CHAPTER 5.0

TRANSPORTATION SYSTEM AND TRAFFIC CHARACTERISTICS

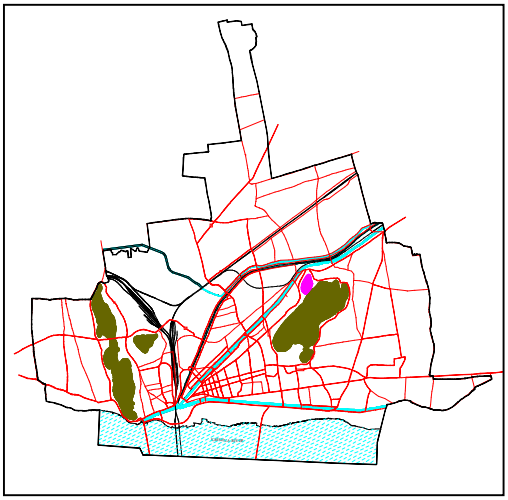
5.1 General

Assessment of traffic characteristics within an urban area is an essential pre -requisite to appreciate the problems with respect to traffic movement and to understand the need for organizing the same in an efficient and economical manner. Traffic characteristics help in appreciating the spatial and temporal features of travel within the area, relationship of traffic intensity with network capacity and the prevailing level of service obtained on various corridors of the network in the study area. This appreciation and understanding is essential for identifying the present conditions and constraints, formulating suitable policies and strategies, selecting relevant systems and designing individual components of the system.

In order to appreciate the traffic and transport system characteristics, a number of field traffic surveys (described in Chapter 4) were conducted within the study area. This chapter presents the survey findings.

5.2 Road Network Characteristics

The appreciation of road network characteristics is important to assess existing capacity level of the roads, level of service offered, identify the constraints, if any and assess the potential for improvement/upgradation of the road network to cater the existing and projected demands of traffic.



For the present study, a detailed inventory of 92 km of road network consisting of Arterials, Sub-Arterials and Collector Streets was carried out.

The road network inventory data was analysed in terms of parameters like type of road, ROW, carriageway, road classification, type of pavement, service lane availability, on -street parking, drainage facilities, footpath, street lighting facilities, road markings and road signage.

5.2.1 Characteristics of Major Roads

The salient characteristics of major roads are presented in **Table 5.1**. It is observed that the ROW of arterial roads varies between 21 m to 65 m. The ROW of roads in CBD area varies between 11 m to 17 m. The ROW of other major roads varies between 12m to 41m.

Table 5.1: Salient Characteristics of Major Roads

Roads	Effective Carriageway Width (m)		Right of Way (ROW)		Divided/ Undivided
	Maximum	Minimum	Maximum	Minimum	
A. Arterial/Sub-Atrerial Roads :					
NH – 5 Road	22.3	17.2	65	48	D
NH – 9 Road	20	7.5	29	22	D
Bandar Road	19.5	16	34	21	D
Eluru Road	20	7	28	24.2	D/UD
Nainavaram Road	5.0	3.5	-	-	UD
Old NH-9 Bypass Road	7	6.2	32	28	UD
B. Other Major Roads :					
Root No-5 Road	16	7	20	16	D
Nirmal Convent road	10	7.5	22	-	UD
Sambamurthy Road	18	18	25	18	D
Gandhinagar Road	15	-	17	-	UD
C K Reddy Road	18	7.5	33.5	17.9	D/UD
G S Raju Road	25.7	15.4	27.4	21	D
Vishalandra Road	7	5	20	14	UD
Indiragandhi Municipal Stadium Road	7.2	7	18	13.9	UD
Nakkala Road	8	-	12.2	-	UD
Dornakal road	12	8.3	19.3	-	UD
Museum Road	6	5.1	10.2	-	UD
Payakapuram Road	15	7.5	41.3	18.5	D/UD
Madhuranagar Road	21	5	27	18	UD
Kedereswaripet Road	7.5	7	19.3	12.4	UD
Vidyadharapuram Road	12	10	19	-	UD
Milk Project Road	16	10.2	28	24	UD
Tunnel Road	11.8	7.3	26.6	11.8	D
Nehru Road	16	-	23	-	D
Panja Road	15	-	20	-	D
Gandhi Hill Road	9.3	7	15	-	UD
C. CBD Roads :					
Besant Road	7.3	7.1	11.3	-	UD
Canal Road	15	-	17	-	D
Vasthralatha Road	10	7.5		-	UD
Lenin Center Road	7.2	6.4	14	-	UD
Apsara Theater	6.2	-	11	-	UD
Route No-5 Road (Part)	8	-	13	-	UD

Source: CES Survey, 2006

5.2.2 Right-of-Way

The distribution of road length by right-of-way reveals that 83.3 percent of the city's primary network has a right-of-way of up to 30 m. Only 16.7 percent of road network has ROW of 30 m and above. This length of road network has the potential for being developed into corridors with 4 lane or above carriageway. The distribution of road length by ROW is presented in **Table 5.2.**

Table 5.2: Distribution of Road Length by Right of Way

ROW(m)	% Road Length
Upto 10	5.4
10 to 15	20.2
15 to 20	25.2
20 to 30	32.5
30 to 40	10.4
40 to 60	4.4
above 60	1.9
Total	**100.0**

Source: CES Surveys, 2006

5.2.3 Carriageway Width

The distribution of road length by carriageway width shows that nearly 52 percent road network has 4-lane configuration. 23 percent of the network has 2-lane carriageway and 7.8 percent of the network has intermediate lane width. The distribution of road length by carriageway width is given below in presented in **Table 5.3.**

Table 5.3: Distribution of Road length by Carriageway width

Carriageway width (m)	% Road Length
Up to 4	2.2
4 to 6	7.8
6 to 8	22.8
8 to 11	10.3
11 to 15	51.9
>15	4.6
Total	**100.0**

Source: CES Surveys, 2006

About 60 percent of the road length in the city has undivided carriageway and needs attention for safety measures. The distribution of road length by type of carriageway is presented in **Table 5.4.**

Table 5.4: Distribution of Road Length by Type of Carriageway

Type of carriageway	% Road Length
Divided	39.2
Undivided	60.8
Total	**100.0**

Source: CES Surveys, 2006

5.2.4 Road Surface

About 98.4 percent of the road network has bituminous pavement. Road length with concrete surface accounted for 1.6 percent. Distribution of road length by type of road surface is given in **Table 5.5.**

Table 5.5: Distribution of Road length by type of Pavement

Pavement Type	% Road Length
BT	98.4
WBM	0.0
Concrete	1.6
Others	0.0
Total	**100.0**

Source: CES Surveys, 2006

5.2.5 Service Lane

Large part of the road network (92.1%), has no provision for service lane, which causes the traffic to use the principal network for all its access movement needs. This inter - mixing of access traffic with the through traffic due to absence of service lanes severe ly affects the level of service on the network.

5.2.6 On-street Parking

On-street parking results in loss of carrying capacity of the road network. It is observed that 33.6 percent of the road network has parking on both sides and 20.5 percent of the road length has parking on one side.

5.2.7 Pavement Condition

Analysis of the pavement condition expressed in terms of surface cracking, rutting, undulation/bumps, potholes, patches etc, reveals that the general quality of pavement is fair and on major corrid ors the pavement condition is good. The distribution of road length by condition of pavement is given in **Table 5.6.**

Table 5.6: Distribution of Road Length by Type of Pavement Condition

Pavement Condition	% Road Length
Very Good	2.0
Good	51.9
Fair	51.4
Poor	8.7
Total	**100**

Source: CES Surveys, 2006

5.2.8 Drainage Facilities

About 60 percent of the road length has roadside drainage facilities on both sides. About 13 percent of road length has drainage on one side only. The distribution of road length by availability of drainage facility is given in **Table 5.7.**

Table 5.7: Distribution of Road Length by availability of Drainage Facility

Drainage Facility	% Road Length
Available on Both sides	60.1
Available on one side	13.1
Not available	26.5
Total	**100.0**

Source: CES Surveys, 2006

Nearly 50 percent of the road length has open drainage facility. Road length with lined type accounted for 13.3 percent, while 3.8 percent of road length has covered drainage. About 33.4 percent of the identified network does not have drainage facility. The distribution of road length by type of drainage is presented in **Table 5.8.**

Table 5.8: Table Distribution of Road Length by Type of Drainage Facility

Type of Drainage	% Road Length		
	Left side	Right side	Total
Open	44.2	55	49.6
Lined	13.8	12.7	13.3
Underground	4.3	3.3	3.8
Not available	37.7	29	33.4
Total	**100.0**	**100.0**	**100.0**

Source: CES Surveys, 2006

5.2.9 Footpath Facilities

There is no footpath facilities on almost all the length of the road network, thereby forcing the pedestrian to walk on the carriageway reducing the capacity for vehicular movement exposing the pedestrians to risk.

5.2.10 Street Architecture & Control Systems

Street Lighting

Inventory of availability of street light facility indicates that abo ut 47 percent of the identified network has streetlight at center and 22 percent of the road length has street facility on both sides. About 31.2% of the network have any street lighting facility only on one side. The distribution of road length by availab ility of street light facility is presented in **Table 5.9.**

Table 5.9: Distribution of Road Length by Availability of Street Light Facility

Status of Illumination facility	% Road Length
Available on Both sides	21.7
Available on one side	31.2
Available at Center	47.1
Total	**100.0**

Source: CES Surveys, 2006

Road Markings

Roadway markings is one of the important features of streets for safety of traffic, especially high speed traffic, as it guides the traffic movement . Nearly 47 percent of the network does not have any road marking facility. The distribution of road length by availability of road marking facility is given in **Table 5.10.**

Table 5.10: Distribution of Road Length by Availability of Road Marking Facility

Road Markings	% Road Length
Center Line	8.0
Lane Marking	24.1
Edge Marking	8.9
Pedestrian Marking	12.1
Not Available	46.9
Total	**100.0**

Source: CES Surveys, 2006

Road Signage

Inventory of availability of road signage indicates that about 79.7 percent of the identified network does not have road signage. Only 20.3 percent of road length has road signage. The distribution of road length by availability of road signage is presented in **Table 5.11.**

Table 5.11: Distribution of Road Length by Availability of Road Signage Facility

Road Signage	% Road Length
Prohibitory	8.3
Mandatory	6.3
Informatory	5.7
Not available	79.7
Total	**100.0**

Source: CES Surveys, 2006

5.3 Traffic Characteristics

The main objective of classified traffic volume counts was to assess the traffic characteristics in terms of average daily traffic, hourly traffic variation, peak hour traffic, traffic composition and directional distribution. The surveys were conducted manually, on a normal working day, for 24 hours at 7 outer cordon (OC) and 4 inner cordon (IC) count stations (0800 – 0800 hrs of next day); at seventeen screen lines (SL) and three mid-block locations for 16 hours (0600 – 2200 hrs); and at seventeen junction (JN) locations for 12 hours (0800 - 2200 hrs).

5.3.1 Passenger Car Equivalency

Many vehicle types different in size and performance can be observed on Indian roads occupying the same space. In addition to the motorized vehicles presence of non - motorized vehicles such as animal/hand drawn, cycle etc, is a common sight. In order to express the intensity of traffic, it would be convenient to express all these different vehicle types in single unit terms. For this purpose, IRC has recommended a set of Passenger Car Units (PCUs) for various vehicle types considering their characteristics, both physical and mechanical. These factors are different for rural and urban conditions.

In the present context PCU factors recommended for urban areas (IRC 106:1990) have been adopted and are given in **Table 5.12**.

Table 5.12: Passenger Car Units

Type	Mode	PCUs
Passenger Vehicles	Two Wheeler	0.5
	Three Wheeler	1.0
	Car/Jeep/Van/Taxi	1.0
	Mini Bus	1.5
	Standard Bus	3.0
Freight Vehicles	Tempo/ LCV	1.5
	2 / 3 Axle	3.0
	Multi Axle	4.5
	Agriculture Tractor	1.5
	Agriculture Tractor Trailer	4.5
Slow Moving Vehicles	Animal / Hand Drawn	2.0
	Cycle	0.5
	Cycle Rickshaw	6.0

Source: IRC-106:1990

5.3.2 Outer Cordon Survey

Average Daily Traffic(ADT)

Traffic volume count surveys were conducted at seven locations at the outer cordon of the study area for 24 hours on a typical working day. On an average about 1,97,784 vehicles (2,69,075 PCUs) move in and out of the Vijayawada Urban Area (Study area) per day. Hyderabad Road (NH-9) (OC-3) caters to highest traffic volume per day amongst the seven locations with about 50,062 vehicles (77,785 PCUs) followed by Kolkata Road (NH-5) (OC-6) at 39,414 vehicles (61,862 PCUs). Lowest traffic volume was observed on Nainavaram Road (OC-4) (1,451 vehicles (2,204 PCUs) per day.

The traffic intensity and the location-wise share in total traffic at the outer cordon locations presented in **Table 5.13**. Hyderabad Road, Barrage Road, Chennai Road, Machilipatnam Road and Kolkata Road account for about 95.4 percent (in vehicles) of the total traffic entering and exiting the Vijayawada Urban Area. Nuzvedu Road caters to about 3.66 percent and Nainavaram Road 0.73 percent of the total traffic.

Table 5.13: Average Daily Traffic at Outer Cordon

Location	Incoming		Outgoing		Total (ADT)	
	Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs
OC1, Tadepalli (Chennai Road)	15759 (15.78%)	30027 (16.86%)	16504 (39.06%)	29025 (21.76%)	32263 (16.31%)	59052 (21.95%)
OC2*, Undavalli (Barrage Road)	19368 (19.39%)	13013 (9.59%)	16153 (16.50%)	10808 (8.10%)	35521 (17.96%)	23821 (8.85%)
OC3, Gollapudi (Hyderabad Road)	25166 (25.19%)	38156 (28.12%)	24896 (25.43%)	39629 (29.72%)	50062 (25.31%)	77785 (28.91%)
OC4, Nainavaram Road	708 (0.71%)	1148 (0.85%)	743 (0.76%)	1056 (0.79%)	1451 (0.73%)	2204 (0.82%)
OC5, Payakapuram (NuzveduRoad)	3769 (3.77%)	4006 (2.95%)	3466 (3.54%)	3818 (2.86%)	7235 (3.66%)	7824 (2.91%)
OC6, Prasadampadu (Kolkata Road)	18589 (18.61%)	30096 (22.18%)	20825 (21.27%)	31766 (23.82%)	39414 (19.93%)	61862 (22.99%)
OC7, Kanoor (Machilipatnam Road)	16534 (16.55%)	19268 (14.20%)	15304 (15.63%)	17259 (12.94%)	31838 (16.10%)	36527 (13.58%)
All Locations	**99,893 100.0%)**	**1,35,714 (100.0%)**	**97,891 (100.0%)**	**1,33,361 (100.0%)**	**1,97,784 (100.0%)**	**2,69,075 (100.0%)**

Note: Figures in bracket indicate percentage share of total
**Buses, HCVs and MAV vehicles are restricted on the Barrage Road*
Source: CES Survey, 2006

No major imbalance in directional distribution has been observed across different outer cordon locations. The overall directional distribution at the cordon line is 50.5 percent in favour of incoming vehicles. The location wise classified traffic count data has been presented in **Annexure 5.1**.

Traffic Composition

Modal composition amongst total traffic varies considerably at different locations (**Table 5.14)**. Amongst the total traffic crossing outer cordon, private vehicles account for 40.1 percent followed by public transport (22.6 percent) and freight vehicles (25.4 percent). **Figure 5.1** presents the modal composition at the outer cordon locations. Heavy truck movements are observed along Kolkata -Chennai(NH-5) Road, and heavy car/taxi movements are observed on Hyderabad(NH -9)road. About 38.92 percent two wheelers are observed at Undavalli on Prakasham Barrage road.

Table 5.14: Traffic Composition at Outer Cordon Count Stations

(In percentage)

Location	Passenger Vehicles				Freight Vehicles		Slow Moving Vehicles
	Two Wheelers	Three Wheelers	Car/ Jeep Van / Taxi	Bus	Truck	Tractor	
OC1, Tadepalli (Chennai Road)	22.91	6.83	15.18	10.60	41.52	0.24	2.72
OC2, Undavalli (Barrage Road)	38.92	30.83	7.95	0.00	3.43	0.00	18.87
OC3, Gollapudi (Hyderabad Road)	17.94	13.66	17.64	8.61	30.78	0.57	10.80
OC4, Nainavaram Road	9.30	39.83	7.10	5.51	31.56	3.31	3.38
OC5, Payakapuram (NuzveduRoad)	35.85	19.16	9.21	7.16	12.63	1.35	14.64
OC6, Prasadampadu (Kolkata Road)	22.90	13.58	14.17	4.18	35.88	0.26	9.03
OC7, Kanoor (Machilipatnam Road)	31.20	15.08	13.95	8.34	14.93	0.13	16.38

Source: CES Survey, 2006

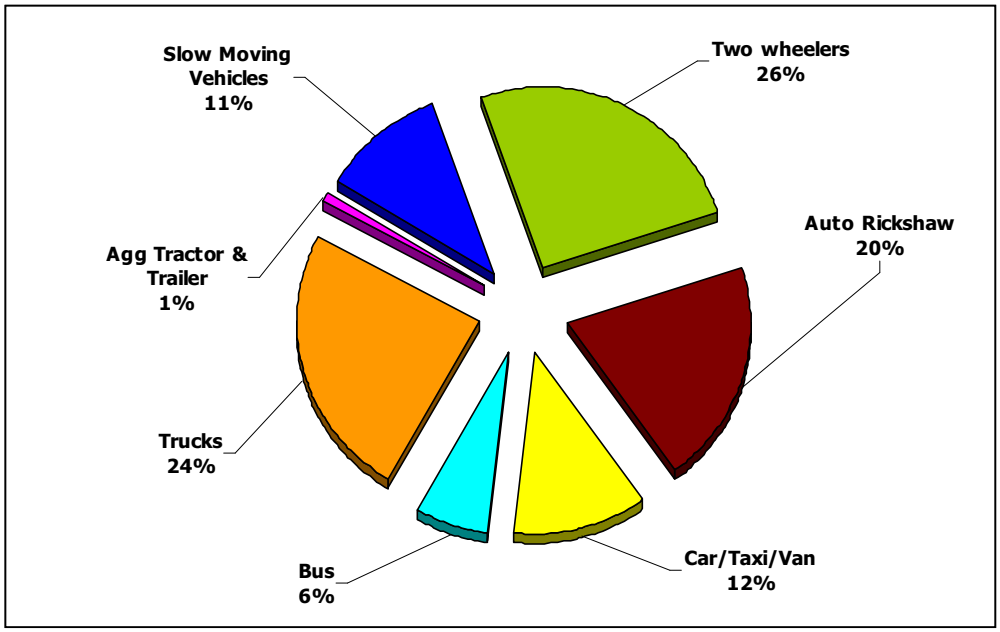


Figure 5.1: Traffic Composition at Outer Cordon

Temporal Variation of Traffic

The temporal variation of traffi c shows that most of the traffic moves in the day time. The hourly variation at the outer cordon shows that about 85 percent traffic moves between 6 AM to 10 PM, while the balance 15 percent moves in the night hours. Hourly variation of traffic at the oute r cordon locations is presented in **Figure 5.2**.

At most of the locations 10:00 AM to 11:00 AM is the peak hour. The day(6:00 AM - 10:00 PM) and night (10:00 PM -6.00 AM) traffic along with peak hour traffic volumes are presented in **Table 5.15**. Peak hour traffic (in terms of total traffic) ranged between 6.7 and 8.7 percent.

Table 5.15: Temporal Variation of Traffic at Outer Cordon

Location	% Share of		Total Traffic (*In Vehicles*)	Peak Hour Traffic (*In Vehicles*)	Peak Hour % of ADT
	Day Traffic	Night Traffic			
OC1, Tadepalli (Chennai Road)	78.2	21.8	32263	2324	7.2
OC2, Undavalli (Barrage Road)	87.1	12.9	35521	3022	8.5
OC3, Gollapudi (Hyderabad Road)	89.7	10.3	50062	3670	7.3
OC4, Nainavaram Road	84.0	16.0	1451	111	7.6
OC5, Payakapuram (NuzveduRoad)	88.1	11.9	7235	547	7.6
OC6, Prasadampadu (Kolkata Road)	81.3	18.7	39414	2628	6.7
OC7, Kanoor (Machilipatnam Road)	83.7	16.3	31838	2777	8.7

Source: CES Survey, 2006.

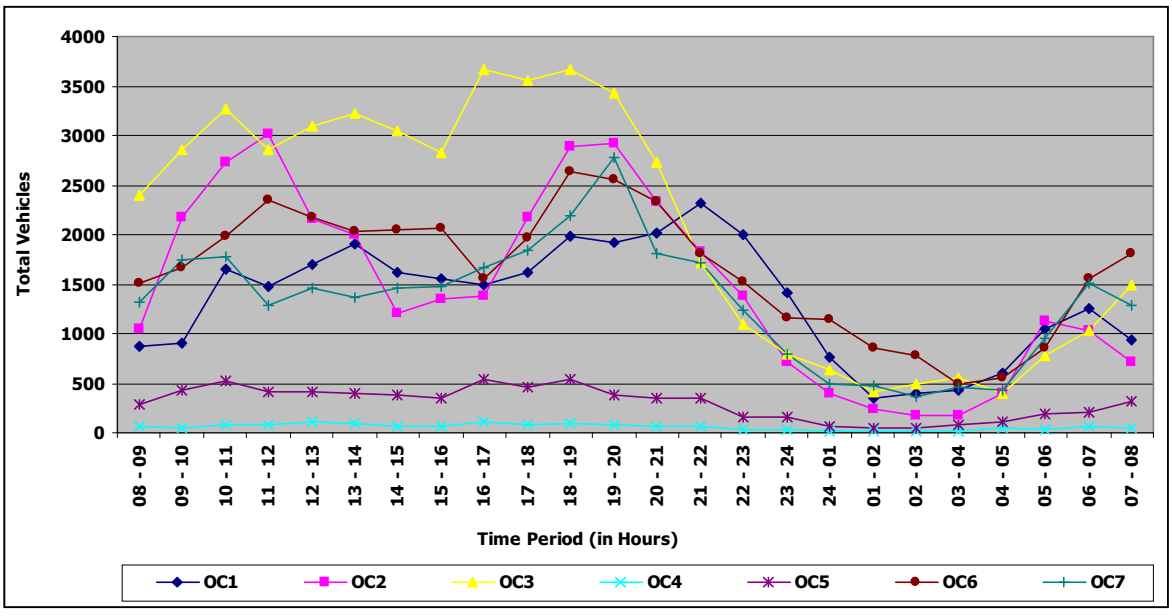


Figure 5.2: Temporal Variation of Traffic at Outer Cordon

5.3.3 Travel Characteristics– Outer Cordon

In order to understand the travel pattern of the traffic entering and exiting the study area, Origin-Destination surveys for 24 hours were conducted at all the outer cordon locations. This section describes the travel desire characteristics, purpose of travel, loading pattern of freight vehicles etc.

5.3.3.1 Passenger Vehicles

Travel Pattern

Travel pattern varied widely amongst different locations. The location wise travel pattern of motorised passenger traffic at the outer cordon is presented in **Table 5.16**. While Internal-External traffic accounts for 45.5 percent share, External-Internal traffic accounts for 49.0 percent share. External-External in through traffic, i.e. 5.5 percent. The combined passenger modes O-D matrix at the outer cordon survey locations is presented in **Annexure 5.2**.

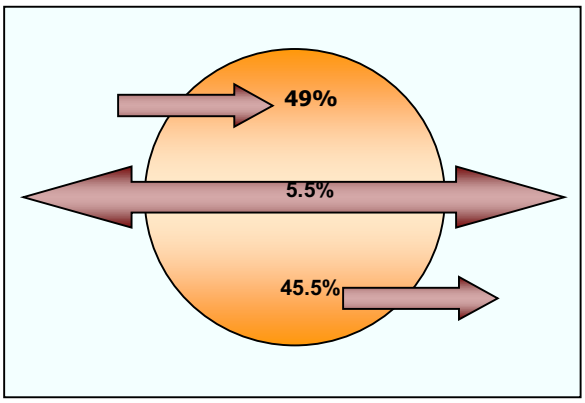


Table 5.16: Travel Pattern of Passenger Vehicles at Outer Cordon

Location	Internal – External	External - Internal	External - External	Total
OC1, Tadepalli on NH-5 Road	8316	7876	1721	17913
	14.7%	13.0%	25.2%	14.4%
	46.4%	44.0%	9.6%	**100.0%**
OC2, Undavalli	12281	14807	511	27599
	21.8%	24.4%	7.5%	22.3%
	44.5%	53.6%	1.9%	**100.0%**
OC3, Gollapudi on NH-9	12080	14235	2643	28959
	21.4%	23.4%	38.7%	23.4%
	41.7%	49.2%	9.1%	**100.0%**
OC4, Nainavaram Road	471	416	9	896
	0.8%	0.7%	0.1%	0.7%
	52.5%	46.4%	1.0%	**100.0%**
OC5, Nuzvedu Road	2471	2602	91	5164
	4.4%	4.3%	1.3%	4.2%

Location	Internal – External	External - Internal	External - External	Total
	47.8%	50.4%	1.8%	**100.0%**
OC6, Prasadampadu on NH5 Kolkata Road	10848	9564	1197	21609
	19.2%	15.7%	17.5%	17.4%
	50.2%	44.3%	5.5%	**100.0%**
OC7, Kanoor on NH-9 Road	9950	11226	653	21829
	17.6%	18.5%	9.6%	17.6%
	45.6%	51.4%	3.0%	**100.0%**
All Locations	56415	60728	6826	123969
	100.0%	**100.0%**	**100.0%**	**100.0%**
	45.5%	49.0%	5.5%	**100.0%**

Source: CES Survey, 2006

Comparatively high intensity of through traffic of passenger vehicles has been observed on Hyderabad Road (NH-9) and Chennai-Kolkata Road (NH-5).

Figure 5.3 shows the desire line pattern of the passenger vehicles at outer cordon.

Average Trip Length

Average trip lengths of predominant modes at the outer cordon are presented in **Table 5.17**. Private Buses have the maximum average trip length (295 km) followed by cars (85 km) and Govt buses (72.9 km). **Figure 5.4.** presents overall trip length of modes at different count stations.

Table 5.17: Mode Wise Average Trip Length at Outer Cordon

(in Km)

Vehicle Type	Location							Total
	OC1	OC2*	OC3	OC4	OC5	OC6	OC7	
2Wheeler	12.5	16.4	14.8	14.5	15.2	15.6	16.7	15.1
3Wheeler	12.5	12.5	12.5	12.6	12.9	12.5	13.0	12.6
Car/Jeep	57.0	55.9	101.3	22.8	39.4	66.3	39.2	57.3
Taxi	90.3	75.9	137.3	14.1	27.8	83.0	74.5	85.0
Mini_Bus	57.5	-	79.2	15.6	20.2	55.5	48.4	52.6
Govt-Bus	78.0	-	103.1	33.3	34.5	117.7	44.3	72.9
Private-Bus	283.6	-	330.8	37.5	25.0	411.0	120.0	295.0

Source: CES Survey, 2006
*Note: * Bus of HCV and MAV Vehicles are restricted on the Barrage road*

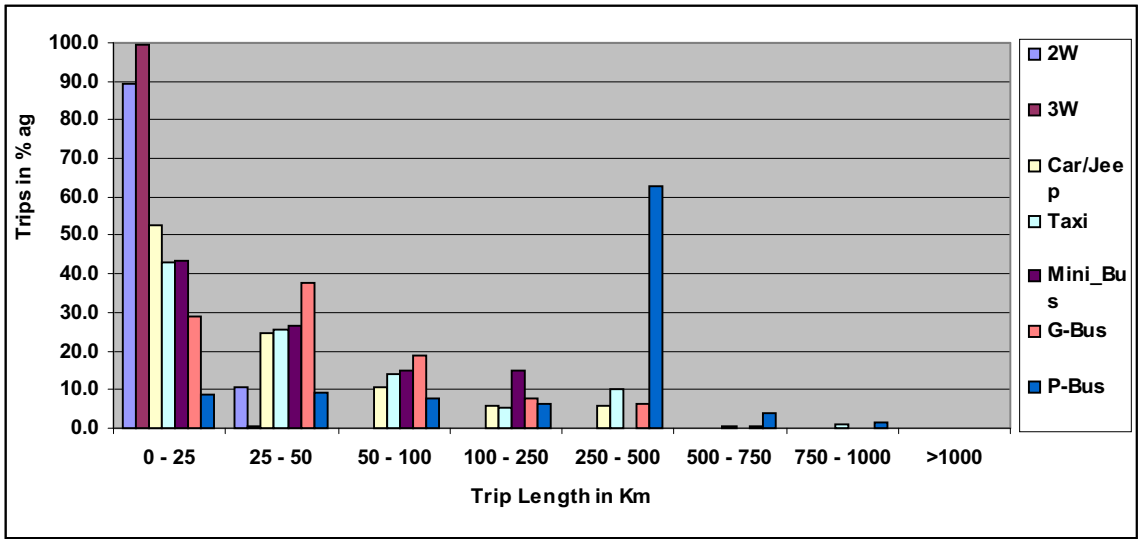


Figure 5.4: Overall distribution of trips by trip length.

Most of the modes (2w, 3w, car, taxi, and mini bus, City Bus) have trip lengths up to 25 km. About 89.6 percent of 2 wheelers and 99.6 percent of 3 wheelers trips have trip lengths of 25 km respectively. About 66.5 percent govt. bus trips have trip lengths of 50 km. On the other hand, 68.3 of percent of private bus trips have trip lengths of above 250 km. 94 percent of Cars and 85 percent of Taxies are observed to make trips upto 250 km. The shares fall down uniformly with increase in average trip lengths.

Annexure 5.3 presents Distribution of Vehicle Trips in 1 length at outer cordon location

Average Occupancy

The average occupancy of the 2w, 3w, car, taxi, mini bus, govt_bus and private_bus is 1.43, 3.6, 3.67, 3.7, 14.3, 46.6 and 42.1 respectively.

Average mode-wise occupancy levels at individual cordon locations are presented in **Table 5.18**.

Table 5.18: Average Occupancy of Predominant Modes

(in number)

Mode	OC1	OC2	OC3	OC4	OC5	OC6	OC7	Total
2Wheelers	1.10	1.40	1.50	1.6	1.4	1.3	1.4	**1.43**
3Wheelers	2.10	3.80	3.60	3.7	3.4	3.4	3.3	**3.6**
Car/Jeep	3.83	3.63	3.78	3.69	3.44	3.68	3.56	**3.67**
Taxi	3.40	4.56	4.03	3.5	3.32	3.17	3.82	**3.7**
Mini_Bus	14.07	-	14.50	7	11	16	15.94	**14.3**
Govt_Bus	41.20	-	54.40	45.4	40.1	45.7	49.1	**46.6**
Private Bus	42.00	-	42.30	35	30.7	40.9	44.3	**42.1**

Source: CES Survey, 2006

Passenger Size

An estimated 8,49,916 passengers enter and exit the city on an average day (**Table 5.19**)

Table 5.19: Passenger Travel Pattern at Outer Cordon

Movement Pattern	Passenger Trips (per day)
Internal - Internal	-
Internal - External	389063
External - Internal	378948
External - External	81904
Total	**8,49,916**

Source: CES Survey, 2006

Trip Purpose

Work and business trips together account for a major share of trips followed by return home and religious trips. **Table 5.20** gives the distribution of passenger trips by purpose.

Table 5.20: Distribution of Vehicles Trips by Purpose of Travel at Outer Cordon

(in Percentage)

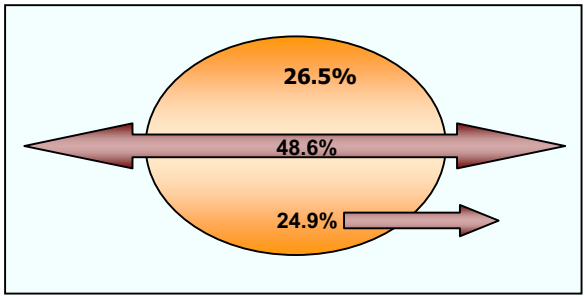
Purpose	Mode				
	2-Wheeler	**3Wheeler**	**Car/Jeep**	**Taxi**	**Mini Bus**
Work	39.4	0.1	11.3	12.7	6.9
Business	18.2	0.0	54.5	42.5	24.8
Education	7.4	1.2	6.5	3.3	7.9
Social	10.0	0.1	3.3	6.9	0.0
Shopping	4.8	0.3	4.3	8.3	0.0
Recreation/Tourism	0.4	0.9	2.8	10.5	4.0
Religious	7.4	0.4	7.1	9.9	18.8
Medical	3.3	0.5	1.9	4.4	37.6
Return Home	8.9	2.5	8.4	1.4	0.0
Others	0.0	94.2	0.0	0.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: CES Survey, 2006

5.3.3.2 Freight Vehicles

Predominant modes carrying freight in to and out of Vijayawada City are light commercial, heavy trucks and multi axle trucks. Following sections briefly describe the freight movement pattern at the outer cordon.

Travel Pattern



About 50,947 freight vehicles entered/exited the city on an average day. Of this 24,774 vehicles (48.6%) were through trips. 12,502 Vehicles (26.5%) were destined to Vijayawada while 12,670 vehicles (24.9%) originated from the city. Kolkata road (NH-5) accounted for a larger share of freight vehicles (59.6%) followed by Chennai road (NH-5)at 56.6 percent and Hyderabad road (NH-9) at 41.4 percent trips. The freight traffic pattern at outer cordon is shown in **Figure 5.5**.

The movement pattern of freight vehicles at different locations of the city outer cordon is presented in **Table 5.21.** The combined freight O-D matrix of the outer cordon survey locations has been presented in **Annexure 5.4.**

The desire line pattern of combined goods vehicles at the outer cordon is shown in **Figure 5.6** and through traffic movement pattern is shown in **Figure 5.7**.

Table 5.21: Location wise Travel Pattern of Freight Vehicles

Location Name	Internal - External	External - Internal	External - External	Total
OC1, Tadepalli on NH-5 Road	2554	3298	7620	13472
	20.2%	24.4%	30.8%	26.4%
	19.0%	24.5%	56.6%	**100.0%**
OC2, Undavalli	476	591	153	1220
	3.8%	4.4%	0.6%	2.4%
	39.0%	48.4%	12.5%	**100.0%**
OC3, Gollapudi on NH-9	4636	4616	6445	15697
	36.6%	34.2%	26.0%	30.8%
	29.5%	29.4%	41.1%	**100.0%**
OC4, Nainavaram Road	227	225	55	506
	1.8%	1.7%	0.2%	1.0%

Location Name	Internal - External	External - Internal	External - External	Total
	44.8%	44.4%	10.8%	**100.0%**
OC5, Nuzvedu Road	496	407	109	1012
	3.9%	3.0%	0.4%	2.0%
	49.0%	40.2%	10.7%	**100.0%**
OC6, Prasadampadu on NH5 Kolkata Road	2892	2870	8484	14246
	22.8%	21.3%	34.2%	28.0%
	20.3%	20.1%	59.6%	**100.0%**
OC7, Kanoor on NH-9 Road	1389	1495	1909	4794
	11.0%	11.1%	7.7%	9.4%
	29.0%	31.2%	39.8%	**100.0%**
Overall	12670	13502	24774	50947
	100.0%	100.0%	100.0%	**100.0%**
	24.9%	26.5%	48.6%	**100.0%**

Source: CES Survey, 2006

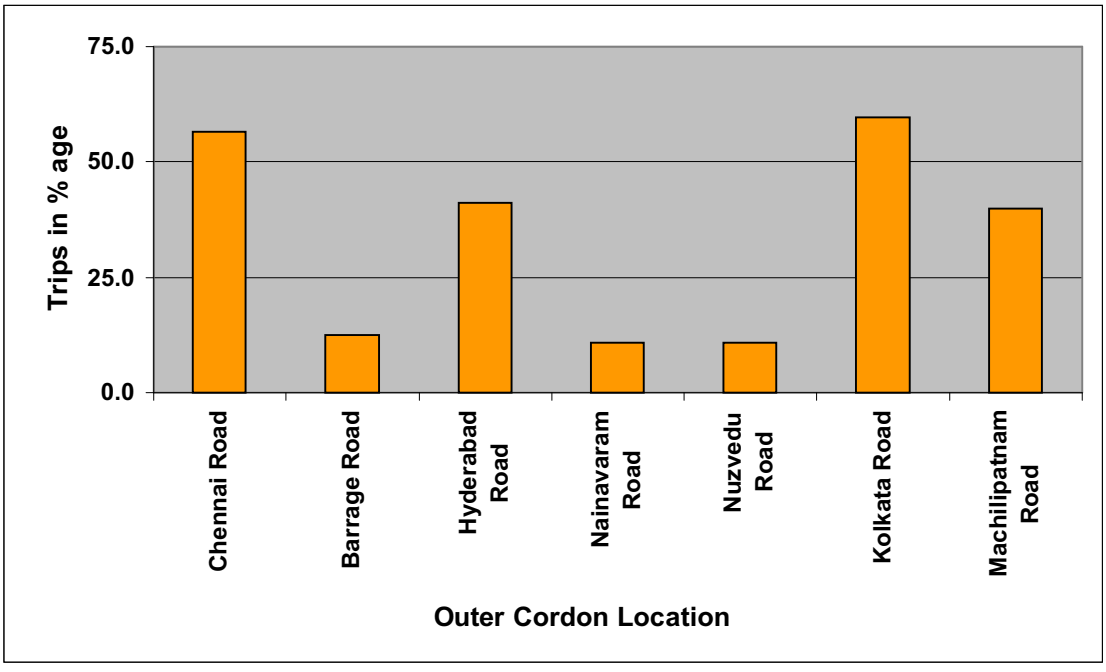


Figure 5.5: Through Traffic Distribution at Outer Cordon Locations

Lead-Load Distribution

The average trip length of 'Heavy Commercial Vehicles' was more than 350 km on Chennai-Kolkata road (NH-5) and Hyderabad road (NH-9). This indicates long distance inter-regional movement of freight vehicles along these roads. Multi Axle trucks have a high trip length of grater than 700 km on same roads. The average trip lengths observed at the outer cordon locations are presented in **Table 5.22.**

Table 5.22: Average Trip Lengths of Freight Vehicles

(in Km)

Location	Average Trip Length (Km)			
	LCV	2 / 3 Axle	MAV	Tractor
OC1, Tadepalli on NH-5 Road	96.8	477.7	745.7	12.5
OC2, Undavalli	32.9	-	-	-
OC3, Gollapudi on NH-9	84.9	373.5	714.1	12.5
OC4, Nainavaram Road	19.7	27.6	375.0	12.5
OC5, Nuzvedu Road	46.4	55.5	37.5	12.5
OC6, Prasadampadu on NH5 Kolkata Road	78.5	596.8	853.3	12.5
OC7, Kanoor on NH-9 Road	46.1	331.9	620.7	12.5

Source: CES Survey, 2006

The observations on lead analysis show that, about 93% of Multi axle trucks and 69.5% of HCV trucks have a trip length greater than 100 km. 78.4 % of LCVs have a trip length of less than 50 km. Tractor and Tractor Trailers (100 %) have a trip length of less than 25 km. The lead distributio n by modes is presented in **Figure 5.8. Annexure 5.5** presents the distribution of vehicle trips by trip length at outer cordon locations.

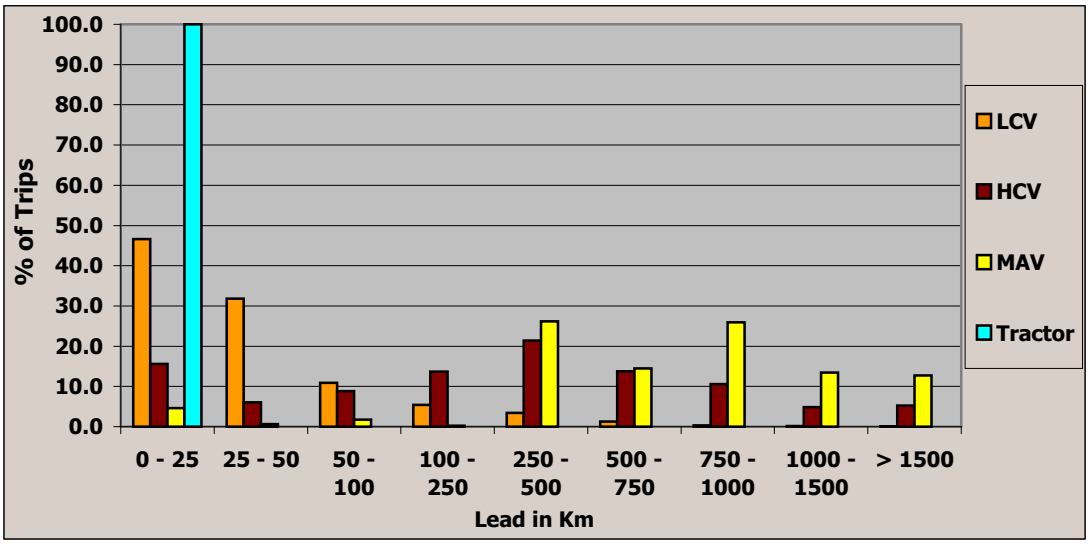


Figure 5.8: Lead Distribution of freight vehicle

The analysis on load characteristics sho ws that the average payload carried by LCVs, HCVs, MAVs and Tractor Trailers are 2.6, 8.2, 13.7 and 1.2 tonnes respectively. Similarly, payload excluding empty vehicles is 3.9, 10.0, 15.0 and 1.8 tonnes for LCVs, HCVs, MAVs and Tractor Trailers respective ly.

The observations on lead analysis show that, 33.4% of LCVs, 17.5% of HCVs and 8.8% of MAVs are empty vehicles. About 89.7% of MAVs carry load greater than 15.0 tonnes and 67.7 % of HCVs carry load between 7.5 to 15.0 tonnes. Similarly, 82.0% of LCVs carry load up to five tonnes. Load distribution of goods vehicles is shown in **Figure 5.9. Annexure 5.6** presents distribution of vehicle trips by Load at outer cordon locations.

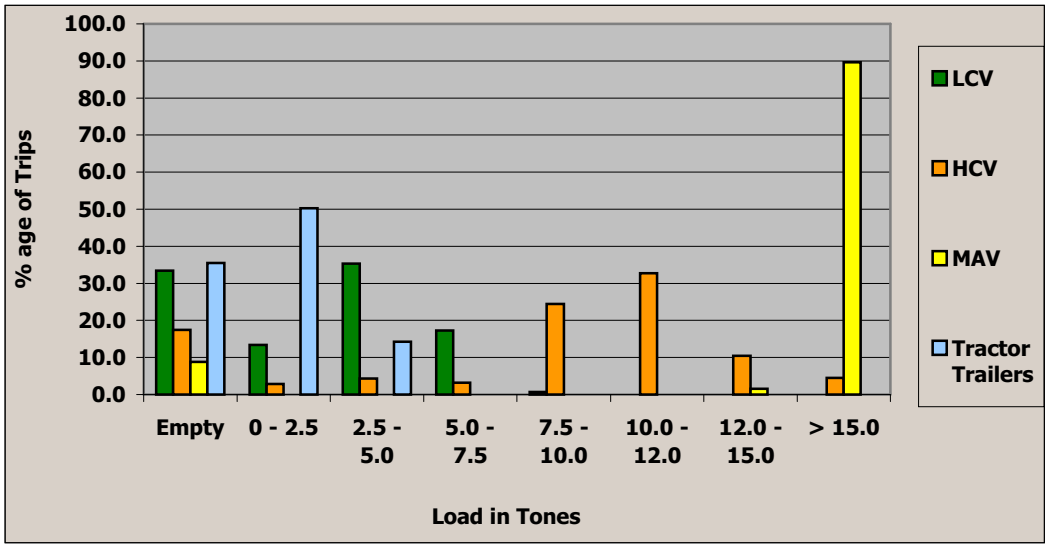


Figure 5.9: Load Distribution of Freight Vehicle

Commodity Distribution

In order to understand the loading pattern and commodity movement, all the commodities have been grouped into 10 categories as given below:

No.	Type of Commodity
1	Empty
2	Agricultural Products
3	Forest Products
4	Fuel, Oil & Gas
5	Construction Materials
6	Chemicals &Fertilizers
7	Iron & Steel
8	Food grains
9	Machinery
10	Others*

** Different commodities (fish, eggs, medicine, textiles, and other small quantities)*

The composition of various comm odities at different cordon points is presented in **Table 5.23**. Empty trucks account for 23.8 percent of the total vehicles, while 'construction materials' account for a major share of 13.7 percent followed by 'machinery' at 12.9%, 'others' at 10.4%, 'iron & steel' at 11.5%, 'fuel, oil & gas' at 7.1 and 'food grains' at 6%.

Table 5.23: Distribution of Freight Vehicles by Commodity Carried

(in percentage)

Commodity	Location							Total
	OC1	OC2	OC3	OC4	OC5	OC6	OC7	
Empty	30.0	69.4	30.7	52.9	32.4	5.2	0.8	23.8
Agricultural Products	3.6	6.3	7.8	6.2	10.6	27.0	4.6	7.9
Forest Products	6.7	8.6	4.9	1.1	2.8	0.2	0.0	3.5
Fuel, Oil & Gas	6.8	2.9	7.6	0.9	1.8	13.6	2.4	7.1
Construction Materials	7.2	0.6	15.8	6.4	11.7	9.4	32.5	13.7
Chemicals &Fertilizers	1.6	0.3	1.6	0.0	0.6	8.5	6.6	3.4
Iron & Steel	13.6	3.7	12.7	3.8	1.8	9.9	23.9	11.5
Food grains	6.7	0.9	7.9	2.6	5.3	1.9	9.3	5.8
Machinery	8.3	0.3	7.6	12.5	26.3	20.4	0.5	12.9
Others*	15.3	7.1	3.4	13.5	6.8	3.9	19.3	10.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

** Different commodities (fish, eggs, medicine, textiles, and other small quantities)*
Source: CES Survey, 2006

5.3.4 Inner Cordon

An imaginary line surrounding the central area of Vijayawada has been identified as the Inner Cordon. A total of four loca tions for traffic survey were identified along the inner cordon and surveys were conducted for 24 hours,on a normal working day.

Average Daily Traffic

The location wise directional classified volume count data at the inner cordon line is presented in **Annexure 5.7**. **Table 5.24** presents the traffic volume at various locations and the location -wise share in total volume.

A total of 1,39,936 vehicles (1,45,769 PCUs) in a day were observed at the four count stations along the Inner Cordon.

Table 5.24: Average Daily Traffic at Inner Cordon

Location	Total Traffic		
	Vehicles	PCUs	% Share in Total Vehicles
IC-1, Bandar Road (MB1)	52,781	45,480	37.7
IC-2, Eluru Road (MB2)	24,941	23,114	17.8
IC-3, Canal Road (MB3)	38,464	58,373	27.5
IC-4,Gandhi Hill Road (MB4)	23,750	18,802	17.0
Total at Inner Cordon	**1,39,936**	**1,45,769**	**100.00**

Source: CES Survey, 2006

Traffic Composition

The traffic composition at the inner cordon locations is presented in **Table 5.25.** The share of private modes was highest at Bandar Road (49.1 percent), followed by Eluru road (42.90 percent). Maximum share of goods vehicles is observed at Canal road (27.3 percent). Significant share of slow moving vehicles was observed at all locations. It varies between 8.9 percent to 22.8 percent. **Figure 5.10** presents the modal composition at the inner cordon locations.

Table 5.25: Composition of Traffic at Inner Cordon Stations

(in percent)

Location	Passenger Vehicles				Freight Vehicles		Slow Moving Vehicles
	Two Wheelers	Three Wheelers	Car/ Jeep Van / Taxi	Bus	Truck	Tractor	
IC-1, Bandar Road	36.57	24.30	12.55	4.57	0.64	0.02	21.36
IC-2, Eluru Road	34.95	26.08	8.05	5.44	2.48	0.16	22.84
IC-3, Canal Road	36.39	34.51	2.86	3.16	2.40	0.00	20.68
IC-4,Gandhi Hill Road	21.62	20.34	14.43	7.30	27.31	0.09	8.92

Source: CES Survey, 2006

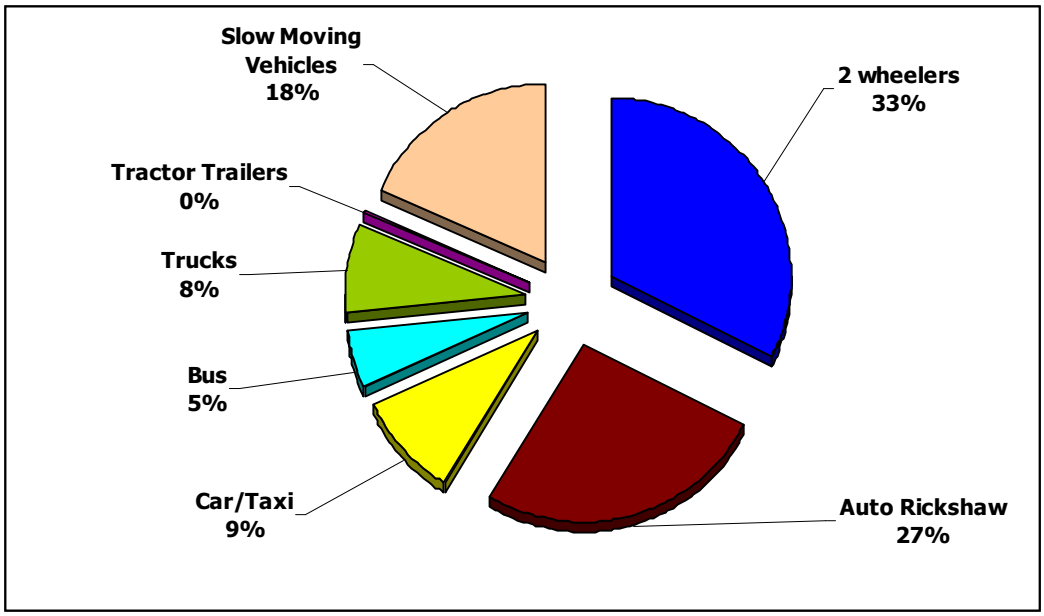


Figure 5.10:Modal Composition at the inner cordon

Temporal Variation of Traffic

The temporal variation of traffic shows that most of the traffic moves in the day time. The hourly variation at the inner cordon shows that about 87.4 percent traffic moves between 6 AM to 10 PM, while the balance 12.6 percent moves in the night hours. Hourly variation of traffic at the outer cordon locations is presented in **Figure 5.11**.

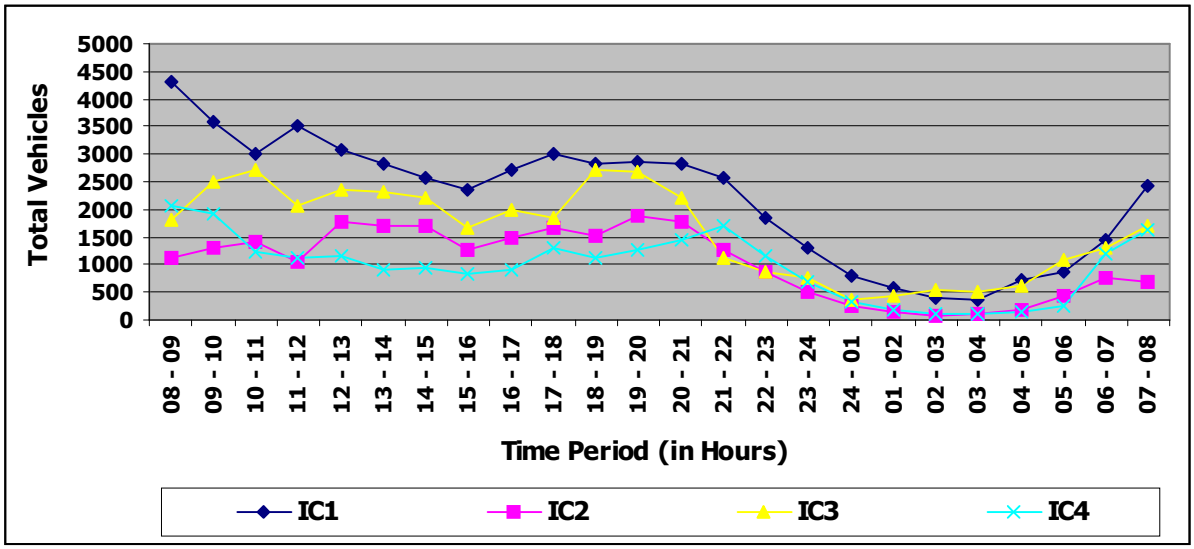


Figure 5.11: Temporal Variation of Traffic at Inner Cordon Location

The daily traffic volume along with morning and evening peak hour traffic volumes are presented in **Table 5.26**. Peak hour as percentage of daily traffic varies between 7.01 to 8.17 percent in the morning period and between 5.7 and 7.5 percent in the evening period.

Table 5.26: Peak Hour Traffic at Inner Cordon

Location	Morning Peak Hour			Evening Peak Hour		
	Peak Hour	Vehicles	% Share	Peak Hour	Vehicles	% Share
IC-1, Bandar Road	08:0000-9:00	4314	8.17	17:00-18:00	3023	5.7
IC-2, Eluru Road	12:00-13:00	1776	7.12	19:00-20:00	1876	7.5
IC-3, Canal Road	08:0000-9:00	2718	7.01	21:00-22:00	2720	7.1
IC-4, Gandhi Hill Road	10:00-11:00	2061	8.7	18:00-19:00	1704	7.1
Total		**10869**	**7.7**		**9323**	**6.6**

Source: CES Survey, December 2006

5.3.5 Screen Line

Ryves Canal Screen Line

Ryves Canal running south-east and passing through the Vijayawada city has been taken as the first screen line for understanding traffic movement pattern in the City. Classified traffic counts (16 hours) were conducted at the crossing facilities. On an average, every day 2,01,040 vehicles (1,88,411 PCUs) cross the Ryves canal of which Kalakshetram Bridge alone accounts for 29.69 percent followed by Kotta Vantena Bridge with 20.21 percent and Alankar Center Bridge with 19.32 percent. **Table 5.27** presents the traffic volume at the Ryves Canal screen line count stations.

Table 5.27: Average Daily Traffic at Ryves Canal Screen Lines (South-East)

Location ID	Location Name	Total Vehicles		Share in Total (%)
		Nos.	PCUs	
SL1	Kalakshetram Bridge	60571	60904	**29.69**
SL2	Hanuman Pet Bridge (Ryves Cannel)	34033	37598	**16.68**
SL3	Alankar Center-Lenin Center Bridge Road	39418	34355	**19.32**
SL4	Kotta Vantena (Ryves Cannel)	41246	33461	**20.21**
SL5	Rokallapalem Bridge	28772	22093	**14.10**
Total Ryves Canal Screen Line		**204040**	**188411**	**100.0**

Source: CES Survey, December 2006

Eluru Canal Screen Line

Eluru Canal running south-east and passing through the Vijayawada city has been taken as the second screen line for understanding traffic movement pattern in the City. Classified traffic counts (16 hours) were conducted at the crossing facilities. On an average, every day 1,18,854 vehicles (92,670 PCUs) cross the Eluru Canal of which maximum traffic was observed at Govt Press Bridge (28.0 percent). **Table 5.28** presents the traffic volume at the Eluru Canal screen line count stations.

Table 5.28: Average Daily Traffic at Eluru Canal Screen Lines (South-East)

Location ID.	Location Name	Total Vehicles		Share in Total (%)
		Nos.	PCUs	
SL6	Government press junction	33321	23216	**28.0**
SL7	Cement Factory - G S Raju road	31258	24663	**26.3**
SL8	Ambedkar Statue - Zimkhana club junction road	23796	16482	**20.0**
SL9	Eluru laakulu junction	18066	16644	**15.2**
SL10	Narayana swamy hotel junction	12413	11665	**10.4**
Total Eluru Canal Screen Line		**118854**	**92670**	**100.0**

Source: CES Survey, December 2006

Bandar Canal Screen Line

Bandar Canal running west-east and passing through the Vijayawada city has been taken as screen line for understanding traffic movement pattern in the City and 16 hours classified traffic counts were conducted at the crossing facilities. On average every day 49552 vehicles (26805 PCUs) cross the Bandar Canal. **Table 5.29** presents the traffic volume at the Ryves Canal screen line count stations.

Table 5.29: Average Daily Traffic at Bandar Canal Screen Lines (North-South)

Location ID.	Location Name	Total Vehicles		Share in Total (%)
		Nos.	PCUs	
SL11	Krishnalanka - Labbipeta road Bridge	28505	20505	**57.5**
SL12	Kedareswarapeta road Bridge	21047	16300	**42.5**
Total Bandar Canal Screen Line		49552	36805	**100.0**

Source: CES Survey, December 2006

Railway Lines Screen Line

Four Railway Lines running in north-south and west-east directions and passing through the Vijayawada city have been taken as other screen lines for understanding traffic movement pattern in the City and Classified traffic counts (16 hours) were

conducted at the crossing facilities. **Table 5.30** presents the traffic volume at different screen line count stations.

Table 5.30: Average Daily Traffic at Railway Line Screen Lines

Location ID.	Location Name	Total	
		Vehicles	PCUs
Vijayawada-Kolkata Railway Line Screen Line :			
SL13	Kedareswarapeta road	21731	16124
SL14	Budameru Bridge (Near Govt Press)	33718	23859
Vijayawada-Machilipatnam Railway Line Screen Line :			
SL15	Madhura Nagar road	17734	13418
Vijayawada-Hyderabad Railway Line Screen Line :			
SL16	Near Goods Cabin Railway Gate	1219	1842
Vijayawada-Chennai Railway Line Screen Line :			
SL17	Near Pandit Nehru Bus Station	20455	30694

Source: CES Survey, December 2006

The location-wise volume count data along the screen lines is presented in **Annexure 5.8**.

Mid Blocks

In order to understand the traffic characteristics o f important roads/corridors not covered in screen lines or inner cordon, mid block counts for 16 hours at three locations across the main roads and streets in the city were conducted. The data will be used to evaluate prevailing level of service on the roa d network.

Maximum traffic was observed at C K Reddy road (18768 vehicles) (18114 PCUs) followed by Y V Rao Hospital road (17093 vehicles 13173 PCUs). **Table 5.31**. presents the traffic volume at various mid blocks. Direction -wise traffic volume count sum mary for the mid block count locations is presented in **Annexure 5.9.**

Table 5.31: Average Daily Traffic at Mid Block Count Stations

Location ID	Location	Vehicles	PCEs
MB-5	C K Reddy Road	18768	18114
MB-6	Ramalingeswara Nagar Road	14878	10297
MB-7	Y V Rao Hospital Road	17093	13173

Source: CES Survey, 2004

Traffic Composition

The traffic composition at the mid blocks individual locations is presented in **Table 5.32**. The maximum share of two wheelers was observed at YVRao hospital road (45 percent). Similarly share of Auto Rickshaws varies between 11.19 percent to 27.47 percent. The significant amount of Slow Moving Vehicles was observed. It varies between 28.47 percent to 38.52 percent.

Table 5.32: Traffic Composition at Mid Block Count Stations

(in percentage)

Location	Passenger Vehicles				Freight Vehicles		Slow Moving Vehicles
	Two Wheelers	Three Wheelers	Car/ Jeep Van/Taxi	Bus	Truck	Tractor	
MB5, C K Reddy Road	27.04	27.47	2.90	1.81	2.22	0.05	38.52
MB6, Ramalingeswara Nagar Road	38.49	23.56	6.45	0.00	0.00	0.00	28.47
MB7, Y Rao Hospital Road	45.01	11.19	6.78	0.14	1.37	0.00	35.48

Source: CES Survey, 2006

Hourly Variation of Traffic

The morning peak hour was observed between 0900 to 1000 hours and evening peak hour between 1900 to 2000 hours. The pea k hour traffic at mid block counts stations are given in **Table 5.33.** Hourly variation of traffic at the mid block locations is presented in **Figure 5.12.**

Table 5.33: Peak Hour Traffic at Mid Block Count Stations

Location	Morning Peak hour Traffic		Evening Peak hour Traffic	
	Peak Hour	Vehicles	Peak Hour	Vehicles
MB5, C K Reddy Road	09:00-10:00	1336	19:00-20:00	1645
MB6, Ramalingeswara Nagar Road	12:00-13:00	680	20:00-21:00	1202
MB7, Y Rao Hospital Road	09:00-10:00	1572	19:00-20:00	1178

Source: CES Survey, 2006

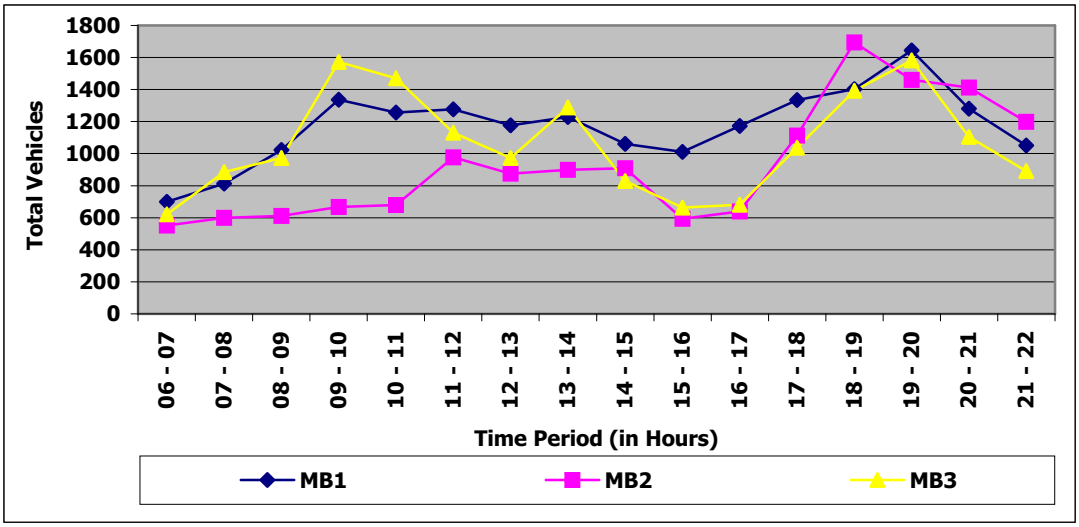


Figure 5.12: Hourly Variation of traffic at Mid Blocks

5.4 Speed and Delay Characteristics

Travel speed is an important characteristic of traffic. Its measurement is important in transport planning particularly to evaluate the road network system, provide vital inputs to transport demand modelling process and assist in economic analysis of improvement plans.

For the present study Speed and Delay survey was carried out on the identified study road network. The survey was carried out in peak hours adopting Moving Car Observer Method. The data collected was analysed to assess the speed characteristics along the identified road network and identify bottleneck locations and quantum of delay.

Spatial Speed profile

Spatial analysis of speeds on the road network indicates that there is a marked difference in average speeds between the core area (Besant Road -Eluru Road-KR Market-BRP Road) and areas outside the core. Distribution of road length by travel speeds is presented in **Table 5.34.**

Table 5.34: Distribution of Road Length by Average Speeds

Speed (km/hr)	% of Road Length		Total
	Core Area	Other Areas	
Upto 10	0.00	0.00	0.00
> 10 and <=20	48.31	17.79	23.13
> 20 and <=30	51.69	63.15	61.14
> 30 and <=40	0.00	16.84	13.89
> 40	0.00	2.22	1.83
Total	100.0	100.0	100.0

Source: CES Survey, 2006

48.31 percent of road length in the core area has speeds less than 20 kmph. On other hand 82.21 percent of road length outside core area has speeds exceeding 20 km.

Among Arterial/sub-arterial roads, NH-5 Road has the maximum speed (41.25 kmph) followed by NH-9 road (32.17 kmph). Low speeds prevail on the city corridors as compared to main arterial corridors. Among the city roads, maximum speed was observed on G S Raju road (28.70 kmph) while the minimum speed was in CBD areas (14 kmph). Maximum delay of 198 sec. occurred along Bandar Road followed by Eluru road (132 sec). **Table 5.35** present the Average Speed and Delay on Major Corridor.

Table 5.35: Average Speed and Delay on Major Corridor

Name of the Road/Corridor/Section	Length (Km)	Average Travel Speed (kmph)	Average delay (sec.)	Remarks
A. Arterial / Sub-Arterial Roads :				
NH – 5 Road	5.70	41.25	117.00	Intersection
NH – 9 Road	9.10	32.17	40.00	Intersection
Bandar Road	4.30	19.28	198.00	Intersection
Eluru Road	6.80	22.18	132.00	Intersection
Nainavaram Road	2.00	26.00	Negligible	-
Old NH-9 Bypass Road	1.40	21.64	Negligible	-
B. Other Major Roads :				
Route No-5 Road (Part)	3.05	21.30	30.00	Congestion
Nirmal Convent road	0.45	27.00	31.00	Congestion
Sambamurthy Road	1.90	28.16	20.00	Congestion
Gandhinagar Road	0.45	19.35	7.00	Congestion
C K Reddy Road	2.20	23.95	Negligible	-
G S Raju Road	2.90	28.70	Negligible	-
Vishalandra Road	2.05	16.71	66.00	-
Indiragandhi Municipal Stadium Road	0.60	27.30	Negligible	-
Nakkala Road	0.00	0.00	20.00	Congestion
Dornakal road	0.00	0.00	15.00	Congestion
Museum Road	0.00	0.00	20.00	Congestion
Payakapuram Road	3.90	26.36	Negligible	-
Madhuranagar Road	1.10	22.54	Negligible	-
Kedereswaripet Road	2.3	20.5	Negligible	-
Vidyadharapuram Road	0.00	20.50	Negligible	-
Milk Project Road	1.60	21.00	Negligible	-
Tunnel Road	4.80	23.33	Negligible	-
Nehru Road	0.80	16.00	22.00	Congestion
Panja Road	1.00	23.00	11.00	Congestion
Gandhi Hill Road	0.70	24.00	Negligible	-
Gurunanak road	1.50	19.26	Negligible	-
Autonagar Road	3.30	19.93	56.00	Congestion
Cresturajupuram Road	3.85	25.53	Negligible	-

Name of the Road/Corridor/Section	Length (Km)	Average Travel Speed (kmph)	Average delay (sec.)	Remarks
Hanumanpeta Road	1.35	23.59	Negligible	-
CBD Area :				
Besant Road	1.20	14.00	42.00	Congestion
Vasthralatha Road	0.40	20.46	31.00	Congestion
Lenin Center Road	1.80	20.00	12.00	Congestion
Root No-5 Road	1.40	14.69	22.00	Congestion
Canal Road	1.80	23.70	Negligible	Negligible

Note: Negligible indicate the delay is less than 5 seconds.
Source: CES Survey, 2006

Speed Profile by Carriageway Width and Type

Table 5.36. shows the speed profile by carriageway(CW) width.

Table 5.36: Distribution of Road Lengths by CW width

Carriageway Width	% of Road Length				
	Speed Range (in Kmph)				
	Upto 10	11 - 20	21 - 30	31 - 40	>40
Single Lane	0.00	23.80	15.97	0.00	0.00
2 Lane	0.00	41.64	44.27	16.04	0.00
Interemediate Lane	0.00	2.27	1.50	0.00	0.00
4 Lane	0.00	32.29	38.26	83.96	100.00
Total	**0.00**	**100.0**	**100.00**	**100.0**	**100.0**

Source: CES Survey, 2006

Generally higher speeds are observed on roads where carriageway widths are more. Distribution of road length by range by type of carriageway is presented in **Table 5.37**. Higher speeds are observed on divided carriageway.

Table 5.37: Distribution of Road Length Type of Carriageway

Carriageway Type	% of Road Length					Total
	Speed Range (in Kmph)					
	Up to 10	11 - 20	21 - 30	31 - 40	>40	
Undivided	0.00	32.79	65.85	1.36	0.00	**100.0**
Divided	0.00	14.16	56.76	25.54	3.54	**100.0**

Source: CES Survey, 2006

5.5 Traffic at Intersections

Classified traffic volume survey has been conducted at 17 intersections. Data has been analyzed to study the traffic movement pattern and performance of individual intersections. Total traffic is expressed in both vehicles and passenger car units (PCUs) . The morning and evening peak hour traffic is presented in **Table 5.38**. and the hourly

directional data is presented in **Annexure 5.10**. In addition, the morning and evening peak hour traffic are shown in **Figure 5.13.**

Table 5.38: Peak Hour Traffic at Intersection

Location	Type of Junction	Morning			Evening			Total		Control
		Peak Hour	Vehicles	PCUs	Peak Hour	Vehicles	PCUs	Vehicles	PCUs	
Sitara junction	+	09 - 10	3001	2160	19 - 20	3529	2832	30454	25089	Un controlled
Kummaripalem center	T	10 - 11	4068	4642	19 - 20	4834	6029	42559	50114	Un controlled
Ashok Pillar Junction	Y	10 - 11	4251	4297	18 - 19	3934	4329	43025	45289	Un controlled
Potti Sree Ramulu Junction	T	10 - 11	2933	3232	18 - 19	3053	3581	30455	34873	Un controlled
VMC junction	+	10 - 11	4304	4007	19 - 20	4692	4585	40246	39196	Un controlled
Polioce Control Room Junction	+	10 - 11	6204	5685	18 - 19	6527	6102	68747	64540	Signal Control
Governer Pet Junction	Y	10 - 11	5445	5367	18 - 19	5916	5781	55578	55883	Un controlled
Swarna Palace hotel junction	+	10 - 11	5338	5179	18 - 19	6322	6376	58384	56316	Signal Control
Chuttugunta junction	+	09 - 10	4963	4211	19 - 20	7060	5678	52392	43108	Signal Control
Pipula road junction	+	09 - 10	3255	2342	19 - 20	3210	2405	30053	23185	Un controlled
Ramavarapupadu Junction	T	08 - 09	2090	2276	19 - 20	2650	3223	22645	27039	Signal Control
N T R Circle Junction	+	11 - 12	5712	5485	18 - 19	6948	7561	57193	57789	Un controlled
Benz Circle Junction	+	09 - 10	6647	6490	18 - 19	6845	7103	75519	77835	Signal Control
I G M Stadium Junction	T	11 - 12	3026	2412	19 - 20	4332	3578	37214	32110	Un controlled
Fire Station Junction	T	09 - 10	5554	5177	19 - 20	6698	8079	60976	66273	Un controlled
Alankar Junction	*	10 - 11	5379	4222	19 - 20	7274	5646	60594	47124	Signal Control
Puspa Hotel Junction	++	10 - 11	8620	2440	18 - 19	9184	2621	81975	25819	Un controlled

Source: CES Survey, 2006

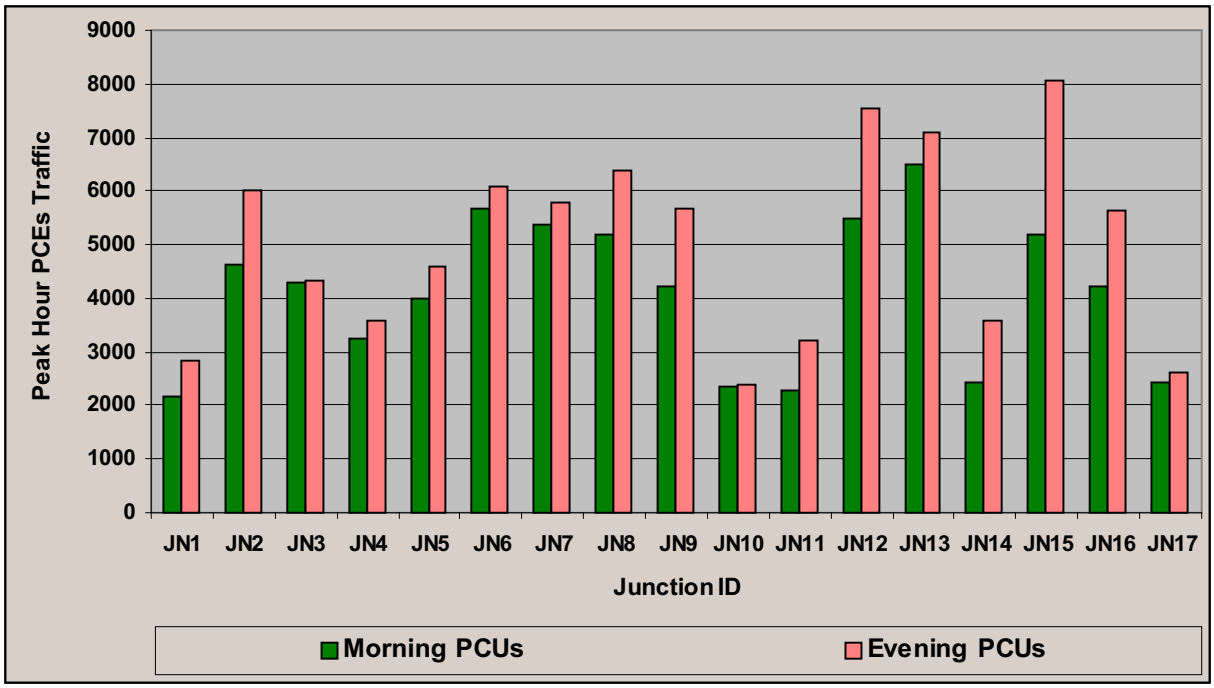


Figure 5.13: Peak Hour Traffic observed at the intersections

Among the surveyed intersections, maximum morning and evenin g peak traffic were observed at Benz Circle 6647 vehicles(6490 PCUs) and at Fire Station junction 6698 vehicles (8079 PCEs). Most of the junctions are already operating at jam condition or are close to saturation. Improvement measures for easing traffic co nditions are necessary. The directional flow diagrams showing the turning movement at all locations are presented in **Annexure 5.11.**

5.6 Parking Characteristics

Parking surveys and their analysis provide information on parking demand and extent of usage of parking facility.

Data was collected from major parking areas within the central area where significant vehicular parking is observed. Vehicular parking within Vijayawada city is generally on street and very limited off-street parking lots exist. In al l a total of 14 on-street and 2 off-street parking sites were surveyed.

For estimating parking demand and planning parking facilities, it would be necessary to express the space occupied by individual vehicles in single unit terms. The Equivalent car spaces (ECS) values for this purpose are presented in **Table 5.39.**

Table 5.39: Equivalent Car Space

Vehicle Type	ECS
Two Wheeler	0.25
Auto Rickshaw	0.5
Car/Taxi/Van	1.00
Bicycle	0.08
Cycle Rickshaw	0.3
Light Commercial Vehicles	1.50
Heavy Commercial Vehicles	2.00

5.6.1 On-Street Parking

Maximum Parking Accumulation

The summary of maximum parking accumulation at individual locations and the corresponding peak hour ECS are given in **Table 5.40.**

Table 5.40: Maximum Parking Accumulation

Location ID	Location	Peak Hour	Maximum Accumulation	
			Vehicles	ECS
ON-1	Canal Road	19:00-19:30	133	79
ON-2	Vastralatha Road	19:00-19:30	90	54
ON-3	Samarangam Chowk Road	12:00-12:30	100	22
ON-4	Besant Road	11:30-12:00	480	70
ON-5	Arround Lenin Center	12:30-13:00	133	34
	Opp Vijaya Dairy Milk Center	19:30-20:00	142	24
ON-6	Cenima Theater Road	13:00-13:30	345	71
ON-7	Apsara Theater Jn - Sonuvision Jn	19:00-19:30	180	39
	Sonuvision - Vijaya Talkies Jn	19:00-19:30	203	40
ON-8	Infront of IGM Stadium on Bandar Ro ad	12:00-12:30	87	30

Source: CES Survey 2006

The maximum parking accumulation was observed at Canal Road (ON -1) at 79 ECS and per hour followed by Cinema Theater Road (ON -6), Besant Road (ON-4) and Vastralatha Road (ON-2) at 71 ECS, 70 ECS and 54 ECS per hour respectively.

The peak time period of accumulation varies between 1100 hrs to 1200 hrs and 1900 hrs to 2000 hrs. **Figure 5.14** shows the parking accumulation at different lots.

Figure 5.14: Hourly Parking Accumulation at different Parking Lots

Composition of Parked Vehicles

Two Wheelers constitute major share of parked vehicles. The other modes like car/van/taxi, auto rickshaws and cycles have predominant share at different locations depending on the area. **Table 5.41.** presents the composition of the parked vehicles at different locations.

Share of two wheelers varies between 37.1 percent to 85.7 percent. Maximum share of cars (44.7%) was observed at Vastralatha road followed by 15.1% share at Canal road and 13.1% at around the Lenin center. Similarly maximum share of LCVs (23.6 %) was observed at Canal road.

Table 5.41: Composition of Parked Vehicles on Major Corridors

Location ID	Location	Mode						Total
		2 Wheelers	Car/van/ Taxi	Auto Rickshaw	LCV	Cycle	Cycle Rickshaw	
ON-1	Canal Road	60.2	15.1	1.1	23.6	0.0	0.0	100.0
ON-2	Vastralatha Road	45.8	44.7	0.8	0.8	5.2	2.3	100.0
ON-3	Samarangam Chowk Road	58.3	1.2	4.8	0.0	31.8	3.8	100.0
ON-4	Besant Road	41.05	2	2.65	0.1	51.9	2.35	100.0
ON-5	Arround Lenin Center	37.6	13.1	1.7	0.0	47.6	0.0	100.0
	Opp Vijaya Dairy Milk Center	53.7	0.1	0.3	0.0	43.7	2.2	100.0
ON-6	Cenima Theater Road	37.1	1.45	3.2	0.65	48.8	8.85	100.0
ON-7	Apsara Theater Jn - Sonuvision Jn	49.85	3.75	5.0	0.2	35.8	5.3	100.0
	Sonuvision - Vijaya Talkies Jn	55.95	1.9	1.5	0.4	34.9	5.4	100.0
ON-8	Infront of IGM Stadium on Bandar Road	85.7	6.1	7.7	0.5	0.0	0.0	100.0

Source: CES Survey 2006

Parking Duration

It is observed that majority of the parking is of short duration (upto 2 hours) with the percentage being over 90 % at all locations (**Table 5.42**). This is the general phenomenon observed in on-street parking.

Table 5.42: Parking Duration of Vehicles

Location	SHORT TERM (upto 2 hours)	% Short Term	MEDIUM TERM (2 to 4 hours)	% Medium Term	LONG TERM (more than 4 hours)	% Long Term
Canal Road	515	90.7	37	6.5	16	2.8
Vastralatha Road	422	93.2	24	5.3	7	1.5
Samarangam Chowk Road	394	96.3	15	3.7	0	0.0
Besant Road	974	91.9	72	6.8	14	1.3
Arround Lenin Center	351	92.9	22	5.8	5	1.3
Opp Vijaya Dairy Milk Center	233	94.7	9	3.7	4	1.6
Cenima Theater Road	1076	96.3	36	3.2	5	0.4
Apsara Theater Jn - Sonuvision Jn	660	95.1	26	3.7	8	1.2
Sonuvision - Vijaya Talkies Jn	778	95.1	34	4.2	6	0.7
Infront of IGM Stadium on Bandar Road	983	99.4	6	0.6	0	0.0

Source: CES Survey 2006

5.6.2 Off-Street Parking

Maximum Parking Accumulation

The summary of maximum parking accumulation at individual locations and the corresponding peak hour ECS are given in **Table 5.43.** Maximum parking accumulation was observed at NTR complex (OFF -1) (49 ECS per hour).

Table 5.43: Maximum Parking Accumulation

Location ID	Location	Peak Hour	Maximum Accumulation	
			Vehicles	ECS
OFF-1	NTR Complex	18:00-18:30	114	49
OFF-2	Complex on Besant Road	17:00-17:30	125	46

Source: CES Survey 2006

The peak time period of accumulation va ries between 1700 hrs to 1800 hrs. **Figure 5.15** shows the parking accumulation at different lots.

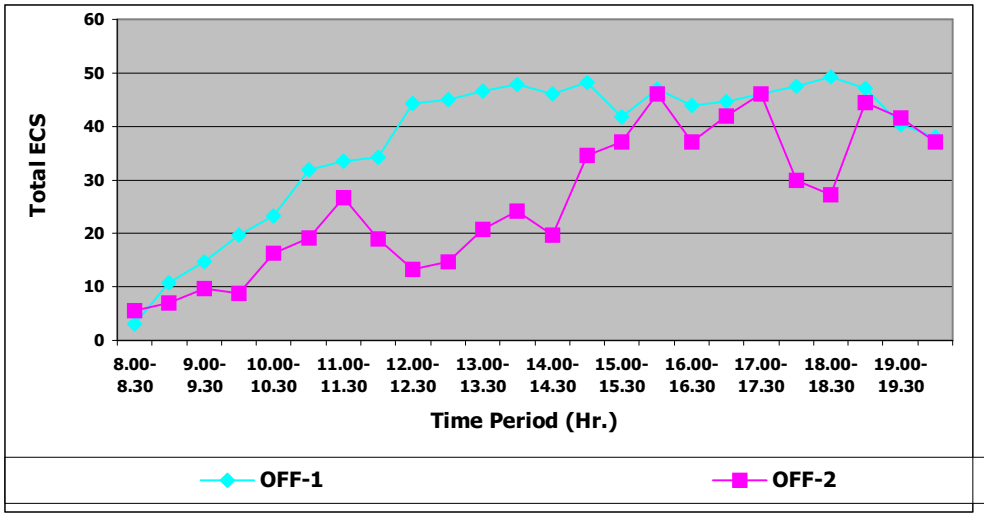


Figure 5.15: Hourly Parking Accumulation

Composition of Parked Vehicles

2-Wheelers constitute major share of parked vehicles (**Table 5.44)**.

Share of 2-wheelers varies between 63.8 percent to 70.6 percent. Maximum share of cars (15.5%) was observed at Besant road. Maximum share of auto rickshaws (26.4 %) was observed at NTR complex.

Table 5.44: Composition of Parked Vehicles on Major Corridors

Location ID	Location	Mode					Total
		2- Wheelers	Car/van/ Taxi	Auto Rickshaw	Cycle	Cycle Rickshaw	
OFF-1	NTR Complex	63.8	5.2	26.4	3.7	0.8	100.0
OFF-2	Complex on Besant Road	70.6	15.5	14.0	0.0	0.0	100.0

Source: CES Survey 2006

Parking Duration

It is observed that majority of the parking is of long duration (more than 4 hours) with the percentage being over 30 % at both locations **(Table 5.45)**. This is the general phenomenon observed in off -street parking.

Table 5.45: Parking Duration of Vehicles

Location	SHORT TERM (upto 2 hours)	% Short Term	MEDIUM TERM (2 to 4 hours)	% Medium Term	LONG TERM (more than 4 hours)	% Long Term
OFF-1, NTR Complex	103	29.9	67	19.4	175	50.7
OFF-2, Complex on Besant Road	550	59.7	92	10	280	30.4

Source: CES Survey 2006

5.7 Pedestrian Flow Characteristics

In order to study the requirement of pedestrian facilities, Pedestrian Surveys at various important locations were conducted for 12 hours.

The peak pedestrian flow across the road observed at various loc ations is presented in **Table 5.46**.

Table 5.46: Peak Pedestrian Flow

Location ID.	Location/Section	Peak Hour	Total Pedestrian Flow
PD-01	VMC Junction	10:00 to 11:00	25753
PD-02	Police Control Room Junction	13:00 to 14:00	14672
PD-03	Benz Circle Junction	09:00 to 10:00	60573
PD-04	I G M Stadium Junction	11:00 to 12:00	13950
PD-05	Fire station Junction	10:00 to 11:00	27692
PD-06	Eluru Road	19:00 to 20:00	10546
PD-07	Besant Road – Lenin center Road (across Eluru Road)	19:00 to 20:00	16385
PD-08	Benz Circle – N T R Statue Road	11:00 to 12:00	7659
PD-09	BRP Road	12:00 to 13:00	9387

Benz Circle carries maximum pedestrian cross movement(60573) followed by Fire Station (27692) and VMC junctions (25753) respectively. Maximum peak pedestrian cross movement is observed at Police Control Room junction and Besant road -Lenin center road. Peak hour varies between 10:00 to 12:00 hours in the morning and 19:00 to 20:00 hours in the evening.

The requirement of controlled crossing for pedestrian facilities i s warranted if:

i) Waiting time is too long
ii) More than five or more injuries occur in a year to pedestrians
iii) Approach speeds of vehicles exceed 65 kmph
iv) $PV^2 >= 1x10^8$ for undivided c/w
$>= 2x10^8$ for divided c/w

where, P = peak hour pedestrian flow
V = peak hour vehicular volume

The need for evolving pedestrian flow control measures at all locations have been assessed. **Table 5.47** shows the values of PV^2 at all locations along with possible remedial actions for pedestrian flow management.

Table 5.47: Vehicle-Pedestrian and Control Measures

Location	PV^2x10^8	Present Control Measures	Comments
PD1, VMC Junction	86.7	Uncontrolled	Footpaths guiding pedestrian to this cross is required and Signal Plan need to be modified
PD2, Police Control Room Junction	53.3	Signal controlled	Signal Plan need to be modified for incorporating pedestrian signal
PD3, Benz Circle Junction	159.2	Signal controlled	Traffic Grade separator is proposed; could be clubbed for providing pedestrian phase in traffic signals
PD4, I G M Stadium Junction	24.1	Uncontrolled	Footpaths guiding pedestrian to this cross are required
PD5, Fire station Junction	108.7	Uncontrolled	Subway is proposed
PD6, Eluru Road	182.6	Uncontrolled	Footpaths guiding pedestrian to this cross are required
PD7, Besant Road – Eluru Road (Across)	321.3	Uncontrolled	Footpaths guiding pedestrian to this cross are required
PD8, Benz Circle – N T R Statue Road	209.0	Uncontrolled	Footpaths guiding pedestrian to this cross are required
PD9, BRP Road	77.6	Uncontrolled	Footpaths guiding pedestrian to this cross are required

5.8 Railway Gate Closure Survey

Rail level crossing survey was conducted for 24 hours at the three existing level crossings along the project road. The IRC -62: 1976, 'Guidelines for Control of Access on Highways', recommends provision of ROB across existing railway crossing if product of ADT (fast moving vehicles) and the number of trains per day exceeds 50,000 per day within the next 5 years. The data analysis is presented below in **Table 5.48**.

Table 5.48: Assessment of ROB Requirement

Location	Total Daily Trains	Base year Daily Queuing (Motorised vehicles.)	Average Daily Delays/Veh (mins)	Total Daily Vehicular Delays (Veh.hrs)
Goods Shed Railway Cabin	26	259	397	38
Gunadal Cabin Crossing (Nunna-Eluru Road)	35	731	204	38
Maduranagar Crossing (Durgapuram-Maduranagar)	35	702	487	100
Nynavaram Crossing (Milk Project-Nynavaram)	69	250	386	51

Note:
**1. Taking into account the random arrival pattern of vehicles on an average, all vehicles are not expecte d to experience total gate closure time delays. Therefore Total Daily Vehicular Delays are estimated based on assumption that for each gate closure, delays per vehicles are equivalent to 50% of gate closure time.*

5.9 Public Transport and Para Transit Characteristics

5.9.1 General

Public Transport System is one of the important and essential components of a transport plan. In the present study public transport (PT) /para -transit operators (IPT) and users survey was carried out to assess their needs. In all 50 IPT operators 150 public transport and 100 para -transit users were enumerated in the survey.

5.9.2 IPT - Operators Characteristics

Vehicle Ownership

Operators of 50 Auto Rickshaw were interviewed. The following sections briefly describe the findings of the study. The distribution of vehicles by ownership is given in **Table 5.49.** Nearly 44% of Auto Rickshaws operating in the study area are hired.

Table 5.49: Distribution of Operators by Ownership

Ownership	% of Auto Rickshaw Operators
Owned	56.0
Hired	44.0
Total	**100.0**

Source: CES Survey 2006

Years of operation

Most of the operators in the study area have an experience of below 10 years (**Table 5.50**) Majority belong to the category having experience less than 5 years.

Table 5.50: Distribution of Operators by Years of Operation

Operating Experience (Years)	% of Auto Rickshaw Owner
< 5	50.0
5 – 10	42.0
10 – 15	6.0
15 – 25	2.0
> 25	0.0
Total	**100**

Source: CES Survey 2006

Fleet size

Maximum operators (89.3%) have only one vehicle (**Table 5.51**)

Table 5.51: Distribution of Fleet Size

Fleet Size	% of Fleet
1	89.3
2	7.1
3	3.6
>3	0.8
Total	**100.0**

Source: CES Survey 2006

Period of Operation

About 95% of operators operate between 10 to 15 hours/day

Daily Average Kilometers Operated

About 64.0% of the IPT operators operate less than 50 km/day followed by 28.0 % who operate between 50-100 km per day(**Table 5.52**). On an average, a Auto Rickshaw operates 50.8 km/day.

Table 5.52: Distribution of Vehicles by Average Kilometers Operated per day

Operated Kms/day	% of Distribution
<50	**64.0**
50-100	**28.0**
100-150	**4.0**
>150	**4.0**
Total	**100.0**
Average km/day	**50.8**

Source: CES Survey 2006

Number of Trips Performed daily

About 54.0 percent of IPT operators perform more than 10 trips/day(**Table 5.53**). On an average Auto Rickshaws operate 11 trips per day.

Table 5.53 : Distribution of Operators Average No. of Trips

Average No. of Trips	% of Trips
<5	**2.0**
5—8	**12.0**
8—10	**32.0**
>10	**54.0**
Total	**100.0**
Average Trips/day	**11.00**

Source: CES Survey 2006

Operating Cost per day

The operating cost of auto -rickshaw by cost components are presented are given below:

Operating Costs by Components

Operation	Cost Per Day (Rs.)
Average Rent Cost	135.22
Average Fuel Cost	172.76
Average Maintenance Cost	25.1

Source: CES Survey 2006

5.9.3 Public Transport User Characteristics (PT)

A User survey covering 150 users of PT system was conducted to assess their characteristics. These are presen ted below:

Age

Maximum users (46.4%) lie in the age group 20 -30 years followed by 30 -40 years (16%). About 28 % share of users are in the age group less than 20 years **(Table 5.54**).

Table 5.54: Distribution of PT Ussers by Age

Age(Years)	%
<20	28.0
20-30	46.4
30-40	16.0
40-50	8.8
>50	0.8
Total	**100.0**

Source: CES Survey 2006

Education

Majority of the users have graduate level education (33.9%) followed by middle/intermediate level (17.7%) The distribution of users by the level of education is presented in **Table 5.55.**

Table 5.55: Distribution of PT users by Education

Educational Qualification	%
Illiterate	17.7
Primary	8.9
Middle/Intermediate	17.7
Graduate	33.9
Post Graduate & Above	18.5
Professional	3.2
Total	**100.0**

Source: CES Survey 2006

Income

Nearly 42% of PT users were not earning any income (**Table 5.56**). The average monthly income is Rs.2670/ user.

Table 5.56: Distribution of PT Users by Income

Income Range (Rs/in month)	Percentage
Non earning	41.6
>1000	8.0
1000 – 2500	9.6
2500 - 5000	24.8
5000 - 7500	4.8
7500 - 10000	7.2
10000 – 15000	2.4
> 15000	1.6
Total	**100.0**

Source: CES Survey 2006

Trip Characteristics

The average trip characteristics of the users are: trip length - 22 km, travel time 24 minutes, trip cost -Rs.16; and monthly expenditure on travel - Rs.594.

Purpose of Travel

The three major purposes of travel of the users are work (23.2%), education (21.6%) and religious trips (22.4%) (**Table 5.57**).

Table 5.57: Purpose wise Distribution of IPT Users

Purpose	Percentage
Work	23.2
Business	7.2
Education	21.6
Social	5.6
Shopping	4.0
Recreation/Tourism	5.6
Religious	8.0
Medical	4.0
Return Home	20.8
Total	**100.0**

Source: CES Survey 2006

5.9.4 Intermediate Public Transport User Characteristics (IPT)

A User survey covering of 100 users of IPT system was conducted to assess their characteristics. These are presented below:

Age

Maximum users (34%) lie in the age group 20 -30 years followed by 30 -40 years (23%) (**Table 5.58**).

Table 5.58: Distribution of IPT Users by Age

Age(Years)	Percentage
<20	17.0
20-30	34.0
30-40	23.0
40-50	18.0
>50	8.0
Total	**100.0**

Source: CES Survey 2006

Education

Majority of the users have graduate level of education (48.0%) followed by middle/intermediate level (22.0%) The distribution of users by level of education is presented in **Table 5.59.**

Table 5.59: Distribution of IPT users by Education

Educational Qualification	%
Illiterate	4.0
Primary	7.0
Middle/Intermediate	22.0
Graduate	48.0
Post Graduate & Above	13.0
Professional	6.0
Total	**100.0**

Source: CES Survey 2006

Income

Majority of the users (30%) belong to non -earning category which is largely due to the fact that nearly 30% of the users comprise of students, housewives and unemployed (**Table 5.60**). The average monthly income is Rs.3220/user.

Table 5.60: Distribution of IPT Users by Income

Income (Rs.)/Month	Percentage
No earning	30.0
>1000	9.0
1000 - 2500	15.0
2500 - 5000	22.0
5000 - 7500	17.0
7500 - 10000	3.0
10000 - 15000	3.0
> 15000	1.0
Total	**100.0**

Source: CES Survey 2006

Trip Characteristics

The average trip characteristics of the users are trip length - 6.6 km, travel time - 20 minutes, trip cost - Rs.5.8, and monthly expenditure on travel Rs. 281.4.

Purpose of Travel

The three major purposes of travel of the users are education (30%), work (27%), social (10%) and business (8.0%). Recreation/Tourisum/Religious trips also account for 14%. (**Table 5.61**).

Table 5.61: Purpose wise Distribution of IPT Users

Purpose	Percentage
Work	27.0
Business	8.0
Education	30.0
Social	10.0
Shopping	8.0
Recreation/Tourism	6.0
Religious	8.0
Medical	3.0
Total	**100.0**

Source: CES Survey 2006

5.9.5 Problems & Issues

The problems, issues and opinion about existing transport system of th e Vijayawada city as percieved and graded by the users/operators are presented below.

- Grading of the problems and issues

Problems & Issues	Order of Importance					Total
	1	2	3	4	5	
No defined Terminals/Stopping points	10.0	26.0	14.0	20.0	30.0	100.0
Limited Passengers/Customers	16.0	30.0	38.0	12.0	4.0	100.0
Empty Operations	40.0	12.0	12.0	10.0	26.0	100.0
High Operation and Maintenance Cost	2.0	32.0	28.0	20.0	18.0	100.0
High Rational Charges	32.0	0.0	8.0	38.0	22.0	100.0

- Opinion about existing transport system

(%)

Opinion	% of Opinion		
	Good	Average	Bad
Town Road Network System	20.0	74.0	6.0
Traffic Management & Enforcement	2.0	50.0	48.0

- All the users/operators have opined that the quality of the existing Road network system in the city is " Average".

- All the users/operators have expressed that traffic management and enforcement in the city is "Average" (50%) to "Bad" (48%).
- Users /operators have described their suggestions in different ways. Some of the suggestions are:

    - All junctions need immediate improvement
    - Besant road area, KR Market area, Lenin center area need traffic management plans
    - and Identification of Off-street parking in the CBD area is necessary
    - City roads need to be widened
    - Pedestrian facilities are required
    - Traffic enforcement is required

5.10 Freight Movement

Freights movement is one of the important aspects of urban movement and urban life. Freight terminals are important components in urban transport system wherein all freight related activities take place.

In order to assess the freight movement characteristics, a survey of major truck operators was carried out. **Table 5.62** shows the salient operational characteristics of freight operators.

Table 5.62: Operational Characteristics of Freight Operators

Characteristics	LCV	HCV	MAV
Average Fleet Size	40	36	5
Average Trip length (km/day)	70	350	225
Average Load carried (tones)	2	11.25	21
Average Fuel Consumption (km/Lit)	7	5	4
Average Maintenance Cost (Rs./day)	30	100	100

Source: CES Survey 2006

Heavy trucks and multi axle trucks have more significant role in providing goods transport service. On an average, the heavy trucks operate 350 km/day, light trucks operate 75 km per day. The average load for heavy and light trucks are 11.2 and 2 tonnes respectively. The average fuel consumption is about 7 km/lt for light trucks, 5 km/lt for heavy trucks and 4 km/lt for multi axle trucks.

Commodity Carried

The share of major commodities (loaded and unloaded) at important terminal locations is presented in **Table 5.63**.

Table 5.63 : Major Commodities Transported

Sl. No.	Commodity Type	% of Share
1	Food grains	24.3
2	Fruits & Vegetables	13.5
3	Fertilizers & Chemicals	8.1
4	Construction Materials	18.9
5	Machinery	13.5
6	Others	21.6
Total		**100.0**

Source: CES Survey 2006

Among the commodities transported, 'Food grains' commanded a share of about 24.3 percent followed by machinery and fruits & vegetables at 13.5% share. 'Others' category which include other minerals, commercial crops, forest products, paper, parcels etc., had the significant share of 21.6 percent of the total goods transported.

5.11 Accident Data Analysis

Accident data was collected from the traffic Police for the last three years. The data was available at the city level. The data apart from providing information on the type and severity of accidents provided details on the following aspects.

- Number of Accidents type wise (fatal, injury etc.)
- Location of accidents
- Cause of accidents
- Vehicles involved in accidents
- Number of persons killed/injured

The analysis for growth trends was carried for the time series data available from 2003 - 2006. The year wise accident data is given in **Table 5.64**.

Table 5.64: Accident Data by Severity of Accident (2003-2006)

Year	EXTENT OF ACCIDENT				TOTAL
	Fatal	Grievous Injury	Simple Injury	Vehicle Damage	
2003	50	207	111	7	375
2004	83	312	370	14	779
2005	82	289	287	20	678
2006 upto July 2006	37	33	116	8	194
Gr.Rate (2003-2005)	**28.1**	**18.2**	**60.8**	**69.0**	**34.5**

The accident location map is shown in **Figure 5.13**. The salient findings of the accident analysis are given below.

- Total Accidents in Vijayawada have grown at a rate 34.5% during year 2003 -2005. Of this accidents resulting in death have grown at 28.1% , while accidents resulting in grievous injury have grown at 18.2%, accidents resu lting in simple injury by 60.8%, and accidents causing vehicle damage by 69%.

- About 194 accidents occurred during January -July 2006

- Analysis of accidents by location shows that maximum accidents occur near intersections, market areas and in CBD area.

- About 56% accidents are at junctions. This is because many junctions in Vijayawada lack traffic control measures.

- About 44% accidents are in straight sections.

- Most of the accidents take place in day light.

- The analysis of accidents by type of maneuver shows that overtaking, turning right and access from side roads are major causes.