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राष्ट्रीय ग्रामीण सड़क विकास एजेंसी
(ग्रामीण विकास मंत्रालय, भारत सरकार)
National Rural Roads Development Agency
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D.O. No.P-17029/2/2011/TA/WB

29th May, 2015

Sub: **Implementation of Geographic Information System (GIS) under World Bank assisted Rural Roads Project-II, PMGSY**

Dear Sir / Madam,

Rural Roads Project-II of PMGSY is being implemented in 8 states with the assistance of World Bank, which aims to establish computerized data base for core rural road network through development of web based Geographical Information System (GIS) linked to Road Condition Inventories and also, development of social and environmental screening using GIS platform. A Software Requirement Specifications (SRS) study was carried out by C-DAC to formulate the entire project requirements & procedure of system design which would provide the basis for various project activities. A copy of this report along with GIS data standard for spatial data creation is enclosed for information and guidance of the States.

2. It has been decided to implement this project for all PMGSY States in two phases as indicated below:-

- **Phase-I** will comprise of procurement & installation of hardware & software at the central level as a part of Web GIS system and integration of data from the States of **Rajasthan, Himachal Pradesh, Gujarat, Maharashtra, Punjab and Uttarakhand**.

- **Phase-II** will integrate all the remaining States, participating & non-participating states, into the Web GIS system progressively, as & when they finalize / update their database.

- C-DAC had earlier developed a GIS system, namely, **GRIMMS-2 for Odisha, Tripura, Mizoram & Manipur** and these States should be able to make their data base ready quickly for integration with the Web GIS system.

3. For implementation of the project, States have to prepare the database as per requirements of C-DAC specifications and data standard laid down in SRS so as to be compatible with the Web GIS system. The states should assess the present status of availability of this data at their level as per following possibilities: -

(i) The States where complete GIS data of the road network including habitation and other parameters is available can be straight away integrated with the GIS Server. The States where GRIMMS -2 was implemented earlier should be at an advanced stage of preparedness with the data available in required format and standards.

(ii) The States where this data is partially available / or not available in required format & standard, would require modification/ upgradation for proper system integration. Action should be started to modify / upgrade this database so as to make it ready for integration with Web GIS system.

(iii) The States where this data is not available at all & require creation from the beginning, action should be taken to start preparing this database so as to make it ready for integration with Web GIS System.

4. Considering the fund availability under RRP-II, PMGSY and upcoming closure of Project, you all are requested for prompt action on following points within the next 2 weeks period:

- To initiate action to prepare / upgrade the data base. States included in **Phase-I** i.e. **Punjab, Rajasthan, Himachal Pradesh, Gujarat, Maharashtra and Uttarakhand** need to do it promptly.

- To assess whether they require SRIS system, as suggested by C-DAC, for their State. This should be considered appropriately taking view of the fact that certain states have already developed standalone GIS systems.

- To assess their requirement of preparing / upgrading the database & requirement of SRIS, make a cost assessment for the same and project it to NRRDA for allotment of funds.

Warm regards,

Yours sincerely,

Encl: (i) SRS Report
(ii) Advisory on Data format

29/05/15

(Rajesh Bhushan)

To,

All Principal Secretaries/Secretaries of Nodal Departments (PMGSY) in States (as per list attached).

Implementation of GIS for

Pradhan Mantri Gram Sadak Yojana (PMGSY)

Ministry of Rural Development, Government of India

Software Requirements Specifications

(SRS) Document

Version 1.01

CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

CONTENTS

1. INTRODUCTION

Pradhan Mantri Gram Sadak Yojana (PMGSY) was launched on 25thDecember 2000 as a fully funded Centrally Sponsored Scheme to provide all weather road connectivity in rural areas of the country. The programme envisages connecting all habitations with a population of 500 persons and above in the plain areas and 250 persons and above in hill States, the tribal and the desert areas. National Rural Roads Development Agency (NRRDA), Ministry of Rural Development (MRD), Government of India is implementing agency for this programme.

OMMAS, a web based application software (www.omms.nic.in), has been established by the NRRDA to effectively manage various activities under PMGSY and flow of information at all levels. OMMAS has been developed with the assistance of C-DAC. It facilitates the officials involved in the Programme in managing the enormous data that will be engaged at various stages of the PMGSY. The software has been designed to data entry at a single point so as to eliminate repetitive and time-consuming tasks of data compilation and aggregation at various levels. This site is open to citizens maintaining transparency and access to information.

Through OMMAS, for the first time, a nation-wide programme is being managed and monitored online; OMMAS envisages that the District Project Implementation Units (DPIU) will upload the data regarding the road proposals and construction progress comprising both physical and financial data on to the PMGSY website. The data will be used for decision-making, and for transactional decisions, monitoring and analysis. From 2003-04 onwards, updating the website is a pre-requisite for availing funds under the Programme.

GIS interface to OMMAS will help in presenting information in the form of maps and charts in an integrated manner for more transparency and accountability. Impact assessment of PMGSY can be effectively monitored using GIS. Depiction of socio-economic data vis-à-vis road network within GIS will help monitoring various parameters including growth, employment and change in demographic profile, which ultimately will improve the socio-economic condition of rural masses.

***Everything that happens happens somewhere**. Knowing "what" is "where," and "why" it is there, can be critically important for making decisions in personal life as well as in an organization. GIS is the technology as well as the science for handling the "where" type of questions and for making intelligent decisions based on space and location. GIS can produce more than just pretty maps although GIS is conventionally used to make a myriad of maps using different scales, themes and symbols. More importantly, GIS has powerful analytical functions that turn data into useful information. GIS can relate otherwise disparate data on the basis of common*

geography, revealing hidden relationships, patterns, and trends that are not readily apparent in spreadsheets or statistical packages, and create new information that can support informed decision making.

The Web changes everything, and GIS is no exception. Web GIS, as the combination of the Web and geographic information system(s) or science (GIS), has grown into a rapidly developing discipline. The vast majority of Internet users use simple mapping or other spatially enabled applications over the Web at some point, though many are not aware of it. GIS has benefited greatly from the Internet paradigm of broad connectivity and the momentum that the Web has generated. The Web has unlocked the power of GIS, from offices to laboratories. It has put GIS in the homes of millions and in the hands of billions, and made it usable across all industries, from government and business to education and research.

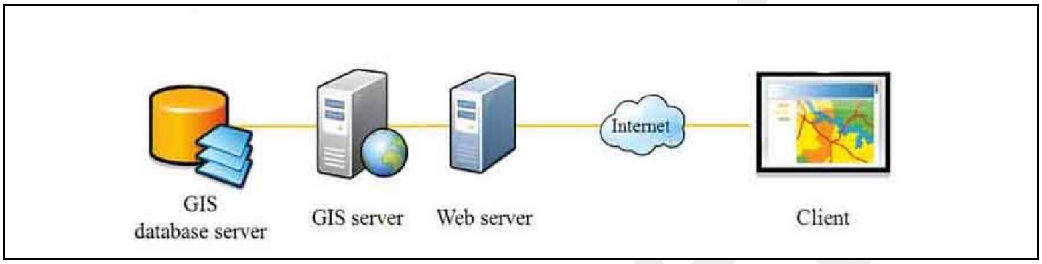

Fig. Web-GIS

Web GIS facilitate the sharing, communication, interoperability, collaboration, and integration of geospatial information on the Web. Web GIS for PMGSY will help to monitor progress of the PMGSY on GIS maps. It includes showing connectivity status of the habitation on a GIS map. Using web GIS can provide following benefits

- A global reach
- A large number of users
- Better cross-platform capability
- Low cost as averaged by the number of users
- Easy to use for end users
- Unified update
- Diverse applications

Web GIS is able to perform all GIS functions involving spatial information, including capture, storage, editing, manipulation, management, analysis, sharing, and visualization. Some of the strengths of Web GIS include the following:

- Mapping (visualization) and query
- Collection of geospatial information
- Dissemination of geospatial information
- Geospatial analysis

1.1 Purpose

The purpose of this Software Requirements Specifications (SRS) document is to provide a detailed description of the requirements for the Web-GIS for Pradhan Mantri Gram Sadak Yojana (PMGSY). This SRS will allow a complete understanding of what is to be expected of the Web-GIS tool. The clear understanding of the Web-GIS tool and its' functionality will allow for the correct software to be developed for the end users and will be used for the development of the future stages of the project. This SRS will provide the foundation for the project. From this SRS, the Web-GIS tool can be designed, constructed, and finally tested.

This SRS will be used by NRRDA, state road departments, software engineers and GIS consultants for developing the Web-GIS tool. The software engineers and GIS consultants will use the SRS to fully understand the expectations from this Web-GIS tool to develop the appropriate software. The end users will be able to use this SRS as a 'test' to see if the software engineers and GIS consultants are developing the system as per their expectations. If it is not as per their expectations the end users can specify how it is not to their liking and software engineers and GIS consultants will change the SRS to fit the end users' needs.

1.2 Scope

The primary objective of the PMGSY is to provide connectivity by way of an all weather road to the eligible un-connected habitations in the rural area as well as upgradation of the existing roads. Effective implementation of the PMGSY needs a system that will monitor the progress of the programme as well as help planning next phases of implementation.

Geographic Information System (GIS) is the obvious tool to achieve this because it provides visual representation showing habitation connectivity status on GIS map. An important part of every web-based GIS tool is its mapping or visualization technology, which makes it possible to show various geographic features like habitations, roads in the form of maps. It helps in identifying the connectivity of the habitations with the road as well as planning new roads for unconnected habitations.

1.2.1 Objective

- ✓ *To conduct system requirement specification study for GIS implementation project under PMGSY.*

- ✓ *Study current status of GIS at State level which includes understanding the availability of spatial data with states, NRRDA and other agencies like Survey of India (SOI) etc.*
- ✓ *Define approach and methodology for preparation/ capture spatial data where it's not available along with estimate of the financial implications of data creation/capture at State level*

1.2.2 Study Area

For developing & implementing the Web-GIS tool, nine states have been considered which include Himachal Pradesh, Rajasthan, Uttarakhand, Punjab, Uttar Pradesh, Meghalaya, Jharkhand, Bihar and Gujarat.

1.3 Abbreviations

SRS	*System requirement Specification*
GIS	*Geographic Information System*
PMGSY	*Pradhan Mantri Gram Sadak Yojana*
NRRDA	*National Rural Road Development Agency*
OMMAS	*Online Monitoring and Management and Accounting System*
C-DAC	*Centre for Development of Advanced Computing*
SoI	*Survey of India*
CN	*Core Network*
DRRP	*District Rural Road Plan*
MP	*Member of Parliament*
MLA	*Member of Legislative Assembly*
PWD	*Public Works Department*
MOD	*Ministry of Defense*
DVD	*Digital Versatile Disc / Digital Vector Data*

LCC	*Lambert Conformal Conic*
MDR	*Major District Roads*
ODR	*Other District Roads*
VR	*Village Roads*
BT	*Bituminous*
WBM	*Water Bound Macadam*
MIS	*Management Information System*
SQL	*Structured Query Language*
GRIMMS	*GIS enabled Road Information Management and Monitoring system*
HQ	*Head Quarters*
PDF	*Portable Document Format*
COTS	*Commercial off-the-shelf*
UTM	*Universal Transverse Mercator*
TM	*Transverse Mercator*
RDBMS	*Relational database management system*
MS	*Microsoft*
WMS	*Web Map Server*
QC	*Quality Checking*
DPIU	*District Project Implementation Units*

1.4 References

1. Letter for preparing System Requirement Specifications (SRS) to be conducted by C-DAC for GIS implementation project under PMGSY from NRRDA
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1.5 Overview

The SRS is organized into two main sections. The first is 'The Overall Description' and the second is `the Specific Requirements'. The Overall Description will describe the requirements of the GIS implementation for PMGSY project from a general high level perspective. The Specific Requirements section will describe in detail the requirements of the system.

2. THE OVERALL DESCRIPTION

The general factors which affect the product and its requirements are described here. This section does not describe specific requirements. Instead, it provides a background for those requirements, which are defined in specific requirement section, and makes them easier to understand.

2.1 Approach

The approach starts with creation of GIS layers from the maps/ digital data available with the respective implementing agencies. Taking into consideration these data as base, various GIS layers required for the GIS implementation of PMGSY project will be digitized. The digitization work can be outsourced to vendors. The quality checking of the digitized data may be carried out by the implementing agency. Geo database will be created using the final GIS layers. Geo database will be integrated with OMMAS database based on common attribute. Finally, Web-GIS system will be developed which will use the same Geo database and serve customized user specific queries along with various GIS functionalities. Implementation of GIS for PMGSY includes following tasks

- ✓ *Study of existing OMMAS for execution of various activities within GIS frame-work*
- ✓ *To prepare GIS database for the nine states specified in study area section. The preparation of GIS database includes creation of various GIS layers including habitation and road layers.*
- ✓ *To integrate the GIS layers with the corresponding attributes in the OMMAS database.*
- ✓ *To develop a high performing and flexible Web-GIS tool to monitor the implementation of PMGSY programme using GIS technologies.*

2.2 Detailed Methodology

The methodology of the proposed study is elaborated in the steps below

2.2.1 Preparation of GIS base layers

Spatial layers (1:50,000 scale) along with required associated attribute information (Habitation id, CN Number, DRRP Number, Package ID etc) will be provided by states, which will be considered as base for creation of GIS database.

Creation of GIS database does not simply means the digitization of maps. In order to make digitized maps available in GIS domain, many other components are involved such as layer-wise data formatting; feature coding, map projection, edge matching, topology building and accuracy. Preparation of various GIS layers involves following

1. Information regarding forest boundary, land use, river, water bodies and railway lines, if required, may be picked from available source.

2. Administrative boundaries of blocks, districts, states, MP/MLA constituency, and PWD Circle/Division from paper maps will be converted to digital format

3. Rural roads (DRRP including Core network) and habitation will be converted from paper maps to digital format

4. PMGSY layer (Package layer), if required, may be created

2.2.2 QC for GIS layers

After creation of GIS database various GIS layers in the database will be checked for its quality. For quality assurance of the GIS, various GIS layers and features in layers need to be checked for following

1. File format and naming: GIS layers shall be in predefined format, e.g. .shp format. The file names shall be checked for if the naming convention is followed.

2. Map projection: Each GIS layer shall be checked for correct projection parameters

3. Positional accuracy: Shape and location of the features in GIS layer shall be checked for the closeness to the actual GIS objects on the map.

4. Attribute accuracy: Attribute fields related to each feature in GIS layer shall be checked for correct data type and value

5. Topological consistency: Topological consistency has to be maintained For example polygon feature shall be closed, line feature shall be continuous.

6. Compatibility with OMMAS database: The number of features in GIS layers shall match corresponding number of records in the OMMAS for each state, district and block. For polygon features sliver polygons should not be present. Each feature in the layer will follow the same ID fields as in OMMAS

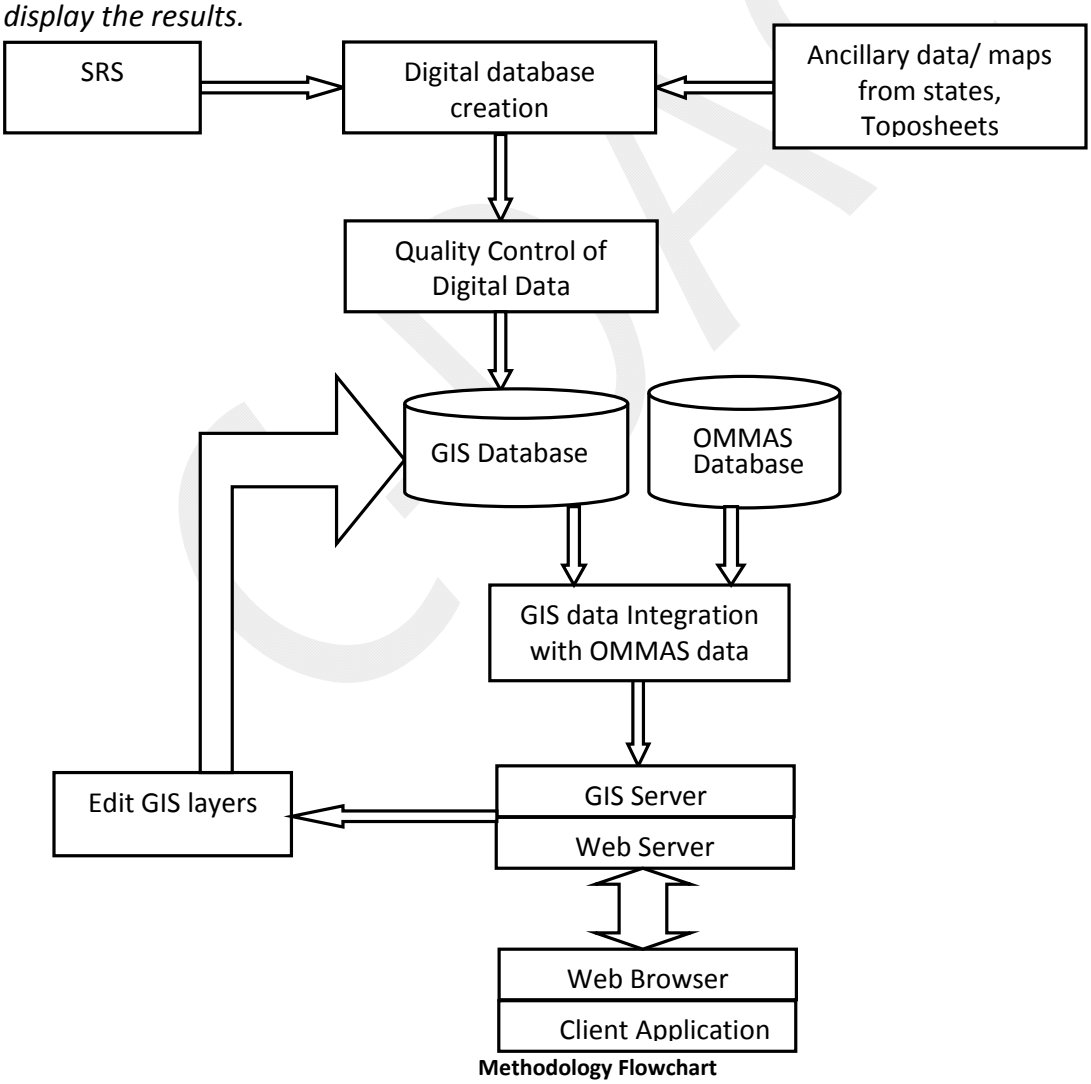
Refer annexure IV for the steps to be followed for acceptance of digitized maps

2.2.3 Integration with OMMAS database

For dynamic linking of attribute data in OMMAS with GIS features, common field will be required. During digitization these fields will be added to the GIS layers as attributes. In OMMAS views, procedure, functions will be created with geographic feature ids along with corresponding attributes attached to it. These database views, procedures, functions will be referenced while performing attribute query in the Web-GIS tool.

2.2.4 Development of Web GIS for PMGSY

Web GIS tool will be developed to monitor habitation connectivity on GIS map. Web GIS tool available on Internet, will allow performing basic GIS functions (display and query) to the remote user through conventional Web browser (Mozilla, Internet Explorer, Google Chrome). The GIS Web Map Server will be used as a back engine for processing and displaying predefined queries executed by user. Utility and query tools arranged on the Web page will allow user to execute the desired queries and display the results.



Methodology Flowchart

2.2.5 Activities involved in the implementation

Activity	*Responsibility*
Funding	*NRRDA,States*
Procurement of data (maps, toposheets etc.)	*States (refer annexure I)*
Clearance from MOD to host GIS maps on web	*NRRDA,States*
Data processing involved Geo-referencing, Ortho rectification, mosiacing, etc.	*States (these activities can be outsourced. Refer annexure III for guidelines of outsourcing the activities)*
Digitization of layers	*States (this activity can be outsourced. Refer annexure II for guidelines of digitization activity)*
Quality checking of digitized data	*States,Implementing agency*
GIS data integration with OMMAS data	*Implementing agency*
Development of Web-GIS	*Implementing agency*
OMMAS data updation	*DPIU*
GIS layers updating	*States*

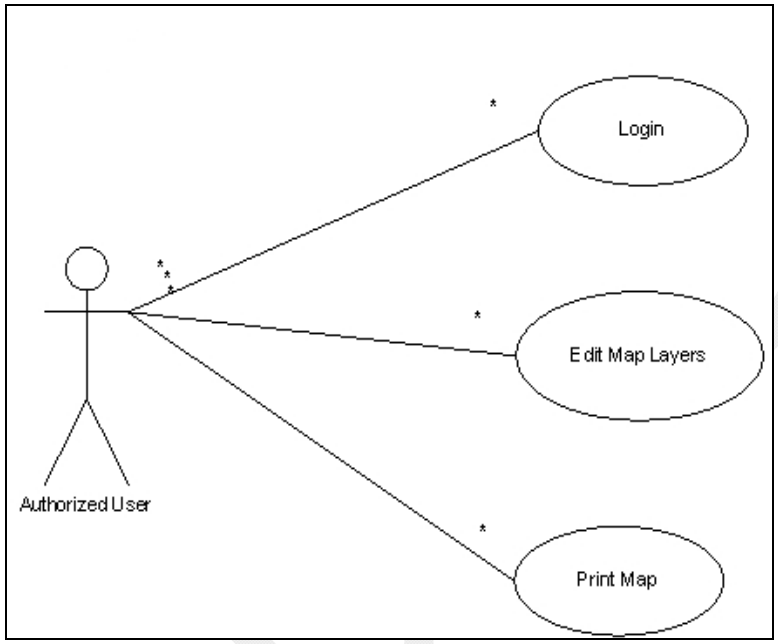
2.2.6 User Characteristics

System shall have three types of users. Each user has a specific role in the system and this SRS appropriately mentions 'user type' for against each requirement.

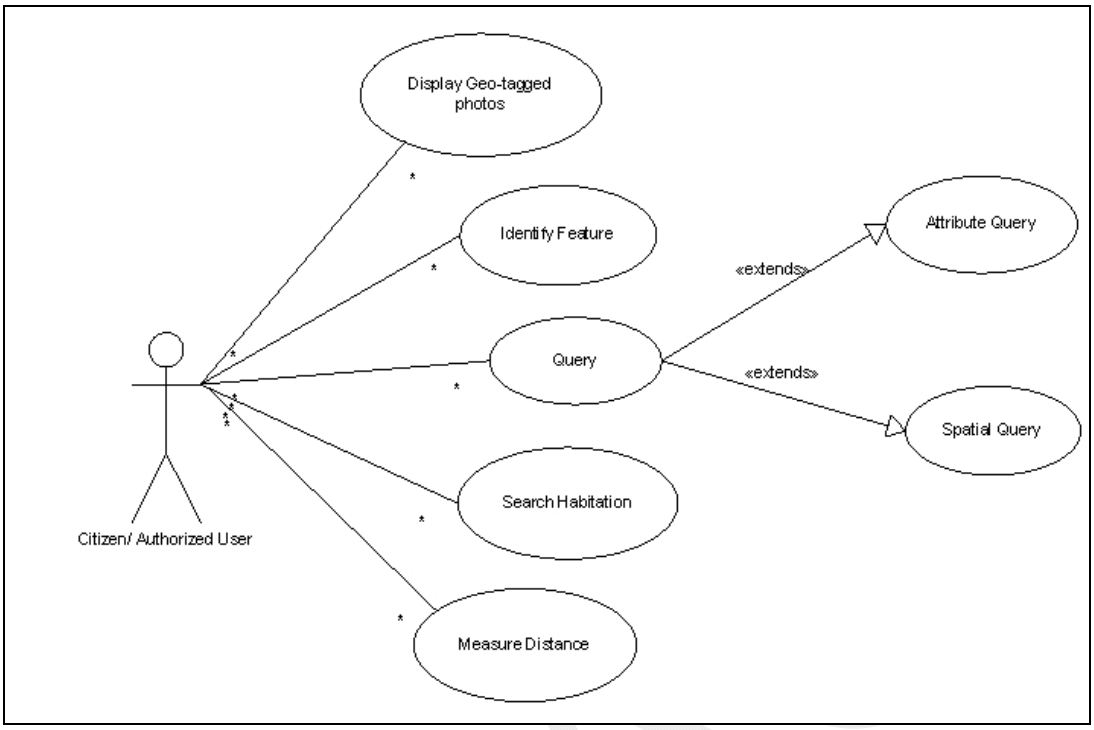
User	*Roles*
Administrator	• *For creating and deleting users as per the user type and access rights* • *database administrator and overall hardware and software system administrator*
Public user /Citizens	• *These users includes citizens as well as policy makers* • *These users will have access to the system for the following purpose* ➢ *View GIS map of all the states* ➢ *Use GIS functionality to navigate the GIS maps* ➢ *Use information tool to access information about GIS features(habitation, road etc)* ➢ *Make query (attribute as well as spatial)*

Authorized user	• *These users includes authorized users from states* • *These users shall have access to the system as public user* • *In addition these users shall have access to the system for editing GIS data of its own state*

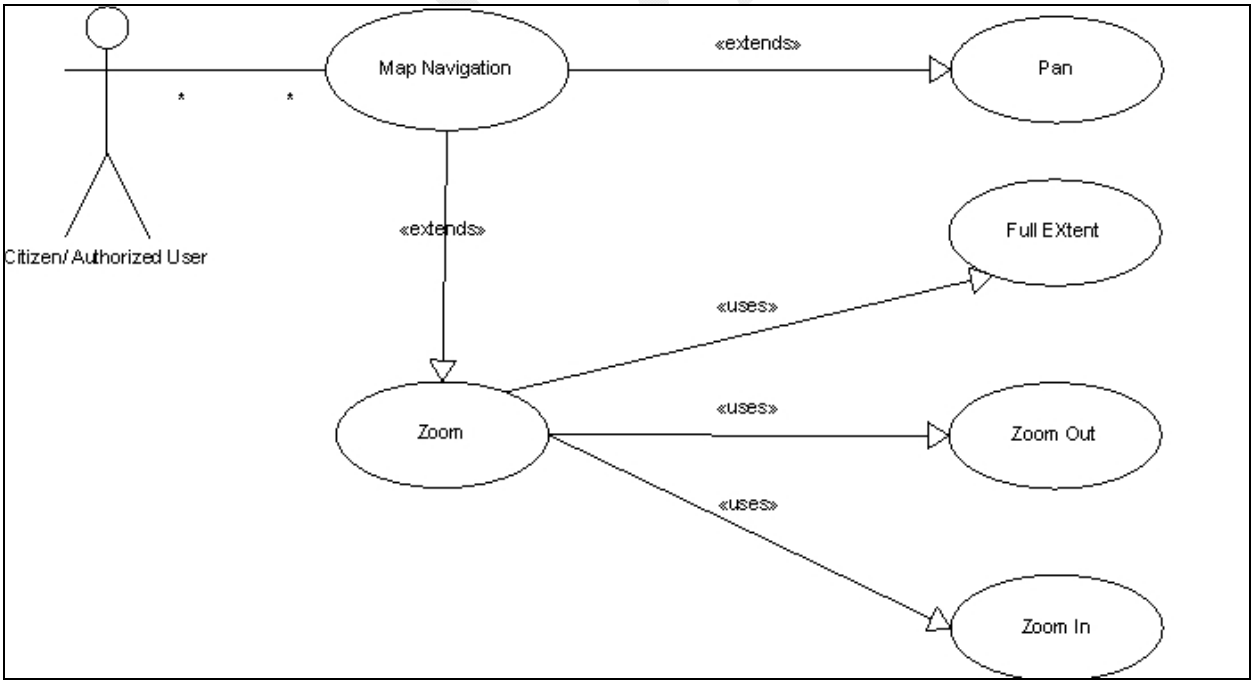
2.2.7 Use Cases



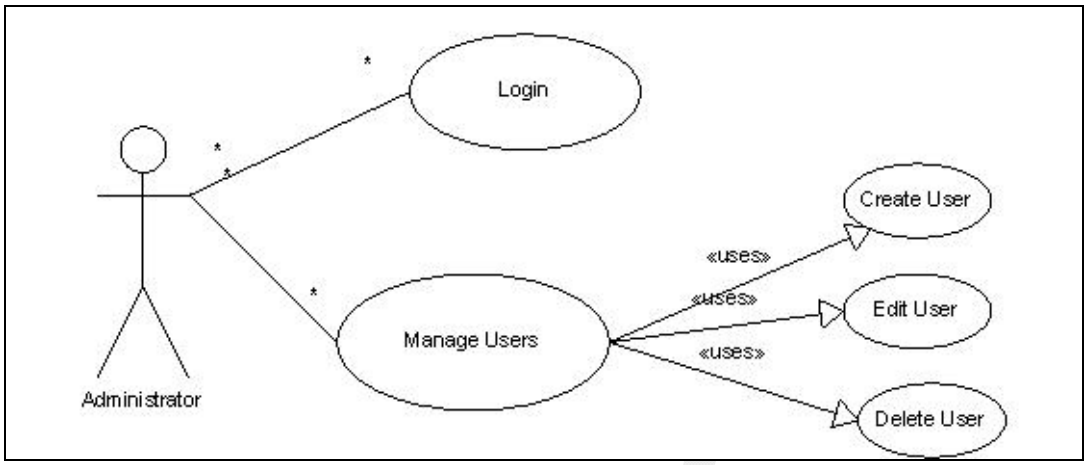
Use Case 1



Use Case 2



Use Case 3



Use Case 4

3. SPECIFIC REQUIREMENTS

3.1 Data Requirements

3.1.1 Spatial Data

SR_Data_01

If map data not available, 1:50,000 digital topographic data, containing the following layers may be procured. The procedure for procurement of data and the list of toposheets are given in Annexure I.

- *Administrative boundaries (International/ State/ District boundaries)*
- *Forest boundary*
- *River & Stream*
- *Water body*
- *Landuse*
- *Railway network*
- *Road network*
- *Habitation*
- *Quarry*

SR_Data_02

*Quality checks on data (**SR_Data_01**) shall be carried out before accepting it.*

- *Data format*
- *Latitude/longitude of 4 corners of a topo map*
- *Projection parameters*
- *Number and type of layers*
- *Continuity of layers*

SR_Data_03

*The digital data (**SR_Data_01**) shall be converted to .shp format which will be used in database creation. This format is also supported by all leading GIS software available in the industry.*

SR_Data_04

The participating states shall trace the following features on tracing sheet in 1:50000 or larger scale using toposheet and/or other relevant maps.

- *District/Block boundary*
- *MP/MLA constituency*
- *PWD Division/Circle*
- *National/State highways*
- *Core Network*
- *DRRP*
- *Habitation*
- *Bridge (Major & Minor)*
- *Level crossing (Manned & Unmanned)*
- *Religious and Tourist places*
- *Quarry site (Stone & Sand)*
- *Market centre*
- *District/Block/Revenue headquarters*

SR_Data_05

Tracing sheets containing the layers shall be scanned and used in GIS database creation in Tiff/a suitable format.

SR_Data_06

Geo-coding of Tiff data shall be done using LCC/a suitable Projection before digitizing.

SR_Data_07

New layers for the following features shall be created by digitizing from the geocoded tracing sheets. The detailed procedure is explained in Annexure II.

- *Block Boundary*
- *MP/MLA constituency*
- *PWD Division/Circle*
- *Tourist / Religious / market places*
- *Major / Minor bridges*
- *Manned / unmanned railway crossings*
- *State / District / Block / Revenue Headquarters*

SR_Data_08

Map layers mentioned in SR_Data_01 shall be updated based on the satellite data.

SR_Data_09

Quality checking of digitized data shall be carried out as described in methodology section

SR_Data_10

State-wise mosaic of toposheets shall be created for seamless digital map on 1:50,000 scale.

3.1.2 Attribute Data

SR_Data_11

During digitization attributes (required for GIS data integration with OMMAS data) shall be attached to the map layers.

SR_Data_12

OMMAS data in SQL on the central server shall be linked with spatial data using unique IDs of map features for Web GIS application.

SR_Data_13

The current system of online updation of the central OMMAS database from the DPIUs shall continue.

3.2 Web-GIS Functionality

SR_Fn_ 01

Home Page shall be required for website. Home page contains information about NRRDA, PMGSY, OMMAS, and GRIMMS etc. The home page shall also contain the GIS map of India from which required state can be selected

SR_Fn_02

Page with GIS map of the state selected by the user shall be displayed. It should have map control which contains various GIS layers of information in the form of raster and vector layers

SR_Fn_ 03

Various vector layers such as shown in the table should be integrated into the map control.

No.	Map layers	Type
1	Habitations	Point
2	State Boundary	Polygon
3	District Boundary	Polygon
4	Block Boundary	Polygon
5	MP Constituency Boundary	Polygon
6	MLA Constituency Boundary	Polygon
7	PWD Division Boundary	Polygon
8	PWD Circle Boundary	Polygon
9	Forest Boundary map	Polygon
10	International Boundary	Line
11	DRRP Road	Line
12	CN Road	Line
13	Bridges	Point

14	Level crossing (Manned & Unmanned)	Point
15	Quarry (Stone & Sand)	Point
16	Market Centre	Point
17	Administrative HQ (Revenue, Block, District, Panchayat)	Point
18	Water body	Polygon
19	Tourist Place	Point
20	Railway	Line
21	Drainage	Line

SR_Fn_04

Tool shall be required to navigate the map which includes

1) *PAN*  *: This tool shall able to panning the map;*
2) *Zoom In*  *: This tool shall zoom in the map;*
3) *Zoom Out*  *: This tool shall zoom out the map;*
4) *Full Zoom*  *: This tool will zoom out the map at full extent.*

SR_Fn_05

GIS layers shall be integrated to the MIS data in OMMAS database to link the attributes in MIS to the GIS features.

SR_Fn_06

There shall be a tool which will identify the features (vector data) such as, district, block habitation, roads on to the map.

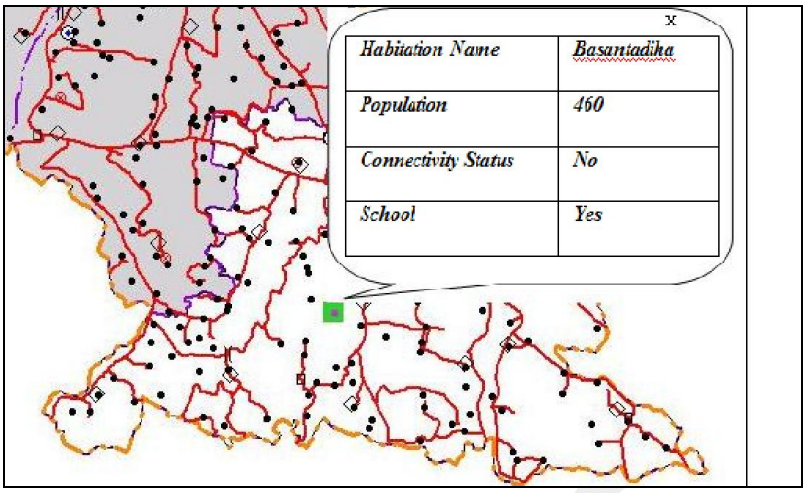


Fig. Info Popup

Following details shall be populated into an Info-Window for corresponding features:

Layer	***Feature***	***Information***
District Boundary	*District*	• *Habitations benefitted* • *Road length completed* • *Total expenditure* • *No of road works cleared* • *New connectivity* • *Upgradation* • *Completed road works* • *Completed Length(Kms)* • *In-progress road works*
Block Boundary	*Block*	• *Habitations benefitted* • *Road length completed* • *Total expenditure* • *No of road works cleared* • *New connectivity* • *Upgradation* • *Completed road works* • *Completed Length Kms)* • *In-progress road works*
Habitation	*Habitation*	• *Name* • *Population* • *Connectivity status* • *Facilities like school,*

		PHC etc.
DRRP Roads	*Road*	• *Road name* • *Road length* • *Road category* • *Land , Carriageway & formation widths* • *Surface type* • *Traffic intensity(Total & commercial vehicles)* • *CD works* • *Habitations mapped*
CN Roads	*Road*	• *Road name* • *Road length* • *Road from* • *Road to* • *Road type(through/link)* • *Habitations mapped*

There shall be provision to close the identify pop-up

SR_Fn_07

Layer tree shall be required. Layer tree shall list all the layers displayed on the GIS map. It should have facility to enable/ disable (visible /invisible) the layers.

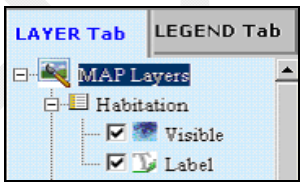


Fig. Layer Tree

SR_Fn_08

There shall be facility to label GIS features in the GIS layer. The user shall be given option to put label to the selected layer.

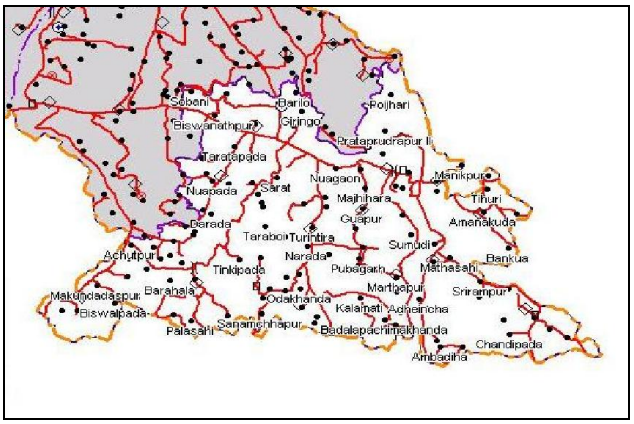


Fig. Map with labels

SR_Fn_09

Legend shall be provided along with the map control representing symbology followed for all the GIS layers in the map control. The GIS features displayed on map shall exactly match with the corresponding symbol in the legend.

Fig. Legend

SR_Fn_10

Selection of map size

The system shall have option to select the size of the GIS map. This facility will help in increase/ decrease the size of the map displayed on the screen according to the need of the user.

SR_Fn_11

Boundary selection

System shall provide facility for boundary selection. This will be required before the performing any query.

Scenario1: *State selection*

System shall have facility to select the state boundary

Scenario2: *Selection district within selected state*

After selection of the state user shall have facility to select district of interest

Scenario3: *Selection block/s within selected district*

Finally system shall have facility to select boundaries of the blocks of interest

Scenario4: *Clip selected boundary*

System shall have facility to clip the selected boundaries where only the selected blocks will be visible on the GIS map

SR_Fn_12

User defined attribute queries shall be customized. These queries will be based on the attributes related to various GIS in database (OMMAS). The result of the queries will be displayed on the GIS map by highlighting the features meeting query criteria with different color. The attributes of the highlighted features shall be displayed in tabular format.

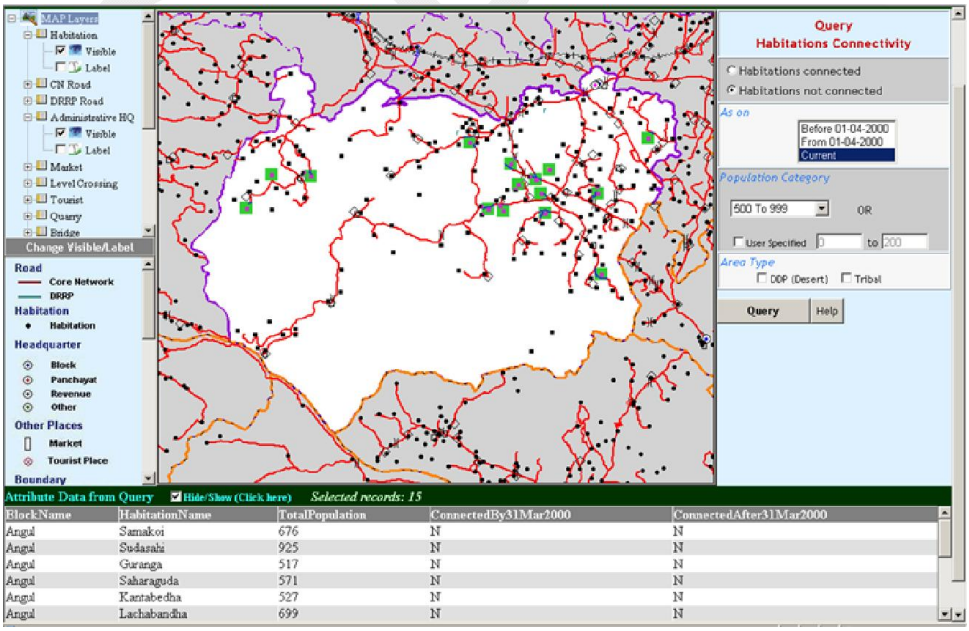


Fig. Attribute Query

SR_Fn_13

System shall have facility to query on habitation classification

Scenario1: *population*

System shall have facility to show/ highlight habitations on GIS map based on population range selected by the user. The option shall be provided to enter user specific population range along with some predefined population ranges.

Scenario2: *area type*

System shall have facility to show/ highlight habitations on GIS map based on area type (desert, tribal) selected by the user.

SR_Fn_14

System shall have facility to query on habitation connectivity

Scenario1: *population*

System shall have facility to show/ highlight connected/ not connected habitations on GIS map based on population range selected by the user. The option shall be provided to enter user specific population range along with some predefined population ranges.

Scenario2: *area type*

System shall have facility to show/ highlight connected/ not connected habitations on GIS map based on area type (desert, tribal) selected by the user.

Scenario3: *Before /after PMGSY started*

System shall have facility to show/ highlight connectivity status of the habitations on GIS map before and after PMGSY started

SR_Fn_15

System shall have facility to query on Panchayat Headquarters

Scenario1: *classification*

System shall have facility to show/ highlight panchayat headquarters on GIS map based on the classification (Population, Area type) similar to the habitation classification

Scenario2: *connectivity*

System shall have facility to show/ highlight connectivity status panchayat headquarters on GIS map similar to the habitation connectivity

SR_Fn_16

System shall have facility to query on connectivity of tourist places

System shall have facility to show/ highlight connectivity status of tourist places on GIS map.

SR_Fn_17

System shall have facility to search habitation on GIS map

System shall have facility to search and highlight habitation/s based on the search input provided by the user. Search will be based on

- *Habitation name exactly matching with the text provided by the user*
- *Habitation name starting with the text provided by the user*
- *Habitation name ending with the text provided by the user*
- *Any part in habitation name matching with the text provided by the user*

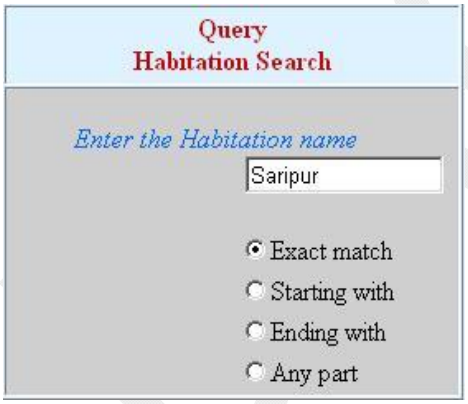


Fig. Habitation Search

SR_Fn_18

System shall have facility to show/highlight habitation along the selected road

System shall have facility to select road of user's interest with feature selection tool.

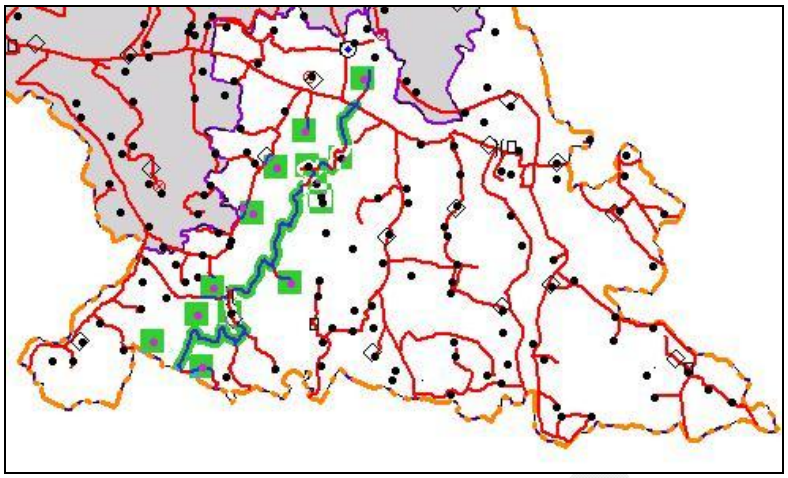


Fig. Habitation Along Road

System shall provide dialog box to input the buffer distance. On submitting the buffer distance system shall show/highlight habitations along the selected road which falls in a buffer of distance entered by the user.

SR_Fn_19

System shall have facility to display geo-tagged images on the GIS map.

Geotagging (also written as GeoTagging) is the process of adding geographical identification metadata to various media such as photograph or video. In PMGSY geotagging will be useful in finding out the road condition with the help of geotagged images of the road condition.

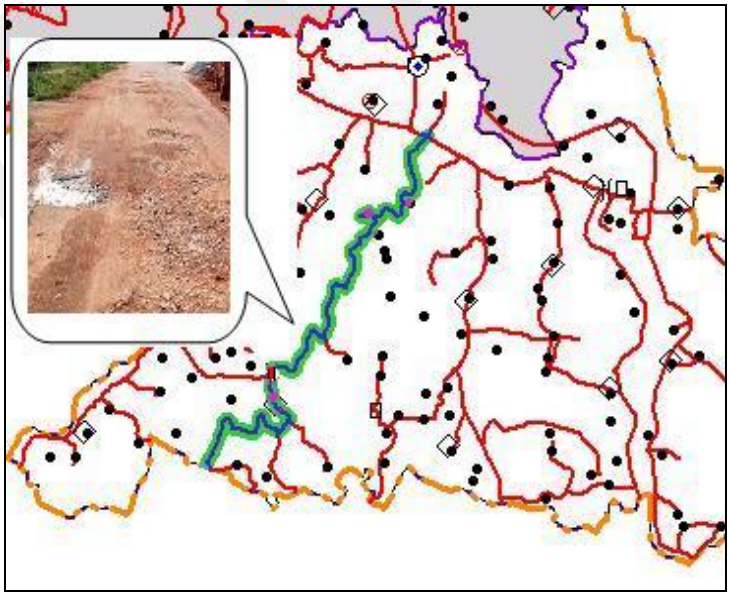


Fig. Geotagged image showing road condition

Scenario 1: *All photos*

System shall display all the photos (showing road condition) for the selected road

Scenario 2: *Latest photo*

System shall display the latest photos (showing road condition) for the selected road

Scenario 3: *Photos taken between range of dates*

System shall display all the photos (showing road condition) for the selected road which are taken between the dates entered by the user

SR_Fn_20

User defined spatial queries, consider the spatial relationship between these geometries, may be incorporated.

SR_Fn_21

System shall have facility to show roads based on type of the road.

Scenario1: *Through Routes*

Selecting this option all through routes shall be highlighted on the map

Scenario2: *Link Routes*

Selecting this option all link routes shall be highlighted on the map

SR_Fn_22

System shall have facility to show information about the roads whether the roads are verified from the toposheets.

SR_Fn_23

System shall have facility to show roads based on quality grading

Scenario 1: *NQM*

In this scenario system shall highlight the roads according to the grades given by national quality agency. The grade can be Satisfactory or Unsatisfactory

Scenario 2: *SQM*

In this scenario system shall highlight the roads according to the grades given by state quality agency. The grade can be Satisfactory or Unsatisfactory

Scenario 3: *NQM and SQM*

In this scenario system shall highlight the roads according to the grades (Satisfactory or Unsatisfactory) given by state quality agency as well as by national quality agency

SR_Fn_24

System shall have facility to show roads based on sponsoring stream.

The system shall have option to select the sponsoring agency (e. g. World Bank, Asian Development Bank, PMGSY etc.).

User shall be able to select year of sanction.

SR_Fn_25

System shall have facility to show roads based physical and financial progress.

Scenario 1: *Physical Progress*

Physical progress refers to the length of the road completed. The system shall highlight the roads completed in terms of percentage length (selected by the user) to the actual length of the road

Scenario 2: *Financial Progress*

Financial progress refers to the payment done towards the work out of the sanctioned amount.

User shall be able to select year of sanction. The scenario 1 & 2 will be applied to the roads which are sanctioned in this year.

SR_Fn_26

System shall have facility to highlight the roads under / due for maintenance.

Scenario 1: *Under maintenance*

System shall highlight all the roads which are under maintenance.

Scenario 2: *Due for maintenance*

System shall highlight all the roads which will be due for maintenance. The system shall provide option to select the date from which roads will become due for maintenance.

SR_Fn_27

The information about the web site shall be provided. The user shall be able to know product features available into the website

SR_Fn_28

User should able to get online help, and user manual (both web-based and documented in PDF) to execute each functionalities of the Web-GIS tool.

SR_Fn_29

Important web-links should be provided for further communication to the authorized nodal agencies or, company details for installation of systems or, any specific query.

SR_Fn_30

If required, the system shall provide facility to edit (add new features/ edit existing features / delete) spatial data to the authorized users. Authorization can be given to the state road department to update the spatial data of its own state.

Scenario: *Add new features*

System should have facility to add new features like habitations and roads to the existing GIS layers .Adding new feature should also include attaching attributes required for linking it to the OMMAS data.

Scenario: *Edit existing features*

System should have facility to edit existing features (habitations, roads) .Editing includes editing spatial features as well as attributes attached to it.

Scenario: *Delete existing features*

System should have facility to delete existing GIS features (habitations, roads) in GIS layers

SR_Fn_31

System shall have facility to measure distance on the GIS map.
This facility will be give option to measure distance on GIS map which will be very useful while calculating distance between a habitation and nearby road.

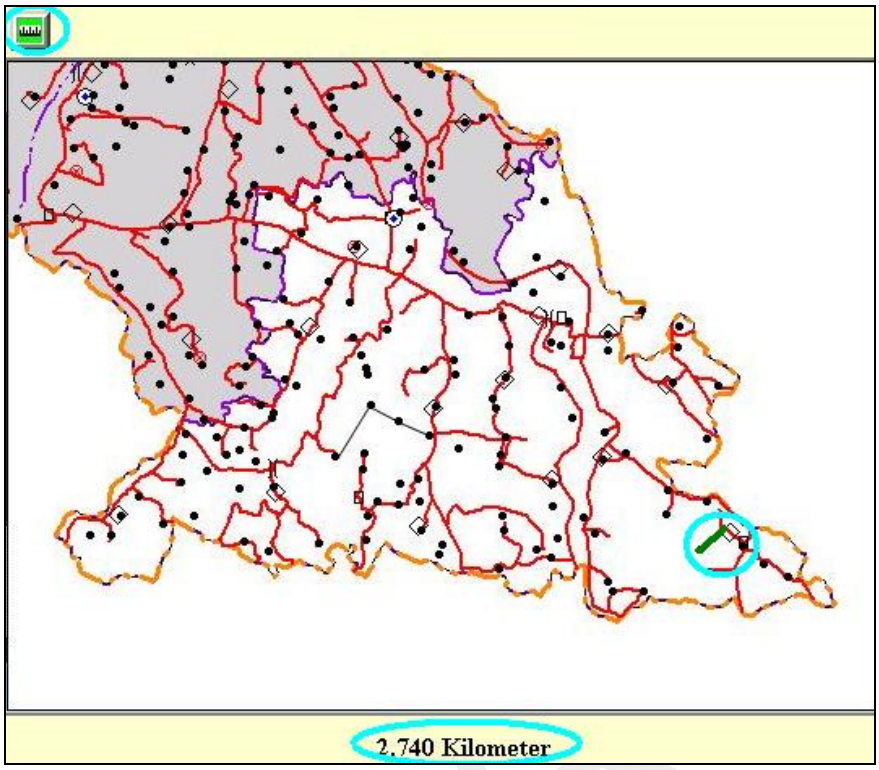


Fig. Distance Masuring

SR_Fn_32

The system should have provision for authorized user to take printout of the maps as well as query results on GIS map for its own state

SR_Fn_33

Maps will be hosted on Web subject to permission from MOD.

SR_Fn_34

Web GIS for PMGSY may have multilingual interface as per the data available in OMMAS.

3.3 System Requirements

3.3.1 Client Side

Following are the minimum system requirements in order to use this Web-GIS tool at the client-side:

Specification	*Description*
Web Browser	*Microsoft Internet Explorer v 8.0 or, higher, Mozilla Fire-Fox v 12.0 or, higher, Google Chrome v27.0.1453.116m or, higher.*
Internet Browsing Speed	*512 kbps*

- *Registration will be required for accessing Web-GIS tool for printing purpose*
- *User has to provide the valid credentials (such as, User ID, Password) to register on to the Web-GIS tool*
- *User can change/modify his or, her credentials after successful log-in.*

3.3.2 Server Side

Minimum system requirement for hosting the Web-GIS for PMGSY will depend on GIS server selection as well as number of concurrent users to be supported by the system. Commonly used GIS servers for Web-GIS are

- *Esri ArcGIS*
- *MaXtreme from MapInfo*
- *GeoServer*

Minimum System Requirements for various GIS servers are as follows

	MapXtreme 2008	**ArcGIS 10.2.x**	**GeoServer**
Platforms	• *Windows Server 2003: 256 megabytes (MB) RAM* • *Windows Server 2003 Web: 256 MB RAM* • *Windows XP: 256 MB RAM* • *Windows 2000: 256 MB RAM* • *Windows 2000 Server: 256 MB RAM* • *Windows 2000 Advanced Server:256 MB RAM* • *Windows Vista: 1 gigabyte (GB) RAM*	• *Windows Server 2012 R2 Standard and Datacenter** • *Windows Server 2012 Standard and Datacenter* • *Windows 2008 R2 Server Standard, Enterprise, and Datacenter (SP1)*	• *Windows(XP and newer),* • *Linux(any modern distribution),* • *Mac(10.5 and newer)* ***Memory** : 512MB minimum dedicated To GeoServer(1GB recommended)*

		• *Windows 2008 Server Standard, Enterprise, and Datacenter(SP2)* • *Windows 8.1 Professional and Enterprise** • *Windows 8 Professional and Enterprise* • *Windows 7 Ultimate, Enterprise, Professional(SP 1)* • *Windows Vista Ultimate, Enterprise, Business(SP2)* • Red Hat Enterprise Linux Server 6 • *Red Hat Enterprise Linux Server 5* • *SUSE Linux Enterprise Server 11* **(RAM: 4 GB or more)**	
Processor	*600 MHz Pentium III-class processor*	*4 cores for 100 concurrent users*	-
Others	*Graphics card that supports at least 256 colors*	*Disk space: 50 GB or more*	*Disk space :100MB* *Minimum (plus data)* *Display:A GUI is recommended*

			For administration *(800x600 orlarger)*

Recommended System Requirements for GIS server is as follows

Processor	*2 x Intel Xeon 8 core processor with at least 12 Mb L3 cache*
Memory	*8 X 8 GB DDR3, 1600 Mhz*
Hard Disk	*2 X 300 GB 15000 rpm SAS SFF*
Platforms	*Windows Server 2012 R2*
Other	*Dual port 10G/Gigabit ethernet , Dual port 8 Gbps FC HBA*

Note:- *For data centre setup two half height Dell servers are recommended as blade enclosure and servers are configured for failover load balancing and redundancy*

Approximate hardware server cost for GIS servers is Rs. 15 Lacs. This cost is exclusive of GIS Software licenses and any additional software required.

3.3.3 GIS data preparation

The systems for digitization shall have minimum configuration depending up on the COTS /Open Source GIS software selected and the amount of data to be handled. Popular GIS software used for GIS data preparation are

- *ArcGIS*
- *Geomatica*
- *QGIS*
- *GeoMedia*
- *MapInfo*

Sr. No.	Software	Hardware/Software Requirement
1.	**ArcGIS**	*Supported platforms* *Windows 8.1 Basic, Professional and Enterprise (32 bit and 64 bit [EM64T])** — Update: April 2014**** *Windows 8 Basic, Professional and Enterprise (32 bit and 64 bit [EM64T])* *Windows 7 Ultimate, Enterprise, Professional, Home Premium (32 bit and 64 bit [EM64T])* — SP1 *Windows Vista Ultimate, Enterprise, Business, Home Premium (32 bit and 64 bit [EM64T])* — SP2 SP2 *Windows XP Professional Edition, Home Edition (32 bit)* — SP3 SP3 *Windows XP Professional Edition, Home Edition (64 bit [EM64T])* — SP2 SP2 *Windows Server 2012 R2 Standard, and Datacenter (64 bit [EM64T])** — Update: April 2014*** *Windows Server 2012 Standard, and Datacenter (64 bit [EM64T])* *Windows Server 2008 R2 Standard, Enterprise, and Datacenter (64 bit [EM64T])* — SP1

		*Windows Server 2008 R2 with Citrix XenApp 6 SP1 SP1 and XenApp 6.5**	
		Windows Server 2008 Standard, Enterprise, and Datacenter (32 bit and 64 bit [EM64T])	*SP2 SP2*
		Windows Server 2003 Standard, Enterprise, and Datacenter (32 bit and 64 bit [EM64T])	*SP2 SP2*
		Windows Server 2003 Terminal Services	*SP2 SP2*
		Hardware requirements	
		CPU Speed	*2.2 GHz minimum ; Hyper-threading (HHT) or Multi-core recommended*
		Processor	*Intel Pentium 4, Intel Core Duo, or Xeon Processors; SSE2 minimum*
			Run this Microsoft utility from your Windows command prompt to check your processor.
			See Dual or dual-core support policy.
		Memory/RAM	*2 GB minimum*
		Display properties	*24-bit color depth*
		Screen	*1024 x 768*

		resolution	*recommended minimum at normal size (96 dpi)*
		Swap space	*Determined by the operating system; 500 MB minimum.*
		Disk space	*2.4 GB* *In addition, up to 50 MB of disk space may be needed in the Windows System directory (typically, C:\Windows\System32). You can view the disk space requirement for each of the 10.1 components in the Setup program.* *If using ArcGlobe, additional disk space may be required. ArcGlobe will create cache files when used.*
		Video/Graphics adaptor	*64 MB RAM minimum, 256 MB RAM or higher recommended. NVIDIA, ATI, and Intel chipsets supported.* *24-bit capable graphics accelerator* *OpenGL version 2.0 runtime minimum is required, and Shader Model 3.0 or higher is recommended.* *Be sure to use the latest available driver.*
		Networking	*Simple TCP/IP, Network*

		Hardware Card, or Microsoft Loopback Adapter is required for the license manager.
2	***PCI Geomatica***	*Supported platforms:* *Windows XP/ Windows 7/Windows 8, Server 2003 / Server 2008,Server* *2012.* *Hardware requirements:* *Processor: 2.2 GHz or higher Multiple core* *processors strongly recommended, Memory: 4 GB minimum, 8 GB or higher recommended,* *Graphics Cards: 4-bit Windows graphics card or accelerator running* *at 1280x1024 pixels 128 MB RAM* *minimum, 256 MB or higher recommended.* *Disk Space: 1 GB free hard disk space for software installation* *1 GB for installing all demonstration* *datasets. Customer data storage requirements vary by project*
3	***QGIS***	*Supported platforms:* *Windows/ Mac OS X/ Linux/ Android* *Hardware requirements:* *Processor: 2.2 GHz or higher Multiple core* *processors strongly recommended,*

		Memory: 4 GB minimum, 8 GB or higher recommended, *Graphics Cards: 4-bit Windows graphics card or accelerator running* *at 1280x1024 pixels 128 MB RAM* *minimum, 256 MB or higher recommended.*
4	***GeoMedia***	*Hardware requirements* *Computer/Processor* *32-bit: 2GHz microprocessor, Intel* *® Pentium ® 4 HT, Core ™ Duo, Xeon ® , or 100% compatible 64-bit: Intel 64 (EM64T), AMD 64, or equivalent* *Memory (RAM) 4 GB - recommended Disk Space* *4.75 GB for software Data storage requirements vary by mapping project16* *Operating Systems17* *n v Windows XP SP3 or higher (32-bit and 64-bit) n v Windows Vista SP2 or higher (32-bit and 64-bit) n v Windows 7 SP1 or higher, Professional and Ultimate (32-bit and 64-bit) n v Windows 8 (Standard), Professional and Enterprise (32-bit and 64-bit)* *n v Windows Server* *®* *2008 R2 SP1 (64-bit)* *n v Windows Server 2012 (64-bit) Notes: n v GeoMedia runs on 64-bit systems in 32-bit emulation mode.*
5.	***MapInfo***	*Windows XP Professional SP3* *Windows Vista Ultimate SP2* *Windows 7 Ultimate*

		Windows 7 Ultimate 64-bit *with* *256 MB RAM,* *400 MHz Pentium* *processor (1 GHz Pentium processor* *recommended),* *1.5 gigabytes (GB) disk space,* *16- or 24-bit color graphics,* *800x600 Display* *Windows 2008 Server* *Windows 2008 Server with XenServer* *With* *512 MB of RAM ,* *400 MHz Pentium processor (1 GHz* *Pentium processor recommended),* *2.9 gigabytes (GB) disk space,* *16- or 24-bit color graphics,* *800x600 Display*

3.4 Software Requirement

3.4.1 GIS data preparation

COTS / Open Source GIS products will be used for implementation GIS for PMGSY programme. The GIS products will be used for creating various GIS layers. The product selected should have following in-built capabilities

- *Digitization & vector editing*
- *Cut/copy/paste vector layer/segment*
- *Vector and raster geocoding*
- *Reprojection of data to LCC/UTM/ PC/TM/ a suitable projection*
- *Edge matching of maps*
- *Topology building*
- *External RDBMS (MS Access/SQL Server/ Oracle) table linking*
- *External RDBMS (MS Access/SQL Server/ Oracle) table join*
- *Map generation in desired scale*
- *Multiple maps product-ion with standard layout*
- *Automatic updation of the map layout*
- *Facility to edit map layout features like scale, north arrow, legend, etc*
- *Facility to automatically generate labels on map features from the attribute table*
- *Annotation of map features*
- *Creation of new cartographic symbols*
- *Generating buffers on selected point/line/area features*
- *Multi-layers query*
- *Dynamic segmentation of linear features*
- *Customization using standard development languages*
- *One to many relation in the attribute database*
- *Import/Export from/to standard GIS & image formats*
- *Clipping/subsetting irregular study area on raster and vector data*
- *Splitting & merging (dissolving) polygons*
- *View vector layers only in user-specified zoom scale*
- *Distance/area measurement on map*
- *Pop-up window showing details of selected features on map*
- *Spatial, attribute and conditional queries*

The following table shows the comparison of different GIS products based on the in-built capabilities required for GIS data preparation

Functionality	***ArcGIS***	***Geomatica***	***QGIS***	***GeoMedia***	***MapInfo***
Digitization & vector editing	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Cut/copy/paste vector layer/segment	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Vector and raster geocoding	*Yes*	*Yes*	*Yes*	*Yes*	*Raster Geocoding only*
Topology building	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
External RDBMS (MS Access/SQL Server/ Oracle) table linking	*Yes*	-	*Yes*	*Yes*	*Yes*
External RDBMS (MS Access/SQL Server/ Oracle) table join	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Map generation in desired scale	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Multiple maps product-ion with standard layout	*Yes*	*Yes*	*Limited support*	*Yes*	*Yes*
Automatic updation of the map layout	-	-	-	-	-
Facility to edit map layout features like scale, north arrow, legend, etc	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*

Facility to automatically generate labels on map features from the attribute table	-	-	-	-	-
Annotation of map features	*Yes*	*Yes*	*Limited support*	*Yes*	*Yes*
Creation of new cartographic symbols	*Yes*	*Yes*	*Limited support*	*Yes*	*Yes*
Generating buffers on selected point/line/area features	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Multi-layers query	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Dynamic segmentation of linear features	*Yes*	*Yes*	*Limited support*	*Yes*	*Yes*
Customization using standard development languages	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
One to many relation in the attribute database	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Import/Export from/to standard GIS & image formats	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Clipping/subsetting irregular study area on raster and vector data	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Splitting & merging (dissolving) polygons	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
View vector layers only in user-specified zoom	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*

scale					
Distance/area measurement on map	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Pop-up window showing details of selected features on map	*No*	*No*	*No*	*No*	*No*
Spatial, attribute and conditional queries	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*

3.4.2 Web GIS Server

The COTS / Open Source tool selected as web GIS server shall have following capabilities

- *GIS functionalities like zoom in, zoom out, Pan, Full View etc.*
- *Digitization & vector editing*
- *Distance measurement tool*
- *Map printing functionality*
- *Capability to integrate / link GIS data with attribute data in database specially with MSSQL server*
- *Geo-tagging capability*
- *Inbuilt SQL query facility in Web GIS at client site (database in SQL Server)*
- *Spatial query/analysis capability*
- *Facility to display query results as map (highlighted features) and table in the same Window*
- *Facility to save the query results at the client end in jpeg/gif format*

Following table shows different Web-GIS servers along with the availability of the required capabilities

Sr. No	Feature	MapXtreme	ArcGIS Server	Geoserver	MapServer
1	GIS functionalities like zoom in, zoom out, Pan, Full View etc	Yes	Yes	Yes	Yes
2	Digitization & vector editing	Limited functionality need Mapinfo for the same	Yes, using ArcGIS Desktop. Web editing is available in Standard & Advance version	Yes	-
3	Distance measurement tool	Yes	Yes	Yes	Yes
4	Map printing functionality	Yes	Yes	Yes	Yes
5	Capability to integrate / link GIS data with attribute data in database specially with MSSQL server	Yes	Yes	Yes	Yes (not much info available)
6	Geo-tagging capability		Yes	Yes (through GeORASS API)	Yes (Using flickr)

7	*Inbuilt SQL query facility in Web GIS at client site (database in SQL Server)*	*Yes*	*Yes*	*Yes*	*Yes*
8	*Spatial query/analysis capability*	*Yes*	*Yes*	*Yes*	*Yes*
9	*Facility to display query results on map (highlighted features) and table in the same Window*	*Yes*	*Yes*	*Yes*	-
10	*Facility to save the query results at the client end in jpeg/gif format*	*Yes*	*Yes*	*Yes*	*Yes*
11	*Support for spatial databases*	*Yes (Microsoft SQL Server 2008, 2012, Oracle 11g, 10g,)*	*Yes (IBM DB2 and IBM Informix Dynamic Server Microsoft SQL Server, Microsoft SQL Server Express, and*	*Yes*	*Yes*

			Microsoft SQL Azure *Netezza* *Oracle* *PostgreSQL)*		
12	*S/W development support (like .net, JAVA)*	*Yes*	*Yes*	*Yes (JAVA)*	-
13	*Other Features*	• *Complies with both geospatial and IT industry standards ensuring interoperability* • *Incorporation of location capabilities such as geocoding and routing within your application* • *New extensible architecture enables you to write your own data provider, extending data access to virtually any source* • *Built-in extensible user interface toolbars and dialogue facilities for rapid development* • *Additional functionality through improved granularity* • *Enhanced flexibility of display options*	• *Support for Spatially Enabled Databases* • *Geodatabase Management* • *GIS Web Services* • *Image Services* • *Web Mapping Applications* • *Smartphone and Tablet Applications* • *Web Editing* • *Geoprocessing* • *Advanced Geoprocessing* • *Real-Time Data Support* • *Mapcentric Content Management*	-	-

		including curved labeling, improved symbology and fill patterns • *New grid capabilities allow you to create continuous grids using a writable grid handler and new* • *IDW and TIN interpolators* • *New API and Dialog additions allow modifications to inflection points for continuous grids*	*System*		

Approximate software cost for GIS server (Map Xtreme (.NET) CPU Deployment (1 CPU))is Rs.7.5Lacs . Two licenses of GIS server will be required.

3.5 Software System Attributes

There are a number of attributes of software system that can serve as system requirements. These attributes are described as follows.

3.6.1 Reliability

Specify the factors required to establish the required reliability of the software system at time of delivery. For example the system gives the right result on a query/ search. The system shall have failover mechanism.

3.6.2 Availability

*The Web-GIS for PMGSY shall be available, up and running for 24*7 throughout the year except due to the routine maintenance activities.*

3.6.3 Security

Public users will access the site without any credentials with limited access. Printing, editing, distance measuring facility will be available for the authorized users only .Site Administrator and users with valid credentials will be able to log in to the Web-GIS. Site

Administrator will have access to the database structures at back-end. Site Administrator will have the rights for modifications as well as any updation work for the datasets and website. Access to the various subsystems will be protected by a user log in screen that requires a user name and password. The system shall automatically log out all users after a period of inactivity.

3.6.4 Maintainability

The application should be easy to extend. The code should be written in a way that it favors implementation of new functions.

3.6.5 Portability

The Web-GIS for PMGSY shall run in any computer environment (such as, Microsoft Windows) which is having Web Browser and Internet connection

3.6.6 Usability

The Web-GIS for PMGSY should be easy to use for common people. It should provide a uniform look and feel between all the web pages.

3.6 Testing Requirements

Software testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test. It involves the execution of a software component or system to evaluate one or more properties of interest. In general, these properties indicate the extent to which the component or system under test:

- *meets the requirements that guided its design and development*
- *responds correctly to all kinds of inputs*
- *performs its functions within an acceptable time*
- *is sufficiently usable*
- *can be installed and run in its intended environments*
- *achieves the general result its stakeholders desire*

Detail the testing levels expected to be applied and who has primary (P) and secondary (S) responsibility for performing this testing

Test Level	***Implementing Agency***	***NRRDA/States***
Unit Testing	*P*	
Integration Testing	*P*	
System Testing	*P*	*S*
User Acceptance Testing	*S*	*P*

Apart from the software testing quality checking of the GIS layers shall be carried out as explained in the methodology section (ref. 2.2.2 QC for GIS layers).

3.7 Training Requirements

SR_Tr_01

A specialized training on Web GIS system for a period of one week shall be conducted at NRRDA, New Delhi

SR_Tr_02

Implementing agency shall prepare a training programme in consultation with NRRDA and states, which will include all components of Web-GIS for PMGSY

SR_Tr_03

Detailed operational and maintenance manuals for the proposed system, and training materials for use of NRRDA and States, shall be prepared by the implementing agency, which will be the property of NRRDA.

SR_Tr_04

The training would cover following topics:

- *Basics in GIS*
- *Data processing involved Geo-referencing, Ortho rectification, mosiacing etc.*
- *Spatial data creation(digitization)*
- *Database management and updation*
- *Quality assurance and quality control*
- *Map visualization*
- *GIS query and analysis*
- *Web GIS (architecture and application)*
- *Backup/restore of GIS database*
- *General troubleshooting*

4. GIS IMPLEMENTATION STATUS AND ACTION PLAN

GIS implementation status in nine States, while creating SRS, is as follows

4.1 Rajasthan

Rajasthan was one of the pilot states selected for the GIS implementation of PMGSY. Standalone version of GIS-enabled Road Information Management and Monitoring System (GRIMMS-S) was developed for Rajasthan. GRIMMS-S uses ESRI Shape file for spatial data and has the option to access/ link SQL Server (OMMAS) as well as MS Access for attribute data. This standalone version helps in executing any user specific query and for displaying massive attribute data apart from the customized queries and taking printouts. Web version (GRIMMS-Web) was also implemented for Rajasthan where customized queries were available to monitor the progress of PMGSY.

Most of the layers required for the GIS implementation of PMGSY are available (in shape format and using Transverse Mercator/WGS84 projection) with the state. Spatial Data is available with SRRDA on the scale of 1:50000. GT Sheets, Remote sensing imageries, blue prints, tracings are also available. GIS softwares like ESRI ArcEditor 9.1, ArcPad 7.0, Autodesk Civil 3D – 2007 are being used by the state apart from the MS SQL Server 2005 Std. Edition as a database server. *One person with Master degree in Geoinformatics from ITC Netherlands; three persons with master degree and PG diploma in GIS and RS hired trough outsourcing*

Action Plan: *Updation of features especially road network (Spatial Data) may be required for the state. The updation may be carried out by the SRRDA through outsourcing or SRRDA Itself. Refer annexure II for spatial data updation and annexure III for outsourcing the jobs.*

4.2 Himachal Pradesh

HP was one of the pilot states selected for the GIS implementation of PMGSY. Standalone version of GIS-enabled Road Information Management and Monitoring System (GRIMMS-S) was developed for HP. GRIMMS-S uses ESRI Shape file for spatial data and has the option to access/ link SQL Server (OMMAS) as well as MS Access for attribute data. This standalone version helps in executing any user specific query and for displaying massive attribute data apart from the customized queries and taking printouts. Web version (GRIMMS-Web) was also implemented for HP where customized queries were available to monitor the progress of PMGSY. Apart from

the standalone and web versions of GRIMMS one database in MS-Access was developed to maintain segment (500 meters) wise data.

Most of the layers required for the GIS implementation of PMGSY are available (in shape format and using Transverse WGS84 projection) with the state but not updated since 2008. ArcGIS 9.1 is available with state as a GIS software. 1:50,000 survey of India , Topo sheets are available with the state but not updated since 2008. GIS trained staff is not available with the state.

Action Plan: *Updation of features especially road network (Spatial Data) may be required for the state. The updation may be carried out by the SRRDA through outsourcing or SRRDA Itself. Refer annexure II for spatial data updation and annexure III for outsourcing the jobs. GIS trained person may be hired for managing the activity.*

4.3 Punjab

GIS implementation for PMGSY is under progress. As per discussions with Project Manager, GIS, PRBDB - All requisite layers are available in standard format (.Shp)with WGS 84 projection. Toposheets at scale of 1:25,000 and satellite images (Cartosat-I)are available with the state 106 sheets of maps are also available with the state . ArcGIS 10.1 is used as GIS software .Project manager GIS is available full time with PRBDB.*

Action Plan: *The spatial data created need to be made compatible to PMGSY/OMMAS data so as to link it to the attribute data. Refer annexure II for spatial data updation and annexure III for outsourcing the jobs.*

4.4 Uttarakhand

As per discussions with IT Nodal Officer, UKRRDA - The project needs to be started from scratch, requisite layers in digital or hardcopy format, GIS software are not available with UKRRDA

Action Plan: *The activity needs to be started right from procurement of digital data (refer annexure I for guidelines for procurement of digital data).Spatial data creation activity may be carried out by the SRRDA through outsourcing or SRRDA Itself. The spatial data created need to be made compatible to OMMAS data so as to link it to the attribute data. Refer annexure II for spatial data creation and annexure III for outsourcing the jobs. GIS trained person may be hired for managing the activity.*

4.5 Jharkhand

As per response from the state, GIS implementation for PMGSY is under progress. Requisite layers in digital format not available. GIS software is being procured. Maps available with 1:50,000. A GIS expert is appointed recently.

***Action Plan:** The activity needs to be started right from procurement of digital data (refer annexure I for guidelines for procurement of digital data).Spatial data creation activity may be carried out by the SRRDA through outsourcing or SRRDA Itself. The spatial data created need to be made compatible to OMMAS data so as to link it to the attribute data. Refer annexure II for spatial data creation and annexure III for outsourcing the jobs.*

4.6 Meghalaya

As per discussions with Chief Engineer, Meghalaya SRRDA - the project need to be started from scratch, requisite layers in digital or Hardcopy format, GIS software are not available with Meghalaya RRDA (Although SOI toposheets hardcopy are available for the state except international border areas).

***Action Plan:** Toposheets which are not available need to be procured and whole activity of spatial data creation has to be carried out. The spatial data created need to be made compatible to OMMAS data so as to link it to the attribute data. Refer annexure I (for procurement of the data), annexure II (for spatial data creation) and annexure III (for outsourcing the jobs). GIS trained person may be hired for managing the activity.*

4.7 Uttar Pradesh

GIS implementation for PMGSY is under progress. As per response received from UP & further discussions with concerned officer layers (habitation and village road) are available in standard format (.shp) with WGS 84 UTNI – 44 NORTS projection. Hardcopy maps are available at scale of 1:1000 at local PIO Level (UPRRDA is not having possession of any Maps) and* map sheets *show latitude and longitude. Maps have been updated on Google earth. ArcGIS 10.0 is available. Trained GIS staff is not available with the state. However the maps are not linked with OMMAS.*

***Action Plan:** The layers (except habitation and village roads) need to be created freshly with 1:50,000 scale and compatibility with OMMAS data. The available layers have to be modified for compatibility with OMMAS. The activity may be carried out by the SRRDA through outsourcing or SRRDA itself. Refer annexure II for spatial data updation and annexure III for outsourcing the jobs. GIS trained person may be hired for managing the activity.*

4.8 Bihar

GIS implementation for PMGSY is under progress Road, Administrative boundary, habitation, Water- feature, Railway line layers are available with state in shape format and having GCS_WNS_1984(projection), Datum (WNS 1984). Maps are available with 1:50000 scale with no latitude and longitude marked. Maps available consists of PMGSY Core Network maps. ArcGIS 10.0 is used as GIS software. No GIS system is developed for PMGSY or which links with OMMAS data. 12 people, 2 GIS expert and 10 GIS operator are available with the state.

Action Plan: *The remaining layers need to be created freshly with 1:50,000 scale and compatibility with OMMAS data. The available layers have to be modified for compatibility with OMMAS. The activity may be carried out by the SRRDA through outsourcing or SRRDA itself. Refer annexure II for spatial data updation and annexure III for outsourcing the jobs.*

4.9 Gujarat

As per response received from Gujrat, GIS implementation for PMGSY is completed. Data collection of habitation, road alignment completed. Georeferencing for PMGSY roads completed. GIS layers are available in .shp, kml kmz formats with WGS84 projection. All the layers are as per guideline of NRRDA. Q-GIS Version 2.2, AutoCAD, Google being used as GIS softwares. Firstly, Layers were created in Autocad format then converted to .Shp file and updated on Google Map. GIS data is available in hardcopy with 1cm : 500 meter scale. Map sheets show latitude and longitude. DRRP/ CORENET / Road showing PMGSY work available as maps. Standalone system is available with DRRP showing 2011 population. A separate Excel file has been created to store attribute data. GIS trained manpower is available with state.

Action Plan: *The Spatial data needs to be formatted for compatability with OMMS; the activity may be carried out by the GSRRDA through outsourcing or SRRDA itself. Need to create remaining GIS layers with OMMAS compatibility. This activity also may be carried out by the GSRRDA through outsourcing or SRRDA itself. Refer annexure II for spatial data creation and annexure III for outsourcing the jobs.*

For approximate cost of spatial data creation for nine states along with the response to the questionnaire refer annexure V.

RISKS & CONTINGENCY

S.N.	Risk Factor	Impact	Description	Contingency Plan
1.	Procurement of Toposheets (Unrestricted /Restricted)	High	Project cannot be executed beyond submission of system study documentation	-
2	Permission from MOD for publishing maps on Web	Medium	Web implementation will be affected	Web development will be continued. Web hosting will be done only after permission from MOD
3.	Procurement of Hardware	Medium	It will put more pressure on existing resources	Existing resources will be utilized
4.	Procurement of Software (GIS data generation)	High	Activities cannot start	-
5.	Procurement of Software (Web development)	Medium	Activities cannot start	Web development will continue with evaluation version of selected software
6.	Availability of all Maps from States	High	Outsourcing activity will not start	-
7.	Late changes to requirements	Medium	Difficult to include the new requirements at last stage	Only feasible requirements can be incorporated while other can be kept for next version

ANNEXURE

ANNEXURE I : Procurement of Digital Topographic Data from Survey of India

Digital Data

The digital data is of confidential nature and is normally issued to only officers in government services and officials in local and administrative bodies when required by them for execution of their official duties. Procurement of digital topographic data of restricted area needs security clearance from Ministry of Defence (MOD). User has to obtain a prior 'No Objection Certificate' from MOD before approaching for data procurements. The agencies like Survey of India (SOI) can be approached for the digital data procurements which provides digital topographical data for whole India

States/ NRRDA will obtain MOD's security clearance certificate for the toposheets to be procured. List of toposheets along with the MOD's clearance certificate will be submitted by NRRDA for the procurement of the data.

States will carry out the following quality checks on DVD data before accepting it from the providing agency (e.g. SOI Dehradun).

- *Data format*
- *Latitude/longitude of 4 corners of a topo map*
- *Projection parameters*
- *Number and type of layers*
- *Standard SOI symbol attachment with layers*
- *Continuity of layers*

Once digital data is procured, states have to submit an annual certificate of safe custody of data (restricted) to the agency from where data is procured. The certificate is to be submitted by 31st December every year.

On the other hand, Open Series Maps (OSM) are prepared on 1:250,000; 1:50,000 and 1:25,000 scales for the use of general public/civilians for supporting development activities in the country. Technically maps of this series are based on WGS-84 Datum and UTM Projection. They do not contain grid and classified information; therefore, they are kept under unrestricted category. They can be obtained from all map sale centre and other authorized agents deputed all over the country.

ANNEXURE II: Spatial Database Creation (Digitization)

1. *Ensure correctness of the projection parameters of the digital maps.*
2. *Tracing sheets containing the layers will be scanned and stored in Tiff format.*
3. *LCC/ a suitable Projection will be used for geocoding the Tiff data before digitizing.*
4. *Road layer will be created for Core Network as well for DRRP roads.*

Instruction for digitization work

- *Nodes and vertices should be minimum to the extent possible.*
- *If road marked on the tracing sheets follows the roads of any category on toposheets, alignment on toposheet should be picked-up.*
- *Special care should be taken while assigning the feature code. If needed, an arc should be divided into two by adding extra node to ensure separate road arc for each road code.*
- *On tracing sheet, road codes are written along the road (above or below the road). Proper care should be taken while entering the code.*
- *All the features mentioned above should be digitized with utmost care to ensure the location accuracy.*
- *Feature coding should be done carefully to ensure correctness of entry. It must be crosschecked thoroughly.*
- *File naming convention must be strictly followed.*
- *Association with OMMAS should be checked.*
- *Output should be provided in Shape (.shp) format.*
- *Output should be in different layers as specified below.*
- *Layer (topological) type should be as follows –*

Layers	*Topology*
a. International / State / District / Block Boundary	*- Polygon & Line*
b. M.P. / M.L.A. Boundary	*- Polygon*
c. P.W.D. Circle / Division Boundary	*- Polygon*
d. Forest Boundary	*- Polygon*
e. Land use	*- Polygon*
f. Water body	*- Polygon*
g. River	*- Polygon*
h. River	*- Line*
i. Road / Railway	*- Line*
j. Bridge	*- Point*
k. Railway Crossing	*- Point*
l. Habitation	*- Point*
m. Quarry	*- Point*
n. Market Centres	*- Point*
o. State / District / Block / Revenue Headquarters	*- Point*
p. Tourist / Religious place	*- Point*

Digitization work can be carried out using another approach where GPS points are collected using actual field visit. These Tabular GPS coordinates can easily be added and displayed as points in GIS softwares like ArcGIS. In this approach a spreadsheet is prepared with X and Y coordinates in two columns in EXCEL (or other program). Additional columns of data can be included in the spreadsheet as well. Save the file as .dbf file. Add this dbf file to the GIS software (e.g. ArcMap),right-click on the table and select Display XY Data.

***Note**: The GPS data must be in the same coordinate system as base maps and data frame for correct display*

ANNEXURE III: Outsourcing Jobs

Following jobs can be outsourced –

1. *Geocoding of scanned tracing sheets. The tracing sheets received from the States will be scanned by states and provided to vendors for digitization.*
2. *Reprojection of digital SOI toposheets.*
3. *Checking accuracy of toposheet with corresponding tracing received from States.*
4. *Creation of separate files for each feature from the digital SOI data. States will convert SOI DVD toposheet data into '.shp' file, which will be provided to vendors).*
5. *Digitization of new / missing features from the scanned tracing sheets.*
6. *Edge Matching and Mosaicking of maps.*
7. *Feature encoding of digitized features.*

Maps from States

Participating States will trace relevant information regarding both DRRP and Core Network, on tracing film. The tracing provided by the states will be the backbone of the project.

Vendor Selection

Following procedure will be adopted –

1. *World Bank norms will be followed to invite vendors for outsourced activity.*
2. *State will award the contract*
3. *A letter will be sent to all vendors describing the job and the fixed price per toposheet*
4. *Briefing meeting will be organized for vendors at state level to explain the requirement.*
5. *Interested vendors will be requested to send their consent to carry out the job at respective states as per the terms and conditions and rate specified in the letter.*
6. *Jobs will be distributed one PWD zone at a time. Further job will be awarded only after successful completion of the allotted job.*
7. *Jobs will be distributed equally, to the extent possible, among the vendors.*

8. *State will constitute a committee to evaluate the job executed by the vendors which will recommend to State for release of payment.*
9. *Payment will be released only after successful edge matching and mosaicking of toposheets, which may or may not be assigned to the same vendor.*
10. *Unsatisfactory work, found at any stage, will be returned back to vendor, and vendor will have to redo the job at no extra cost.*
11. *The job has to be completed in stipulated time. If job is not completed in time, LD (Late Delivery) clause will be applied. Penalty will be imposed @ 2% per week with maximum of 10% of the total order value to the vendor.*
12. *Vendors who fail to deliver the quality output will not be assigned more work.*

ANNEXURE IV: Quality Assurance

For quality assurance of any digitized map, certain standard procedures need to be adopted. The steps followed for acceptance of digitized maps are given below:

1. *File naming convention has been followed.*
2. *Projection parameters are correctly defined.*
3. *For polygon features, like administrative boundaries, following checks should be performed*
    a. *There should not be any sliver polygon.*
    b. *Total number of polygons should match the number of units wherever possible.*
    c. *Shape and location of polygon should be checked for randomly selected polygons.*
    d. *Feature code should be checked.*
4. *For line features, like road network, following checks should be performed –*
    a. *Feature coding should be checked.*
    b. *Linear feature is checked for alignment and location for randomly selected arcs.*
5. *For point features, like habitation, following checks should be performed –*
    a. *Feature coding should be checked.*
    b. *Point feature is checked for location for randomly selected points.*
6. *Softcopy Output should be in predefined formats, e.g. .shp format.*
7. *Association with OMMAS should be checked*

ANNEXURE V: Spatial data creation for nine states (approx. cost)

S.No.	***Name of State***	***Status***	***Approx. Number of Toposheets ****	***Approx. Cost @ 15k per sheet***
1	*Himachal Pradesh*	*Completed*	*080*	*Available – Requires Updation*
2	*Rajasthan*	*Completed*	*489*	*Available – Requires Updation*
3	*Punjab*	*Completed as per Nodal Person for GIS Implementation*	*072*	*Available – Requires Data conversion as per PMGSY/OMMAS format*
4	*Gujarat*	*Completed*	*280*	*Available – Requires Data conversion as per PMGSY/OMMAS format*
5	*Uttar Pradesh*	*Under process*	*348*	*Rs. 52,20,000/-*
6	*Bihar*	*Under process*	*135*	*Rs. 20,25,000/-*
7	*Meghalaya*	*Not Available*	*032*	*Rs.04,80,000/-*
8	*Uttarakhand*	*Not Available*	*076*	*Rs. 11,40,000/-*
9	*Jharkhand*	*Not Available*	*114*	*Rs. 17,10,000/-*
			Total (for 5 States**)	***Rs. 01,05,75,000/-***

** Represents approx. number of toposheets. Data creation cost as per the proposal*

ANNEXURE VI: Web-GIS development for PMGSY (approx. cost)

Option 1 (Fresh Development)

This will be a totally fresh development of Web-GIS for PMGSY. All the modules will be developed from the scratch and new proposed features will be incorporated.

Component	***Approx. Cost***
Web- GIS development consultancy charges	*Rs **3,07,20,000/-***
Hardware server cost	*Rs 15,00,000/-*
GIS Software license cost	*Rs 15,00,000/-**
Total	*Rs **3,37,20,000/-***

Option 2 (Upgradation MapXtreme software)

Old GRIMMS-Web will be upgraded with new version of MapXtreme software. Some new features may be added to the system agreed by NRRDA and the implementing agency.

Component	***Approx. Cost***
Web- GIS development consultancy charges	*Rs **1,63,20,000/-***
Hardware server cost	*Rs 15,00,000/-**
GIS Software license cost	*Rs 15,00,000/-**
Total	*Rs **1,93,20,000/-***

****Hardware and GIS software cost will be on actual in option 1 and option 2. NRRDA will be procuring the h/w and s/w for the project. In case C-DAC procures the same on behalf of NRRDA, C-DAC will charge 10% as facilitation/procurement process cost***

Note: *For annual maintenance 2 manpower will be required and cost per manpower will be decided by the implementing agency*

ANNEXURE VII: Software for states (optional)

Component	***Cost***
Spatial Road Information System (SRIS)- Stand Alone customized GIS System	*Rs 3,00,000/-*
Training on SRIS	*Rs 2,00,000/-*
Total per state	*Rs **5,00,000**/-*

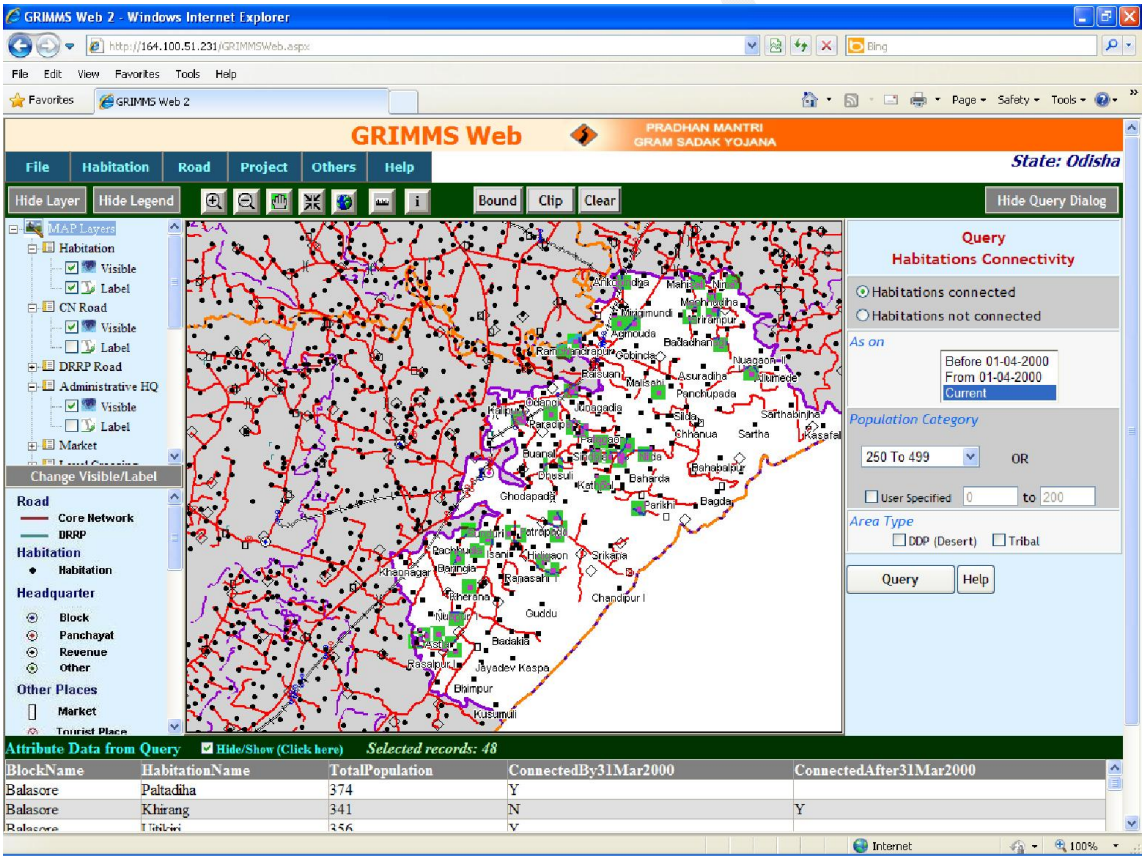
ANNEXURE VIII: Project cost (approx. Cost)

Component	***Option 1 (Fresh Development)***	***Option 2 (Upgradation of MapXtreme software)***
Data creation & QC for 5 states	*Rs.* ***01,05,75,000****/-*	*Rs.* ***01,05,75,000****/-*
Web-GIS development, Hardware & GIS software	*Rs* ***3,37,20,000****/-*	*Rs* ***1,93,20,000****/-*
SRIS for 9 states (Optional for states)	*Rs 45,00,000/-*	*Rs 45,00,000/-*
Total	*Rs* ***4,87,95,000****/-*	*Rs* ***3,43,95,000****/-*

ANNEXURE IX: GRIMMS

GIS Enabled Road Information Management and Monitoring System *was developed by C-DAC for NRRDA. This implementation of the GIS system for PMGSY coined as "GRIMMS" for two States – Rajasthan and Himachal Pradesh. The PMGSY GIS project involved generation of spatial database, customisation of a standalone system (GRIMMS-S) and development of web GIS (GRIMMS Web, http://omms.nic.in/grimms) application.*

For this GIS project, the non-spatial data was from OMMAS, which was available in SQL Server 2000 and was for the entire country. GRIMMS contained a range of user-friendly menus for various queries and it highlighted the query result on the map and on the attribute data table. The queries run on various spatial layers such as Habitation, Core Network road, DRRP road, by having a live link with OMMAS database.



GRIMMS Web 2 was an extension to GRIMMS Web for PMGSY and implemented in the states of Odisha, Tripura, Mizoram and Manipur; with additional functions and better interfaces. Using the data standards/consultancy provides by C-DAC, Odisha and Mizoram states along with respective state remote sesing agencies, created better quality GIS data. GRIMMS Web 2, that was operational till 2014, received two awards, one in 2013 and the other in 2014.

ANNEXURE X: Tool for preparation/ updation of GIS data

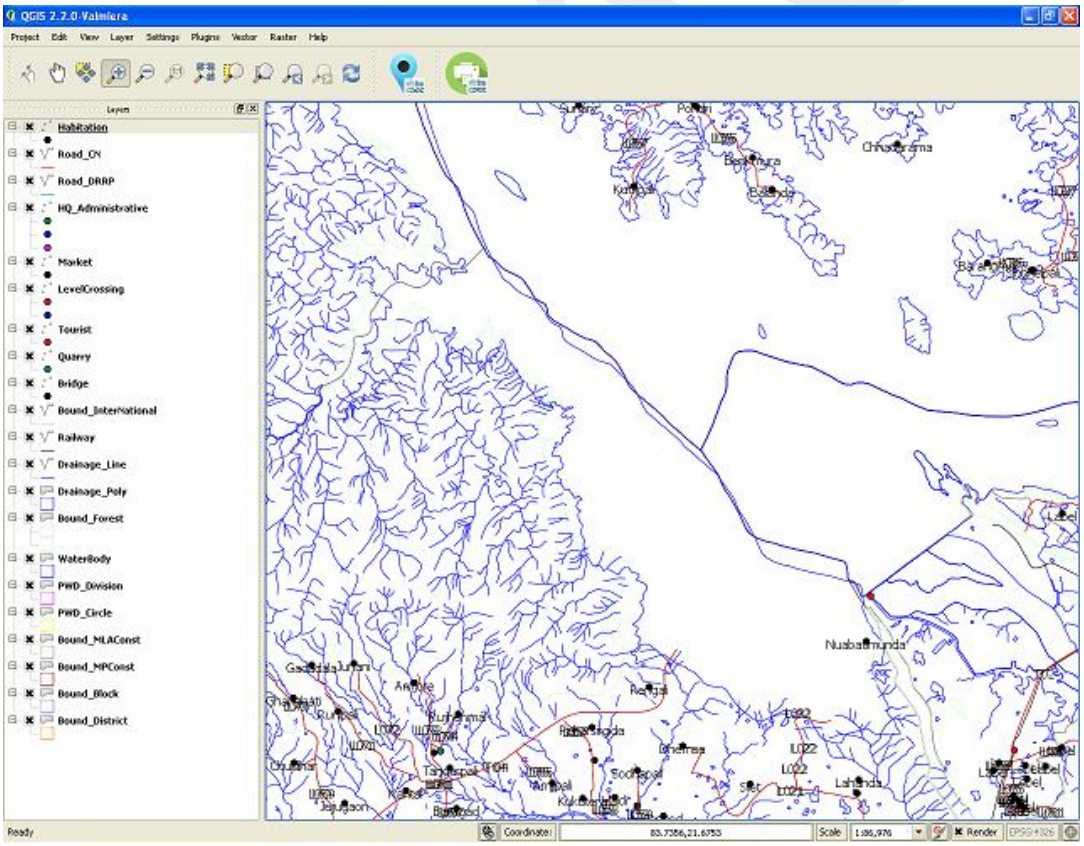
Spatial Road Information System (SRIS)

Version 1.0

Spatial Road Information System is a GIS based customized open source solution that will help primarily in road related projects; and more relevant to PMGSY.

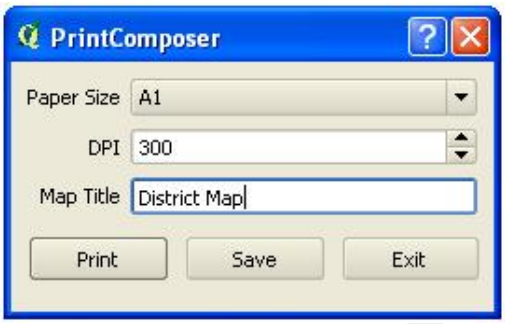
Map Composer

Clicking the map composer icon can generate custom map and link to required/custom subset database of OMMAS database of PMGSY; as shown in the figure below. The user can modify the properties of any of the map layers.



Map Printing

This customised functionality can be used to take printout of the GIS map as well as save it as a tiff image. With a single click, it captures all the components visible on the canvas and print/save the map.

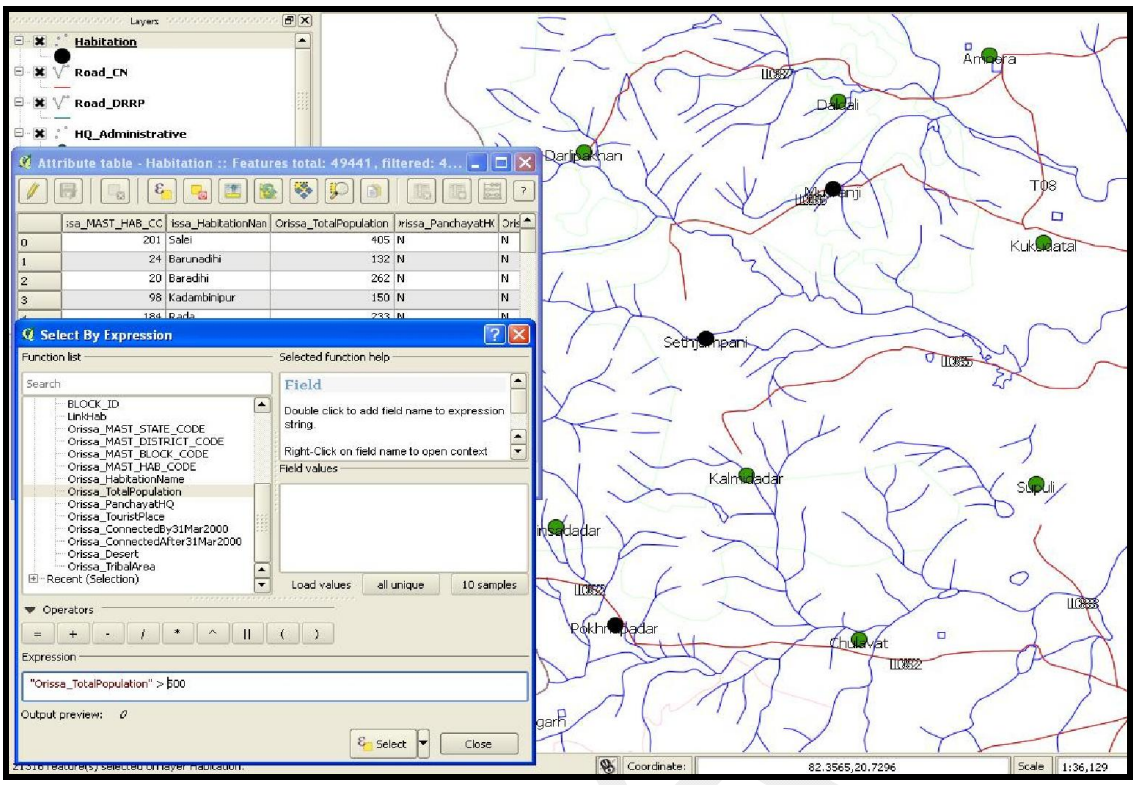


GIS functionalities

Once the map is loaded user can use all GIS functionalities provided by the base open source software. Some of the basic functions that may be used for the PMGSY are as follows:

GIS functionalities like  *(zoom in),*  *(zoom out),*  *(info button), make the layers visible/ invisible, enable/disable labels for features such as names for habitations can be used. The software can be used to add/delete/update features in the map and to create new layers. Google map or any other available service can also be used in the background.*

User can also make queries similar to the customized queries found in GRIMMS. The image (below) shows a query example to find the habitations having population more than 500. The habitations meeting the criteria are highlighted in green colour.


Layers
Habitation
Road_CN
Road_DRRP
HQ_Administrative
Attribute table - Habitation :: Features total: 49441, filtered: 4...
Select By Expression
Function list
Selected function help
Field
Double click to add field name to expression string.
Right-Click on field name to open context
Field values
Load values
all unique
10 samples
Operators
Expression
"Orissa_TotalPopulation" > 500
Output preview:
Select
Close
Coordinate:
82.3565,20.7296
Scale
1:36,129

ANNEXURE XI: Replies to the questionnaires by states

State: Himachal Pradesh **Date:** 20/08/2014

1. Status of GIS programme implemented for PMGSY in the state – **Completed / Not Completed /Under Process-**Himachal Pradesh& Rajasthan was part of Pilot Project forGRIMMS project prepared by CDAC but could not be updated since 2008.Base layer of Core network& DRRP in 1:50,000 survey of India , Topo sheets

2. List of GIS software (along with version)used/available-ArcGIS 9.1

3. GIS layers available in softcopy

   a. Format used (e.g – .shp / .tab/ etc.)- .shp

   b. Datum &projection used for GIS database-WGS84

   c. List of layers- Core network & DRRP

4. GIS data available in hardcopy-Not updated

   a. Specify the Scale of map: 1:50,000 survey of India , Topo sheets (Not updated since 2008)

   b. Specify whether the map sheets show latitude and longitude-Yes

   c. List of maps available-Core Network &DRRP(But not updated)

5. Any GIS programme(s) implemented / GIS system(s) developed

If Yes, Details

   a. Name/Title :GRIMMS WEB
   b. Features :Integrated with OMMS data base
   c. Standalone /Web based :Both
   d. Linked with OMMAS data :Yes
   e. Database (Spatial /Non spatial)used : Part of Pilot Project forGRIMMS project prepared by CDAC but could not be updated since 2008.Base layer of Core network in 1:50,000 survey of India , Topo sheets.Now the online page is also not available(URL: www.omms.nic.in/grimms)

6. Expert / trained manpower available with the agency for GIS implementation

No special trained staff is available

7. Contact person details for the GIS implementation for PMGSY
   Name : Lalit Kumar Pandey, Nodal Officer(IT)
   E-mail : hp-sno@nic.in
   Phone : 09418108484 , 0177-2629315

Status of GIS Implementation in the State

State: Meghalaya **Date: 29/08/2014**

1. Status of GIS programme implemented for PMGSY in the state – **Completed/ Not Completed /Under Process**	**Not Completed**
2. List of GIS software (along with version) used/available	**Not Available**
3. GIS layers available in softcopy a. Format used (e.g -.shp /.tab/ etc.) b. Datum & projection used for GIS database c. List of layers	**Not Available**
4. GIS data available in hardcopy a. Specify the Scale of map b. Specify whether the map sheets show latitude and longitude c. List of maps available	**Not Available**
5. Any GIS programme(s) implemented / GIS system(s) developed If Yes, Details a. Name /Title b. Features c. Standalone /Web based d. Linked with OMMAS data e. Database (Spatial /Non spatial) used	**Not Available**
6. Expert/ trained manpower available with the agency for GIS implementation	**No**
7. Contact person details for the GIS implementation for PMGSY Name : M. BANSHANBOR ROIN, ITNO, SRRDA E-mail : mbroin_080674@yahoo.com Phone : 9436100460	

29/8/14

(M. M. Sun)
Empowered Officer, SRRDA, PMGSY,
Meghalaya, Shillong.

Status of GIS Implementation in the State

State: Rajasthan **Date: 26/ 08 /2014**

1. Status of GIS programme implemented for PMGSY in the state – **Completed**

8. List of GIS software (along with version)used/available :
    - ESRI ArcEditor 9.1 -3 Licenses
    - ESRI ArcPad 7.0
    - MS SQL Server 2005 Std. Edition (5 User)
    - Customized Stand Alone GIS Software –GRIMMS
    - Autodesk Civil 3D – 2007 - 2 Licenses
    - ILWIS 3.0
    - QGIS
    - SAGA

9. GIS layers available in softcopy

    d. Format used (e.g – .shp / .tab/ etc.)
    .shp, .mdb

    e. Datum & projection used for GIS database :
    Transverse Mercator/WGS84

    f. List of layers
        1. Revenue Villages
        2. Habitations
        3. Head Quarters administrative
        4. Market centers
        5. Tourist places
        6. Quarry sites
        7. All road network
        8. Core Network roads
        9. DRRP Road network
        10. Railway line
        11. Level Crossing Major CD works
        12. District Boundaries
        13. Block boundaries
        14. Tehsil boundaries
        15. Village boundaries
        16. PWD Zone, Circle, District boundaries
        17. MP/MLA constituencies boundaries
        18. Drainage layer
        19. Forest boundaries
        20. Water bodies.

10. GIS data available in hardcopy (All data has been digitized)

    a. Specify the Scale of map 1:50000

    b. Specify whether the map sheets show latitude and longitude: yes

    c. List of maps available GT Sheets, Remote sensing imageries, blue prints, tracings

11. Any GIS programme(s) implemented / GIS system(s) developed

    If Yes, Details

    f. Name/Title
       : GRIMMS
    g. Features
       : Web GIS for performing queries
    h. Standalone /Web based :Web Based and Standalone both
    i. Linked with OMMAS data : Yes
    j. Database (Spatial /Non spatial)used : Spatial layers and OMMAS data backup

12. Expert / trained manpower available with the agency for GIS implementation
    One person with Master degree in Geoinformatics from ITC Netherlands and

    three person with master degree and PG diploma in GIS and RS hired trough outsourcing

13. Contact person details for the GIS implementation for PMGSY
    Name : Kamal Kant Mishra
    E-mail : rj-itno@nic.in
    Phone : +919829885321

Status of GIS Implementation in the State

State: PUNJAB **Date:** 22 / 09 /2014

1. Status of GIS programme implemented for PMGSY in the state – ~~**Completed**~~ / ~~**Not Completed**~~ **/Under Process** ✓
2. List of GIS software (along with version)used/available ARC GIS 10.1
3. GIS layers available in softcopy
   a. Format used (e.g – .shp / ~~.tab/ etc~~.) .shp (SHAPEFILE)
   b. Datum & projection used for GIS database INGS 1984_ UTM_ZONE_43 N
   c. List of layers
      - Toposheets of state of PB - 1:25000.
      - Satellite Image - cartosat-I
      - Block Boundary, District Boundaries,
4. GIS data available in hardcopy
   a. Specify the Scale of map Toposheets – 1:50,000
   b. Specify whether the map sheets show latitude and longitude YES
   c. List of maps available 106 Sheets
5. Any GIS programme(s) implemented / GIS system(s) developed

   If Yes, Details
   a. Name/Title :
   b. Features :
   c. Standalone /Web based :
   d. Linked with OMMAS data :
   e. Database (Spatial /Non spatial)used :

   } None
6. Expert / trained manpower available with the agency for GIS implementation
   Project Manager GIS (Available full time with PRBDB)
7. Contact person details for the GIS implementation for PMGSY
   Name : Yogesh Gupta, Chief Engineer
   E-mail : yogeshgupta.pwd@gmail.com
   Phone : 0172- 6626620.

Status of GIS Implementation in the State

State: Uttarakhand **Date: 19 / 08 /2014**

14. Status of GIS programme implemented for PMGSY in the state – **Completed / Not Completed /Under Process** **Under Process**

15. List of GIS software (along with version)used/available Not available

16. GIS layers available in softcopy Not available

    g. Format used (e.g – .shp / .tab/ etc.)

    h. Datum & projection used for GIS database

    i. List of layers

17. GIS data available in hardcopy Nill

    a. Specify the Scale of map

    b. Specify whether the map sheets show latitude and longitude

    c. List of maps available

18. Any GIS programme(s) implemented / GIS system(s) developed Nill

    If Yes, Details

    k. Name/Title :
    l. Features :
    m. Standalone /Web based :
    n. Linked with OMMAS data :
    o. Database (Spatial /Non spatial)used :

19. Expert / trained manpower available with the agency for GIS implementation -Nill-

20. Contact person details for the GIS implementation for PMGSY
    Name : Arvind singh Jyala
    E-mail : ut-itno@pmgsy.nic.in
    Phone : 01352608125, 9760456256

Status of GIS Implementation in the State- Gujarat

26 Districts - 225 block

Sr	Question	:	Reply - for all Blocks/districts
1	Status of GIS programme implemented for PMGSY in the state	:	Completed. Data collection of habitation and road alignment completed and geo referenced for PMGSY roads
2	List of GIS software (along with version)used/available	:	Q-GIS VERSION 2.2, AUTOCAD AND GOOGLE
3	GIS layers available in softcopy	:	
	a) Format used (e.g – .shp / .tab/ etc.)		.shp and kml or kmz
	b) Datum & projection used for GIS database		WGS 84
	c) List of layers		All the layer as per guideline of NRRDA.
4	GIS data available in hardcopy	:	(YES)
	a) Specify the Scale of map	:	1 CM :500 MT
	b) Specify whether the map sheets show latitude and longitude	:	YES.
	c) List of maps available	:	DRRP/ CORENET / Road showing PMGSY work
5	Any GIS programme(s) implemented / GIS system(s) developed, If Yes, Details	:	
	a) Name/Title	:	DRRP/CORENET/PMGSY MAPS (FOR STAGE - 1) DRRP SHOWING 2011 POPULATION
	b) Features	:	ALL THE FEATURE AS PER NRRDA GUIDELINE
	c) Standalone /Web based	:	STAND ALONE
	d) Linked with OMMAS data	:	DATA IS LINKED BUT MAPS ARE PENDING
	e) Database (Spatial /Non spatial)used	:	SPATIAL
6	Expert / trained manpower available with the agency for GIS implementation	:	Yes
7	Contact person details for the GIS implementation for PMGSY	:	GSRRDA, Nirman Bhavan, Sec-10A, Gandhinagar-382007
		:	Consultant: CCS (CAD CONSULTANTS & SERVICES), E-mail : ccsstp@gmail.com Phone : 0265 2342772, 982435332

Status of GIS Implementation in the State

State: Bihar **Date: 14.11.2014**

1	Status of GIS programme implemented for PMGSY in the State –Completed /Not completed/Under Process	**Under process**
2	List of GIS Software (along with version)used /available	**Arc GIS 10.0 (ESRI)**
3	GIS layers available in softcopy a. Format used (e.g- shp/ tab/ etc.) b. Datum & projection used for GIS database **c.** List of layers –	**.Shp** **GCS_WNS_1984(projection), Datum (WNS 1984)** Road, Administrative boundary, habitation, Water- feature, Railway line.
4	GIS data available in hardcopy a. Specify the Scale of map b. Specify whether the map sheets show latitude and longitude – **c.** List of maps available –	**1 : 50000** **No** **PMGSY Core Network maps**
5	Any GIS programme(s) implemented / GIS system (s) developed If Yes, Details a. Name/Title : b. Features : c. Standalone/Web based : d. Linked with OMMAS data : e. Database(Spatial / Non spatial) used:	**No**
6	Expert / trained manpower available with the agency for GIS implementation	NIC , Patna(12 Person, 2 GIS expert and 10 GIS operator)
7	Contract person details for the GIS implementation for PMGSY	Name : Shailesh Kumar Shrivastva E-mail : S.K.Shrivastava@nic.in Phone : 9431432962

Status of GIS Implementation in the State

State: Uttar Pradesh **Date: / /2014**

21. Status of GIS programme implemented for PMGSY in the state – **Completed / Not Completed /Under Process : Under Process**

22. List of GIS software (along with version)used/available

    1.) ARC-GIS-ARC Info 10.0 version

23. GIS layers available in softcopy

    j. Format used (e.g – .shp / .tab/ etc.) : .shp

    k. Datum & projection used for GIS database : WGS 1984 UTNI – 44 NORTS

    l. List of layers : a) Habitation Layer , b) Village road Layer

24. GIS data available in hardcopy

    a. Specify the Scale of map :- 1:1000

    b. Specify whether the map sheets show latitude and longitude : YES

    c. List of maps available : No maps available

25. Any GIS programme(s) implemented / GIS system(s) developed

    If Yes, Details

    p. Name/Title :
    q. Features :
    r. Standalone /Web based :
    s. Linked with OMMAS data :
    t. Database (Spatial /Non spatial)used :

26. Expert / trained manpower available with the agency for GIS implementation : NO

27. Contact person details for the GIS implementation for PMGSY
    Name : MOHAMMAD MURTAZA
    E-mail : er.murtaza@gmail.com
    Phone : 09956223307

Status of GIS Implementation In The State

State : JHARKHAND **Date : 13 / 11 / 2014.**

1. Status of GIS programme implemented foe PMGSY in the state – Completed / Not completed / Under Process - Under Process.
2. List of GIS Software (along with version) used/ available - GIS software is being procured.
3. GIS layers available in softcopy.
    a. Format used (e.g.-.shp/.tab/etc) - N.A.
    b. Datum & projection used for GIS database - N.A.
    c. List of layers - N.A.
4. GIS data available in hardcopy
    a. Specify the Scale of map - 1:50,000
    b. Specify whether the map sheets show latitude and longitude - Yes
    c. List of Maps available -
5. Any GIS programme (s) implemented / GIS System (s) developed

    If yes, Details

    a. Name/ Title :
    b. Features :
    c. Standalone / Web based :
    d. Linked with OMMAS data :
    e. Database (Spatial / Non Spatial) Used :
6. Expert / trained manpower available with the agency for GIS implementation :

    A GIS expert is appointed recently.
7. Contact person details for the GIS implementation for PMGSY -

    Name : SHRI PRAVEEN KUMAR

    E- Mail : spacetechnology.01@gmail.com.

    Phone : 0651-2446175.

National Rural Roads Development Agency (NRRDA)

No 15 NBCC Tower 5th Floor,

Bhikaji Cama Place, Near Hyatt Regency,

Delhi – 110066

Centre for Development of Advanced Computing (C-DAC)

Spatial Sciences and Disaster Management (SS&DM) Group

Westend Center III, S.No. 169/1, Sector II, Aundh,

Pune - 411007

GIS DATA STANDARDS FOR SPATIAL DATA CREATION

Apart from the guidelines in SRS, the following should be followed by all states for the national implementation of GIS for PMGSY.

DATA FORMAT

States should provide GIS layers in .shp format.

PROJECTION

States should provide all GIS layers in a single map projection; WGS84 datum and latlong.

GIS DATA MOSAIC

All spatial features should be finally captured to the WGS84 datum and they should be verifiable as per GPS. That means the accuracy should be verifiable on the ground as per GPS and not directly as per SoI toposheets. Therefore, any corrections on the data required should be carried out by States. This activity may be done in Spatial Road Information System (SRIS) procured from C-DAC. As soon as SRIS is procured, States will be trained by C-DAC for the activities. States will provide spatial data as a mosaic of all blocks/districts. In other words, there can not have more than one layer of same map layer (eg, only one Habitation layer on the mosaic). Once the spatial data of adjoining States are completed, if any editing/shifting, on feature or feature boundary required, shall be carried out by States.

UNIQUE ID TO FEATURES IN BLOCK

As per PMGSY guidelines features such as habitation and road have a unique Id within its Block. For example, in a Block there should be only one habitation having id 50. The same way, there should be only one CN road having id L055 within a Block. If a road (same road id) is disconnected within a Block, then those should be joined together. Similarly all the roads should be disconnected at the Block boundary (i.e., start node and end node of road line within the block only). Figure shows two blocks of Rajasthan selected. Info of a NH is shown in a Window on right side. The NH is a single entity/feature within the block. The same NH continues as a separate entity in the next Block.

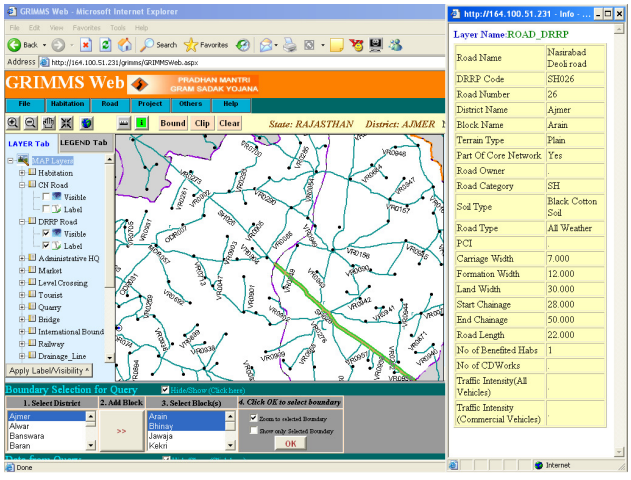


Fig: Unique ID for feature within block

GIS LAYERS AND NAMING CONVENTIONS

All the GIS layers should be created as per the PMGSY guidelines. For example, the name/location of habitation may not always match with that of the habitation from other sources such as toposheets. The naming convention of each layer should be as given in the table. All the layers are compulsory and if there is no feature in a layer, it can be kept empty.

No.	File name	Map layers	Type
1	Habitation	Habitation	Point
2	Bound_District	District Boundary	Polygon
3	Bound_Block	Block Boundary	Polygon
4	Bound_MPConst	MP Constituency Boundary	Polygon
5	Bound_MLAConst	MLA Constituency Boundary	Polygon
6	PWD_Division	PWD Division Boundary	Polygon
7	PWD_Circle	PWD Circle Boundary	Polygon
8	Bound_Forest	Forest Boundary	Polygon
9	Bound_InterNational	International Boundary	Line
10	Road_DRRP	DRRP Road	Line
11	Road_CN	CN Road	Line
12	Road_Package*	Package of Road* (optional/Future layer)	Line
13	Bridge	Bridges	Point
14	LevelCrossing	Level crossing (Manned & Unmanned)	Point
15	Const_Material	Construction Material Sites	Point
16	Waste_Material	Waste Material Sites	Point
17	Market	Market Centre	Point
18	HQ_Administrative	Administrative HQ (Revenue,Block,District,Panchayat)	Point
19	WaterBody	Water body	Polygon
20	Tourist	Tourist Place	Point
21	Drainage_Line Drainage_Poly	Drainage	Line & Polygon
22	Railway	Railway	Line

Table: Naming conventions of spatial layers

*Road_Package layer was not created/implemented in GRIMMS Web. If the layer is provided, certain queries can be implemented more efficiently. Moreover, CN code for certain entries is not entered in Sanctioned Project details table of OMMAS. Thus, if CN code is missing in the OMMAS table, the corresponding entities of road in spatial layer will not be linked to OMMAS data. This will result in incomplete graphic representation of roads in project related queries. For each new road package in OMMAS, a new road feature should be created in Road_Package layer. This activity may be done in (SRIS) procured from C-DAC.

TABLE STRUCTURE

All the spatial layers should have standard fields with data as entered in OMMAS.

1. ***Habitation***

Field Name	Type	Field width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code
HAB_ID	Integer	4	Habitation Code

2. ***Bound_District***

Field Name	Type	Field width	Remark
DIST_ID	Integer	2	District Code

3. ***Bound_Block***

Field Name	Type	Field width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code

4. ***Bound_MPConst***

Field Name	Type	Field width	Remark
MP_CON_ID	Integer	3	MP Constituency code

5. ***Bound_MLAConst***

Field Name	Type	Field width	Remark
MLA_CON_ID	Integer	3	MLA Constituency code

6. ***PWD_Division***

Field Name	Type	Field width	Remark
DIV_ID	Integer	2	PWD Division Code
DIV_NAME	String	20	PWD Division Name

7. ***PWD_Circle***

Field Name	Type	Field width	Remark
CIR_ID	Integer	2	PWD Circle Code
CIR_NAME	String	20	PWD Circle Name

8. ***Bound_Forest***

Field Name	Type	Field Width	Remark
FB_Type	String	1	R/P (Reserved/Protected)

9. ***Bound_InterNational***

Field Name	Type	Field Width	Remark
INTNAME	String	20	Name of Neighbour

10. ***Road_DRRP***

Field Name	Type	Field width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code
ER _ID	String	10	ER_ROAD_ CODE

11. ***Road_CN***

Field Name	Type	Field width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code
ER _ID	String	10	ER_ROAD_CODE
PLAN_RD_ID	String	10	PLAN_RD_NUMBER

12. ***Road_Package *(Optional)***

Field Name	Type	Field width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code
PACKAGE_ID	String	10	Package Id as in OMMS
ROAD_ID	String	10	Road Id as in OMMS

13. ***Bridge***

Field Name	Type	Field width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code
ER _ID	String	10	ER_ROAD_ CODE**
BRIDGE_ID	Integer	4	MAST_CD_NUMBER**

**ER_ID and BRIDGE_ID are not entered in database and not used in any of the queries. If the data is entered, it can be used for future implementations.

14. ***Level Crossing***

Field Name	Type	Field width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code
LC_Type	String	1	M/U (Manned/Unmanned)

15. ***Construction Material Site***

Field Name	Type	Field width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code
M_Type	String	1	Material Type
S_Name	String	20	Material Site Name

* Construction material list/detials to be provided by NRRDA

16. ***Waste Material Site***

Field Name	Type	Field width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code
W_Type	String	1	Material Type
S_Name	String	20	Material Site Name

* Waste material list/details to be provided by NRRDA

17. ***Market***

Field Name	Type	Field Width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code
MarketName	String	25	Name
MarketDays	Integer	1	Number of market days

18. ***HQ_Administrative***

Field Name	Type	Field Width	Remark
AHQ_Type	String	1	AHQ Type (R/B/D/P)
AHQ_Name	String	25	HQ Name

Administrative Headquarter Types are R/B/D/P (Revenue, Block, District, Panchayat)

19. ***WaterBody***

Field Name	Type	Field Width	Remark
WB_Type	String	10	WB Type

20. ***Tourist***

Field Name	Type	Field Width	Remark
DIST_ID	Integer	2	District Code
BLOCK_ID	Integer	2	Block Code
TP_Name	String	25	Name

21. ***Drainage_Line/ Drainage_Poly***

Field Name	Type	Field Width	Remark
D_Name	String	20	Name (Major)

22. ***Railway***

Field Name	Type	Field Width	Remark
blank			