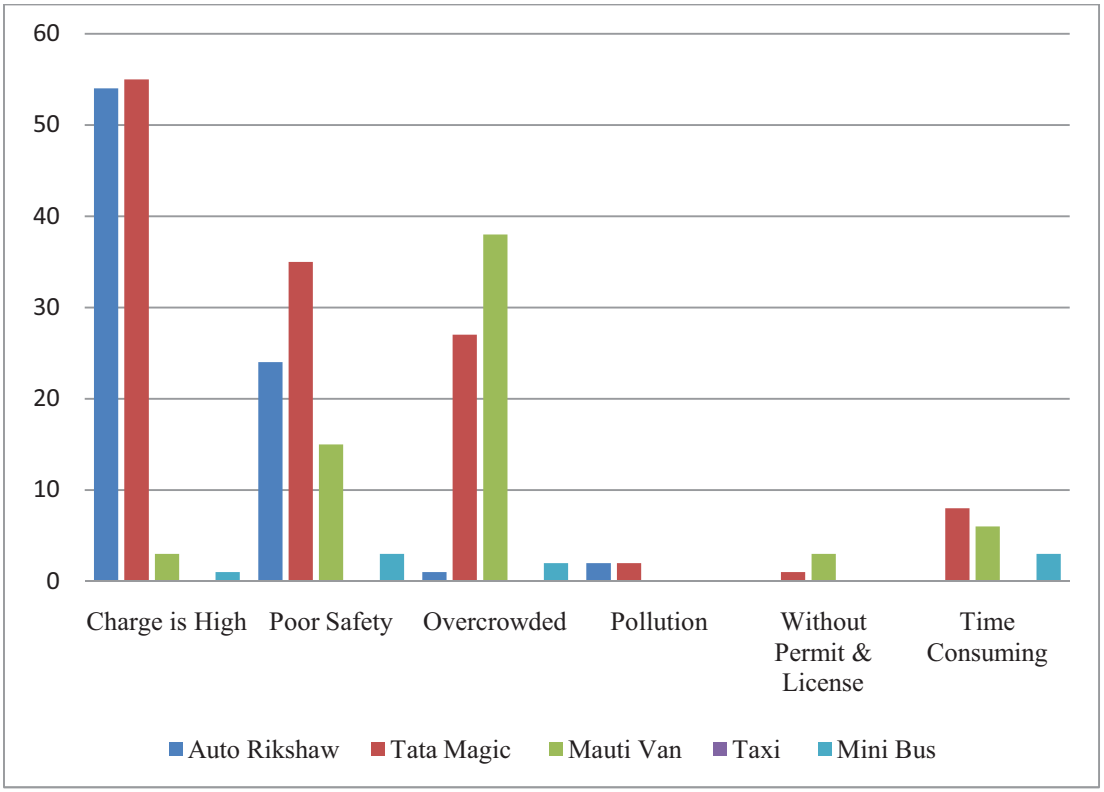
Figure 11-2: Overcrowding in PTS

Source: Chimanbagh Road location

From the analysis it is evident that people are comfortable using PTS and find it convenient. Except for economy, Auto-rickshaw was found to be relatively more convenient, safe, ensures privacy, accessible and easily available (24 hours a day). Issues that need attention

includes, lack of safety, overcrowding, pollution, travel time, travel without licence & permits time and privacy. Women and children try to avoid PTS mainly for these reasons.

Figure 11-3: Disadvantages of PTS



Source: Passenger Survey, TARU 2010

Household Surveys

12 HOUSEHOLD SURVEYS

TARU had conducted a detailed household survey as a part of Asian Cities Climate Change Resilience Network (ACCCRN) project in 2009. The results from the ACCCRN survey are used within this study. One hundred (100) households were interviewed across different socio economic categories. Old city area with dense settlements and narrow roads dominated by buildings older than 25 years was considered as the core area. The core area has around 30% of the city population while 70% reside in the peripheral areas.

Table 12-1: Average Monthly Household Expenditure

SEC	Average Expenses per Month (Rs)
Slums-Core	3,682
Slums-Periphery	5,556
Lower-Core	7,239
Lower-Periphery	8,485
Middle-Core	15,863
Middle-Periphery	10,321
Upper-Core	56,958
Upper-Periphery	67,126
Source: TARU analysis, 2009; Sample Size 100	

From the Table 12-1, it can be inferred that the capacity to afford and maintain vehicles (two to four wheelers) does exist among households. Over the years, along with an increase in affordability among people, there has also been an aspiration growth. Due to this, vehicles are the first assets that the households prioritize to purchase especially given the poor public transport system and the high cost of commuting.

Private Vehicle Ownership

The traffic volume survey indicated that the vehicles on the road are mainly composed of private (personal) vehicles. The ownership of private vehicles per households across SEC is presented in the Table 12-2.

Table 12-2: Vehicle Ownership per Household

SEC	Bicycle	2 Wheeler	4 Wheeler	Nos. of Samples
Slums-Core	1.0			2
Slums-Periphery	1.0	0.6		28
Lower-Core	0.8	1.8		4
Lower-Periphery	0.8	1.1	0.0	26
Middle-Core	0.6	1.6	0.4	14
Middle-Periphery	0.7	1.5	0.2	16
Upper-Core		1.5	3.5	2
Upper-Periphery	0.8	2.3	1.1	8
Source: TARU Analysis, 2009; Sample Size 100				

12.1 Weekly Travel Patterns

Weekly travel pattern by purpose and mode of travel is presented in the Table 12-3. The results indicate that, irrespective of SECs (except Slum in core area), the households prefer travelling by private vehicles for work. While the middle and lower SECs use two wheelers, the upper SEC households predominantly use cars. This wide usage of personal vehicles by most individuals contributes to the increasing traffic congestion within the city. This also provides a rationale for an organized paratransit and public bus system to reduce the number of private vehicles on the road and improve mobility.

Table 12-3: Classification of Average Household Travel Distances by Mode of Travel across SECs (km/week)

Average Travel Distances by Modes Across SECS (km/week)								
SEC		Work	Business	Education	Shopping	Social	Health	Recreation
Public bus	Slums-Core	7			3		8	10
	Slums-Periphery	6	7	3	5		4	8
	Lower-Core	15			1		2	
	Lower-Periphery	10	19	4	8	5		4
	Middle-Core			4	5			
	Middle-Periphery	6	12	5	5	3	2	
	Upper-Core			5				
	Upper-Periphery			6				
PTS	Slums-Core						5	5
	Slums-Periphery	9	8	3	5	4	2	4
	Lower-Core	20			3		2	4
	Lower-Periphery	10	7		5	4	3	3
	Middle-Core	4	5		4	3	3	3
	Middle-Periphery		5		4	5	3	6
	Upper-Core							
	Upper-Periphery		50	4	3			
Private vehicle	Slums-Core						2	
	Slums-Periphery	9	6	3	4	4	4	6
	Lower-Core	19		1	4	9	3	10
	Lower-Periphery	22	14	3	6	7	4	5
	Middle-Core	19	14	2	5	7	5	6
	Middle-Periphery	27	17	1	6	6	4	7
	Upper-Core		20	10	8	14	8	15
	Upper-Periphery	46	25	11	10	8	6	12

Source: TARU analysis, 2009; Sample Size 100

12.2 Expenses on Transport

The average monthly expenditure per household across different SECs are presented in the Table 12-4.

Table 12-4: Average Monthly Expenditure on Transportation across SECs

SEC	Private Vehicle	Public Bus	PTS	Total Transport costs
Slums-Core		242	175	417
Slums-Periphery	813	297	246	942
Lower-Core	900	389	238	1,429
Lower-Periphery	1,473	359	371	1,933
Middle-Core	2,621	412	436	3,439
Middle-Periphery	2,143	404	280	2,541
Upper-Core	8,500	950		9,450
Upper-Periphery	14,813	422	239	15,324
Source: TARU analysis, 2009; Sample Size 100				

The total market size of upper SECs is less than 10%. Shifting them away from the private vehicles may not drastically reduce the number of vehicles on road or improve the traffic situation. On the other hand, the results indicate that expense on public bus and PTS are high among lower and middle SECs. Since they constitute the majority of the population, satisfying their needs may reduce the number of private vehicles on road.

The percentage share of household income spent on transportation by different SECs is presented in the Table 12-5. The table indicates that the slum and lower SEC (households) spend higher percentage of their monthly expenditure on transport. There is a systematic reduction in proportion of transport expenses across SECs as well as significant differences between core and periphery.

Table 12-5: Share of Transport Costs in Total Monthly Expenditure

Socio Economic Category	<5%	>5-10%	>10-15%	>15-25%	>25%	Nos. Of Sample
Slums-Core					100%	2
Slums-Periphery	11%	4%	25%	4%	57%	28
Lower-Core		25%	25%	25%	25%	4
Lower-Periphery	8%	12%	12%	35%	35%	26
Middle-Core	7%	29%	36%	14%	14%	14
Middle-Periphery	13%	44%	13%	19%	13%	16
Upper-Core	100%					2
Upper-Periphery	88%	13%				8
Source: TARU analysis, 2009; Sample Size 100						

Safety

13 SAFETY

13.1 Safety Measures

All the PTS vehicles are mandatory to install the following safety features within their vehicles:

- First aid box,
- Fire extinguishers, and
- Emergency window.

However, in practices these safety measures are unavailable in most vehicles. This is mainly due to the negligence of the concerned authorities in enduring the same through regular inspections. New generation PTS vehicles such as Maruti van and Metro Taxi are equipped with above safety measures and equipment, but are not maintained effectively.

13.2 Overcrowding

In Indore city, overcrowding is a common phenomenon in the PTS vehicles, which is a safety issue. Overcrowding in PTS vehicles is because of uncertainty regarding the availability of next PTS vehicle and passengers prefer to take an already crowded vehicle.

At the terminus, most of the vehicles are forced to leave before full capacity is achieved, due to peer pressure to give way to the next vehicle on queue. However, during the trip, the vehicles often get overloaded. Passengers do not bother about having to travel unsafely perched outside the vehicles. A snapshot of overloaded PTS vehicle is presented in Figure 13-1.

Figure 13-1: Overloaded Paratransit Vehicles

Source: Chimanbagh Road & Jawahar Marg location

13.3 Speed Limits

The traffic authorities have stipulated speed limits to PTS vehicles. Table 13-1 illustrates the road sections and their stipulated speed limits.

Table 13-1: Permissible Vehicle Speed Limit

Sl. No.	Name of the Road	Maximum Speed in Kmph	
		Cars, Jeep, Two Wheelers etc.	All Transport Vehicles including TSRs
1	MG road	50	40
2	Ring Road and Outer Ring Road (except inside all Residential areas/ Commercial markets)	50	40
3	All areas between Outer Ring Road and beyond Outer Ring Road except National Highways and inside all Residential Areas / Commercial Markets	40	30
4	By pass Road	60	40
Source: http://www.indoretrafficpolice.org			

The paratransit vehicles break the permissible speed limits wherever possible. This behavior combined with overcrowding increases the risk of accidents. Traveling around the traffic circles is a major problem due to poor design (lack of visibility).

13.4 Roles and Responsibilities of RTO/Traffic Police

RTO officials usually conduct vehicle inspection during traffic safety weeks. The official also conducts random inspections of route permit vehicles. During these inspections, the officials check the validity of the driving licence, condition of the vehicle, tax and other documents.

13.5 Insurance

Details about vehicle insurance are presented in Table 13-2. Even though third party insurance is mandatory for all vehicles most operators (above 30%) are not aware of the same. This is because, most drivers are not aware of the policy bought by the owners. This usually gives rise to disputes during any accidents or disaster. Therefore, awareness regarding the insurance and the advantages of the same should be brought to the notice of the operators by both RTO officials and traffic police.

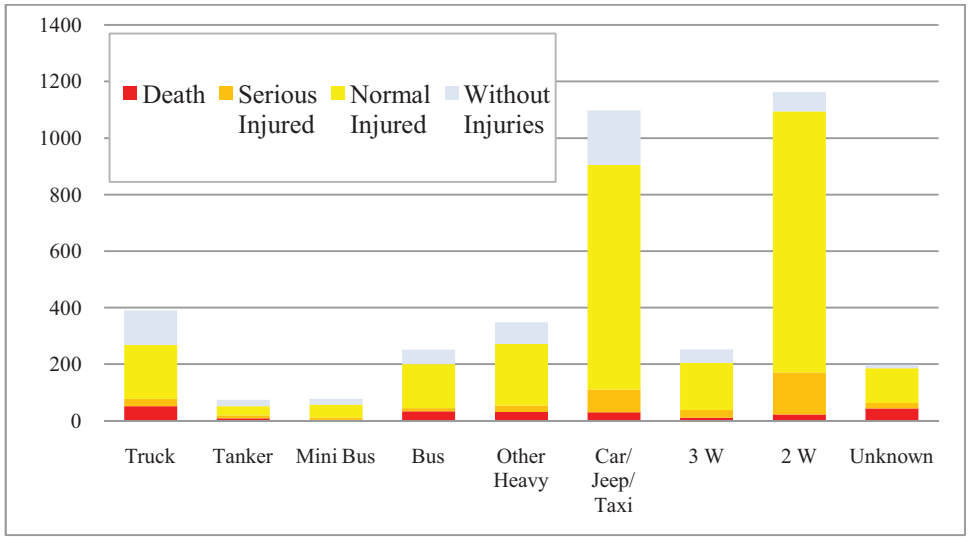
Table 13-2: Details on Vehicle Insurance

Description	Auto	TATA Magic	Taxi	Maruti Van	Total
Comprehensive	5	4	4	4	17
3rd Party	7	3		6	16
Don't know		4	7	5	16
Source: PTS Operator Survey, 2010; TARU Analysis, 2010					

13.6 Accidents

Road accidents in the Indore city are common due to traffic congestions. Most accidents occur during peak hours (9:00 am to 11:30 am). Accident details across different vehicle types for the year 2009 – 2010 is presented in the Figure 13-2. From the figure it is evident that the numbers of accidents are high in two wheelers and four wheelers (private vehicles). Nevertheless, the numbers of accidents per thousand vehicles are high in the case of Bus followed by Auto-Rickshaws i.e. 75/1000 and 20/1000 vehicles respectively.

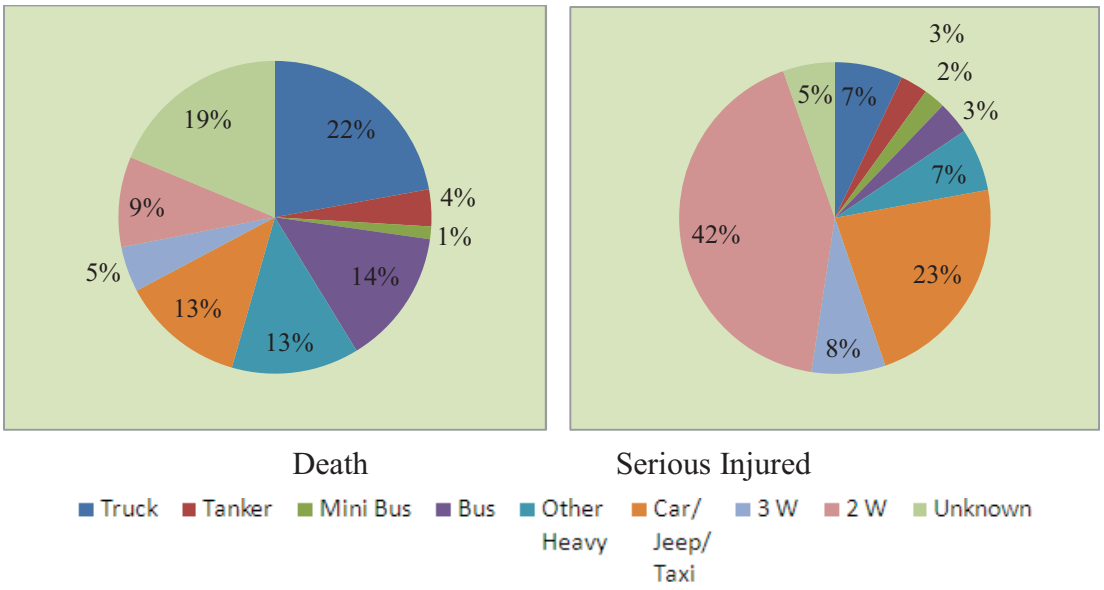
Figure 13-2: Accident Details (2009-2010)



Source: Traffic Department, Indore

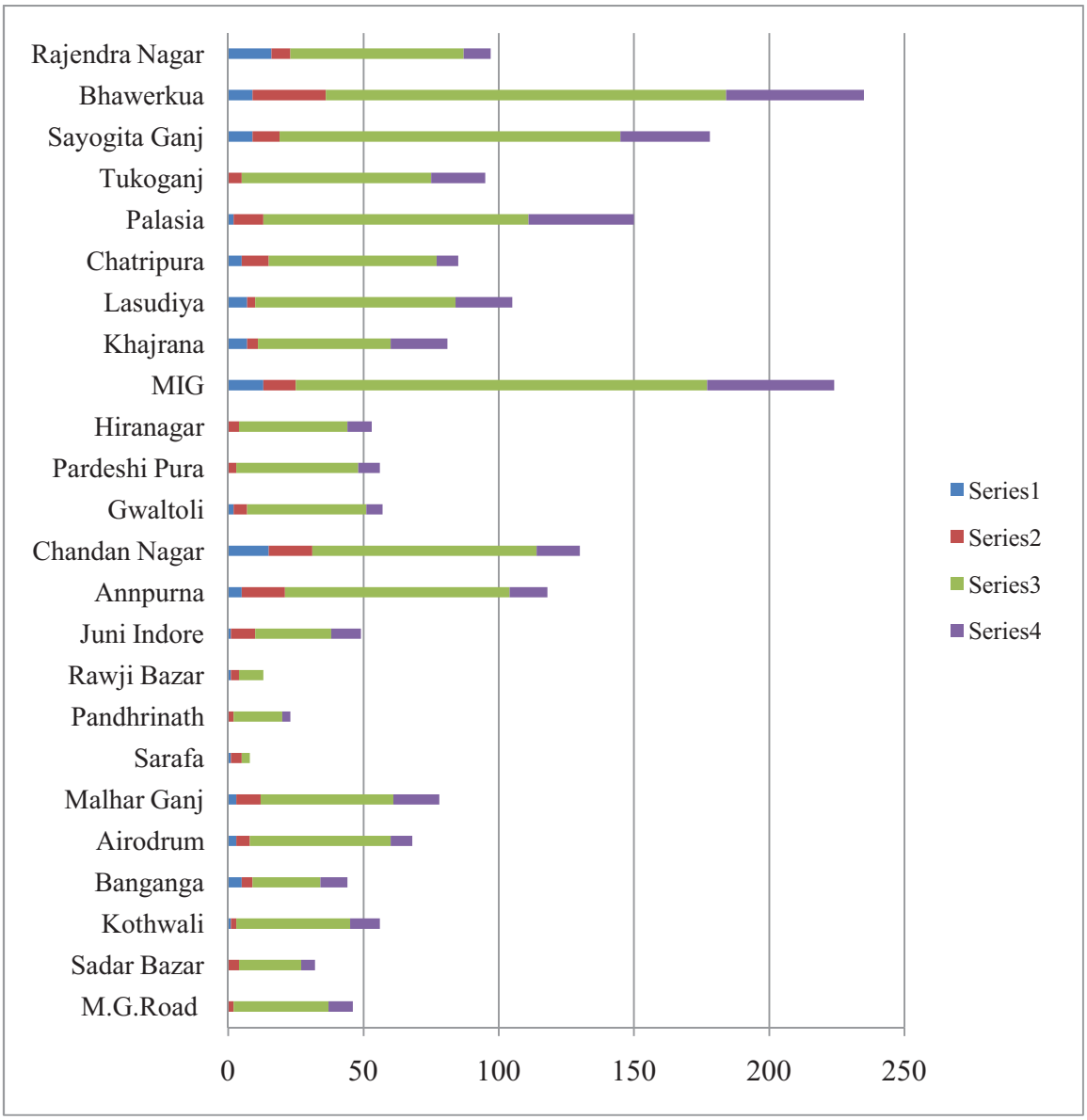
The highest proportion of the accidents in the city involves two wheelers followed by car/jeep and taxis. The information regarding the vehicle type and accidents is presented in the Figure 13-3.

Figure 13-3: Vehicle Accident Details (Including PTS in %)



The accidents reported to the nearby Police Stations between 1st Jan 2010 to 31st May 2010 is presented in Figure 13-4.

Figure 13-4: Details of Accident Registered at Police Stations (2010)



Series 1: IPC-304: Punishment for culpable homicide not amounting to murder

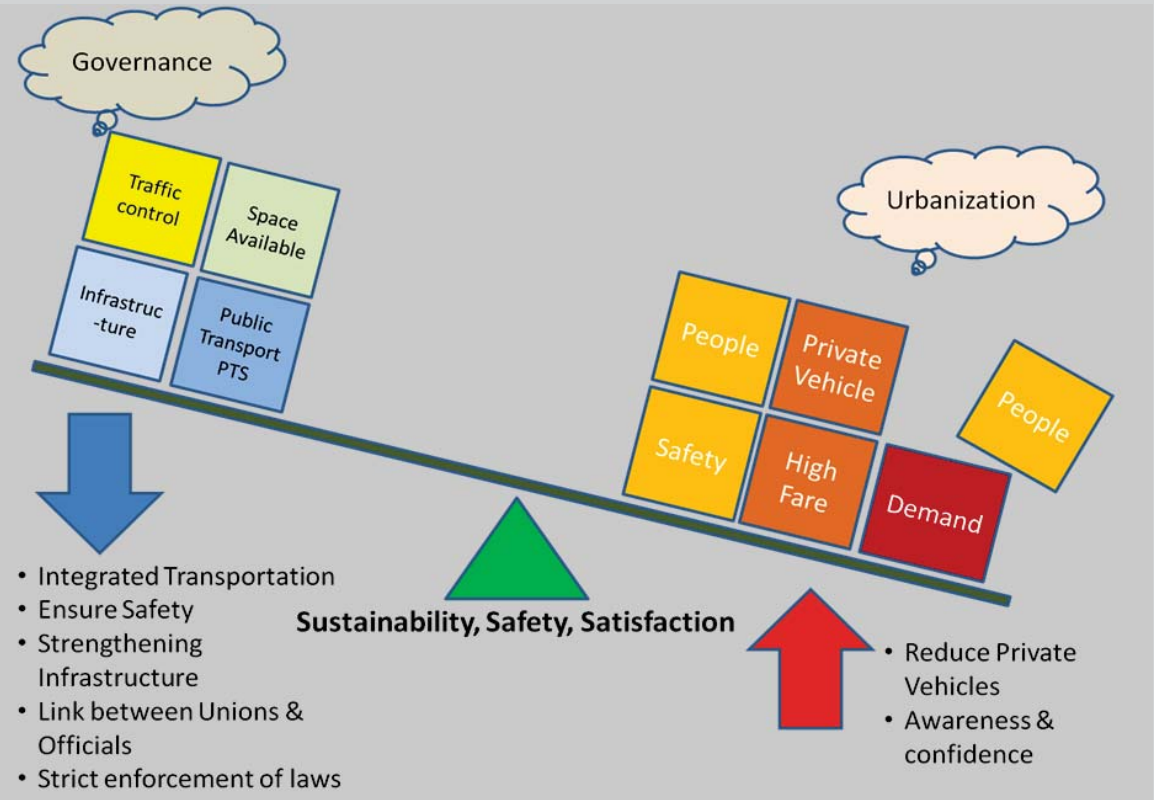
Series 2: IPC-338: Causing grievous hurt by act endangering life or personal safety of others

Series 3: IPC-337: Causing hurt by act endangering life or personal safety of others

Series 4: IPC-279: Rash driving or riding on a public way

Source: Traffic Department, Indore; http://www.indiankanoon.org/doc/1569253/

The Figure 13-4 highlights the registered complaints under the Indian Penal Code (IPC). Bhawar Kua, Sayogita Ganj, Palasia, MIG, Chandan Nagar & Annapurna Police Stations exhibit high number of accidents in comparison to other police stations.



Conclusions and Recommendations

14 CONCLUSIONS AND RECOMENDATIONS

14.1 Conclusions

This study was conducted to understand paratransit system in the context of its overall mobility within Indore city. It collected spatial information and non spatial information through primary survey supplemented by stakeholder interviews. The results provide a snapshot of the situation. Some of the issues identified through this study are as follows:

- Core areas with narrow roads limit the access of public transport buses. This increases the reliance on PTS.
- Inadequate public transportation in the fringe areas resulting in near complete reliance on PTS.
- The road networks within the city are limited. Some of the roads are narrow, unpaved or poorly maintained
- A significant proportion of the right of the way is infringed by vendors and unauthorized parking resulting in narrowing of the effective width of the road.
- Extremely congested roads with an incompatible mix of both motorized and non-motorized vehicles traveling at widely different speeds
- Most of livelihoods and economic activities are concentrated in and around the core (CBD) requiring high proportion of population to travel to these areas on a daily basis. This results in peak hour congestion. Maximum traffic congestion is found in Nehru Square.
- PTS not accepted by the authorities as an integral part of transportation systems resulting in growth of an informal demand and supply.
- Limiting the number of PTS vehicles on road while inability to improve the public transport leads to high reliance on private vehicles. This in turn leads to increased traffic congestion.
- Overcrowding, unreliability, safety, timely availability and low value for money spent on PTS are the majors concerns amongst users. The system therefore is perceived to be inconvenient and unsafe especially for women and elderly.
- Poor educational background of the drivers combined with lack of enforcement by regulatory authorities is currently leading to poor safety within the PTS operations.
- Systems for traffic control & management is either primitive or non-existent. Limited staff with the traffic department and lack of technology causing inefficient and ineffective traffic control.
- Increasing number of traffic accidents, especially among pedestrians and motorcyclists are evident
- High densities of vehicles on road contribute to environmental impacts including air and noise pollution.

Due to increasing vehicular population, the carrying capacity of the roads within city is highly reduced. Insufficient public transport and high reliance on the private vehicles are the main reasons for this situation. The results indicate that two wheelers constitute majority of vehicles along with private cars. Bicycle usage is moderate and contribution of public transport is very low, which is one of the main reasons for traffic congestion. Numbers of vehicles on the roads are high and increasing during morning peak hours, compared to

evening. Positive initiatives such as ICTSL are expected to reduce the problem of traffic congestion due to excessive use of private vehicles.

The PTS vehicles are the only option of transportation for majority of lower income inhabitants. Due to the lack of alternatives, they usually get the worst end of the bargain. They are often riddled with problems like overcrowding, lack of safety and comfort. One of the major disadvantages quoted by PTS passengers is its unreliability. The average monthly expenditure by household across all SECs on transportation ranges from Rs. 400 to Rs. 15,000. The share of PTS expenses ranges from Rs. 175 to 450. The upper SEC inhabitants do spend very less on PTS compared to lower SEC inhabitants. This is due to their (upper SEC inhabitants) high reliance on private vehicles.

PTS vehicles are mainly used for business/work purpose, education, followed by shopping and social visits. Among the paratransit vehicles, Auto-rickshaws constitute the highest numbers, whereas Tata Magic carries the maximum passengers. The surveys indicate that many of the route permit vehicles ply on routes, which are not allocated to them. The rural PTS vehicles spend significant part of their operational travel within the urban boundaries. Cream skimming is quite common among operators. Recently, RTO has stipulated rural paratransit vehicles to be painted in a unique color to differentiate them from urban permit vehicles. This system was introduced to prevent/monitor rural permit vehicles from plying on urban routes.

Most locations within the city are in proximity to an Auto-rickshaw stand (less than 500 m). The availability of Auto-rickshaws is significantly less during nighttime; however, Auto-rickshaws drivers make themselves available in case of need (medical emergencies). The Auto-rickshaw operators mostly avoid following the metering system. They charge the passengers not according to the fares stipulated by the RTO. While negotiations with the passengers are common practice among the operators, the unions play an important role in fare fixing. Auto-rickshaws followed by Tata Magic secured high rating among users for their convenience, accessibility and availability. Nevertheless, these two paratransit modes charges high fare and follow poor safety standards.

The PTS vehicle union representatives indicated about 3000 unauthorized Auto-rickshaws (without permits) plying in the city. The fuel station survey indicates that there may be more than 500 vehicles without valid permits plying the city.

The route permit vehicles and Auto-rickshaws operate about 12 hours or more in a day with minimum breaks compared to taxis. The PTS operators have to struggle hard to break even with their investment and earn a living. The uncertainty in incomes across seasons makes this situation further precarious. Under this constrained environment, the PTS operators are forced to overcrowd or bypass the safety regulations wherever possible to increase their earnings. On the other hand, overcrowding along with lack of basic safety equipments increases the risk to the passengers. Overcrowding is also one of the reasons that limit middle and upper segments of the society as well as older people and women from choosing route permit paratransit vehicles. Poor education and dangerous behavior of PTS drivers along with lack of enforcement of traffic rules results in lack of passenger safety.

In the current environment, the effective implementation of public transportation is constrained due to financial availability, road width availability and lack of parking spaces for the passengers. The acceptance of any public transportation system would depend upon a variety of social and economic factors as well as effective integration of the multiple systems including paratransit, so that, regular commuters can travel efficiently from their point of origin to destination without having to use their private vehicles.

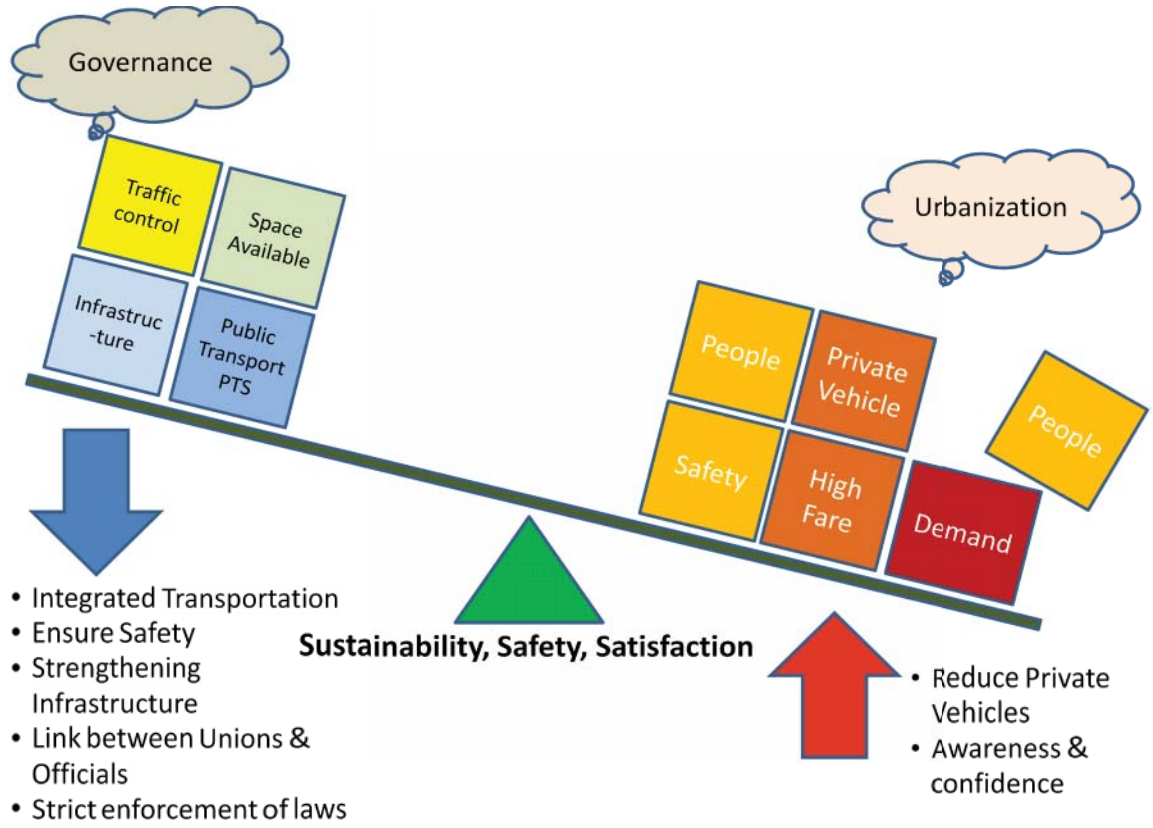
14.2 Recommendations

The proposed BRTS covers only about 109 km while the paratransit covers the entire city (road length of 900 km). This indicates that there is sufficient opportunity for PTS to be effectively integrated with the BRTS. This would necessitate changes in routes, vehicle types along with enforcement of traffic and route rules. On the other hand, this will also ensure last mile connectivity. However, the quality of PTS services and associated safety issues needs to be improved significantly to give confidence to all SECs to use BRTS supported by PTs.

The distance between the BRTS stops to the point of origin/destination of travel (especially in peripheral areas) may soon become an issue. Further, based on the carrying capacity of the current road networks providing parking spaces (for private vehicles) near BRTS stops will be an issue (especially in core area). Therefore, the overlap of routes between BRTS and PTS may have to be rationalized/ reorganized to complement each other and act as supplementing systems rather than complementing systems. But, the image of PTS as poor's transport has to be changed in order to bring in complimentarily.

Availability and reliability of PTS are two main issues. These issues can be addressed by designing proper signage at PTS stops and SMS based public information system. Stricter enforcement of the routes and passenger loading limits by the regulatory authorities and passengers are necessary. Such action may reduce overcrowding which is currently a major constraint. Color-coding of vehicles according to the routes and establishment of complaint redressal system may increase public participation and help in improving the image of PTS.

Figure 14-1: Solution for Sustainable Transportation Network



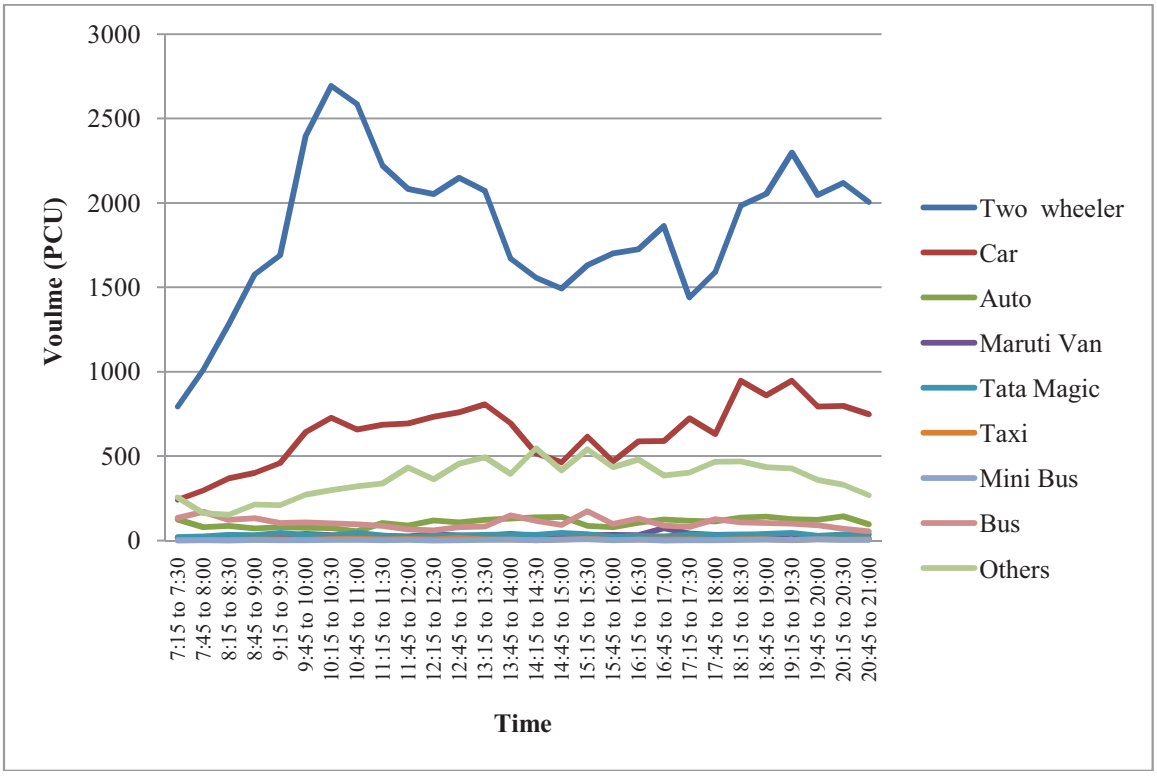
14.3 Way Forward

1. Detailed GIS assisted origin to destination (OD) survey needs to be mapped. This will throw light on the travel needs, pattern and choice of modes of transportation. This may be supported by socio-economic survey to understand the current mobility patterns, costs and salient features across SECs.
2. Origin to destination solution is necessary to solve the problem of increasing private vehicles and ensuring last mile connectivity. In order to achieve this, integrated transportation system will be required. This can be made effective through integration of PTS and BRTS. To achieve this, there is an immediate need for conducting system feasibility study and implement pilot project in setting up a two way SMS based information/ communication system. An effective system should provide three basic services
    a) Help the passengers plan their trip
    b) Enable passengers to inform and access the PTS vehicles from the point of their origin to the nearest BRTS stop
    c) BRTS alighting point to the destination. Unions and BRTS should be working in tandem to provide this service so that private vehicle usage are minimized. Effective SMS based system can achieve this goal.
3. Concerns raised by passengers include safety and affordability issues. Currently unions provide support in rate fixing and legal support. RTO need to work in tandem with unions and increase their responsibilities to include issues such as ensuring passenger safety and providing awareness to the operators at more regular intervals. The police department is currently carrying out awareness program only once every year, especially during traffic week. This should be a regular activity and safety certificates should be made mandatory to enforce the implementation process.

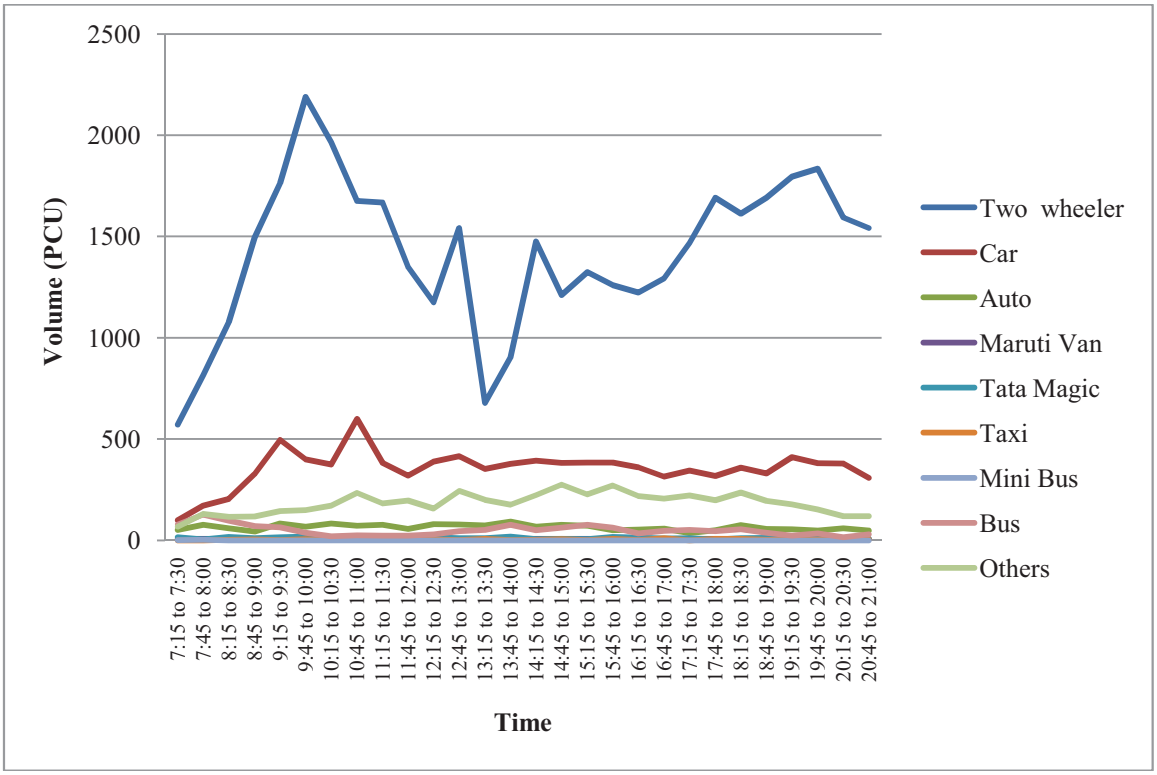
Annexure

Annex A: Traffic Volume Count

Bangali Square

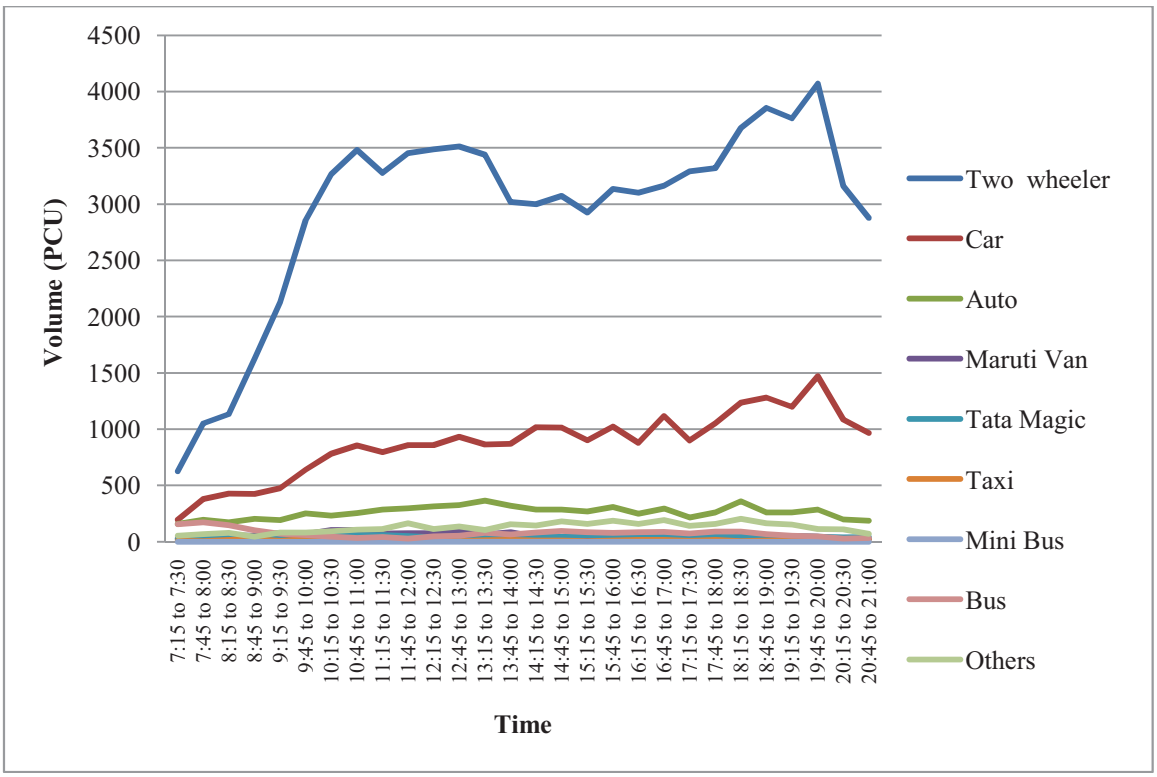


Bapat Square

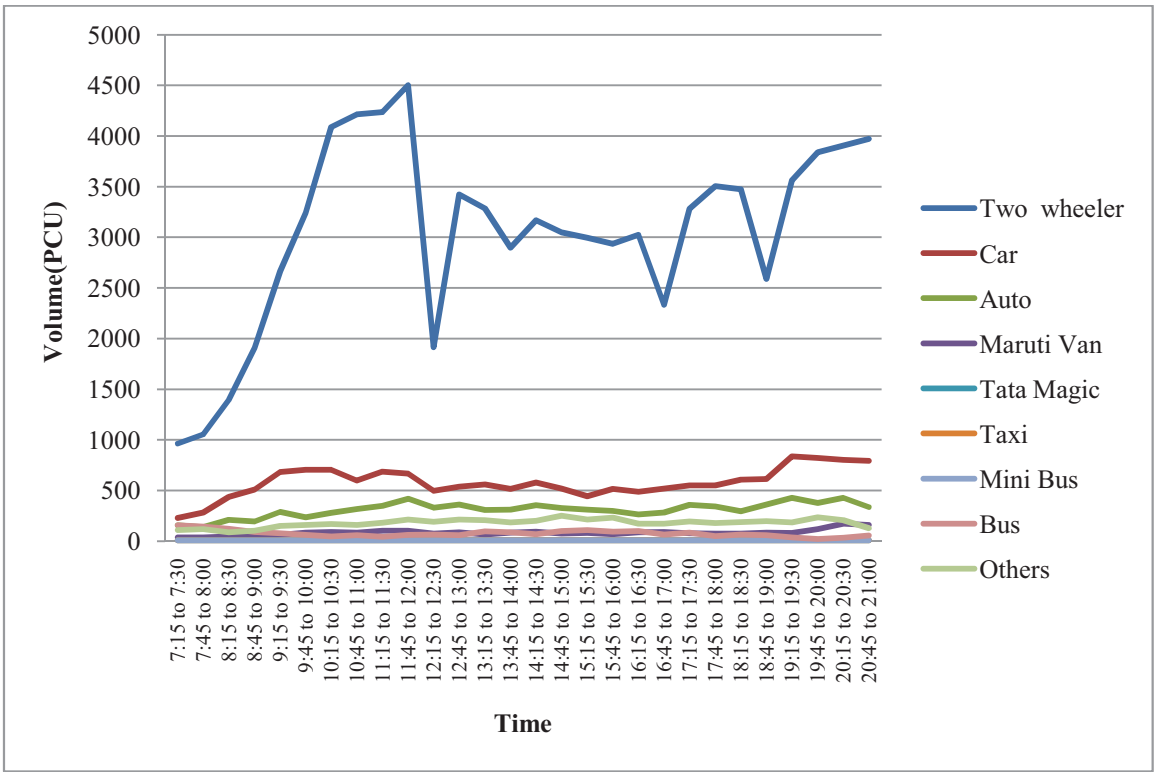


Bhawerkuan Square

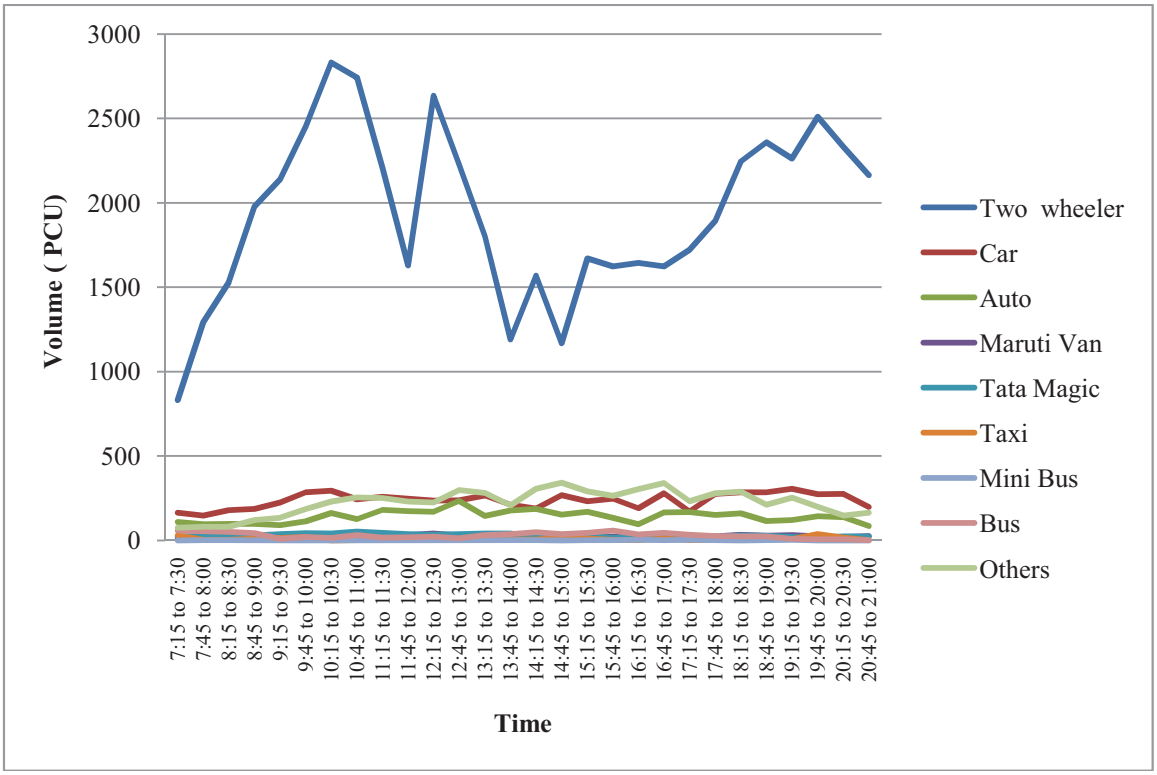
Geeta Bhavan Square



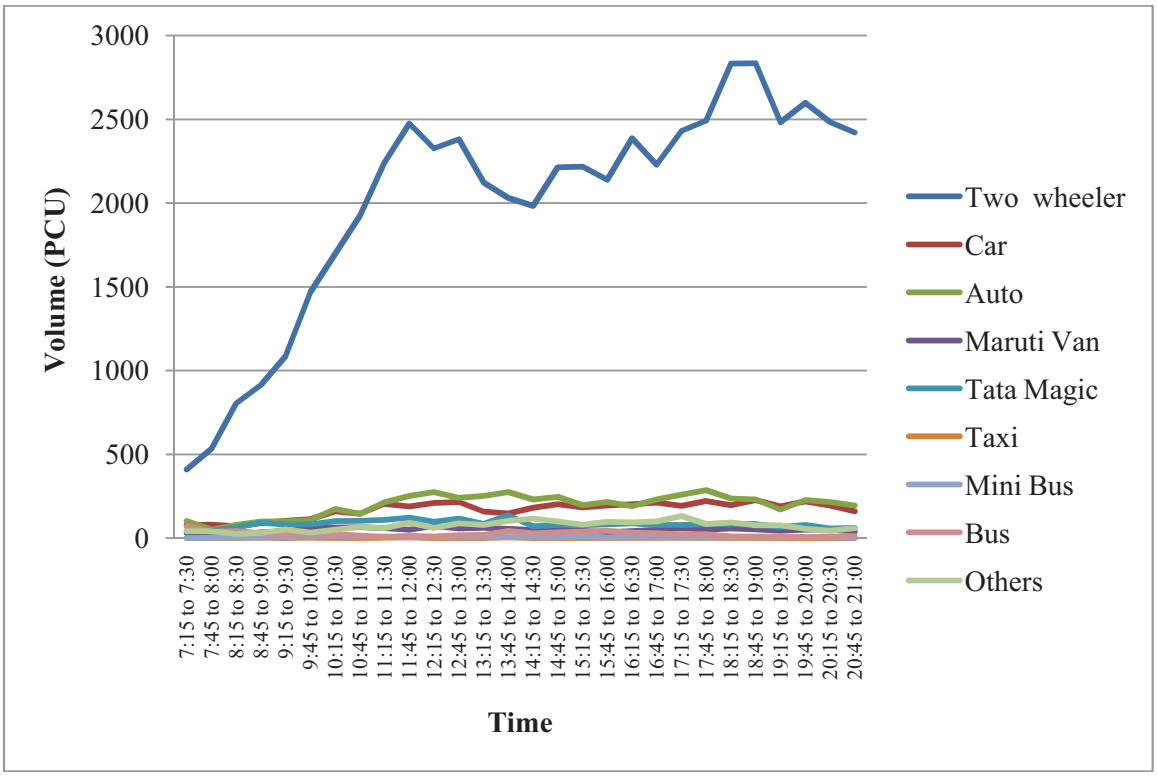
MhowNaka Square



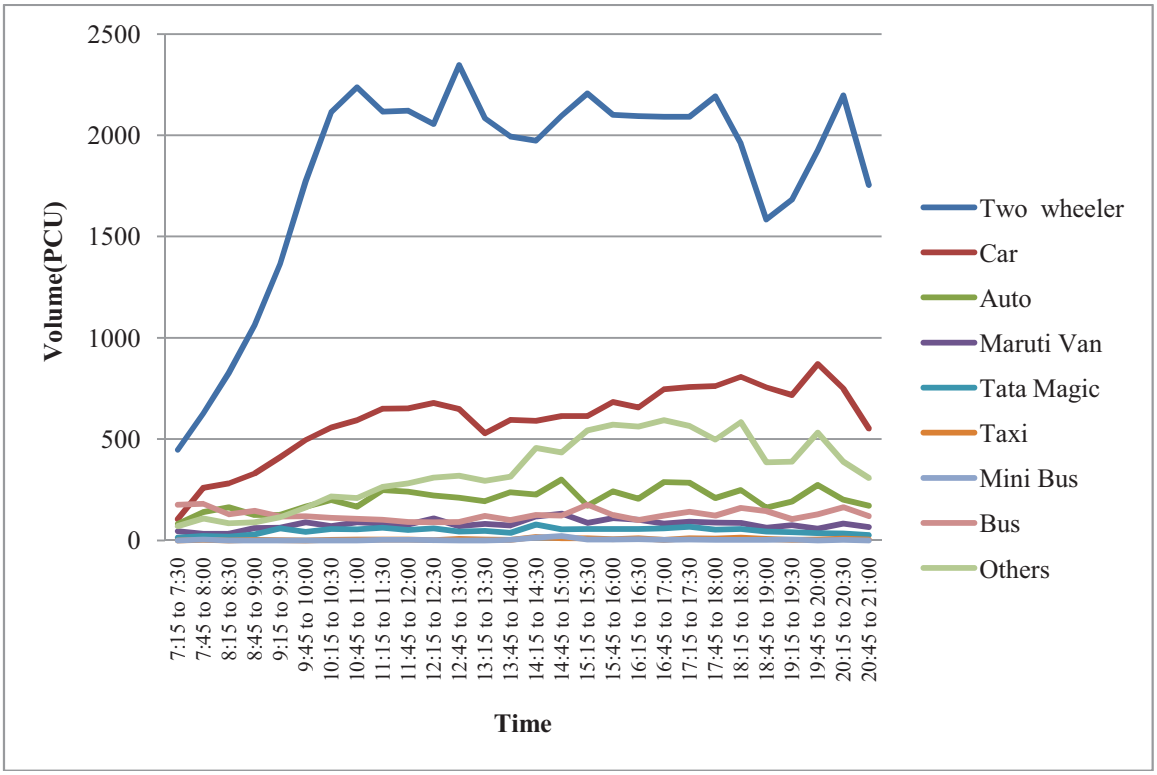
Marimata Square



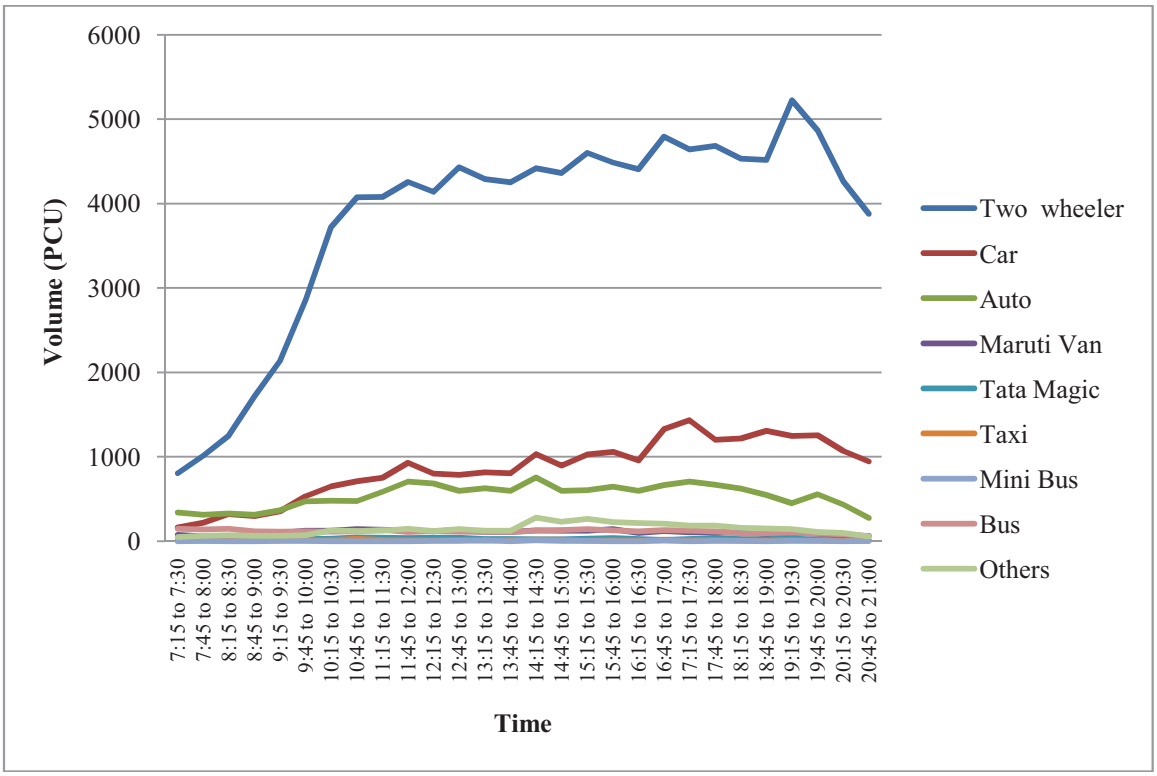
Nagar Nigam Square



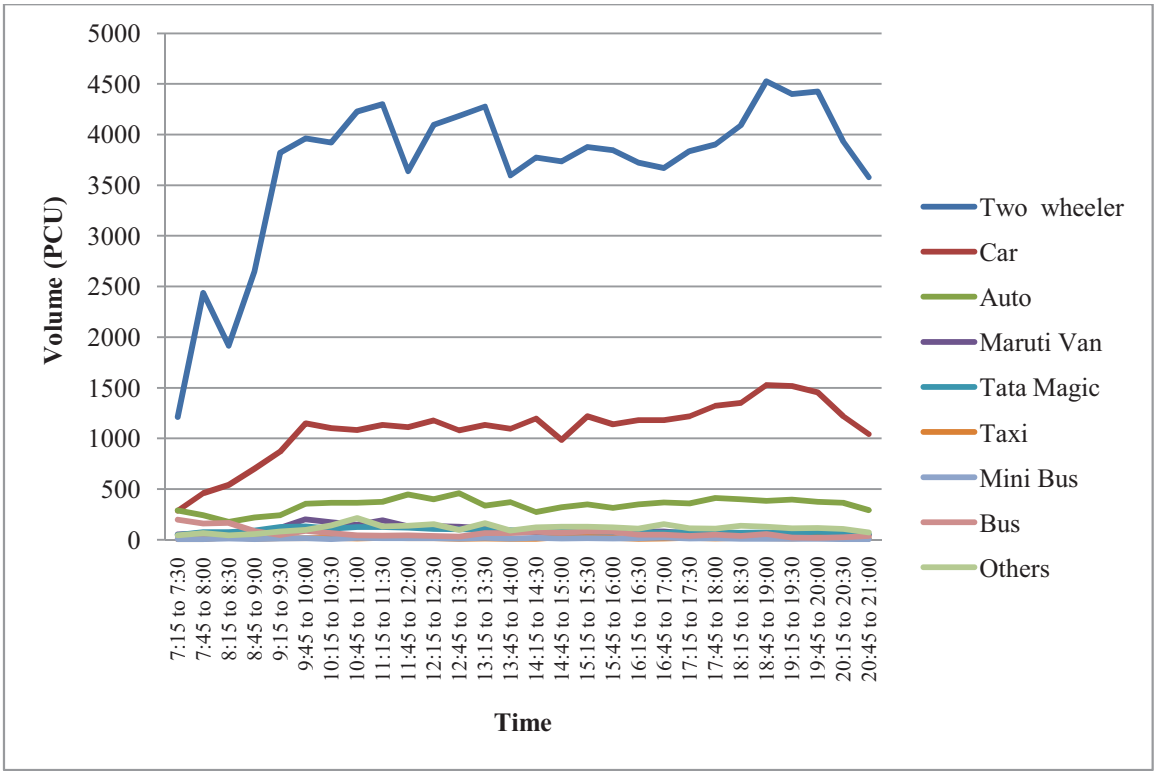
Navlakha Square



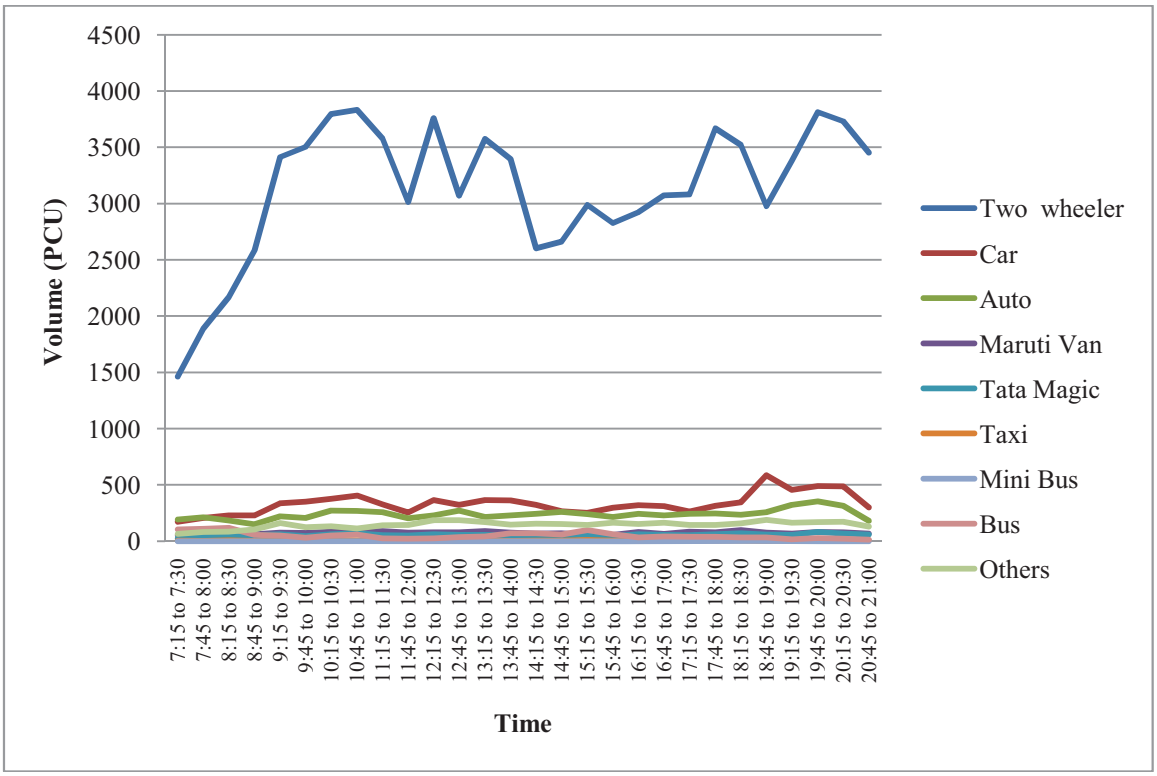
Nehru Square



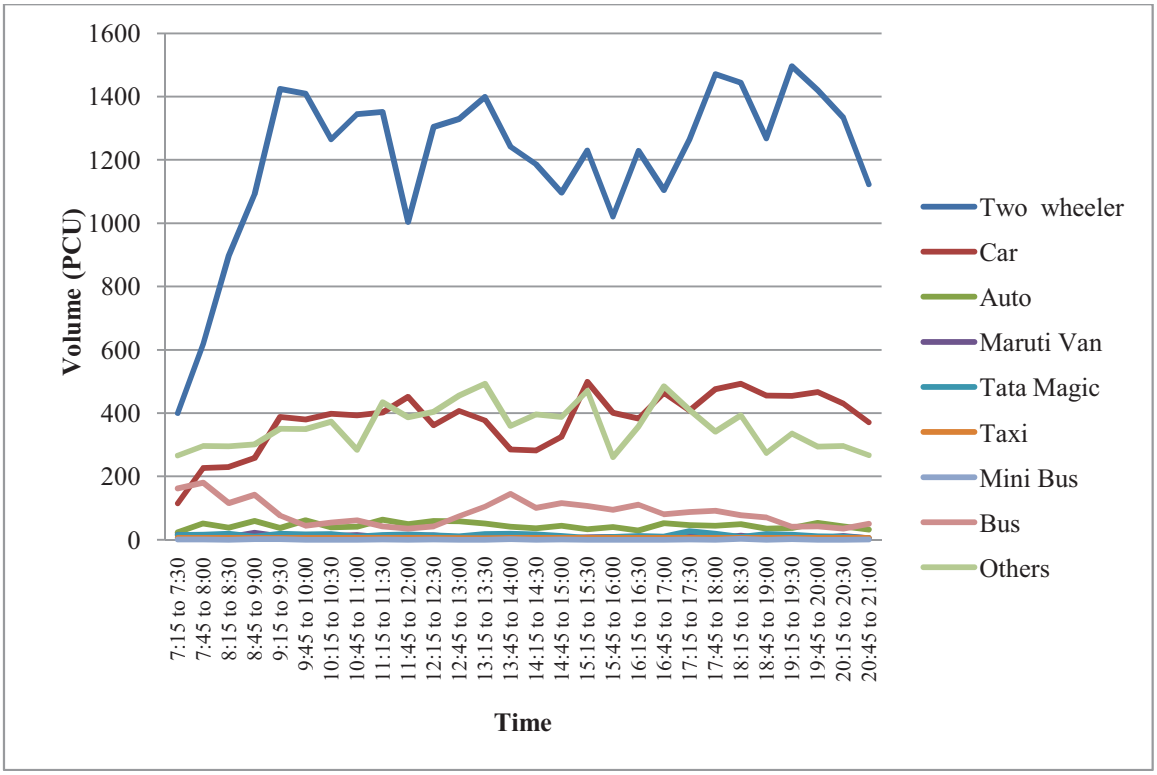
Palasiya Square



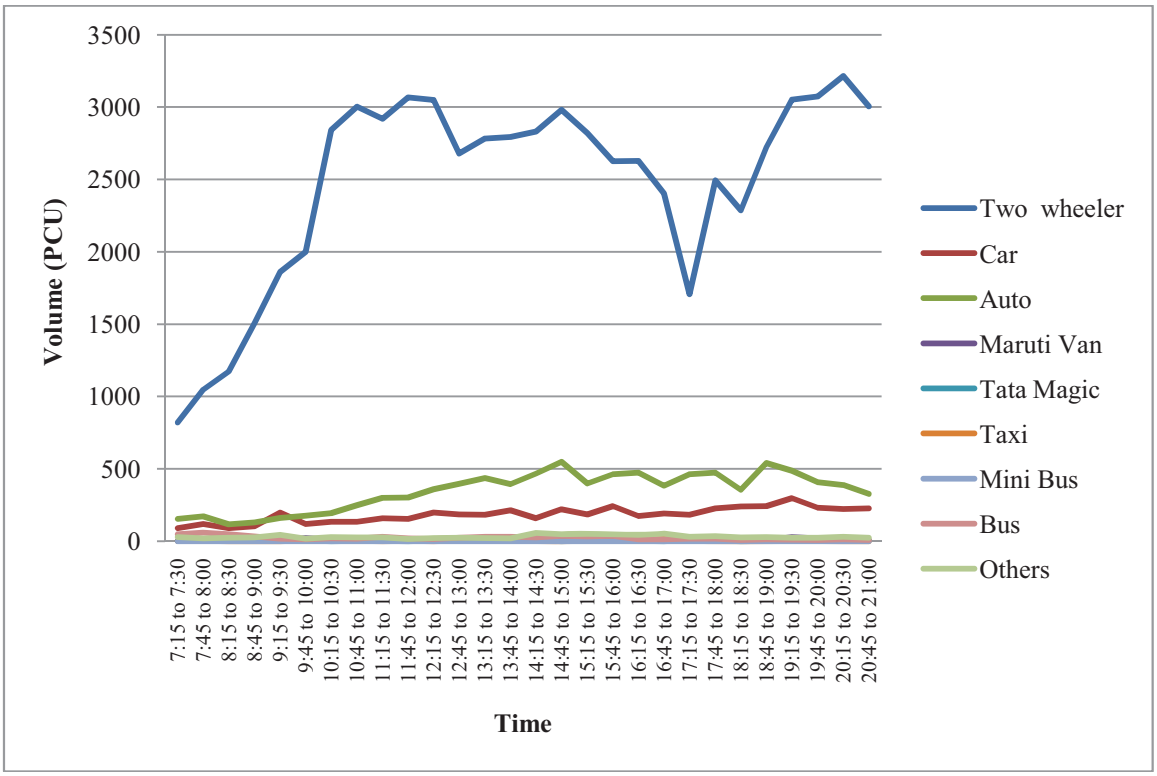
Patnipura square



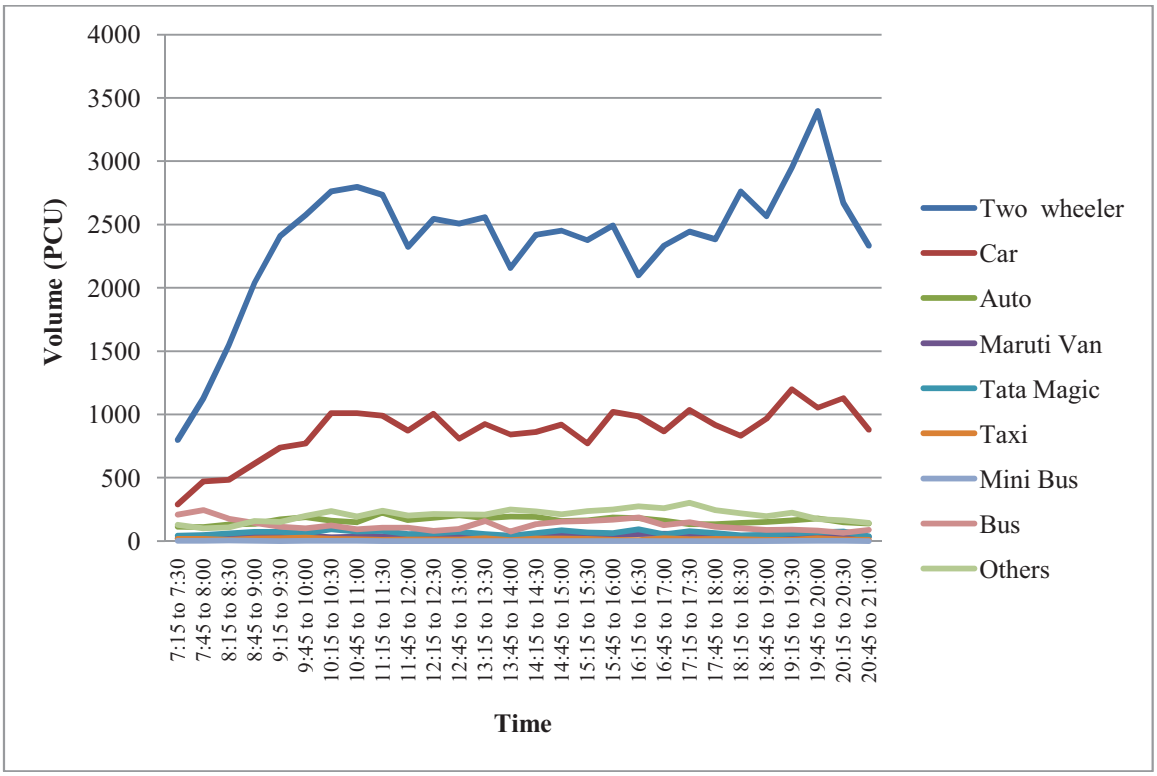
Rajiv Gandhi Square



Rajwada Square



Vijay Nagar Square



Annex B: Registered New Motor Vehicles-From 1990-2010

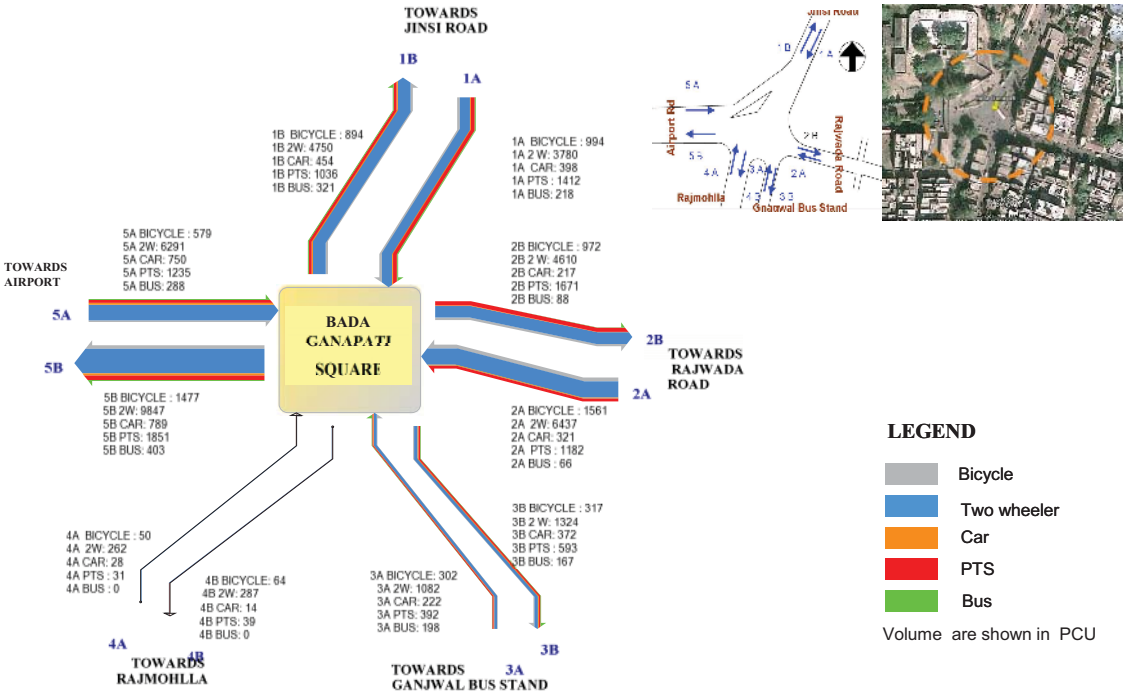
Sl. No.	Year	Goods Vehicle	Bus	Motor Cab Metro Taxi	Tempo (6+1 to 12)	Maruti City Van & Tata Magic	Auto Rickshaw	2W Moped/ Auto Cycle	2W Motor Cycle/ Scooter	Car	Jeep	Tractor	Trolley	Others	Total
1	90-91	1547	596	16	0	0	115	4990	11735	3490	572	615	273	22	23970
2	91-92	2625	580	187	0	10	113	4912	11298	3695	1066	549	440	17	25492
3	92-93	1902	868	316	0	3	121	3403	8740	3395	168	381	265	39	19601
4	93-94	1924	515	12	2	15	191	3679	9775	2324	154	444	263	40	19338
5	94-95	2484	517	5	0	2	270	3830	13842	4082	190	954	496	56	26728
6	95-96	3623	1023	2	15	91	495	5603	17263	8705	276	1175	823	94	39188
7	96-97	4039	1644	9	9	13	339	5932	19060	7827	239	911	570	51	40643
8	97-98	2531	1855	15	0	0	202	5352	25760	3487	221	1641	781	78	41923
9	98-99	2098	1358	29	0	1	83	6041	28369	3137	148	1187	662	151	43264
10	99-2000	2238	2220	117	2	0	45	5557	31529	4333	101	702	454	61	47359
11	2000-01	1152	1100	163	0	0	10	3409	26091	3399	37	435	288	33	36117
12	2001-02	1424	761	133	0	0	5	1824	28048	2810	10	189	127	21	35352
13	2002-03	2235	1098	193	0	0	744	1666	34012	3827	47	164	100	26	44112
14	2003-04	3684	1878	102	0	0	70	986	42143	5279	34	81	65	11	54333
15	2004-05	4053	2123	168	0	0	57	732	48984	6651	21	175	103	30	63097
16	2005-06	4285	1974	224	0	0	81	554	53690	6907	11	315	219	33	68293
17	2006-07	6634	2397	103	0	193	135	569	57145	9372	18	509	209	100	77384

Sl. No.	Year	Goods Vehicle	Bus	Motor Cab Metro Taxi	Tempo (6+1 to 12)	Maruti City Van & Tata Magic	Auto Rickshaw	2W Moped/ Auto Cycle	2W Motor Cycle/ Scooter	Car	Jeep	Tractor	Trolley	Others	Total
18	2007-08	6295	2770	199	79	254	141	913	61054	12427	6	1033	395	334	85900
19	2008-09	4894	3361	146	90	0	224	1069	55968	13758	946	946	335	312	82049
20	2009-10	5235	3716	301	0	300	1447	1584	67483	15488	0	1143	318	237	97252

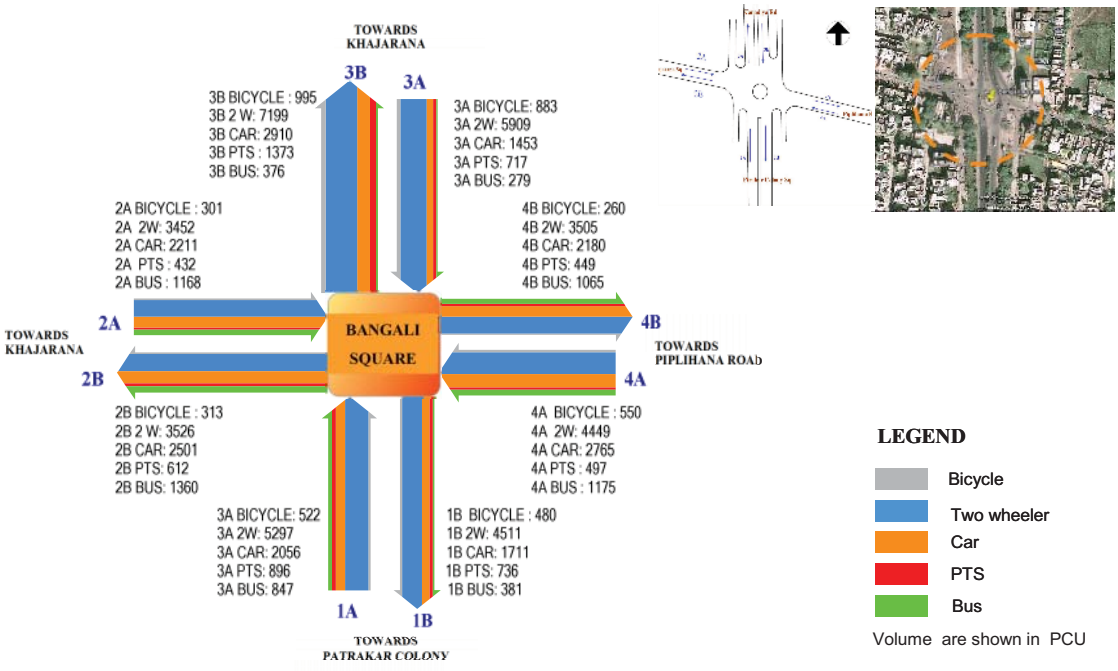
Source: Source: Regional Transport Office, Indore

Annex C: Sankey Diagram for Road Junctions

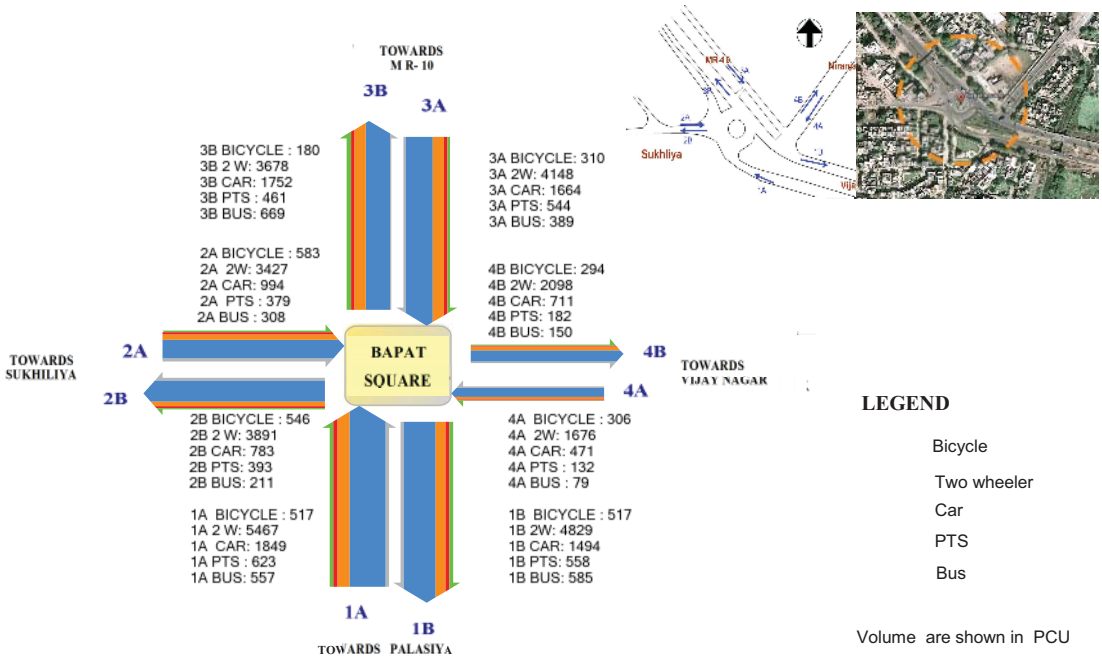
Bada Ganpati Square



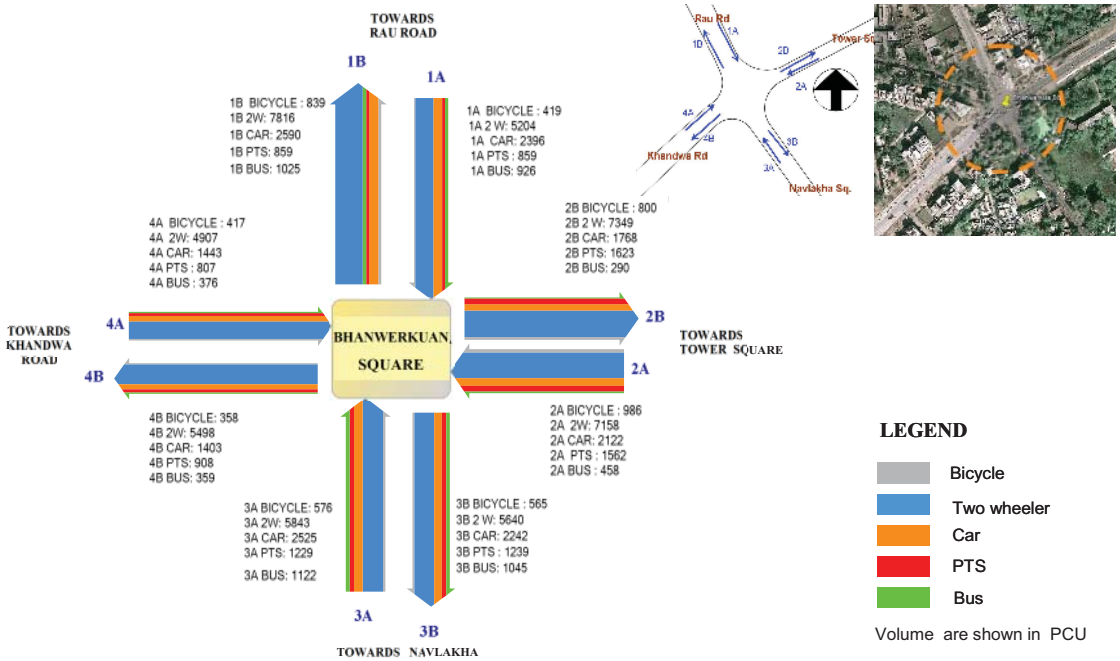
Bangali Square



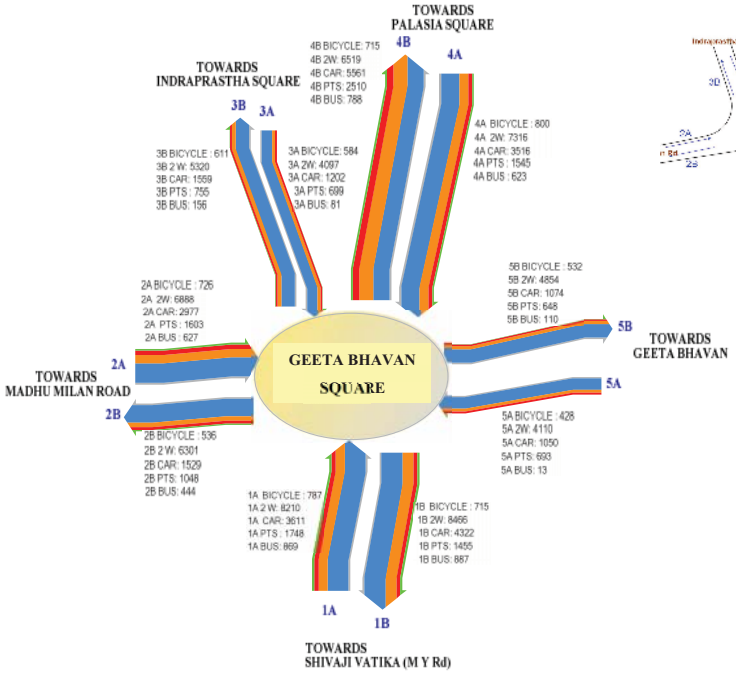
Bapat Square

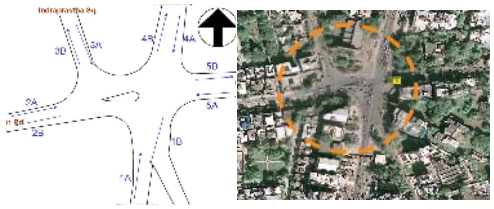


Bhanwerkuan Square



Geeta Bhavan Square



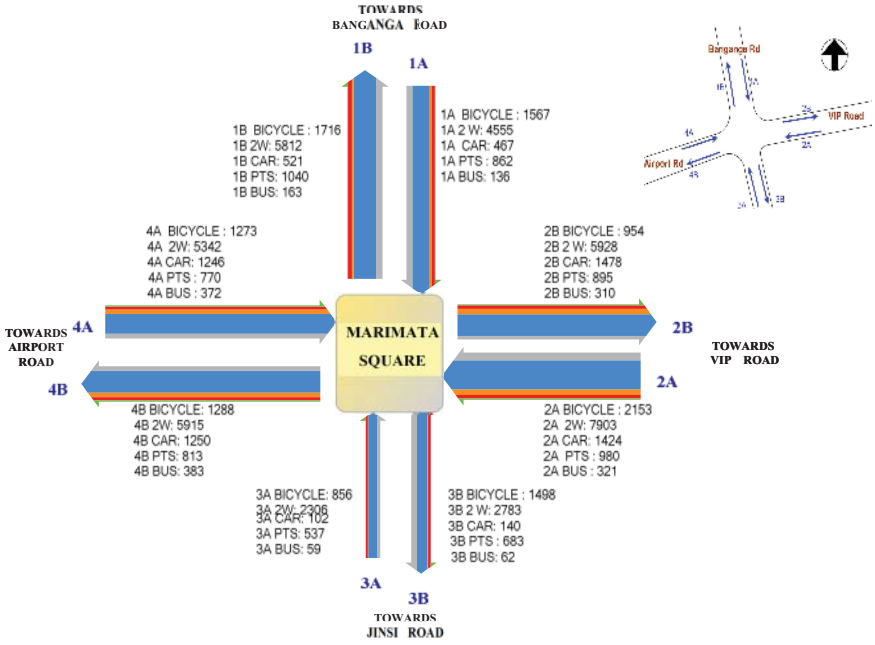


LEGEND

- Bicycle
- Two wheeler
- Car
- PTS
- Bus

Volume are shown in PCU

Marimata Square

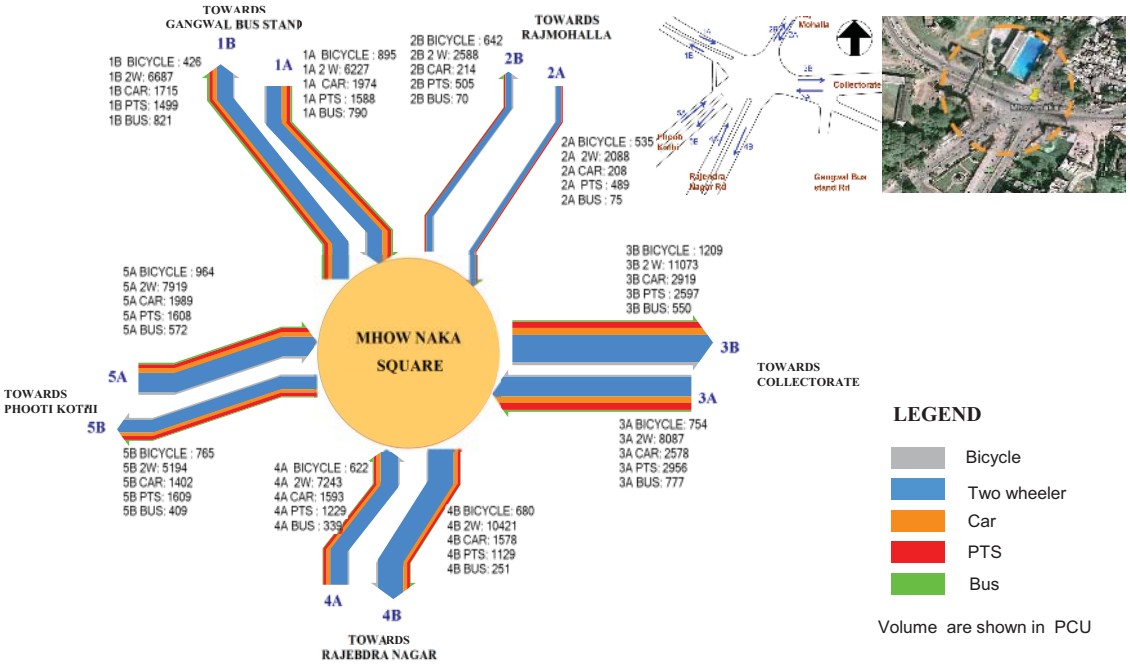


LEGEND

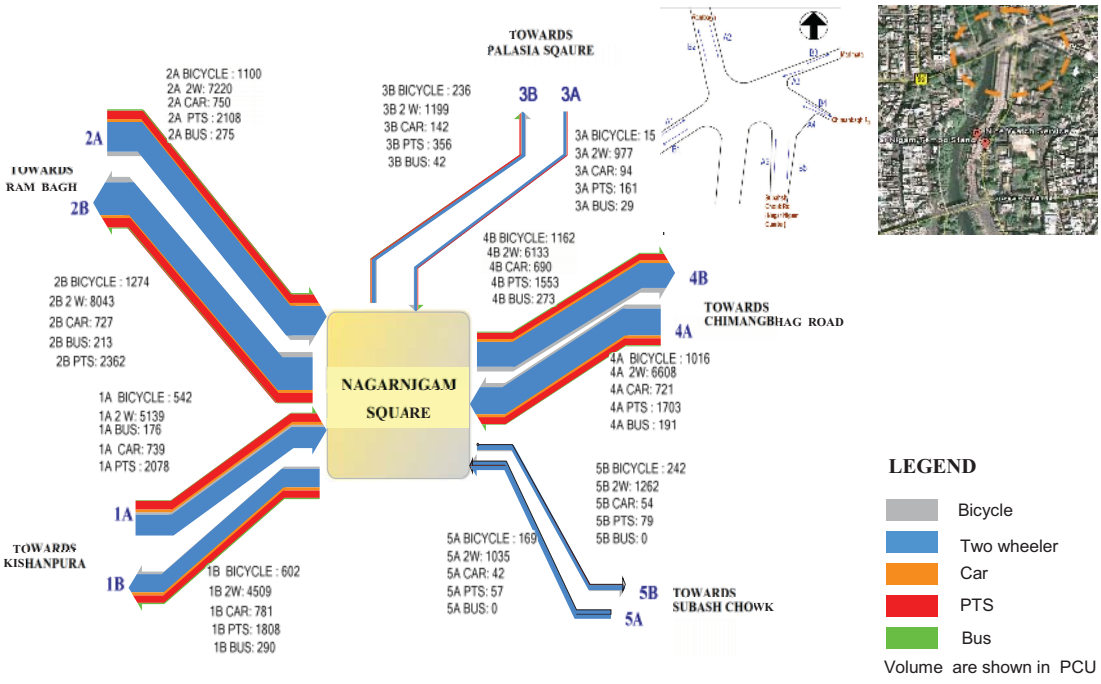
- Bicycle
- Two wheeler
- Car
- PTS
- Bus

Volume are shown in PCU

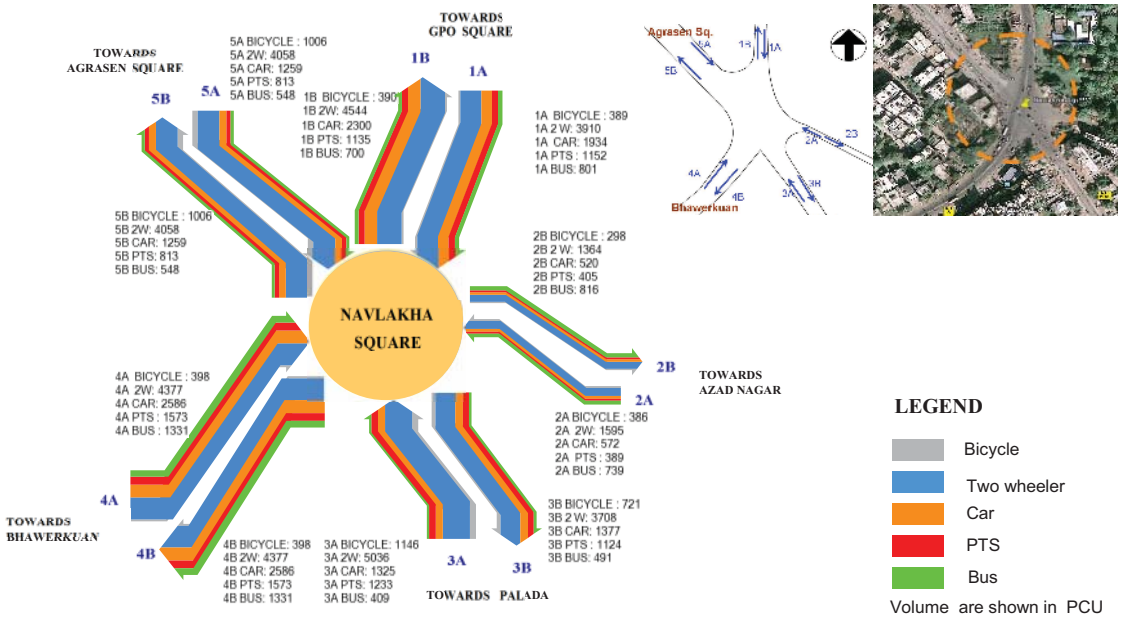
Mhow Naka



Nagarnigam Square



Navlakha Square



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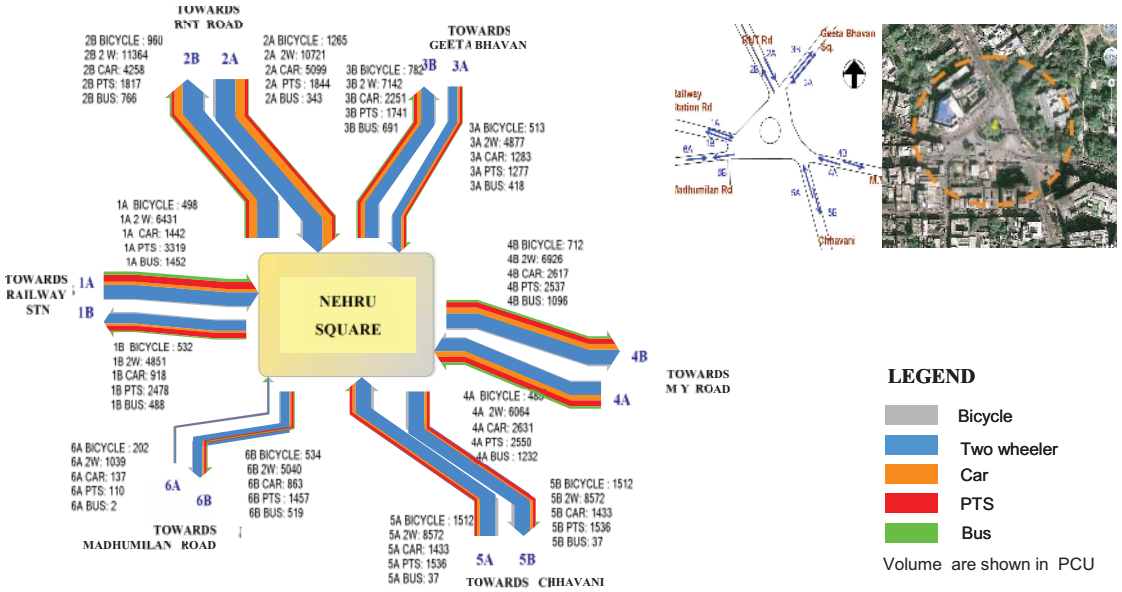
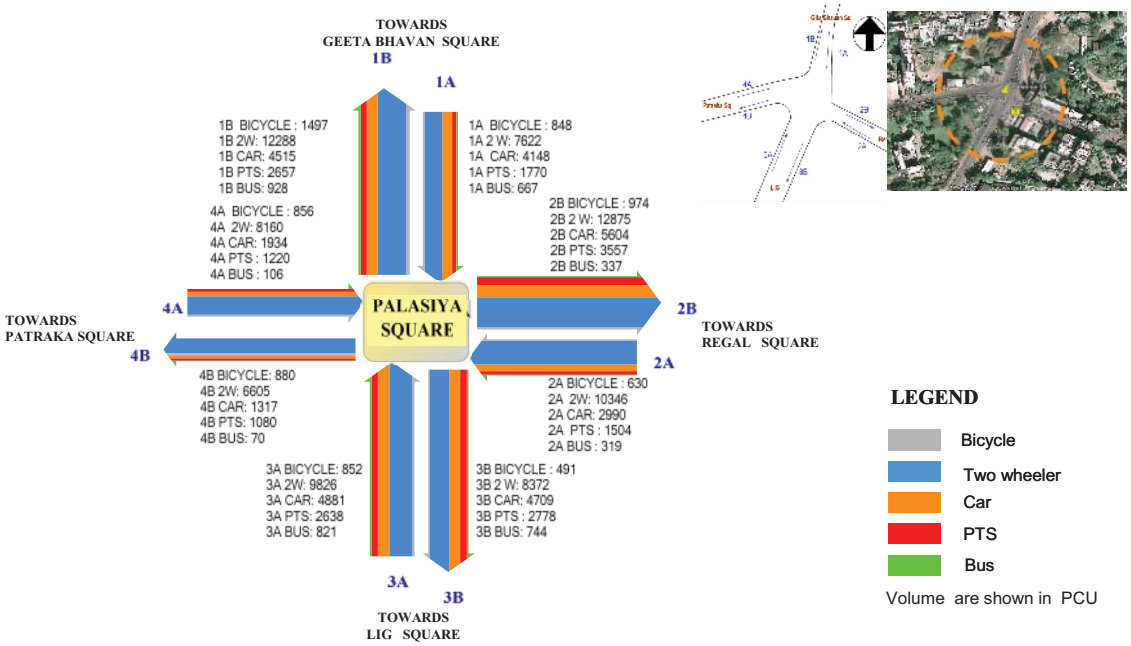
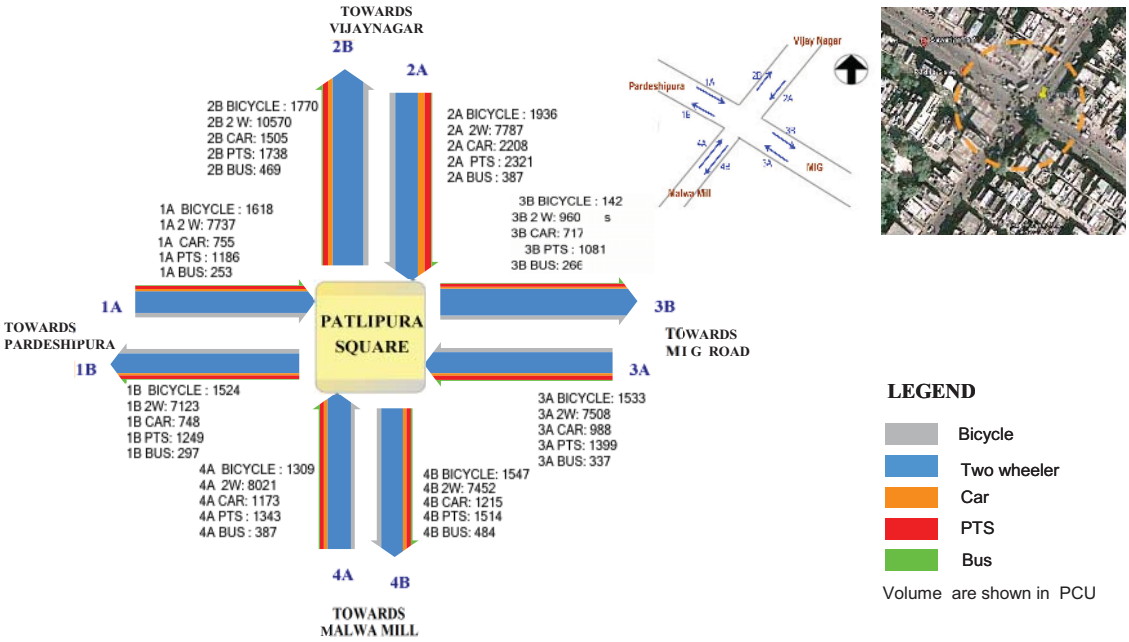


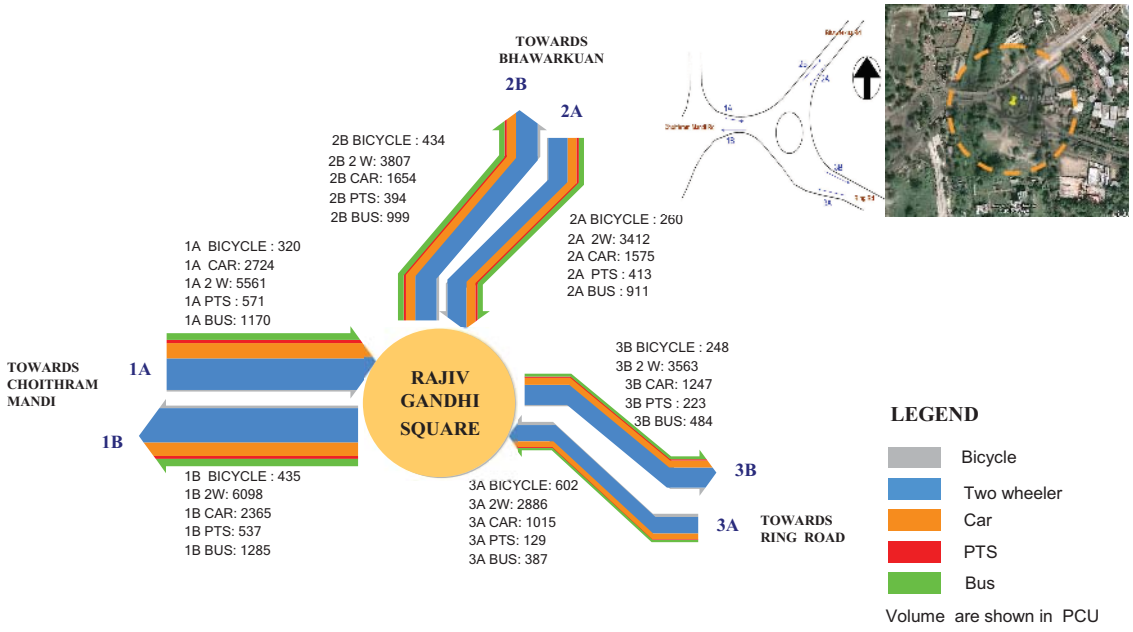
Palisiya Square



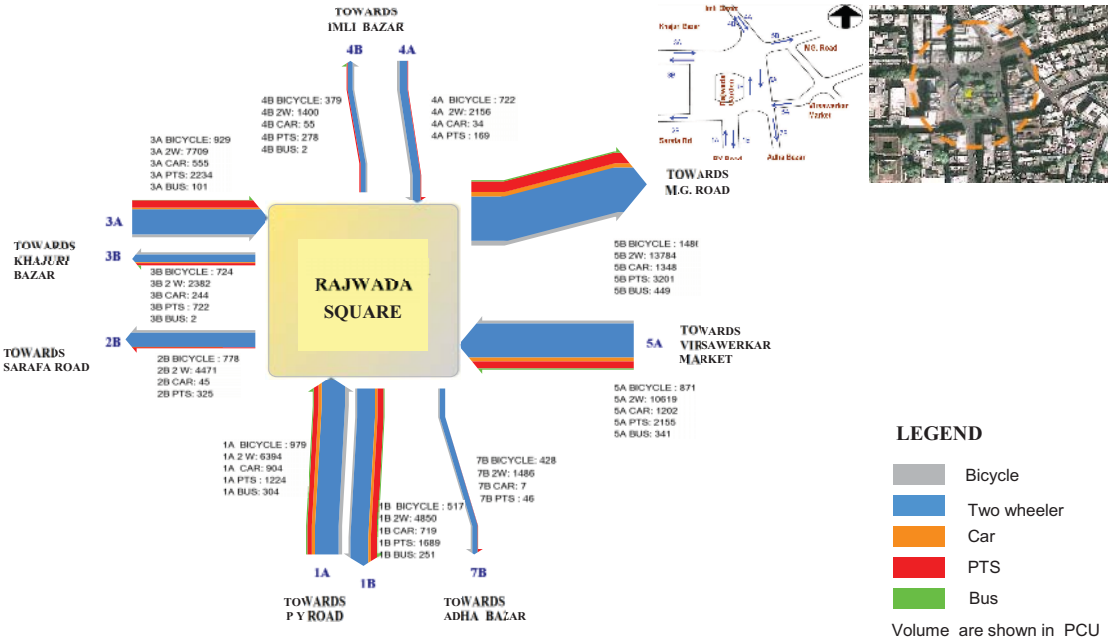
Patlipura Square



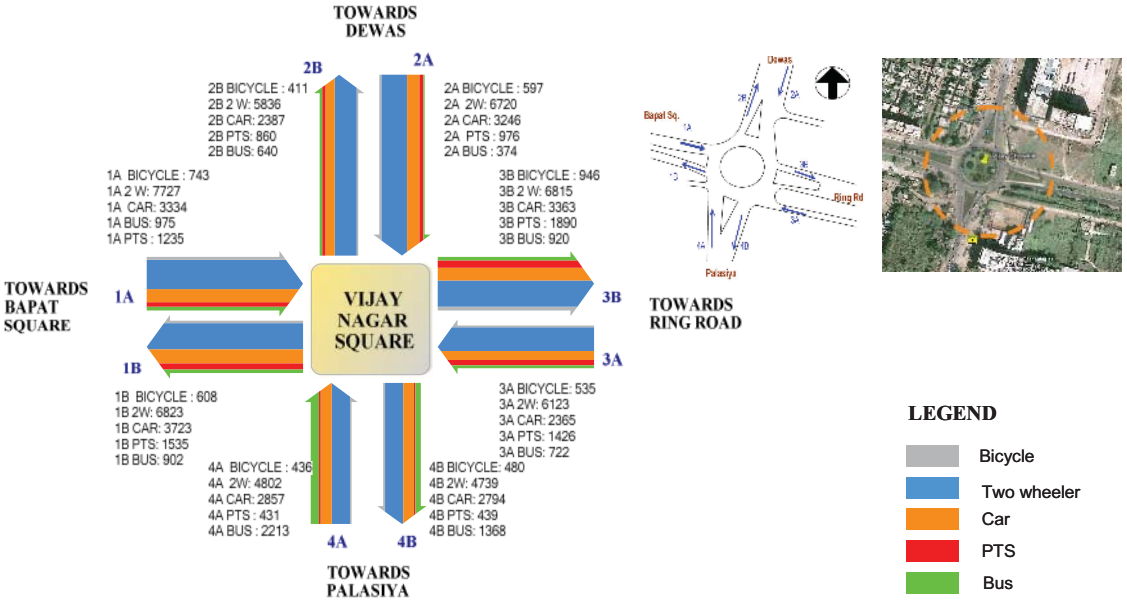
Rajiv Gandhi Square



Rajwada Square

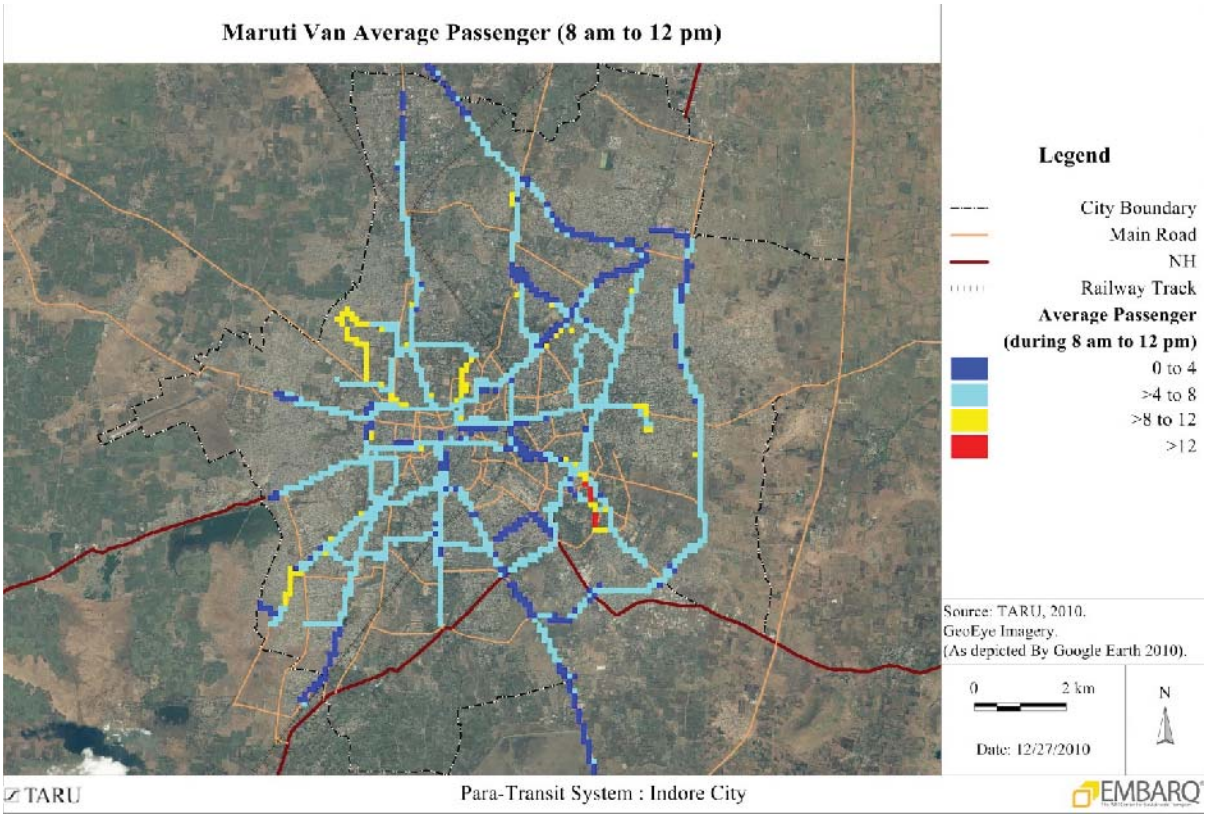


Vijay Nagar Square

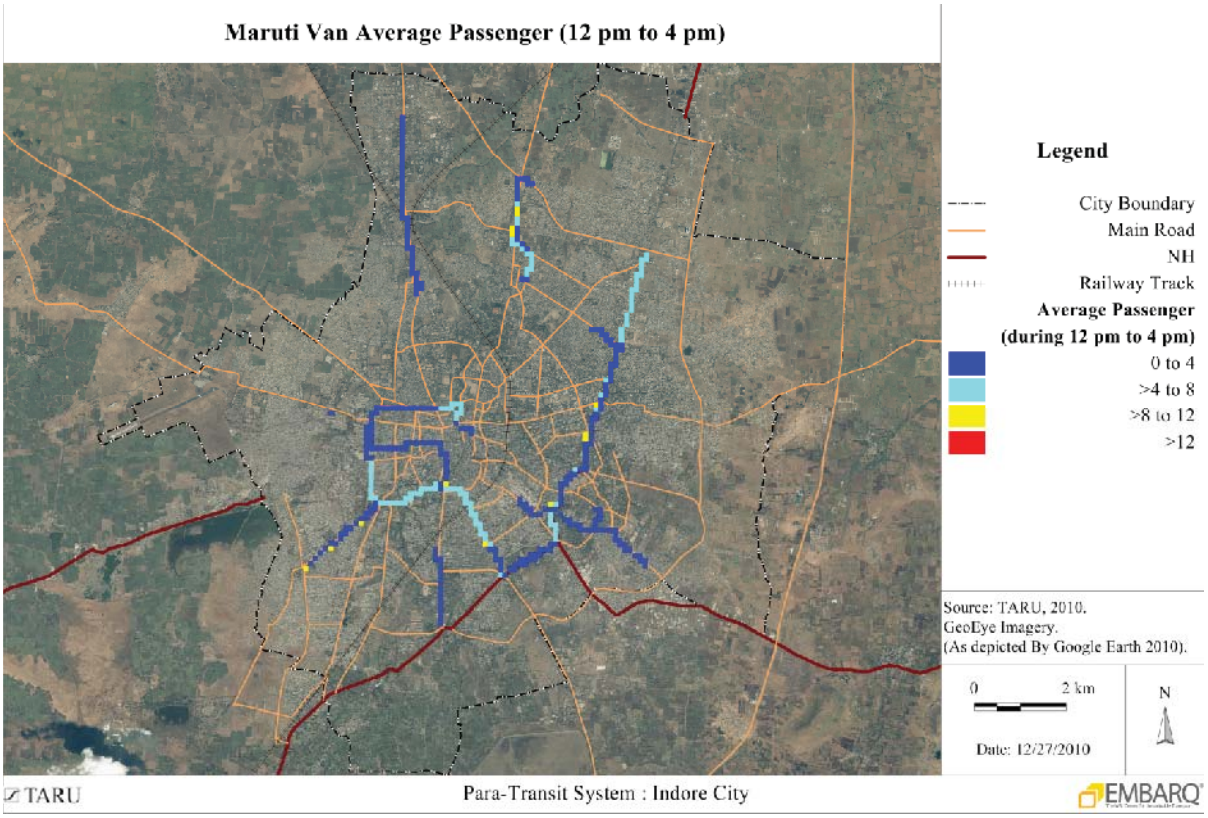


Annex D: Maruti Van Average Passenger

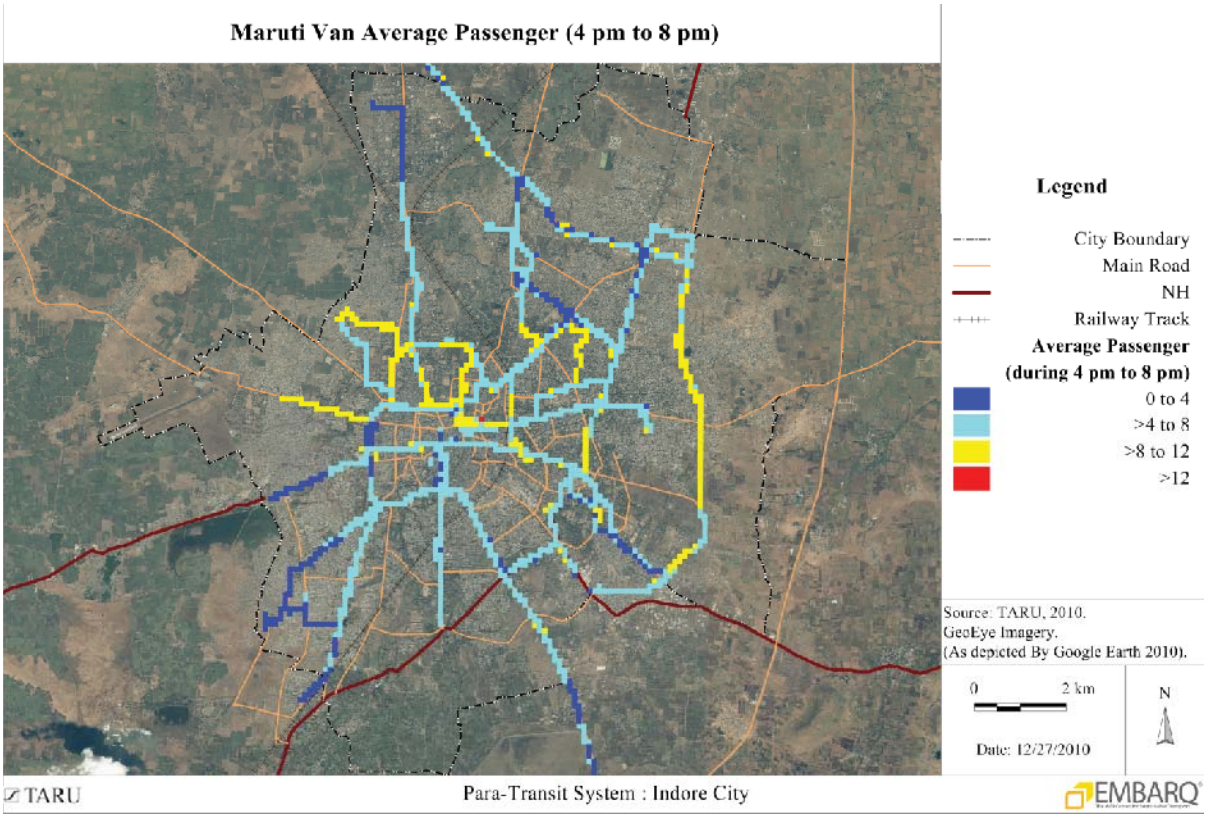
Indore City: Maruti Van Average Passenger (8 am to 12 pm)



Indore City: Maruti Van Average Passenger (12pm to 4pm)

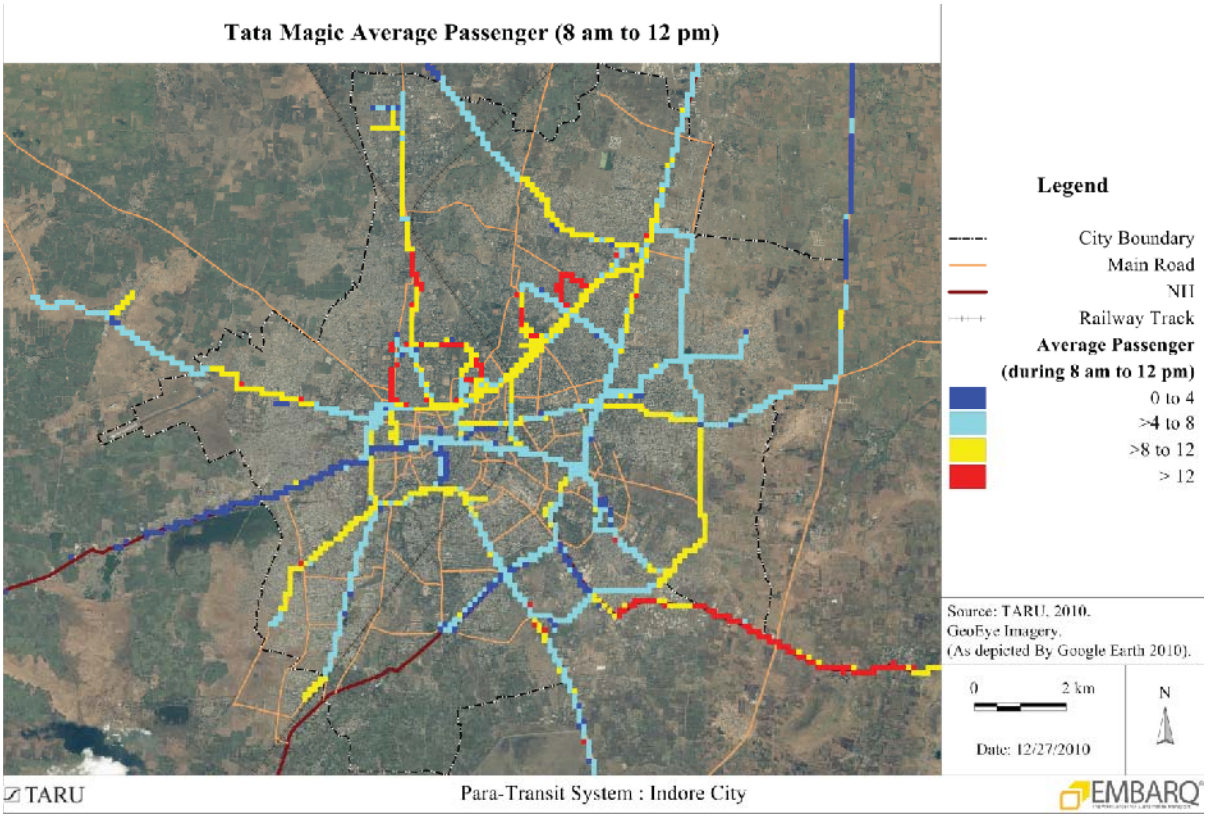


Indore City: Maruti Van Average Passenger (4 pm to 8 pm)

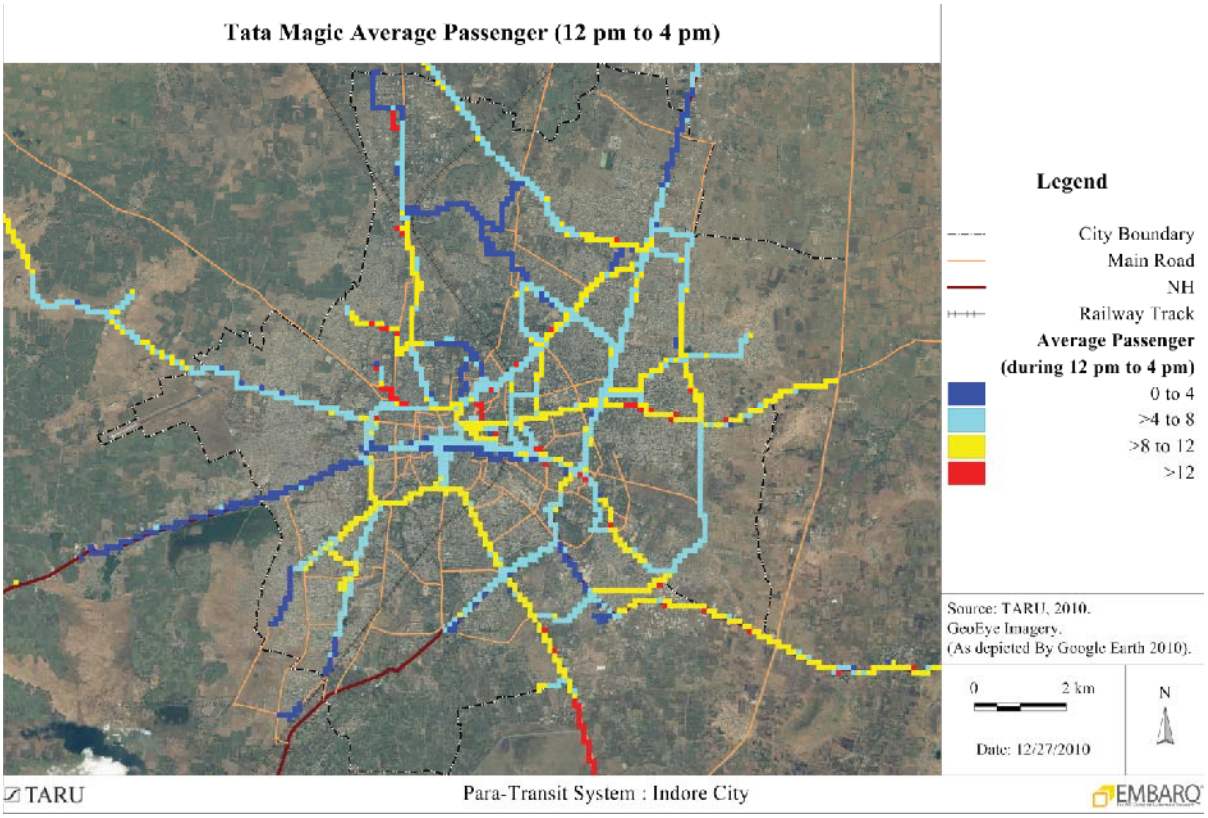


Annex E: TATA Magic Average Passenger

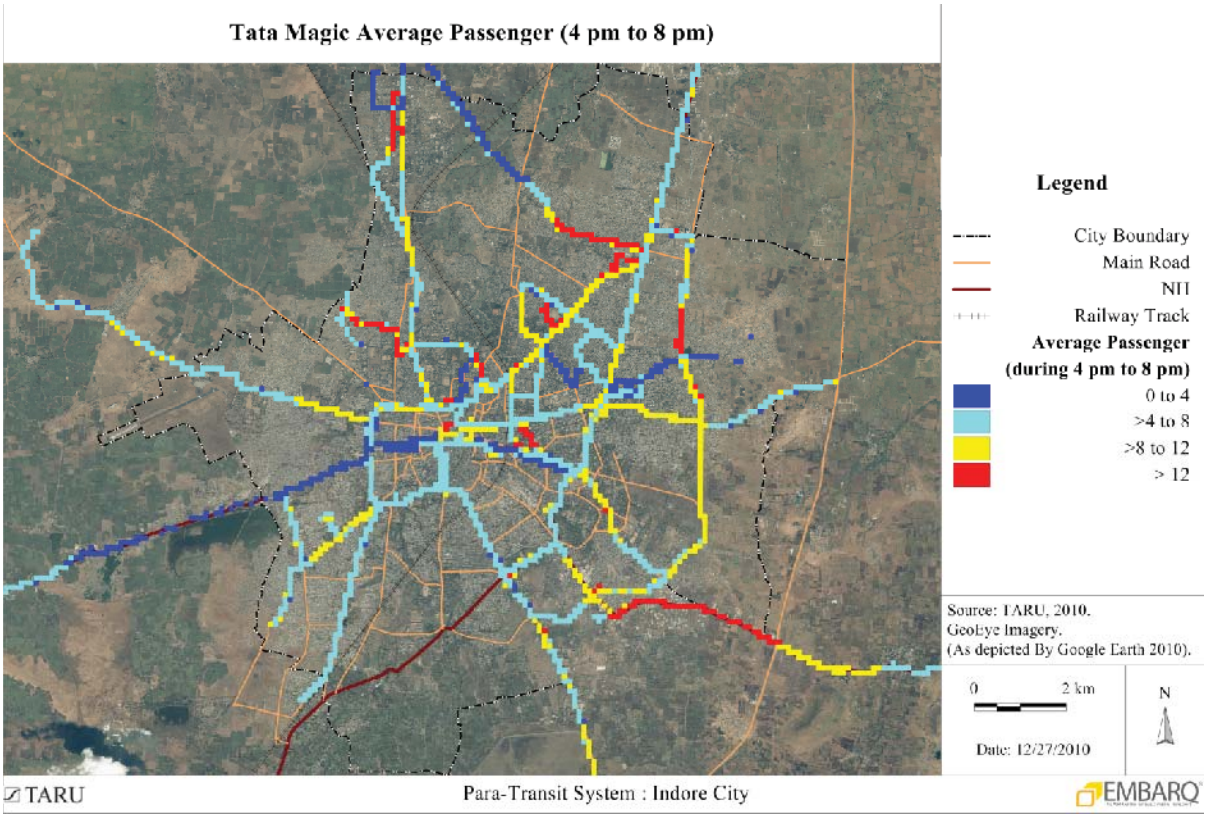
Indore City: Tata Magic Average Passenger (8 am to 12pm)



Indore City: Tata Magic Average Passenger (12 pm to 4pm)

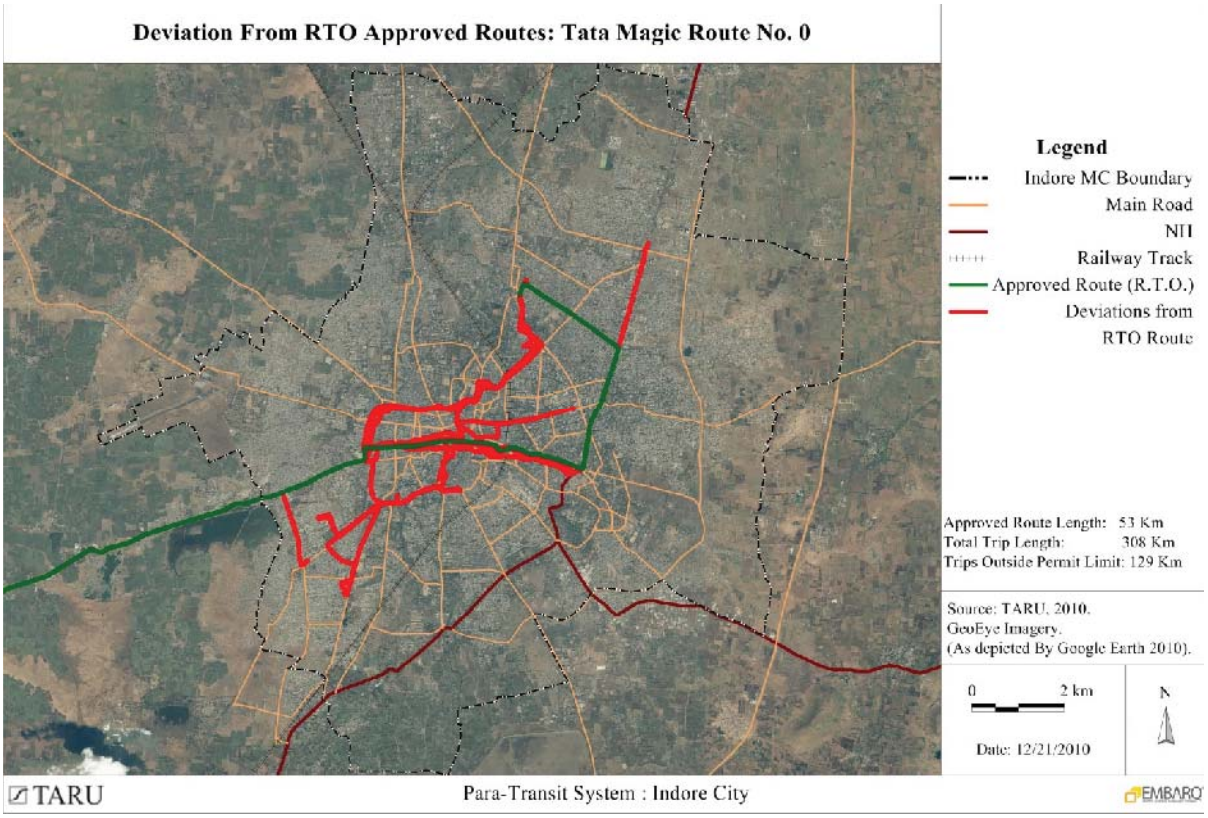


Indore City: Tata Magic Average Passenger (4 pm to 8 pm)

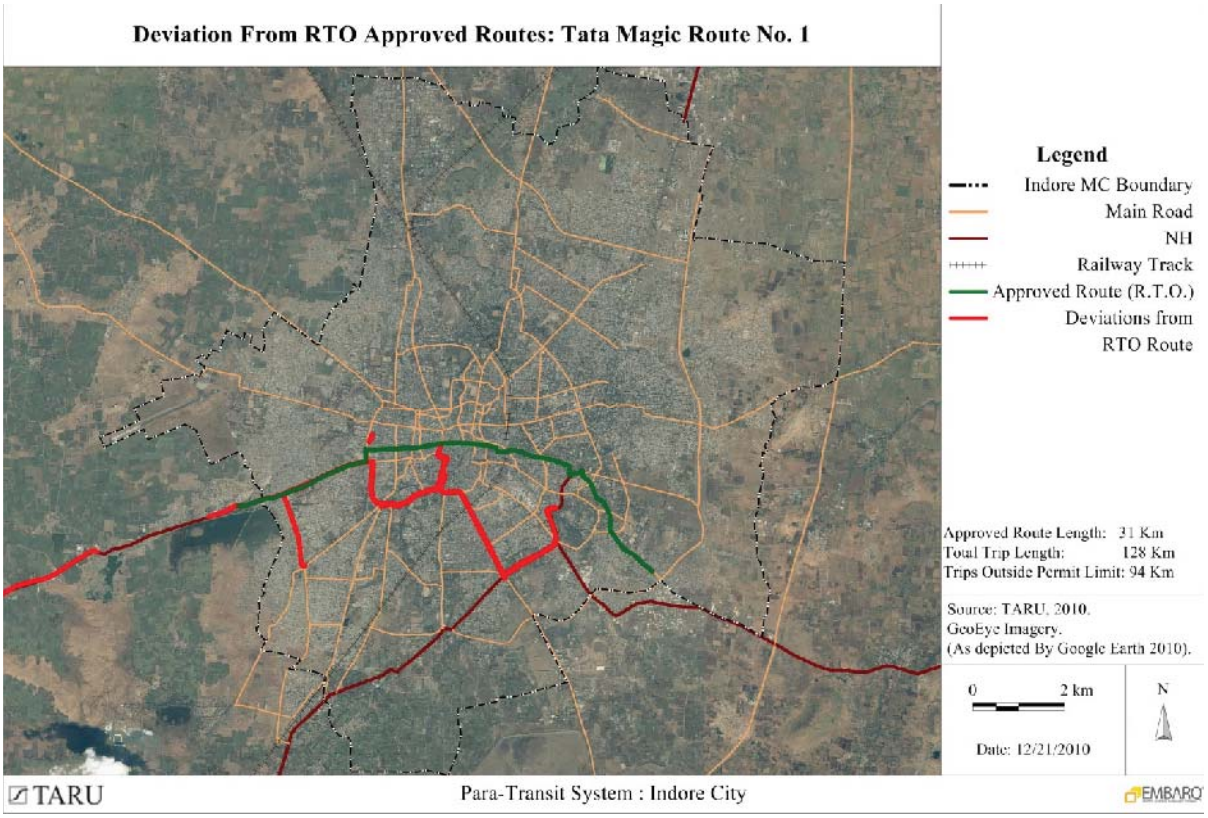


Annex F: Deviation from RTO Approved Routes

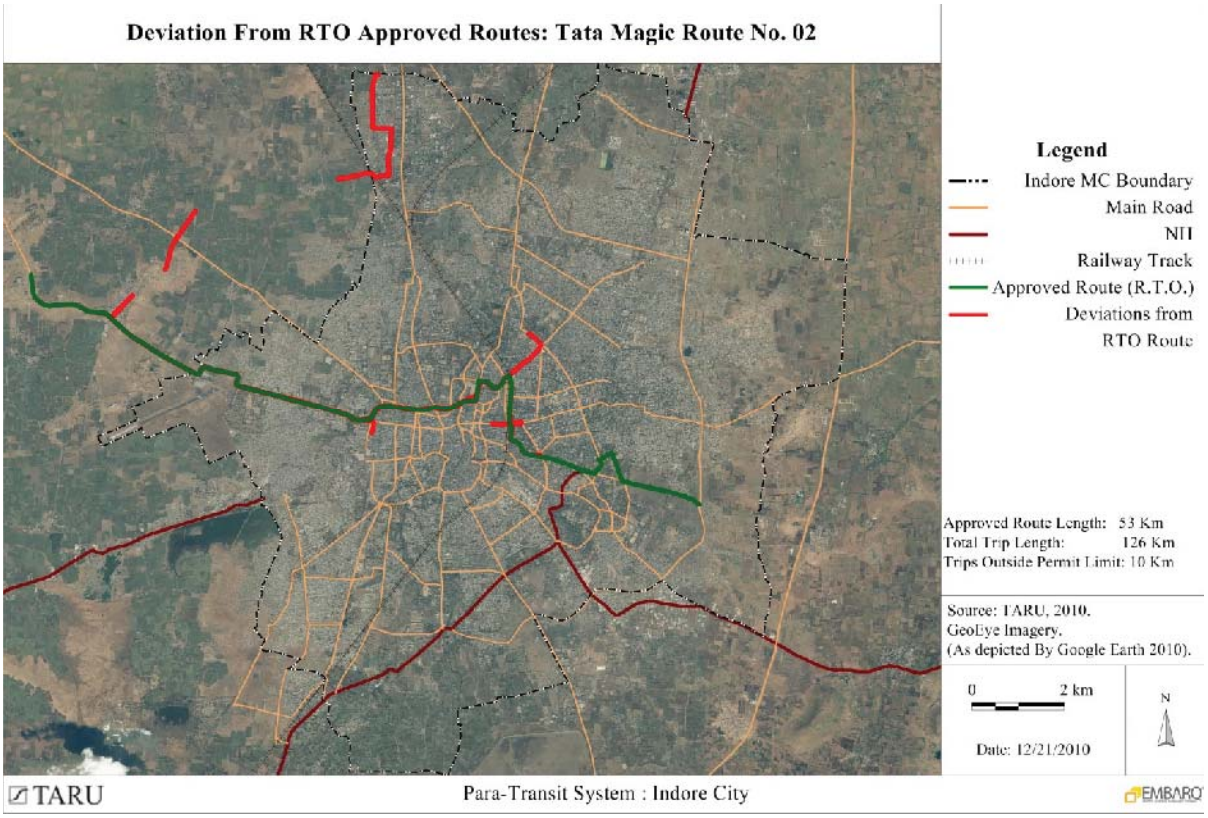
Tata Magic Route No.0



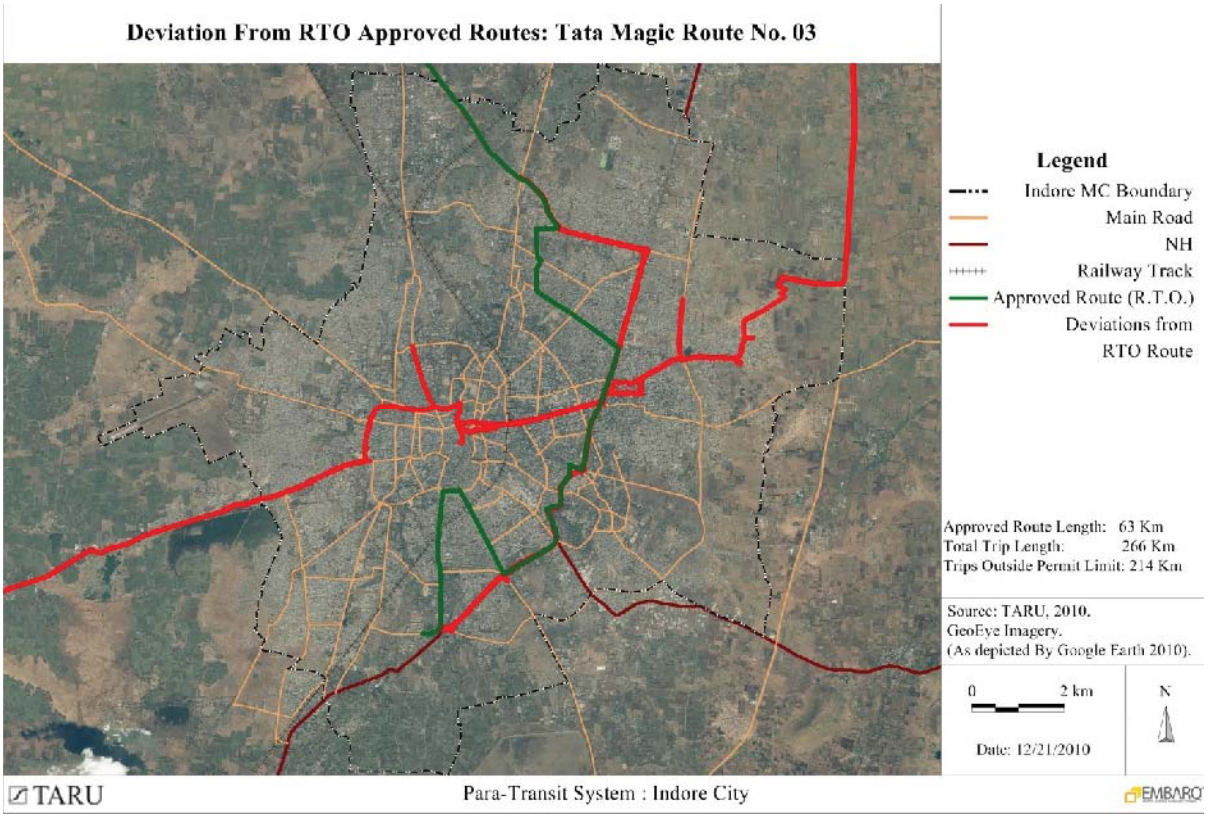
Tata Magic Route No.1



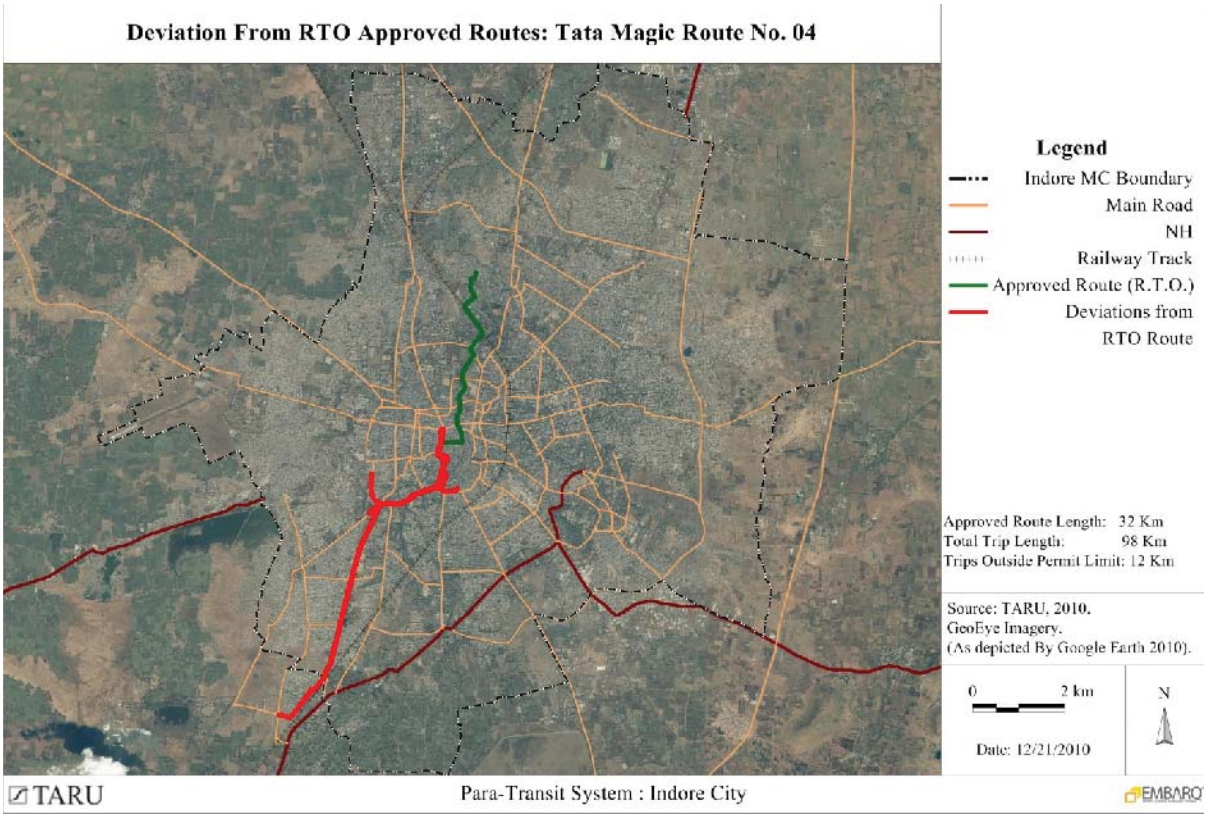
Tata Magic Route No.02



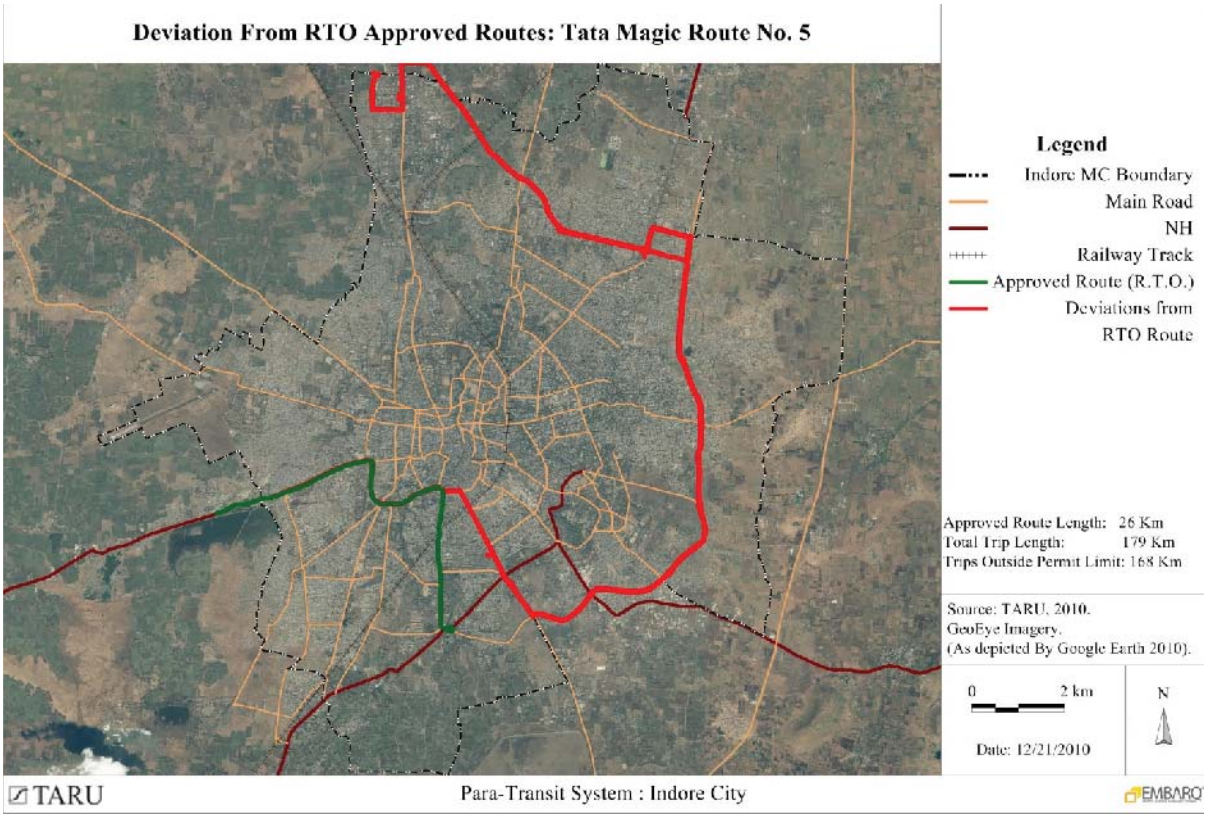
Tata Magic Route No.03



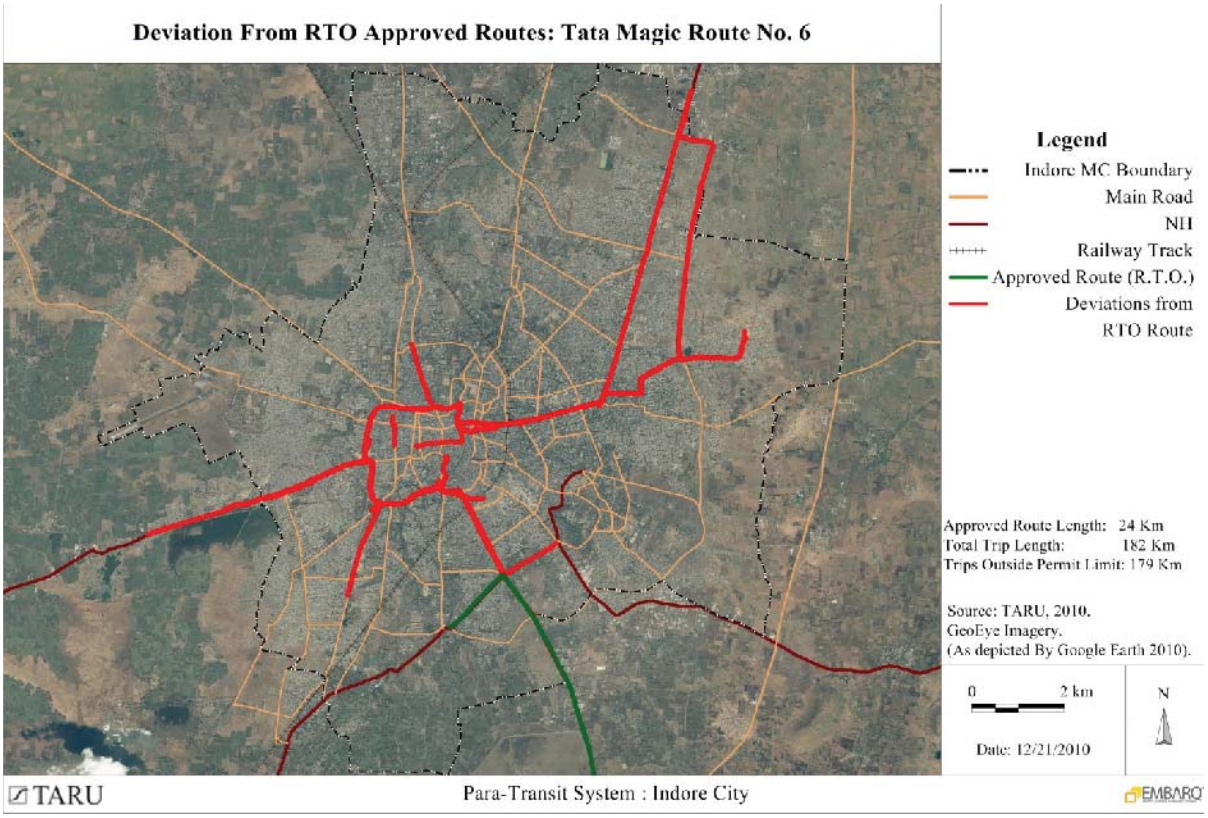
Tata Magic Route No.04



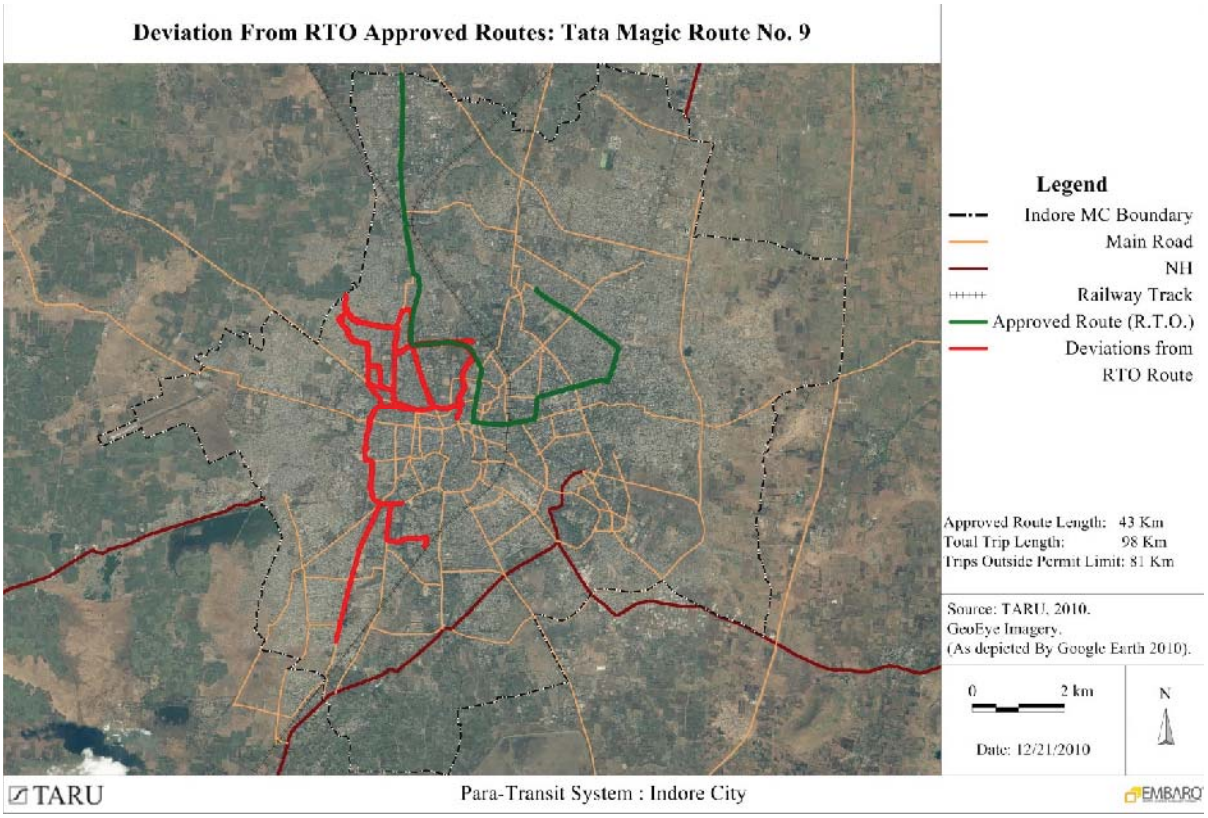
Tata Magic Route No.05



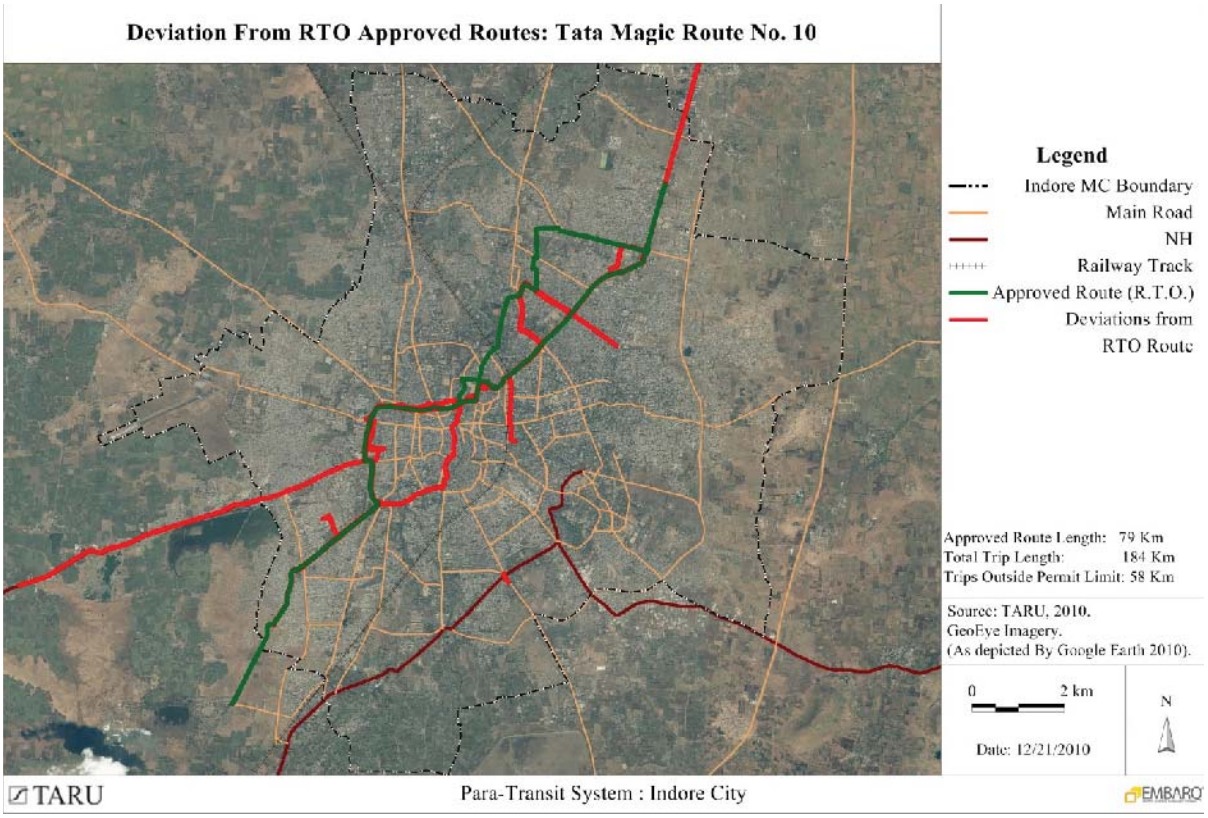
Tata Magic Route No.06



Tata Magic Route No.09



Tata Magic Route No.10



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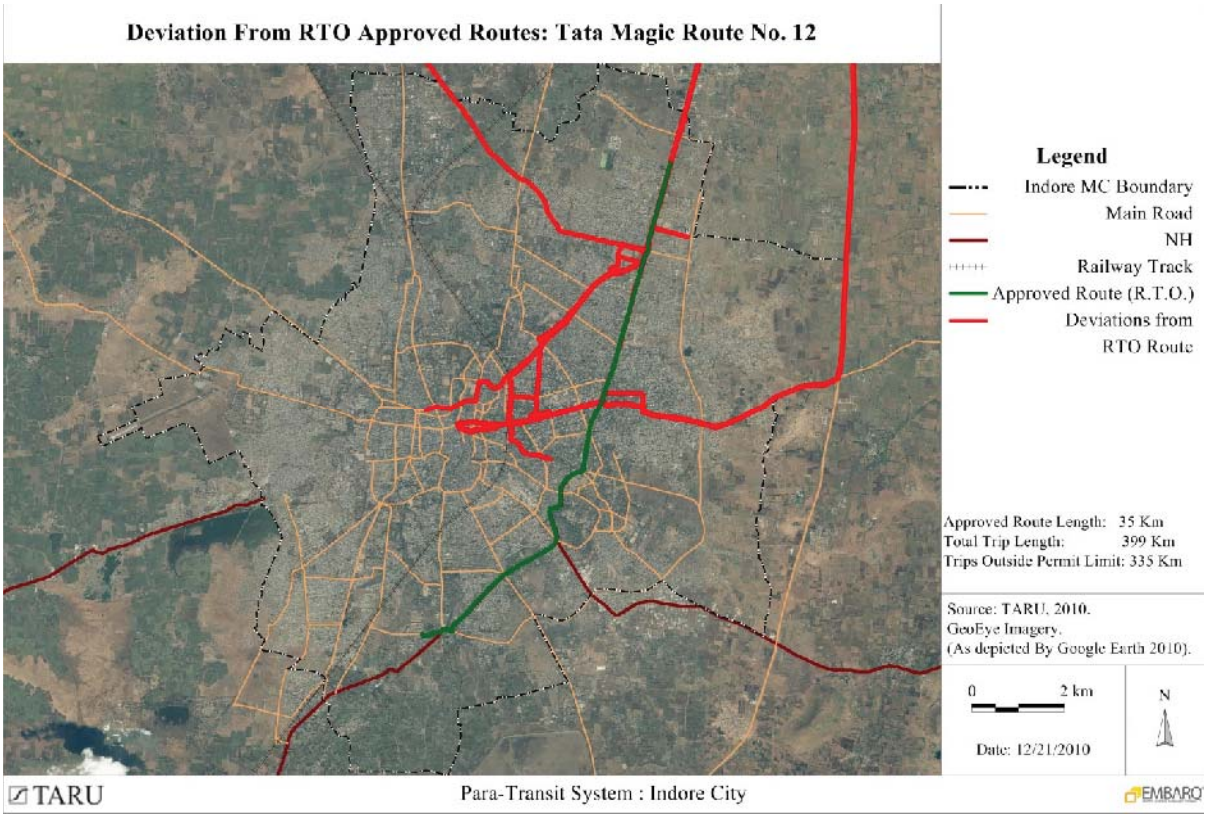

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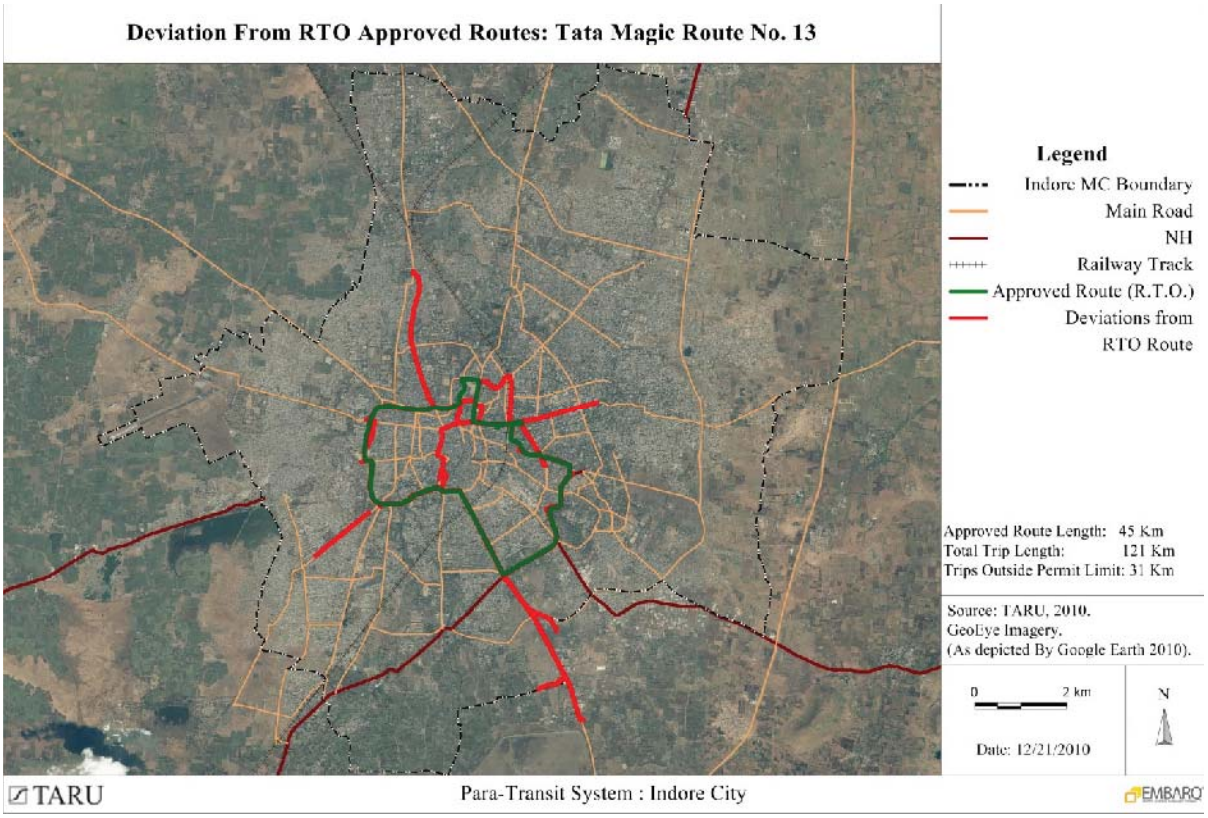

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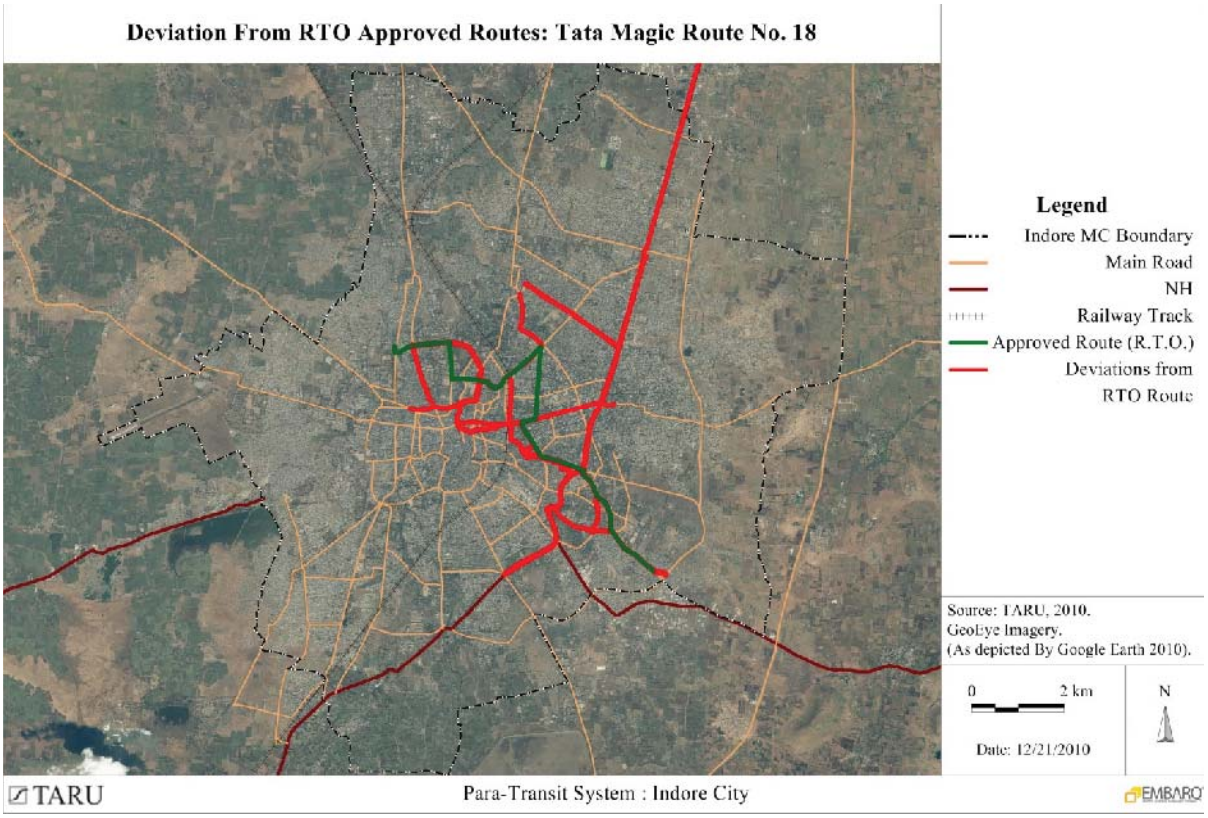
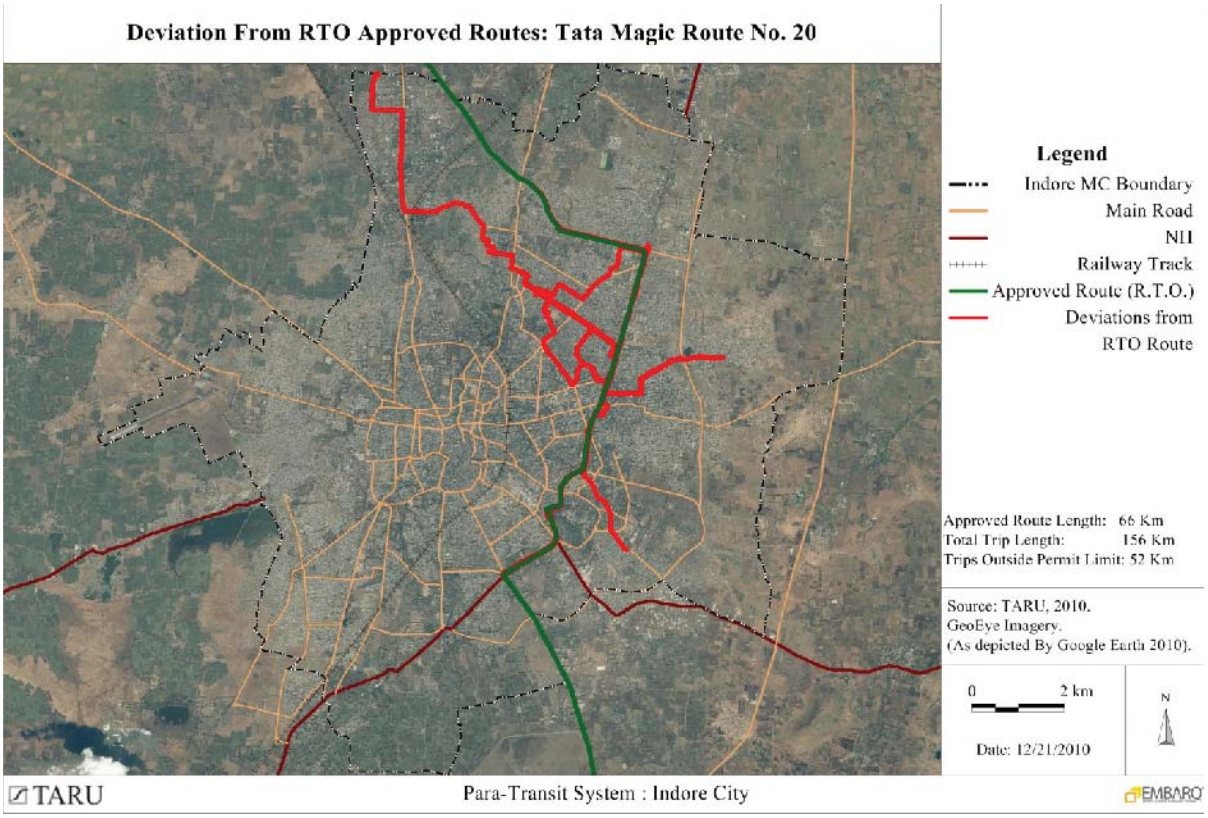
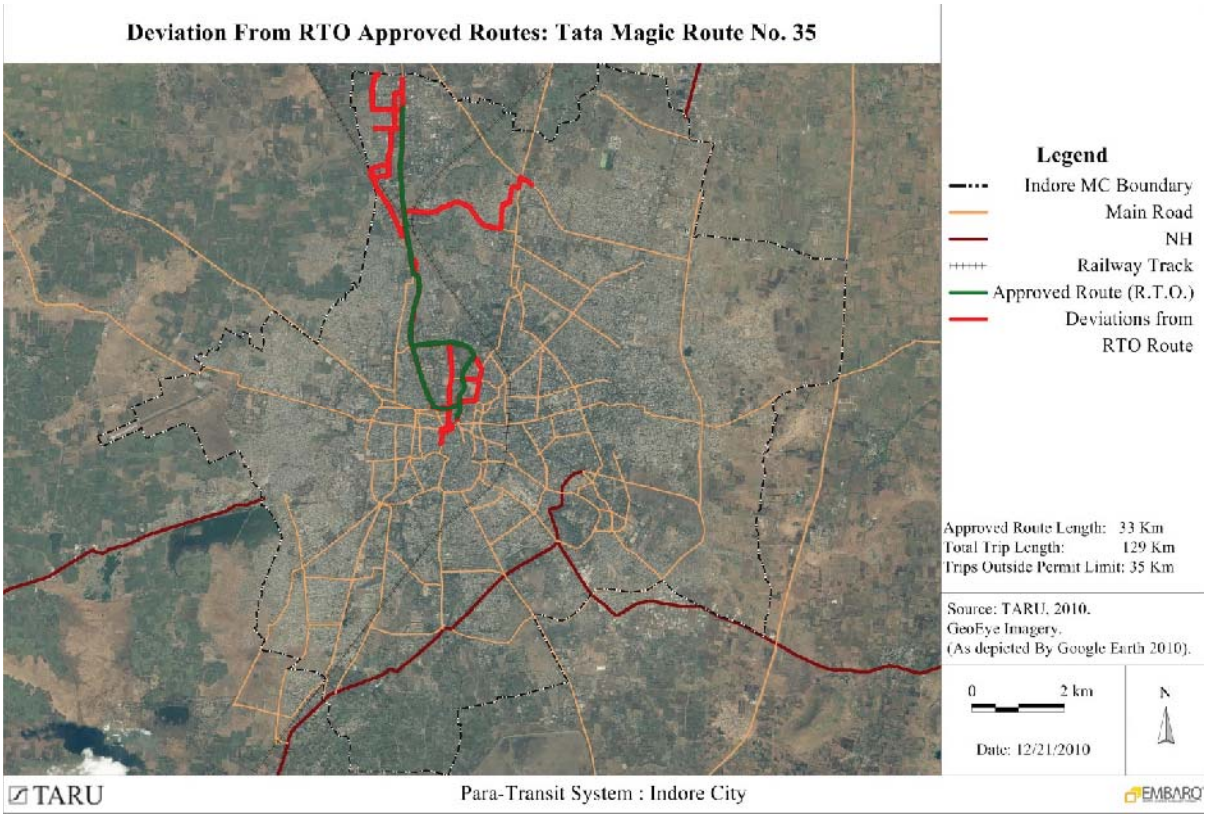


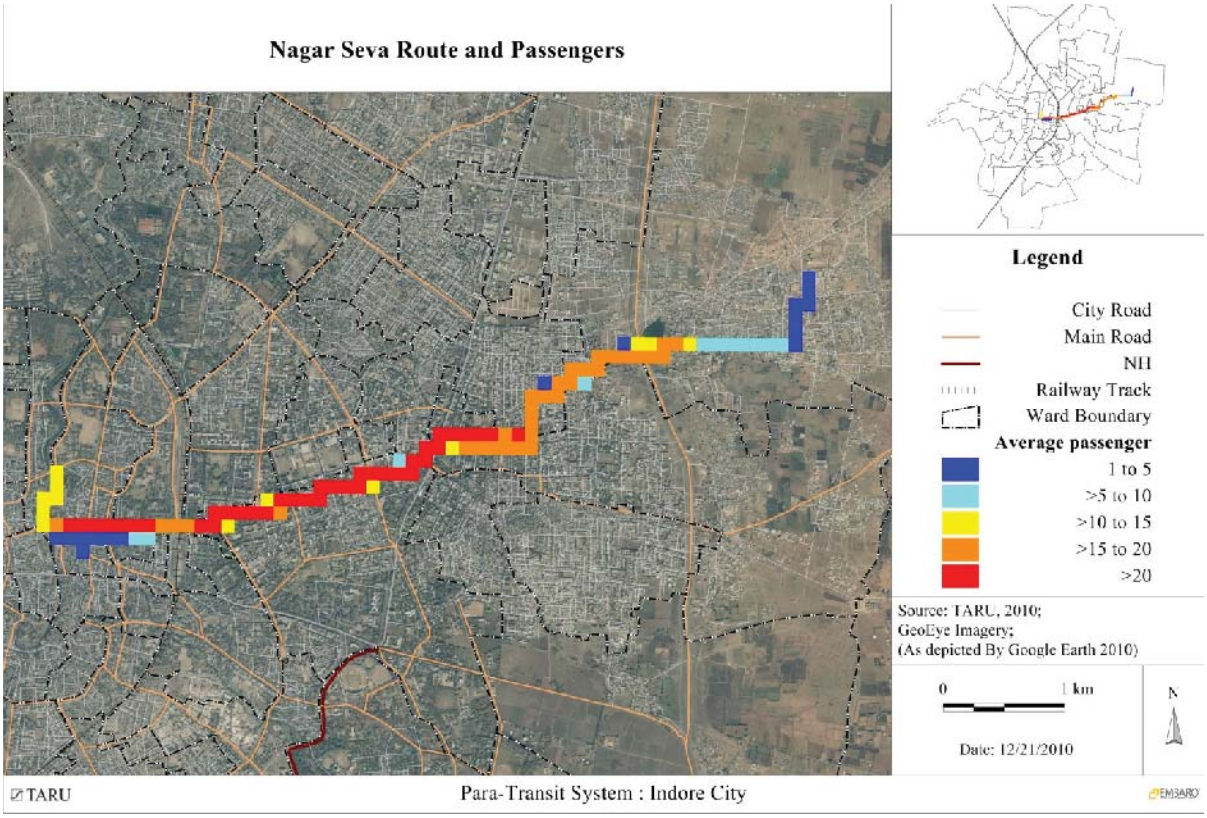
Tata Magic Route No.20



Tata Magic Route No.35



Annex G: Nagar Seva Route and Passengers



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