Digital India
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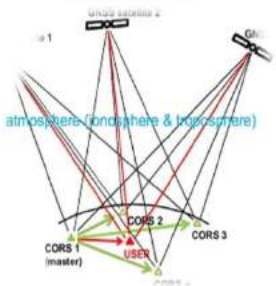
Azadi Ka Amrit Mahotsav

DIGITAL INDIA LAND RECORDS MODERNIZATION PROGRAMME (DILRMP)

GUIDELINES, TECHNICAL MANUALS AND MANAGEMENT INFORMATION SYSTEM 2021-2026







GOVERNMENT OF INDIA
MINISTRY OF RURAL DEVELOPMENT
DEPARTMENT OF LAND RESOURCES

गिरिराज सिंह
GIRIRAJ SINGH

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

ग्रामीण विकास तथा पंचायती राज मंत्री
भारत सरकार
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MINISTER OF
RURAL DEVELOPMENT AND PANCHAYATI RAJ
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI

संदेश

मुझे यह जानकर प्रसन्नता हो रही है कि भूमि संसाधन विभाग, ग्रामीण विकास मंत्रालय, भारत सरकार द्वारा डिजिटल इंडिया भूमि अभिलेख आधुनिकीकरण कार्यक्रम (डीआईएलआरएमपी) पर संशोधित दिशानिर्देश जारी किए जा रहे हैं।

भूमि अभिलेखों से संबंधित सूचना, केंद्रीय/राज्य सरकार के विभागों जैसे कृषि और किसान कल्याण विभाग, रसायन और उर्वरक विभाग, सार्वजनिक वितरण प्रणाली (पीडीएस), वित्तीय संस्थानों आदि की सेवाओं/लाभों की प्रभावशीलता और दक्षता बढ़ाने के लिए बहुत कारगर हो सकती है। इन विभागों/एजेंसियों/मंत्रालयों द्वारा प्रभावशाली ढंग से सेवा तभी प्रदान की जा सकती है जब उनके बीच भूमि अभिलेखों से संबंधित सूचना के आदान-प्रदान में एक रूपता हो, इंटर-आपरेबिलिटी और कंपेटिबिलिटी हो।

मुझे यह विश्वास है कि राज्यों/संघ राज्य क्षेत्रों की सक्रिय भागीदारी से भूमि संसाधन विभाग दिनांक 31-03-2023 तक देश के सभी बुनियादी प्रारंभिक भूमिअभिलेखों के शतप्रतिशत डिजिटलीकरण कार्य को पूरा कर लेगा और दिनांक 31-03-2026 तक डीआईएलआरएमपी के अन्य सभी शेष घटकों को भी शतप्रतिशत पूरा करने में सक्षम होगा ताकि सभी नागरिकों और हितधारकों को भूमि अभिलेखों से संबंधित सूचना बिना किसी परेशानी के उपलब्ध कराई जा सके।

मैं डीआईएलआरएमपी कार्यक्रम को समयबद्ध और प्रभावी तरीके से लागू करने के लिए एक मजबूत और व्यापक दिशानिर्देश तैयार करने तथा तकनीकी नियमावली को सावधानीपूर्वक सोच विचार कर डिजाइन करने के लिए भूमि संसाधन विभाग के प्रयासों की सराहना करता हूं।

(गिरिराज सिंह)

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GIRIRAJ SINGH

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ग्रामीण विकास तथा पंचायती राज मंत्री
भारत सरकार
कृषि भवन, नई दिल्ली
MINISTER OF
RURAL DEVELOPMENT AND PANCHAYATI RAJ
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI

Message

I am delighted to know that revised guidelines on Digital India Land Records Modernization Programme (DILRMP) is being brought out by the Department of Land Resource, Ministry of Rural Development, Government of India.

Land records related information could be very effective for enhancing the effectiveness and efficiency of services/benefits of Central/State Government Departments like Agriculture and Farmers Welfare, Chemicals and Fertilizers, Public Distribution System (PDS), Financial Institutions, etc. The effectiveness in delivery of services to aforesaid Departments/Agencies/Ministries depends upon the uniformity, inter-operability, compatibility for sharing of land records related information among different stakeholders.

I am confident that the Department of Land Resources with active participation of States/UTs would be able to achieve completion of 100% digitization work of all basic primary land records of the country by 31.03.2023 and 100% completion of all other remaining components of DILRMP by 31.03.2026 so as to provide hassle free access of land records and related information to all citizens and stakeholders.

I appreciate the efforts of Department of Land Resources for meticulously conceptualization, designing and devising a robust and comprehensive Guidelines and Technical Manuals for effective implementation of DILRMP programme in a time bound manner.

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आज़ादी का अमृत महोत्सव

इस्पात एवं
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MINISTER OF STATE FOR STEEL
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GOVERNMENT OF INDIA
UDYOG BHAWAN, NEW DELHI-110011

Message

It gives me immense pleasure to know that the Department of Land Resources is bringing out the new guidelines on Digital India Land Records Modernization Programme (DILRMP).

These guidelines have been prepared keeping in view the needs of the States/UTs towards implementation of various components of DILRMP approved by the Government of India extending the programme for a further period of five years i.e., 2021-22 to 2025-26 with newly added components (i) Linkage of Aadhaar number with land records database and (ii) Computerization of Revenue Courts and their integration with land records. Administration of The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 and the Registration Act, 1908 are important legislation being handled by the Department that are linked to / dependent on the land records. Timely updation of land records with accuracy will enable the Government to decide and pay compensation for land acquisition to the affected owners in time Rehabilitation and Resettlement benefits including establishment of resettlement colonies for affected families both land owners and those whose livelihood has been dependent on the land acquired will be expedited.

Department of Land Resources has developed Land Acquisition Compensation Rehabilitation Resettlement Information System, an MIS portal to capture information on various parameters of land acquisition, required for ranking of the State/UTs, which was launched by the Union Minister of Rural Development and Panchayati Raj on 16.12.2021. The ranking will provide a platform and a healthy competition to the States/UTs to expedite land acquisition process including updation of land records.

I am sure that these Guidelines would be helpful for States/UTs to achieve completion of 100% basic and primary computerization and digitization work of all land records of the country by 31.03.2023 and completion of all other components of DILRMP by 31.03.2026 so as to provide the citizens ease of living and ease of doing business to stakeholders.

(Faggan Singh Kulaste)

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सचिव
Ajay Tirkey, I.A.S.
Secretary

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

भारत सरकार
भूमि संसाधन विभाग
ग्रामीण विकास मंत्रालय
Government of India
Department of Land Resources
Ministry of Rural Development

Message

For modernization of land records system in the country, a modified Programme, viz., the National Land Records Modernization Programme (NLRMP) a Centrally Sponsored Scheme, was formulated by merging two Centrally-sponsored schemes of Computerization of Land Records (CLR) and Strengthening of Revenue Administration and Updating of Land Records (SRA&ULR). The NLRMP, has since been revamped as the Digital India Land Records Modernization Programme (DILRMP) as a Central Sector Scheme with cent percent Central funding with effect from 01st April 2016. While extending the Programme beyond 31.03.2021, it was also mandated to revise the guidelines. The Guidelines have been revised in consultation with all stakeholders accordingly.

Detailed Guidelines and Technical Manual are enclosed for better implementation of the DILRMP. The Technical Manuals have been revised after obtaining inputs from the leading technical agencies as well as field experience of States which have done commendable work in specific areas of the Programme.

These Guidelines are in three parts - **Part-A: The Guidelines, Part-B: The Technical Manual and Part-C: The MIS.**

I would like to place on record my appreciation of efforts of the officers and staff of DoLR who have put in extra efforts in finalizing these Guidelines and Manuals especially Shri Hukum Singh Meena (Additional Secretary), Ms. Leena Johri (Additional Secretary & Financial Advisor), Shri Sonmoni Borah (Joint Secretary), Shri P.C. Prasad (Director), Shri Dayanidhi Joshi (Deputy Secretary) and all supporting Divisional officers and staff.

The Department is grateful for the overall guidance and encouragement it received from the Hon'ble Minister of Rural Development and Panchayati Raj and Hon'ble Minister of State for Rural Development and Steel. Hon'ble Minister of Rural Development and Panchayati Raj has emphatically stated on various occasions that the Reforms and initiatives of the Department will transform India in the near future and prepare us for Global partnership and leadership. We are extremely grateful for his continued support.

And finally let me also place on record the tremendous amount of work put in by the States/UTs in DILRMP as well as iconic initiatives like National Generic Document Registration System (NGDRS), Unique Land Parcel Identification Number (ULPIN) as well as Multilingual Land Records which is being developed to break the linguistic barriers across States, and coming up very soon.

(Ajay Tirkey)

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अपर सचिव
HUKUM SINGH MEENA, IAS
ADDITIONAL SECRETARY

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भूमि संसाधन विभाग
ग्रामीण विकास मंत्रालय
भारत सरकार
Department of Land Resources
Ministry of Rural Development
Government of India

आज़ादी का अमृत महोत्सव

Hukum Singh Meena
Additional Secretary
Department of Land Resources

Digital India Land Records Modernization Programme is an important programme specially for the overall economic growth of the country. The importance of the programme is self-evident from the fact that the programme has been revamped from Centrally Sponsored Scheme to Central Sector Scheme since April 2016 with hundred percent funding from Central Government. I am happy to share that Department of Land Resources has taken number of innovative initiatives under DILRMP to enhance the effectiveness and efficiency of not only the programme of Revenue Department but also other sectors/Departments/Ministries. These initiatives *inter-alia* includes Unique Land Parcel Identification Number (ULPIN), National Generic Document Registration System (NGDRS), Integrated Land Information Management System (ILIMS) and Multilingual Land Records Software application. These initiatives have resulted into multifold benefits like- the initiatives, National Generic Document Registration system (NGDRS)- is an advanced software application that is scalable, flexible according to the need of the states. It has been reported by states/UTs that it has substantially reduced time, cost and procedures required for registration of the documents.

Similarly, ULPIN is another good initiative to assign a unique IDs to the land parcels. It is of international standard complying Electronic Commerce Code Management Association (ECCMA) and Open Geospatial Consortium (OGC) standards. It is a very good tool for sharing of the information on Land Records with other sectors. It has enabler instrumentalities for taking informed decisions.

These guidelines and technical manual will provide support to the States/UTs and other implementing agencies for implementing the different components of the DILRMP. I acknowledge the hard work that have been put by Shri Sonmoni Borah, Joint Secretary and his team members Shri PC Prasad Director (LR), Shri Dayanidhi Joshi DS (LR) and other officers of Land Regulation division for preparing of the guidelines. These guidelines cover almost all aspects of the programme including Guidelines, Technical Manual and MIS of the programme.

(Hukum Singh Meena)

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The Digital India Land Records Modernization Programme (DILRMP) has been extended by the Government of India for a period of five years from 01.04.2021 to 31.03.2026 with addition of 2 new components (i) Linkage of Aadhaar number with land records database and (ii) Computerization of Revenue Courts and their integration with land records. The Guidelines of DILRMP have been revised to meet the requirements of States/UTs to implement all components of DILRMP with full pace and complete the basic digitization work of land records by 31.03.2023 and completion of all components of DILRMP by 31.03.2026.

While we are celebrating "Azadi Ka Amrut Mahotsav" during the 75th Year of Independence, every State/UT is expected to chalk out annual action plan to complete the basic digitization work i.e. (i) Computerization of record of rights; (ii) digitization of cadastral maps; (iii) integration of record of rights (textual) and cadastral maps (spatial)by March, 2023. Some States/UTs, which have made substantial progress in basic digitization work, may fix the target to complete the work of these three components by 15.08.2022 as an occasion to celebrate the "Azadi Ka Amrut Mahotsav".

States/UTs are expected to work out year wise plan for coming years complete the work of all components of DILRMP by March, 2026.

For achieving the above said goals, States/UTs are expected to allocate District and village wise targets and monitor the progress through State/District/Sub Division/Tehsil level monitoring committees as detailed in DILRMP guidelines.

From this year, LR division has initiated National Awards for states/ UTs and Districts in implementation of DILRMP to recognise excellent works in revenue and registration administration. Likewise, to encourage States /UTs to update data on regular basis, we have decided to initiate monthly grading among the districts from February, 2022 onwards on the basis of the data fed by States/UTs/ districts on MIS of DILRMP in respect of following parameters / indicators:- (i)Computerization of Land Records (RoR), (ii)Digitization of Cadastral Maps/FMBs, (iii)Linkage of RoR with Cadastral maps, (iv) Computerization of Registration, (v) Integration of Registration (SRO) with Land Records (Revenue Office) and (vi) modern Record Room establishment. Grading will be done on the basis of performance of districts as

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reflected in MIS of DILRMP in these six (6) components as per the following percentage pattern and a ranking list will be prepared for each component / category wise as Platinum (99% and above), Gold (95% and above till 99%) and Silver (90% and above till 95 %).

We have also initiated Ranking of states/ UTs/ Districts in Land acquisition performance and awards for best 3 performing Districts, under the RFCTLAAR, 2013 Act are being instituted. The Portal was inaugurated by Hon'ble Minister, MoRD on 16.12.2021.

A FIVE EYES FRAMEWORK has been envisaged for strong Monitoring and Review mechanism from Central to state to division to District and upto Sub District of Revenue level. Likewise, benchmarking for Evaluation of the programme has been envisioned where apart from CRS, Mussoorie, involvement of National / International level reputed agencies, and other organizations etc. will be roped in for research and development purpose, information analytics, consultation, collaboration, and other activities. The guidelines also envision a proactive and comprehensive IEC and Communication Plan for easy reach of the benefits of the programme to the common man. With thrust on Geo-spatial data and use of modern Technology, we strive to create a data -driven, transparent, trustworthy and eco-friendly and citizen-friendly pan -India single platform for integrated land records information and management system .The guidelines and general instructions will fulfil the mission of DILRMP and propel to work for a transparent land administration and management system and to finally achieve ease of living, ease of doing business and good governance for the people of India. I extend my best wishes to all States/UTs for timely completion of all components of DILRMP in their respective State/UT.

I am extremely grateful to Hon'ble Minister, MoRD for his constant direction, guidance, leadership and support for the programme and other activities of the division. I am also grateful to Hon'ble MoS for his guidance and support for LR Division related work and activities.

I owe my sincere gratitude to Secretary (DoLR) for his leadership, constant guidance and unconditional support, I wish to thank AS (DoLR) for his guidance and valuable inputs in framing the guideline.

Needless to say that this Herculean task of framing guidelines was possible only with the support of Revenue and Registration Departments of the States/UTs.

Last but not the least, I am deeply indebted to my able team namely Sh. Phool Chandra Prasad (Dir.), Sh. Dayanidhi Joshi (DS), Sh. Asit Halder (US), Sh. Naval Singh Meena (AD), Sh. Abhishek Tiwari (AD), Sh. Nikesh Singh, Sh. Mayank Rajput, NIC team and my office for their support, promptness and contribution.

(Sonmoni Borah)

TABLE OF CONTENT

LIST OF ABBREVIATIONS

ADM	**Additional District Magistrate**
ASA	**Audited Statement of Accounts**
ATI	**Administrative Training Institutes**
C-DAC	**Centre for Development of Advanced Computing**
CEO	**Chief Executive Officer**
CERT	**Computer Emergency Response Team**
CLR	**Computerization of Land Records**
CORS	**Continuously Operating Reference Station**
CRO	**Circle Revenue Officer**
CTAG	**Core Technical Advisory Group**
DEM	**Digital Elevation Model**
DGPS	**Differential Global Positioning System**
DILRMP	**Digital India Land Records Modernization Programme**
DMS	**Data Model Structure**
DoLR	**Department of Land Resources**
DPI	**Dots Per Inch**
DPR	**Detailed Project Reports**
DPS	**Digital Photogrammetric Station**
DRO	**District Revenue Officer**
DTDB	**Digital Topographic Data Base**
EO	**Executive Officer**

ETS	**Electronic Total Station**
FMB	**Field Measurement Books**
FSI	**Forest Survey of India**
GCP	**Ground Control Point**
GCPL	**Ground Control Point Library**
GDOP	**Geometric Dilution of Precision**
GIS	**Geographic Information System**
HRSI	**High Resolution Satellite Imagery**
IEC	**Information, Education and Communication**
IGS	**International Geodetic Survey**
ISMS	**Information Security Management System**
ISRO	**Indian Space Research Organization**
JL	**Jurisdiction List**
LAN	**Local Area Network**
LBSNAA	**Lal Bahadur Shastri National Academy of Administration**
LISS	**Linear Imaging Self-Scanner**
LPMs	**Land Parcel Maps**
LRD	**Land Revenue Department**
MoU	**Memorandum of Understanding**
NGDRS	**National Generic Document Registration System**
NGO	**Non-Governmental Organisation**
NIC	**National Informatics Centre**
NIRD	**National Institute of Rural Development**
NLRMP	**National Land Records Modernization Programme**
NNRMS	**National Natural Resource Management System**
NRSC	**National Remote Sensing Centre**
NSDB	**National Spatial Data Base**

NSDI	**National Spatial Data Infrastructure**
O&M	**Operational and Maintenance**
OSS	**Open-Source Software**
PFMS	**Public Financial Management System**
PMU	**Programme Management Unit**
PoP	**Point of Presence**
RDBMS	**Relational Database Management Systems**
REAT	**Receipts, Expenditure, Advances and Transfers**
RMS	**Root Mean Square**
RoR	**Record of Right**
RPN	**Rendered Plot Numbers**
SAN	**Storage Area Network**
SDM	**Sub-Divisional Magistrate**
SDO	**Sub-Divisional Officer**
SLDC	**State Level Data Centres**
SLUSI	**Soil & Land Use Survey of India**
SOI	**Survey of India**
SRA & ULR	**Strengthening of Revenue Administration and Updating of Land Records**
SROs	**Sub-Registrar‘s Offices**
SWAN	**State Wide Area Network**
TS	**Total Stations**
ULPIN	**Unique Land Parcel Identification Number**
UT	**Union Territory**
UTF	**Unicode Transformation Format**
UTM	**Universal Transverse Mercator**
VPN	**Virtual Private Network**

WAN	**Wide Area Network**
WGS	**World Geodetic System**

EXECUTIVE SUMMARY

Land a finite natural resource, is not only main source of livelihood of the majority of rural population but is also connected with the pride, emotions, and socio-economic values of the land owners and as such the land record showing their rights over land has immense value. While the various welfare services and benefits of the government schemes primarily depend on the land records, a person, to avail these services/benefits based on land rights and also for transactions of land, has to visit various offices and places several times. In our country, land administration and its management are diverse on account of language, culture, regions, topography, nomenclature and socio-economic factors. In this milieu, digitization of land record with accuracy and updated status and access to these by the public in easy and online mode becomes very important. Though the land and its management (Entry No.18 and 45 of the State List of the 7th Schedule of the constitution) fall in the domain of the States, Government of India has always been assisting the States/UTs by way of financial assistance and technical support to digitized the land record and placed the same in the public domain.

The digitization of land record initially started in 1980s through Centrally Sponsored Schemes called Computerisation of Land Records (CLR) and Strengthening of Revenue Administration and Updating of Land records (SRA&ULR) followed by a comprehensive scheme called the National Land Record Modernization Programme (NLRMP) a Centrally Sponsored Scheme in 2008 with the aim to implement Conclusive Titling System.

Keeping in view the importance of the land record and expedite digitization process of land records, in 2015-16, the scheme was revamped and brought under the Digital India umbrella initiative of the government and renamed as Digital India Land Records Modernization Programme (DILRMP). It was revamped and made a Central Sector Scheme with the 100% funding from the Central Government w.e.f. 01/04/2016. The scheme has now further been extended up to 2025-26 (co-terminus with Fifteenth Finance Commission) with the overall aim to place all the information available in respect of a piece of land at one place and make them easily accessible to the public trough ILIMS.

During last 4-5 years, substantial progress has been achieved under different component of the scheme e.g., computerization of record of rights (RoR) have been completed in 606138 villages out of 656127 villages (92.38%), out of 5224 Sub-Registrar Offices in the country, 4883 (93.47%) have been computerized, out of 16257261 Maps / FMBs in the

country, 11097713 Maps /FMBs (68.26%) have been digitized and out of 5224 SROs, 3999 SROs (77%) have been integrated with land records data base.

Further, Department has also taken a number of innovative initiatives to empower citizens, facilitate ease of living of the people and Ease of Doing Business of the prospectors. These initiatives *inter alia* include:

(i) Integrated Land Information Management System (ILIMS) to integrate the information related to land including linkage with banks to facilitate credit facility to land owners, (ii) the National Generic Document Registration System (NGDRS) that provides option to the prospectors to submit documents online for registration and take online appointment which ultimately result in reducing compliance burden on account of reduced time, cost, processes and physical visits, (iii) Similarly, Unique Land Parcel Identification Number (ULPIN) was conceptualized and circulated in 2020 to States /UTs for adoption. In this system, 14 digits – Alpha-numeric unique ID is assigned a land parcel based on the vertices of the co-ordinate of the land parcel. The system is of International Standard and meet Electronic Commerce Code Management Association (ECCMA) and Open Geo-Spatial Consortium (OGC) standards, (iv) The other initiative of the Department in the pipeline is to facilitate States /UTs to have land records in all 22 languages mentioned in the Constitution of India to remove linguistic barrier. This is being done in association with C-DAC; and (v) Inter-linking of e-Court System of the Civil Courts with land record data base and registration has also taken off in collaboration with Department of Justice, e-Court Committee of Supreme Court, State Governments and NIC.

The basic components of the DILRMP i.e., Computerization of Land Records, Digitization of Cadastral Maps, integration of Records of Rights with cadastral maps, Computerization of the Registration and their integration with land records are proposed to be completed by march 2023 in the entire country and remaining components by 2025-26. To sum up, it may be concluded that all the activities of the Department under the broad aegis of DILRMP is directed towards Atmanirbhar Bharat through enhancing transparency, creating awareness, making information available online on real time basis, ease of living of the people, and Ease of Doing Business for the entrepreneurs.

PART – A: OPERATIONAL GUIDELINES
OF DIGITAL INDIA LAND RECORDS MODERNIZATION PROGRAMME (DILRMP)

1.0 INTRODUCTION:

1.1 Historically, India inherited different land systems and different practices of land records management system with asymmetrical practices, un-surveyed records and measurement units in the States. Some States in the North Eastern Region have land systems based on customary laws and even have land governing systems administered by traditional village chiefs. The diversity in land governance and land records system, therefore, requires a major programmatic intervention to ensure computerization and digitization to make the system transparent and robust for delivery of various schematic benefits of the Government Schemes/Programmes.

1.2 Further, land governance is a subject of State list (List II), listed at Sl. No.18 & 45 and Concurrent list (List III) listed at Sl. No. 6 & 42 of VII Schedule of the Constitution wherein land revenue system is governed by State specific Acts/Rules/Regulations. It is essential that land systems and land governance in the country be integrated for achieving the larger benefits of the Central/State Governments/Schemes/Programmes.

1.3 The National Land Records Modernization Programme (NLRMP), approved in 2008 as a Centrally Sponsored Scheme, has since been revamped as the Digital India Land Records Modernization Programme (DILRMP) as a Central Sector Scheme with hundred per cent Central funding with effect from 01st April 2016.

1.4 The components and activities:

The programme has the following major components and activities:

S. N.	Component	Activities
1	Computerization of Land Records	(i) Computerization of record of rights; (ii) digitization of cadastral maps; (iii) integration of record of rights (textual) and cadastral maps (spatial); (iv) data centres at state level.
2	Computerization of Registration	(i) Computerization of Sub Registrar Offices (SROs); (ii) connectivity between sub-registrar offices and tehsils; (iii) integration of registration and land records, (iv) Data entry

		and legacy data regarding property, (v) Scanning and preservation of old data and (vi) Data entry of property valuation details.
3	Survey / resurvey and innovative initiatives	Survey / resurvey and updating of the survey & settlement records.
4	Modern record rooms	Modern record rooms / land records management centres at tehsil/taluk/circle/block or equivalent level
5	Training & capacity building, IEC and Evaluation Studies	(i)Creation of DILRMP Cells at Administrative Training Institutes and / or the Survey / Revenue / Patwari Training Institutes of states, strengthening of training institutes, imparting training to Revenue/Registration/Survey officials, (ii)IEC activities and impact assessment/post completion evaluation studies.
6	Project Management Unit (PMU)	To provide human resources and other infrastructure for ensuring effective implementation of various components of DILRMP.
7	Consent-based linkage of Aadhaar with Record of Rights	Linking of Aadhaar number with Record of Rights on voluntary basis and authentication through Aadhaar.
8	Computerization of Revenue Courts	Computerization of Revenue Courts and their integration with land records.

1.5 Need for formulation of revised guidelines has arisen to incorporate changes emerging out of the recommendations of the EFC for extension of the Programme from 1.4.2021 to 31.3.2026 that *inter alia* include component-wise allocation of funds, as per

details given in Table below:

S.No.	Component	Amount Approved (Rs. Crore)
Existing Components		
1	Modern record room (Tehsil/Taluka/Circle/Block level)	130
2	Survey/ re-survey and innovative initiatives	300
3	Computerization of Land Records	
3(a)	Data entry/re-entry	15
3(b)	Digitization of cadastral maps/FMBs/Tippans	52
3(c)	State level data centre	32
3(d)	Core GIS/Software Applications	20
4	Computerization of Registration process	50
5	DILRMP Cell	12
6	PMU	47
7	Evaluation Studies, IEC and Training	40
Sub-Total (Existing components)		***698***
New Components		
8	Consent-based integration of Aadhaar number with the land record database	62
9	Computerization of Revenue Courts and their integration with land records	115
Sub-Total (New components)		***177***
Total		***875***

2.0 VISION:

Seamless access to land records related information can be very effective for enhancing the effectiveness and efficiency of services/benefits of Central/State Government Departments. The effectiveness in delivery of services to stake-holders depends upon the uniformity, interoperability, and compatibility for sharing of land records related information among different stakeholders. Development of a comprehensive integrated land information management system would work as the main driver for development of infrastructure, economic growth of the country; more so because livelihood of majority of the rural population of our country is dependent on land resources. This will be achieved through active participation of States/UTs.

To develop a modern, comprehensive and transparent land record management system with the aim to develop an Integrated Land Information Management System which will inter alia provide error-free, transparent and tamper-proof land records, aiming to provide security of tenancy to citizen, reduce land disputes, simplify procedure of transfer of property title, assist in policy / planning etc.

3.0 MISSION:

Pan-India digital initiative to integrate land information and management systems, to empower and benefit the citizens of India, irrespective of caste, creed, religion, region, rural or urban, poor or rich, farmers or labourers or entrepreneurs, so on and so forth, through the benefits of computerization & digitization of land records in the first place.

Secondly, to achieve optimal service delivery by way of integration with several services/agencies/schemes/programmes under various Ministries of Government of India and states/ UTs.

Thirdly, to enable an eco-system where the integrated land records information system can effectively be used for planning, decision-making, policy-making.

4.0 OBJECTIVE:

To develop a modern, comprehensive and transparent land record management system with the aim to put in place an Integrated Land Information Management System (ILIMS) which will inter alia: (i) improve real-time information on land; (ii) optimize use of land resources; (iii) benefit both landowners & prospectors; (iv) assist in policy & planning; (v)

reduce land disputes; (vi) check fraudulent / benami transactions (vii) obviate need of physical visits to Revenue/Registration offices (viii) enable sharing of information with various organizations/agencies.

To complete the work of basic components of Computerization and Digitization of Land Records, Integration of Records of Rights with cadastral maps, Computerization of Registration and integration of registry offices with Revenue offices by 31.3.2023 and completion of all components by 31.3.2026 with support of States/UTs.

5.0 SCOPE:

5.1 Computerization of land records

a) Data entry/re-entry/data conversion of all textual records including mutation records and other land attributes data
b) Digitization of cadastral maps
c) State-level data Centre
d) The Unique Land Parcel Identification Number (ULPIN):14 digits – Alpha–Numeric unique ID for each land parcel based on Geo-coordinates of vertices of the parcel

5.2 Survey/resurvey and updating of the survey & settlement records:

This component including ground control network and ground truthing should be implemented using the following modern technology options.

a) Pure ground method using electronic total station (ETS) and differential

   Global positioning system (DGPS)

b) Hybrid methodology using aerial photography and ground truthing by ETS and DGPS

c) Hybrid Methodology using High Resolution Satellite Imagery (HRSI) and ground truthing by ETS and DGPS
d) Other technologies as approved by Core Technical Advisory Group (CTAG) from time to time.

5.3 Computerization of Registration

a) Computerization of the sub-registrar’s offices (SROs)
b) Data entry of valuation details

c) Data entry of legacy encumbrance data

d) Scanning & preservation of old documents

e) Connectivity of SROs with revenue offices

5.4 Modern Record Rooms/land records at tehsil/taluk/circle/block level

5.5 Training & capacity building, IEC and evaluation studies

a) Training, workshops, etc.

b) Strengthening of the Survey and Revenue training institutes

c) IEC activities

d) Evaluation/impact assessment studies

5.6 Core GIS

There is a paradigm shift in availability of affordable GIS technologies over the past few years for survey. Quality satellite imagery is also improving from 1m to 50 cm and 30 cm. Nowadays, high resolution satellite imagery acquired by CARTOSAT - 3 of ISRO is also available with around panchromatic (PAN) resolution of 0.25 m and multispectral (Mx) resolution of 1 m making it one of the highest spatial resolution imaging satellites in the world. The establishment of the CORS network for the entire India is already in process by SOI and till now a grid of 278 reference stations (figure attached) have been set up covering a broad landmass of north and central India. All these technologies will make preparation more accurate, georeferenced, cadastral maps up-to date and affordable.

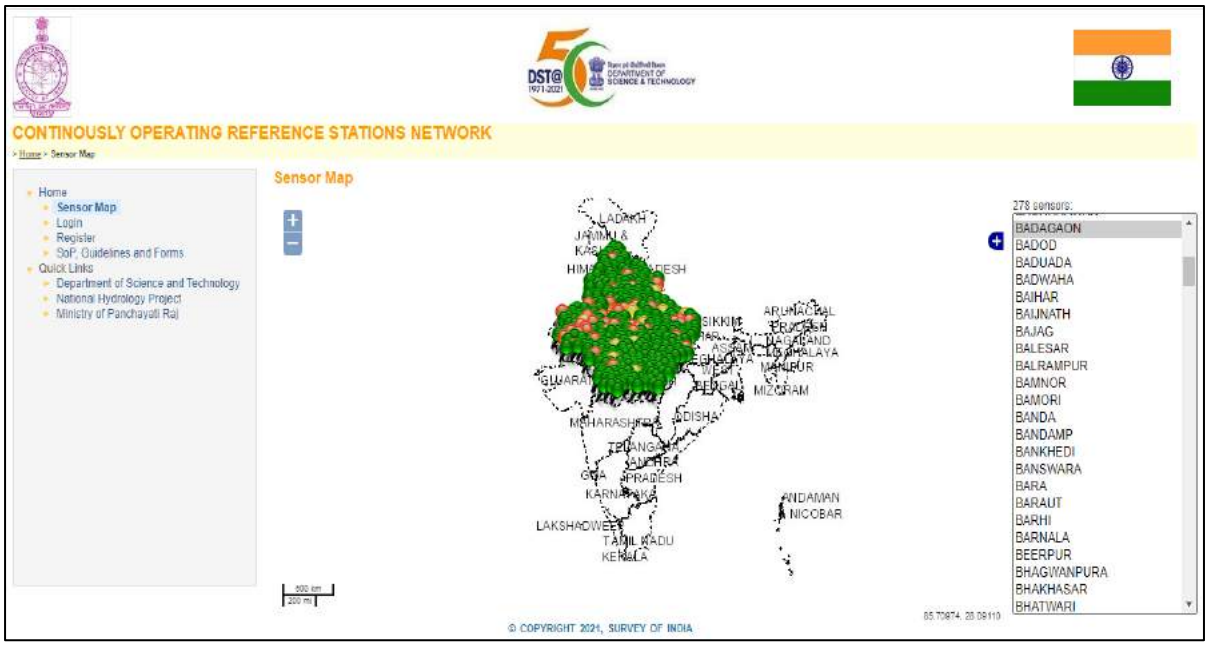


Fig: Spatial distribution of CORS network grid

Based on the technology used - Aerial/ Satellite or ground based survey, the State GIS database will have the following components:

a) A raster database of Village index base maps in soft copy for record purpose

b) Based on technology deployed geo-referenced and ortho-rectified raster base maps of imagery (Aerial, Satellite)

c) GCP (Ground control Point) database

d) GIS-ready digitized cadastral maps from revenue records at village/ tehsil and district levels

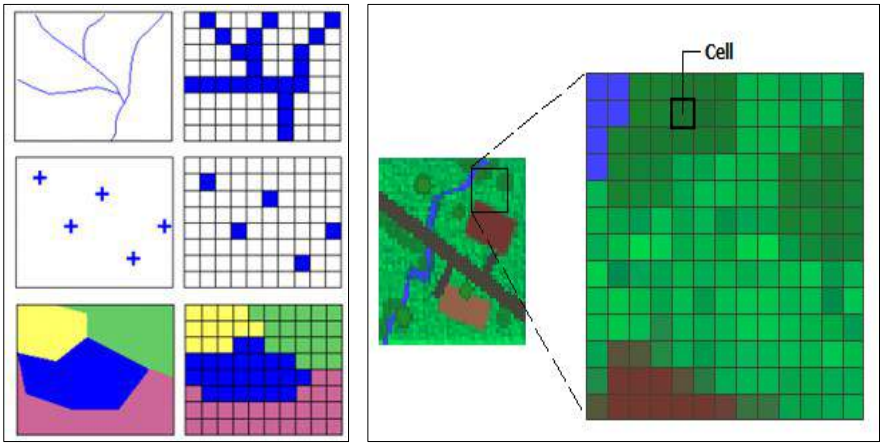
Once the basic plot-wise data is created by the States/UTs, seamless integration would be possible for micro and macro-planning and other relevant applications.

Vectorized map can be stored in any open GIS format without any loss of freedom, as the conversion from one format to another is built into the software for automatic raster to vector conversion. To maintain the topology of the GIS data, it is preferred to store data in a file geo-database/ personal geo-database or new format GeoPackage, an open standard. Data may also be stored in GIS enabled RDMS such as Post GIS, MS SQL Server etc.

5.6.1 Raster Data

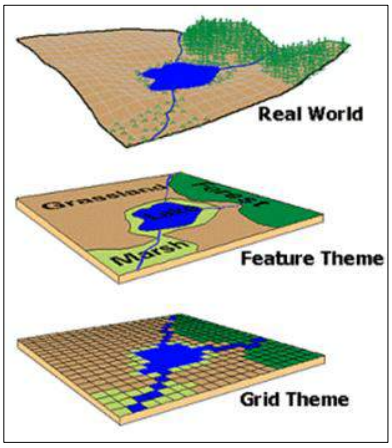
In its simplest form, a raster dataset is composed of rows (running across) and columns (running down) of pixels (also known as cells). Each pixel represents a geographical region, and the value in that pixel represents some characteristic of that region. Rasters are digital aerial photographs, imagery from satellites, digital pictures, or even scanned maps. A raster data type is, in essence, any type of digital image represented in grids. The representation of the objects is based on the elements of a (2D or 3D) matrix. Anyone who is familiar with digital photography will recognize the pixel as the smallest individual

unit of an image.



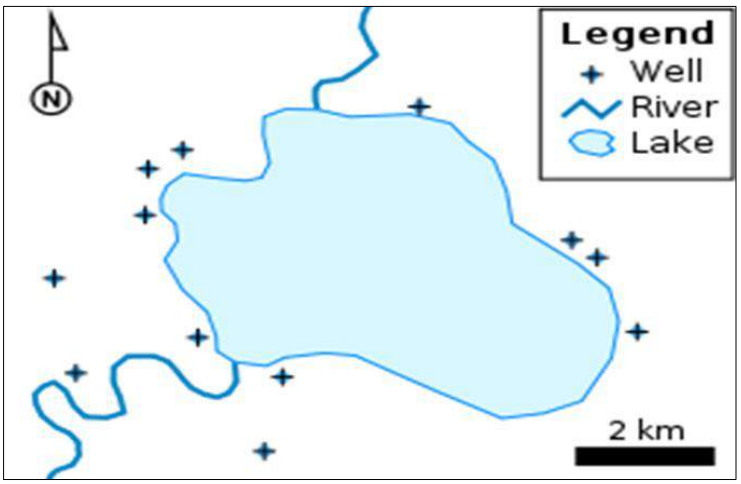
5.6.2 Vector Data

In a GIS, geographical features are often expressed as vectors, by considering those features as geometrical shapes. The representation of the objects is based on distinct points described by their co-ordinates in the reference system. Different geographical features are expressed by different types of geometry:

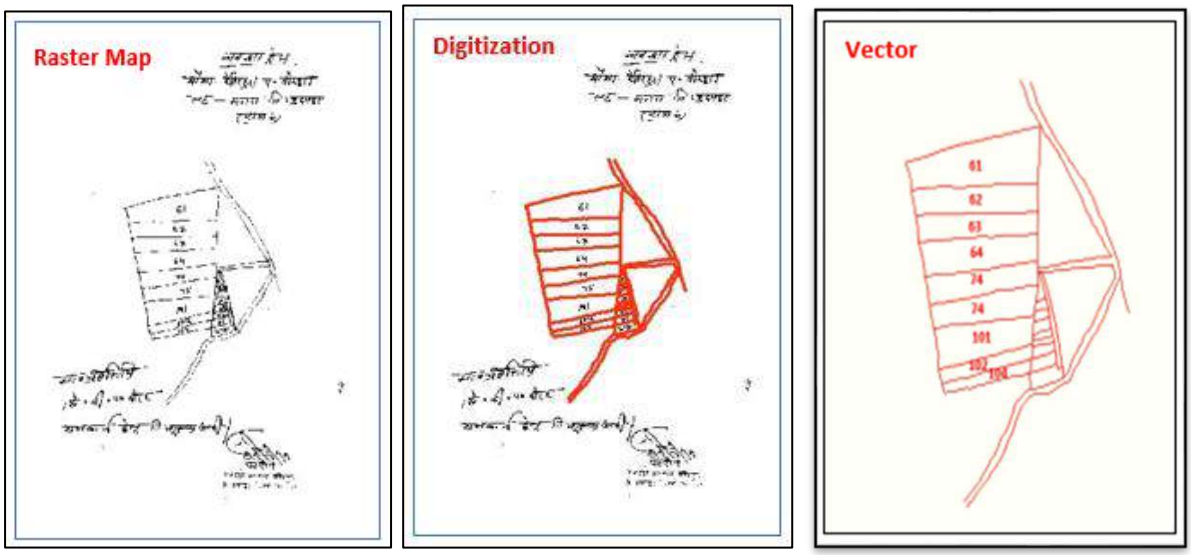


- Points
- Lines
- Polygons

An indicative vector representation is given in the diagram below:



Vector data provide a way to represent real world features within the GIS environment. A feature is anything you can see on the landscape like houses, roads, trees, rivers, land parcels etc. Vector features have attributes, which consist of text or numerical information that describe the features. A vector feature has its shape represented using geometry. The geometry is made up of one or more interconnected vertices. A vertex describes a position in space using an X, Y and optionally Z axis. When a feature's geometry consists of only a single vertex, it is referred to as a point. Where the geometry consists of two or more vertices and the first and last vertex are not equal, a polyline feature is formed. Where three or more vertices are present, and the last vertex is equal to the first, an enclosed polygon feature is formed. Examples of raster and vector data can be seen below;



Note: illustration only

5.7 Legal framework and requirements: -

a) Amendments to The Registration Act, 1908
b) Amendments to The Indian Stamp Act, 1899
c) Amendments to land related legislations of the States/UTs

5.8 Consent-based integration of Aadhaar number with the land record database:

a) Linking Aadhaar with Record of Rights
b) Authentication of owner/holder of Record of Rights through Aadhaar

5.9 Computerization of Revenue Courts: Establishment of an efficient Case Management System

Huge number of land related cases are pending in different courts in the country. To have efficient monitoring of these cases, a portal will be developed for filing of cases, generation of case no, allotment of court, generation of notices, hearing of cases, disposal, restoration and appeal, availability of judgment with the following services:

- Tracking of cases.
- Monitoring of the disposal of the cases.
- On-line availability of the judgments/order passed in the cases.
- Facilitation in the speedy disposal of the cases.
- Better supervision & Monitoring of the work of the courts.
- Unique id of the cases.
- Standardized Role-based levels for easy customization.
- Dynamic Role-Based Dashboard.
- Alerts for the courts.
- Automatic Generation of Notices.
- Alerts for the litigants/advocates.
- Auto Generation of Cause lists.
- Auto Generation of Registers (Misilband).
- Bar Coded Order Sheet
- Typing/Uploading of Orders and Judgments.
- On-Line Caveat Filing

- On-Line of applications for Mutation of succession or transfer
- On-Line of applications for Non-Agricultural land Use change
- Management of the transfer of cases from one court to another.
- MIS/Statistical Reports.

For Organization

- Unique id of the cases
- Standardized Role-based levels for easy customization
- Dynamic Role-Based Dashboard
- Alerts for the courts
- Automatic Generation of Notices
- Alerts for the litigants/advocates
- Auto Generation of Cause lists
- Auto Generation of Register (Misilband)
- Typing/Uploading of Orders and Judgments
- Management of the transfer of cases from one to court to another
- MIS/Statistical Reports

For Citizen

- 24X7 accessibility of the revenue courts by the citizen
- Transparency and Accountability in the working of the courts
- Online availability of the information relating to cases viz. the Status of the case, next date of hearing, orders/judgments passed etc.
- Alerts to the litigants and advocates.
- Automatic internal mechanism for speedy disposal of the cases

For Other Stakeholders

- Instant availability of the information relating to the cases without physically going to the court at zero cost by using internet.

- Online availability of the information relating to cases via the Status of the case, next date of hearing, orders/judgments passed.
- Online availability of the cause list of the courts.
- Tracking of cases

5.10 Integration of Revenue Courts with land records

Revenue Court Management System (RCMS) will have to be integrated with the land records essentially to facilitate and ensure accuracy, transparency, accountability and efficiency in all proceedings of computerized revenue courts in States/UTs making online availability of information and depicting information about pending revenue cases.

5.11 Programme management

a) Programme Sanctioning & Monitoring Committee in the DoLR

b) Core Technical Advisory Group in the DoLR and the States/UTs

c) Programme Management Unit (PMU) in the DoLR and the States/UTs

6.0 IMPLEMENTATION

6.1 The State Governments/UT Administrations would implement the programme through their Project Management Units already set up under the Programme. However, the Central Government may extend technical/Administrative support to the States/UTs for implementation and Monitoring.

6.2 Effort should be made by the States/UTs to ensure that the basic components of Computerization of Land Records and Computerization of Registration are completed by 31.3.2023. All districts would try to complete all activities by 31.3.2026.

6.3 All the activities shall be taken up in a systematic manner. A diagrammatic depiction of the indicative nature of activities being/to be undertaken is provided at **Annexure-GL-I**. The States/UTs may suitably adapt them with suitable modifications as per their need by exercising proper re-engineering process involved, if any.

6.4 Sanction of project/components: States / UTs will submit a detailed annual and three-year action plan (both financial and physical) inter-alia providing plan for expenditure - district-wise, component-wise / sub-component wise proposals along with due Utilization Certificates (component-wise and separately for PMU & DILRMP Cell) and the same will be placed before the sanctioning authority i.e. Project Sanctioning &

Monitoring Committee (PS&MC) for recommendation/approval.

6.5 Release of funds: Subsequent upon approval of PS&MC, funds will be released by Programme Division in consultation with Integrated Finance Division to the State level bank account of Project Management Unit (PMU) through Public Financial Management System (PFMS) in two instalments. First instalment shall be 60% of the total sanctioned amount/fund. Second instalment shall be remaining 40% of the total sanctioned funds subject to 75% expenditure/utilization of the first instalment. This will be subject to instructions issued by Ministry of Finance in this regard from time to time. The utilization reported by the State should tally with the corresponding figures in the Receipt Expenditure Advance Transfer (REAT) module of the PFMS. These provisions/conditions are subject to the directions issued by Department of Expenditures, Ministry of Finance from time to time.

6.6 States/UTs would identify a nodal Department for implementing the DILRMP. This Department must, in turn, put in place a Programme Management Unit (PMU) under the charge of an officer not below the rank of Director/Settlement Commissioner to oversee the DILRMP in its entirety. This PMU will ensure coordination among all concerned Departments as well as among the various units of the implementing Department. For each activity under this Programme, the duties and responsibilities of officials as well as of the vendors, if any, must be listed out in detail in harmony, as far as possible, with the Guidelines and also be intimated to the DoLR. The PMU must ensure that milestones and time frames as well as physical and financial achievements, are monitored on a regular basis and online data are uploaded.

6.7 PMUs of States/UTs will receive funds from Government of India in a single State level account and shall strictly follow the REAT module of PFMS. **'R**' Stands for Receipts. Receipts under this scheme are from GoI and bank Interest and other receipts, if any, as per the scheme guidelines. **'E**' stands for Expenditure. Expenditure is done on the activities or items as per Scheme guidelines. These items of expenditure are called components of the scheme. **'A'** stands for Advance and settlement. Advance is given to Vendors and Staff for supply or service. **'T'** stands for Transfer. Transfer of fund is made by the implementing agency to the lower-level agency.

6.8 States/UTs shall share geospatial/non-geospatial data available with them as and

when required and for Geo portal/any DoLR initiative.

7.0 CONTENT MANAGEMENT

7.1 Data Entry, Updation& Data Verification/Validation Process

7.1.1 Land records data are available as (a) textual data, and (b) spatial data (cadastral maps). All textual data including the records of rights (RoRs), mutation orders and other land attributes shall be updated and computerized. All pending mutation orders shall be incorporated in records and the data entry pertaining to such updation shall be completed on priority basis. All spatial data shall also be updated and digitized as described below.

7.1.2 Each State/UT, wherever applicable, should fix a reasonable cut-off date after which only digitally signed RoRs should be issued, and issue of manual RoRs should be discontinued thereafter. After the cutoff date, further mutation and updation of data should be done in the computerized system on a continuous basis after following the due procedure as prescribed in the Land Records laws/Revenue laws/manuals.

7.1.3 Responsibility of Revenue officials shall be fixed to ensure 100% checking, verification and validation of the data so entered. The patwari (by whatever names the grass root revenue functionaries are known like Lekhpal, Halka Karamchari, patwari, Talati etc.) shall carry out 100% checking, and the Revenue Inspector, or an officer of the equivalent rank, the Tehsildar, the SDO and the Deputy Commissioner/District Collector shall randomly check at least 50%, 10%, 3% and 1%, respectively on mutually exclusive basis, of the data, so as to ensure the accuracy of the data vis-à-vis the manual records. In order to ensure the quality of data and timely completion, roster system for field visit of officials may be adopted. Accuracy of data entry and assurance of the same through verification is key to the success of this exercise, which would ultimately result in reduction in land disputes in future. Therefore, a strict view needs to be taken where unexplained errors are found in the records.

7.1.4 The States/UTs, which have authorized Gram Panchayats to pass mutation orders, must ensure their inter-connectivity with the corresponding Revenue offices for real time updation of records.

7.1.5 As for the encoding standards, the UNICODE should be used for data storage, local language display and support. Any database created using the ISCII or any other font-based solution should be converted into the UNICODE. The necessary assistance

in data conversion may be taken from NIC or other authorized technical support agency.

7.1.6 Reducing Linguistic Barriers

Computerization of land records (both textual and spatial) have been main components of the Digital India Land Records Modernization Programme (DILRMP), a Central Sector Scheme of the Government of India and most of the States/UT's have completed Computerization of Land Records and that are available in public domain. Currently, the Records of Rights in each State and Union Territory is maintained in t**he local state official language and in some states in English.** The linguistic barriers pose serious challenges for inter change / access of information in understandable form.

In order to address the problem of **linguistic barriers** in land governance management of the country, Department of Land Resources, with the support of Centre for Development of Advanced Computing (C-DAC), Pune, a premier R&D organization under the Ministry of Electronics and Information Technology (MeitY), has undertaken initiative to transliterate the Records of Rights available in local language to any of the 22 languages recognized by the Constitution. The Pilot test is underway and it is targeted to launch the aforesaid initiative on Pan-India shortly. This initiative will enable the State Governments and Central Government to take informed policy decisions for the benefit of the citizens and farmers in particular of this country on one hand and on the other hand it will also enable the all citizens and stakeholders to get benefits of an open national economy conveniently.

7.2 Regulatory/Procedural Changes for maintenance of Land Records

7.2.1 The States/UTs may carry out the Regulatory (enactment/rules) procedural changes to support the activities and innovative initiatives (like ULPIN, NGDRS), wherever necessary, including the following:

7.2.2 Simplify/amend/revise/prepare the land records, manuals, RoR formats on land records maintenance procedures for the entire State/UT.

7.2.3 Standardize the codifications, feature codes etc. in case of cadastral maps, RoRs and other land attributes. Standard data codes for land attributes have been prepared by the NIC and placed on the DoLR web site http://dolr.gov.in.

7.2.4 Encouraged to confer legal sanctity to the computerized land record extracts as the official records.

7.2.5 Discontinue manual land record writing and issuing of hand-written copies of the RoRs, once the computerized system stabilizes.

7.2.6 Wherever a State Government/UT Administration adopts any procedure detailed in these Guidelines and Technical Manuals, it must ensure that it is duly incorporated in the relevant State/UT laws/rules/regulations/manuals or that the same are duly amended to ensure their legal validity.

7.3 Digitization of Maps (spatial data) and its Integration with Textual Data

7.3.1 There is an urgent need to convert the existing cadastral maps into GIS- encoded digital mode to facilitate updation of cadastral maps in sync with the changes made in the RoRs. RoRs provide information on ownership of land, its classification, uses, irrigation status, etc. Detailed attributes of every piece of land, called “parcel” or “plot”, shall be shown in the digital map accurately in 1:4000 scale. The smallest piece of land that can be measured is 1 decimal (1/100th of an acre) i.e. 435.6 sq. feet. Changes in a cadastral map may take place due to various reasons, e.g. a plot of land may have been further sub- divided into two or more sub-plots and transferred to other persons by way of deed of gift or sale or inheritance, or conversion of classification of land use. The need for indicating these changes in the map arises every time a change as mentioned above takes place so as to depict the ground reality.

7.3.2 Broadly, there are two ways in which spatial data have been organized in the country. In certain States/UTs, village maps with parcel boundaries are used, whereas, in certain other States, ladder data on individual land parcels or tippans or field measurement books (FMBs) or gat maps are used. In most parts of the country, the land parcels depicted in village maps are covered in one or more sheets, depending upon the scale of mapping and area of the village. These village maps/sheets will be considered as the basic input for digitization and mosaicing of the cadastral maps in these States/UTs. In other States/UTs, where ladder data or gat maps/tippans/FMBs are used, the same will be taken for digitization and further mosaicing of the maps.

7.3.3 GIS encoded digitization of cadastral maps and their integration with RoRs involve the following steps:

(a) Scanning of the village map or part of the village map and feeding this scanned map into the computer to create a computer image of the map which

is known as a **raster map**.

(b) The next step involves going over the outline of the village boundary on the computer image of the map with the mouse and marking the outlines of each plot. This process, known as **vectorization**, provides the coordinates of each point on the map.

(c) A printout of this vectorized map is given to the Revenue Department by the digitizing agency for thorough checking with the original cadastral map. The Revenue Department checks the vectorized map on a glass table with the original map placed below it. This process is known as the **table check**. Every line and point on the two maps have to match. The correctness of the digitized map is certified by the Revenue Department. If any error is detected, the same has to be rectified by the vendor/digitizing agency.

(d) The software used in the digitization process creates a number of files. Each of these files pertains to a GIS-based layer and each layer consists of three files. The GIS data are organized in layers. Each layer contains a subset of information that would be present on a regular map, such as (1) geographic information (where something is located), (2) attributes information (what is located at a specific location), and (3) its interlinking information. These three sets of information are represented in three physical files in the computer. All the files are placed in a storage device-e.g., a pen drive and given to the Revenue Department for checking. If any error is detected, the same has to be rectified.

(e) The GIS layers are of three types: point layers, line layers & area layers. Each of the 9 GIS layers mentioned above belongs to one of the three types. Symbols or Alamats are used to record the legends that have been made on the map such as wells, temples, etc. These alamats are incorporated in all the three layers, i.e., point, line and area layers.

(f) Once the Revenue Department clears the vectorized map and the files, the digitizing agency proceeds to add each of the handwritten information on the original map except the signature at the bottom.

(g) While digitizing the land records including scanned copies or vector formats, open series specification of datum and projections parameters would be followed.

7.3.4 Integration of spatial database with textual RoR data involves the following process:

(a) Each plot of land is represented on the digital map as a closed polygon. Each polygon is identified by a unique plot number known as the Khasra number, parcel id or survey number or dag number as the terminology varies from State to State. In the textual RoR database, each plot is also referenced by this unique plot number. This provides a basis for integration of digital map data with the textual RoR data.

(b) The basic textual RoR database consists of several tables having both master tables & transaction tables which provide information on ownership, land classification, crop information, source of irrigation, soil type etc. All the tables are linked by certain common data fields which is a composite code of district, sub-district & revenue village along with the Plot number or survey number or khasra number:

(c) After integration of the textual and spatial RoR data, the digitized map is shown on the computer, which indicates through colour codes the plots which do not have a corresponding textual detail or plot number, or where the textual and spatial data do not match each other. Such plots require patch survey using Electronic Total Station (ETS) and Differential Global Positioning System (DGPS) and re-entry of the correct data to produce a 100% correct digitized map. Thereafter, computerized and digitized RoRs can be issued to property owners.

7.3.5 Citizen Services

The integration software facilitates citizen services, some of which are:

(a) RoR with plot map (parcel map), showing dimensions of each side, area & the adjoining plots.

(b) Deriving various maps based on possessions, land use classifications, sizes of plots, sources of irrigation, types of crops etc.

(c) Textual RoR updation in sync with spatial data updation.

7.3.6 The technical details are available in the Technical Manual-Chapter-1. Two models of digitization of maps have been described viz. Model-1 based on the best practices followed in most of the successful States/UTs and Model-2 based on the use of satellite imagery. The States/UTs may adopt either of the models as per their convenience or develop a model suitable to the State/UT, in which case the details may be communicated to the Department of Land Resources.

8.0 UNIQUE LAND PARCEL IDENTIFICATION NUMBER (ULPIN) SYSTEM:

The Unique Land Parcel Identification Number System has been conceptualised with the vision that the Unique Land Parcel Identification Number (ULPIN) shall be a **Single, Authoritative Source of Truth** of information on any parcel of land or property.

The Unique Land Parcel Identification Number (ULPIN) system is for generating and assigning 14 digits – Alpha–numeric unique ID for each land parcel based on Geo-coordinates of vertices of the parcel which is of international standard and complies with Electronic Commerce Code Management Association (ECCMA) standard and Open Geospatial Consortium (OGC) standard.

Transfer of present system of Unique IDs to the ULPIN would *inter alia* yield following benefits:

(a) Sharing of land records data across departments, financial institutions and all stakeholders.
(b) Delivery of citizen services of land records through single window.
(c) Keeping the land records always up-to-date.
(d) Auto-update on Registration / mutation.
(e) Enforce uniqueness of all transactions
(f) A link of all property transactions gets established.
(g) Helps cross validate land records related data across departments.
(h) Standardization at data and application level would bring in effective integration and interoperability across departments.

Concept paper on ULPIN and its technical architecture have been given in the Technical Manual of the Guidelines.

9.0 STATE-LEVEL DATA CENTRES

In order to maintain data repository and backup, each State/UT may need to establish a dedicated data centre for the land records data (including maps and registration data) at the State/UT level. This data centre would have estimated storage capacity scalable from 2 to 20 terabytes, depending upon the volume of records, along with highspeed processors, switches, fiber optic channels, software and security devices. Further, these would have appropriate backup media (like CDs and tape devices, etc.) for high volume storage. Storage Area Network (SAN) may also be set up where feasible and necessary. Action for setting up of the SLDCs may be taken up when sufficient data has been created in the districts for storage at the State/UT level.

10.0 SURVEY/RE-SURVEY AND UPDATION OF SURVEY & SETTLEMENT RECORDS

10.1 India has about 6,40,867 villages (as per 2011 Census) and 6,56,190 as per MIS reporting of the states/UTs till 31st December 2021. Most of the villages were surveyed and corresponding village (cadastral) maps were prepared at 1:4,000 to 1:1000 scales during late 19th and early 20th century. However, where original cadastral survey is yet to take place, the States/UTs will need to draft the laws/manuals/guidelines for the purpose, and the Government of India is willing to extend necessary help in this regard.

10.2 The cadastral survey of an area, which has already been surveyed earlier is known as Resurvey. This may be required under the following circumstances:

- When the framework of survey in field has completely broken down. In such cases, the boundaries shown in the records do not tally with the actual conditions on the ground. This may happen due to obliteration of field and sub-division of boundaries and/or due to misplacement of a large percentage of the local ground control point markers, as a result of which it is difficult to identify the fields with reference to the records.
- Resurvey is also necessary in the case of sudden development of the area due to causes such as:
    - Sub-divisions
    - Transfer of dry lands into wetlands
    - Large scale transfer of holdings
    - Acquisition of land due to infrastructural developmental activities

10.3 Factors influencing the mode of survey/re-survey: In place of the conventional, chain survey, plane table survey and theodolite methods of survey, modernized technology in the form of Electronic Total Station (ETS) and Differential Global Positioning System (DGPS) are now available. The selection of technology for cadastral survey depends upon several factors as shown in Flow Chart No.1 in Chapter-2, Model-I of the Technical Manual. These are enumerated below:

- Terrain conditions (hilly, undulating, plain)
- Vegetative cover (dense, sparse)
- Built-up areas
- Size of survey area
- Accuracy
- Timeliness
- Cost
- Availability of skilled manpower

10.3.1 Terrain conditions: Where the land area is within a gradient of 15%, aerial photography or high-resolution satellite imagery is expected to give adequately accurate output. However, in undulating terrain and hilly slopes, pure ground method using ETS+DGPS may be used for cadastral survey.

10.3.2 Vegetative cover: Dense vegetation obstructs the line of sight in the vertical direction, thus preventing the aerial and satellite images from capturing the field boundaries. Pure ground-based methods using ETS+DGPS are suitable in these conditions. In open areas, devoid of vegetation, aerial photography or satellite imagery is likely to give adequately accurate output. However, sparse vegetative cover prevents pinpointing the field corners and, in these conditions, aerial photography or satellite imagery should be supplemented by ground truthing.

10.3.3 Built-up areas: In urban areas, high-rise buildings prevent aerial/satellite images from capturing building corners and boundaries. A lot of shadow areas appear in the remote sensing data, depending upon the height of the buildings. In these conditions, pure ground-based methods using ETS+DGPS are preferable for cadastral survey. Where there are lower built-up areas, aerial images or high-resolution satellite images are likely to give better results.

10.3.4 Size of survey area: In a small survey area, ground-based survey will give faster output, but in a larger area, such as a district, aerial photography or high-resolution satellite imagery is likely to suffice.

10.3.5 Accuracy: In cadastral survey, the scale of the map and precision of the instruments greatly influences its accuracy. The accuracy of the survey is the highest with TS followed by, plain table and chain survey, respectively.

10.3.6 Timeliness: Pure ground truthing methods of cadastral survey such as chain, plain table and total station, which require 100% measurement to be made on the ground, are time-consuming. Ortho-products from aerial photos and satellite images supplemented by ground validation greatly reduce the time factor in preparation of cadastral maps.

10.3.7 Cost: The cost is the driving force in adopting a particular technology for cadastral survey. High-resolution satellite images from CARTOSAT series are cost effective, compared to digital aerial images and pure ground methods.

10.3.8 Skilled Manpower: The requirement of skilled manpower for technology intensive survey/resurvey methodologies are relatively higher than other modes of survey; and in some cases, it becomes an important factor for selecting the technology for survey/resurvey.

10.4 For reaching the stage of integrated land information management system which ultimately lead to titling as envisaged in erstwhile scheme of NLRMP, the States/UTs shall undertake survey/re-survey using modern technology of surveying & mapping, i.e., aerial photography or high resolution satellite imagery combined with ground truthing using ETS+DGPS so as to ensure true ground depiction on cadastral maps and land records, adopting the methodology most appropriate for the terrain, location, etc. and update the survey & settlement records. For fresh survey, in areas where cadastral maps are not available, the following options are suggested:

i. Electronic Total System (ETS) + Differential Global Positioning System (DGPS)
ii. Hybrid Aerial Photographs + ETS + DGPS
iii. Hybrid High resolution satellite imagery + ETS+DGPS (< 1 m spatial resolution)

In open areas, the process will be greatly facilitated by the use of aerial photography,

combined with ETS+DGPS for ground truthing. In densely vegetated areas, use of ETS+DGPS is suitable. In hilly areas, use of terrain- corrected aerial photographs (digitally-rectified ortho-photographs) with ETS+DGPS for ground truthing may be appropriate. All efforts should be made to arrange for aerial photography; however, where it is not possible to arrange for aerial photography, ETS+DGPS must be adopted for completing the work with the desired level of accuracy.

10.5 For resurvey, aerial photography (wherever possible) and ETS+DGPS for ground truthing is recommended.

10.6 Where large open areas and large land holdings are there, e.g., arid and semi-arid areas, and good quality and reasonably up-to-date cadastral maps are available, the vectorized cadastral maps may be geo-referenced using high resolution satellite data and DGPS control points. The geo-referenced cadastral maps shall be overlaid on the high-resolution satellite imagery (HRSI) to study the discrepancy, both qualitatively and quantitatively. If the discrepancies are high, ground truthing using ETS+DGPS is recommended.

10.7 The technical details on different methodologies as mentioned above and setting up of the ground control network are given in Chapter-2 of the Technical Manual.

10.8 However, each state/UT is expected to prioritize Survey/ Resurvey work to fill critical gaps like un-surveyed villages, or villages where data is lost or some parts were left out in earlier surveys, or where there is an urgent requirement. Survey/ resurvey proposals should not be initiated in a routine manner.

11.0 COMPUTERIZATION OF THE REGISTRATION PROCESS

11.1 The manual (non-computerized) registration process involves maintenance of paper copies of all the registered documents. This procedure of maintaining and registering property documents often results in misclassification of documents, is representation of facts, and other such losses. Searching of reports, records and issuance of non-encumbrance certificates also take long time and turn out to be cumbersome tasks.

11.2 Computerization of registration is necessary not only for making property registration efficient and hassle-free but also for initiation of mutation process

immediately thereby bringing more transparency and accountability in effecting changes in records. Registration, therefore, has been made one of the major components of DILRMP. The Sub-Registrars' Offices (SROs) in the States/UTs carry out registration and recording of various types of documents related to the transfer of immovable property. In order to facilitate computerization of registration system some States/UTs have aligned the Rules made under the Registration Act 1908. Other States/UTs also need to align their Rules to make the process of computerization legally tenable and effective.

11.3 DILRMP provides full support of computerization of all components of registration. All the SROs will be fully computerized with adequate hardware, software, process re-engineering, staff training and connectivity with the revenue records maintenance system, banks, treasuries, etc. Also, the following functions will be computerized:

11.3.1 Determination of Stamp duty

It can be facilitated by preparing the list of prevalent circle rates, list of properties, list of plots, floor space, nature and year of construction, etc., or by computerizing the guidance values/circle rates for different kinds of land and properties so that the transacting parties can ascertain stamp duty liability online.

11.3.2 Formats

Re-engineer the process, wherever necessary, by fixing the templates/formats of the deeds in 2-3 pages. The first page may contain the parties' details, second page property/land details, and the third page may contain legal issues and conditions, or as the State/UT may decide and place the format(s) on the web.

11.3.3 E-stamping

E-stamping or franking system, etc. for depositing stamp duty should be implemented as soon as possible.

11.3.4 Verification of identity of executors

Computerizing the registration process involves verification of identity of the presenting person(s), taking photographs, fingerprints, other biometric identification, verification of stamp duty, etc.

11.3.5 Legacy data

Entry/scanning of legacy registered data for distribution of copies of registered deeds and non-encumbrance certificates.

11.3.6 Integration

Integration of the registration process with the land records maintenance system so that mutation notices and mutation remarks in the corresponding RoRs are generated automatically after registration.

11.4 The technical details are available in Chapter-3 of the Technical Manual.

11.5 National Generic Document Registration System (NGDRS)

11.5.1 In order to have a uniform process for registration for deeds/documents, Department of Land Resources is providing technical support to the States /UTs in implementing "One Nation One Registration Software namely National Generic Document Registration System (NGDRS)" which is an in house developed software (by NIC) under the broad aegis of Computerization of Registration' a component of the DILRMP that aptly address the diversity prevailing across the states on account of languages, processes, formulae and formats, and includes requirements of all the States and enables user States / UTs to provide ease in interoperability and compatibility with other applications of other sectors.

11.5.2 The major benefits of the system include:

a) Citizen empowerment through online entry of deed, online payment, online appointment, online admission, document search and certified copy generation.
b) Checks on fraudulent /benami transaction
c) Reduces document registration process, time and cost at Sub Registrar level.
d) Cost effective solution with improved efficiency and transparency achieved in document registration process
e) Accommodating all variations/gaps prevailing across the states
f) SMS and email enabled alerts related to transactions on property.
g) Rule based transparent online valuation with accurate calculation of property cost**.**

11.5.3 System Requirement Specification (SRS) for National Generic Document

Registration System (NGDRS) are with DoLR /NIC. Technical concept note on NGDRS has been made part of the Technical Manual of the Guidelines

11.5.4 Funds for NGDRS shall be provided from the "Computerization of Registration" Component of DILRMP to the technical agencies of the DoLR at central level.

11.6 MODERN RECORD ROOMS/LAND RECORDS MANAGEMENT CENTRES

Support for upgrading modern record rooms/land records management centers with a) a storage area with compactors/storage devices for physical storage of records and maps, b) an operational area with computers/servers, storage area network (SAN), printers, etc., and c) a public services area for waiting/reception, etc. will be essential. The land records details may be indexed and stored. A document management system, i.e., scanning of old records, digital storage and retrieval system should be introduced for online storage and retrieval of the records, indexing of data and images, etc. so as to move towards cyber record rooms/maintenance of land records in the dematerialized (demat) format. It is also expected that all MRR/LRMC will be geo-tagged and photo will be uploaded in MIS.

12.0 TRAINING & CAPACITY BUILDING

12.1 States/UTs are required to draw up a comprehensive training programme to develop their human resources for effective maintenance and sustenance of the DILRMP, covering the policy makers, heads of the departments of revenue, survey, registration and their offices and staff, master trainers and field-level functionaries including the surveyors, village accountants and other revenue staff, who will be trained for operating the system including mutation and updating of land records, issue of authenticated copies of RoRs with maps-to- scale, handling modern survey equipment such as DGPS, ETS and photogrammetry.

12.2 Expert organizations like the Survey of India, NIC and Indian Space Research Organization (ISRO), and other reputed organizations in this field, etc. should be involved in imparting training to master trainers, who in turn, will train the State/UT staff on ETS/DGPS, survey methodologies, scanning, digitization, GIS and ICT activities. For better outreach, e-learning and video-conferencing facilities may be used. The capacity building programme should include awareness/appraisal workshops, long-term training programmes for field-level officers with hands-on training, and short-term training modules

for senior-level officers.

12.3 The capacity building programme should cover not only technical contents, but also quality procedures, technological advancements, outsourcing procedures, project management, etc. The States/UTs may tie up with leading training institutions for this purpose. A core group of officers and staff from the States/UTs may be sent on exposure visits to other States/UTs which have demonstrated considerable success in implementing the project. Discussion forums and help lines may be established to guide the field staff in solving technical problems.

12.4 Each state/ UT should make a training and capacity building plan for the programme at state, district and sub-district/tehsil level with appropriate training modules. This plan should be approved by State Level Monitoring and Review Committee.

13.0 CHOICE OF SOFTWARE AND STANDARDS

13.1 Based on the process and functionality requirements, user-friendly application software for capturing, editing and updating land records textual data, integration of textual data and maps, registration system workflow, integration of registration with mutation, and proper authentication mechanism using digital signature/public key infrastructure (PKI), etc. may be required by the States/UTs.

13.2 In order to have uniformity, standardization and integration, the software development and software maintenance support may be provided by the NIC, which may set up core development teams consisting of IT and GIS experts at the Central level, supported by State/UT-level teams for software customization, technical coordination and State/UT-wide support. While it will be open for the users to select the operating system for their client machines— Windows-based or Linux-based, but in so far as the server machines are concerned, open-source platforms that implement mandatory access control policies are preferred. A write-up on the choice of software and standards, prepared by the NIC, is given **in Chapter-4 of the Technical Manual**.

14.0 DATA SECURITY

14.1 Assuring security and effective performance

The Integrated Land Information Management System (ILIMS) gives rise to new concerns and new functions that need to be properly understood and addressed. These concerns relate to security of information system assets and data integrity. One important

information system function, therefore, is asset safeguarding and data integrity. At the international level, two sets of standards have been codified by the International Organization for Standardization (ISO): one is the ISO/IEC 27001, also called the information security management system (ISMS) standard of 2005; the other is ISO/IEC 27002:2005, a codification of practices for information security management. The ISO/IEC 27001 (earlier called ISO/IEC BS-17799) lists the standards required from any management in implementing information system security function. This lays down standards for the management to perform four core functions: planning-determining the goals of information systems function and the means of achieving this goal; organizing-gathering, allocating and coordinating the resources needed to accomplish the goals; leading-motivating, guiding and communicating with personnel; and controlling-comparing actual performance with planned performance as a basis for taking any corrective action that may be needed. This also deals with management processes: plan-do-check-act (PDCA) model. The ISO 27002 lists the security controls (such as password controls). The two standards, together, imply that unless the management itself is serious about security and goes about doing it in a systematized way (ISO/IEC 27001), no amount of technical controls (ISO/IEC 27002) would suffice. ISO 15489-1:2016 (e.g.), Information and documentation - Records management - Part 1: Concepts and principles

This part of ISO 15489 defines the concepts and principles from which approaches to the creation, capture and management of records are developed. This part of ISO 15489 describes concepts and principles relating to the following:

- records, metadata for records and records systems;
- policies, assigned responsibilities, monitoring and training supporting the effective management of records;
- recurrent analysis of business context and the identification of records requirements;
- records controls;
- processes for creating, capturing and managing records.

This part of ISO 15489 applies to the creation, capture and management of records regardless of structure or form, in all types of business and technological environments, over time.

- Strong Password Policy implementation and Multifactor Authentication for extracting sensitive user related information.
- Principle of least privilege should be applied at all levels (i.e. User/ DBA/ System

Admin etc.)

Extracts from the report of the Committee of Revenue Secretaries on CLR, covering the Information Security Requirements and Authentication Mechanism are at **Technical Manual Chapter-5 (Section-A).**

14.2 User and Data Authentication

14.2.1 User authentication is the process of identifying a user. The information system must satisfy itself that the user is the one who he/she claims to be. There are a number of ways a user can be authenticated. Password authentication is sufficient for the purpose of extracting user-related information. However, for users who are to have more privileges on the database than that of merely reading it, then stronger forms of authentication are recommended. For such users, a two-factor authentication scheme is recommended; for example, authenticating a user both with a password and the biometric technology.

14.2.2 Besides authenticating the user, every land record data that is entered into the database needs to be approved/authenticated by the officer who is competent for the purpose as per the local revenue manual. The land information system should provide a user interface for performing this task. Once a data item has been approved/authenticated, the application system does not allow any further changes to it. That is, there is no user interface provided to make any change directly to an approved record. If any change does occur, a new record is entered, verified and authenticated. Thus, the information system also records a history of the changes occurring to any piece of data.

14.2.3 In a database environment, the database administrator (DBA) may have all privileges on the database, i.e., he/she can insert any record, change any record or delete any record, irrespective of the fact that he/she is not the approving authority as per the local revenue manual. Such overriding privileges with a single person must be used with propriety; otherwise, these can be abused. On the one hand, centralizing certain functions to be performed in the database environment improves communication, coordination and control. On the other hand, vesting substantial powers in the DBA role runs contrary to the fundamental principles of sound internal control. This problem is not unique to Integrated Land Information Management System, but is common to all e- Governance initiatives that use databases. Therefore, the States/UTs must take remedial measures for reducing the risks associated with the DBA role. Certain suggestions in this regard are

outlined in **Technical Manual Chapter- 5 (Section-B).**

States may put in place a system to prevent misuse of the privileges of the data base administrator (DBA), system of electronic approvals by the legally prescribed competent authorities.

14.3 Emerging Technologies

14.3.1 Introduce the cutting edge Blockchain technology for ensuring data security of land and revenue records

The Blockchain is basically a decentralized digital ledger or digital archive to store successive transactions in a chronological order, which makes it virtually impossible to hack or manipulate the data for ulterior designs. For example, once a data is fed into the system under the Blockchain technology, it is visible to all related departments and as such any fresh changes get recorded, and reflect in all the connected systems. This makes the underlying data secure and the processes transparent.

15.0 PURCHASE PROCEDURES

The States/UTs shall follow their Governments' rules and procedures in purchase of services, hardware, equipment, etc. with comprehensive warranty.

16.0 PUBLIC-PRIVATE PARTNERSHIPS (PPP)

16.1 The DILRMP has generated an enormous workload on the existing Revenue and Registration machinery. It also requires a high level of technological inputs at almost every stage. Capacity building of the in-situ staff is essential but is likely to take time. In order to streamline the implementation of the Programme and to achieve the targets within the proposed time frame, the States/UTs may like to go for the PPP models in respect of certain activities under the Programme or outsource them on a turnkey basis.

16.2 All outsourcing/PPP arrangements under the DILRMP shall be subject to the following conditions:

(a) No outsourcing or PPP should normally be allowed in the sensitive districts/areas, as identified by the appropriate Government.

(b) All legal duties/actions required under the State/UT laws shall continue to be performed by the designated officials.

(c) The State/UT must work out a modus operandi and affix responsibilities of

Departmental officials to conduct and verify 100% quality check of the work done by the outsourced/PPP vendor(s). Outsourcing/PPP is merely a convenience and will in no way absolve the State/UT from its legal obligations.

(d) Full control and responsibility for the execution and monitoring of the outsourced/PPP works, as well as of utilization of funds released by the DoLR, shall rest with the concerned State/UT, which will be responsible for rendering the accounts thereof, to the DoLR.

(e) No extra funding beyond the approved cost norms shall be provided by the DoLR.

(f) Proper tendering processes must be followed for outsourcing/PPP.

(g) The technical output of the outsourced/PPP works must be compatible with the IT system architecture/parameters being followed in the State/UT in areas relevant to the DILRMP.

16.3 Where the State/UT opts for a private agency for implementing any work under the DILRMP, it may be beneficial to the State/UT to involve the NIC in an advisory role in the following areas:

(a) Support and advice the State/UT on relevant technical matters.

(b) Help the State/UT in formulating the terms of references (ToRs) for outsourcing/PPP and in establishing the relevant milestones and time frames.

(c) Vet the relevant deliverables including the architecture, standards, technical specifications, business process re-engineering (BPR), functional requirement specifications (FRS), software/system requirement specifications (SRS), etc. from the vendor(s) and give specific recommendations on these to the State/UT.

(d) Support the State/UT in the evaluation of the technical and financial bids.

(e) Assist the State/UT in reviewing the progress and quality of the work carried out by the vendor(s).

(f) Bring to the notice of the State/UT any deviations from the standards for software development on the part of the vendor(s) responsible for the development and integration of application software.

(g) Assist the State/UT in exercising strategic control over critical components including data, database, applications, network and security components for maintaining sovereignty and accountability of the State/UT, and to help the State/UT formulating a strategic control policy for the purpose.

(h) Interface with the certifying agencies for third-party certifications for the IT infrastructure and software developed and deployed by the vendor(s).

16.4 These must be ensured at the time of signing the MoU with the outsourced agency, and the State/UT may consider entering into a tripartite MoU with the vendor and the NIC in this regard. However, the overall decision- making responsibility, supervision, monitoring and control in respect of these matters shall rest with the State/UT.

16.5 Given below are some of the activities that can be considered for outsourcing/PPP:

a) Preparation of the DILRMP Perspective Plan/Detailed Project Report (DPR) for the State/UT and district, respectively.

b) Survey/resurvey work using modern survey technology (only for ongoing activities as per EFC).

c) Ground-truthing through ETS/DGPS.

d) Data entry/re-entry of textual records.

e) Preparation of records of undisputed mutations for the approval of designated authority as per the relevant laws.

f) Data entry of approved mutation records, subject to mandatory authentication by designated Departmental officials as per the State/UT laws.

g) GIS-ready digitization of cadastral maps and integration of digitized textual and spatial records.

h) Computerization of the Sub-Registrar’s office.

i) Data entry of legacy data regarding property.

j) Data entry of property valuation details.

k) Scanning and preservation of old records.

l) Computerization of Revenue Courts.

m) Setting up of, preferably self-sustaining, information kiosks, software applications.

n) Training and capacity building.

o) Development of Integrated Land Information Management System (ILIMS)

p) Information, Education and Communication (IEC) activities.

q) Evaluation.

17.0 ROLE OF THE PANCHAYATI RAJ INSTITUTIONS

Gram Panchayats (GPs) can play a significant role in updation of land records and identification of property owners in the course of the settlement operations.

The Gram Panchayats could be involved to facilitate survey/re-survey, wherever necessary and in dissemination of information. The States/UTs may consider giving the power of doing undisputed mutations to the gram panchayats subject to making necessary provisions in revenue laws. Where GPs are involved in carrying out undisputed mutations, inter-connectivity with tehsils may be worked out by the States/UTs with their own funds or by dovetailing funds from other sources. The District Administration should take up mass awareness programme with the help of Panchayati Raj Institutions (PRIs). The District Monitoring and Review Committee, of which the CEO/EO of Zila Parishad is also a member, may give due weightage to the recommendations of the PRIs in the implementation of the Programme.

18.0 TECHNICAL SUPPORT TO THE STATES / UTs AND IMPLEMENTING AGENCIES

The necessary technical guidance and hand-holding support to the States/UTs and the implementing agencies shall be arranged through the Core Technical Advisory Group (CTAG) created for the DILRMP in the DoLR with members from the national-level technical agencies such as the NIC, Survey of India, NRSC, ISRO, C-DAC, Forest Survey of India, Soil & Land Use Survey of India, and experts in the field. A copy of the order issued in this regard is given at **Technical Manual Chapter-6 (Section-A)** The States/UTs may also approach the regional offices of these technical agencies, wherever necessary. The addresses of these technical agencies along with their regional offices

are given at **Technical Manual Chapter-6 (Section-B)**. Specifically, technical support of the following nature may be obtained after following due procedure from these agencies:

a) **Survey of India:** Training to the survey staff/master trainers, guidance in application of modern survey technology.

b) **NRSC/ISRO:** Guidance in aerial photography and use of high-resolution satellite imagery for survey/re-survey purposes.

c) **C-DAC:** Guidance in Indian language computing.

d) **Forest Survey of India**: Guidance in mosaicking of the cadastral maps with forest boundaries and overlaying of forest boundaries.

e) **Soil & Land Use Survey of India:** Guidance in data coding of the relevant data.

f) **NIC:** Software development and customization, training of staff/master trainers, ICT support to the State/UT staff in computer applications, data coding and digitization of map systems and standards, interfaces for integration of textual and spatial data, data Centre specifications at various levels, inter- connectivity amongst revenue and registration offices, computerization of registration, technical guidance in setting up of land record management centres and strengthening of survey and revenue training institutes, data security/backup and disaster recovery, authentication mechanism, wherever necessary.

19.0 MONITORING AND REVIEW MECHANISM

The following monitoring and review mechanism at different levels is to be adopted under the Programme.

19.1 Monitoring and Review at the National Level:

At the national level, for sanctioning of projects and monitoring and reviewing of the programme, a Project Sanctioning and Monitoring Committee (PSMC) has been set up under the Chairpersonship of the Secretary, Department of Land Resources. The Committee will monitor and review progress of the DILRMP work in the country. Area Officers / Officers from the Department of Land Resources would also be visiting the States/UTs to review the implementation of the Programme. It is recommended to conduct at least 2 meetings to Monitoring and review of the programme in a year.

19.2 State/UT- level Monitoring and Review Committee:

A State/UT-level Monitoring and Review Committee shall be constituted in each State/UT for the DILRMP under the chairpersonship of the Chief Secretary/Chairman, Board of Revenue. It is recommended that a representative from the Board of Revenue, Principal Secretary/Secretary of the Departments of Revenue, Registration, Finance, Planning and IT, the Divisional Commissioners, Inspector General of Registration, Commissioner/Director of Survey & Settlement and of Land Records, State Forest Department, State Informatics Officer of the NIC and any other expert as decided by the State Government/UT Administration should be its members. Representatives from SoI, NRSC/ISRO, C-DAC, FSI, and SLUSI may be involved/ invited as per the need as special invitees. The Committee shall monitor and review the progress of implementation of the Programme, facilitate the necessary process re-engineering, and guide the implementation authorities. The committee will approve training and capacity building plan, IEC and communication plan for the state/ UT. The Committee shall submit quarterly progress reports in the prescribed format to Department of Land Resources. The States/UTs shall develop a system of checks by the State/UT level officers through field visits. It is recommended to conduct at least 2 meetings to Monitor and review of the programme in a year and these can be reported in the MIS (Online).

19.3 Division-level Monitoring and Review Committee:

All the Divisions in the State /UT need to have a division-level Monitoring and Review Committee under the Chairpersonship of the Divisional Head/Commissioner (or a Senior Officer to be assigned by the respective state/ UT government where divisional system is not available) along with District Collector/Deputy Commissioner and Registrar, Survey & Settlement/Consolidation Officers, representative of State Forest Department and District Informatics Officer of the NIC as members. Representatives from other technical agencies such as the SoI, NRSC/ISRO, C-DAC, FSI, and SLUSI may be involved as per the need as special invitees. The Committee will review the progress of implementation of the Programme at least once in a quarter, and the Divisional Head/Commissioner shall submit report to the State-level Monitoring & Review Committee. Online monitoring reports shall be submitted by the Divisional Head/Commissioner to the State Govt. as well as to the DoLR as per the MIS reporting formats and periodicity prescribed.

19.4 District-level Monitoring and Review Committee: All the districts need to have

a District-level Monitoring and Review Committee under the Chairpersonship of the District Collector/Deputy Commissioner/ and District Magistrate, along with ADMs/SDMs dealing with land revenue matters, CEO/Executive Officer of the Zila Parishad, Sub-district Registrar, Survey & Settlement/Consolidation Officer having jurisdiction over the district, representative of State Forest Department and District Informatics Officer of the NIC as members. Representatives from other technical agencies such as the SoI, NRSC/ISRO, C-DAC, FSI, and SLUSI may be involved as per the need as special invitees. The Committee will review the progress of implementation of the Programme at least once in a month, and the District Collector/Deputy Commissioner shall submit report to the Divisional-level Monitoring and Review Committee, State-level Monitoring & Review Committee. Online monitoring reports shall be submitted by the District Collector/Deputy Commissioner to the State Govt. as well as to the DoLR (online) as per the MIS reporting formats and periodicity prescribed.

19.5 Sub Division / Sub District Level Monitoring and Review Committee

All the Sub Divisions need to have a Sub Division level Monitoring and Review Committee under the Chairpersonship of the Sub Divisional Officer (Revenue), along with Tehsildar/Naib Tehsildar/Patwari/Village Development Officer, Sub-district Registrar, Survey & Settlement/Consolidation Officer having jurisdiction over the Tehsil, representative of State Forest Department and District Informatics Officer of the NIC or his representative as members. The Committee will review the progress of implementation of the Programme on fortnightly basis, and the Sub Divisional Officer (Revenue) shall submit report to the district and also updation of information in MIS portal to be filled at Tehsil and village level.

20.0 EVALUATION OF THE PROGRAMME

20.1 To get the impact assessment and feedback about the actual implementation of the Programme at field level, the DoLR will get the concurrent and terminal evaluation of the Programme carried out through NITI Aayog and reputed organizations such as the Lal Bahadur Shastri National Academy of Administration (LBSNAA), the National Institute of Rural Development (NIRD), State Administrative Training Institutes (ATIs), etc.

20.2 The Department may also directly engage National / International level recruited consortium, IITs, IIMs, Central Universities, NITs and other organizations and industry association like FICCI, ASSOCHAM etc. for research and development purpose,

information analytics, consultation, collaboration, and other activities.

20.3 The States/UTs are also advised to carry out concurrent evaluation and impact assessment through in- house teams/experts to assess the on-site progress vis-à-vis deliverables of the sanctioned projects and suggest the measures for improving the system. These concurrent evaluation results must be intimated to the DoLR for obtaining the second installment of Central funding.

20.4 Since land record procedures and systems are different in different States, a baseline survey on the current status of the States and their requirements under the sanctioned components of the programme along with evaluation of the work already undertaken so far is required to be completed within the financial year 2021-22. Due to rapid change in space technology and sophistication in the measurement process, DoLR will firm up technology related guidelines with sufficient flexibility for the State Government to execute the programme as per their contextual need.

20.5 DoLR will take appropriate action for conducting third party independent evaluation of the scheme and rationalization / restructuring of the scheme accordingly for achieving the desired results and also to take appropriate action to reduce unspent balances.

20.6 While undertaking the third-party independent evaluation of the progress of the scheme so far, the baseline survey may also be conducted to ascertain the current status of the States/UTs on each component of DILRMP and the further need and requirements. The expenses on this count may be borne from the head “Evaluation Studies”, IEC and Training. States /UTs are free to add any additional components in terms of their contextual needs on the basis of such data being available (or already available) from their own resources and converge the same with DILRMP.

21.0 FUNDING

21.1 Allocation of Funds and Fund Flow Mechanism

The DILRMP is a demand-driven scheme. Funds will be allocated / released to the respective PMUs of State Governments/UT Administrations for carrying out the activities under the DILRMP. Funds for various components of the DILRMP will be provided at different scales by the Central Government. The assistance of Central Government will be restricted to the cost approved by the EFC as given in **Annexure-GL-III**.

21.2 The total outlay of the scheme Digital India Land Records Modernization

Programme (DILRMP) is Rs. 875 crores for the five-year period 2021-22 to 2025-26 with the following components:

S.N.	Component	Amount approved (Rs. Crore)
Existing Components		
1	Modern record room (Tehsil)	130
2	Survey/ re-survey and innovative initiatives	300
3	Data entry/re-entry	15
4	Digitization of cadastral maps/FMBs/Tippans	52
5	State level data centre	32
6	Computerization of Registration process	50
7	DILRMP Cell	12
8	PMU	47
9	Evaluation Studies, IEC and Training	40
10	Core GIS/Software Applications	20
Sub-Total (existing components)		***698***
New Components		
11	Consent-based integration of Aadhaar number with the land record database	62
12	Computerization of Revenue Courts and their integration with land records	115
Sub-Total (new components)		***177***
Total		**875**

21.3 Department of Land Resources is authorized to alter inter-se allocation among components within the range of (+) (-) 30% of individual allocations within the overall allocation of Rs. 875 crores as per actual needs and utilization of funds. Revision/ rationalization of costs may be allowed to be done by the competent authority.

21.4 Revised cost rates for various components are provided at **Annexure-GL-IV**.

21.5 Revision/rationalization of costs would be done from time to time as per need by the competent authority i.e., Core Technical Advisory Group (CTAG) headed by Secretary (DoLR) or any other officer authorized.

21.6 Funds for developing/upgrading software of NGRDS shall be provided to NIC out of the allocated funds for Computerization of Registration component.

21.7 Funds allocated under PMU also include funds for PMU at Central Level (DoLR).

21.8 Funds to NIC/CDAC and other dully approved agencies for ICT/technical support etc. shall be provided out of the allocated funds for Core GIS/Software Applications

component.

21.9 Once a project proposal is sanctioned by the Project Sanctioning and Monitoring Committee (PSMC), conveying of the sanction and release of funds to States/UTs/Agencies (all installments) and also inter- component transfer of funds will be done with the approval of Divisional Head in consultation with Integrated Finance Division (IFD).

21.10 States / UTs will submit a detailed year wise action plan annual and for three years) inter-alia providing plan for expenditure, district-wise, component-wise / sub-component wise proposals along with due Utilization Certificates (component-wise and separately for PMU &DILRMP Cell) and the same will be placed before the sanctioning authority i.e. PSMC for sanction.

21.11 Funds will be released to the single State level account of Project Management Unit (PMU) established in the States / UTs through PFMS. First installment shall be 60% of the total sanctioned funds. Second and final installment shall be the remaining 40% of the total sanctioned funds subject to 75% utilization of first installment. This will be subject to instructions issued by Ministry of Finance in this regard from time to time. The utilization reported by the State should tally with the data available in the Receipt Expenditure Advance Transfer (REAT) module of PFMS.

21.12 All instructions / circulars etc. issued by the Ministry of Finance on the subject should also be adhered to by the concerned departments.

21.13 States/UTs may make provision for O&M costs and also fix suitable user charges on deliverables for sustainability of the Programme and meeting the expenses of hardware maintenance and obsolescence etc. The State/UT may consider putting in place appropriate institutional mechanisms for the purpose, wherever necessary.

22.0 IEC/ Communication Plan

22.1 Publicity: DoLR/States/UTs may arrange for wide publicity about the advantages of the Programme at the revenue village, gram panchayat, tehsil, district and State levels, involving elected representatives in different media and forum. States/UTs may highlight the success stories of the Programme through newspapers, radio, television, cinema slides, posters, video films, road shows, publications, literature, etc.

22.2 Communication Plan: For easy reach of the benefits of the programme to the common man and also to commemorate 75 years of Azadi Ka Amrut Mahotsav, an active

and effective communication plan and IEC activities are imperative. DoLR may **publicize** its aim and achievements through Website, Social Media, Electronic Media, Newspaper, Exhibition, Competition, Communication Plan, organize Bhoomi Samvaad/ Workshop /Seminars etc. at International Level, National Level, Regional Level, District Level etc.; may undertake Video making, Best Practices, awards, recognition, scholarship / Fellowship, incentives for study report, distribution of publicity material, participation at National/International symposium, exhibition, sponsoring events, Seminars/Workshops in collaboration with public and private reputed organizations.

22.3 Participation in National / international competitions / awards / quiz etc.: DoLR may also participate in National / international competitions / awards / quiz etc. for achievements and innovative initiatives taken under the DILRMP.

22.4 National Land Records Management Awards:

Department has instituted a 'National Land Records Management Awards' under Digital India Land Records Modernization Programme (DILRMP) starting from the year 2021-22. Awards would be given in following categories:

- **a)** Best State (Overall Implementation)
- **b)** Best State (Innovative Services)
- **c)** Best District (Overall Implementation)
- **d)** Best Tehsil (Overall Implementation)

The assessment will be based on the achievements in terms of outputs and outcomes under different components of DILRMP during a financial year.

23.0 MISCELLANEOUS

23.1 In case any clarification is required on any issue, the DoLR may be consulted. Final decision will be taken by DoLR in consultation with the concerned State(s)/UT(s).

23.2 DoLR may revise/update the guidelines and its annexures, technical manuals and the MIS formats, from time to time in consultation with concerned Ministries/Departments of Government of India and State Governments.

Annexure-GL-I

Primary & Secondary Ladders proposed under the DILRMP

- Primary ladder – for reaching the stage of Integrated Land Information Management System

Primary Ladder: approach 1

• Registration -computerization of SROs • Integration of registration and land records maintenance systems • Automated mutation process following registration • Mutation – updating of pending cases and their computerization • Integration of textual and spatial data • Survey, including ground control networks and ground truthing (ongoing)	• Training and strengthening of training institutions • Strengthening of technical organizations • Record rooms at Registration/ tehsil levels • Computerization of Revenue Courts and their integration with land records • Consent based linkage of Aadhaar number with Record of Rights and authentication • Link up with development process • Legal changes for maintenance of records • Integrated Land Information Management System

Primary Ladder approach 2

• Survey, including ground control networks and ground truthing (ongoing) • Mutation – updating of pending cases and their computerization • Integration of textual and spatial data • Registration -computerization of SROs • Integration of registration and land records maintenance systems • Automated mutation process following registration	• Training and strengthening of training institutions • Strengthening of technical organizations • Record rooms at Registration/ tehsil levels • Computerization of Revenue Courts and their integration with land records • Consent based linkage of Aadhaar number with Record of Rights and authentication • Link up with development process • Legal changes for maintenance of records • Integrated Land Information Management System

- Secondary ladder – for archival purposes and strengthening of revenue administration

  - Computerization of old records
  - Scanning of old survey maps
  - Computerization of legacy mutation data
  - Establishing Record Rooms

Annexure-GL-II

Digital India Land Records Modernization Programme

Memorandum of Understanding (MoU) Between the Department of Land Resources, Government of India and the State Government/ UT Administration / Implementing Agency

1. Preamble

1.1 *WHEREAS* the Digital India Land Records Modernization Programme, hereinafter referred to as DILRMP is being implemented as Central Sector Scheme with 100% funding by Central Government.

1.2 *AND WHEREAS* the main components of the DILRMP are computerization of land records, digitization of existing cadastral maps, integration of textual and spatial data of RoRs, undertaking survey/resurvey to depict true ground positions and boundaries, automation of the registration process, integration of registration process with mutation for updation of records, computerization of revenue courts and their integration with land records, consent based linkage of Aadhaar with record of rights and authentication and strengthening the capacities of revenue and registration staff to handle new instruments/equipment and technologies

1.3 *AND WHEREAS* the Department of Land Resources, Ministry of Rural Development, Government of India, and the concerned Department in the State Government/UT Administration/ State Implementing Agency shall be parties to this Memorandum of Understanding.

1.4 *NOW THEREFORE* the signatories to this Memorandum of Understanding (hereinafter referred to as MoU) have agreed as set out here in below.

2. Duration of the MoU

This MoU will be operative with effect from the date of its signing by the parties concerned and will remain in force till the end of financial year 2025-26 i.e. the period up to which the Government has extended the scheme. Thereafter, it can be extended with mutual consent subject to further continuance of the scheme.

3 Government of India Commitments

The DoLR shall:

3.1 frame guidelines for the implementation of the programme, detailing the components, indicative methodology/technology and funding pattern under the scheme.

3.2 provide financial assistance as per the approved norms, out of the budget available under the DILRMP scheme.

3.3 coordinate the production of technical guidelines, at the national level, among the technical agencies such as NIC, Survey of India, NRSA and ISRO and others.

3.4 assist the State Governments/UT Administrations in capacity building to ensure that the DILRMP is properly implemented.

3.5 develop and disseminate uniform data codes, training modules and other materials necessary for effective implementation of the programme.

3.6 host online monitoring system for real time monitoring of the scheme.

4. State Government/UT Administration Commitments:

The State Government/UT Administration shall:

4.1 identify a nodal Department for the purpose of receipt of funding for DILRMP and for implementing the same. This Department shall, in turn, put in place a Programme Management Unit (PMU) in the charge of an officer not below the rank of Secretary, to oversee the DILRMP in its entirety. The nodal Department shall submit monthly progress reports to DoLR as delineated in **Part-C-MIS**

4.2 set up a State-level Monitoring and Review Committee for the DILRMP to monitor and review the progress of the implementation of the programme, facilitate coordination and the necessary process re-engineering and to give guidance, wherever required.

4.3 Provide corresponding State share due, if any, to the funds released by the Central Government upto 31.3.2016.

4.4 take the district as the unit of implementation of the DILRMP.

4.5 prioritize the activities under the DILRMP in the chosen district(s) in the systematic,

ladder-like manner, as indicated in the Annexure-GL-I of the guidelines.

4.6 set up a District-level Monitoring and Review Committee in each district covered under the DILRMP, under the Chairpersonship of the District Collector/Deputy Commissioner to review the progress of implementation of the programme on a regular basis.

4.7 ensure submission of online monitoring reports from the District Collector/Deputy Commissioner of each district covered under the DILRMP, to the nodal department of the State Government/UT Administration, which in turn will submit the necessary monthly progress reports as indicated in para 4.1 above.

4.8 carry out concurrent evaluation and impact assessment in each district covered under the DILRMP and convey the results to DoLR.

4.9 bring the district(s) where the DILRMP activities have been completed under the law for conclusive titling.

4.10 make a Perspective Plan indicating the time-frame within which the State/UT Administration will cover all its districts under the DILRMP, preferably by 2022-23.

4.11 undertake all process re-engineering involved in implementing the DILRMP, including legal changes, wherever required.

4.12 undertake all necessary action for capacity building of the staff to ensure that the DILRMP is implemented properly.

4.13 make positive efforts towards deployment of the Revenue, Survey and Registration staff for their designated tasks under the DILRMP and divesting them of non-departmental duties.

4.14 provide “single window” service to citizens for distribution of RoRs and for registration.

4.15 set up a Core Technical Advisory Group for providing technical guidance in implementing the DILRMP.

4.16 place the updated property records on the official website(s) in such a manner that property owner(s)/enjoyer(s) have access to their property records.

4.17 make a time-bound programme for abolition of stamp paper and introduce payment of stamp duty and registration fees through banks/treasuries.

4.18 ensure adherence to the DILRMP guidelines issued by the Central Govt. or any other advisories issued from time to time.

5.0 Redressal Mechanism

5.1 Any irregularity brought to the notice of the State Government/UT Administration shall be enquired into promptly and corrective action taken thereupon. Non-compliance of the commitments and obligations set hereunder and/or lack of satisfactory progress may require the Department of Land Resources to review the financial assistance provided under the DILRMP, leading to suspension, reduction, cancellation and/or recovery thereof.

5.2 In the case of any dispute between the State Government/UT Administration and the DoLR on any matter covered under this MoU, the matter shall preferably be resolved mutually. In other cases, the decision of the DoLR on such matters shall be final.

6.0 This MoU shall be signed by the officers duly authorized by the State Government/UT Administration and by the DoLR.

Signed this ……day of……. ……. of ……....

(Date) (Month) (Year)

For and on behalf of the State Government/UT Administration of ……	For and on behalf of the Government of India, Ministry of Rural Development, Department of Land Resources
(Designation)	(Designation)

Annexure-GL-III

Components under the DILRMP and financial outlays (Year 2021-22 to 2025-26) for them are as given below.

S.No.	Component	Amount Approved (Rs. Crore)
Existing Components		
1	Modern record room (Tehsil/Taluka/Circle/Block level)	130
2	Survey/ re-survey and innovative initiatives	300
3	Computerization of Land Records	
3(a)	Data entry/re-entry	15
3(b)	Digitization of cadastral maps/FMBs/Tippans	52
3(c)	State level data centre	32
3(d)	Core GIS/Software Applications	20
4	Computerization of Registration process	50
5	DILRMP Cell	12
6	PMU	47
7	Evaluation Studies, IEC and Training	40
Sub-Total (existing components)		***698***

New Components		
8	Consent-based integration of Aadhaar number with the land record database	62
9	Computerization of Revenue Courts and their integration with land records	115
Sub-Total (new components)		***177***
Total		***875***

Annexure-GL-IV

Revised Rates of components of DILRMP

S.N.	Component	Sub-Activity	Previous Cost Rate	Revised Cost Rate (Approved)
1	**Computerization of Land Records**	1. Data entry/re-entry/data conversion of all textual records including mutation records and other land attributes data.	(a) Rs. 10 lakh per new district	Rs. 5 per record entry for new/old district
			(b) Rs. 5 lakh per old district	
		2. Digitization of Cadastral Maps/ FMBs.	(a) Rs. 1500 per map sheet	(a) Rs. 1900 per map sheet (2.5 man-days per map sheet @ Rs. 750 per day by Digitizer = Rs. 1875 ≈ Rs. 1900 per map sheet)
			(b) Rs. 33 per FMB	(b) Rs. 45 per FMB
		3. State Level Data Centre.	(a) Rs. 1 crore for small State/UT	(a) Rs. 1.50 crore for small State/UT (population < 2 crore)
			(b) Rs. 2 crore for large State	(b) Rs. 3 crore for large State (population ≥ 2 crore)
2	**Computerization of Registration**	1. Computerization of Sub-Registrar's Office (SRO)	(a) Rs.10.00 lakh / SRO where not computerized	(a) Rs.13.00 lakh / SRO where not computerized
			(b) Rs. 2.50 lakh / SRO, if already computerized	(b) Rs. 5 lakh / SRO, if already computerized for Hardware/ Software upgradation
		2. Data entry of valuation details	Rs. 50,000 per SRO	Rs. 65,000 per SRO
		3. Data entry of legacy encumbrance data	Rs. 50,000 per SRO	Rs. 3 lakh per SRO for sub-activities at S.N. 3 and S.N. 4 by merging them

		4. Scanning & preservation of old documents	Rs.1.25 lakh per SRO	
		5. Connectivity of SRO with revenue office	Rs. 3.50 lakh per SRO	Rs. 1.50 lakh per SRO (connectivity charges @ Rs. 30,000 p.a. for 5 years)
3	**Modern Record Room at Tehsil**	Upgradation with necessary equipment/ infrastructure, scanning of all documents, storing metadata and offering as service	Rs. 25 lakh per Tehsil	Rs. 30 lakh per Tehsil
4	**Survey / Resurvey**		(a) Rs. 25,500 for HRSI method	(a) Rs. 25,500 for HRSI method
			(b) Rs. 27,600 for Aerial/hybrid method	(b) Rs. 27,600 for Aerial/hybrid method
			(c) Rs. 34,050 for ETS/DGPS method	(c) Rs. 34,050 for ETS/DGPS method
5	**Core GIS**	1.Preparation of village index base maps by geo-referencing cadastral maps with satellite imagery for creating the core GIS. 2. Integration of three layers of data: (i) Spatial data from aerial photography or HRSI; (ii) Survey of India and Forest Survey of India maps; and (iii) GIS-ready digitized cadastral maps from revenue records.	No prescribed rate.	Rs. 30 lakh to 60 lakh per State; depending on specific proposals GIS lab will not be allowed. Purpose of CORE GIS is seamless integration of data e.g. *Bhunaksha* etc.
6	**Programme Management Unit (PMU)**		Rs. 39.20 lakh as one-time cost & Rs. 34.20 lakh as recurring cost	Rs. 50.00 lakh as one-time cost & Rs. 44.00 lakh as recurring cost as per

				Appendix - I
7	**DILRMP Cell**		Rs. 245.57 lakh	Rs. 245.57 lakh. Indicative list of items as per Appendix-III
8	**Computerization of Revenue Courts and their Integration with Revenue Offices**		New component	Rs. 1.00 lakh per court & Software & Training Cost as per Appendix – II
9	**Consent-based Linkage of Aadhaar with Record of Rights**	1. Linking Aadhaar with Record of Rights (Aadhaar seeding)	New component	Rs. 3 per Record of Right
		2. Authentication of Record of Rights through Aadhaar		Rs. 2 per Record of Right

Appendix – I (Annexure-GL-IV)

Detailed Cost Estimate of PMU

S.N.	Item	Unit/ Quantity	Rate/Unit	Amount (Rs. lakh)
1	Expert Consultant	1	Rs. 1 lakh p.m.	12.00
2	Programmer	3	Rs. 40,000 p.m.	14.40
3	Accountant	1	Rs. 40,000 p.m.	4.80
4	Data Entry Operator	1	Rs. 25,000 p.m.	3.00
5	Peon	1	Rs. 20,000 p.m.	2.40
6	Recurring expenditure (o*ffice expenses, TA/DA, hiring of vehicles, workshop/meeting etc.)*	-	Lumpsum	7.40
7	One-time fixed expenditure *(computers, furniture etc.)*	-	Lumpsum	6.00
			Total	50.00

The posts mentioned above are only indicative. DoLR/States / UTs may hire more professionals including posts or revise unit/ rate other than as mentioned above as per their needs but within the total approved cost of Rs. 44 lakh.

Appendix – II (Annexure-GL-IV)

Computerization Of Revenue Courts And Their Integration With Revenue Offices:

S. N.	Item	Quantity	Rate/Unit (In Rs.)	Amount (in Lakh Rs.) inclusive GST& other charges
1	Desktop Computer	1	60,000	0.60
2	Laser Printer	1	15,000	0.15
3	Digital Signature	1	2,000	0.02
4	Internet Charges	1	1,000 (P.M.)	0.12
5	Contingency		11,000	0.11
Total Cost for 1 Revenue Court				**1.00**
(A) Cost for 25,732 Revenue Courts @ Rs. 1 Lakh per Court				25732.00
(B) Software & Capacity Building at Central Level				368.75
(C) Software & Capacity Building at State Level @ Rs. 24 Lakh per state				868.00
Grand Total (A+B+C)				**26968.75**

Appendix-III(Annexure-GL-IV)

Indicative List of Items For The DILRMP Cell

Sl. No.	Items	Unit cost (Rs. in lakh)	Minimum quantity within total fund allowed	Maximum limit of fund allowed (Rs. in lakh)
1.	Electronic Total Station with ± 3 seconds and minimum 2 km. range (with reflector), or better, with pre-processing software and at least two weeks training by the vendor to 4 persons per instrument, with AMC, renewable after 5 years. **Additional Features:** High memory backup, USB support, bluetooth support, serial port, electronic guide light, 2nd keyboard with full VGA color touch screen, additional traverse set, additional external battery kit.	7 lakh	8	56.00
2.	Global Positioning System (GPS) with dual frequency receiver and processing software along with at least 2 weeks training for 4 people onsite. **Additional Features** DGPS is being used for cadastral survey, the receiver must have the capability to support the satellite signals from US, Russia (GLONASS) and European Union (Galileo), Indian (Bhuvan), Rover for DGPS, Rover for triangulation, AMC renewable after 5 years.	18 lakh	1 pair	18.00
3.	GIS-ready digitization software- Any standard GIS digitization software capable of vectorizing/creating topology of cadastral maps.	1.75 lakh	15	26.25
4.	Flatbed Colour Scanner (A0)	25.00 lakh	1	25.00
5.	A0 Colour Plotter with 2 extra cartridges.	6.00 lakh	1	6.00

6.	High resolution satellite imagery (samples) for the particular State/UT from National Remote Sensing Centre (NRSC), Hyderabad.	1.00 lakh	-	1.00
7.	Aerial ortho-photos (samples) from Survey of India (SoI)/National Remote Sensing Centre (NRSC).	5.00 lakh	-	5.00
8.	Any standard-Image Processing Software (IPS).	10.00 lakh per set	1 set	10.00
9.	Computing Infrastructure -1 server, 15 desktop system with high resolution 20″-21″ monitors, one 1 KVA UPS, 15 500 VA UPS, 1 Laptop, 1LCD projector, 3 laser printers including one MFD.	12.00 lakh per set	1 set	12.00
10.	Record Room-A3 size scanner, 50 DVD, 1external USB hard-disk, web camera-1, barcode device, bio-metric device, photocopier-1, compacter-1 double size.	7.00 lakh per set	1 set	7.00
11.	System software- OS/Office-Suite /Anti-Virus.	1.00 lakh per set	1 set	1.00
12.	Furniture- as per the requirement (tables, chairs, etc.)	Not exceeding the total amount of 5.00 lakh, one-time	-	5.00
13.	Infrastructure upgradation for hosting the equipments and training Lab- 1 room for hosting the equipments (600 sq.ft), 1 room for record room set up (400 sq. ft), 1 training hall (600 sq. ft) etc.	Not exceeding the total amount of 10.00 lakh, one-time	-	10.00
14.	Faculty –On hire	8.00 lakh per annum	-	8.00
15.	Library, books and training material/manuals	2.00 lakh per annum	-	2.00
16.	Installation, networking and broadband, Video Conferencing system	Not exceeding the total amount of 5.00 lakh, one-time	-	5.00
17.	Management overheads including hiring of vehicles for field exposure, etc.	5.00 lakh per annum	-	5.00
18.	Boarding & lodging for trainees.	6.00 lakh per annum	-	6.00

19.	Stationery and consumables.	Rs. 5.00 lakh per annum	-	5.00
20.	Generator (10 KVA total installed capacity).	Not exceeding the total amount of 10.00 lakh, one-time	-	10.00
	Total			223.25
21.	Miscellaneous (10% of the total)			22.32
	Grand Total			245.57

PART-B: TECHNICAL MANUALS

DILRMP Technical Manual

Chapter-1
Digitization of Cadastral Maps and Integration with RoR Data
Model-I

The following technical details may be helpful to the digitizing agency or the vendor, if the work is outsourced, in GIS-ready digitization of cadastral maps and their integration with the textual RoR data:

1.0 Revenue village cadastral map: The revenue village cadastral maps showing plots (land parcels) in the scale of 1:3960, popularly known as 1:4000. Each revenue village cadastral map has an estimated 1200/1500 plots (property parcel boundaries) on the average surveyed true to scale by either traverse, plane table or chain survey as is the practice earlier. Later on, the length of each side of the plot and plot area are extracted from the paper map using acre comb. No field dimensions of the individual plots are noted on the map. Each revenue village map has the following features-

- **a)** Sheet heading (Mouza Name & North Direction.)
- **b)** Scale of the map
- **c)** Plot boundaries with Plot numbers
- **d)** Legends
- **e)** Conventional signs or symbols popularly known as Alamats, Bata Plot nos. & Missing Plot nos.
- **f)** Contents of the certificate block i.e., contents of the rectangle bearing the signature of the Revenue Officer certifying the contents of the cadastral map

2.0 Scope of work for digitization: In order to prepare GIS-ready digitized revenue village cadastral maps, they should be digitized in three layers i.e., line, point & polygon layers, to facilitate digital capturing of all the features of the existing paper map. Maps, digitized in this way, provide flexibility required for future corrections. Each plot of land is viewed as a closed polygon and digitized in area layer to provide the area of the plot. A suitable number, which is written within the paper map itself, is used for unique identification of the digital polygon. Maps should be scanned to their true scale, vectorized and converted into shape file format consisting of three files i.e. the shape file (*.shp), the index of the shape file (*.shx) and the data associated with the shape file (*.dbf) [item 2 & 3 above], .gif (graphic interchange format) formats [item 1,4, 5 & 6] along with the data in

.dbf format [item 5] as detailed in the scope and methodology of the work. If the cadastral map is geo-referenced, the projection file or. prj are also a part of the shape file.

S.No.	Job Description
1.	Accurate scanning of original paper-based maps (generation of raster image of the map).
2.	Digitization of plots (drawing digital line on each plot boundary of the scanned map).
3.	Topology creation and closed polygon generation in area layer.
4.	Creation of plot numbers in polygon area layer.
5.	Creation of rendered plot numbers (RPN) and centroid point of each polygon in point layer. The centroid, which is the geometric centre point of the polygon, is where the plot number is indicated. When the size of the polygon is too small for the number to be written within it, then the last one or two digits are written to represent the original number. This plot number is called **rendered plot number**.
6.	Creation of in-situ lines, i.e., geographically fixed lines and point alamats (line and point layers).
7.	Thoka lines of village (i.e., boundary lines of the other two neighbouring villages) and sheet control points (fixed points on earth used while preparing the maps which are also used for future references), bi-junction (pillars fixed at the meeting point of two neighbouring villages) &tri-junction pillars (pillars fixed at the meeting point of three neighbouring villages), permanent features or marks, old control stations used in earlier surveys, roads, railway tracks, rivers or streams, relay lines of acquisition plans (i.e., demarcation lines of the land proposed to be acquired – relevant only in land acquisition cases),etc., in .shp format of line, point and area layers.
8.	Creation of DBF files for point/area alamats and bata (sub-divided) plots (point and area layers).
9.	Creation of GIF files of non-map features (sheet heading, north direction, legends, list of conventional signs, contents of certificate block).
10.	Creation of text files in point layer.

3.0 Four Database Tables

The following four database tables should be developed from the data available in the paper map. This is done by carefully observing each plot in the map sheet.

Table No. 1 - The conventional signs or alamats have to be codified along with the reference of bata plot number in the following dbf:

Village code	Sheet No	LR/RS (L or R)	Plot No.	Symbol Code	Reference of bata plot numbers
1	2	3	4	5	6

The original plot numbers are to be written in Column 4 and any reference of parent plot number from which the original plot has been created is to be written in Column 6.

Table No. 2 - Data developed with respect to symbols in point layer is master data information and should be developed and maintained centrally, and not developed separately, for each map. It should contain the following information:

Symbol Code	Symbol name	Actual file as OLE (Object linking and embedding) object
1	2	3

Table no. 3 - This table contains the information on the first plot and the last plot number in a sheet of cadastral map for a particular village.

Mouza Code	Sheet no.	L or R for LR / RS	First plot no.	Last plot no.
1	2	3	4	5

Table no. 4 - This table will keep track of missing plots and missing plot numbers within the 1st and last plot numbers in a particular sheet of a village.

Village Code	Sheet no.	L or R for LR / RS	Missing plots.
1	2	3	4

4.0 STRINGENT ACCURACY REQUIREMENT:

The digitized map should exactly match the original map& be a true replica on a 1:1 basis, like a contact print, since the dimensions and area of plots, or the whole village, are to be extracted from the map itself. As such, a difference of 0.25 mm of sheet measurement in 1:3960 scale between the original map and its copy, whether conventional or digitized, gives rise to a difference of about 1 metre on the ground. So, an accuracy of 0.25 mm or higher is desirable and tolerance may be treated as nil to 0.25 mm per metre.

5.0 OUTPUTS OF DIGITIZATION:

Vectorized map can be stored in any open GIS format without any data loss as the conversion from one format to another is built into the software for automatic raster to vector conversion. To maintain the topology of the GIS data, it is preferred to store data in a geo-database or open standard. Data may also be stored GIS enabled RDMS such as Postgre SQL (Postgre SQL with Post GIS as a plug in for GIS enabled).

6.0 METHODOLOGY FOR DIGITIZATION:

6.1 The revenue department in the respective State/UT having the Commissioner of Survey &Settlement (CoSS), Directorate of Land Records &Survey (DLRS) are the nodal organization. These organizations are involved in the digitization of revenue village cadastral maps from the existing manually-prepared maps. The process involves (i) scanning of maps to produce raster data, (ii) checking the dimensional accuracy of the raster data, (iii) garbage cleaning in the raster data,(iv) vectorizing the raster data, (v) cleaning the vector data, (vi) topology building, i.e., building each plot polygon as a totally connected entity, to ensure that all the polygons are closed and connected; (vii) data integration, (viii) map composition from different layers, and (ix) integration of regional language script as label.

S.No.	Job Description	Responsibility
1	Putting label of village code, whether RS or LR map and the sheet number sticker on the map sheet	Department Employees (DE)
2	Handing over the labeled map to the vendor for digitization	DA
3	Scanning of original paper-based maps.	Empanelled Agency (EA)
4	Study of original paper map for dimension extraction. This is to measure the dimensions of any two points in the horizontal and vertical directions in the original paper map	EA
5	Adjustment of scanned raster map with the measurement as available in Sl. No. 2.	EA
6	Digitization of plots using R2V or AutoCAD software	EA
7	Cleaning up of map, topology creation and closed polygon generation using AutoCAD map software	EA
8	Creation of plot numbers and attaching text database with the spatial data	EA
9	Quality checking to account for all plots and plot numbers available in the map	EA
10	Printing for dimensional accuracy-checking of all plots	EA
11	Comparison of print with original for accuracy checking	EA
12	Refinement of digitized map with respect to Sl. No. 9 and repeat of Sl. Nos. 9 and 10 till desired accuracy is achieved	EA
13	Quality checking for correctness of plot numbers as attached	EA
14	Creation of rendered plot numbers (RPNs) and centroid points	EA
15	Creation of in-situ lines and point alamats	EA

16	Quality checking to ensure that all alamats are considered and coded correctly	EA
17	Creation of DBF files for point/area alamats and bata plots	EA
18	Creation of GIF files	EA
19	Handing over the print copy for checking correctness	EA
20	Checking of print copy with the original	DE
21	Handing over the soft copy	EA
22	Soft copy check (availability of files - 35-38 numbers)	DE
23	Generation of complete map from the files available and also digital RoR database using software developed by the NIC	DE
24	Printing of composed map in 120 GSM paper for preservation	DE
25	Software checking of areas extracted digitally with that available in the RoR for each plot. This provides an error report showing plots whose areas in the RoR do not match with the areas extracted digitally.	DE
26	Error report is sent to districts for review and correction	DE
27	Integration of RoR data with spatial data using the software developed by the NIC (explained in detail below)	DE
28	Map and record correction through the software developed by the NIC (explained in detail below)	DE

6.2 Scanning and dimensional accuracy

6.2.1 The original map is scanned to produce the raster form. For cadastral map, scanning may be done in 400 dpi (dots per inch). Special attention should be given to see that the map is not deformed dimensionally. For this purpose, “X” (cross) marks are placed

at corners of the original map before scanning. In the next step, the lengths between the "X" marks of the original map are compared with those of the scanned map to check whether any differences exist. Finally, raster editing is done for the elimination of unwanted patches in order to enhance vectorization of the raster data.

6.2.2 Dimensional accuracy of the raster data implies total correspondence between the raster data and the original map. The following procedures are used to achieve dimensional accuracy:

1. Checking for expansion.
2. Checking for contraction.
3. Checking for translation.
4. Checking for rotation.

Raster form of the map may appear to be expanded or contracted as compared to the original map, which in turn affects the vector data. The checking for expansion and contraction is based on the principle that 'area is invariant'. The Land Records Department has Jurisdiction List (JL) in which the total mouza area is defined and the land records information contains each plot area of an owner. These two are compared with the vector data of the map to check for the expansion or contraction of the map with respect to the original map. Using open source technologies, NIC has developed software-BhuNaksha, which can easily integrate the land records data with the digitized data based on the plot numbers.

Translation and rotational error may occur during the scanning process. Checking for this purpose is done using the check-point. A calibrated plotter HP 1050C or higher is used to plot a map from the vector data. This map is then compared with the original map to find complete correspondence between the lines of the two maps. Any mismatch between the two reveals the existence of the abovementioned errors. These errors may be removed by accurate scanning of the original map and confirming its correctness with the original.

6.2.3 While digitizing, the scale should be maintained accurately, so that the output corresponds 1:1 with the original. Flat bed scanner is preferred to roller type scanner depending on the condition of the cadastral maps. For maps that are brittle, flat-bed scanners would be more suitable.

6.3 Vectorizing, topology building and data integration:

6.3.1 The raster data may be converted to vector data using raster-to-vector converting software. This software works in three distinct methods as mentioned below:

1. Fully automated method
2. Semi-automated method
3. Completely manual method

The Semi-automated method is preferable, because traverse lines may have some breaks which can be corrected through this method during the process of vectorization, but which create problems with the fully automated method.

6.3.2 No plot on the map is isolated; hence one should possess some knowledge about its adjacent plots. That is why topology building is necessary. This is done by treating each intersecting point as a node. Overshoot, undershoot and duplicate lines are the major problems, which are to be eliminated during the process of topology building. The overshooting lines are deleted and the undershooting lines are extended to their nearest node.

6.3.3 Non-spatial data (plot number, area, etc.) are included in the database containing the spatial data for the map, during the process of data integration.

6.4 Testing of correctness of the digitized map:

6.4.1 The printed copy of the digitized map should be thoroughly checked so that all the plot boundaries and other line works match with the original like a contact print. Plot numbers assigned should also match with the original. In-situ alamats should be placed at exactly the same points as they are located in the original map. A glass table, lighted from below, is used to match such accuracy.

6.4.2 Software checking is done through the “Map Management System” software developed by the NIC to find all the files deliverable for a map sheet.

7.0 MAP COMPOSITION AND QUERY RETRIEVAL:

7.1 Different layers (point, line, area) are used for map composition. Line layers are required for the map composition part, while area layers are mainly required for both map checking and composition. However, map composition not only involves construction of

the map from a particular layer, but also the inclusion of various non-map features such as the legend for the map, the label of the map specifying its identification from the point of view of Police Station Code, Jurisdiction List Number, etc., bata information for the mouza, the authentication seal of the Government, etc. and various geographical features (the alamats) such as the railway lines, the traverse stations, letter boxes, etc., which can be represented by symbols.

7.2 The non-map features are mostly available in the form of images. A point layer is provided for the insertion of these images. The point layer contains the coordinates of the points where the images are to be positioned. During map composition, the images are to be placed on the map (already composed from the line layer) at their appropriate positions. The geographical features (alamats) can be displayed on the map by using the line, area and point layers. Specific symbols are used for this purpose and the layers contain information regarding these symbols. The final output is a completely composed map identical to the original one.

8.0 IMAGES

The images (in *.gif format) provided for map composition must be accompanied with a point layer in which each point coordinate would give the **lower-left** corner of the image. The layer must have a separate attribute column, named "**image**" along with the necessary columns (specific to a point layer table). This attribute column will contain the file name of the image files corresponding to each point of the point layer. There is no restriction on the names of the image files, but it must be noted that the file names mentioned in the "**image**" column of the point layer must correspond to the file names of then images provided. The base name of the files for this point layer must be "**img**". Thus, the ".shp" file for the above-mentioned point layer must be "**img.shp**". The names of other necessary files (.shx, etc.) for the same point layer must be given accordingly. All the images (*.gif or *.tif) of a particular sheet must be given in the same directory, i.e., the **JL**-No. sub-directory.

Note: i) The scale of the map must not be an image, but must be digitized and provided in the line layer.

ii) Attribute naming: The "image" attribute column must be a character field and have a maximum length of 8 characters.

8.1 Symbol library

8.1.1 At point layer

Some of the symbols that can be represented by points should be provided in a point layer. The point layer required for this purpose must contain the attribute field “alamat symbol code” along with other necessary fields. The following: Table 1 contains the “symbol code” column for the above mentioned point layer. The other columns are given as descriptions to the “symbol code” column. The column named “Sl. No.” is the serial number of the various symbols as per the conventions followed in the respective States/UTs by their revenue department. The base name of the files for the point layer for the alamats must be “almp” i.e. the “.shp” file for the point layer must be “almp.shp”. The names of other necessary files (.shx, etc.) for the same point layer must be given accordingly.

Note: i) Some alamat notations comprise of a line and several points on the line. In such cases, the points are to be provided in the point layer and the lines are to be provided in the line layer that is described below.

ii) Attribute naming: The “alamat symbol code” attribute column must be a character field and have a maximum length of 4 characters.

Table 1

Item	Symbol code	Descriptions	(NR: Not Required, R: Required) (*)
Municipal/Notified Town Boundary	1	**1)** Only the circles on the boundary line should be given in the point layer (the broken line being on the line layer as described in the next table). **2)** The center of each circle should lie exactly on the line representing the	NR

		boundary.	
Wire fencing/railing along property boundary (showing ownership)	2	Only the 'X' marks should be given in the point layer, the line being given in the line layer (as mentioned in the next table).	NR
Village (or plot) boundary cutting across river or road	3	Only the dots on the boundary should be given in the point layer.	R
Village boundary cutting along the length of river/ road	3	Only the dots on the boundary should be given in the point layer.	NR
Village boundary along one bank/ edge of the river/ road not common to two units	3	Only the dots on the boundary should be given in the point layer.	NR
Geodetic Triangulation Station (GTS)	4	**1)** Appropriate name of the GTS should be given as an image. The dot in the middle of the symbol should be at the 'surveyed in situ' position of GTS	R

Bench Mark with number		5	**1)** The dot in the symbol should be at the position of the Bench Mark as surveyed in situ. **2)** The figure indicating height should be the appropriate height of the Bench Mark concerned above the Mean-Sea.	NR
Tri-junction Pillar		6	Only the dot at the center of the triangle should be given in the point layer.	R
Traverse Station	(i) Present Survey	7a		R
	(ii) Last Survey	7b		R
Boundary Mark (pillar)	(i) Permanent pillar	8a		R
	(ii) Iron pilla	8b		R

r			
Swampy Land or Marsh	10	Several points in close proximity should be given such that entire marsh is covered.	NR
Overhead Tank	11	Only the center of the symbol should be provided in the point layer.	R (.dbf)
Pucca well	12	Only the center of the symbol should be provided in the point layer.	R (.dbf)
Kutcha well	13	Only the center of the symbol should be provided in the point layer.	R (.dbf)
Tube well	14	Only the center of the symbol should be provided in the point layer.	R (.dbf)
Deep Tube well / Shallow tube well	15a	Only the dot at the center of the symbol should be given in the point layer.	R (.dbf)
	15b		
Hillock with peak of known height	16	Only the center of the symbol should be provided in the point layer.	NR
Hillock without peak of known height	17	Only the center of the symbol should be provided in the point layer.	NR

Mill / Factory	18	Only the base of the symbol should be provided in the point layer.	R (.dbf)
Coal pit	19	Only the center of the symbol should be provided in the point layer.	R (.dbf)
Temple	20	Only the base of the symbol should be provided in the point layer.	R (.dbf)
Mosque	21	Only the base of the symbol should be provided in the point layer.	R (.dbf)
Church	22	Only the base of the symbol be provided in the point layer.	R (.dbf)
Gurudwara	23	Only the base of the symbol should be provided in the point layer.	R (.dbf)
Graveyard	24	1) Several points (each point representing one symbol) should be given such that the entire plot is covered.	R (.dbf)
		2) Only the base of each symbol should be given in the point layer.	
Pucca building within a plot	25	Only the base of the symbol should be provided in the point layer.	R (.dbf)

Pucca building within a plot not surveyed in situ	26	Only the base of the symbol should be provided in the point layer.	R (.dbf)
Kutcha house	27	Only the base of the symbol should be provided in the point layer.	R (.dbf)
Tin/tiled shed having pucca plinth	28	Only the base of the symbol should be provided in the point layer.	R (.dbf)
Daily market with plot boundary	29	The point must be taken inside the plot and preferably on the lower- left corner of the plot such that the symbol can be fitted completely within the plot.	R (.dbf)
Tree	30	Only the base of the symbol should be provided in the point layer.	R (.dbf)
Trees in grove (not surveyed in situ) other than orchard	30	Several points in close proximity should be given such that entire grove is covered.	R (.dbf)
Forest (reserved / protected) with name	31a	1) Several points in close proximity should be given such that entire forest is covered. 2) Only the base of each symbol is to be provided in the point layer.	R (.dbf)
	30 & 31b		R (.dbf)
	30, 31a & 31b		R (.dbf)

Bush jungle	32	Several points in close proximity should be given such that entire bush jungle is covered.	R (.dbf)
High grass	33	Several points in close proximity should be given such that entire High grass is covered.	R (.dbf)
Uncultivable fallow	34	Several points in close proximity should be given such that entire uncultivable fallow is covered.	R (.dbf)
Bamboo clumps	35	Several points in close proximity should be given such that entire bamboo clump is covered.	R (.dbf)
Cluster of palmyra	36	Several points in close proximity should be given such that entire plot containing cluster of palmyra is covered.	R (.dbf)
Cluster of coconut palm	37	Several points in close proximity should be given such that entire plot containing cluster of coconut palm is covered	R (.dbf)
Cluster of date palm	38	Several points in close proximity should be given such that entire plot containing cluster of date palm is covered	R (.dbf)

Cluster of betel palm	39	Several points in close proximity should be given such that entire plot containing cluster of betel palm is covered	R (.dbf)
Orchard (perennial – like mango, litchi, etc.)	40	Several points in close proximity should be given such that entire plot containing the orchard is covered.	R (.dbf)
Flower garden	41	Several points in close proximity should be given such that entire plot containing flower garden is covered.	R (.dbf)
Light house	42	The symbol should be drawn at some convenient space inside the plot concerned.	R (.dbf)
Burning ghat	43	The point must be taken inside the plot and preferably on the lower- left corner of the plot such that the symbol can be fitted completely within the plot.	R (.dbf)
Power house	44	The symbol is to be drawn at some convenient space inside the plot concerned.	R (.dbf)
Electric sub-station	45	The symbol is to be drawn at some convenient space inside the plot concerned.	R (.dbf)
Transmitting/ microwave station	46	The symbol is to be drawn at some convenient space inside the plot concerned.	R (.dbf)

Trestle of ropeway	47	The center of the baseline of the symbol should be provided in the point layer.	R (.dbf)
Pylon/electric/ telegraph/ telephone post with line	48	Only the dots at the center of the symbol should be given in the point layer.	R (.dbf)
Lamp post	49	Only the dot at the center of the symbol should be given in the point layer.	R (.dbf)
Letter box (immovable) of P&T Deptt.	50	Only the dot at the center of the symbol should be given in the point layer.	R (.dbf)
Kilometer post	51	Only the mid-point of the base of the symbol should be given in the point layer.	R (.dbf)
North Direction	52		NR
Text scripts mentioned on the map	53a, 53b, 53c, …		NR

(*) These may be customized as per the need of individual states.

8.1.2 At line layer

8.1.2.1 Some of the alamats that can be represented by lines are to be provided in a line layer. The line layer required for this purpose must contain the attribute field “style” along with other necessary fields. The following table contains the “style” column for the above-mentioned line layer. The other columns are given as descriptions to the “style” column. The column named “Sl. No**.**” is the serial number of the various symbols as per the conventions followed. The base name of the files for the line layer for the alamats must be “alml” i.e., the “.shp” file for the line layer must be “alml.shp”. The names of other necessary files (.shx, etc.) for the same line layer must be given accordingly.

8.1.2.2 In order to define the extent of the total map area, it is essential to have a sheet boundary. This boundary is to be provided in a separate line layer, which must contain similar attribute fields as defined previously for the above-mentioned line layer. This layer should contain a single line with thickness of style number 16. The base name of the files for the line layer for sheet boundary must be “bnd”, i.e., the “.shp” file for the line layer must be “bnd.shp”. The names of other necessary files (.shx, etc.) for the same line layer must be given accordingly.

Note: i) Some alamat notation comprises of a line and several points on the line. In such cases the lines are to be provided in the line layer and the points are to be provided in the point layer that is described in Table 1.

ii) Attribute Naming: The “style” attribute column in the following Table 2 must be a character field having a maximum length of 4 characters.

Table 2

Item	Style	Description	(NR: Not Required, R: Required) (*)
Specific lines on the village boundary	0	The portion of the village boundary drawn with broken lines must be digitized in a continuous fashion as a separate line and provided with the mentioned style no.	R
Village boundary	1	The alignment of the village boundary is along the middle of the thick line.	R
Municipal/Notified Town Boundary	2	Only the broken line of the boundary should be given in the line layer.	NR
Ward (municipal) boundary	2	This is for the broken line denoting the boundary.	NR
	4	This is for the small line segments that are perpendicular to the broken line.	NR

Forest boundary	3	Only the line representing the forest boundary should be given in the line layer. The entire boundary may be divided into different segments such that each segment is an entity in the line layer, provided all these segments contain the same style no.	NR
Wire fencing/railing along property boundary (showing ownership)	4	Only the line representing the property boundary should be given in the line layer (the 'X' marks had already been given in the point layer as mentioned in the previous table). The entire boundary may be divided into different segments such that each segment is an entity in the line layer, provided all these segments contain the same style no.	NR

Village boundary cutting along the length of river/road	2	Only the line representing the village boundary should be given in the line layer. The entire boundary may be divided into different segments such that each segment is an entity in the line layer, provided all these segments contain the same style no.	R
Village boundary cutting across a water body	2	Only the line representing the village boundary should be given in the line layer.	R
lot boundary where there is a water body across it	2	Only the line representing the plot boundary should be given in the line layer.	R (.dbf)
Tram line	5	Only the line representing the Tram line should be given in the line layer. The entire line may be divided into different segments such that each segment is an entity in the line layer, provided all these segments contain the same style no.	NR

Railway	6	Only the line representing the Railway line should be given in the line layer. The entire line may be divided into different segments such that each segment is an entity in the line layer, provided all these segments contain the same style no.	R
Trekking route in hilly areas (too narrow for both sides of the path to be surveyed separately).	7	Only the line representing the Trekking should be given in the line layer. The entire line may be divided into different segments such that each segment is an entity in the line layer, provided all these segments contain the same style no.	NR
Culvert	4	Only the small line segments representing the culvert should be given in the line layer.	NR
	4	1) Style 4 is used for the Edges of the Road	NR

Road (flyover) over Railway	6	(flyover) above the Railway. 2) Style 6 is used for the Railway line under the Road (flyover). 3) The Railway line as shown in the figure comprises of two line segments on either side of the road (flyover).	NR
Railway (flyover) over road	4	1) Style 4 is used for the edges of the railway (flyover) above the road. 2) Style 6 is used for the road under the railway (flyover). 3) The road as shown in the figure comprises of two parts on either side of the railway (flyover).	NR
	6		NR
	4		NR

Railway (flyover) over railway	6	1) Style 4 is used for the edges of the flyover. 2) Style 6 is used for the railway line passing under the flyover. 3) The railway line as shown in the figure comprises of two line segments on either side of the road (flyover).	NR
Subway (underground) under railway	2	1) Style 2 is used for the broken line denoting the subway under the railway line. 2) Style 6 is used for the railway line.	NR
	6		NR
Subway (underground) under road	2	1) Style 2 is used for the broken line denoting the subway under the road. 2) Style 4 is used for the road above the subway.	NR
	4		NR

Road (flyover) over road	4	The road lying below consists of two parts on either sides of the road lying above it	NR
Level crossing	7	It is assumed that the railway line is already present as an item as given in Sl. No. 19.	NR
River with, ferry and direction of flow of water	4	1) Style 4 is used to denote the direction of water flow along the river. 2) The entire arrow showing the direction should be digitized. 3) Style 7 is used denote the ferry.	NR
	7		NR
Tidal stream	4	The entire arrow is to be digitized.	NR
Jhora (rivulet in hills)	4	1) Style 4 is used to indicate the edges of the jhora as surveyed in situ. 2) Style 8 is used to indicate the middle of the deepest courses of the jhora as surveyed in situ.	NR
	8		NR

Narrow water channel along the plot boundaries with direction of flow of water (having width too Small to be surveyed).	9	The arrows on the line (boundaries) must be digitized such that it shows the proper direction of the water flow.	NR
Drain/nala (in basti or town areas) with direction of flow of water.	4	The arrow showing the direction of flow of water should be given in the line layer.	NR
Pylon/electric/ telegraph/telephone post with line	2	Only the broken line is required in the line layer, the dots being provided in the point layer as mentioned in the previous table.	NR
The north-west sides of the water bodies including tank drawn with thick lines in the map	16	Only the thick lines are to be provided with the mentioned style number. Any other lines inside the mouza having a line thickness identical to the north-west side of the water bodies should be allotted the same style.	NR

(*) These may be different for individual States.

8.1.3 At area layer

Some of the alamats (in-situ) that are to be represented by areas must be provided in an

area layer. The area layer required for this purpose must contain the attribute field “shade” along with other necessary fields. The following table contains the “shade” column for the above mentioned area layer. The other columns are given as descriptions to the “shade” column. The column named “Sl. No.” is the serial number of the various symbols as per the conventions followed by the Directorate of Land Records and Survey. The base name of the files for the area layer for the alamats must be “alma” i.e. the “. shp” file for the line layer must be “alma.shp”. The names of other necessary files (.shx, etc.) for the same line layer must be given accordingly.

Note: i) Some alamat notation comprises of a line and several points on the line. In such cases the lines are to be provided in the line layer and the points are to be provided in the point layer that is described in Table 1.

ii) Attribute Naming: The “shade” attribute column must be a character field having a maximum length of 4 characters.

Table 3

Item	**Shade (specified by the NIC)**	**Description**	**Required features for States (NR: Not Required, R: Required)**
Pucca buildings (in situ)	1	Specific to State	NR
Pan baroz	2	Specific to State	NR
Sand char	3	Specific to State	R (.dbf)

Note: IMPORTANT

1. The “.shp”, “.shx” and the “.dbf” files for the mouza containing the area and the line layer should be named as “<JLNo>.shp”, “JL.shx” and “JL.dbf”

respectively. Thus, if the JL No. of a mouza is 100, then the three abovementioned files

should be “100.shp”, “100.shx” and “100.dbf” respectively. The files are to be placed in the “JL No.” subdirectory under the corresponding “PS Code” directory in the following format:

<PS Code> \ <JL No.> \ <JL No>.shp

<PS Code> \ <JL No.> \ <JL No>.shx

<PS Code> \ <JL No.> \ <JL No>.dbf

Thus, if for a particular mouza, the PS Code is 50 and the JL No. is 100, then the files corresponding to the layers of that mouza should be organized as follows:

50 \ 100 \ 100.shp

50 \ 100 \ 100.shx

50 \ 100 \ 100.dbf

2. If the mouza map comprises of more than 1 sheet, then the files for all the sheets are to be given the same names and as per the convention mentioned in point 1 above. However, in order to avoid controversy, the files must be kept in different subdirectories denoting the sheet number under the “JL No” directory, which itself is kept under the “PS Code” directory. Thus, if the mouza map with JL No. 100 (see the example in point 1) comprises of 2 sheets then the file should be organized as follows:

For sheet no. 1	For sheet no. 2
50 \ 100 \ 1 \ 100.shp	50 \ 100 \ 2 \ 100.shp
50 \ 100 \ 1 \ 100.shx	50 \ 100 \ 2 \ 100.shx
50 \ 100 \ 1 \ 100.dbf	50 \ 100 \ 2 \ 100.dbf

3. The layers for the images and the alamats need not be qualified with their corresponding JL Nos., but they must be kept in the same directory alongwith the layer files mentioned in the above two points. The files will be named as centroid.shp, almp.shp, alml.shp, scale.shp, bnd.shp, mbnd.shp, img.shp, alm_bata.dbf, first_last.dbf, missp.dbf, name.gif, lege.gif, bata.gif, sign.gif, etc.

4. The attribute field giving the plot number of each plot of the mouza is a compulsory field. It must be a 5-character field and have the name “plotno”.

5. The list of conventional symbols for the alamats as followed by the department should be referred whenever required.

6. For symbols, which are not “in-situ”, the points of insertion of the symbol are to be given at the approximate center of the symbol in the point layer for alamats.

7. The scale for each map should be digitized and provided as a separate line layer along with the other layers for the mouza. The base name of the files for the line layer for the alamats must be “scale”, i.e., the “.shp” file for the line layer must be “scale.shp”. The names of other necessary files (.shx, etc.) for the same line layer must be given accordingly.

8. The values in the different attribute fields in the various layers should be left justified.

9.0 INTEGRATION OF MAP WITH ROR

9.1 Each plot of land is represented on the digital map as a closed polygon. Such polygons are identified by a unique plot number known as the parcel id, khasra number or survey number. In the LR database, such plot numbers are referenced. This provides a basis for integration of digital map with the digital RoR data. The LR database consists of several related tables both main tables, master tables & transaction tables that provide ownership, land classification, etc. information.

9.2 For digital map, cadastral map data of each revenue village is in the form of shape files (.shp, .shx, .idx, .dbf& .prj) are imported into the BhuNaksha map database in PGSQL RDBMS.

9.3 Data, both spatial and textual, are used by the application software Bhulekh (textual or a spatial data-ROR) & its variants in various States/UTs &BhuNaksha-cadastral mapping solution (spatial or map data-Map) both developed by the NIC to provide the necessary integration of data. Such integration provides all the flexibility to manipulate textual data and spatial data without any constraint and provides a platform for various improved citizen-centric services and MIS reports. Some of them are given as follows:

1) Providing plot map (parcel map), showing dimensions of each side and area along with the RoR.

2) Generating analytical reports on area in the RoR with respect to the digital map so as to help in data correction, both text as well as map.

3) Integrating the RoR updation with its map updation.

10.0 MAP UPDATION

10.1 Problem definition and purpose

Every digitized map needs to be updated every time when classification of a portion of the plot changes or ownership of a portion changes. Such plot divisions are effected on the digital map based on field measurements data.

10.2 Scope

It aims to realize the following processes and database requirements:

I) Divide the plots as per the practice in the respective States/UTs such as free hand method, angle distance method, point measurement method, graphical method, arc method from adjacent side, arch method from opposite side, diagonal & offset method (for FMBs) with the help of field measurements.

II) After map updation, update the RoR data in the database so that both map data & textual data are in sync to provide both as a service to the citizen.

10.3 Techniques

Digital map looks like the following:

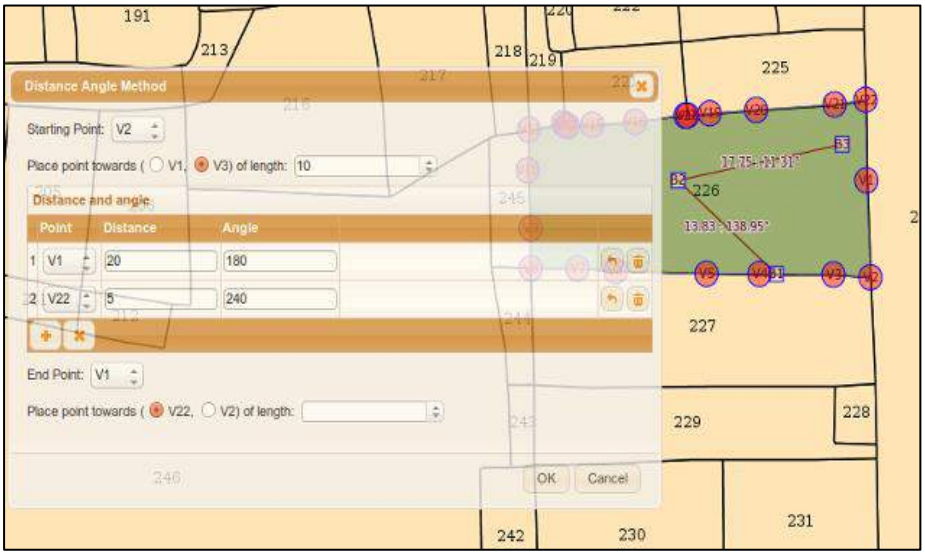
Figure 1: Village map view

10.3.1 Splitting plot methods

A plot can be split into any number of subdivisions. Splitting is done by creating division line. There are a number of methods for creating division line. A background grid can be used to help in creating division line.

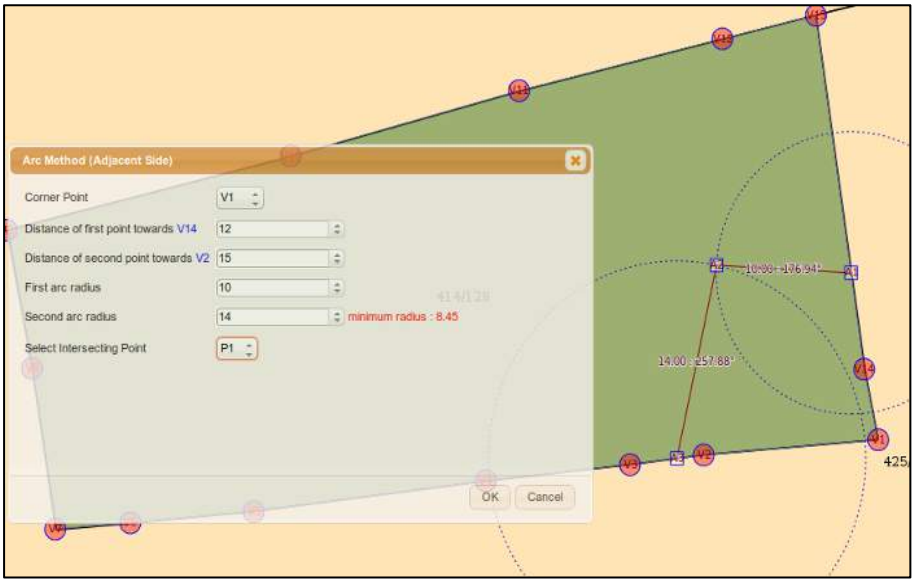
a) Distance angle method:

This method can be used to create a division line by specifying distance and angle of each point on the line with respect to some known reference points. The line can either start and end on any border of the plot or it can be inside the plot. Distance has to be mentioned with respect to ground measurements.



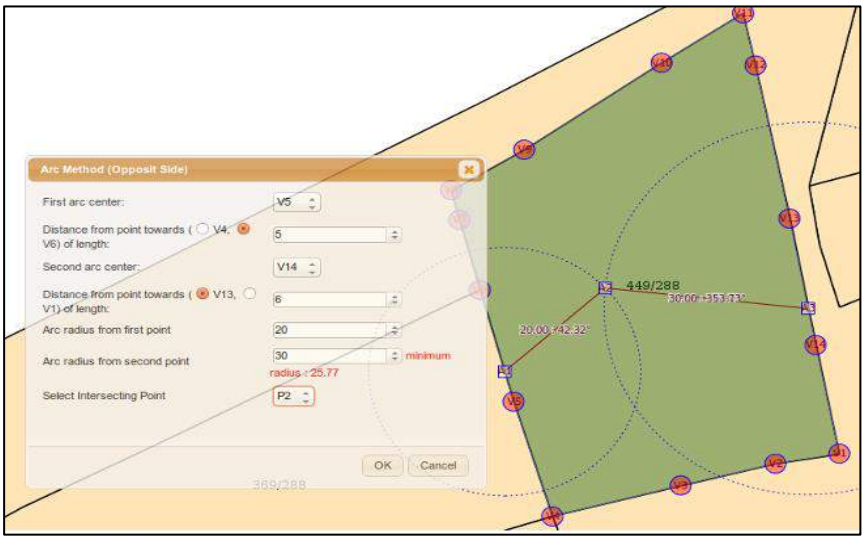
(b) Arc method (adjacent side)

This method can be used for creating division line at a corner of a plot. Two end points of the line can be identified by specifying distance from the corner point. This method will also allow us to specify a third point on the line as intersection of two arcs of specific radius from the end points.



(c) Arc method (opposite side)

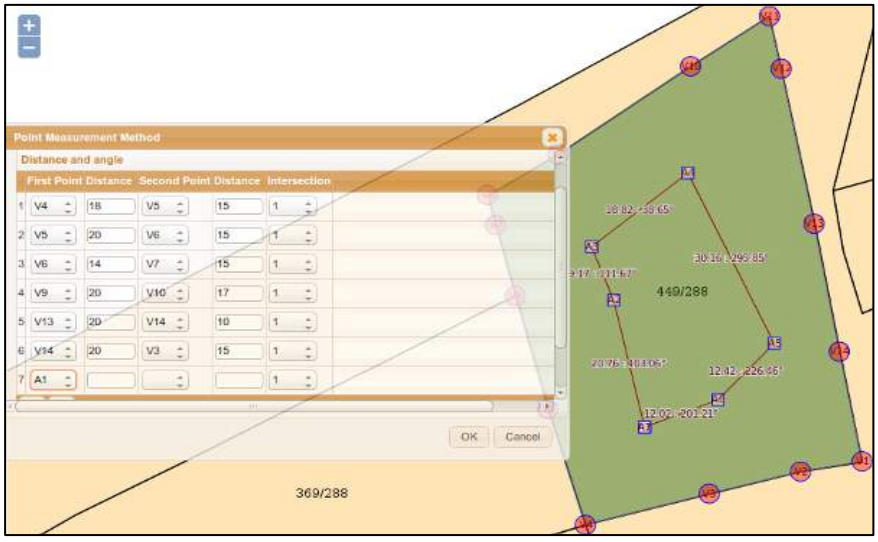
This method can be used for creating division line between two sides of a plot. Two end points of the line can be identified by specifying distance from two known points. This method will also allow us to specify a third point on the line as intersection of two arcs of



specific radius from the end points.

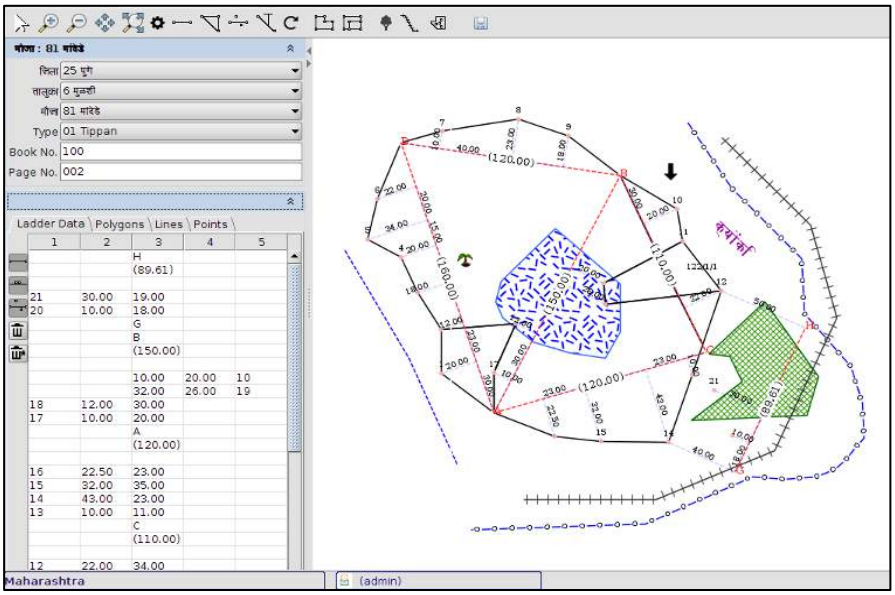
(d) Point measurement method

This method can be used for creating complex division lines accurately. Each point of the division line can be identified by measuring it from two known points. This is a more complex version of the arc method where more than one points can be created by intersecting arcs.



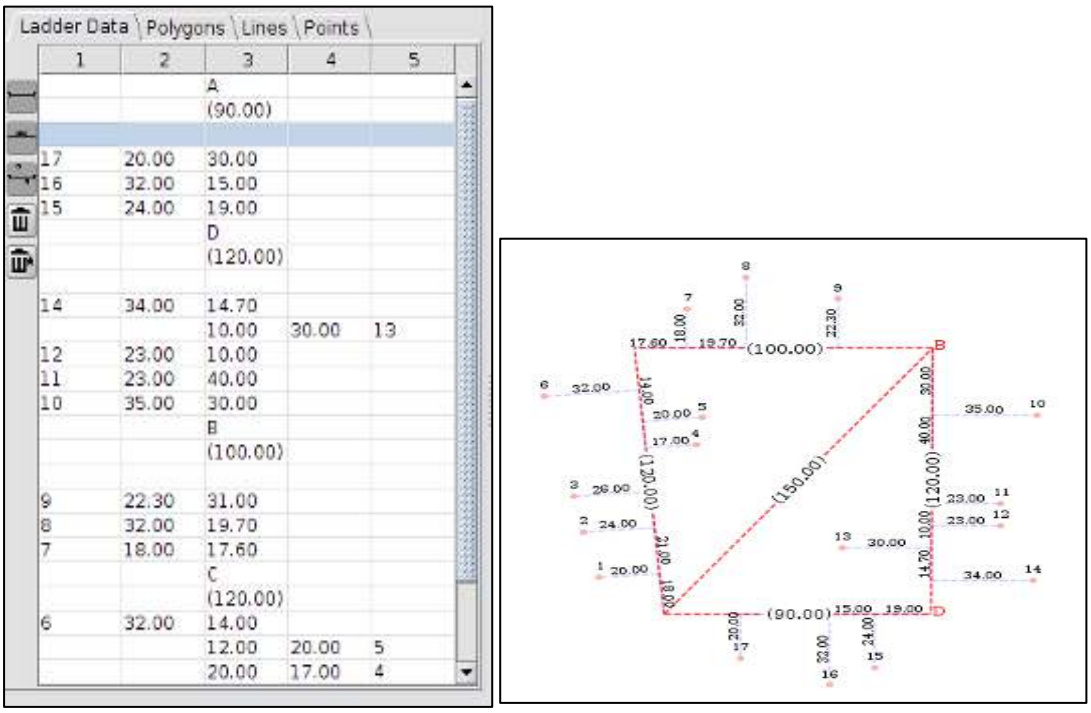
(e) Creating map from FMB/Tippon data

Maps can be created interactively from FMB (Field Measurement Book) data and tippon sketch. Once the map is created it will be similar to any other map in Bhunaksha.



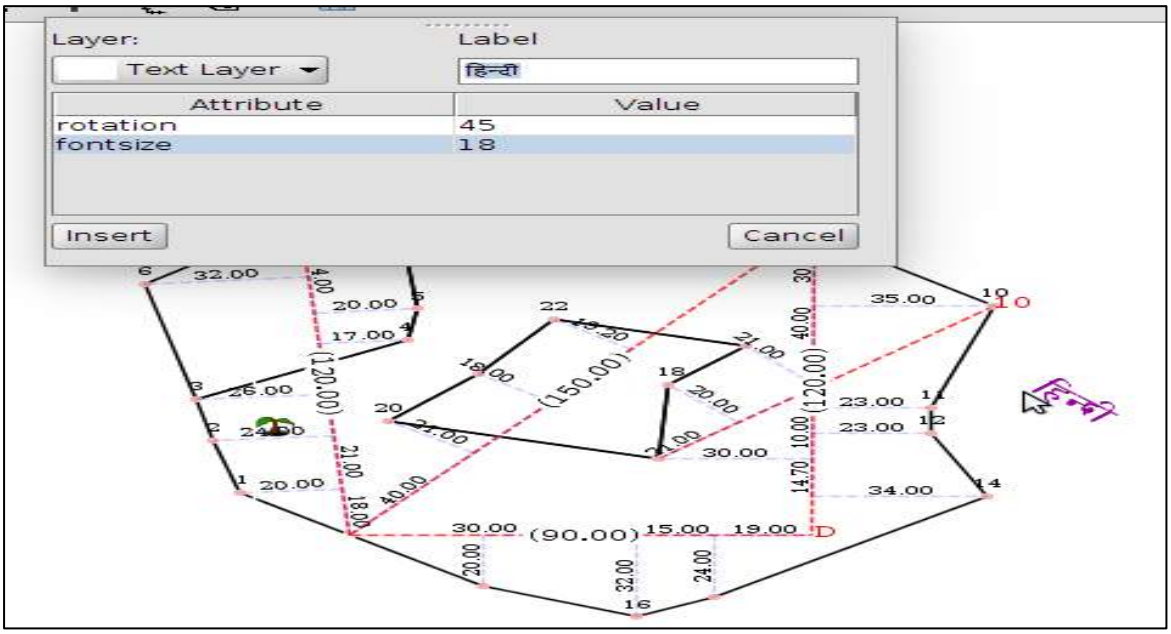
(f) Real time base line/offset points

Base line and offset points will be drawn in the map area on real time while entering data in ladder table. It is also possible to create hanging baseline by specifying distance from 2 offset points



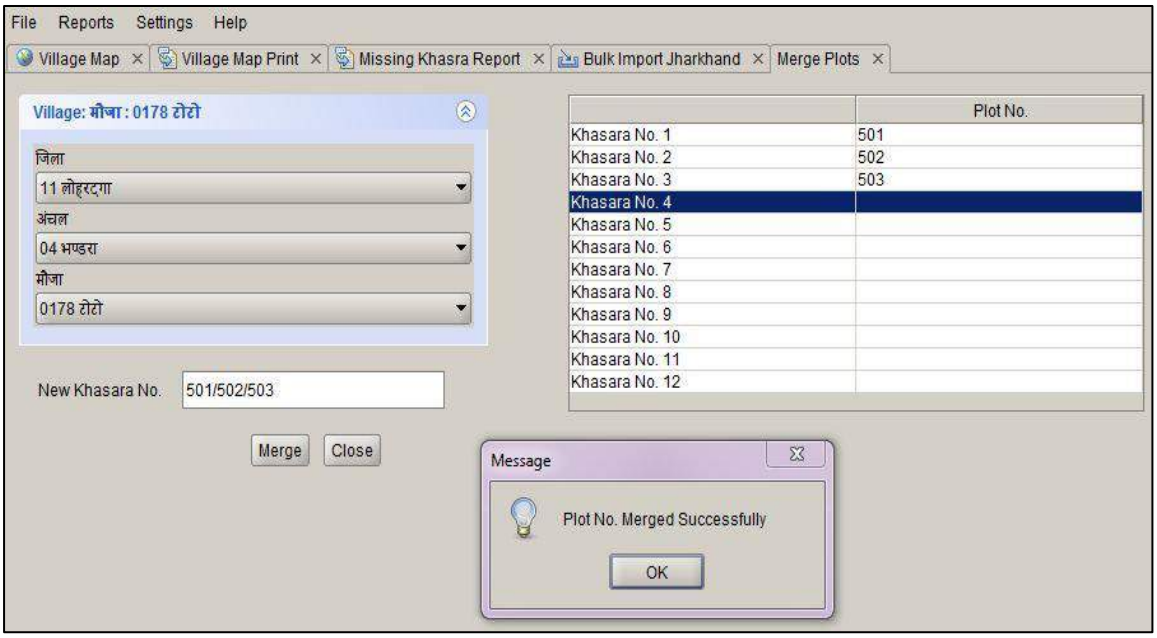
(g) Sub division & layers

It is possible to interactively create subdivision and place any kind of layers in the map area.



(h) Merging or Amalgamation of plots

Bhunaksha has a module for merging one or more plots in a village. A user can merge upto 12 khasras through this module and assign a new khasra number to the newly created plot.



10.4 Integration of Map with RoR text data (Sample screen shots)

Schedule I Form No.39-A

ଖତିୟାନ

ମୌଜା : ଅଳସୁଆ	ତହସିଲ : ଢେଙ୍କାନାଳ
ଥାନା : ଢେଙ୍କାନାଳ ସଦର	ତହସିଲ ନମ୍ବର : 5
ଥାନା ନମ୍ବର : 5	ଜିଲ୍ଲା : ଢେଙ୍କାନାଳ

ଜମିଦାରଙ୍କ ନାମ ଓ ଖେୱାଟ ବା ଖତିୟାନର କ୍ରମିକ ନମ୍ବର	ଓଡିଶା ସରକାର ଖେୱାଟ ନମ୍ବର					
1) ଖତିୟାନର କ୍ରମିକ ନମ୍ବର	52					
2) ପ୍ରଜାର ନାମ, ପିତାର ନାମ, ଜାତି ଓ ବାସସ୍ଥାନ	ଅନାବାଦି ।					
3) ସ୍ୱତ୍ୱ						
4) ଦେୟ :	ଜଳକର	ଖଜଣା	ସେସ୍	ନିସ୍ତାର ସେସ୍ ଓ ଅନ୍ୟାନ୍ୟ ସେସ୍ ଯଦି କିଛି ଥାଏ	ମୋଟ	5) ଗ୍ରାମଦର୍ଶକଙ୍କ ଖଜଣାର ବିବରଣୀ
6) ବିଶେଷ ଅନୁସଙ୍ଗ ଯଦି କିଛି ଥାଏ						

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ଖଜଣା ଧାର୍ଯ୍ୟ ତାରିଖ -

ରାଷ୍ଟ୍ରୀୟ ସୂଚନା ବିଜ୍ଞାନ କେନ୍ଦ୍ର 24/12/2021 01:03:45 IP :10.1.57.240

RoR Back Page | Khatiyan Page | Print

BHULEKH
LAND RECORDS WEB PORTAL OF ODISHA

ଖତିୟାନର କ୍ରମିକ ନଂ : 52		ମୌଜା : ଅଳସୁଆ				ଜିଲ୍ଲା : ଢେଙ୍କାନାଳ
ପ୍ଲଟ ନମ୍ବର ଓ ଚକର ନାମ	କିସମ ଓ ପ୍ଲଟର ଲକ୍ଷଣ	କିସମର ବିସ୍ତାରିତ ବିବରଣୀ ଓ ଚୌହଦି	ରକବା			ମନ୍ତବ୍ୟ
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144/164	ପତିତ	ଗୋଚିମାଣି ଖଣିମାଟି	0	0400		
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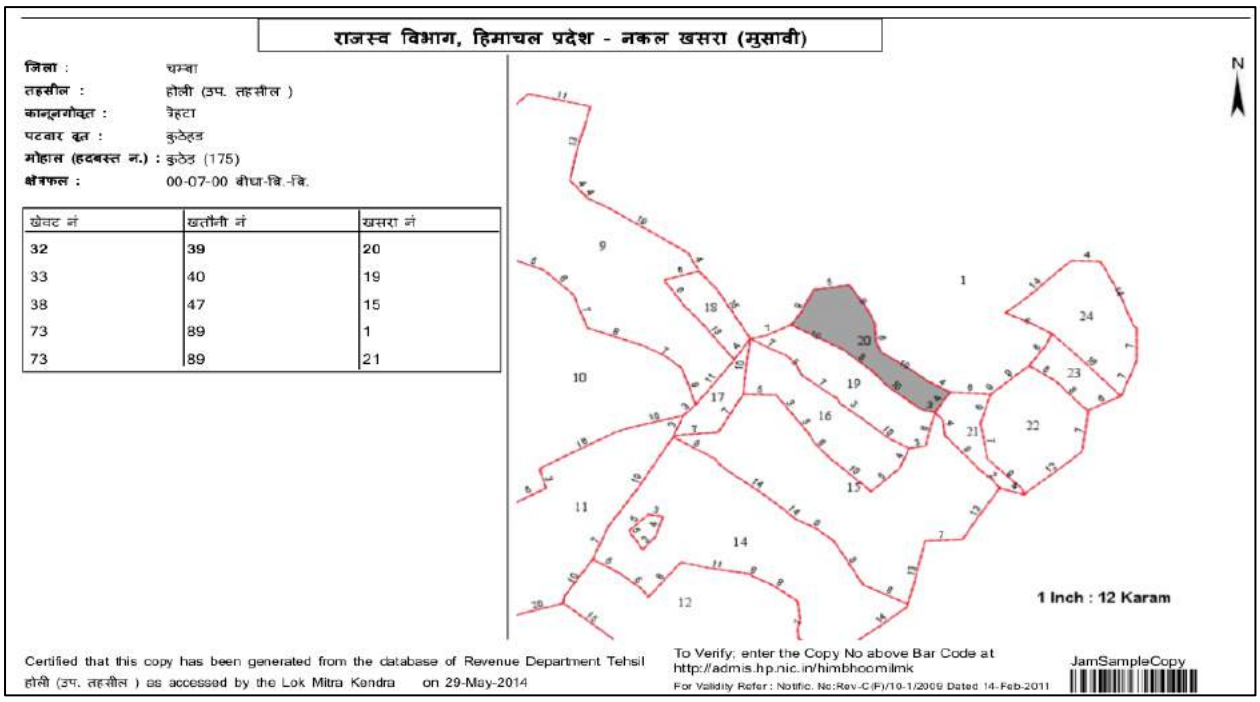
10.5 Embedded plot map in ROR report:



राजस्व विभाग, हिमाचल प्रदेश - नकल खसरा (मुसावी)

जिला : चम्बा
तहसील : होली (उप. तहसील)
कानूनगोवृत : रेहटा
पटवार वृत : कुठेड़
मोहाल (हदबस्त न.) : कुठेड़ (175)
क्षेत्रफल : 00-07-00 बीघा-वि.-वि.

खेवट नं	खतौनी नं	खसरा नं
32	39	20
33	40	19
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73	89	1
73	89	21

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1 Inch : 12 Karam

Certified that this copy has been generated from the database of Revenue Department Tehsil होली (उप. तहसील) as accessed by the Lok Mitra Kendra on 29-May-2014

To Verify, enter the Copy No above Bar Code at http://admis.hp.nic.in/himbhoomilmk
For Validity Refer : Notific. No:Rev-C(F)/10-1/2009 Dated 14-Feb-2011

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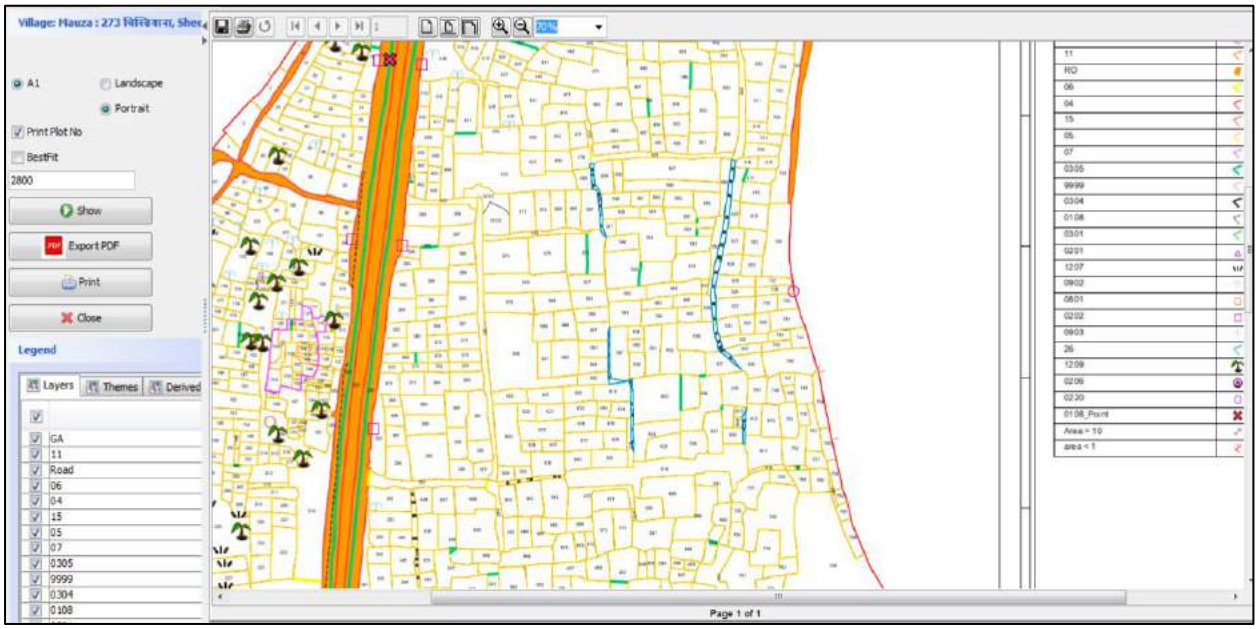
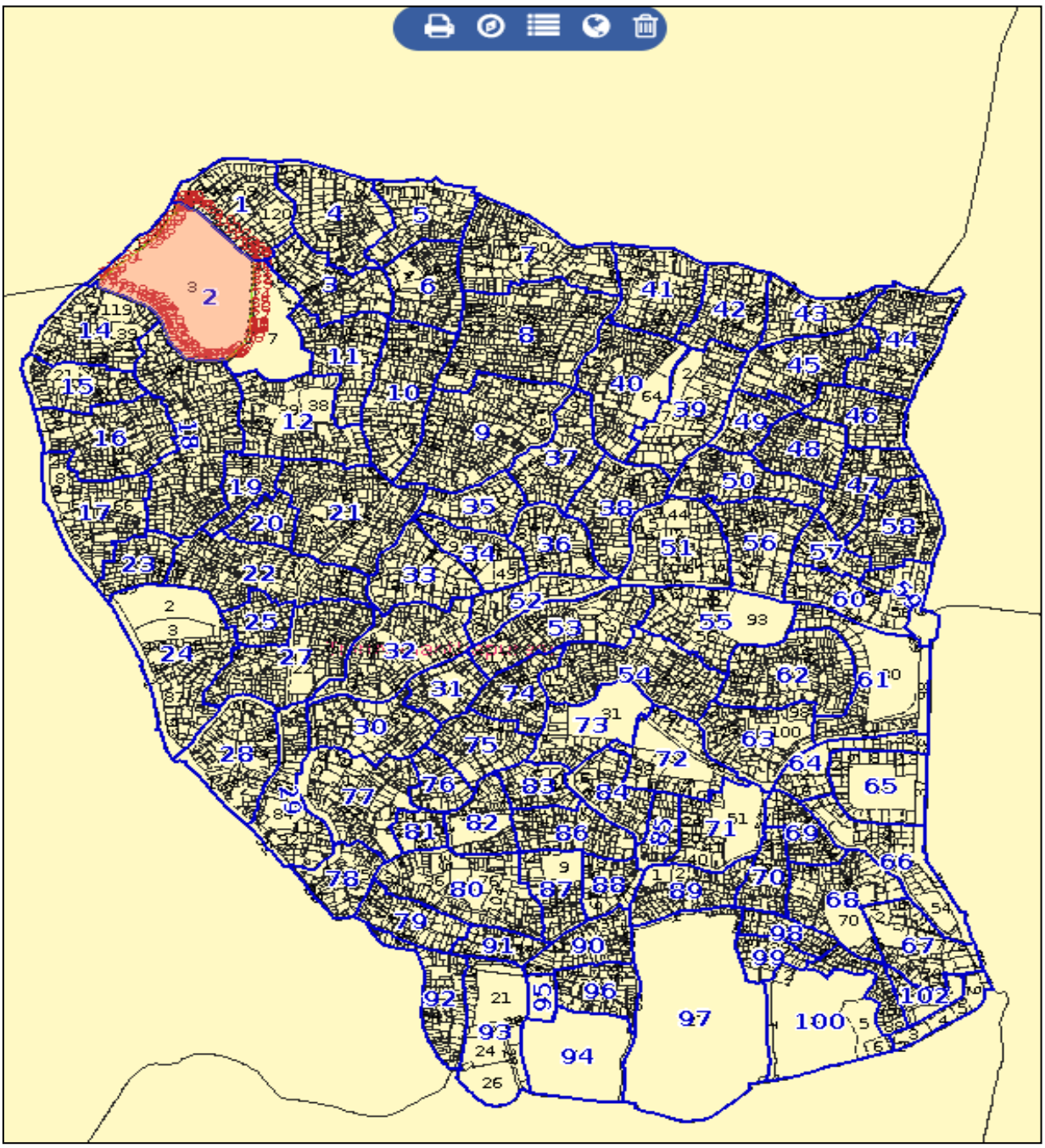


10.6 A complete village map printed output



Digitization of Cadastral Maps and Integration with RoR Data
MODEL-II
(Based on inputs from the ISRO/NRSC, involving use of High- Resolution Satellite Imagery)

1.0 INTRODUCTION

The cadastral map for each village is available on larger scales like 1:4000 to 1:10,000. These maps depict the survey boundaries with survey numbers, cultural features like transport network, location features viz. temple, trees, abadi and natural features like drainage etc. These cadastral maps have been prepared using plane table survey and chain survey. These maps need to be brought under standard projection/coordinate system for effective linkage of the developmental plans generated in the GIS environment. The following is the general description of the scope of the work of digitization of the cadastral village maps, geo-coding and their integration with textural data (RoR):

- The village cadastral maps will be traced on to tracing film/paper wherever required, scanned and grid-corrected.
- These maps will then be vectorized and labeled, parcel-wise.
- The parcel-wise information will then be attached uniquely to identify with the help of key identifier to obtain the details of each parcel.
- A grid-corrected map of the original sheets has to be provided in hard copy format.
- The sheets will be edge-matched, mosaiced, and the topology created as per the conventions specified.
- The mosaiced digitized maps will then have to be converted to GIS format and transformed using ortho-rectified geo-coded High-Resolution Image
- The accuracy standards should be maintained as per the pre-specified spatial framework, projection system, co-ordinate units, tolerances, feature- coding scheme, etc.
- The deliverables have to be provided in proper format, structure, precision and

metadata, as specified, so that they are ready for use with other revenue-related activities.

2.0 STEPS FOR DIGITIZATION OF CADASTRAL VILLAGE MAPS

The process of digitization can be summarized in following steps (Fig 1):

i) Collection of analog cadastral village maps (sheet-wise)

ii) DQC-1 (Input data evaluation)

iii) Tracing or re-production of the analog map

iv) Sheet indexing and scanning of the analog maps (converting analog to raster cadastral images)

v) DQC-2 (check DPI, format, quality, speckle removal and cleaning)

vi) Grid correction of the scanned (raster) map

vii) DQC-3 (grid overlay checking with scanned map)

viii) Feature abstraction from the scanned map

ix) DQC-4 (check for the accuracy of the type, location and attributes)

x) Layout and printing hard copy for evaluation by the Land Revenue Department (LRD)

xi) DQC-5 (detailed checking of the digitized features by the LRD)

xii) Incorporation of the corrections suggested by the LRD

xiii) Sheet mosaicing of a village

xiv) DQC-6 (feature continuity and attribute carry forward)

xv) Conversion of the digitized data into topologically-correct GIS data format

xvi) DQC-7 (checking for GIS feature conversion, attributes, null and duplicate errors)

xvii) Final deliverables (hard copy print and GIS data for geo-coding)

xviii) Metadata preparation

2.1 Collection of the sheet-wise analog cadastral village maps

Before executing the project, availability of sheet-wise cadastral maps have to be ascertained. The maps should be up-to-date and in good condition. The condition should be such that it can be scanned through a contact (roller) scanner or a flat-bed scanner (prefer flat-bed scanner). The DQC-1 has to be performed at this stage before it is sent for scanning. The quality check procedure will include the condition of the map – it should not be a cloth mounted, nor be torn or ragged, and not have too many folds. The control points (tics) should be available. The features of the map should be clear and distinguishable. Parcel number (khasra no.) should be distinct and readable. All symbols (*alamats*) should be distinct and properly understandable. Once found acceptable on all the above-mentioned characteristics, the sheet is tagged suitable for scanning.

2.2 Tracing or re-production of the analog map

If the sheet is not suitable, then the sheet has to be sent for tracing (preferably on a 75-100 GSM mylar film) or reproduction of the sheet by the LRD. The reproduced sheet has to be quality checked (DQC-1) and finally sent for scanning. The maps are to be traced using the following specification:

- Tracing to be done on 75 micron polyester film.
- Tracing should be done with 0.1 pen using black ink only.
- All the features should be traced.
- The labels should be placed neatly in the center of the feature with free hand drawing.
- In case the feature is too small to accommodate the label, it should be placed at a convenient location with a marker arrow.
- The heading and legend data should also be traced along with scale, north arrow, sheet no., etc. along with map border.

2.3 Sheet indexing and tics (tick-marks) highlighting

2.3.1 All sheets have to be indexed with appropriate index numbers. The index number is to be generated using the village metadata with respect to the various administrative codes (State, district, tehsil, and revenue inspector/patwari/thana/mouza and village code). The index number should be a unique number with information of the administrative hierarchy of the village. A typical example of index number may be I120501007035101 (IDDTTRRHHHVVVVnn).

2.3.2 One of the very important processes before scanning is the highlighting the tics (wherever they are present) and transferring of the tics (where absent). The following procedure should be followed in this regard:

- **Gridlines & tics are available** - The tics on the maps may be faint or in the form of grid lines. Uniformly distributed tics should be highlighted with a cross (X) depicting the exact intersection of the gridlines or tic position. The distance between the tics/gridlines, based on the scale, has to be ascertained and measured. This will be useful in selecting the mathematical grid for grid correction.
- **Four corner tics available** – The tentative distance of the corner tics has to be measured, based on the scale, and highlighted with a cross (X) depicting the tics position.
- **No gridlines or tics available** – This map will have no reference points, but to remove the scanning error, if any, the situation may be rectified by using the transferred tics. The tics from standard mathematical grid (grid will change depending upon the scale) have to be transferred on the analog sheets by overlay method on light-table. These transferred tics will rectify any distortion during scanning of the sheet. However, the map sheet can be corrected by registering the graphical scale with the standard template scale.

2.4 Scanning of the analog maps (converting analog to raster cadastral images)

2.4.1 The cadastral maps are scanned using AO size raster scanner. While scanning, the important parameter - DPI (dots per inch) - has to be precisely set. The DPI is based on drawing characteristics and information required. In general, the following minimum

specifications should be adopted while scanning the cadastral sheets: Maps should be scanned at 100-200 DPI Black/White (8 bit gray tone) mode depending upon the density of the features. If all the details are not picked up during scanning, the scanning parameters should be changed to 400 DPI on 24-bit color. While scanning, the sheet has to be fed in straight upright position and smoothened so that any fold is not generated while scanning. In the flat-bed scanner, the map has to be laid flat on the glass, smoothened and scanned; and bulging should be avoided.

2.4.2 After successful scanning, the DQC-2 procedure has to be followed. The raster image of scanned map should be stored in TIFF format (*.tif or tagged image format). The scanned map orientation should be upright (north oriented). The scanned map should be cleaned and free from noise (i.e., unnecessary pixels or darkness in the image). To remove the noise, de-speckling should be applied. The measured length and width within the bounding box of the scanned map should be +/-0.1% of the map manuscript measurements. The scanned image should not be skewed or warped; if there are any, it should be de-skewed or necessary correction should be applied, or it should be re-scanned. The scanned image should not have any line dropouts or stretched pixels; otherwise, it will have to be re-scanned. The scanned file will take the name of map index name, such as **I120501007035101.tif**

2.5 Grid correction of scanned cadastral map

2.5.1 Even after appropriate quality checks during the scanning process, there can be few errors due to machine specification and scanning techniques. There can also be some distortion in the input manuscript (analog cadastral map). The scanned map may carry forward the errors due to differential scanning, wear and tear or differential shrinkage/expansion. The net result may be non-uniform scale at parts of the map, deflection in north orientation, etc. To make the map plani-metrically accurate, rectifying the map with the vector grid is suggested.

2.5.2 Prior to the correction, selection of the appropriate grid has to be made. The grid is scale-dependent. Generally, the grid found on 1:3960 (16”=1mile) will be placed at a distance of 10 zaribs (i.e., 50.8 cm or 2.00000008 inch); the maps with 1:4000 scale will have a metric system grid and will be placed at a distance of 25 cm. Each sheet will have

10 X 14 grid blocks in 1:3690 scale, or 20 X 28 grid blocks in 1:4000 scale sheet. After ascertaining the scale of the maps under consideration, an appropriate mathematical grid has to be generated.

2.5.3 After selecting the appropriate grid, the cadastral scanned maps have to be registered with the grid.

- **Gridlines and tics are available** - The highlighted tics in the scanned map have to be stitched/tagged with its appropriate intersections of the gridlines of the mathematical grid and then transformed.
- **Four corner tics available** – The highlighted four corner tics in the scanned map have to be stitched/tagged with its appropriate intersections of the gridlines of the mathematical grid and then transformed.
- **No gridlines and tics available** – This needs to be executed in two steps:
  (a) The transferred tics before scanning are to be stitched/tagged with its appropriate intersections of the gridlines of the mathematical grid which was used to transfer the tics. Then first transformation is made. This will remove the scanning distortion, if any.

  (b) Comparing the available graphical scale of the map with the mathematically generated graphic scale of the same type and then registering the scale and transform. This may correct the distortion of the map scale, if any.

2.5.4 The process should eliminate the possible warping effect of cadastral maps. High accuracy and low residual error are to be achieved in grid correction of cadastral images. The transformed rectified cadastral scanned image is termed as 'registered scanned cadastral map' and can take the name such as **R120501007035101.tif**. The quality check DQC-3 is performed on the image to see whether the gridlines overlay with the tics of the map. If the errors are not within the acceptable limits, re-registration has to be performed.

2.6 Feature abstraction from the grid-corrected scanned cadastral images

2.6.1 Template creation: Before starting the vectorization, a standard template has to be created. In the template, the layer name, line type, color and thickness for each feature

(e.g., parcel, roads, canals, river, etc.) present on the map is standardized. Different graphical representation (symbol-*alamats*) in the map is to be standardized as point features with proper layer name, symbol and colour. This maintains uniformity in all the map outputs. The template also holds various mathematical grids, graphical scales, and other map features like north arrow, boundary lines, headings and other permanent annotations. A symbol library is created, which contains the various symbols shown in a village map. The symbol library gets depicted in the legend of the template. The main intention behind this is to maintain the uniformity over all the village maps that are digitized. The template should also address the font type of the annotation in the maps. Generally, UNICODE system is adopted with proper font for depicting the local language script. However, the template standards may vary from State-to-State and have to be regenerated with changes in the input specifications.

2.6.2 Feature abstraction is the process of capturing the point, line, and polygon features as vectors and text as annotation. The grid-registered scanned cadastral map sheet is displayed in the background, the required environment settings for digitization are set, and the required features are captured into different layers (based on the feature type). During digitization, attributions to the features will also be done. Only heads-up manual digitization should be carried out. Auto-vectorisation should not be attempted. Error should be within permissible limits for digitization, viz., weed tolerance, coordinate movement tolerance, sliver polygon tolerance, coordinate unit, planimetric errors, fuzzy tolerance, etc.

2.6.3 The uniformity in layers, line type, color, annotation, etc. during digitization will be maintained by using the template, as described above, to capture all the features in their respective layers. The final output of this process will be a digital map which will be a true copy of the paper map, along with necessary legends, scale bar, north arrow, borders, etc.

2.6.4 Once the digitization process is over, the DQC-4 is performed. This process assures the features abstracted from the scanned map sheets are true in its type (i.e. point, line or polygon), accurate in location and its attributes. Tag should be maintained wherever the feature/annotation could not be read along with null and duplicate errors. The errors

have to be reported in the draft output map, which will be sent to the LRD for through checking (*for details refer to the Quality assurance*)

3.0 GUIDELINES FOR FEATURE DIGITIZATION/ABSTRACTION

3.1 The general specifications for digitization are given below:

- The data is to be digitized using heads-up digitization.
- The features are to be captured such that the polygon features are put in one layer, the line features are in another layer while the points are in a different layer.
- The lines are to be digitized as polylines only, coincident lines are to be digitized once and copied to appropriate layer.
- Feature specific codes are to be assigned uniquely as given in the format.
- The data should be topologically correct for each of the layer.

3.2 The accuracy requirement and specifications for each of the type of features is indicated below:

3.2.1 Polygon feature specifications

- The parcel boundary should be digitized in such a manner that the resulting vector line falls in the center of the raster data image element being vectorized.
- The parcel boundaries are generally straight, hence should be digitized using 2 nodes/vertices in keeping with the shape of the polygon.
- The feature should be digitized in such a manner that there is no overshooting or undershooting of arcs, or duplicate arcs.
- The feature should be captured with specked symbol. The feature should be digitized with minimal number of vertices while, at the same time, maintaining the smoothness or angularly of the lines, as the case may be.
- The feature should be a closed polygon without any dangles or sliver.
- Each polygon should have a unique PIN as per the coding scheme indicated

below.

- The tolerance values for arcs, node snapping and vertices should be such that the features snap within the pixels defining that feature and do not snap outside.
- All features like parcels, roads, rivers, etc., which form the polygons, are to be digitized and coded as per the coding scheme.
- The connectivity of the rivers/roads is to be maintained and should not be disjointed.
- The label (parcel no.) should be placed in the center of the feature.
- Nodes are to be added wherever symbols are depicted on the parcel boundaries.

3.2.2 Point feature specifications

The features shown on maps as points, like wells, temples, trees, etc., are to be digitized as point features, for which the digitizing rules and coding scheme are given below:

- The feature should be digitized as a point placed at the center of the raster image defining it.
- There should only be one point at one location.
- Each feature should have a unique ID

3.2.3 Line feature specifications

The linear features shown as single line arcs on the map or linear double line features or symbols like rivers, roads, pipelines, etc. are to be digitized and compiled into the line layer for the village. The single line arc features, whether shown as continuous lines or broken lines, are to be captured from the map image. In addition to this, the double line roads, rivers, pipelines, etc. from the polygon coverage are also to be put into the line coverage. The feature coding guidelines are given below:

- The river/roads depicted on the image represent the outside edges in case of double line features and should be digitized as such. The resulting vector should not deviate from the pixels defining it. These features should be

captured only once and copied into the appropriate layers before building the topological relationships.

- The feature should be vectorized in such a manner that the shape is captured and retained as it is.
- The feature should be vectorized using optimum member of nodes/vertices so that the shape is retained and does not appear jagged.
- The continuity of the features such as rivers, roads, etc. must be maintained across the map sheets.
- At crossings, the features should be digitized with or without intersection, as the case maybe.
- In case of single line features, they should be captured as a single continuous feature from one end of the feature to the other end without break.
- In case of double line features the centerline should not be digitized. This will be represented by appropriate symbol.
- There should not be any gap between two connecting features, nor any over-shoots; the features should be snapped to connecting features.
- The features should be coded as per the coding scheme.

3.2.4 Attribute data specifications

Attribute data for each parcel is attached in the text layer. The parcel number and parcel land use are the two main attributes that are linked to the village polygons. Parcel number is the primary key for linking of RoR details.

4.0 LAYOUT AND PRINTING HARD COPY FOR EVALUATION

4.1 Hard copy color output would be generated using the template decided upon by the State/UT concerned for the purpose, as described above. The first draft hard copy is generated at the original scale of input map for each sheet. Good quality paper is used for printing the digitized map. The color scheme and paper thickness should be according to the standards specified for printing and is to be decided by the State/UT.

4.2 The officers from the concerned department dealing with land records/maps should carry out 100% validation of the hard copy color output (DQC-5). The output will be validated completely for physical dimensions, parcel size, shape, numbering, feature location and coding, annotation, etc. The corrections are marked on the output and are to be incorporated in the digitized digital data.

4.2.1 Quality check guidelines on hardcopy output by Land Revenue Department

Input:

- Plotter output at A0 size generates at the true scale
- A4 size output depicting zero fills and duplicate labels

Process:

The quality check is carried out on total population (100% data) and there is no sampling involved in this quality check.

- Check for the color scheme in the hardcopy output with reference to the template designed for this project
- Check for content, size and color of the various elements of the map
- Check for the logo details:
    - Group number
    - Village number
    - Bandobust number
    - Village name
    - Halka number
    - Halka name
    - Revenue Inspector (RI) circle name
    - RI circle number
    - Tehsil name
    - District name
    - Year
    - Scale
    - Sheet number

- Check for legend details
- Check for title disclaimer details
    - Project name
    - Map title
    - Generated for _____
    - Generated by _____
- Check for sheet index
- Check for north arrow
- Check for the dimensions of the grid cells and the map with reference to the original map used for digitization
- Check for feature matching
    - parcel boundaries
    - parcel number
    - parcel attributes – zero fills, duplicate labels
    - part parcels, combined parcels, etc.
- The features to be checked are:
    - Permanent parcel boundaries, temporary parcel boundaries, paddy bund boundaries, village boundaries, etc.
    - Drainage and water body details
    - Road network, rail network, cross drainage details, etc.
    - Vegetation details, etc.
    - Traverse lines and points details
    - Forest boundary details
    - Historical, religious places, etc.
    - Amenities details
    - Settlement locations, etc.
- After validation by the LRD, check for the signature of the validation officer from LRD for authenticating the quality check
- Check for the list of all parcel numbers provided on A4 size with reference to the details available from the LRD

4.2.2 Incorporation of the corrections suggested by the LRD

The draft hard copy color output, checked and corrected in all aspects by the Land Records Department is compared with the digital data. The corrections suggested by the LRD are incorporated in to-to. Special checks have to be performed to certify the incorporation of the error-corrections. After the correction of each sheet, the sheets pertaining to each village is mosaiced.

5.0 SHEET MOSAICING OF A VILLAGE

Village-level mosaicing is done by joining the individual map sheets of the village to form a complete village map. Edge matching is done by bringing two different map sheets of the same village into the same file and matching their edges with reference to the grid and the features on the maps. Continuity should be maintained for all the features at the edges and its attributes. Care is taken to eliminate all dangles (undershoot/overshoot) and label errors. On-screen checking is done to check the common edge between the mosaicing maps. One has to ensure the completeness of the polygon features such as parcels, continuity in line features such as rivers, roads, etc. Duplicate features along the edge, especially symbols have to be removed. Finally, topologically correct features for the entire village have to be generated and quality checked. The DQC-6 quality check procedure is for ascertaining the feature continuity and attribute carry forward.

6.0 CONVERSION OF THE DIGITIZED DATA INTO TOPOLOGICALLY CORRECT GIS DATA FORMAT

6.1 After mosaicking, the digital data is converted into topologically- corrected GIS data features. The GIS data will have separate point, line, polygon and annotation features. The strength of the GIS features is the establishment of the spatial relationships within and between the various features with respect to position, containment, contiguity, proximity, adjacent and intersection. After establishing the topology, the attribute data in the standard structure should be filled up. The unique primary key and the foreign key are generated. The completeness and accuracy of the attributes are checked by both display and automatic S/W method.

6.2 Null and duplicate attributes' lists are generated, both as text file and spatial data

outputs. This forms part of the DQC-7 procedure. The error report is again evaluated and checked. Wherever possible, corrections are incorporated, or else tagged with appropriate error codes. The data, at this stage, is ready for the further process of overlaying on the satellite data and query.

7.0 FINAL DELIVERABLES (HARD COPY PRINT AND GIS DATA FOR GEO-CODING)

The final hard copy print is taken on a paper of specified thickness (preferably 150 GSM of A1 size) of the actual sheet size for archival. The GIS data in prescribed format has to be stored in the central data warehouse and used for further processing of linking with the RoR data.

8.0 METADATA PREPARATION

8.1 The system and procedures of database generation should evolve a strong metadata, for which the metadata standard has to be designed. The objectives of the standard are to provide a common set of terminology and definitions for the documentation of digital geospatial data. The standard establishes the names of data elements and compound elements (groups of data elements) to be used for these purposes, the definitions of these compound elements and data elements, and information about the values that are to be provided for the data elements.

8.2 The major uses of metadata are:

- to maintain an organization's internal investment in geospatial data,
- to provide information about an organization's data holdings to data catalogues, clearinghouses, and brokerages, and
- to provide information needed to process and interpret data to be received through a transfer from an external source.

8.3 The information included in the standard are based on four roles that metadata play:

- **Availability** -- data needed to determine the sets of data that exist for a geographic location.
- **Fitness for use** -- data needed to determine if a set of data meets a specific

need.

- **Access** -- data needed to acquire an identified set of data.
- **Transfer** -- data needed to process and use a set of data.

Finally, developed metadata will store information pertaining to each cadastral village map layer and tabular data available from all sources. Future metadata should also describe the updation rate, time and history of the land transaction.

9.0 QUALITY ASSURANCE

9.1 A comprehensive quality control program for ensuring the quality of data has to be followed based on the criteria provided and permissible accuracy. The measure of accuracy derived based on the allowable limits would fall under one of the following heads, viz., physical accuracy and logical accuracy.

9.2 Physical accuracy

In any data conversion, some amount of variations would creep into the data sets depending on the type of digitization procedures followed and the subsequent projection and transformation methods followed. Following tests would be made to ensure that all the features in a dataset are within the permissible limits:

Point features

- Location of a feature with reference to a standard layer would be the same or within the prescribed limits.
- A feature carries the same information after migration.

Line features

- Variation in length of a line segment selected based on an attribute or combination of attributes.

Polygon features

- Variation in the number of lines that makes the polygon, their length (perimeter) and subsequently amounting to area.

9.3 Logical accuracy

This accuracy corresponds to completeness and correctness of data when a data set is

analyzed. Following tests would be performed to ensure the logical accuracy of the data sets:

An attribute query run on the datasets should give a consistent result in terms of

- Number of features selected;
- The content of the features selected.

Any data set resulting out of analysis of two or more datasets should be logical. Any spatial query run on the datasets should give the same result in terms of

- Number of features selected;
- The content of the features selected.

10.0 DATABASE DESIGN & STANDARDS

10.1 Database Design: A data design provides a comprehensive architecture for the database to be viewed in its entirety and evaluated as to how the various aspects of it need to interact. A good design results in a well-constructed, functionally- and operationally-efficient database that –

- Satisfies the objectives and supports requirements.
- Contains only required data without redundancy.
- Organizes data so that different users access the same data.
- Accommodates different versions of the data (i.e., allows manipulation and updates).
- Distinguishes applications that maintain data from those that use it.
- Appropriately represents codes and organizes geographical features and their relationships (topology).
- Support interoperability.

10.2 Database standards are an important element of the database design. Standards enable applications and technology to work together, they encourage efficiency and effectiveness, help reduce costs, protect investments in data against technological change, and lead to availability of accurate, compete and current data. Tools, applications

and data affect each other, and the standards are established with this condition.

10.3 Database construction guidelines

The digital database prepared under the DILRMP should form the base of any further activities, viz., revenue data management (RoR), spatial data management (geo-database), development and updation of land records, etc. Strong database standards, supported with the link to survey/resurvey procedures and future operational and maintenance procedures, are a must. This helps in backward and forward integration of the existing database with the ever-changing database management technology. Broadly, the database construction guidelines can be divided into four major categories under the present scope of digitization of cadastral maps, overlay on the satellite data and integration with textual data:

i) Satellite image database preparation.
ii) Digitization (analog to digital conversion) of cadastral village maps.
iii) Geo-referencing of digitized GIS data with satellite image data.
iv) Metadata generation and achieving of the database for transactional use.

10.4 Procedures for building the database

10.4.1 The elements of the database are to be created as per the standards herein and the vendors/agency/service provider has to take care that digitization is as per the standards. The inputs are subject to validation at each stage and will include qualitative as well as quantitative checks for input and output accuracy.

10.4.2 The creation of a clean digital database (topologically-corrected and geo-coded) is the most important and complex task upon which the usefulness of the database lies. Two aspects need to be considered here: one is the geographic data necessary to define where the parcel of land or, for that matter, any other feature is located, and second is its unique identification for associating attributes that link to the records. At every stage, there should be necessary and proper data verification to ensure that the resultant database is as free as possible from error. Errors would generally be of the following types:

- Spatial data are incomplete or double.
- Spatial data are in the wrong place.

- Spatial data are at the wrong scale.
- Spatial data are distorted.
- Spatial data are linked to wrong attributes.
- Non-spatial data are incomplete.

10.4.3 For evaluating the digital data, the following guidelines/parameters would be followed:

i) Assuring that appropriate digitization methods with proper template, accuracy, precision and quality check procedures are followed.

ii) Verification of the co-ordinate system (in CAD); projection and datum (in geo-database).

iii) Checks for digitization errors like silvers, dangles, and topology rules.

iv) Attribute verification providing the correctness of feature coding by listing it out and comparing with the manuscript maps. Randomly checking a few parcels for shape and form listing of polygons with null and duplicate attributes.

v) Verification of edge-match with adjacent sheets and villages by displaying them side by side.

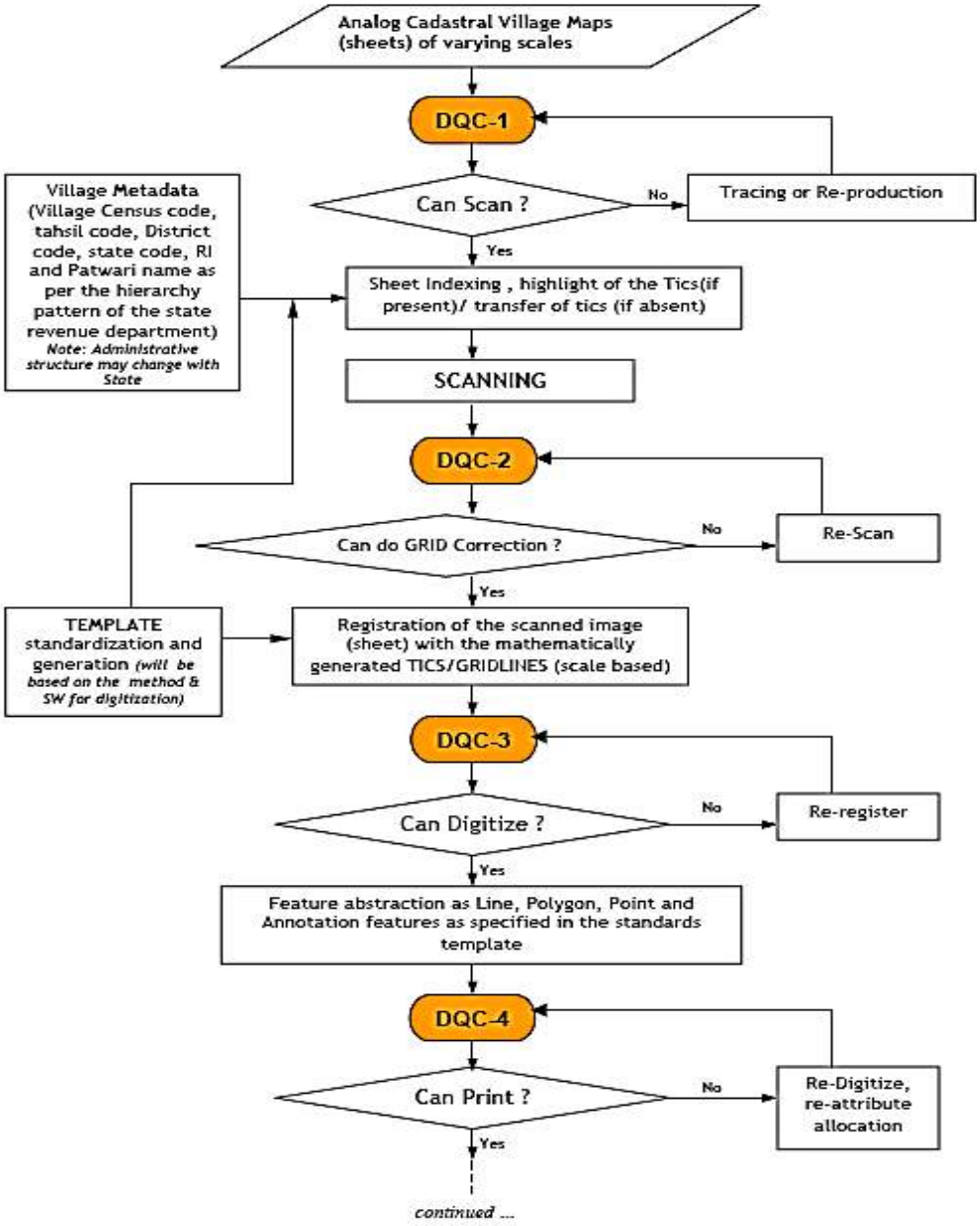
vi) Comparison of the total area of the village by aggregating the parcels, etc. vis-à-vis the area reported in census handbooks or available with the Land Records Department in the RoRs.

vii) Verification of geo-referenced control points (GCPs) and RMS (Root Mean Square) error for the transformation model.

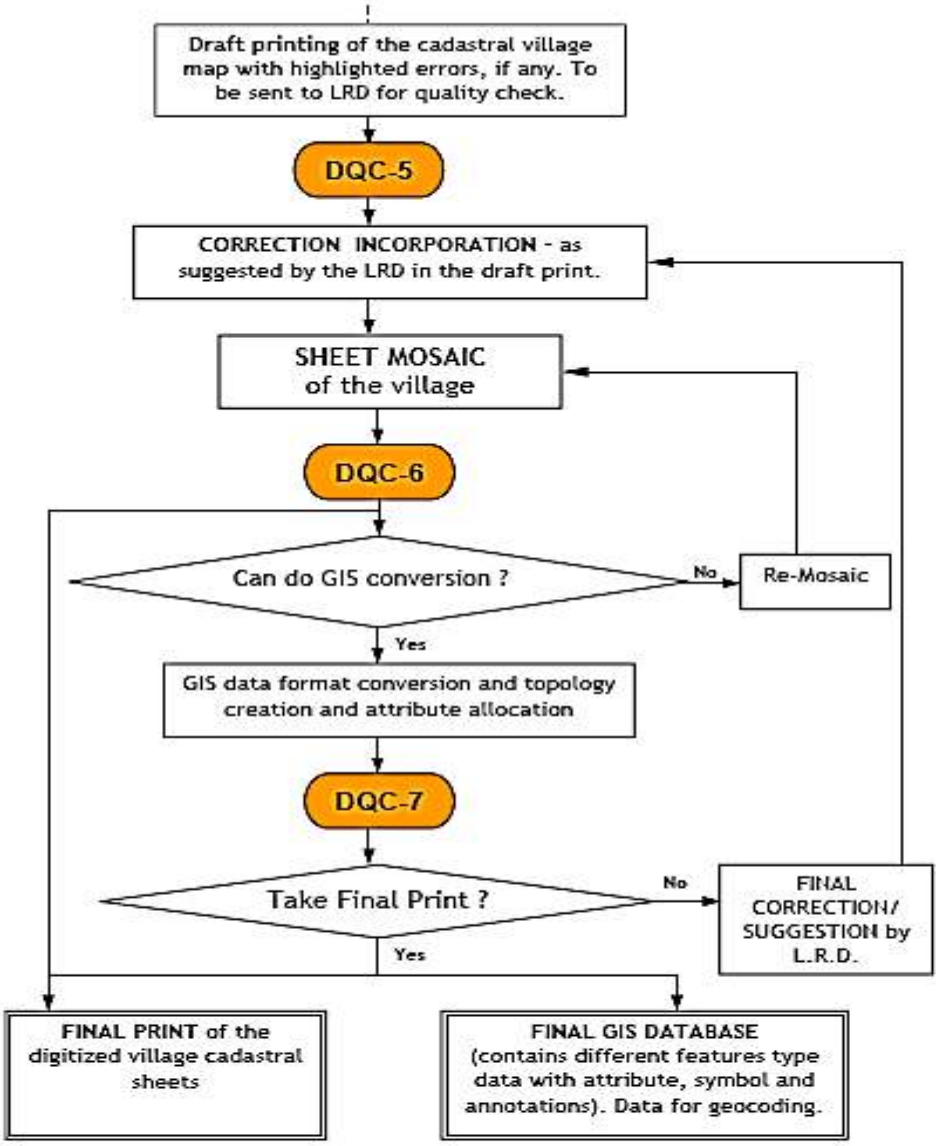
viii) Checks for mosaicing of maps and overlay on the satellite data.

ix) Attachment of appropriate metadata at all stages of the database preparation.

Flow chart of the Digitization process in NLRMP



Flow chart of the Digitization process in NLRMP



Digitization Quality Check (DQC 1 to 7) :

DQC-1 : Visual quality check of the analog sheets for visibility, readability, folds/straightness and scan worthy.
DQC-2 : Checking of the digital scanned sheets for DPI, format, quality, speckle removal, scan lines dropout, feature clarity and GRID correction worthy.
DQC-3 : Final checking of the GRID corrected scanned image with overlaid mathematical grid (scale dependent) and approval for the final feature abstraction.
DQC-4 : Quality assurance of the features abstracted from the sheet for its type, location and attribute. Also checking has been done for the unread attributes, features, null attribute and duplicate errors, if any.
DQC-5 : Detail quality checking of the digitized sheet be the Land Record Department (LRD) with detail error reporting and suggestion, if any.
DQC-6 : Checking for the feature continuity and attribute carry forward or loss of features of attribute during the mosaic process.
DQC-7 : Checking for the topologically corrected GIS feature conversion, its attribute allocation, duplicate IDs and Null IDs.

11.0 DIGITIZATION OF FMB/TIPPANS: In the States where ladder data is the basic records, the same is fed into the computer to generate tippan. The tippans are mosaiced to generate village maps.

12.0 FIELD MEASUREMENT BOOK (FMB)

FMB is a sketch showing measurement boundaries of the survey number. It is a rough sketch and not to scale. It provides a record of measurement and boundaries. Field Measurement Book contains several field measurement sheets covering measurements of all lands in a village. In some cases it is drawn to a scale of 1:1000 or 1:2000 showing all field and subdivision boundaries and their measurements. It is also called the atlas of field maps. A record of measurement of individual fields and subdivisions is thus provided, which will enable any inspecting officer to identify the boundaries, and whatever is required for investigation of boundary disputes, detection of encroachments, and for the measurement of further sub-divisions, etc.

12.1 Various components of the Field Measurement Book are discussed below:

12.1.1 G-line

This is an imaginary line (Guess Line) which converts the map into various sizes of triangles in order to accurately fix the boundary lines and the various points in the map. This line is the foundation on which the entire map is built. Any error in a G-line will affect all calculations based on that G-line.

12.1.2 F-line

It is the outer boundary line in a sketch, which signifies the actual field boundaries of the outer lines of the sketch. The F-line points are fixed with reference to its offset distance from the G-line.

12.1.3 Subdivision lines

These lines demarcate a small parcel of land within a survey number. A sub- divisional polygon’s extent is directly correlated to the extent found for the particular sub division. The sub-division lines are generally defined through a ladder, except for the graphical representation in the FMB.

12.1.4 Ladder

As mentioned earlier, the field line points are defined with reference to an offset distance from the G-line. The offset distance may be to the left or right side of the G-line. This left or right angle deviation (offset) is depicted by the ladder. By converting the ladder details into electronic data, one can produce the outline of the FMB sketch. The ladder details get attracted whenever there is a change in the field line, involving a bend.

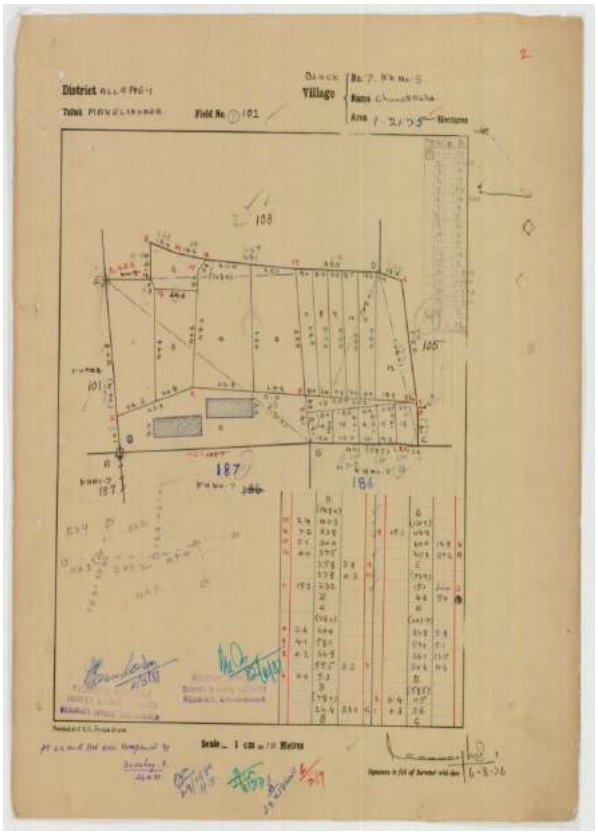
12.1.5 Extension lines

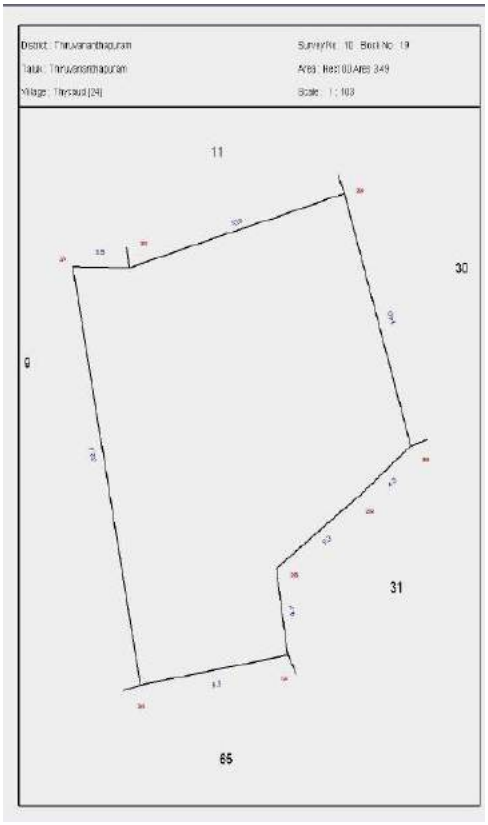
Each survey number field is an integral part of the village map and hence other fields surround each sketch. The exact direction in which the subject field joins the neighboring field is shown on the FMB as an extension line.

12.1.6 Neighboring field survey numbers

As mentioned earlier, each survey sketch is surrounded by other fields. These surrounding field numbers are marked around each FMB. This enables mosaicing of FMBs into D-sketches and village maps and so on.

13.0 In FMB, the traverse coordinates are provided in five columns. The FMBs also depict the dimensions of each field boundaries and the sub- divisions. As mentioned earlier, the field line points are defined with reference to an offset distance from the G-line. The offset distance may be to the left or right side of the G-line. This left or right angle deviation (offset) is depicted by Ladder. By converting the ladder details into electronic data, once can produce the outline of the FMB sketch. The ladder details get attracted whenever there is a change in the field line, involving a bent. At present, Field Measurement Books are drawn and maintained manually. Digitization of Field Measurement Books will result in faster processing of the FMB sketches including creation of new sub-divisions, modification of existing sketches, portability of data, facility to draw the FMB sketches to different scales leading to higher clarity, and quicker delivery of copies of FMBs to land-owners.

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Chapter-2

(A) Survey/Resurvey

MODEL-I

Pure Ground Method using ETS and DGPS

1.0 METHODOLOGY: This model should be adopted for survey/re-survey of the areas for which the ortho-photos from aerial photography or high-resolution satellite imagery (HRSI) are not available, or it is decided to carry out the survey work using ETS+DGPS and without going for aerial photography or HRSI. The technical details are also applicable to ground truthing in the hybrid methodology involving aerial photography or HRSI. The major steps involved will be:

1.1 Notifications, survey plan and publicity

a) Publication of notifications under the relevant rules of the State Government/UT Administration in the State/UT and District Gazettes by the Department concerned with the survey and settlement work.

b) Opening of a publicity cell at the district level, which will generate awareness among the owner(s)/enjoyer(s) in the area notified for survey, emphasizing the need for them to be present at the time of visit of the survey team, and to show the boundaries of their land parcels and participate in the survey and settlement process. The establishment of the publicity cell shall be the responsibility of the Department concerned with the survey and settlement work.

c) Preparation of a detailed schedule, tehsil/taluk-wise, of the visit of the survey team to each village, and to publish them at the district, tehsil/taluk and village levels. The program should be given wide publicity. The detailed schedule should be prepared by the survey agency, and, where the agency is outsourced, approved by the Department concerned with the survey and settlement work.

d) Circulating the detailed schedule of the visits of the survey team among the heads of the land-owning departments, so that the officials from those departments help the survey agency in the identification of the boundaries of the land parcels owned by their departments.

e) Publication of the village-level survey-plans, showing details of the day-wise program of survey in the concerned tehsil/taluk/village, at least 10 days before commencement of field survey. The revenue village should be taken as a unit for survey.

1.2 Preparations for the survey work using ETS+DGPS

a) There should be adequate number of survey teams and adequate number of adjudicating teams to complete the work as per the schedule.

b) Each survey team should have at least one ETS operator, one plane-tabler and four support staff.

c) Each survey team should have adequate number of field workers and supervisory staff conversant with the local language.

d) The adjudication team shall consist of the survey adjudicator, who will invariably be a Government official, assisted by one surveyor and one ETS operator. Where the work is outsourced, the vendor will provide the ETS operator along with equipment(s).

e) A well-equipped survey centre shall be established in each village by the survey agency. Where the work is outsourced, the State Government/UT Administration may decide upon sharing of the expenses between the government and the vendor.

f) A Gram Sabha meeting should preferably be called, to which the concerned local officials should be invited, and the entire action plan (including the day- wise survey schedule) should be discussed before commencing the survey work to facilitate further cooperation for the survey exercise.

g) Two tertiary control points and one auxiliary control point should be established with the help of the DGPS by extending the primary/secondary control network, before the commencement of ground truthing.

h) The tertiary and auxiliary control points should be plotted on a blank plane- table (PT) section on 1:2000 scale, on which the Universal Traverse Mercator (UTM) grids (X, Y) have been drawn.

1.3 Participatory ground truthing

(a) The field work shall commence as per the schedule published.

(b) Delineation of parcel boundaries shall be carried out using ETS and plane- tabling, as indicated below:

i) The surveyor with ETS will start the work from a tertiary control point, using the auxiliary control point for back sighting. The vertices/corner points of the land parcel will be surveyed as offsets from various traverse stations. The traverse will finally be closed on the second tertiary point for checking the accuracy of the traverse. The systematic errors in the traverse will be distributed for computing the final co-ordinates of vertices/corners of the land parcel. The work will be carried out with reference to the existing land records and as per the procedure laid down in the relevant Revenue manual, in the presence of the concerned owner(s)/enjoyer(s) and the owner(s)enjoyer(s) of the adjacent land parcels.

ii) The land parcel boundary, as surveyed using the ETS, will be plotted on the PT section in the field itself. For this purpose, the plane-tabler will position himself/herself close to the ETS, so as to enable plotting of the parcel boundaries simultaneously.

iii) Wherever there is reserved forest or land transferred to the Forest Department, or Government/community land is involved, the concerned officials should be involved in identifying the relevant parcel boundaries.

iv) The survey team should take care that the ridges which are not actually boundaries of the parcels, are not taken into account for delineation of the parcel boundaries.

v) In cases where collective cultivation is done, or where boundaries are not demarcated, the parcel boundaries should be recorded only after their demarcation on the ground has been carried out with reference to the existing land records and as per the procedure laid down in the relevant revenue manual, in the presence of the concerned owner(s)/enjoyer(s).

vi) Each land parcel should be identified by its owner(s)/enjoyer(s) and should be

given a unique ID which shall be used for linking the attributes data collected in respect of the land parcel.

vii) The land owner(s)/enjoyer(s), who intend to affix stones at their field junctions, may be shown the points where stones can be affixed.

viii) The current land use, irrigation status and other land attributes data shall also be collected by the survey team. All such information should also be incorporated on the PT and its auxiliary records

1.4 Survey of Government/community lands

(a) The village-wise list of Government/community lands with area and the list of private lands adjoining those lands shall be prepared by the survey agency. The Government/community lands shall be surveyed first, preferably in the presence of officials from the concerned departments/PRI representatives, who should bring necessary records with them, and the owner(s)/enjoyer(s) of the adjoining parcels.

(b) The land parcel maps pertaining to the Government/community land parcels should be handed over to the concerned officials, who shall record objections, if any.

1.5 Details of the land parcels should be recorded in the prescribed formats. Acknowledgement, responsibilities and quality control

After surveying the parcel boundaries and plotting them on the plane-table sections, the authorized representative of the survey team shall affix his/her signature and seal on the spatial record so created, and, thereafter, shall proceed to obtain the signatures of the owner(s)/enjoyer(s) and also those of the concerned Revenue official(s), in case the survey work is outsourced, certifying that the survey has been carried out in their presence and to the satisfaction of the owner(s)/enjoyer(s). Information containing the details of the surveyors, who have carried out the survey, should also be recorded. 100% verification and validation shall be carried out, by the Department concerned with the survey and settlement work, for quality control, against each field PT section.

1.6 Digital topographic database (DTDB) and final plotting

The boundaries of parcels surveyed shall be downloaded from the ETS and linked with the attributes data collected, in the GIS format so as to create the DTDB. The final plotting

and softcopy DTDB of the land parcels and other topographic details shall be generated from the ETS data and associated software by the survey agency.

2.0 PREPARATION AND DISTRIBUTION OF DRAFT LAND PARCEL MAPS (LPMS) AND LINKING ATTRIBUTES

(a) The draft LPM should be prepared for each land parcel, in duplicate. The draft LPM shall be given to the concerned owner(s)/enjoyer(s) preferably by the same evening, or latest by the next morning, for receiving objections, if any.

(b) The draft LPM shall contain:

i) The LPM sketch at a suitable scale to fit to an A4 size paper. The scale should be rounded off to the next scale of 50 (e.g., if the scale is coming to 1:446, then it should be fitted to a scale of 1:450; in case the scale is coming as 1:421, then it should be fitted to a scale of 1:450; and in case the scale required to fit in the paper is 1:496, then it should be fitted to a scale of 1:500).

ii) The actual dimensions of the parcel and details of the adjoining survey numbers should be indicated on the sketch.

iii) The attributes of the land parcel should also be printed in a tabular form, at the back of the sketch.

3.0 RECORDING OBJECTIONS

A register shall be maintained by the survey agency to record and track the objections raised by the owner(s)/enjoyer(s). The objections should also be flagged in the DTDB for better control and monitoring.

4.0 OBJECTIONS REDRESSAL/ADJUDICATION

(a) Individual notices in the prescribed format, as per the provisions of the applicable revenue manual, shall be given to all recorded owner(s)/enjoyer(s) with a copy of the land parcel map and measurement details, marked on the same notice. The notices shall be served, either personally, or sent by registered post with acknowledgement due, if the land owner(s)/enjoyer(s) live outside the concerned area. On the expiry of the stipulated period, if any objection is raised by the owner(s)/enjoyer(s), it shall be recorded in the Objections Register.

(b) The survey team shall assist the Government officers in resolving the objections. The survey team will resurvey the field of the owner(s)/enjoyer(s), if required and incorporate the necessary changes and generate the revised LPM.

(c) The survey team shall maintain the Objections Register. The objections shall also be tracked in the DTDB in GIS form.

5.0 SURVEY COMPLETION REPORT

After completion of the survey, the survey team shall submit the completion report to the Department concerned with the survey and settlement work.

6.0 PROMULGATION OF SURVEY

(a) Subsequently, the draft record of land register, village map, and individual parcel maps of agricultural and non-agricultural lands would be displayed for the stipulated period in the office of the Gram Panchayat and tehsil/taluk for the information of the public.

(b) A record of the complaints received during the above-mentioned period, should be maintained, and each complaint received should be acknowledged by a receipt.

(c) The complaints received shall be verified and necessary corrections, if warranted, shall be carried out. The survey agency shall carry out the resurvey of the land parcel, if required.

(d) The adjudication team will take up the objections, village-wise. They should draw up a day-wise program for redressal of the objections and inform the concerned owner(s)/enjoyer(s) within the prescribed timeframe as per the State/UT laws/manuals. They shall dispose of all objections as per the relevant Acts/rules.

(e) As soon as the disposal of objections is completed, a final notification under the relevant Acts/rules/regulations will be published as per the prescribed procedure, completing the process of survey.

(f) The land parcel register will be updated by the survey agency as per the information received from the adjudication team, after the latter has redressed the objections.

7.0 IMPORTANCE OF QUALITY CHECK

Since these survey records will form the basis of the conclusive titling system, they must be prepared with utmost care and accuracy. Hence, the Department concerned with survey and settlement will be responsible for ensuring 100% quality check at each stage of the preparation of the survey records and the responsibilities for this checking must be clearly spelt out among the Departmental officials. The patwari shall carry out 100% checking, and the Revenue Inspector, tehsildar or an officer of the equivalent rank, the SDO and the Deputy Commissioner/District Collector should randomly check 50%, 10%, 3% and 1%, respectively, or as stipulated in the State/UT laws/manuals. A strict view should be taken where too many errors are found un-checked in the survey records.

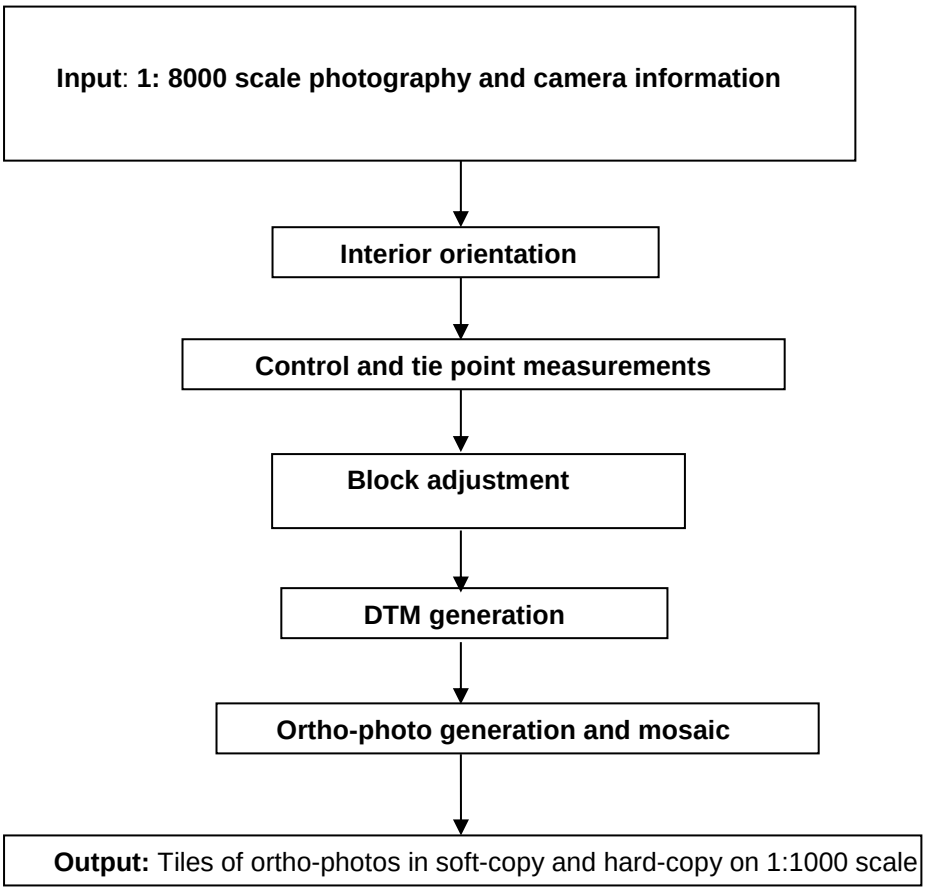
MODEL-II

Hybrid Survey Methodology using Aerial Photography and Ground Truthing using DGPS/ETS

1.0 SURVEY METHODOLOGY

1.1 The major steps involved in cadastral survey using aerial photography and ground truthing by ETS/DGPS are:

1.1.1 Generation of ortho-photos, i.e., terrain-corrected digitally-rectified aerial photographs in softcopy and hardcopy (bromide/coated paper prints) by digital photogrammetric techniques by the technical agency/vendor designated for the purpose by the State Government/UT Administration. The following flow chart indicates the technical process involved:



1.1.2 Notifications, survey plan and publicity

a) Publication of notifications under the relevant rules of the State Government/UT Administration in the State/UT and District Gazettes by the Department concerned with the survey and settlement work.

b) Opening of a publicity cell at the district level, which will generate awareness among the owner(s)/enjoyer(s) in the area notified for survey, emphasizing the need for them to be present at the time of visit of the survey team, and to show the boundaries of their land parcels and participate in the survey and settlement process. The establishment of the publicity cell shall be the responsibility of the Department concerned with the survey and settlement work.

c) Preparation of a detailed schedule, tehsil/taluk-wise, of the visit of the survey team to each village, and to publish them at the district, tehsil/taluk and village levels. The program should be given wide publicity. The detailed schedule will be prepared by the survey agency, and, where the agency is outsourced, approved by the Department concerned with the survey and settlement work.

d) Circulating the detailed schedule of the visits of the survey team among the heads of the land-owning departments, so that the officials from those departments help the survey agency in the identification of the boundaries of the land parcels owned by their departments.

e) Publication of the village-level survey plans, showing details of the day-wise program of survey in the concerned tehsil/taluk/village, at least 10 days before commencement of field survey. The revenue village should be taken as the unit for survey.

1.1.3 Preparations for ground truthing

a) There should be adequate number of survey teams and adequate number of adjudicating teams to complete the work as per the schedule.

b) Each survey team should have at least one ETS operator and two support staff.

c) Each survey team should have adequate number of field workers and supervisory staff conversant with the local language.

d) The adjudication team shall consist of the survey adjudicator, who will invariably be

a Government official, assisted by one surveyor and one ETS operator. Where the work is outsourced, the vendor will provide the ETS operator along with an ETS.

e) A well-equipped survey centre shall be established in each village by the survey agency. Where the work is outsourced, the State Government/UT Administration may decide upon sharing of the expenses between the Government and the vendor.

f) All tiles of ortho-photos (on bromide/coated paper prints) covering a village shall be handed over to the village-level survey team well before the commencement of field work.

g) Before the commencement of survey in the village, quality checking of the ortho-photo images shall be carried out for clarity of details in the bromide/coated paper prints. A report shall be submitted by the survey team regarding the suitability/unsuitability of the print for ground truthing. If the print is of poor quality or of poor brightness/contrast, or if there is any problem relating to plotting, a fresh print will be taken out.

h) A Gram Sabha meeting should preferably be called, to which the concerned local officials should be invited, and the entire action plan (including the day- wise survey schedule) should be discussed before commencing the survey work to facilitate further cooperation for the survey exercise.

1.1.4 Participatory ground truthing of land parcels

a) The field work shall commence as per the schedule published.

b) The field team shall mark boundaries of the land parcels on the bromide/coated paper prints, as shown by the concerned owner(s)/enjoyer(s) in the presence of the owner(s)/enjoyer(s) of the adjacent land parcels.

c) After identifying boundaries in the presence of the owner(s)/enjoyer(s) and marking them in the bromide/coated paper prints, the survey team should obtain an acknowledgement from the owner(s)/enjoyer(s)/concerned officials that the boundaries and details of the land parcel are recorded in their presence and to their satisfaction. The details of the surveyors, who have carried out the survey, should also be recorded.

d) In case the parcel limits are obscured in the ortho-photo, or the ortho-photo is not available, parcel boundaries, as shown by the concerned owner(s)/enjoyer(s) in the presence of the owner(s)/enjoyer(s) of the adjacent land parcels, shall be surveyed using ETS/DGPS. In such cases, the survey agency shall generate the land parcel map based

on their ETS readings and obtain acknowledgement of each plot/parcel from the owner(s)/enjoyer(s).

e) The tertiary control point should be used as the reference station for DGPS. The tertiary control point and auxiliary point should be used for ETS survey. The plot boundaries can also be surveyed using the offsets from the details appearing on the ortho-photo, in which case, tertiary control and auxiliary points will not be needed.

f) The survey team should take care that the ridges, which are not actually boundaries of the parcels, are not taken into account for delineation of the parcel boundaries.

g) In cases where collective cultivation is done, or where boundaries are not demarcated, the parcel boundaries should be recorded only after their demarcation on the ground has been carried out with reference to the existing land records and as per the procedure laid down in the relevant Revenue manual, in the presence of the concerned owner(s)/enjoyer(s).

h) Each land parcel should be identified by its owner(s)/enjoyer(s) and should be given a unique ID, which shall be used for linking the attributes data collected in respect of the land parcel.

i) The land owner(s)/enjoyer(s), who intend to affix stones at their field junctions, may be shown the points where stones can be affixed.

j) The current land use, irrigation status and other land attributes data shall also be collected by the survey team as per the Data Model Structure (DMS).

1.2 Survey of Government/community lands

a) The village-wise list of Government/community lands with area and the list of private lands adjoining those lands shall be prepared by the survey agency. The Government/community land shall be surveyed first, preferably in the presence of officials from the concerned Departments/PRI representatives, who should bring necessary records with them and the owner (s)/enjoyer(s) of the adjoining parcels.

b) The land parcel map pertaining to the Government/community land parcels should be handed over to concerned officials, who shall record objections, if any.

c) Details of land parcels should be recorded in the prescribed formats.

1.3 Acknowledgement, responsibilities and quality control

After surveying the parcel boundaries, the authorized representative of the survey team shall affix his/her signature and seal on the spatial record so created, and, thereafter, shall proceed to obtain the signatures of the owner(s)/enjoyer(s) and also those of the concerned Revenue official(s), in case the survey work is outsourced, certifying that the survey has been carried out in their presence and to the satisfaction of the owner(s)/enjoyer(s). Information containing the details of the surveyors, who have carried out the survey, should also be recorded. 100% verification and validation shall be carried out, by the Department concerned with the survey and settlement work, for quality control.

1.4 Creation of Digital Topographic Database (DTDB)

The boundaries of parcels delineated in the presence of owner(s)/enjoyer(s)/officials should be digitized in GIS format and the attribute information collected in prescribed proforma should be linked as GIS to create the Digital Topographic Database (DTDB). Preparation and distribution of draft land parcel map (LPM) and linking attributes

1.5 The draft LPM should be prepared for each land parcel, in duplicate. The draft LPM shall be given to the concerned owner(s)/enjoyer(s) preferably by the same evening or latest by the next morning, for receiving objections, if any.

1.6 The draft LPM shall contain:

a) The LPM sketch at a suitable scale to fit to an A4 size paper. The scale should be rounded off to the next scale of 50 (e.g., if the scale is coming to 1:446, then it should be fitted to a scale of 1:450; in case the scale is coming as 1:421, then it should be fitted to a scale of 1:450; and in case the scale required to fit in the paper is 1:496, then it should be fitted to a scale of 1:500).

b) The actual dimensions of the parcel and details of the adjoining survey numbers should be indicated on the sketch.

c) The attributes of the land parcel should also be printed in a tabular form, at the back of the sketch.

2.0 RECORDING OBJECTIONS

A register shall be maintained by the survey agency to record and track the objections

raised by the owner(s)/enjoyer(s). The objections should also be flagged in the DTDB for better control and monitoring.

3.0 OBJECTIONS REDRESSAL/ADJUDICATION

a) Individual notices in the prescribed format, as per the provisions of the applicable revenue manual, shall be given to all recorded owner(s)/enjoyer(s) with a copy of land parcel map and measurement details, marked on the same notice. The notices shall be served, either personally or sent by registered post with acknowledgement due, if the land owner(s)/enjoyer(s) live outside the concerned area. On the expiry of the stipulated period, if any objection is raised by the owner(s)/enjoyer(s), it shall be recorded in the Objections Register.

b) The survey team shall assist the Government officers in resolving the objections. The survey team will resurvey the field of the owner(s)/enjoyer(s), if required, and incorporate the necessary changes and generate the revised LPM.

c) The survey team shall maintain the Objections Register. The objections shall also be tracked in the DTDB in GIS form.

4.0 SURVEY COMPLETION REPORT

After completion of the survey, the survey team shall submit the completion report to the Department concerned with the survey and settlement work.

5.0 PROMULGATION OF SURVEY

a) Subsequently, the draft record of land register, village map, and individual parcel maps of agricultural and non-agricultural lands would be displayed for the stipulated period in the office of the Gram Panchayat and tehsil/taluk for the information of the public.

b) A record of the complaints received during the above-mentioned period, should be maintained, and each complaint received should be acknowledged by a receipt.

c) The complaints received shall be verified and necessary corrections, if warranted, shall be carried out. The survey agency shall carry out the resurvey of the land parcel, if required.

d) The adjudication team will take up the objections, village-wise. They should draw up

a day-wise program for redressal of the objections and inform the concerned owner(s)/enjoyer(s) within the prescribed timeframe as per the State/UT laws/manuals. They shall dispose of all objections as per the relevant Acts/rules.

e) As soon as the disposal of objections is completed, a final notification under the relevant Acts/rules/regulations will be published as per the prescribed procedure, completing the process of survey.

f) The land parcel register will be updated by the survey agency as per the information received from the adjudication team, after the latter has redressed the objections.

6.0 IMPORTANCE OF QUALITY CHECK

Since these survey records will form the basis of the conclusive titling system, they must be prepared with utmost care and accuracy. Hence, the Department concerned with survey and settlement will be responsible for ensuring 100% quality check at each stage of the preparation of the survey records and the responsibilities for this checking must be clearly spelt out among the Departmental officials. The patwari shall carry out 100% checking, and the Revenue Inspector, tehsildar or an officer of the equivalent rank, the SDO and the Deputy Commissioner/District Collector should randomly check 50%, 10%, 3% and 1%, respectively, or as stipulated in the State/UT laws/manuals. A strict view should be taken where too many errors are found un-checked in the survey records.

MODEL-III

Survey Methodology using Satellite Imagery and Ground Truthing with DGPS and ETS

(Based on inputs from the ISRO)

1.0 THE DGPS SURVEY is a very critical element in this methodology. The high-resolution satellite imagery is geo-coded using precise ground control survey. The GPS coordinates for each ground control point (GCP) are collected and processed in a precise manner. The sequence of steps of the DGPS survey is given below:

- Identification of the reference station in the centre of the study area
- GPS data collection, using dual frequency geodetic GPS receivers, for 72 hours
- Determining the reference station coordinates with reference to National Spatial Reference Frame (NSRF) established by Survey of India as per National Map Policy (NMP), 2005
- Identification of GCP locations in the satellite image
- Collection of GPS data at GCP locations for 3 hours
- Determining the GCP coordinates, with reference to the reference station, in DGPS mode
- Quality verification of GCP coordinates

2.0 BUNDLE BLOCK ADJUSTMENT: Where multiple over-lapping images are taken and control points established, all images can be adjusted for parallax simultaneously. This process is known as Bundle Block Adjustment. Digital photogrammetric bundle block adjustment of multi-resolution and multi-mode satellite data, all together, is carried out in DPS COTS (Digital Photogrammetric Station Commercial Off- the-Shelf) packages:

- Cartosat-1 Stereo-scopic data for entire area
- LISS-IV MX nadir mono-scopic data for entire area
- Cartosat –2/2A nadir mono-scopic data limited area.

The final adjusted block is seamless among Cartosat-1, LISS-IV and Cartosat-2. The

photogrammetric processing will ensure perfect one-to-one correspondence between different data sets facilitating optimum utilization of multi-resolution satellite data set.

3.0 DIGITAL ELEVATION MODEL (DEM) GENERATION: DEM can be generated by semi-automatic techniques to the accuracy required for ortho-rectification. A regular DEM is generated from the point clouds produced by forward intersection via triangulation and interpolation. DEM editing via cloud- and water-masks, etc. is carried out to generate error-free DEM.

4.0 ORTHO-PRODUCT GENERATION, i.e., generating an image corrected for terrain-induced distortions for achieving better planimetric accuracy

- Ortho-rectification of Cartosat-1 Aft images for the entire study area
- Physically separate images, but virtually seamless
- Ortho-rectification of LISS-IV MX images for the entire study area
- Physically separate images, but virtually seamless
- Ortho-rectification of Cartosat-2/2A images for few areas
- Physically separate images, but virtually seamless with Cartosat- 1 and Linear Imaging Self-Scanner (LISS)-IV images

5.0 DATA FUSION, i.e., synergistic merging of higher resolution black- and-white (panchromatic) data with coarser resolution colour (multi- spectral) data for getting colour-coded images of high resolution

- Fusing of CartoSAT-1 PAN and LISS-IV MX ortho-images to obtain high resolution (2.5m) MX images, individually for the entire area.
- Fusing of Cartosat-2/2A PAN and LISS-IV MX ortho-images to obtain high resolution (1m) MX images, individually for selected dense cadastral area.

6.0 QUALITY VERIFICATION

- Accuracy of fused ortho-products (10 cm and 20 cm) is carried out using GPS-based ground check points.
- Positional accuracy of individual product or image, internal distortions within an image and seamlessness across images (image-to-image) are carried out through checkpoints.

- Only those products which pass through this quality verification should be used.

7.0 OVERLAY OF CADASTRAL MAPS ON HIGH-RESOLUTION SATELLITE IMAGE (HRSI)

The vectorized cadastral maps are overlaid on high-resolution satellite images to find out the changes in parcel quantity and quality in terms of size and shape. Based on the changes, the areas are identified for re-survey and updation. The procedure is described in Flow Chart 4 and the details are given below:

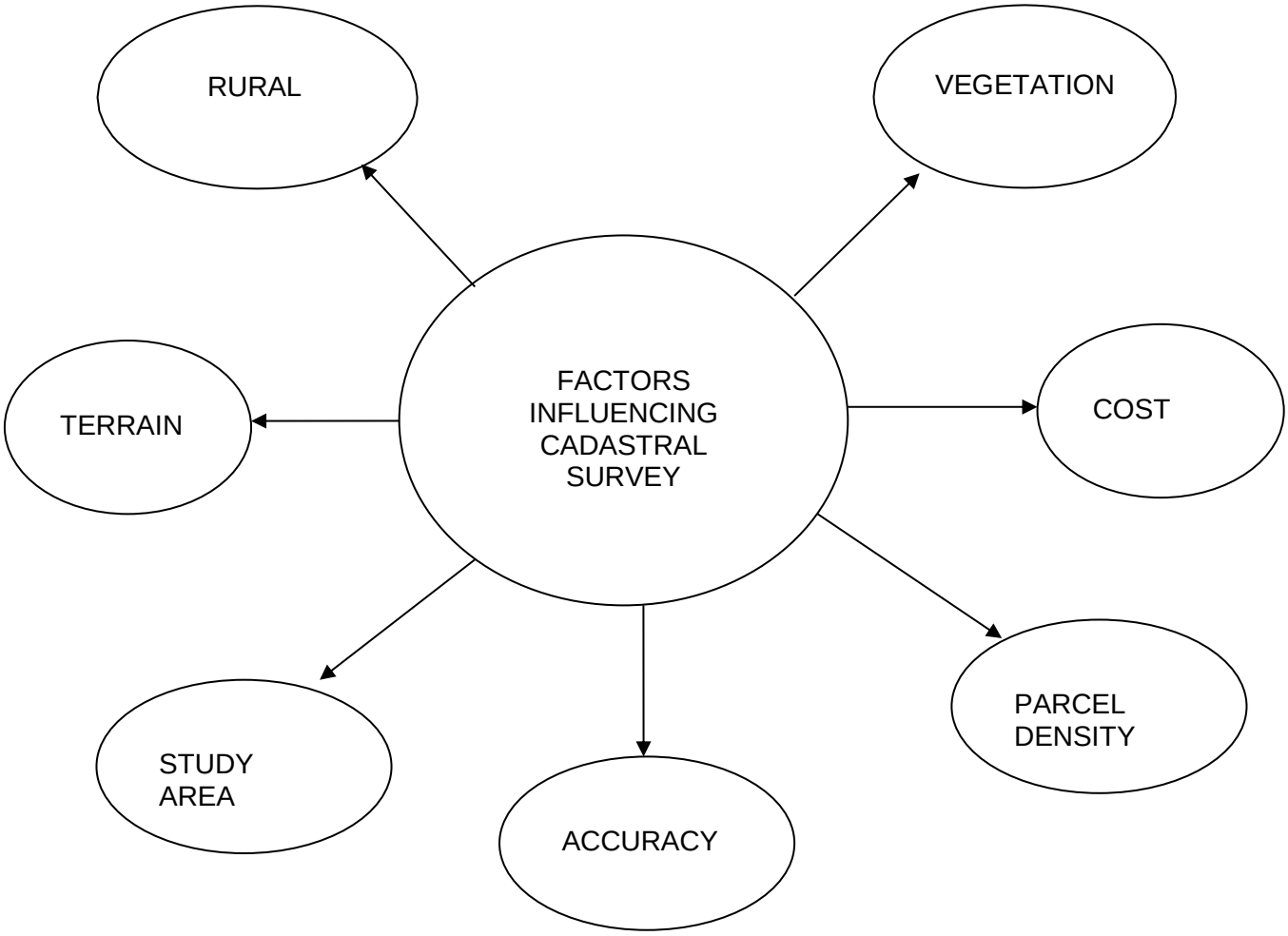
- The high-resolution satellite images are generated from fused ortho- products from CartoSAT-1, CartoSAT-2/2A and LISS-IV MX images.
- The analog cadastral maps are vectorized and village-level digital cadastral maps are prepared. Few ground control points are collected using DGPS survey.
- For each village, 15 to 20 GCPs are collected with reference to HRSI. The GCP numbers and their distribution play a major role in overlaying the cadastral maps on HRSI with good accuracy.
- For transferring the cadastral map to the HRSI image, the mathematical model used is the affine transformation model. The model is validated in terms of residual error at each GCP location and root mean square value of the model. In general, the threshold for RMS value and residual error is 1-pixel and 2-pixels respectively.
- Based on the validated model, the village cadastral maps are geo- referenced and new outputs are generated.
- The individual geo-referenced vectors are overlaid on HRSI. The primary network of each village map, i.e., road network, drainage network, water-bodies and *abadi*is verified across the village. Well- defined field boundaries are also validated.
- Using a similar process, all villages in a tehsil/taluk are geo-referenced and validated.
- All the villages in a tehsil/taluk are overlaid on the satellite data and validated for under-lap and over-lap across the villages as per the acceptable threshold defined for the purpose.
- Based on the thresholds, appropriate corrections are carried out.

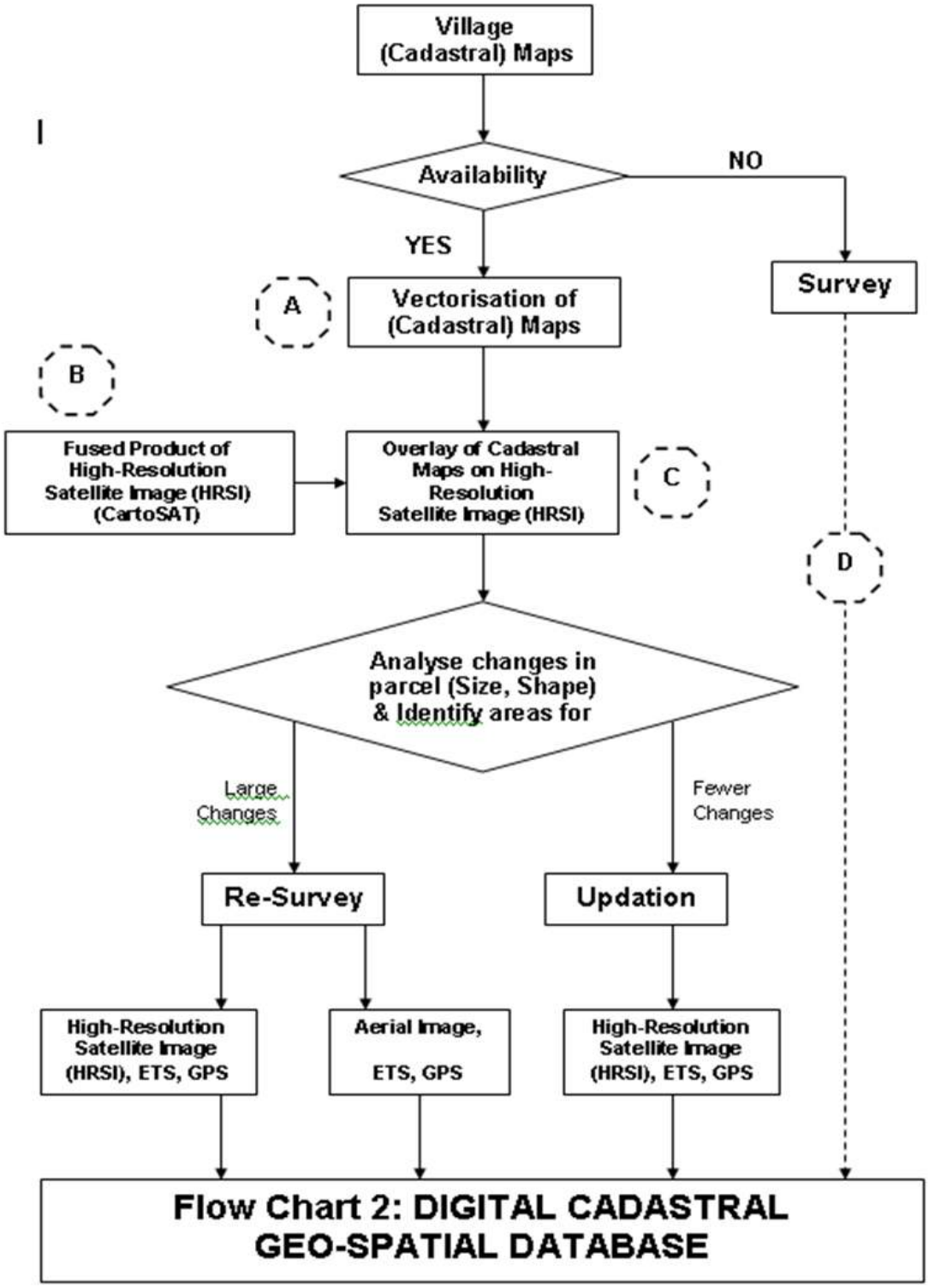
- After due corrections, a single mosaic of all the village parcels in a given tehsil/taluk is generated.
- This is the final product that is used for identifying the areas for resurvey and updation.

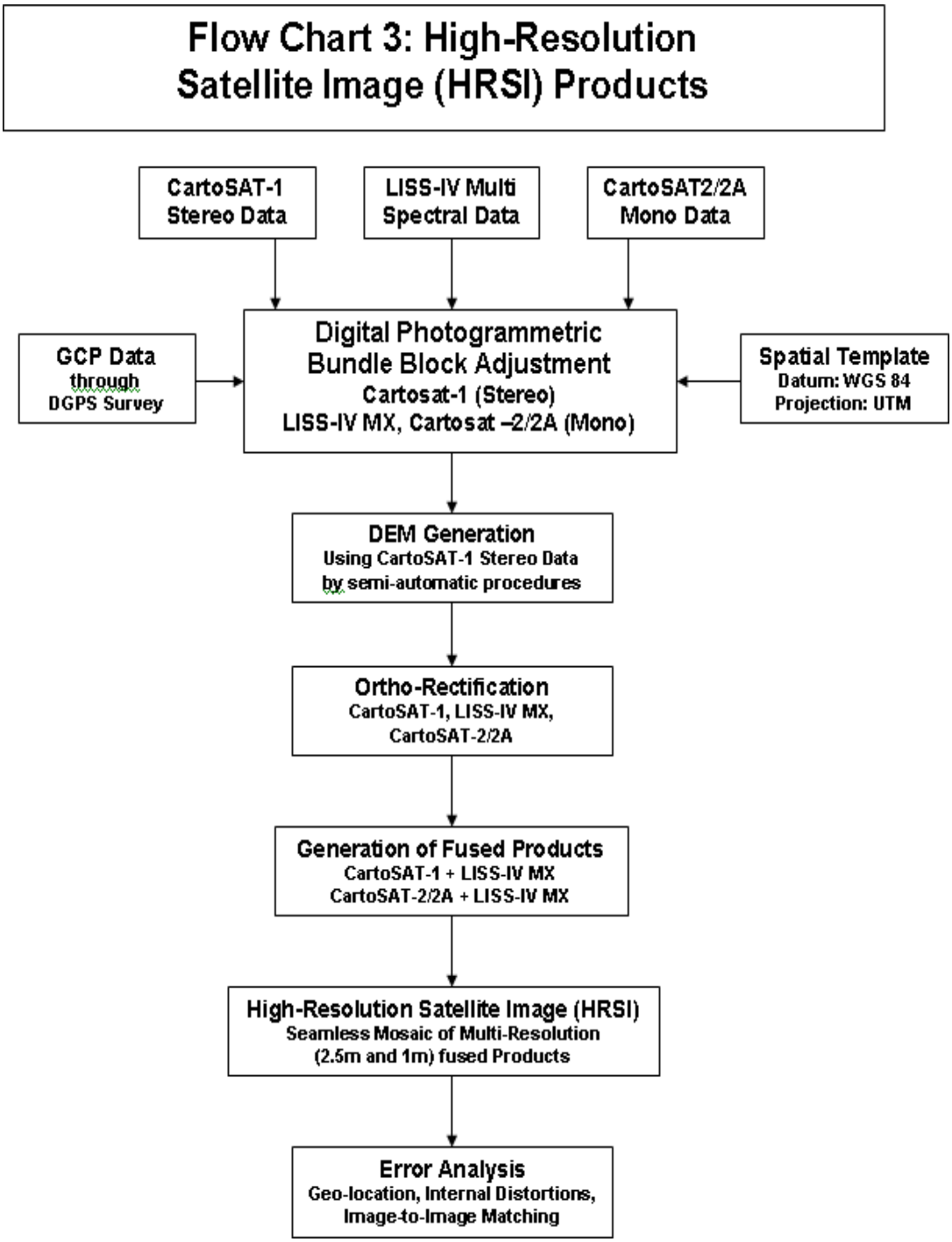
8.0 GROUND TRUTHING

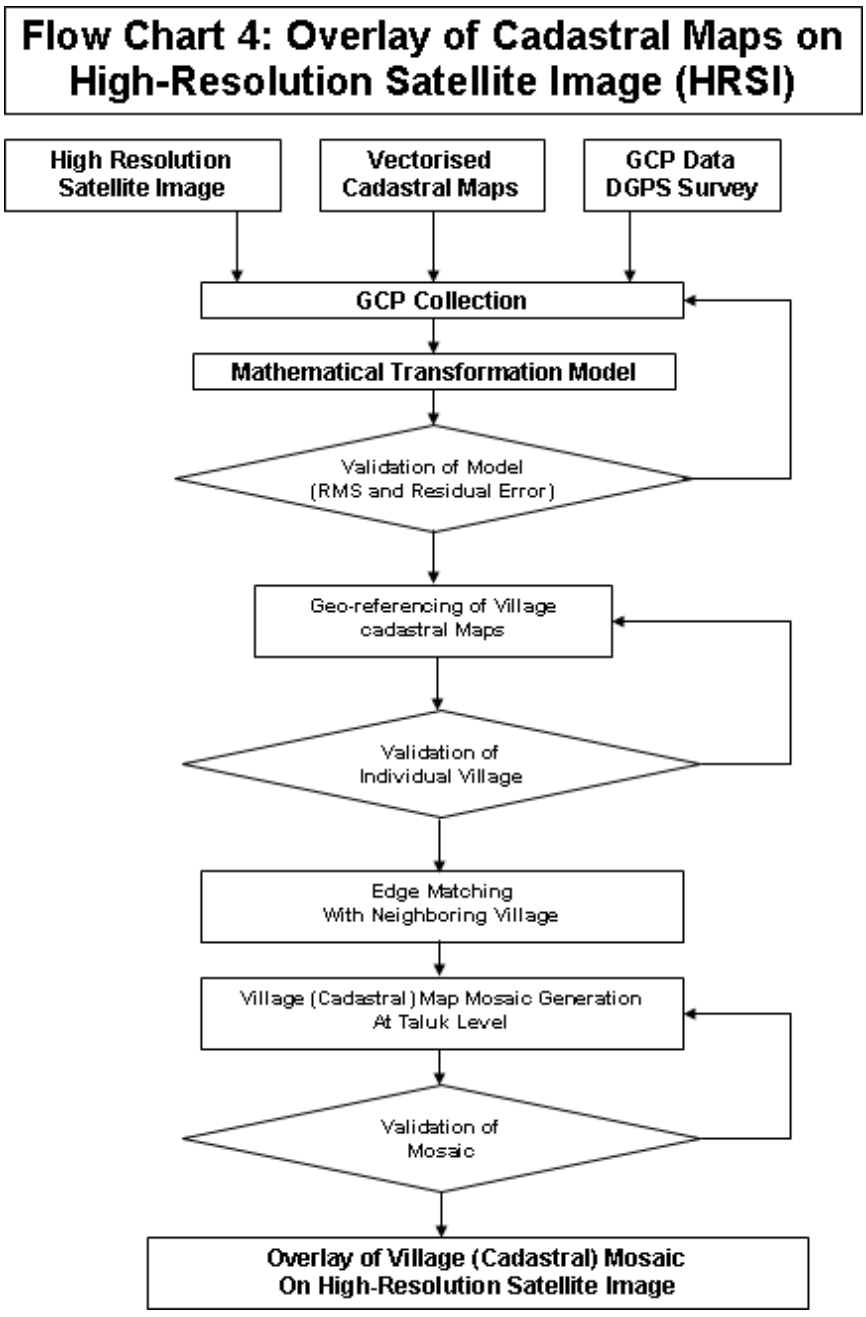
For ground truthing and other steps in completing the survey and settlement process, the Model-I (Ground Method of survey/resurvey using TS and DGPS) may be referred to.

Flow Chart 1: Factors influencing Cadastral Survey




Village (Cadastral) Maps
Availability
NO
YES
Survey
A
Vectorisation of (Cadastral) Maps
B
Fused Product of High-Resolution Satellite Image (HRSI) (CartoSAT)
Overlay of Cadastral Maps on High-Resolution Satellite Image (HRSI)
C
D
Analyse changes in parcel (Size, Shape) & Identify areas for
Large Changes
Fewer Changes
Re-Survey
Updation
High-Resolution Satellite Image (HRSI), ETS, GPS
Aerial Image, ETS, GPS
High-Resolution Satellite Image (HRSI), ETS, GPS
Flow Chart 2: DIGITAL CADASTRAL GEO-SPATIAL DATABASE


Flow Chart 3: High-Resolution Satellite Image (HRSI) Products
CartoSAT-1 Stereo Data
LISS-IV Multi Spectral Data
CartoSAT2/2A Mono Data
GCP Data through DGPS Survey
Digital Photogrammetric Bundle Block Adjustment
Cartosat-1 (Stereo)
LISS-IV MX, Cartosat –2/2A (Mono)
Spatial Template
Datum: WGS 84
Projection: UTM
DEM Generation
Using CartoSAT-1 Stereo Data
by semi-automatic procedures
Ortho-Rectification
CartoSAT-1, LISS-IV MX,
CartoSAT-2/2A
Generation of Fused Products
CartoSAT-1 + LISS-IV MX
CartoSAT-2/2A + LISS-IV MX
High-Resolution Satellite Image (HRSI)
Seamless Mosaic of Multi-Resolution
(2.5m and 1m) fused Products
Error Analysis
Geo-location, Internal Distortions,
Image-to-Image Matching


Flow Chart 4: Overlay of Cadastral Maps on High-Resolution Satellite Image (HRSI)
High Resolution Satellite Image
Vectorised Cadastral Maps
GCP Data DGPS Survey
GCP Collection
Mathematical Transformation Model
Validation of Model (RMS and Residual Error)
Geo-referencing of Village cadastral Maps
Validation of Individual Village
Edge Matching With Neighboring Village
Village (Cadastral) Map Mosaic Generation At Taluk Level
Validation of Mosaic
Overlay of Village (Cadastral) Mosaic On High-Resolution Satellite Image

(B) Setting up the Ground Control Network

1.0 INTRODUCTION

The Survey of India is undertaking the task of establishing a ground control point library (GCPL) for the entire country. In the first phase, 300 points of GCPs have been established at a spacing of 200 to 300 km apart. 2200 points, at a spacing of 30 to 40 km apart are to be established in the second phase of their project. Survey of India is in the process of establish Continuous Operating Reference Stations (CORS) network for the entire country which would become the National Spatial Reference Frame for provision of Ground Control Network Points. Therefore, extension of Tertiary & Auxiliary establishment of ground control points has to be done by implementing agency only.

2.0 CONTROL POINTS: All the control points should be based on datums given below:

2.1 Horizontal Datum: WGS-84 (i.e., the latest version of the World Geodetic System standard for use in cartography)

2.2 Vertical Datum: MSL, i.e., the Mean Sea Level.

3.0 PRIMARY CONTROL POINTS

3.1 Horizontal

The primary control points of the Survey of India (SoI), provided by static GPS observation (72 hours) with dual frequency GPS receivers, should be used. The primary control points of the SoI have been post-processed with precise ephemeris adjusted with the help of Bernese s/w to the ITRF co-ordinate system. All the secondary and tertiary control points should be connected to the primary control points of the SoI, to ensure connection to the National Framework.

3.2 Vertical

The precision Bench Marks of the SoI should be used as primary vertical control.

4.0 SECONDARY CONTROL POINTS

4.1 Horizontal

The secondary control points of the SoI should be used, wherever available. In areas where the requisite density of secondary control points (16 km) are not available from the SoI, these should be provided.

i. **Best places for affixation:** In protected areas like premises of government buildings including school buildings, veterinary hospitals, etc. and other protected structures, etc. The selected site should be open and clear to sky with a cut off angle of 15º. High- tension power lines, transformers, electric sub-stations, microwave towers, high-frequency dish antennas, radars, jammers, etc., which interfere with GPS signals, should be strictly avoided.

ii. **Densification:** 16 km average

iii. **Instrument to be used:** Dual-frequency GPS receivers

iv. **Accuracy levels required:** 1 cm as determined by the residuals of the network adjustment with 95% confidence interval

v. **GPS network design:** Secondary control points should be observed with a geometrically sound network plan, connected to primary control points of the SoI.

vi. **Schedule of observations:** Observations should be scheduled with proper mission planning, considering the optimum availability and geometric dilution of precision (GDOP) of satellites (i.e., geometric strength of satellite configuration on GPS accuracy). Minimum observation time should be 3 hours.

vii. Monumentation of secondary control points

- Rock-stone or Sand-stone 23*23*75 cm or RCC.
- The control point should be 15 cm above the ground and 60 cm inside the ground.
- The control points should be fixed to the ground using at least 15 cm of cement block.
- Monuments shall bear a triangle on top with a plummet hole in the middle and a 15 cm steel rod inserted (flush with concrete surface).
- The control point number should be inscribed on the monument.

4.2 Vertical

All the secondary control points should be connected by spirit-leveled heights. The leveling lines for such connections should terminate at precision control points of the SoI and all errors adjusted within them.

Permissible error for leveling line: 0.025 ♪k (in metres), where k is the length of leveling line in km.

5.0 TERTIARY CONTROL POINTS

5.1 Distribution: These shall be governed by the photogrammetric requirements of the block of imagery for which photogrammetric survey is to be carried out. The distribution and location of horizontal, vertical and full control points should be decided after preparing the photo-index with the help of input images.

5.2 GCP selection criteria: The selection of location for a control point on the photograph will depend on the identification of the image point and the measurement characteristics of the image point. But, at the same time, they should also meet the horizon parameters (15º cut-off angle). Thus, the criteria for selection of such points should be:

a) GCP should be precisely identifiable on aerial imagery as well as on the ground.

b) GCP should be a sharp point on image and ground.

c) The selected GCP shall be open and clear to the sky, without any obstruction to the sky.

5.3 Post-pointing: All tertiary control points should be post-pointed on imagery (i.e., the points should be identified on the image), preferably in softcopy. If post-pointing on hardcopy is to be done, the control point should be post- pointed at full resolution. In addition, a sketch magnifying the vicinity of control points and their detailed description should be prepared on the ground, to aid the photogrammetric operator.

5.4 Additional points: In addition, tertiary control points may be provided on structures like village boundary tri-junction or bi-junction, existing govt./non- govt. buildings like gram panchayat offices, school buildings, veterinary hospitals, etc., as per the field survey requirements.

5.5 Instrument: Single/Double-frequency GPS, Total Station

5.6 Accuracy levels required: 5 cm

5.7 Monumentation of tertiary control points

Since the location of control points will be governed by photogrammetric requirements of the block of images and the selection criteria of the GCP, it will not be possible to construct a monument at most of the tertiary control. However, some additional control points provided with the objective of further survey by TS may be monumented. The specifications of monumentation are as given below:

a) Pillar should be of rock-stone or sand-stone 15*15*45 cm.
b) The pillar should be 10 cm above the ground and 35 cm inside the ground.
c) The pillar should be fixed to the ground using at least 15 cm of cement block.
d) Monuments shall bear a triangle on top with plummet hole in the middle and a 15 cm steel rod inserted (7.5 cm inside and 7.5 cm outside).
e) Provision of a strip of granite to put GPS reading on.
f) The control point number should be inscribed on the monument.
g) In case some modern technology develops later, the details will be circulated separately.

5.8 GPS network design: Tertiary controls should preferably be observed as triangular offsets. Single offsets should generally be avoided.

5.9 Schedule of observations: Observations should be carried out with proper mission planning. Minimum observation time should be 45 min to 1 hour.

5.10 Vertical control: Single GPS offset upto 5 km from secondary vertical control may be allowed for connection of GPS heights in WGS 84 datum to MSL heights. However, such offsets should not be extended.

6.0 AUXILIARY CONTROL POINTS

6.1 Best places for affixation: Each secondary and monumented tertiary control point shall be paired with one auxiliary control point, which should be located on permanent structures like bridges, culverts, permanent building corners, etc. The auxiliary control points should be within the line of sight from the primary, secondary and tertiary control points.

6.2 Densification: There shall be one auxiliary point for each secondary and tertiary

control point, typically 200 m or more.

6.3 Instrument: Dual/Single-frequency GPS Receiver (as used for main control).

6.4 Accuracy levels required: same as their respective primary, secondary and tertiary control points.

7.0 NOTE:

7.1 The co-ordinate list and description of the location of all the control points shall be submitted to the State Land Revenue and Survey authorities. The locations and IDs of all the control points should be maintained in GIS form.

7.2 The co-ordinate list should be supplied both for geodetic system (Lat/Long) and Projected System – Universal Traverse Mercator, i.e., the UTM projection of the respective zone.

7.3 In case a village tri-junction has not been marked and monumented by a primary, secondary or tertiary control point, the same should be monumented as per the parameters.

8.0 GENERAL REQUIREMENTS

i) Village boundaries are to be marked.

ii) The (X, Y, Z) coordinates for the control points should be given in spherical coordinates, i.e., geometric figures in three dimensions using three coordinates, as well as in Cartesian coordinates, i.e., each point defined uniquely in a plane through two numbers, called the *x-coordinate* or abscissa and the *y-coordinate* or ordinate of the point, separately.

iii) The (X, Y) coordinates should be in WGS 84.

iv) The survey agency should specify the specifications of the instruments used to achieve the required accuracy.

v) Some baselines for calibration of the monumentation should be maintained at selected locations.

vi) A sketch for each category of the control points shall be submitted, showing the location of the control points along with their description for easy identification.

vii) A district map showing all the primary, secondary and tertiary control points along

with their coordinates shall be submitted to the State Land Revenue and Survey authorities.

viii) The survey agency shall submit a village map showing the primary, secondary and tertiary control points along with their description and coordinates in the prescribed format to the State/UT Land Revenue and Survey authorities.

ix) The grid supplied by the State Land Revenue and Survey authorities has to be superimposed on the geodetic network of the Survey of India to derive the control point numbering.

x) Control points should be on the boundaries of the land parcels and not in between.

xi) When located in govt. premises, the control point should be at a corner of the building or the premises.

Chapter-3

Computerization of Registration and Integration with the Land Record Management System

1.0 INTRODUCTION

In the deed registration system as followed in India today, property registration deals with the registration of deeds and documents involving transactions related to immovable property. Registration of property transactions triggers about 90% of the changes in land records. Integration of the property registration and land records maintenance systems is very important and a necessary step for achieving the goal of maintaining real-time revenue records. This, in turn, will help in reducing the risk factor due to reduction in the number of frauds and litigations. Thus, the integration of the Revenue and Registration systems through IT services is imperative.

2.0 WORKING OF THE INTEGRATED SYSTEM

The steps leading to the integrated system are given below:

i) Pre-Registration

ii) Registration

iii) Post-Registration

iv) Citizen Services

Each of these steps consists of a number of activities, as delineated below:

2.3 Pre-Registration – This stage includes the following activities:

2.1.1 Obtaining a copy of the Record of Right (RoR) after paying the vendor service charges and the Government fee.

2.1.2 Calculation of the stamp duty – on the basis of the value of the property as per the approved collector/circle rates.

2.1.3 E-Stamping - E-Stamping will be implemented in collaboration with the nationalized banks. Under E-stamping, the transferee will deposit the requisite stamp duty in the

designated Bank and the latter will issue a receipt printed on security paper from Security Press, Nasik, containing security features such as watermarking, unique number, special sticker, etc. This special receipt will be pasted on the deed. At the time of registration, the Registration staff will check the particulars of the receipt online from the website of the Bank, which will issue the username and password to the staff of SR office for checking the details of stamp duty received by the Bank. One hard copy of the scroll of the transactions will be sent by the Bank to the concerned Sub-Registrar's office and to the Treasury office for verification purposes. Nominal charges may be levied by the Banks for providing the E-stamping service. It is recommended that all State Governments and UT Administrations make concerted efforts to introduce E-stamping services as early as possible, as part of the citizen services charter, and abolish the cumbersome use of stamp papers.

2.1.4 Deed Preparation – For drafting a deed, three options are available:

- Self-drafting
- Drafting by a deed writer
- Drafting by an advocate

It will be convenient and time-saving if templates of standard deeds are created for deed preparation with facility for editing, wherever required. Deeds prepared by the software will be treated as the self-drafted deeds.

2.1.5 Deed Presentation – Interested parties will appear before the concerned sub-registrar to present the above-mentioned deed. Sub- registrar will mark the deed to the Registry Clerk (RC). The RC will check the deed and the attached annexures. If the deed has all the requisite annexures attached with it, then the RC will put the stamp "Checked and Found OK" on the deed and send it to the Registration counter. Otherwise, the software will print the list of objections.

2.2 Registration – Registration stage is one of the most important stages in the whole document registration process.

2.2.1 Data entry of basic details of the deed - like property location and area, and details of the parties.

For the areas having land records integrated with the registration system, the details of the property, as well as of the sellers, will be verified from the land records database. Since the transferor cannot sell the property without mutation in the land records first, this process will help eliminate mutation pendency and fraudulent sales on the basis of fake RoRs will no longer be possible.

2.2.2 Capturing of fingerprints and photographs – of the parties and the witnesses using a fingerprint device and a webcam. Photographs and fingerprints will be stored in the database.

2.2.3 Generation of endorsement and certificate of registration – Endorsement will be printed on the backside of the first page of the deed. To check errors in the data entry, some of the details of the deed such as property location, area, consideration amount, stamp duty and Registration fee should be printed along with the endorsement. Endorsement will be in the local language. Certificate of registration will be printed on the backside of the last page of the deed. It will also contain the photographs of the parties and witnesses.

2.2.4 Signatures of the Sub-Registrar – Finally, the deed will be again presented to the Sub-Registrar for signatures. After the signatures of the Sub- Registrar, the deed will be regularized in the software to freeze the transaction. The regularization process will send a remark to the relevant RoR, automatically. This remark will contain the registration no., date of registration and names of seller(s) and buyer(s), and may be recorded in red colour until the time the mutation process is completed. While the mutation is pending, it will also alert any other prospective buyer that a transaction has already taken place in respect of the property. In this way, any fraudulent attempt at multiple sale of the same piece of land will be checked.

2.2.5 Post-Registration audit of deed – will be done by the auditor of the Registration Department within the specified time period.

2.2.6 Document delivery – After the post-registration audit, the deed will be returned to

the Registry Clerk, who will deliver it to the concerned party within the specified time period. In case of areas having land records integrated with the registration process, mutations will be entered in the software immediately after the deed is signed by the SR and a hard copy of this mutation can be given to the buyers for their reference.

This entire process of computerized Registration should be completed within half-an-hour to one hour.

2.3 Post-Registration activities include deed scanning and the mutation process (mutation notice generation, data entry, verification, sanction and incorporation of the mutation in the RoR).

2.3.1 Deed scanning will be a background operation, which is required in order to provide copies of the registered deeds to the buyer(s). In the process of deed scanning, digital index will be created for locating the scanned deeds in the computerized registration record maintenance system.

2.3.2 Mutation notice generation – The mutation notice mentioning the tentative date, venue and time when the concerned Revenue authorities shall carry out the required formalities for sanctioning the mutation, will be generated by the software, the copies of which shall be given to the buyer(s) and seller(s).

2.3.3 Mutation data entry – The mutation data entry will be done through the registration software. First of all, the Sub-Registrar will mark the particular deed for mutation data entry. The mutation data will be entered for the marked deed, capturing the details of the seller(s) and buyer(s) from the registration database. In the RoR, this data entry will remove the red remarks created during the registration process and generate the “pencil” remarks for further action by the Revenue authorities. This linkage of the registration and mutation processes will also track the pending mutation cases and help the Revenue officers to reduce mutation pendency.

2.3.4 Mutation verification and sanction – The Kanoongo or equivalent Revenue Officer will verify the mutation and send it to the Circle Revenue Officer (CRO)/Tehsildar/Assistant Collector or equivalent Revenue Officer for sanctioning. The CRO will hold a public hearing to sanction or reject the mutation. The Tehsildar can reject

the mutation on the grounds mentioned below. After the mutation is sanctioned, the color of the remarks in the Parat Patwar of Jamabandi will automatically change to red, by the software, in the RoR in place of the pencil remarks.

2.3.5 Grounds for rejection

a) Non-payment of fee.
b) Absence of buyer.
c) Legal heirs not confirmed by the Nambardar/designated official in case of inheritance.
d) Land mortgaged to bank.
e) Registration is not in confirmation with Jamabandi/village-level land record.

2.3.6 Procedure to be followed after rejection

a) Mutation fee will be refunded to the concerned party.
b) Party can appeal within 30 days to District Revenue Officer (DRO) or Sub-Divisional Magistrate as per the location of the property. If decided in the favour of party a mutation will be sanctioned otherwise party can further appeal to Collector. Appeal of collector will go to Divisional Commissioner and appeal of Divisional Commissioner will go to Financial Commissioner Revenue (Principal Secretary). If the party is not satisfied with the decision of Financial Commissioner they can go to civil court.
c) If the rejection was because of absence of buyer or due to some mistake in the earlier mutation then a fresh mutation will be written.

2.3.7 Mutation incorporation and scanning – All the sanctioned mutations will be incorporated in the RoR by the designated officer. Red remarks for the sanctioned mutations will be converted to black remarks in the next Jamabandi/updation of village-level land records. The Tehsildar records his order on the mutation register generated by the software. The detailed order of the Tehsildar is scanned so that copies can be issued to the concerned parties.

2.4 Citizen Services

The following services will be available to the citizens due to integration of registration and land records system:

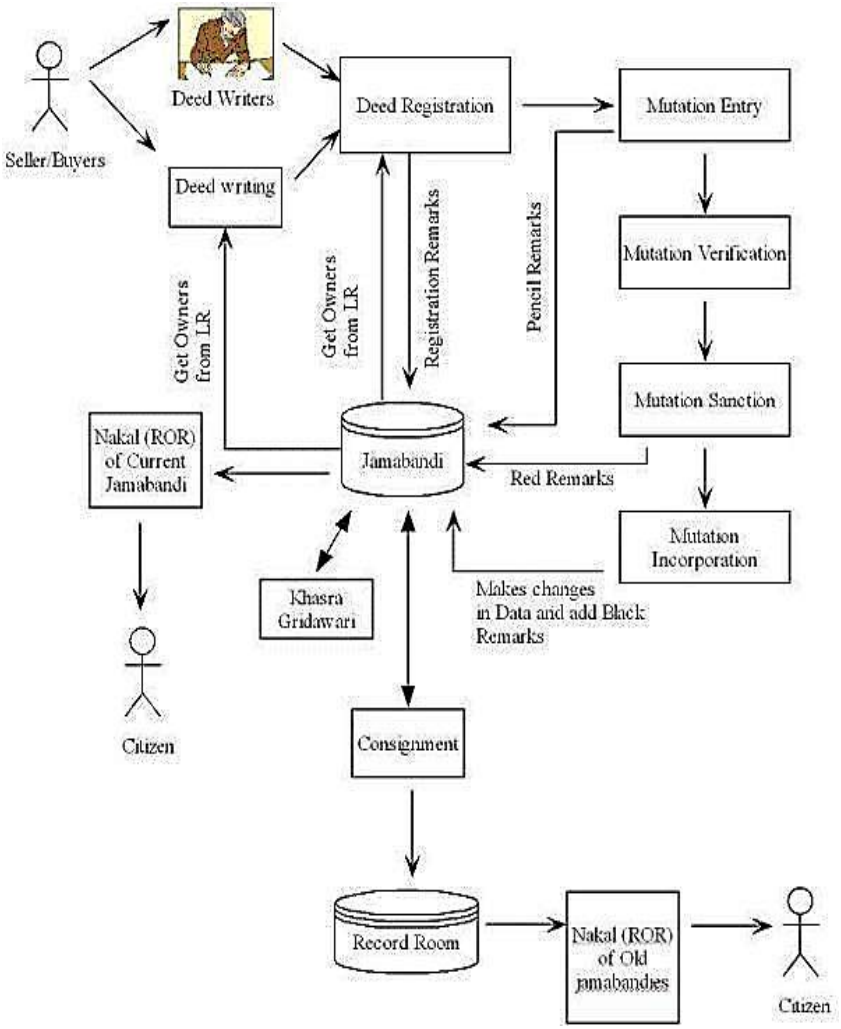
2.4.1 Title Search

Using this feature, a citizen can enquire about the details of the property including its current and past ownerships.

2.4.2 Issue of non-encumbrance certificates/certified copies

All details of past transactions in respect of a property including the old registered deeds and index registers, i.e., the historic data, will be digitized/scanned and entered into the computerized system.

"Integrated Registration and Mutation workflow"



Chapter-4

CHOICE OF SOFTWARE AND STANDARDS

1.0 OPEN STANDARDS

Open standards are technical specifications and policies governing information flow across projects. They cover domain, interconnectivity, data integration, e- services, access and content management. The principles and practice of operating the standards make them “open”, i.e., they are available for all to read and use. This creates fair and competitive market for implementation of the standards and do not lock the customer to a particular vendor or group. Generally, open standards are available free of cost to the user.

1.1 Benefits of using open standards

i) Ease of inter-operability and communication with other systems or data sets.

ii) Open specifications, i.e., the outputs are known to all.

iii) Protection against obsolescence of the data and files created using standards.

iv) Easier porting or transfer of data and application from one platform or format to another, since the technical implementation follows known guidelines and rules, and the interfaces, both internally and externally, are known.

v) No dependence on, or locking with, any single technology or product.

1.2 Some examples of the standards that can be used under the DILRMP are listed below:

1.2.1 Scanning process:

a) 300 dpi in black and white.

b) Image should be stored in .tiff (tagged image file format) or .gif (graphic interchange format) only.

c) The image orientation should be upright.

d) The image should be cleaned and free of noise.

e) Legibility features should be good.

f) Measured length and width with in bounding box of the maps.

g) The image should not be skewed or wrapped.

h) Quality printout of 100% matching (1:1) scanned map on 90-micron transparent sheet for verification with original sheet.

i) Final printout: One printout of verified scanned map on 75-micron matt polyester paper.

1.2.2 Digitization of cadastral maps

a) Layers to be computerized

b) Administrative boundaries of a revenue village with name of village, tehsil and district

c) Parcel boundaries with plot numbers

d) Road network along with road code and type

e) Railway network

f) Major water bodies and drainage network

g) File format

i) Shape file (.shp)

ii) 100% matching (1:1)

iii) Final printout – 75-micron matt polyester paper

h) Scale: 1:4000

i) Accuracy: 0.025%

1.2.3 Registration Process

1.2.3.1 Database standards

SQL-92 (Relational Model) /SQL -1999 (Object Model) to be adopted as standard for relational database management systems (RDBMSs).

1.2.4 Indian language computing

UNICODE – character encoding for each and every alphabet of all the languages. The most commonly used encodings are UTF-8 (Unicode transformation format) and UTF-16.

1.2.5 Survey

a) Scale: 1:2000

b) Format –Shape format or geo-database format

c) Projection System = UTM (Universal Transverse Mercator)

d) Datum: WGS 84 (World Geodetic System-1984)

e) Reference with survey stone details/bench mark point

f) Contour interval: 1 meter contour with height information

g) Village/taluk/district boundaries with annotation

h) Village boundaries with tri-junction pillars

i)District/tehsil/village codification as per Census 2011 10)

j)Distances in meters

k) Area in hectares/sq meters

l)Output:

m)Accurate geo-referenced digital map using established control survey network around existing Survey of India permanent reference points

n) Proper indexed map with proper sheet number

o) Sheet-wise as well as complete mosaic map of village/tehsil/taluk/district

p) Open file format (.shp)

q) Spatial and non-spatial data dictionary with feature codes, feature type (point, line and polygon)

r) Feature description and symbols

s) Accuracy: horizontal accuracy of 20 cm for rural areas, 10 cm for urban areas, or better.

1.2.6 Location codification – As per the Census codes, as further updated by the NIC.

1.3 The use of open standards is mandatory for the States/UTs for data sharing and inter-operability among different systems.

2.0 OPEN SOURCE VS. PROPRIETY SOFTWARE

2.1 Open-Source Software (OSS)

OSS is defined as computer software for which source codes are available in the public domain. This permits the users to use, change and improve the software and to redistribute it in a modified or unmodified form. It is developed in a public and collaborative manner.

2.1.1 Advantages of OSS

a) Most OSS products are available free of royalties and fees.

b) The OSS have qualities of adaptability to standards and integration with other

systems.

c) It has better software security, because of the availability of source codes and multi-user, network-centric environment.

d) It offers wider testing and faster fixation of problems and is, therefore, more reliable and stable.

e) Near-zero vulnerability to viruses, thereby eliminating the need for virus checking, data loss and downtime.

f) Since it is collaborative development and source codes are freely available, the same can be easily customized as per the user requirements.

g) Small footprint allows use on older computers.

h) Service orientation, rather than product orientation, for induction of IT solutions in e-Governance.

2.1.2 Disadvantages of OSS

a) Lack of professional support, since there is no direct obligation or responsibility on anyone.

b) There is no co-ordination of different releases and version upgrades. Since new developments keep coming up, the support vendors find it hard to provide the immediate solution.

c) Several updates keep getting released without any centralized mechanism to handle them, leading to erratic updates.

2.2 Proprietary software

It is the computer software which is legal property of one company. The terms of use for the buyer are defined by contract and licensing. The terms may include restrictions on privileges to share, alter, dissemble and use of the software.

2.2.1 Advantages of proprietary software

a) Better vendor professional services.

b) Better user interface.

c) Regular and easy availability of updates and patches to the users.

d) These systems are available in packaged and modular form.

2.2.2 Disadvantages of proprietary software

a) Proprietary software comes at a significantly higher cost.

b) Complete dependence on the vendor.

c) Source codes are generally not available to the end-user, leading to lack of freedom to modify or adapt the software to changed requirements.

d) At times, proprietary software may be locked to a proprietary standard, making inter-operability difficult.

e) Vulnerability to withdrawal of support by, or collapse of, the vendor.

f) Unforeseen gaps may be discovered in the course of software deployment, causing gaps in functionalities.

3.0 CHOICE OF SOFTWARE

While making a choice of the software, State Governments/UT Administrations should keep in mind the cost and inter-operability of the system, as well as the time taken for designing software. Since inter-connectivity, inter-operability and completion of projects within set timeframes have been emphasized as major planks in the DILRMP, isolated systems may present a major difficulty in the future. It has been seen that where IT penetration is less, proprietary software services and solutions are better and reliable assistance is available from the supplier. However, open source provides distinct cost advantages where the number of installations are large. The States/UTs should bear in mind that they have to meet the required funding for software from their own resources. With regard to further updates on open sources and open standards, the website of the Ministry of Electronics & Information Technology, i.e., www.meity.gov.in may be seen from time to time.

Chapter-5
(Section-A)
Data Security
Information Security requirements and Authentication Mechanism
(Revenue Secretary Committee Report)

Purposes and Scope:

One of the terms of reference of the Committee was to deliberate in depth about the security framework for the CLR domain and suggest a suitable framework for security of the system and digital land record data sets. NIC has prepared detailed Security Guidelines for Computerization of Land Records listing the purpose, procedure and security framework, which also envisages creation and adoption of an Information Security Policy and Standards for the Land Records Information System domain. The committee discussed the security framework and agreed to the following guidelines;

The Security guidelines primarily focus on the following:

- To extend necessary guidance and lay standards for the land revenue department on various IT-security related issues such as physical, technical and administrative concerns, which need to be addressed from the implementation/operational perspective of Land Records Computerization at the Tehsil (Revenue circle) level.
- ISO/IEC BS 17799 has been recommended for cyber security standards. ISO –BS 17799 is the internationally recognized security framework, which extensively deals with almost all security mechanisms in terms of 127 controls. According to domain needs 60 security controls have been short listed out of these 127 controls for the security mechanism of the land records domain.
- Information for designers & developers of applications software and databases that should be taken into account by technology service providers.
- Security Audit and Risk assessment that are necessary constituents for reducing vulnerabilities.
- Important technological devices and methods to strengthen security in the operational workflow environment.

Requirements for building a Security Framework:

It has been observed by the committee that several states have successfully implemented Computerization of Land Records without following proper security standards. In such a scenario, it is necessary to create a security management system for land records and documents, as these are of immense significance due to rising land values. It may be mentioned that without adequate physical and administrative security, reliable digital security is not possible. In the case of digital data, issues and concerns regarding integrity and authentication of data need to appropriately addressed. Necessary provision for backup, storage, archiving of digital data is to be made to fit the requirements of the domain.

The extent of security management is directly dependent on risk assessment. It will be very difficult to determine the severity of the risk without any critical assessment study. In case of total automation, any damage to the IT system will have a very serious impact especially when the manual system of records is done away with. Therefore, the importance of security management cannot be over emphasized.

Observations of the Committee:

After detailed deliberations on the issues relating to security, the Committee made the following observations:

- It was noted that the existing manual system has various safeguards, descriptive procedures, roles and responsibilities, set out in the State land administrative manuals. It is necessary that while switching over to an IT enabled system for LR, appropriate steps be initiated to incorporate suitable provisions catering to the requirements for a secure computerized environment for Land Records. Therefore, it is necessary to accord high priority to confidentiality and Integrity of the available data, records, process and systems.
- The Committee observed that as of today, prime security concerns relate to PHYSICAL as well as CYBER security. Accordingly, it is necessary to have a composite strategy for domain security.
- The Committee is of the opinion that there are several areas pertaining to physical, technological and administrative security that need attention in the existing scenario of computerized operations at the Tehsil level.
- Security requirements are dynamic in nature. To build an appropriate security management system, it is necessary that each state should follow the Security

policy guidelines. Moreover, each state should create a mechanism to continuously assess the risks and vulnerabilities and strengthen security measures through rules, procedures, responsibilities and technology.

- The Committee understands that ISO/IEC BS 17799 is an internationally accepted standard, which could be used to define the standard framework for the Land Record domain. ISO/IEC BS 17799 standards cover various aspects on policy, review mechanism, risk assessment, confidentiality and integrity needs for an Information Security management system.

Recommendations:

In view of these observations, the Committee recommends that the suggestions given below must be initiated to strengthen the existing security provisions.

- Adoption of Security policy guidelines and annual audit of security of data software and hardware.
- Risk assessment for operational sites and security breaches.
- Policy for hardware, software, system software configuration management.
- Policy for Password, Confidentiality and Accountability required
- Policy and procedures for backup of data and software for a defined period.
- Policy for access control of system, data and other resources.
- Arrangement for physical security of the digital infrastructure.
- Technical updates for users and responsible officials.
- Policy for data access over network and distribution.
- Provision of documented procedures for legal compliance and security.
- Budgetary allocation for an accepted level of security

Approaches for Security Management & the Information Security Management System:

The Committee agreed that there is a need for uniformity in standards and protocols for security management amongst the states. "ISMS" is an approach by which management can monitor and control information security to reduce risk to an acceptable level to fulfill corporate, customer and legal requirements. Implementation of Security management requires that:-

- Security controls are in place and are effective;
- Residual risks are acceptable; and
- Assumptions about threats remain valid.

These security controls as specified in the ISO/IEC specification will help in minimizing the risks of human error, theft, fraud or misuse of facilities. These measures may be adopted to secure confidentiality, accountability and integrity of the system. For this purpose, it is necessary to address various issues concerning Physical and Cyber Security in the LR domain, Access Control, Security Awareness and Training, System Configuration, Data Management, etc.

The document on security guidelines provides a detailed description of various security measures to be adopted to reduce risk and curtail vulnerabilities.

Cyber security is an ongoing process and it is desirable that security concerns should be addressed and resolved through a permanent mechanism.

Security Audit:

Security audit is important for protecting digital data. Keeping this in mind, the Committee agreed that each state should create a security review mechanism and mitigation management plans. Further, it is also recommended that security audit should be carried out for each state by a third party/expert once the policy is implemented. It is suggested that NIC should take necessary steps to ensure application software security. The major steps involved in LR Information system security are:

a) System study;
b) Application Security audit; and
c) Infrastructure audit for known vulnerabilities & configurations.

The security audit should be carried out as per guidelines issued by the Government of India in this regard. The following approach could be followed at various levels:

(i) **At site of operation:**

a. Physical security and access control at Taluk level
b. System hardening and Incident detection /reporting at site of operation.

c. Workflow authentication, non-repudiation and record management.
d. Backup and Archival data, software and records.
e. Security updation, Version control and Configuration management

(ii) **At State Level:**

a. Steering committee to review the security of operations periodically;
b. Incident management mechanism and support;
c. Technological and financial support;
d. Address various legal & policy issues emanating from field experiences.

Recommended Technical measures for Secured Operation at Tehsils/SRO:

The committee recommends the following security measures:

	Issues	Proposed Solutions
1	**Physical Security of the Site** Access Control - For Public - Work- flow area - Server Area - Client Area - Digital Record Room Equipped with Access Control Device and Log Register	
2	**Electrical and Fire Safety:**	As per the fire safety and electrical requirements. (Expenditure to be supported under site preparation fund as provided in existing CLR guidelines – unit cost per Taluk)
3.	**LAN Connection:** - Server and Client - Network Device - kiosk	Protected connectivity to avoid interception of the clinet/server over/through LAN.Entire set-up should be within restricted access area. (No cost as of now. In future hub may be replaced with switch)

4.	**HARDWARE:** - Server - Clients - Printer - Scanner	All servers/clients/printers/scanner should be as per the configuration prescribed in the CLR guidelines. All these devices should be entered in stock register . Each machine should be authenticated.
5.	**System Software & updates:**	Valid copy of System Software should be used for installation. The Hard Disk should be partitioned for the Operating System(OS) and data. Funds for this has been provided under the revised tehsil unit cost.
6.	**Password:** - Administrator - Default accounts - Guest accounts - BIOS level password - Bio Metric Thumb impression - Digital Signature (Digital Signature Certificate to authenticate server and client with secure communication may be taken from NIC)	The administrator password should have a minmum of eight characters incorporating the special characters and alphanumeric. All guest and default accounts should be disabled. System should have BIOS password The user is accountable for keeping the password with himself. Only specified finger is to be used in bio-metrics device. Funds for Biometrics are already allocated under revised unit cost of tehsil. Digital Signature Certificate(DSC) for each site may be acquired from NIC which requires Rs. 3600 per site for card & readers (one for each machine).
7.	**Virus and Intrusion Detection System:** - Disabling unwanted ports	Updation of Virus protection with latest Updates
8.	**Version Control:** - Key validation - Key revalidation with request - Same version of s/w at all sites	Application Software with key Duration of the Land Record application s/w can be extended by request and keys granted by the administrator. One version at all sites.
9.	**Disabling of Floppy Drive/Desktop:** - Desktop should be disabled	Floppy Drive may be disabled Application s/w should run directly at the system startup
10.	**Installation of DATABASE:** - Certified copy - Database users password	SQL database should be installed using the authorized CD. System Administrator "sa" password

		should be changed and protected regularly
11.	Creation of LRC Users: - Authentication and authorization - Role bases Access - Unused accounts	Authenticated users with password / biometrics. Role based authentication and function All unused accounts/guest should be disabled.
12.	Backup/Restore of Database:	Backup of database with password. Stored at different location. Backup under the custody of the officer in charge System before shutdown must prompt for backup.
13.	Routine Check up of the System for unwanted s/w and games:	Only authorized s/w should be installed in the server/client
14.	Use of LR s/w beyond schedule hours: - Use of s/w on holidays - Use of s/w beyond working hours	Use of the computer center and application s/w beyond schedule hours should be recorded and permitted only on permission from competent authority.
15.	Security breaches log/report: - Breaches of security - Unintended use of a module - Wok flow violation	Documentation of all breaches & reporting.
16.	Audit log:	Periodic log will be kept separately in CDs with time stamp
17.	Backup of Application & Language s/w:	LR s/w and Language Related Application s/w will be backed up in CDs with all keys.

(Section-B)
Data Security
Evaluating and implementing ISO/IEC 27001 and ISO/IEC 27002 security standards

1.0 For any Land Records Information System, asset safeguarding (that includes data security) and data integrity are important objectives. Regular assessments need to be carried out as to how well these objectives are being met. This is an Information System Audit function. Information system (IS) auditing is the process of collecting and evaluating evidence to determine whether a computer system safeguards asset, maintains data integrity, allows organizational goals to be achieved effectively and uses resources efficiently. Information system auditing must be carried out by an agency other than the implementing agency (which in most cases is the NIC) and holds necessary competency/accreditations. IS Audit is carried out by organizations empanelled by the Indian Computer Emergency Response Team (CERT-In), an organization that works under the auspices of the Ministry of Electronics and Information Technology, Government of India. Carrying out of periodic (at least twice a year) IS Audit of a computerized land records management system is strongly advised. Such auditing will increase usability of computerized land records and bring in more confidence among institutional users, such as banks, who may base some of their decisions on these records.

1.1 It is recommended that State Governments/UT Administrations may strive to achieve ISO 27001 certification as regards the computerized land records system. CERT-In website (www.cert-in.org.in/ProgressiveSteps.htm) lists the progressive steps that a State Government/UT Administration may take to achieve this certification. The certification process can be set into motion as soon as even one component of the land records system, say the text-database has been put in production use.

2.0 Making the data secure as per the ISO standards and drawing up the security policies

2.1 While it is debatable whether an IT audit organization should be associated right from the inception stage of the computerized land records system, yet with the growing

complexity of information systems, auditors do need to have in-built tools and outputs to test various internal system processes and collect evidence. Auditors may also suggest various controls at system development stage that may reduce threats to system. If these suggestions are taken into account at system development stage itself, a more integrated and robust system evolves. Therefore, there is a growing tendency among organizations implementing IT-based solutions to also associate an accredited IT system auditor at the system development stage itself.

2.2 This IT system auditor should also be assigned the important task of helping the State Government/UT Administration in writing and promulgating across the State/UT various security policies/best practices-related memoranda/circulars in line with the ISO standards. However, to maintain audit independence and objectivity, the IT system auditor team who was associated at the system development stage may not be engaged later at the actual auditing of the computerized lands records system, i.e., after the system has started functioning.

3.0 Supervising the security policy implementation

3.1 Formulating and implementing security policies and internal control practices give rise to another organizational issue, that is, of a requirement of overseeing such functions within the State/UT. There is a need for an information system security and internal controls administrator at the State/UT-level with the responsibility for ensuring that the information system assets are secure and data integrity is maintained. One major function of the security administrator is to conduct security program. A security program is a series of ongoing, regular periodic reviews conducted to ensure that assets (including data) associated with the information system function are safeguarded adequately. Each review leads to changes in security and internal control policies. The very first security review (possibly conducted in association with the IT system auditors and the NIC) is often a major exercise. Subsequent security reviews, carried independently, might focus on changes that have occurred since the last review. A formal approach to security review has eight major steps: (1) preparation of the security review plan, (2) identification of the assets, (3) valuation of the assets, (4) threats identification, (5) threats likelihood assessment, (6) exposures analysis, (7) controls adjustment, and (8) report preparation.

3.2 Result of a security review is a security policy in respect of nine major threats, as: (a) unauthorized intrusion — access controls must be designed to prevent both logical and physical intrusion; (b) hackers — strong logical access controls mitigate expected losses from the activities of hackers; (c) viruses and worms —controls should be implemented to prevent use of virus infected programs and to close security loopholes that allow worms to propagate; (d) misuse of software, data and services — a code of conduct should govern the actions of information systems employees that should also prominently take into account user privacy concerns; (e) fire — well-designed, reliable fire- protection systems must be implemented; (f) water — facilities must be designed and sited to mitigate losses from heavy rain, moisture and flooding; (g) energy variations — voltage regulators, circuit breakers and uninterrupted power supplies be used; (h) structural damage — controls must exist to safeguard against structural damage occurring from earthquakes and other disasters; (i) pollution — regular cleaning of facilities and equipment should occur; also, take steps to prevent heavy corrosion in equipments installed at sea-side locations.

Chapter-6
(Section A)
CORE TECHNICAL ADVISORY GROUP

Composition of Core Technical Advisory Group for the Digital India Land Records Modernization Programme (DILRMP).

1.0 A Core Technical Advisory Group, with the composition and terms of reference as indicated below, is constituted to advise the Department of Land Resources, Government of India and the States/UTs on the technological aspects related to the implementation of the DILRMP: -

(i)	Secretary, Department of Land Resources	Chairperson
(ii)	Additional Secretary, Department of Land Resources	Member
(iii)	The Director-General, National Informatics Centre (NIC), or his representative	Member
(iv)	The Surveyor General of India, or his representative	Member
(v)	A representative of the India Space Research Organization (ISRO)	Member
(vi)	A representative of the National Remote Sensing Centre (NRSC)	Member
(vii)	The Director-General, C-DAC, or his Representative	Member
(viii)	The Director General, Forest Survey of India, or his representative	Member
(ix)	The Director, Soil and Land Use Survey of India, Ministry of Agriculture, or his representative	Member
(x)	The Registrar General of India (RGI), or his representative	Member

(xi)	A representative of the Ministry of Home Affairs, Govt. of India	Member
(xii)	A representative of the Ministry of Defence, Govt. of India	Member
(xiii)	A representative of State Govt	Member
(xiv)	A representative of State Govt	Member
(xv)	Director (LR), Department of Land Resources	Member
(xvi)	Joint Secretary/Director (DILRMP), Department of Land Resources	Convenor

2.0 CTAG would advise the Department of Land Resources and the States and UTs on the technological aspects of the implementation of the DILRMP including its following components and activities:

I. Computerization of Land Records

a) Data entry/re-entry/data conversion of all textual records including mutation records and other land attributes data

b) Digitization of cadastral maps

c) State-level data centres

II. Survey/resurvey and updating of the survey & settlement records (including ground control network and ground truthing) using the following modern technology options:

a) Pure ground method using electronic total station (ETS) and differential global positioning system (DGPS)

b) Hybrid methodology using aerial photography and ground truthing by ETS and DGPS

c) High Resolution Satellite Imagery (HRSI) and ground truthing by ETS and DGPS

III. Computerization of Registration

a) Computerization of the sub-registrar's offices (SROs)

b) Data entry of valuation details

c) Data entry of legacy encumbrance data

d) Scanning & Preservation of old documents

e) Connectivity of SROs with revenue offices

IV. Modern record room/ land records management centres at tehsil/taluk/circle/block level

V. Evaluation Studies, IEC and Training

VI. Core GIS

VII. Programme Management Unit (PMU)

3.0 The Advisory Group may associate any other official/non official expert for guidance.

4.0 The TA/DA of the non-official experts shall be borne by the Department of Land Resources Ministry of Rural Development, Govt of India.

Chapter-6
(Section-B)

Addresses of Technical Agencies

1) National Informatics Centre (NIC)

NIC - Head Quarter

Land Records Information
Systems Division,
NIC(HQ), A Block, CGO
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Delhi - 110003

Phone : 011-24360563, 24305331

E-mail :**dcmisra@nic.in**

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Andaman & Nicobar (UT)

NIC Andaman & Nicobar UT Centre
First Floor, A Block, General Pool
Office Accommodation (GPOA),
Ranchi Basti, Dairy Farm,
Port Blair – 744101

Phone : 03192-232733

E-mail :sio-and@nic.in

URL :https://andaman.nic.in/

Andhra Pradesh

NIC AP State Centre,
A-Block,
Government Offices Complex,
Tank Bund Road,
Hyderabad – 500063

Phone : 040-23494300

E-mail :sio-ap@nic.in

URL :https://ap.nic.in/

Arunachal Pradesh

NIC Arunachal Pradesh State Centre,
Room 07, Block-03,
Civil Secretariat,
Itanagar – 791111

Phone : 0360-2212919

E-mail :sio-arn@nic.in

URL :https://arunachal.nic.in/

Assam

NIC Assam State Centre,
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Guwahati – 781006

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E-mail :sio-asm@nic.in

URL :https://assam.nic.in/

Bihar

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Bailey Road, Patna – 800015

Phone : 0612-2547964

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Chandigarh (UT)

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UT Secretariat, Sector 9-D,
Chandigarh – 160017

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URL :https://nicchandigarh.nic.in

Chhattisgarh

NIC Chhattisgarh State Centre,
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Mantralaya,
Raipur - 492 001

Phone : 0771-2221238

E-mail :**sio-cg@nic.in**

URL :https://chhattisgarh.nic.in/

Dadra and Nagar Haveli (UT)

NIC Dadra and Nagar UT Centre,
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Silvassa - 396230

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Daman and Diu (UT)

NIC Daman and Diu UT Centre,
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Fort Area, Moti Daman,
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URL :https://del.nic.in/

Goa

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Porovorim,
Goa – 403521

Phone : 0832-2411332

E-mail :**sio-goa@nic.in**

URL :https://nicgoa.nic.in/

Gujarat

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E-mail :sio-guj@nic.in

URL :https://guj.nic.in/

Haryana

NIC Haryana State Centre,
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New Secretariat Building,
Sector-17,
(Opposite Main Bus Stand),
Chandigarh - 160017

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E-mail :sio-hry@nic.in

URL :https://nicharyana.nic.in/

Himachal Pradesh

NIC HP State Centre,
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URL :https://nichimachal.nic.in/

Jammu and Kashmir

NIC Jammu & Kashmir UT Centre,
Room NB-12, Mini Secretariat,
Jammu – 180001

NIC Jammu & Kashmir UT Centre,
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Srinagar – 190001

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Jharkhand

NIC Jharkhand State Centre,
Second Floor, Engineer's Hostel,
Near Golchakkar, Dhurwa,
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Phone : 0651-2401076

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URL :https://nicjharkhand.nic.in/

Karnataka

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Dr Ambedkar Road, Vasanth Nagar,
Bangaluru – 560001

Phone : 080-22863218

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URL :https://karnataka.nic.in/

Kerala

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NIC Maharashtra State Centre,
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Manipur

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sgo@nde.vsnl.net.in

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helpdesk.soi@gov.in

GEO-SPATIAL DATA CENTRES

Sl. No.	Name of the Geo-spatial Data Centre	Mailing Address
1	Andhra Pradesh Geo-spatial Data Centre, Hyderabad	Additional Surveyor General, Andhra Pradesh Geo-spatial Data Centre, Survey of India, UPPAL, Hyderabad-500039 Fax: 040-27206064 & 27200359 E-mail:addlsgapgdc@yahoo.com
2	Assam and Nagaland Geo-spatial Data Centre, Guwahati	Director, Assam and Nagaland Geo-spatial Data centre, Survey of India, Ganesh guri Chariali Dispur G S Road, Guwahati - 781006 Fax: 0361-2261725 E-mail:angdcguwahati@yahoo.co.in

3	Bihar Geo-spatial Data Centre, Patna	Director, Bihar Geo-spatial Data Centre, 164, Sheikhpura House (Near JD Women's College), PO- B.V. College, Patna-800014 (Bihar). Tel:0612-2280756, 2280261 Fax: 0612-2280265 Email: bihargdc@yahoo.co.in
4	Chhattisgarh Geo-spatial Data Centre, Raipur	Director, Chhattisgarh Geo-spatial Data Centre, Survey of India, Reena Apartment 3rd Floor,Pachpedi Naka, Dhamtai Road, Raipur - 492001 Fax: 0771-2411135 E-mail:cggdc@sancharnet.in
5	Gujarat, Daman & Diu Geo-spatial Data Centre, Ahmedabad	Director, Gujarat, Daman & Diu Geo-spatial Data Centre, Survey of India, Motor Sales & Service Building,2nd Floor, Ashram Road, Ahmedabad - 380009 Fax: 079-26576696 E-mail:dirgddgdc@yahoo.com
6	Haryana Geo-spatial Data Centre, Chandigarh	Director, Haryana Geo-spatial Data Centre, Survey of India, SOI Complex, Dakshin Marg, Sector 32 A, Chandigarh - 160030 Fax: 0172-2604671. E-mail:addlsg_hgdc@sify.com

7	Himachal Pradesh Geo-spatial Data Centre, Chandigarh	Director, Himachal Pradesh Geo-spatial Data Centre, Survey of India, SOI Complex, Dakshin Marg, Sector 32 A, Chandigarh - 160030 Fax: 0172-2613398. E-mail:hpgdcsoi@yahoo.com
8	Jammu & Kashmir Geo-spatial Data Centre, Jammu	Director, Jammu & Kashmir Geo-spatial Data Centre, H No.65, Zorwar Stadium, Channi Himmat, Jammu - 180015 (J & K) Phone: 0191-2466556, Fax: 0191-2450185 E-mail:jkgdcjammu@yahoo.co.in
9	Jharkhand Geo-spatial Data Centre, Ranchi	Director, Jharkhand Geo-spatial Data Centre, Survey of India, Survey of India Complex, Near Magistrate Colony, Doranda, PO - Hinoo, Ranchi – 834002 Fax: 0651-2482789 E-mail:jgdc@sancharnet.in
10	Karnataka Geo-spatial Data Centre, Bangalore	Director, Karnataka Geo-spatial Data Centre, Survey of India, Sarjapur Road, Koramangala, 2nd Block, Bangalore - 560034 Fax: 080-25533595 E-mail:soikargdc@yahoo.com
11	Kerala and Lakshadweep Geo-spatial Data Centre, Thiruvananthapuram	Director, Kerala and Lakshadweep Geo-spatial Data Centre, Survey of India, CGO Complex, Poonkulam, Vellayani PO, Thiruvananthapuram - 695522 Fax: 0471-2481852 E-mail:surveykerala@asianetindia.com

12	Madhya Pradesh Geo-spatial Data Centre, Jabalpur	Additional Surveyor General, Madhya Pradesh Geo-spatial Data Centre, Survey of India, Survey Colony, Vijay Nagar, Jabalpur-482002 Fax: 0761-2643182 E-mail:dccsvy@sancharnet.in
13	Maharashtra and Goa Geo-spatial Data Centre, Pune	Additional Surveyor General, Maharashtra and Goa Geo-spatial Data Centre, Survey of India, Phulenagar, Alandi Road, Pune – 411006 Fax: 020-26614665 E-mail:mgdcsoipune@vsnl.net.in
14	Meghalaya and Arunanchal Pradesh Geo-spatial Data Centre, Shillong	Director, Meghalaya and Arunachal Pradesh Geo-spatial Data centre, Survey of India, Post Box No.89, MALKI, Shillong - 793001 (Meghalaya) Fax: 0364-2224937 E-mail:soi1@sancharnet.in
15	Orissa Geo-spatial Data Centre, Bhubaneshwar	Director, Orissa Geo-spatial Data Centre, Survey of India, Survey Bhawan, PO - RR Laboratory, Bhubaneshwar - 751013 Phone: 0674-2300355, Fax: 0674-2301418 E-mail:ogdco5@sancharnet.in
16	Punjab & Chandigarh Geo-spatial Data Centre, Chandigarh	Director, Punjab & Chandigarh Geo-spatial Data Centre, Survey of India, SOI Complex, Dakshin Marg, Sector 32 A, Chandigarh - 160030 Fax: 0172-2606916. E-mail:pbchdgdc@yahoo.co.in

17	Rajasthan Geo-spatial Data Centre, Jaipur	Additional Surveyor General, Rajasthan Geo-spatial Data Centre, Survey of India, Great Arc Bhawan, Plot No.19, Sector-10, Vidyadhar Nagar, Jaipur- 302023 Fax: 0141-2236891/2236286. E-mail:surwest@datainfosys.net
18	Survey (Air) and Delhi Geo-spatial Data Centre, New Delhi	Director, Delhi Geo-spatial Data Centre, Survey of India, West Block No.4, R.K. Puram, New Delhi - 110066 Fax: 011-26196301,26107035 E-mail:dsa@nda.vsnl.net.in
19	Tamilnadu, Pondicherry and Andaman & Nicobar Island Geo-spatial Data Centre, Chennai	Director, Tamilnadu, Pondicherry and Andaman & Nicobar Island Geo-spatial Data Centre Survey of India Block-III,Electronics Complex, Thiru-Vi-Ka Industrial Estate, Guindy Chennai-600032 Fax: 044-22328145 E-mail:soitnpani@dataone.in
20	Tripura, Manipur and Mizoram Geo-spatial Data Centre, Silchar	Director, Tripura, Manipur and Mizoram Geo-spatial Data Centre, Survey of India, P.O.Rangir Khari, N.S. Avenue, Haila Kandi Road, Silchar - 788005 Fax: 03842-240555
21	Uttar Pradesh Geo-spatial Data Centre, Lucknow	Additional Surveyor General, Uttar Pradesh Geo-spatial Data Centre, Survey of India, B-2, 2nd Floor, Pickup Bhavan, Gomati Nagar, Lucknow - 226010 Fax: 0522-2720634 E-mail:upgdc_lko@yahoo.com

22	Uttaranchal Geo-spatial Data Centre, Dehradun	Director, Uttaranchal Geo-spatial Data Centre, Survey of India, 17 E.C. Road, DehraDun-248001 Fax: 0135-2656402. E-mail: surveynco@sancharnet.in
23	West Bengal & Sikkim Geo-spatial Data Centre, Kolkata	Director, West Bengal & Sikkim Geo-spatial Data Centre, Survey of India, No.13, Wood Street, Kolkata - 700016 Fax: 033-22800196.22879038 E-mail:social@vsnl.net

PRINTING GROUPS		
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1	Eastern Printing Group, Kolkata	Director, Eastern Printing Group, Survey of India, No.14, Wood Street, Kolkata - 700016 Fax: 033-22834694 E-mail: epgkol@vsnl.net
2	Northern Printing Group, Dehradun	Director, Northern Printing Group, Survey of India, Post Box No. 28, Hathibarkala Estate, Dehradun - 248001 Fax: 0135-2744402 E-mail: dmpsoi@sancharnet.in
3	Southern Printing Group, Hyderarbad	Director, Southern Printing Group, Survey of India, CST & MP Campus, Uppal, Hyderabad - 500039 Fax: 040-27205663 E-mail: dirspg@yahoo.com
4	Western Printing Group, New Delhi	Director, Western Printing Group, Survey of India, Palam Village Road, Near Railway Crossing, Palam Delhi Cantt. E-mail: wpg_del@indiatimes.com Map sales Office of WPG: - Map Sales Office, August Kranti Bhawan Shop No. 151 & 152, Bhika Ji Cama Place, New Delhi. Telephone No. 011-26184388

SPECIALISED DIRECTORATES		
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1	Business & Publicity Directorate, Dehra Dun	Director, Business & Publicity Directorate, Survey of India, Hathibarkala Estate, Post Box No. 28, Dehra Dun (Uttarakhand). Telephone:- 0135-2747051-58 Fax: 0135-2749793
2	GIS & Remote Sensing Directorate	Director, GIS & Remote Sensing Directorate, Survey of India, Uppal Hyderabad-500 039 Fax: 040-27200430 E-mail:hyd2_dmchdsoi@sancharnet.in
3	Geodetic & Research Branch, Dehra Dun	Director, Geodetic & Research Branch, Survey of India, 17 E.C. Road, Dehra Dun - 248001 Fax: 0135-2654528 E-mail:gandrb@vsnl.net.in
4	National Geo-spatial Data Centre, Dehra Dun	Director, National Geo-spatial Data Centre, Block 6, Hathibarkala Estate, Dehra Dun (Uttarakhand) Fax: 0135- 2747623 E-mail: ngdcsoi@yahoo.co.in
5	National Spatial Data Infrastructure (NSDI), New Delhi	Director, National Spatial Data Infrastructure(NSDI),East Block No. 7,Level-5 R K Puran ,New Delhi - 66 Fax: 011 - 26519530 E-mail: Siva_k@nic.in

6	Indian Institute of Surveying &Mapping, Hyderabad.	Director, Indian Institute Of Surveying & Mapping, Survey of India, Uppal, Hyderabad - 500039 Fax: 040 - 27200286 E-mail: hyd2_surtrain@sancharnet.in Website: www.soisti.gov.in
7	Digital Mapping Centre, Dehradun	Director, Digital Mapping Centre, 17 EC Road, Dehra Dun - 248001 (Uttarakhand) Phone/Fax: 0135- 2656945

3) NATIONAL REMOTE SENSING CENTRE

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040 23884001

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For General Information:

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040 23879573

040 23879574

For Data & Products Related Queries:

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data@nrsc.gov.in

4) FOREST SURVEY OF INDIA

4 Forest Survey of India		
1	Forest Survey of India-HQ	Forest Survey of India (Ministry of Environment and Forests) Kaulagarh Road, P.O. IPE Dehradun- 248195 Uttarakhand (India) Nodal Officer : **Shri Sushant Sharma** Deputy Director(P&A) **91135-2755840 (o), +919411110764(mobile)**
2	Regional Director(Central Zone)	Forest Survey of India **(CENTRAL ZONE)** C.G.O. Complex, A-Block Ground Floor, East Wing Seminary Hills **NAGPUR – 440 006** Phone: 0712 – 2510194 & 2510432 FAX: 0712 – 2510194
3	Regional Director(South Zone)	Regional Director (SZ), Forest Survey of India, 8th Floor, B-Wing, Kendriya Sadan, Koramangala, Bangalore - 34.
4	Regional Director (Eastern Zone)	Deputy Director Forest Survey of India, 97/1-B, Hazra Road, Kolkata - 700 026.
5	Regional Director (North Zone)	Regional Director (North Zone) Forest Survey of India (Northern Zone), Himlok Parisar, "Shivalik Khand", Batsley Longwood, Shimla, Himachal Pradesh – 171001.

5) NATIONAL SOIL AND LAND USE SURVEY

5. National Bureau of Soil and Land Use Survey	
HEADQUARTERS (NAGPUR)	**KOLKATA**
Director, NBSS&LUP Amravati Road, Shankarnagar PO, Nagpur-440 010 Tel : (0712) 2500386, 2500319, 2500545, 2500664, (0712) 6451643 (R) Fax : (0712) 2500534 E-mail: director@nbsslup.ernet.in	Regional Head, NBSS&LUP Salt Lake City,D.K.Block, Sector-II,. Bidhan Nagar Calcutta-700 091 Tel : (033) 23586926, 23590727(O) (033) 24301461(R) Fax : (033) 23215491 E-mail : nbsscal@wb.nic.in
BANGALORE	**JORHAT**
Regional Head, NBSS&LUP P.B. No. 2487, Hebbal, Agricultural Farm P.O. Bangalore-560 024 Tel : (080) 3412242, 3415683, 3410993(O) (080) 3532641, 3331499(R) Fax : (080) 3510350 E-mail: nbsslup@kar.nic.in	Regional Head, NBSS&LUP NER Centre, Jamujuri Road, Rawriah Jorhat-785 004 Tel : (0376) 2340089(O) (0376) 2341164(R) Fax : (0376) 2340089 Email: utpalb@sancharnet.in
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Regional Head, NBSS&LUP IARI Campus, NTC Building New Delhi - 110 012 Tel : (011) 25840166,25841624 (O) (011) 25833471 (R) Fax : (011) 25840166	Regional Head, NBSS&LUP University Campus Udaipur-313 001 Tel :(0294) 24171421(O) (0294) 2464754(R) Fax : (0294) 2471326

6) C-DAC: Centre for Development of Advanced Computing

1) C-DAC

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ANNEXURE

UNIQUE LAND PARCEL IDENTIFICATION NUMBER (ULPIN) :A CONCEPT PAPER

1. VISION

The Unique Land Parcel Identification Number (ULPIN) shall be a **Single, Authoritative Source of Truth** of information on any parcel of land or property to provide **Integrated Land Services** to the citizens as well as all stake holders.

2. MISSION

(i) Identify departments which provide land related services

(ii) Identify services of these land departments

(iii) Assign a unique Id to each parcel

(iv) Set up a federated Land information system which works in collaborative manner

3. OBJECTIVES

The finer goals and objectives of the proposed system would be:

(i) To identify departments dealing with land that are regulating and rendering Land related services to the citizens

(Ex: Revenue, Municipal, Panchayat, Forest, Registration, Survey etc)

(ii) To identify the services of such departments, including that are multi-departmental in nature

(Ex: Mutation of Land, Land use conversion from Agricultural to Non-Agricultural, etc)

(iii) To Work out a strategy and develop a system to assign Unique ID for each Land parcel by the respective States/UTs

(iv) To create online Land Information System with open standards APIs (Application Programming Interface) that is based on GIS and OGC compliant so that other stakeholders could use them online to generate further value.

(v)To provide comprehensive information on land and properties, consisting of textual and spatial data

(vi) To maintain the **consistency of core data** across all departments and agencies of the Government countrywide

4. APPROACH/ METHODOLOGY

(i) Board of Revenue/Department of Revenue and like concerned departments of the States/UTs is to take lead initiative

(ii) Identify all departments dealing with Land Resources

(iii) List the services being rendered by these departments/agencies single-handedly or multi-departmentally in a collaborative manner.

(iv) Identify common data sets being maintained by these Departments about Land Resources, Ownership etc from database schema used by departmental e-Applications

(v) Standardize common data attributes

(vi) Finalize the protocol (process-flow, role of each work flow player, access rights etc.) to guide inter-departmental-database transactions to maintain consistency.

(vii) Prepare collaborative applications in order to manage the multi-departmental work-flow, core data and transactions (Create/Update/View) etc to be performed by different stakeholders

(viii) Strategy for assigning Unique ID for each Land Parcel can be worked out based on the following situations:

(a) Where Land has Geo Referenced Lat/Long Coordinates:

(i) There is a formula to generate and assign ECCMA Standard prescribed Unique 14-digit Unique ID (PNIU) using the parcel Geo Referenced coordinate of vertices

(ii) This computationally generated Unique ID, would be organically dependent on Parcel vertices expressed in Lat/Long coordinates (PNIL)# and Unique ID (PNIU)## would spatially be pointing to the surface of the parcel.

(iii) A new Unique ID would be generated by the System itself as and when mutation takes place as Lat/Long of Mutated Parcel would be different.

(iv) This Unique ID of Parcel, being very precise & accurate, should not be shared in public domain due to their strategic and accurate locational & security values and hence may be mapped with another Unique random number with prefix state code, which can be shared with Owner and in public domain for all practical purposes.

However, sharing of the Unique ID with the land owners or keeping it in public domain **before mapping it to another Unique random number with prefix State code** is in the purview of the respective State Revenue Departments of the States/UTs as the ownership

of the land records data is vested in the respective Revenue Departments of the States/UTs Administration.

Property Natural Identifier Lot (PNIL#): The modern survey equipment and technologies has made the geospatial representation of boundaries and features commonplace in everything from websites to mobile devices. It is technically feasible to translate the coordinates of a polygon representing a property boundary into a string in such a way that the string can be resolved back to the polygon within the Earth coordinate system

Property Natural Identifier Unit (PNIU#) is a globally unique identifier. It is created through the application of a reversible algorithm to the position and elevation of the midpoint of the plane representing the primary point of entry to a legally delineated unit space within a building. It is natural as it can be derived from the characteristics of the property, without relying on a third party such as a central property registry, to mint and manage IDs.]

(b) Where presently Land Parcels do not have Geo Referenced Coordinates:

(i) There are many States which have assigned Unique IDs to Land Parcels that are composite in nature and dependent on Administrative Unit codes such as District code, Tehsil Code, Village code etc.

1. Such codes face issues e.g. in case of reorganization of boundaries that is quite a common practice now though it can be managed from the IT angle

(ii) State of Andhra Pradesh adapted a strategy and assigned random code to each land parcel with first two digits for State code

1. This would remain unaffected during delimitation of boundaries of Administrative units
2. Would change only when mutation happens

(iii) State of Uttar Pradesh adapted another strategy and assigned 16 digit unique code for each land parcel as

1. First 6 digits is revenue village code, 7^{th} digit to 10^{th} digit is Bhukand Ghata code(Plot No.), 11^{th} digit to 14^{th} digit is subdivision number (bata, ka, kha, gha, min jumla), 15^{th} and 16^{th} digit for land type.

5. VALUE PROPOSITION

(i) The Single source of truth on Land will stand as authoritative reference to authenticate the ownership and the other land parameters of the record

(ii) Unique Categorization of Govt Lands would benefit in instant identification and prevention of transfer of such lands to individuals during transactions such as Registration

(iii) A Unified ID (viz., uniformity in assignment like Aadhaar number) would in future lead to Certificate-less governance

(iv) Standardization at Data and Application level would bring in effective integration and interoperability across Departments and other Stakeholders/ Service Providers

(v) Assigning Unique ID to each Land Parcel in State, irrespective of the Department dealing with land, would help Unified system to track the Land, its reconciliation etc and to bring higher values to all stakeholders

6. CASE STUDIES

NIC has taken up case studies in:

(i) Bihar-The geo-referenced cadastral map data of Saidpur revenue village-Katrisarai revenue circle-Rajgir subdivision-Nalanda district were taken as a case study to test the concept.

(ii) Haryana-The geo-referenced cadastral map data of Sirsi village of Karnal District was taken for study.

7. CONCLUSION

The Proposed approach/ methodology to build a Unified Land Information system (ULIS) is expected to provide quality services to users through single portal on one hand and achieve transparency in land transactions. The Architecture shall be generic enough to include more department/agencies as and when they become a stakeholder as per criteria. Department of Land Resources (DoLR) in collaboration with NIC may take pilot project in the States/UTs that are at advanced stage of digitization of land records (cadastral maps) with geo-referenced coordinates in consultation with them to generate Unique ID. After successful implementation of pilot, State/UTs as per their preparedness may approach NIC team/other agencies to roll out the system in their respective States/UTs.

For implementation of ULPIN, administrative and financial support shall be extended by DoLR according to guidelines of DILRMP and technical support for roll out the system will be facilitated by NIC, Survey of India, Department of Science and Technology and National Remote sensing centre.

PRESENTATION ON ULPIN

UNIQUE LAND PARCEL IDENTIFICATION NUMBER

(ULPIN)

Department of Land Resources

Need Unique (Parcel) ID for Land Parcel

Digital India-Land Records Modernization Programme is one of the most important Mission Mode Projects(MMPs)

−Citizen is the key stakeholder

-Approx 94 crore land parcels across 6.55 lakh revenue villages

-Emphasis on (a) Integrated Land Management System(ILIMS)

(b) Effective service delivery across sectors

−Assign Parcel ID to every plot to identify it uniquely and unambiguously

− Data analytics should be easier and comply international standards

−Compatible with the data protocol of other departments and easy to provide link

Standard-Electronic Commerce Code Management Association (ECCMA)

−United Nations sponsored membership-based standards organization

−Provides an open, transparent, and efficient process for the development, maintenance, and distribution of electronic commerce codes over the internet.

−ECCMA DSTU (Description and Identification of Real Property Location)
- −Lot [PNIL]
- −Unit Space (ex: condominiums, Office suits) [PNIU]

−OGC and Other Standards
- −OGC 07-147r2, OGC KML
- −RFC 4648, The base16, base32, and base64 data encodings

Property Natural Identifier-Lot(PNIL)

- The modern survey equipment and technologies has made the geospatial representation of boundaries and features commonplace in everything from websites to mobile devices.

- Technically feasible to translate the coordinates of a polygon representing a property boundary into a string in such a way that the string can be resolved back to the polygon within the Earth coordinate system. This is the **property natural identifier–Lot**(PNIL).

- It is “natural” because it is not generated from a registry but from coordinates on the Earth’s surface that are intrinsic characteristics of a lot.

−PNIL will be unique to a single property—the property fingerprint.

−Any change in property boundaries would create a different PNIL. Beyond its value as a natural identifier, PNIL is intended to display boundaries in any geospatial enabled system

−PNIL not intended to replace any of the existing property identifiers but represents an opportunity to add a standard geospatially interpretable identifier to visualize the boundaries of a property in commonly available geospatial systems.

Property Natural Identifier-Unit (PNIU)

- globally unique identifier
- created through the application of a reversible algorithm to the position and elevation of the mid-point of the plane representing the primary point of entry to a legally delineated unit space within a building.
- natural in that it can be derived from the characteristics of the property, without relying on a third party such as a central property registry, to mint and manage IDs.
- The following attribute shall be used to describe a unit space:
  - Latitude and longitude coordinate and the floor of the outer surface of an entryway to a unit space
  - Represented inWGS84

Example [Regular Plot]

Khasra No :109

Calculation of Interior Point :

Step I :

Horizontal Segment: 361143.756299999 , 2773202.3439999996 , 361157.0087 , 2773202.3439999996

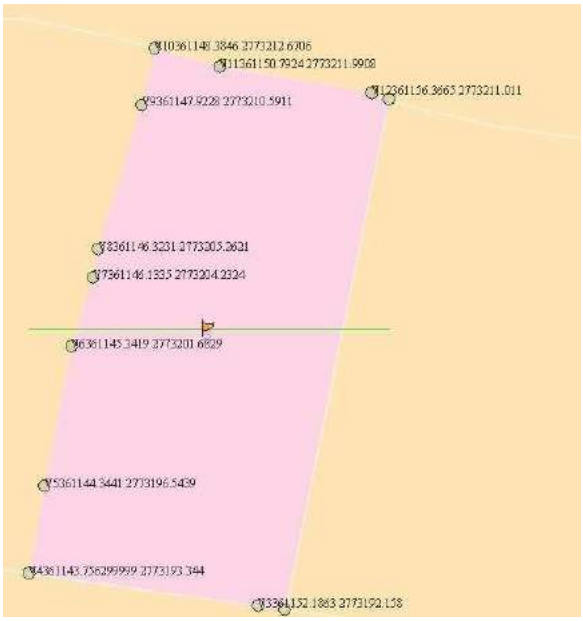
Step II :

Point on Parcel : x : 361150.4171111173 y: 2773202.3439999996

Interior Point P :

x : 85.62334656418898 y: 25.068164087273757

Projection: WGS 84 / UTM zone 45N (EPSG:32645)



Example [Regular Plot]

Khasra No :109

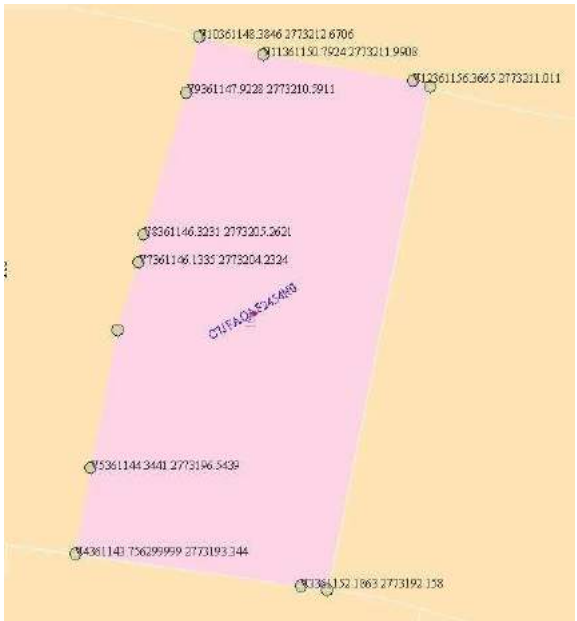
Interior Point x : 85.62334656418898 y: 25.068164087273757

Projection:WGS84/UTMzone45N(EPSG:32645)

Latitude	**Longitude**
Step1:	**Step 5:**
085.623346	*025.068164*
Step2:	**Step6:**
C7	*AF*
Step3:	**Step7:**
JF	*24*
Step4:	**Step8:**
AQ	*54*

Floor
Step 9:
0
Step 10:
H0

PNIU : C7JFAQAF2454H0



[PNIUplottedatthepointfromwhichitisderived]

Example [Regular Plot] Khasra No :109

KML :

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Example [Irregular Plot] Khasra No :725

Calculation of Interior Point :

Step I :

Horizontal Segment: 361617.7186 , 2773058.7507999996 , 361773.1969 , 2773058.7507999996

Step II :

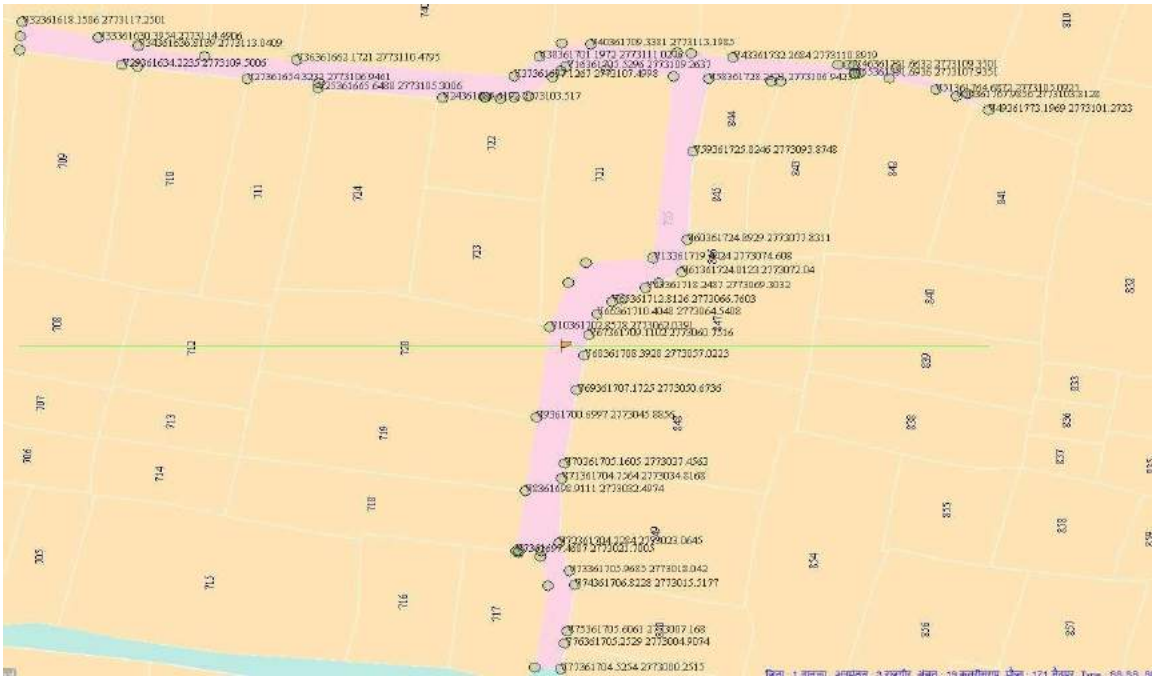
Point on Parcel : x : 361705.571896845 y: 2773058.7507999996

Interior Point P :

x : 85.628863951137 y: 25.066918601399813

Projection: WGS 84 / UTM zone 45N (EPSG:32645)

Example [Irregular Plot] Khasra No :725



Example [Irregular Plot] Khasra No :725

Interior Point: x : 85.628863951137 y: 25.066918601399813
Projection: WGS 84 / UTM zone 45N (EPSG:32645)

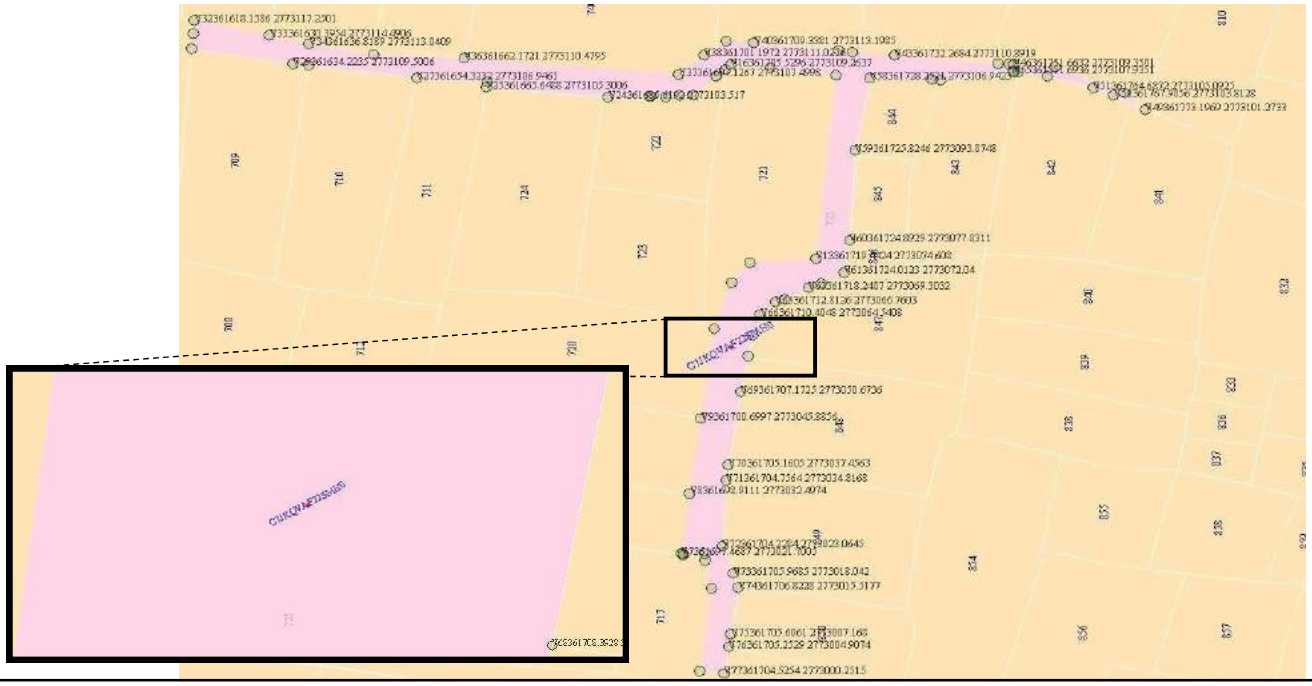
Latitude
Step 1 :
085.628863
Step 2:
C7
Step 3:
JK
Step 4:
QV

bngitudeSte
p 5 :
025.066918
Step 6:
AF
Step 7:
22
Step 8:
SM

Floor
Step 9:
0
Step 10:
H0

PNIU :C7JKQVAF22SMH0

Example [Irregular Plot] Khasra No :725



Example [Irregular Plot] Khasra No :725

KML:

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Example [Irregular Plot] **Khasra No :725**

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MLJgyK1Z9UFHinWGjRabRM/MzAD939r7ZvfvXfnV10ff7NO7/967d98u57tv/jN4++ofzUKlVg==

Khasra No : 757/1 [Outer Area]

Calculation of Interior Point :

Step I :

Horizontal Segment: 361640.4125 , 2773233.0936000003 , 361693.6148 , 2773233.0936000003

Step II :

Point on Parcel :

x : 361650.9561592695 y: 2773233.0936000003

Interior Point P :

x : 85.62830504692322 y: 25.068487638350735

Projection: WGS 84 / UTM zone 45N (EPSG:32645)

Khasra No : 757/2 [Inner Area]

Calculation of Interior Point :

Step I :

Horizontal Segment: 361652.56030903 , 2773232.417595785 , 361684.632627297 , 2773232.417595785

Step II :

Point on Parcel :

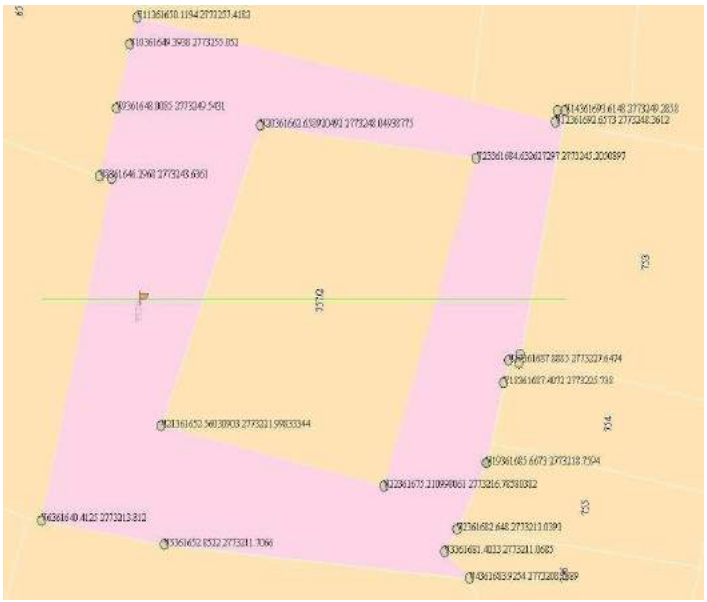
x : 361668.49629554537 y: 2773232.417595785

Interior Point P :

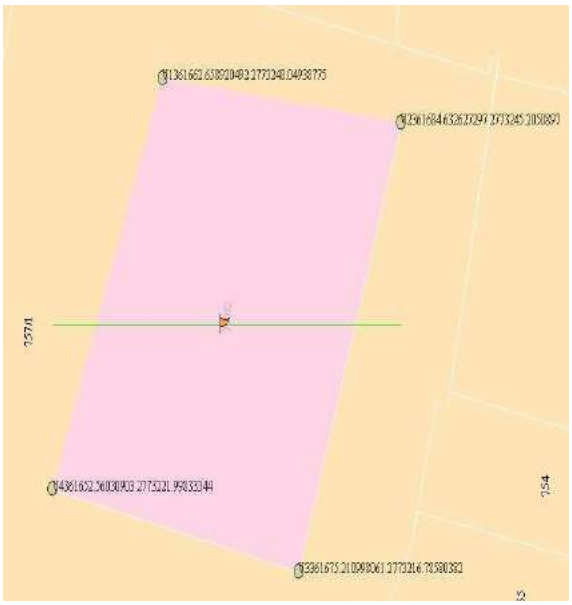
x : 85.62847898147653 y: 25.068483141662192

Projection: WGS 84 / UTM zone 45N (EPSG:32645)

Example [Embedded Plot]



Khasra No: 757/1 and757/2



Khasra No: 757/1 [Outer Area]

Interior Point : x : 85.62830504692322 y: 25.068487638350735
Projection: WGS 84 / UTM zone 45N (EPSG:32645)

atitudeStep 1 :
085.628305
Step 2:
C7
Step 3:
JK
Step 4:
9H

bngitudeStep 5 :
025.068487
Step 6:
AF
Step 7:
24
Step 8:
F7

Floor
Step 9:
0
Step 10:
H0

PNIU : C7JK9HAF24F7H0

Khasra No: 757/2 [Inner Area]

Interior Point : x : 85.62847898147653 y: 25.068483141662192
Projection: WGS 84 / UTM zone 45N (EPSG:32645)

Latitude
Step 1 :
085.628478
Step 2:
C7
Step 3:
JK
Step 4:
EU

Longitude
Step 5 :
025.068483
Step 6:
AF
Step 7:
24
Step 8:
F3

Floor
Step 9:
0
Step 10:
H0

PNIU : C7JKEUAF24F3H0

Example [Embedded Plot] Khasra No : 757/1 and757/2

Example [Embedded Plot] **Khasra No :757/1**

KML :

<?xml version="1.0" encoding="UTF-8"?>
<kml:Placemarkxmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:kml="http://earth.google.com/kml/2.1" id="">
<kml:Polygon>
<kml:outerBoundaryIs>
<kml:LinearRing>
<kml:coordinates>85.62865056227605,25.068361402407298
85.62862120862212,25.068309482498275 85.62860906870662,25.068291575319726
85.6286343001916,25.06827104455252885.62832599224149,25.06829472142874685.628202472
18215,25.06831259035360385.62827007341556,25.068580460919332
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167994,25.0686857446605585.62829430622085,25.068707175050324
85.6287168744662,25.06862929971838 85.62871917059984,25.068638187741517
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</kml:outerBoundaryIs>
<kml:innerBoundaryIs>

<kml:LinearRing>
<kml:coordinates>85.62841954656703,25.068623737245012
85.62832206387327,25.068387612677892 85.62854711274083,25.068342626395065
85.62863764713877,25.068600070203598
85.62841954656703,25.068623737245012</kml:coordinates>
</kml:LinearRing>
</kml:innerBoundaryIs>
</kml:Polygon>
</kml:Placemark>

PNIL :

eJydlE1r20AQhu/5FUbnVprPndkQJ9BDoZBC6Qf0ahzhmNhSkZ06+fcdU+1CWlpoLxLafXbmnXdmdXXztN8tvvfTYTsOywZbaBb9sB7vtsNm2Xz5/Pa1
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Example [Embedded Plot] Khasra No :757/2

KML :

```
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<kml:Placemark xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:kml="http://earth.google.com/kml/2.1" id="">
<kml:Polygon>
<kml:outerBoundaryIs>
<kml:LinearRing>
<kml:coordinates>85.62841954656703,25.068623737245012 85.62863764713877,25.068600070203598
        85.62854711274083,25.068342626395065 85.62832206387327,25.068387612677892
        85.62841954656703,25.068623737245012</kml:coordinates>
</kml:LinearRing>
</kml:outerBoundaryIs>
</kml:Polygon>
</kml:Placemark>
```

PNIL :

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PZlOD8Ns7prXTR7jVlnofI+xOjlaleNkVShSXkmUyWVBnGHkolyCoUWGlMJHJMLplRWqebCaL1AAKABQcjMzJCMBEedglmcRloKlcgkKDlDA
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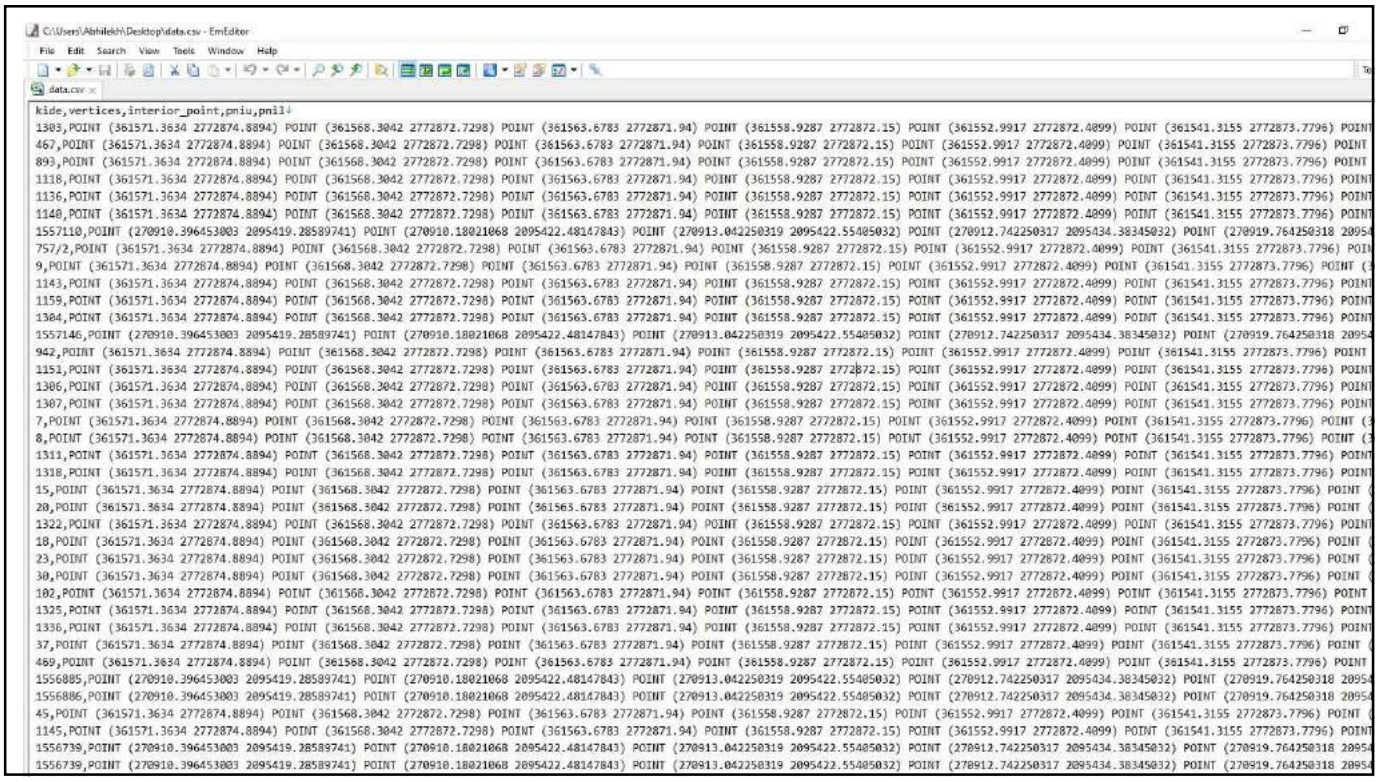
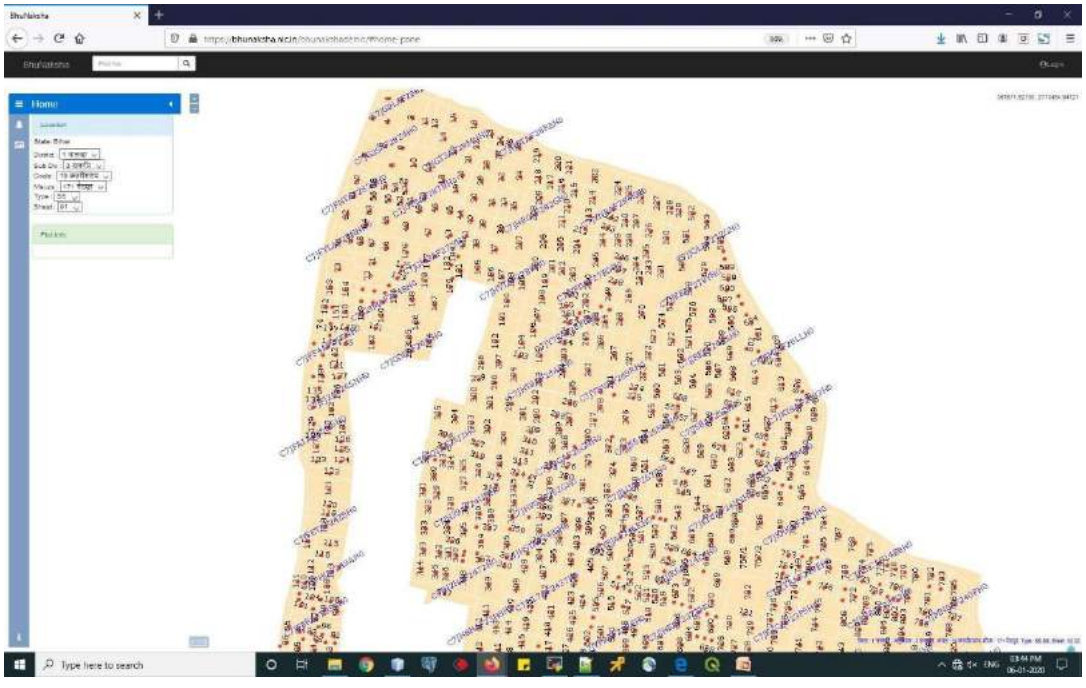
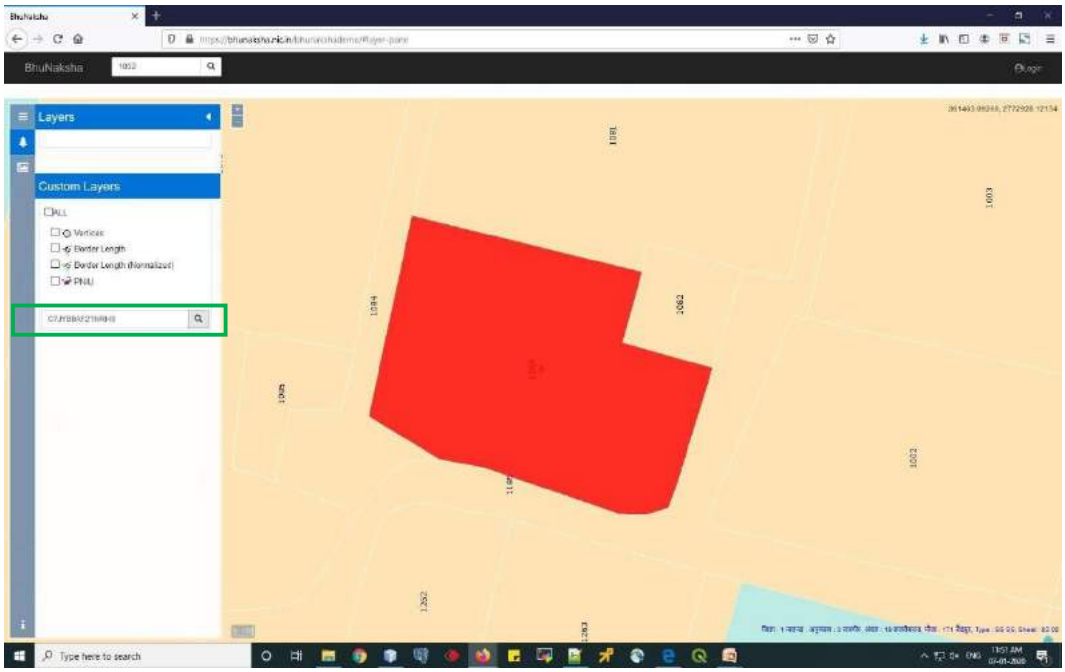


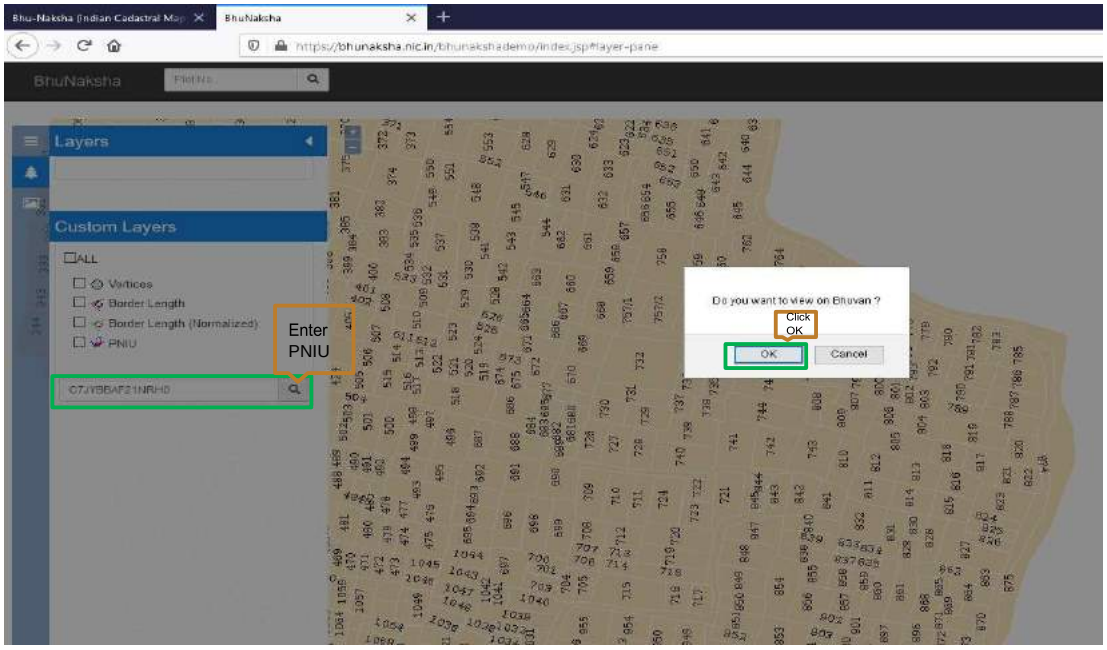
PNIU for sample data is accessible at : https://bhunaksha.nic.in/bhunakshademo/



Plot can be highlighted giving PNIU as input



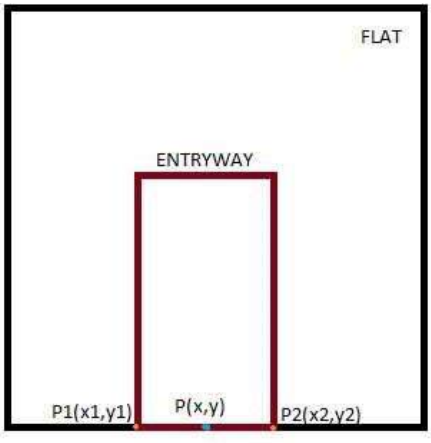
Plot from selected PNIU over laid on Bhuvan Imagery



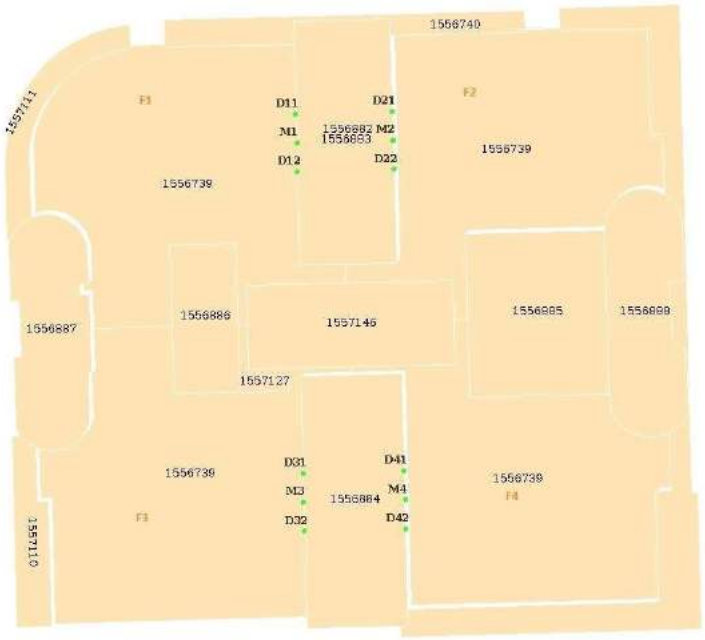
Plot from selected PNIU overlaid on Bhuvan Imagery

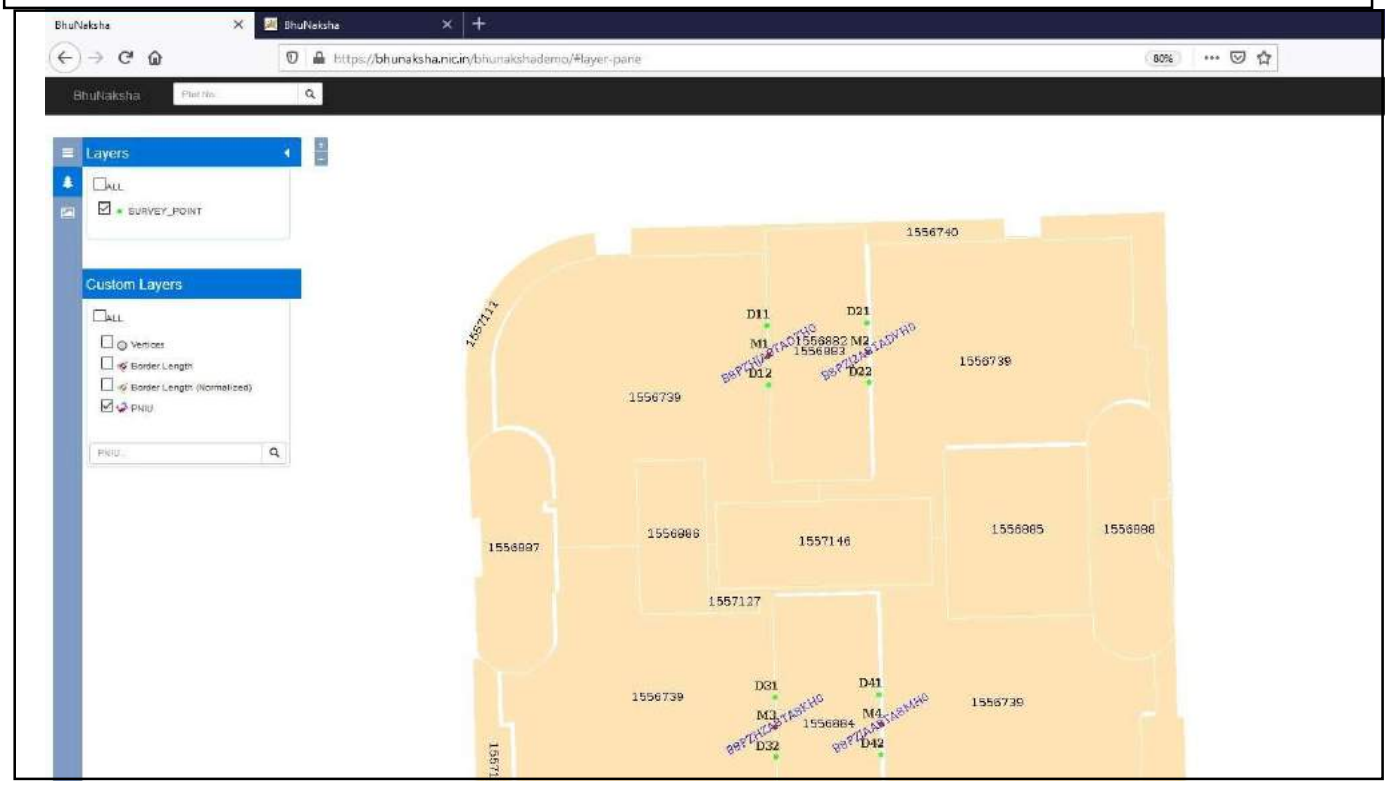
PNIU - Urban Space

- It is encoding of the latitude, longitude, and floor (elevation) of the front door/entryway of the unit space.
- Consider the point P1,P2 be the vertices of the front door of the flat.
- Calculate the point P which is midpoint of the point P1 and P2.
- Take point P and floor and encode them to form PNIU as per procedure explained in slide12and13.



- single floor is represented in image
- F_i represent the flats present and the door is represented by $D_{i1}$and D_{i2}
- The midpoint of the door is represented by M_i
- Encode M_i to form PNIU as per procedure explained in slide 12 and 13.
- The generated PNIU's are shown in slide 34





One Property have more then one unit

−All Properties will have separate PNIL/PNIU .

− One property will be main property & other will be linked property to it (Parent Child relation)

Benefits of using PNIL/PNIU (ECCMA) Standards (contd.)

- Enforce uniqueness of all transactions
- Keeping the land records always up-to-date
- Auto-update on Registration /mutation
- A link of all property transactions gets established
- Delivery of citizen services of land records through single window
- Sharing of land records data across departments, financial institutions and all stakeholders
- Helps cross validate land records related data across departments
- Standardization at data and application level would bring in effective integration and interoperability across departments

Benefits of using PNIL/PNIU (ECCMA) Standards

−Provides an open, transparent, and efficient process for the development, maintenance, and distribution of electronic commerce codes over the internet.

−Each georeferenced parcel/property is uniquely identified.

− ECCMA standard compliant.

− Exchange of data associated with parcel will be easy.

−The geometry characteristics are captured in the identifier.

Implementation Strategy

1. For Non-Bhu Naksha States
    - Webservice
        - **Purpose:** Generation of PNIU, PNIL
        - **Input Parameters:** Parcel Geometry, EPSG Code
        - **Output Parameters: PNIU**, PNIL
2. For BhuNaksha implemented States
    - Option to generate PNIU and PNIL for the existing parcels
    - PNIU and PNIL can be generated automatically on creation of new parcels

NATIONAL GENERIC DOCUMENT REGISTRATION SYSTEM
A CONCEPT PAPER

1.0 VISION

National Generic Document Registration System (NGDRS) is a common, generic, and configurable application developed to assist registration departments across the country. The product is designed to achieve following aspirations:

i) Put for the state of Art, single window document registration platform.

ii) Develop a common generic configurable registration system across pan India for the aspects of planning activity.

iii) Maintain a single Data Structure.

iv) Provision of Cloud Enabled Centric Solutions.

v) Develop Virtual SRO.

2.0 MISSION

i) Design a start to end citizen centric platform.
ii) To facilitate e-Registration process wherever possible in the jurisdiction of Registration Act.
iii) Offer an outright user interface for document registration.
iv) To identify the process for presence less registration.
v) To identify stakeholders, Government Institutions, Payment Banks, Mortgagee Banks/NBFC, Urban Local Bodies, Rural Local Bodies, Real Estate Regulation Bodies.
vi) To identify internal departments and other organizations.
vii) To identify the linked services.
viii) Reduce the need of frequent visits to the sub-registrar office.
ix) To identify the various payment gateways for online payments.
x) Provide a smooth and coherent process for the payment of stamp duty, online appointment booking, uploading the documents, and payment of registration charges.

3.0 OBJECTIVES

The system aims to ensure that the registrations and delivery of documents happen in

accelerated and swift manner comparing to the conventional methods. The broad level objectives are:

- A one nation one software concept is developed by NIC under DILRMP (Digital India Land Records Modernization Programme) a central sector scheme to register deeds and documents of property transactions across the country.
- Considering India's diversity of languages, legal terminology state specific laws and legislations, provide single nationwide software for registering property transaction documents.
- Assist the states and UTs to customize and design their own state specific Document Registration System (DRS) enterprise architecture to analyze and establish their document registration landscape and guide them in implementing NGDRS as a generic solution.
- Provide e-Registration/Presence less registration with remote authentication.
- Citizen will visit Registration Departments with prior appointment only which reduces effective registration time.
- Citizen empowerment by enabling property valuation and online document submission.
- Maintain a single platform for all the stakeholders in the registration process.
- Uphold this generic platform for the registration of properties and documents across the country.
- Provide easy and user-friendly interface for the convenience of the citizens.

4.0 Development of NGDRS

The platform has been developed using open-source development tools and is a web-based system implementing single instance for an entire state. Being generic in nature, the software is deployed as state specific instance. The registration departments of every state have specific and definite approach and this factor was considered and acknowledged while developing the software.

The steps followed are enlisted here:

i) To begin with, a questionnaire was designed and circulated to the Inspector General of all states. Majority of them were filled as per state specific requirements with the

assistance of local NIC officials.

ii) Examining the inputs, a gap analysis report was formulated.

iii) Following it, a System Requirement Specification document was prepared which was approved by the Department of Land Resources at the Government of India level.

iv) Based on the requirements derived and brought forth from the tacit knowledge of functionaries, NGDRS was developed.

5.0 VALUE PROPOSITION

i) Single source code and single data structure across pan India.

ii) State IGR is the Custodian of Data as per the Registration Act.

iii) eKYC based party authentication and PAN verification.

iv) Configurable restriction on registration of any prohibited property.

v) Integration of state specific digital payment gateways as well as bank payment gateways.

vi) Presence less e-Registration with remote eKYC.

vii) Auto-mutation of land parcels after the completion of registration process.

viii) Paid Tatkal appointment facility available for emergency registration.

ix) Template based e-Registration to minimize the scan document space which is for retrievals in such reports.

x) Integration with urban local bodies for property tax.

xi) Facility of generating Encumbrance Certificate.

xii) 13 Block Chain components for property registration and land records to check records of rights (ROR).

xiii) The software is provided with an online valuation module with stamp duty calculation.

6.0 Cloud Security: NGDRS applications use INHERIATED CLOUD Security and implies the best practices designed to protect data and information within the CLOUD ARCHITECTURE. It ensures data privacy and compliance around the data stored in the cloud. Cloud security includes controls and process improvements that strengthen the system, warn of potential attackers and detect incidents when they do occur. Further, Web Server Security, Application Security and Database Security is also insured.

7.0 CONCLUSION

The proposed approach/ methodology of using NGDRS is intended to provide quality services to users through single portal on one hand and achieve transparency in registration process. The Architecture is generic in nature to include more department/agencies as and when they become a stake holder as per criteria.

National Generic Document Registration System has made the registration process easier so that one can quickly adapt to the system and start utilizing it.

Part-C: MIS

ANNEXURE-C-I

PROFORMA FOR THE SUBMISSION OF PROPOSALS FOR THE RELEASE OF FUNDS

SECTION A: STATE-LEVEL INFORMATION	
1.Name of the State /UT:	
2.Number of Revenue districts	
3.Number of Sub Registrar Offices (SROs)	
4.Number of *tehsil*s/*taluka*s/*mandal*s	
5.Number of revenue circles/RI circles/*patwari* circles	
6.Number of revenue villages	
7.Total No. of Land Records	
8.Total No. of 1) Cadastral Maps 2) FMBs	
9. Total Geographical area (insq.km.) 1)Rural 2)Urban 3)Forest 4)Total	
10.State-level Data Centre (SLDC)	Yes/No
11.Total No. of Revenue Courts	
12.Programme Management Unit (PMU)	Yes / No If Yes, please mention year of sanction
13. DILRMP Centre/Cell	Yes / No If Yes, please mention year of sanction
14. No. of land parcels (khatian, etc.) in the District:	

1) Rural 2) Urban	

Section B: Plan to cover all the districts within five years (2021-22 to 2025-26)			
Sl. No.	**Year**	**No. of districts to be taken up during the year**	**Names of the districts**
1.	**2021-22**		
2.	**2022-23**		
3.	**2023-24**		
4.	**2024-25**		
5.	**2025-26**		

Section C: District-wise proposal (Summary)

Name of the District:
Total No. of Tehsils:
Number of revenue villages:
Number of Sub Registrar Offices (SROs):
Total No. of Land Records:
Total No. of: 1) Cadastral Maps: 2) FMBs:
Total Geographical area (in sq.km.): 1) Rural: 2) Urban: 3) Forest:
Total No. of Revenue Courts:
No. of land parcels (khatian ,etc.) in the District: 1) Rural 2) Urban

District-wise proposal (Component-wise break up)

1. COMPUTERIZATION OF LAND RECORDS

<table>
<tr><td rowspan="5">Data entry/re-entry/data conversion</td><td colspan="4">Total No. of Land Records:</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="2">No. completed</td><td colspan="2">No.to be taken up</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Unit cost:</td><td colspan="2">Unit cost: Rs. 5 per record entry</td></tr>
<tr><td colspan="2">Total cost:</td><td colspan="2">Total cost:</td></tr>
<tr><td rowspan="6">Digitization of Cadastral Maps / FMBs</td><td colspan="2">Total No. of Cadastral maps</td><td colspan="2">Total No. of FMBs</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>No. completed</td><td>No. to be taken up</td><td>No. completed</td><td>No. to be taken up</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>Unit cost:</td><td>Unit cost:</td><td>Unit cost:</td><td>Unit cost:</td></tr>
<tr><td>Total cost:</td><td>Total cost:</td><td>Total cost:</td><td>Total cost:</td></tr>
</table>

2. COMPUTERIZATION OF REGISTRATION

Computerization of Registration offices	**No. completed**	**No. in progress**	**No. to be taken up**
			Unit cost:
			Total cost:
Data entry of valuation details			
			Unit cost:
			Total cost:
Data entry of legacy encumbrance data			
			Unit cost:
			Total cost:
Scanning and preservation of old documents			
			Unit cost:
			Total cost:
No. of Registration offices connected with the concerned Tehsil office			
			Unit cost:
			Total cost:

3. SURVEY/RESURVEY

<table>
<tr><td colspan="3">The year in which the last survey & settlement operation was carried out in the District</td></tr>
<tr><td rowspan="3">Modern survey methodology being proposed now for survey/ resurvey of the District</td><td>Pure ground method using ETS & DGPS; or</td><td></td></tr>
<tr><td>Hybrid methodology using aerial photography and ground truthing by ETS & DGPS; or</td><td></td></tr>
<tr><td>Hybrid methodology using high-resolution satellite imagery and ground truthing by ETS&DGPS</td><td></td></tr>
<tr><td colspan="3">Total estimated time for completing the survey/resurvey of the entire district (in months)</td></tr>
<tr><td colspan="3">Area already sanctioned (in sq km):
Sanctioned year:
Cost Sanctioned (along with rate at which Survey / Resurvey was sanctioned):

Area Proposed (in sq km):
Rural:
Urban:
Forest:
Cost proposed:
Rural:
Urban:
Forest:

Type of technology to be used:</td></tr>
<tr><td colspan="3">Milestones along the timeline for completing the survey/resurvey in the entire district, please indicate the month by which it will be completed:</td></tr>
<tr><td colspan="2">1. Establishing the ground control network</td><td></td></tr>
<tr><td colspan="2">2)Aerial photography or HRSI, if opted for</td><td></td></tr>
<tr><td colspan="2">3)Ground truthing by ETS & DGPS</td><td></td></tr>
</table>

4)Completion of the settlement operation	
5)Updating of the maps and textual data in the computerized environment	

4. MODERN RECORD ROOM

Total No. of Tehsils / MRR	Total No.	No. completed (with names of Tehsil/SRO)	No. in progress (with names of Tehsil/SRO)	No. to be taken up (with names of Tehsil/SRO)
				Unit cost:
				Total cost:

5. COMPUTERIZATION OF REVENUE COURTS

Computerization of Revenue Courts and their integration with Revenue Offices	Total No.	No. completed (with location)	No. in progress (with location)	No. to be taken up (with location)
				Unit cost:
				Total cost:

6. Consent-based Linkage of Aadhaar number with Record of Rights

	No. completed	No. in progress	No. to be taken up
Linking Aadhaar number with Record of Rights (Only with consent of RoR holder)			
			Unit cost:
			Total cost:
Authentication of Record of Rights through Aadhaar number (only with consent of RoR holder)			
			Unit cost:
			Total cost:

7. Training & capacity building plan for the entire State/ UT

Total number of officers and staff to be trained:	
1)At policy level and the HoD level, including the2nd-and 3rd–in-command levels	
2)From the land records establishment	
3)From the survey & settlement (or consolidation) organization	
4)From the SROs	
5) From Revenue Courts	
6) Master trainers to be trained for training the field-level staff out of (1) to (5) above	
7) Preferred training institution(s), if any:	
8) Duration of training, batch-sizes, best time of the year, separately, for each of the above categories; and the estimated cost:	

FINANCIALS

(Separately, for each district proposed to be taken up)

S.No.	Components/activities	Total cost (Rs. In lakh)
1.	**Computerization of land records**	
	Data entry/re-entry/data conversion	
	Digitization of cadastral maps and integration of textual and spatial data	
	Tehsil, sub-division/district data centres	
	Inter-connectivity among revenue offices	
2.	**State Level Data Centre**	
3.	**Survey/resurvey and updating of survey& settlement records (including ground control network and ground truthing) (only ongoing works)**	
4.	**Computerization of registration**	
	Computerization of SROs	
	Data entry of valuation details	
	Data entry of legacy encumbrance data	
	Scanning & preservation of old documents	
	Connectivity to SROs with revenue offices	
5.	**Modern record rooms/land records management centres at tehsil/taluk/circle/block level**	
6.	**DILRMP Cell**	
7.	**PMU**	
8.	**Core GIS / Software applications**	
9.	**Training & Capacity Building**	
10.	**IEC Activities**	
11.	**Computerization of Revenue Courts and their integration with Revenue Offices**	
12.	**Consent-based Linkage of Aadhaar number with Record of Rights and Aadhaar-based authentication of RoR**	

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Annexure-C-II

FORMAT FOR QUARTERLY PROGRESS REPORT
Financial Year:

S.No.	Indicator	Progress during First Quarter (March-June)	Progress during Second Quarter (July-September)	Progress during Third Quarter (October-December)	Progress during Fourth Quarter (January-March)
1	Record of Rights (RoRs) computerized (No. of villages)				
2	Maps / FMBs digitized (No.)				
3	RoRs integrated with cadastral Maps/FMBs (no. of villages)				
4	No. of geo-referenced cadastral maps				
5	Sub-Registrar Offices (SROs) computerized (No.)				
6	SROs connected and integrated with revenue offices (No.)				
7	Integration of Land Records (RoRs) with Bank (No. of Districts)				
8	Integration of Land Records (RoRs) with Aadhar (No. of Districts)				
9	Computerization of Revenue Court (e-RCMS- Revenue Court Management System) (No. of Districts)				

Annexure-C-III

ONLINE MONITORING FORMAT FOR DILRMP (DISTRICT WISE)

1 District Profile (One Time Entry)

1.	Name of District	**Select from List**
2.	Number of Sub-divisions	
3	Number of Tehsil/Taluks	
4.	Number of Sub-Registrar Offices	

2 Physical Performance (Quarterly Reporting)

A. Computerization of Land Records District Level Centre

1	Whether District Centre set up under DILRMP	Y/N
2	IF not, is it sanctioned during current year	Y/N
3	If Yes, Progress made so far	

B. Sub-Division Level Centre

Sr.	**Activities**	**Name of Sub-Divisions**		
1	Whether Sub-division Computer Centre set up	Y/N	Y/N	
2	If not, is it sanctioned during current year	Y/N	Y/N	
3	If yes, progress so far			

C. Tehsil Operational Details

	Activities	Name of Sub-divisions			
		Name of Tehsils		Name of Tehsils	
1	Whether Tehsil Computer Centre set up	Y/N	Y/N		
	IF not, is it sanctioned during current year	Y/N	Y/N		
	If yes, progress so far				
2	Data Entry of RoR completed	Y/N			
	If not progress so far				
3	Data Entry of other attributes completed				
	If not progress so far				
4	Whether copies of RoR being distributed through computers	Y/N			
	If not progress so far				
5	Whether legal sanctity given to computerized copy of RoR	Y/N			
	If not progress so far				
6	Whether manual distribution of RoR stopped	Y/N			

	If not, by when manual distribution of RoR will be stopped				
Issuance of other Certificates					
7	Distribution of other Certificates from Tehsil Computer Centre (Tick out of the following)	Domicile			
		Income			
		Caste			
		Backward Area			
		Succession			
		Others			
Connectivity Details					
7	Details of Last Mile connectivity arranged (Tick out of following)	Broadband			
		Broadband with VPN			
		Leased Line			
		SWAN -POP			
		Other			

		Not yet arranged			
Digitization of cadastral Maps					
8	Total Number of Maps/FMB/Gat maps				
9	No of Maps /FMB Vectorized				
10	Whether Mosaicing done for all villages	Y/N			
	If not, progress so far				
11	Whether Geo-referencing done for all villages	Y/N			
	If not, progress so far				
12	Whether textual and spatial data integrated?				
	If not progress so far				

D. Computerization of Registration

	Activities	Sub- registrar -1	Sub-registrar – 2	……
1	Whether SRO computerized	Y/N	Y/N	

	If Yes, tick the functions computerized	Availability of Deed Formats on Web		
		Property Valuation		
		Property & parties details capturing		
		Photo and Finger Printing		
		Scanning and Retrieval System		
		Issue of Non-Encumbrance Certificate		
		Any Other....		
	If Not, progress so far			
Connectivity Details				
2	Details of Last Mile connectivity arranged *(Tick out of following)*	Broadband		
		Broadband with VPN		
		Leased Line		
		SWAN -POP		
		Other		
		Not yet arranged		
3	Whether SRO and Tehsil have been integrated			
	If Not, progress so far			

E Survey and Settlement using modern technology

Total area of districts in SQ KM:

Choice of Technology

Technology being used (Tick)	*Area being surveyed in SQ KM*
1)Aerial Photography +DGPS/ETS	
2)DGPS+ETS (Ground Methods)	
3)HSRI+GPS+ETS	
4)Any other...LIDAR/ALTM etc.	

F Modern Land Records Management Centre under DILRMP at Tehsil/Taluk Level

Name of Tehsil /Taluk:

1	Whether Record Room co-located with tehsil computer Centre	Y/N
2	Physical Storage	Physical storage through compactors Y/N
		No of compactor installed :
		Whether stored file (Paper) indexed and referenced through computerised system
3	Operational Area	No of Server installed:
		No of Clients installed:

		Whether Storage Area Network (SAN) required: Y/N
		Whether archival records scanned and stored digitally: Y/N
		If yes, stored in CD/DVD/TAPE/HDD/SAN (Tick)
4	Public Services	Whether scanned records are distributed
5	Reception and Waiting facility exist	Y/N

G Computerization of Revenue Courts

1	How many Revenue Courts have been computerized so far under DILRMP	District-wise details
2	How many Revenue Courts have been computerized so far by State using its own resources (other than DILRMP)	District-wise details
3	How many Revenue Courts have been integrated with Revenue Offices (land records) so far under DILRMP	District-wise details
4	How many Revenue Courts have been integrated with Revenue Offices (land records) so far by State using its own resources (other than DILRMP)	District-wise details

H Consent-based Linkage of Aadhaar

1	How many Records of Rights have been linked with Aadhaar (consent based)	Village-wise number and percentage
2	How many Records of Rights have been authenticated with Aadhaar (consent based)	Village-wise number and percentage

3 Financial Performance/ Position (Quarterly Reporting) - District Wise

S. No	Broad Activities	Opening Balance as on 1st April of the year	Funding Received during the year (in Lakh)	Total Amount Available (in Lakh)	Amount Utilized (In Lakh)
1	Computerization of Land Records				
2	Survey/resurvey and updating of survey & settlement records (only ongoing work)				
3	Computerization of registration				
4	Modern record rooms/land records management centres at Tehsil				
5	Computerization of Revenue Courts				
6	Consent-based Linkage of Aadhaar with Record of Rights				

7	Training and capacity Building				