



CHAPTER 4.0

TRAFFIC SURVEYS AND STUDIES

4.1 General

Traffic surveys and studies are an integral component of a comprehensive Traffic & Transportation study. Appreciation of existing traffic and travel characteristics is extremely important for developing comprehensive traffic and transportation plan. Comprehensive traffic and transport surveys were carried out along with secondary data collection from April 2006 to August 2006.

The baseline data, apart from helping in understanding the existing traffic and transportation situation along with its problems and constraints, would help in development, calibration and validation of the travel demand forecasting models. Base year data has been analyzed to provide the planning, transport and land use information, trip end summaries and travel time matrix that form the basis for model construction.

A number of traffic & transportation surveys were conducted as a part of the study in order to assess the passenger and goods movement pattern, travel characteristics, pedestrian & parking characteristics and the available infrastructure facilities within the study area. The data collection activities included classified traffic volume counts, origin-destination surveys, road inventory and condition surveys, household socio-economic & travel surveys, speed and delay survey, public & IPT operator and user surveys, parking surveys, pedestrian surveys and rail gate closer surveys. In addition, significant data from secondary sources pertaining to demographic, socio-economic characteristics, public transport system etc. was also collected as part of the data collection activity.



4.2 Survey Preliminaries

4.2.1 Zoning System

For better understanding of travel pattern within the study area and its interaction with regions external to this area, a total of 74 zones, designated as *Traffic Analysis Zones* (TAZs) have been identified. The zoning system has been developed based on network connectivity and importance of towns/districts with respect to Vijayawada. Of these, 59 zones have been demarcated within the study area i.e. internal zones. They are coterminous with the municipal wards. Apart from these, 15 zones are identified



external to the study area spread over the different districts and the neighboring states.

An attempt has been made to disaggregate external zones to the extent possible for the purpose of micro level analysis on the travel pattern outside the study area. These zones may however be aggregated suitably during travel demand modeling stage if required.

The list of traffic zones is given in **Annexure 4.1.** and the internal TAZ map of Vijayawada is depicted in **Figure 4.1.**

4.2.2 Identification of Screen and Cordon Lines

An imaginary line circumscribing the boundary of the study area is termed as the *cordon line*. Similarly, imaginary lines along the physical and natural barriers, having road crossing points within the study area, are termed as *screen lines*. The screen lines were delineated in order to check the accuracy of the data collected and for validation of demand forecasting models for north-south and east-west travel. The following six screen lines have been identified:

- i) First screen line along the Ryves Canal
- ii) Second screen line along the Eluru Canal
- iii) Third screen line along the Bandar Canal
- iv) Fourth screen line along the Vijayawada-Machilipatnam Railway line passing through the study area.
- v) Fifth screen line along the Vijayawada-Hyderabad Railway line passing through the study area
- vi) Sixth screen line along the Vijayawada-Chennai Railway line passing through the study area.

An imaginary line circumscribing of the study area has been identified as the Outer Cordon line. The identified screen lines along with outer cordon line have been depicted in **Figure 4.2.**

4.3 Secondary Data

While field traffic surveys provide information on the existing traffic characteristics, secondary data provides details on the existing landuse, demographic and other features related to the study area.

Secondary data have been collected to describe:

- Characteristics of existing demand for travel
- Accident details on the road network



- Existing supply of transport infrastructure including fleet size of mass transport system, operation, cost, performance, regulation and utilization
- Demographic and socio-economic characteristics
- Present and proposed land use patterns
- Planned transport investments, policy changes and other government actions
- Funding sources and expected funds available for transport improvements

While planning level (landuse, demographic, socio-economic) and transport policy related information is largely available from secondary sources, a number of primary surveys have been undertaken to obtain information on network, system and travel pattern.

4.4 Primary Surveys

The following primary traffic surveys were conducted for appreciating the existing traffic and travel demand characteristics and to prepare the transport infrastructure improvement plans:

- a) Road Inventory survey
- b) Classified Traffic Volume Count survey
- c) Origin-Destination Survey
- d) Intersection Turning Movement Survey
- e) Household Interview Survey
- f) Speed & Delay Survey
- g) Parking Survey
- h) Pedestrian Survey
- i) Rail Gate Crossing Survey
- j) Intermediate Public Transport Operator Survey
- k) Intermediate Public Transit (IPT) User Survey
- l) Public Transit (PT) User Survey
- m) Truck Operators Survey

The brief methodology adopted, location, nature and extent of data collected under each of the above mentioned surveys have been discussed below. The field data collection activities were taken up during the period April 2006 to August 2006.

4.4.1 Road Inventory Survey

The objective of this survey was to assess the physical characteristics and condition of roads within the study area, identify physical constraints and bottlenecks, assess potential capacity and to identify the extent for its future development/improvement.

About 91.6 km of primary road network was identified for road inventory within the study area. The survey was conducted by traveling along the identified road network and by collecting details on road characteristics by visual evaluation, inspection and



physical measurements. The road network included for study is shown in **Figure 4.3**.

The data collected includes information on right-of-way available, carriageway width and surface type, abutting land use, utility & services (on surface), on-street parking and condition of drains, ROW, traffic control and management measures and other special features.

The following is extracted from the road network inventory survey:

- Identification of existing road hierarchy
- Road geometrics in-terms of cross sectional elements
- Existing capacity levels, LOS, bottleneck zones
- Existing street infrastructure in-terms of street lighting, signs, markings, guard rail etc.
- Potentials, problems and constraints for evolving traffic management plans

4.4.2 Classified Traffic Volume Count Survey

These surveys were conducted in order to appreciate the traffic characteristics in terms of average daily traffic, traffic composition, peak hour traffic and directional split at individual survey locations at the cordon & screen lines.

4.4.2.1 Outer Cordon Survey

Classified Traffic Volume count surveys at the outer cordon were conducted for 24 hours on a typical working day to identify locations with high intensity of traffic at the cordon line. In all, seven locations were identified along the outer cordon to obtain daily and hourly mode wise traffic at individual locations.



The locations included for outer cordon survey are shown in **Figure 4.4** and the schedule for conduct of surveys is presented in **Table 4.1**.

Table 4.1: Outer Cordon Survey Locations and Schedule

| Location Code | Location/Road Section | Date | Duration |
|---------------|--------------------------------|----------|----------|
| OC-1 | Tadepalli on NH-5 Chennai Road | 10/07/06 | 24 Hours |
| OC-2 | Undavalli | 10/07/06 | 24 Hours |
| OC-3 | Gollapudi on NH-9 Road | 05/07/06 | 24 Hours |



| Location Code | Location/Road Section | Date | Duration |
|---------------|--------------------------------------|----------|----------|
| OC-4 | Mylavaram road | 04/07/06 | 24 Hours |
| OC-5 | Payakapuram | 03/07/06 | 24 Hours |
| OC-6 | Prasadampadu on NH-5 Kolkata Road | 14/07/06 | 24 Hours |
| OC-7 | Poranki on NH-9 Road | 07/07/06 | 24 Hours |

4.4.2.2 Screen Line Counts

17 screen line count stations were selected of which 5 screen line count locations were along Ryves Canal, 5 screen line count locations on Eluru Canal, 2 screen line count locations along Bandar Canal, 2 screen line counts along Vijayawada -Kolkata railway line, one screen line count location along Vijayawada -Machilipatnam railway line, one screen line count location along Vijayawada -Hyderabad railway line and another screen line count location along Vijayawada -Chennai railway line. The survey was carried out for 16 hrs on an average working day.

The locations included for Screen Line survey are shown in **Figure 4.5** and the schedule for conduct of surveys is presented in **Table 4.2**.

Table 4.2: Screen Line Survey Locations and Schedule

| S. No. | Location Code | Road Section | Date | Duration |
|--------|---------------|---|----------|----------|
| 1 | SL-01 | Police Control Room – Goods Shed Junction | 28/06/06 | 16 Hours |
| 2 | SL-02 | MRO's Office Road | 20/04/06 | 16 Hours |
| 3 | SL-03 | Alankar-Lenin Center | 04/05/06 | 16 Hours |
| 4 | SL-04 | Durgapuram-Seetarampuram Road | 20/04/06 | 16 Hours |
| 5 | SL-05 | Rokallapalem-Chuttugunta Road | 20/04/06 | 16 Hours |
| 6 | SL-06 | Govt. press-Ajit singh Road | 19/04/06 | 16 Hours |
| 7 | SL-07 | Cement factory-GS raju Road | 19/04/06 | 16 Hours |
| 8 | SL-08 | Ambedkar Statue-Zimkhana Club Road | 19/04/06 | 16 Hours |
| 9 | SL-09 | Gamdhinagar center-Eluru Lakulu Road | 19/04/06 | 16 Hours |
| 10 | SL-10 | Narayanaswami hotel-Railway station Road | 19/04/06 | 16 Hours |
| 11 | SL-11 | Ranga Statue – Fire Station Road | 2/05/06 | 16 Hours |
| 12 | SL-12 | Krishna Lanka-Labbipeta Road | 21/04/06 | 16 Hours |
| 13 | SL-13 | K L Rao nagar-Kedareswara pet Road | 24/04/06 | 16 Hours |
| 14 | SL-14 | Govt. press-Ajit singh Road on Budameru Canal | 19/04/06 | 16 Hours |
| 15 | SL-15 | Madhuranagar Road | 24/04/06 | 16 Hours |
| 16 | SL-16 | Nainavaram Road | 04/07/06 | 16 Hours |
| 17 | SL-17 | Near Pandit Nehru bus station Road | 21/04/06 | 16 Hours |



4.4.2.3 Mid-Block Traffic Counts

Mid-block traffic count survey was conducted within the study area at 7 locations. These surveys were conducted for 24 hours at 4 major locations and 16 hours at the remaining 3 locations.

The details regarding locations and survey duration are presented in **Table 4.3**. The survey locations are indicated in Figure 4.5.

Table 4.3: Mid-block Survey Locations and Schedule

| Location Code | Location/Road Section | Date | Duration |
|---------------|---------------------------|----------|----------|
| MB1* | Bandar Road | 06/07/06 | 24 Hours |
| MB2* | Eluru Road | 06/07/06 | 24 Hours |
| MB3* | Canal Road | 06/07/06 | 24 Hours |
| MB4* | Nehru Road | 13/07/06 | 24 Hours |
| MB5 | C K Reddy Road | 19/04/06 | 16 Hours |
| MB6 | Ramalingeswara Nagar Road | 13/07/06 | 16 Hours |
| MB7 | Y V Rao Hospital Road | 21/04/06 | 16 Hours |

Note: * Taken as internal cordon points

The following outputs are derived from the Mid Block and Screen line s survey data:

- Traffic characteristics, in terms of average daily traffic (ADT),
- Hourly variation of traffic (PCUs & vehicles),
- Peak hour flows and directional distribution of traffic,
- Traffic composition and intensity along the corridors.

4.4.3 Origin –Destination Surveys

The main objective of O-D survey was to obtain information on travel pattern of passenger and goods vehicles at the cordon line along with the trip desire in terms of destined to/originated from and through trips to the study area.

The O-D survey was conducted at seven locations along the outer cordon line (Figure 4.4) simultaneously with the classified traffic volume counts. The survey was conducted by roadside interview method for 24 hours on a random sample basis. The survey locations are listed in **Table 4.4**.





Table 4.4: Origin-Destination Survey Locations and Schedule

| Location Code | Location/Road Section | Date | Duration |
|---------------|-----------------------------------|----------|----------|
| OC-1 | Tadepalli on NH-5 Chennai Road | 10/07/06 | 24 Hours |
| OC-2 | Undavalli | 10/07/06 | 24 Hours |
| OC-3 | Gollapudi on NH-9 Road | 05/07/06 | 24 Hours |
| OC-4 | Mylavaram road | 04/07/06 | 24 Hours |
| OC-5 | Payakapuram | 03/07/06 | 24 Hours |
| OC-6 | Prasadampadu on NH-5 Kolkata Road | 14/07/06 | 24 Hours |
| OC-7 | Poranki on NH-9 Road | 07/07/06 | 24 Hours |

The survey elicits information regarding travel pattern in terms of size and desire, trip purpose, trip length and mode of travel. In addition, details on goods movement in - terms of commodity by type, tonnage, mode, trip length, lead -load spectrum etc. were also obtained.

4.4.4 Intersection Turning Movement Survey

The objective of the survey was to assess the traffic flow and delay characteristics on individual arms at the intersections. The survey was conducted for 12 hours on a normal working day at 17 junctions (**Figure 4.6**). The survey locations and the schedule are listed in **Table 4.5**.



Table 4.5: Intersection Volume Count Survey Locations and Schedule

| Location Code | Location | Date | Duration |
|---------------|-------------------------------|----------|----------|
| JN-01 | Sitara junction | 28/04/06 | 12 Hours |
| JN-02 | Kummaripalem center | 28/04/06 | 12 Hours |
| JN-03 | Ashok Pillar Junction | 30/06/06 | 12 Hours |
| JN-04 | Potti Sree Ramulu Junction | 30/06/06 | 12 Hours |
| JN-05 | VMC junction | 28/04/06 | 12 Hours |
| JN-06 | Polioce Control Room Junction | 28/06/06 | 12 Hours |
| JN-07 | Governer Pet Junction | 07/06/06 | 12 Hours |
| JN-08 | Swarna Palace hotel junction | 25/04/06 | 12 Hours |
| JN-09 | Chuttugunta junction | 27/04/06 | 12 Hours |
| JN-10 | Pipula road junction | 27/04/06 | 12 Hours |
| JN-11 | Ramavarapupadu Junction | 08/06/06 | 12 Hours |
| JN-12 | N T R Circle Junction | 08/05/06 | 12 Hours |
| JN-13 | Benz Circle Junction | 29/06/06 | 12 Hours |
| JN-14 | I G M Stadium Junction | 02/05/06 | 12 Hours |
| JN-15 | Fire Station Junction | 02/05/06 | 12 Hours |
| JN-16 | Alankar Junction | 27/06/06 | 12 Hours |
| JN-17 | Puspa Hotel Junction | 09/06/06 | 12 Hours |



Data collected from these surveys is used for preparation of geometric improvement plans for critical intersections under the Immediate Improvement Plan and Short Term Measures. In addition, this data, along with pedestrian volume count data, has been used to assess the pedestrian-vehicular conflicts thereby need for providing pedestrian subways at critical locations.

4.4.5 Household Travel Survey

The objective of Household Interview Survey (HIS) was to assess the household, socio-economic and trip characteristics of residents within Vijayawada. The survey was carried out on a sample basis in 4252 households, representing about two percent of households within the study area.

In addition, an opinion survey pertaining to the existing public transport system, its adequacies and problems, suggestion for improvements and the city dwellers need for an alternate public transport system along with their paying capacities was also carried out.

The sample households were selected based on simple random sampling technique out of the ward wise Electoral Lists. The number of households within each zone was based on the respective residential population in each zone.

The main steps involved in conducting the surveys were:

- Design of draft questionnaire
- Appointment and training of enumerators
- Conduct of pilot surveys
- Conduct of main survey, data coding, punching and checking
- Data analysis

The questionnaire was divided into three main modules, viz. household information, personal level information and trip information. The questionnaire was designed to incorporate cross-checks on some of the most important responses for which it may be difficult to obtain reliable, information like household/ personal income etc.

Details were collected for trips performed by the respondent and the family members during the previous working day. The trip details were broken down into individual stages to study the characteristics of linked trips.

Selection and training of interviewers is an important component for successful conduct of household travel surveys. The training program for the enumerators was organised prior to





conduct of actual field surveys to make them fully aware of the nature, extent, method and necessity to conduct the surveys in an organised manner.

Pilot household survey was conducted for about 50 households spread over three zones within Vijayawada.

The household survey provided details on socio-economic and personal characteristics at household and individual levels. In addition, it provided detailed household trip making pattern (zone to zone trip tables) and its relation with socio-economic characteristics.

A trip has been defined as a journey from a place of origin to a place of destination by a person capable of performing independent trips by any mode, for any purpose and at any time of the day (24 hours).

4.4.6 Speed & Delay Survey

The objective of this survey was to assess the speed and delay characteristics along the existing road network (Figure 4.3), identify bottleneck locations and their probable causes.

Speed & Delay survey along the identified road network was carried out by 'Moving Car Observer Method' by traversing along the road sections, in the peak and off peak hours. Information regarding number of vehicles overtaking the test car, overtaken by test car, number of vehicles in opposite direction to the test car, journey and running time along with cause and quantum of delay were recorded.

Following outputs are derived from the surveys:

- Journey speeds along the corridors
- Running speeds along links between intersections
- Nature and extent of delay at intersections and mid blocks

The speed data is being used to develop zone-to-zone travel time matrices for use in trip distribution and traffic assignment stages of demand modeling.

4.4.7 Parking Survey

The main objective was to appreciate the parking demand and supply characteristics, identify issues and constraints & suggest appropriate policies for meeting the horizon year parking demand.

The survey was conducted in order to assess the level of usage of on-street and off-street parking





facilities at pre-selected locations where significant parking was observed. The survey provides information on utilization of parking space by hour of the day, parking turnover rates and the average parking duration. The survey was conducted for 12 hours at 9 locations given in **Table 4.6**. The survey locations are indicated in **Figure 4.7**.

Table 4.6: Parking Survey Locations & Schedule

| Location Code | Location/Road Section | Date | Duration |
|-----------------------------|------------------------------|----------|----------|
| <i>On-Street Parking :</i> | | | |
| ON-01 | Canal road | 28/04/06 | 12 Hours |
| ON-02 | BRP Road | 23/06/06 | 12 Hours |
| ON-03 | Samarangam Chowk Road | 23/06/06 | 12 Hours |
| ON-04 | Besant Road | 23/06/06 | 12 Hours |
| ON-05 | Lenin Center | 22/06/06 | 12 Hours |
| ON-06 | Cinema Theator Road | 23/06/06 | 12 Hours |
| ON-07 | Eluru road | 22/06/06 | 12 Hours |
| ON-08 | In front of I G M Stadium | 02/05/06 | 12 Hours |
| <i>Off-Street Parking :</i> | | | |
| OF-01 | N T R Complex | 04/07/06 | 12 Hours |
| OF-02 | Besant Road Near Fish Market | 04/07/06 | 12 Hours |

4.4.8 Pedestrian Survey

The objective was to assess the pedestrian flows along and across the intersecting arms at important junctions and mid blocks and to suggest improvement measures for safe movement of pedestrians.

The pedestrian surveys were conducted at nine (9) locations over 16 -hour duration at important intersections and mid blocks within the study area. The survey locations and schedule is given in **Table 4.7** and shown in Figure 4.7.

Table 4.7: Pedestrian Survey Locations and Schedule

| Location Code | Location/Road Section | Date | Duration |
|---------------|---------------------------------|----------|----------|
| PD-01 | VMC junction | 28/04/06 | 12 Hours |
| PD-02 | Police Control Room Junction | 28/06/06 | 12 Hours |
| PD-03 | Benz Circle Junction | 29/06/06 | 12 Hours |
| PD-04 | I G M Stadium Junction | 02/05/06 | 12 Hours |
| PD-05 | Fire station Junction | 02/05/06 | 12 Hours |
| PD-06 | Eluru Road | 26/06/06 | 12 Hours |
| PD-07 | Besant road – Eluru road | 25/04/06 | 12 Hours |
| PD-08 | Benz Circle – N T R Statue Road | 08/05/06 | 12 Hours |
| PD-09 | BRP Road | 26/06/06 | 12 Hours |



4.4.9 Rail Gate Closure Survey

The main objective of this survey was to assess the need of providing ROB/R UBs at the level crossing under study .

Railway gate closure survey was carried out at the four level crossings for one day (24 hours) to assess the number of trains passing and the average delay to vehicular traffic at these crossings. The survey data will be analyzed to assess the traffic intensity (in PCUs) and the viability for provision of ROB/RUBs at these crossings. Railway level crossings are one of the major sources of delay and hindrance to smooth flow of traffic. The survey locations and schedule is given in **Table 4.8** and shown in Figure 4.7.



Table 4.8: Rail Gate Closure Survey Locations and Schedule

| Location Code | Location/Road Section | Date | Duration |
|---------------|---------------------------------------|----------|----------|
| RG-01 | Nainavaram Rail Gate (at Goods Cabin) | 04/07/06 | 24 Hours |
| RG-02 | Nainavaram Rail Gate | 28/07/06 | 24 Hours |
| RG-03 | Madhuranagar Rail gate | 27/07/06 | 24 Hours |
| RG-04 | Gunadala Rail Gate | 27/07/06 | 24 Hours |

4.4.10 Public Transport User Survey

Bus & Rail

The objective was to appreciate the public transport user characteristics (origin, destination, mode, trip length and travel cost).

The survey was carried out at four terminals (3 bus and 1 rail). In a ll 150 passengers were interviewed.

The details of survey locations (Figure 4.7) along with the sample passengers covered at each location are shown in **Table 4.9**.



Table 4.9: Terminal Survey Locations

| Location Code | Terminal Name | No of Passengers interviewed |
|---------------|----------------------------|------------------------------|
| PT-01 | Pandit Nehru Bus station | 50 |
| PT-02 | City Bus Terminal Location | 50 |
| PT-03 | Autonagar Bus Terminal | 25 |
| PT-04 | Railway Station | 25 |
| Total | | 150 |

Goods Terminal

The objective of goods terminal survey is to assess truck operator characteristics and their requirements, issues and problems.

The survey was carried out at Bhavanipuram terminal and Light commercial vehicles union office near VMC office. 25 operators including agencies acting as middle men were covered under this survey.



The survey data provided the basis for assessing the operational characteristics of truck operations.

4.4.11 Intermediate Public Transport (IPT) Survey (Operators & Users)

The objective of this survey was to assess the operational characteristics of the IPT (Auto Rickshaw), identify problems & issues and suggest appropriate policies for its rational development. The IPT users were interviewed to assess their trip pattern (origin-destination) along with trip purpose and cost.

The survey was conducted at locations (Figure 4.7) with high concentration of IPT modes and trips. In all 100 passengers and 50 operators were interviewed. The major locations included are:

- City Bus Terminal
- Pandit Nehru Bus Station
- Autonagar Bus Terminal
- Railway Station
- Gunadala Center

The survey provided information relating to trip characteristics in terms of origin and destination of trip, purpose of trip, frequency and cost of trips, IPT operational characteristics in terms of route of operation, vehicle utilization, passengers carried, operating cost and revenue.

Survey formats used for the collection of data through field surveys have been presented in **Annexure 4.2**.