3. METHODOLOGY

3.1 OVERVIEW

The methodology adopted for village information system was to maintain digital database using spatial and non-spatial data. Spatial data includes all the topographic and thematic maps, viz., base, drainage, transport, Land use/Land Cover geomorphology, watershed, soil, physiography and soil, etc. The attribute data comprises of generally education and population details, socio-economic and utilities information from different government organizations and private sectors, etc. This chapter includes the steps involved in deriving these all data.

For interpretation and analysis, two types of data products are required, i.e., basic data and ground data.

**Basic Data:**

(a) Toposheets  
(b) Satellite data  
(c) Local knowledge  
(d) Area map on any scale to transfer details  
(e) Reports and other literature of the study area
**Ground Data:** Ground data is very much necessary to verify and to get better accuracy of the interpreted image classes and also its reduce the field work.

**Data Analysis:**

For data interpretation and analysis of satellite data, the study can be divided into three parts:

a. Preliminary work

b. Field work

c. Post field work

**a.) Preliminary Work Includes:**

i. To see the limitation of satellite data.

ii. To lay down the criteria for land use classification to be adopted.

iii. To fix the size of mapping units, which depends upon the scale.

iv. Interpretation of different land use/land cover classes.

v. Demarcation of doubtful areas.

vi. Preparation of field land use/land cover map.
b.) **Field Work:**

i. Type of ground data to be collected.

ii. Selection of sample area for final classification.

iii. Checking of doubtful areas.

iv. Change in land use/land cover due to wrong identification, fresh development, and nomenclature.

v. General verification.

c.) **Post Field Work:**

i. Reinterpretation and analysis or correction of doubtful areas.

ii. Transfer of details on base map.

iii. Marginal information.

iv. Preparation of final land use/land cover map.

Creation of Village Information System (VIS) is structured by grouping all the activities into five groups; the five group activities are:

- Development of data model for land use/land cover on 1:10000 scale.
- Scanning and digitization of maps.
- Georeferencing and registration.
• Field work, field data collection, and GPS survey for GCPs.
• Generation of thematic maps.

3.2 DATA PRODUCTS AND SOURCES

3.2.1 Data & Software Used
The following datasets have been used to prepare the village information system:

- Survey of India toposheet No.s 66a1NE, SE, and 66a5 NW, SW having 1:25,000 scale.
- IRS-P6 LISS-IV MX (5.8 X 5.8 mt) 2006.
- Secondary data from local revenue officer.
- Primary data acquired through field survey.

For this purpose ERDAS IMAGINE 8.6, ArcGIS 9.1, ArcVIEW 3.2 software has been used.

3.2.2 Data Products Used
Development of VIS needs baseline data, topographic data, thematic data and collateral data. All such data products have been derived and extracted through various sources, which are given in the following table.
<table>
<thead>
<tr>
<th><strong>Type of Data</strong></th>
<th><strong>Source of Data</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Toposheets (1:25,000 Scale)</td>
<td>SOI (Survey of India), Hyderabad</td>
</tr>
<tr>
<td>Cadastral maps</td>
<td>Central Survey office, Hyderabad.</td>
</tr>
<tr>
<td>Satellite Data IRS-P6(LISS-IV MX)</td>
<td>NRSC (National Remote Sensing Centre)</td>
</tr>
<tr>
<td>Village Infrastructure and Utilities Information</td>
<td>Revenue office, Mandal office and Village panchait offices.</td>
</tr>
<tr>
<td>Census data</td>
<td>Bureau of Economics and Statistics (BES), Hyderabad</td>
</tr>
<tr>
<td>Industries Information</td>
<td>APPCB (Andhra Pradesh Pollution Control Board) and district Industrial Centre</td>
</tr>
<tr>
<td>Meteorological Data</td>
<td>Indian Meteorological Department (IMD)</td>
</tr>
<tr>
<td>Agricultural and Water Resources data</td>
<td>AP Irrigation Departments and district Agricultural office</td>
</tr>
<tr>
<td>Land use / Land cover map</td>
<td>Satellite data analysis</td>
</tr>
<tr>
<td>Other data like Administrative maps</td>
<td>Concerned Departments of State Government and Central Govt.</td>
</tr>
<tr>
<td>(Districts maps, mandal maps, forest maps)</td>
<td></td>
</tr>
</tbody>
</table>

*Table 3.1 showing the data sources from various departments*
3.3 GEOREFERENCING OF TOPO SHEET:

- Acquisition of toposheets from SOI as hard copies are scanned to make them as softcopy, this softcopy is in “Tiff” or “Jpg” format.
- Toposheets, which are in tiff & Jpg format are imported into ERDAS 8.6 image software to make them as img (ERDAS native format).
- The geometric correction of toposheet has been done in “geometric latitude/longitude” projection and “Modified Everest” datum by placing 16 tick points on 16 corners of a toposheet by entering the corresponding latitude/longitude values, which are available on toposheets.
- After placing all the tick points, the toposheet is resampled (nearest neighbor).
- Finally after resampling, georeferenced toposheets are available for use.
- Mosaicing of georeferenced toposheets has been done to show the continuous terrain.

3.4 GEOREFERENCING OF SATELLITE DATA:

- Acquisition of satellite data from NRSC is in soft copy.
- Processing of satellite data has been done, so as to make data free from all the errors caused by atmosphere, geometry, and radiometry during the acquisition of data.
Georeferencing of high resolution IRS-P6 LISS-IV MX (5.8 mt resolution) satellite data is done by using georeferenced toposheets and GCPs collected from field survey.

After placing GCPs, input file and reference file have to be saved and after that resampling of satellite data is done. This procedure is repeated for every scene of concerned path and rows of satellite of the study area.

Overlaying of the georeferenced satellite data on respective toposheets has done to check whether the features are perfectly matched or not with toposheets, if some error results, repeat the above procedure of georeferencing.

Georeferenced LISS-IV MX (5.8 X 5.8 mt), and CARTOSAT-1 (2.5 mt) images have been merged to get high resolution data (i.e. 2.6 spatial resolution) with multispectral.

Mosaic process of these scenes is done to make the image to show continuous terrain of study area.

3.5 CREATION OF THEMATIC MAPS & FIELD SURVEY:

Thematic maps have been developed, namely, base map, drainage map, transportation map and land use/land cover map using ARC GIS 9.1 Software.
ArcGIS 9.1 software is used to fix 1:10,000 scale. In the ArcGIS software without moving the scale, visible features in 1:10,000 scale has been digitized.

For Ground truth using Global Positioning System (GPS) and identifying doubtful areas occurred in preparing of land use/land cover.

Before going to filed survey, village infrastructure data at mandal level and other collateral data has been collected form concerned organization

3.6 METHODOLOGY:

The overall methodology adopted for the present study is broadly divided into three phases:

1. Data collection and analysis
2. Field work and ground truth data collection
3. Data integration and generation of village information system in GIS
Flow chart 3.1: The methodology for Village Information System.
3.7 SPATIAL DATA FROM TOPOSHEET

Creation of spatial data base is a complicated operation and it is baseline of whole work. It involves the processes of data capture, structuring, and verification. Since all the geographical data is obtained in the raw format, such as toposheets, satellite imageries, ariel photographs different types of table formats. Among these all, toposheets are much more concerned to the environmentalist and scientist. In the study area, generation of thematic maps from the toposheets are baseline map, drainage network map, transport network map, physiography map, watershed map, and mandal reference map. For preparation of these thematic maps in digital format, toposheet are scanned and then converted into image (img) format using ERDAS 8.6 software. Then, further these toposheets images are georeferenced and mosaiced to form a continuous terrain of the study area. By using ArcGIS 9.1 software, these toposheets are digitized theme wise using point, line, and polygon feature. The detailed procedure is explained in the subsequent chapters.

3.8 SPATIAL DATA FROM SATELLITE IMAGERY

Generation of thematic maps from satellite data, i.e, land use/land cover, soil, and geomorphology. Extraction of thematic maps from the satellite data depends on the visual interpretation key elements, i.e., tone, texture, shape, size, and association with other features. Satellite images
are brought from NRSC in a raw format. Further pre-processing and processing is done for satellite imagery by using ERDAS 8.6 software. These satellite images are interoperated and digitized in order to prepare digital thematic maps. The detailed procedure is explained in the subsequent chapters.

3.9 ATTRIBUTE DATA AND FIELD DATA

Attribute data is the data which gives the description about the spatial data. These data are collected from different government and private organizations. ArcGis is a software, which can store spatial and non-spatial data both. After creation of spatial data, attribute data is linked to the spatial features in ArcGis software. Linkage of spatial and non-spatial data is discussed in the up coming chapters.

3.10 SPATIAL AND ATTRIBUTE DATA LINKAGE IN ARCGIS PLATFORM

ArcGIS has a sophisticated geographic data model for depicting spatial data information as rasters features and other spatial data types. ArcGis upholds an implementation of data model used for both data base management system and file systems. The data models, which are file based, consist of shapefiles, features, images, coverages, grids and Triangulated Irregular Networks (TINs). Geodatabase manages the equivalent types of geographic information in a data base management
system, providing many of the management benefits offered by a DBMS. Both the file-based data models and the DBMS-based geodatabase model define a generic model for geographic information. This generic model can be used to define and work with a wide variety of different user or application-specific models. By defining and implementing the behavior of a generic geographic data model, geographic information in ArcGIS provides a robust platform for any GIS application. ArcGIS enables large volumes of imagery to be made quickly accessible to a wide range of applications and users. ArcGIS provides the infrastructure that supports multiple workflows associated with collection, management, production, and exploitation of imagery; this includes the ability to serve imagery quickly through dynamic and server-side image processing, which complements a rich capability for image management and dissemination.

### 3.10.1 OVERVIEW

ArcMap is the premier application for desktop geographic information systems (GIS) and mapping. ArcMap gives you the power to:

- **Visualize**: Working with geographically data by seeing different types of patterns.
- **Create**: Creating maps in ArcMap is very easy to express message. ArcMap provides all the tools, which are required to put the
attribute data on the map and displays the layout in very effective way.

- **Solve:** Being working with geographically data let us query and answer questions for instance "Where is...?", "How much...?", and "What if...?" it makes us to take better decisions.

- **Present:** In ArcMap we can show the results. High quality maps and good looking map can be prepared and published. Link reports, tables, graphs, drawings, photographs, and other data can be prepared.

- **Develop:** The ArcMap customization environment lets you tailor the interface to suit your needs, build new tools to automate your work, and develop standalone applications based on ArcMap mapping components.

### 3.10.2 ArcGIS Desktop applications

**ArcMap:** Lets you view, create, query maps, identify results, as well as edit data. The following map shows land use/land cover and village map in ArcGIS platform of Karamchedu mandal.
Fig 3.1 showing land use/land cover map and village map in ArcGIS platform.

3.10.3 Query Builder

ArcGIS is a very advanced software for mapping purposes. This entire project is developed in ArcGIS platform 9.1. Query builder is a tool by which we can select any desire feature to get spatial and attribute information. The below figure shows the query done for residential area.
3.10.4 Identify Results

In ArcGIS, by taking identify tools and clicking on the feature, we can find the identity of the feature and detailed information about the feature. The below cadastral map is showing the detailed spatial and non-spatial information about the village.
3.10.5 Spatial and Attribute Data Linkage

Map showing base information of karamchedu mandal with attribute database.

Fig 3.4: showing spatial and attribute data linkage

3.10.6 ArcCatalog

ArcCatalog provides data access and spatial data management tools including the reading and creation of metadata. Metadata shows the geographical coordinate system name, description of the shapefile, and spatial and attribute information of the shapefile.
3.10.7 Geoprocessing (including ArcToolbox)

Embedded in ArcMap and ArcCatalog, the new geoprocessing functionality provides an environment for performing Geographic Information System (GIS) analysis. Geoprocessing tools are organized into toolboxes and toolsets within ArcToolbox. They can be used individually or in combination in models and scripts to perform many GIS analysis tasks including data conversion.
3.11 DEVELOPMENT DECISION SUPPORT SYSTEM

The step by step procedure followed for development of Decision Support System for Karamchedu mandal.

The Decision Support System (DSS) application is developed by using Visual Basic 6.0 as front end and MS-Access as back end for database purpose. The designing part is developed/designed by using the default tool and derived tools from the components option of project menu of Visual Basic. Visual Basic 6.0 is a GUI (Graphical User Interface), which means it is easily understandable to everyone.

In the designing part, the first form is login form, which asks for the correct user name and password. After providing the correct user name and password, one can further view the “HOME PAGE” of the project. On the home page, there is a tab option (to click) to view the main page of the project.