NAKSHA

NAtional geospatial Knowledge-based land Survey of urban HAbitations

शहरी भूमि की सही पहचान

Standard Operating Procedure

भूमि संसाधन विभाग

DEPARTMENT OF
LAND RESOURCES
Government of India

सत्यमेव जयते

शिवराज सिंह चौहान
SHIVRAJ SINGH CHOUHAN

सत्यमेव जयते

ग्रामीण विकास तथा
कृषि एवं किसान कल्याण मंत्री
भारत सरकार
कृषि भवन, नई दिल्ली
MINISTER OF
RURAL DEVELOPMENT AND
AGRICULTURE & FARMERS WELFARE
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI

MESSAGE

While significant progress has been made in digitizing rural land records through initiatives like the Digital India Land Records Modernization Programme (DILRMP) and the SVAMITVA scheme, urban and peri-urban areas have remained largely unaddressed. The creation and modernization of urban land records is a crucial step toward ensuring transparency, efficiency, and accountability in land administration. Recognizing this critical gap, the Government of India has launched the **NAtional geospatial Knowledge-based land Survey of urban HAbitations (NAKSHA) Programme**, a transformative initiative aimed at creating accurate, up-to-date, and integrated urban land records.

Hon'ble Prime Minister has emphasized the importance of leveraging modern technology for governance, and the Hon'ble Finance Minister's 2024-25 Budget Speech further reinforced the need for comprehensive land-related reforms in both rural and urban areas. The NAKSHA Pilot Programme aligns with this vision by employing advanced geospatial and IT-based solutions to digitize land records, enabling better urban planning, streamlined property administration, and improved financial sustainability of Urban Local Bodies.

This **Standard Operating Procedure (SOP) Handbook** has been meticulously designed to serve as a guiding document for all stakeholders, ensuring a structured and coordinated approach to implementing the NAKSHA Programme. It outlines the operational framework, methodologies, and best practices to be followed by participating State Government agencies, Urban Local Bodies, and technical partners such as the Survey of India.

I am confident that this SOP Handbook will serve as an invaluable resource in achieving the programme's objectives and will contribute significantly to modernizing India's urban land governance framework. I extend my appreciation to the Department of Land Resources, Ministry of Rural Development, and all collaborating agencies for their dedicated efforts in this ambitious endeavour.

Together, let us work towards a future where urban land records are comprehensive, transparent, and accessible to all, ensuring ease of living and sustainable urban development for generations to come.

(Shivraj Singh Chouhan)

Office: 'G' Wing, Ground Floor, Krishi Bhawan, New Delhi-110001, Tel.: 011-23383548, 23782373, 23782327, Fax: 011-23070309
Email: minister.rd@gov.in

डॉ. पेम्मासानी चंद्र शेखर
Dr. Pemmasani Chandra Sekhar

सत्यमेव जयते

राज्य मंत्री
संचार एवं ग्रामीण विकास मंत्रालय
भारत सरकार
Minister of State for Communications
and Rural Development
Government of India

MESSAGE

Digitization of urban and peri-urban land records is the need of the hour to make land administration more transparent, accurate, and efficient. The Government of India has taken a significant step in this direction by launching the **NAtional geospatial Knowledge-based land Survey of urban HAbitations (NAKSHA) Programme**. This initiative will bring a transformational change by leveraging advanced surveying technologies and IT-based solutions to modernize and streamline urban land records.

By ensuring accurate and up-to-date land records, the NAKSHA Programme will not only facilitate better urban planning and governance but also enhance property administration, reduce land disputes, and strengthen the financial position of Urban Local Bodies (ULBs). The collaborative efforts of the Department of Land Resources, Ministry of Rural Development, Ministry of Housing and Urban Affairs, Survey of India, third party agencies, NICSI, MPSEDC and State Governments will be instrumental in the successful implementation of this ambitious initiative.

This **Standard Operating Procedure (SOP) Handbook** has been prepared to provide clear guidelines, methodologies, and best practices for all stakeholders involved in the NAKSHA Pilot Programme. It will serve as a comprehensive reference document, ensuring a standardized and coordinated approach across participating agencies.

I congratulate the Department of Land Resources and all partner organizations for their dedication and efforts in shaping this visionary programme. I am confident that this SOP will play a crucial role in achieving the programme's objectives and in strengthening India's urban land governance framework.

Together, let us work towards a future where urban land records are seamless, transparent, and accessible to all, contributing to ease of living and sustainable urban development.

(Dr. Pemmasani Chandra Sekhar)

Office : Room No. 102, Sanchar Bhawan, 20, Ashoka Road,New Delhi - 110 001
Tel. : (O) +91-11-23372414, 23342565
Room No. 301, Dak Bhawan, Sansad Marg, New Delhi-110 001
Tel. : (O) +91-11-23096269, 23096270 E-mail : mosc-office@gov.in

मनोज जोशी
सचिव
Manoj Joshi
Secretary

सत्यमेव जयते

एक कदम स्वच्छता की ओर

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

MESSAGE

The Department of Land Resources has introduced the NAtional geospatial Knowledge-based land Survey of urban HAbitations (NAKSHA), a transformative pilot programme under the Digital India Land Records Modernization Programme (DILRMP). This initiative represents a groundbreaking step towards creation of urban land records in India. With a financial outlay of ₹193.81 crore, NAKSHA pilot will be implemented across 152 ULBs over one year. The Survey of India (SoI) is the technical partner, working alongside Revenue and Urban Development/Local Self Government Departments of States and Union Territories (UTs).

By leveraging advanced geospatial technologies, fostering institutional collaboration, and focusing on capacity building, the programme addresses critical challenges in urban land administration. Its emphasis on accuracy, transparency, and integration positions it as a model for nationwide implementation.

Through the pilot programme of NAKSHA, the government aims to empower urban citizens, improve governance, and enable sustainable urban development. As cities continue to grow, accurate and accessible land records will play a pivotal role in ensuring that this growth is inclusive, sustainable, and resilient. The lessons learned from the NAKSHA pilot will serve as a foundation for scaling up the initiative, contributing to India's vision of Digital India and sustainable urbanization.

This Standard Operating Procedure (SOP) outlines the procedures for data collection, processing, analysis, and dissemination within the NAKSHA Programme. This SOP also suggests the process for managing geospatial data and creating urban land records. However, variations as per regulatory frame work, data set availability and technological efficiency outcomes desirable to be captured in various State/UT and at ULBs level.

The Department of Land Resources (DoLR) is grateful for overall guidance and encouragement it received from the Hon'ble Minister of Agriculture & Farmers Welfare and Rural Development and Hon'ble Minister of State for Rural Development & Communications. We are extremely grateful for their continued support.

Finally, let me also place on record the tremendous amount of work put in by the States/UTs in modernizing land records under DILRMP programme in the past and the continued momentum for NAKSHA pilot implementation.

Manoj Joshi

(Manoj Joshi)

एन.बी.ओ. बिल्डिंग, निर्माण भवन, नई दिल्ली-110011 दूरभाष: 91-11-23063927, 23063183 फैक्स: 23062541
NBO Building, Nirman Bhawan, New Delhi-110011 Ph.: 91-11-23063927, 23063183 Fax: 23062541
E-mail: secylr@nic.in

कुणाल सत्यार्थी, भा.व.से.
संयुक्त सचिव
KUNAL SATYARTHI, IFS
Joint Secretary

सत्यमेव जयते

आजादी का अमृत महोत्सव

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

Foreword

Proper urban land records are a cornerstone of effective urban governance, property taxation, urban planning and disaster management in a rapidly urbanizing country. By investing in comprehensive data collection, digitalization, public accessibility, capacity building, community engagement and awareness, a robust urban land record system needs to be created that supports sustainable urban development and enhances the quality of life for citizens and also ease of business.

NAKSHA (NAtional geospatial Knowledge-based land Survey of urban Habitations) encompasses a comprehensive set of activities, each designed for creation of urban land records through cutting-edge technology and capacity-building measures in 152 ULB: (Urban Local Bodies).

Aerial Survey component in the programme uses advanced methodologies tailored to varying urban scenarios w.r.t. congestion, vertical growth, elevation, terrain conditions and vegetation cover. Three approaches are being tested in this one-year pilot programme:

i) 2D Nadir imaging which captures 2D vertical imagery for precise mapping and accurate boundary identification in 80 ULBs which are planned, smaller and horizontal.
ii) Oblique Imaging (3D) additionally, provides angled imagery to reveal building heights, facades, and terrain details in 47 ULBs with vertical growth and congestion.
iii) Oblique (3D) and LiDAR (Light Detection and Ranging) combines angled imaging with laser scanning for enhanced 3D mapping accuracy and detailed topographic analysis in 25 ULBs which are Complex with congestion and vertical growth specially in Hilly regions.

Data acquired from aerial surveys would be processed to generate Ortho Rectified Imagery (ORI) out of which features will be extracted based on the visual interpretation which will then be handed over to respective States and UTs for field validation after QA & QC.

Room No. 110, NBO Building, Nirman Bhawan, New Delhi-110011
Ph.: 91-11-23063462, Fax: 23062351, E-mail: jslr-dolr@nic.in

Thereafter, field survey will validate and update the data collected through aerial survey by using GNSS (Global Navigation Satellite System) Rovers and utilising the CORS (Continuously Operating Reference Station) network. The States and Union Territories field survey teams woud demarcate the individual land parcels using rovers on a end-to-end WebGISplatform with ORIs as the basemap. Each ULB level team will consist of a permanent staff member from the State Revenue and Urban Development Departments, supported by a surveyor, a helper and a vehicle provided under the NAKSHA programme.

To sustain the programme's impact, extensive training and capacity-building initiatives would be undertaken simultaneously. State personnel will be equipped with the knowledge and skills needed to create, manage and update land records effectively.

I owe my sincere gratitude to Mr. Manoj Joshi, Secretary (DoLR) for his leadership, constant guidance and unconditional support in conceiving and implementing the flagship NAKSHA programme. I acknowledge the sincere efforts and valuable inputs by Additional Secretary, DoLR. Mr. R. Anand.Needless to say, I am deeply indebted to National Program Management Unit (NPMU) team under the leadership of Shri Shyam Kumar, Director (LR) for their support, hard work and contribution. Last but not the least, sincere gratitude to Shri Hitesh Makwana, Surveyor General of India, Survey of India (SoI), Dehradun; Shri N. K. Sudhansu, Director General, YASHADA, Pune; Shri Munish Moudgil, Special Commissioner (Revenue), Govt. of Karnataka; Shri N Prabhakar Reddy, Addl CCLA (Revenue), Govt. of Andhra Pradesh and Lt. Gen. (Rtd) Girish Kumar, Former Surveyor General of India, for their valuable suggetions in framing this Standard Operating Procedure (SOP) document.

I extend my best wishes to all stakeholders including the participating States/UTs, Survey of India, Third Party Agencies for Aerial Survey, MPSEDC (Madhya Pradesh State Electronics Development Corporation), NICSI (National Informatics Centre Services Inc.) for successful implementation of NAKSHA programme.

(Kunal Satyarthi)

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1. Rectitude of the NAKSHA Programme

All India Debt and Investment Survey, 2019 (NSSO) highlights that 90% of assets of individuals in India are held as land and buildings. Various studies reveal that 2/3rd of the private disputes in subordinate courts in India relate to land and building. Lack of updated land records and maps are one of the main reasons for this. According to a McKinsey study (2001), land market distortions cost India about 1.3% in GDP growth. Another McKinsey report (2020), highlights that informal settlements and unregistered land could be formalized by speeding up the digitization of land records, cadastral maps, and surveys, deploying modern technologies including Differential Global Positioning System (DGPS) and aerial survey. These exercises would also significantly ease the process of land acquisition in urban and peri urban landscape.

The reforms in urban planning capacity in India report of 2021 by NITI Aayog has elaborated the need of spatial planning of urban areas. Further, cities play a decisive role in achieving India's commitments to global agendas, such as United Nations Sustainable Development Goals (SDGs) 2030, UN-Habitat's new urban agenda, and the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC). The SDGs specifically Goal 11 (making cities inclusive, safe, resilient, and sustainable) promotes urban planning as one of the recommended methods for achieving sustainable development. They include a new focus on participatory and integrated planning for urban areas, peri-urban areas, and rural areas land resources.

One of the major components of urban planning are land records and property management which requires very precise survey, resurvey and creation & updation of the land records. This includes setting up ground control network and the process of cadastral revenue map, if any being on very high-resolution base map or GIS ready topographical layers generated using property tax database, urban layout plans etc. Hybrid method involves use of professional survey grade Unmanned Aerial Vehicle (UAV)/ Drone for large scale mapping and precise field measurements by Differential Global Positioning System (DGPS) or Global Navigation Satellite System (GNSS) Receivers also known as GNSS Rovers. Since many Urban Local Bodies (ULBs) have multi storey structures, congested constructions, narrow roads and streets, this calls for mapping the ULBs in 3D environment to accurately capture, visualize and interpret the ownership data and other categorization of property in 3D spatial domain.

The digitization of urban land records is an essential step towards achieving transparency, efficiency, and accountability in land administration.

While the Government of India (GoI) has made significant progress in digitizing rural land records through initiatives such as the Digital India Land Records Modernization Programme (DILRMP) of Department of Land Resources (DoLR) and the Survey of Villages Abadi and Mapping with Improvised Technology in Village Areas (SVAMITVA) scheme of Ministry of Ministry of Panchayat Raj (MoPR), but the urban and peri urban areas are completely unaddressed.

Source: 1. All India Debt and Investment Survey, 2019 (NSSO): www.mospi.gov.in/sites/default/files/publication_reports/Report_no588-AIDIS-77R-SeptFinal_0.pdf
2. McKinsey study (2001): www.mckinsey.com/~/india/mgi_the_growth_imperative_for_india.pdf
3. McKinsey Report (2020): www.mckinsey.com/~/mgi-indias-turning-point-report-august-2020-vfinal.pdf
4. Reforms in Urban Planning Capacity in India Report (2021) by NITI Aayog: https://www.niti.gov.in/sites/default/files/2021-09/UrbanPlanningCapacity-in-India-16092021.pdf

These areas often lack clear update and accessible land records, including Record of Rights (RoRs), cadastral maps and their digital linkages which leads to uncertainties and prolonged legal disputes and numerous grievances.

Strengthening the urban and peri-urban land records system by creating, modernizing, updating, integrating records and maps is the need of the hour. Hon'ble Finance Minister of India in July 2024-2025 Budget Speech emphasized that

"Land-related reforms by state governments (para 98) – Land related reforms and actions, both in rural and urban areas, will cover (1) land administration, planning and management, and (2) urban planning, usage and building bylaws. These will be incentivized for completion within the next 3 years through appropriate fiscal support.

Rural Land related actions (para 99) – Rural land related actions will include (1)assignment of Unique Land Parcel Identification Number (ULPIN) or Bhu-Aadhaar forall lands, (2) digitization of cadastral maps, (3) survey of map subdivisions as percurrent ownership, (4) establishment of land registry, and (5) linking to the farmersregistry. These actions will also facilitate credit flow and other agricultural services. Urban Land related actions (para 100) – Land records in urban areas will be digitizedwith GIS mapping. An IT based system for property record administration, updating,and tax administration will be established. These will also facilitate improving thefinancial position of urban local bodies."

(Source: www.indiabudget.gov.in/ Government of India, Budget 2024-2025, Speech of Nirmala Sitharaman, Minister ofFinance, July 23, 2024, page no. 18, para 98, 99 and 100)

To bridge this gap, NAtional geospatial Knowledge-based land Survey of urban Habitations (NAKSHA) Programme is sanctioned by Department of Land Resources, Government of India since September 2024 to create and digitize urban and peri-urban land records, offering an integrated solution that leverages modern surveying and mapping technologies.

Under this proposed pogramme the demarcation of government land, public land, various utilities like roads, railways, etc., inhabited land in urban and peri urban areas would be done using aerial surveying technology with the collaborative efforts ofthe Department of Land Resources (DoLR), Ministry of Rural Development (MoRD), Government of India; Ministry of Housing and Urban Affairs (MoHUA), Government of India; Survey of India (SoI), Dehradun; State Revenue & Urban Development Department/ Local Self Government, Madhya Pradesh State Electronics Development Corporation (MPSEDC), Bhopal, National Informatics Centre (NIC).

"The NAKSHA Pilot Programme has been initiated by the Department of Land Resources in 152 ULBs across the country with Survey of India as, Technical Partner which would cover the aerial survey and feature extraction part. The State/Union Territory (UT) Governments would complete the field survey, ground truthing and final publication of urban and peri-urban land records. As of now 26 States/ 3 UTs are participating in the Pilot Programme with a variable number of Urban Local Bodies (ULBs) to a maximum of 10 ULB: per State/Union Territories

2. Objectives of NAKSHA Programme

The NAKSHA Programme is designed to support urban, peri-urban and regional planning by generating and providing high-quality, geospatial data to the States/UTs. It is essential to prioritize the creation of land records in urban and peri-urban areas to enhance the ease of living for citizens, streamline the urban land records optimization and improve overall urban development outcomes, including better property tax collection, urban planning and redevelopment. It would also lead to ease of business by way of easier access to credits, precise geospatial decisions, and ownership clarity etc. A key step in this direction is the creation of the urban land record system which provides comprehensive and reliable information for all urban land parcels within ULBs and peri-urban areas in an easily accessible format.

Given the limitations of existing data sets, the most reliable approach to establishing such a system is to conduct a survey and create a database using the latest technology. This process should include robust safe guards by cross-referencing already existing data bases and actively involving citizens through ground truthing and a transparent process for addressing cliams and grievences. This approach ensures accuracy, reliability and public trust in the new urban land record system.

The primary objectives of the NAKSHA Programme are:

a) **Creation of urban land records:** To create spatial data enabled urban land records system as a comprehensive, digitized and accurate database in urban and peri-urban areas using latest technologies and to correlate the existing digitized town survey records, wherever available.

b) **Creation of Web GIS platform:** To develop a user-friendlyend-to-end Web GIS platform that allows government and citizens to access urban land records allowing interoperability of data across sectors and digital system.

c) **Empower urban citizens and improve ease of living:** Creation of urban land records resulting in reduction of disputes, simplification of access to urban utilities like electricity, water, telephone, etc and credit facilities.

d) **Better financial health of urban local bodies:** Scientific accurate and transparent property taxation regime would improve financial health of ULBs.

e) **Better urban planning:** Provide geospatially accurate data to support scientific urban planning, redevelopment and disaster resilience & management.

3. Scope of Standard Operating Procedure (SOP)

This Standard Operating Procedure (SOP) outlines the procedures for data collection, processing, analysis, and dissemination within the NAKSHA Programme. This SOP suggests the process for managing geospatial data and creating urban land records. However, variations as per regulatory framework, data set availability and technological efficiency outcomes desirable to be captured in various State/UT and at ULBs level would be the core of the programme.

The document is illustrative in nature to provide the required uniform nationwide framework and technical workflow models. In case of any of the suggested provision is at variance from the provisions existing in or being formulated by the State/UT concerned, the State/UT provision(s) would prevail as per local situations and requirements.

The key steps and components discussed in this SOP include:

a) **Aerial Photogrammetric Data Collection and Ortho Rectified Imagery Generation:** Collecting geospatial data i.e. establishment of Ground Control Network (GCN) and generating Ortho-Rectified Imagery (ORI) using designated technologies.

b) **Quality Assurance and Quality Control:** Ensuring accuracy and consistency throughout the data acquisition and processing stages of Aerial survey and Feature extraction extraction.

c) **Data Processing and Analysis:** Processing and analyzing collected data schema to facilitate urban land records updation and data dissemination sharing processed data with relevant stakeholders seamlessly for field survey and ground validation as Map-1.

d) **Field Survey and Ground Truthing:** Conducting field surveys and ground-truthing foreach land parcel under the jurisdiction of concerned Urban Local Bodies (ULBs) as required.

e) **Land Record Validation and System Update:** Validating existing land records if any and other documents maps, and generating updated maps, and uploading the data into the end to end WebGIS Application for Urban Land Record Management and publication of Map-2.

f) **Final Map Publication:** After acceptance or cliam/grivence resolution, the final Map-3 publication of ULBs, containing details of ownership, area etc., of all the land parcels would be carried out with issue of Urban Property card (UrPro)

4. Stakeholders, their Roles and Responsibilities

Table 4.1: Details of NAKSHA's component wise activity and responsibility

S. No	Component	Activity	Responsibility / Implementation by
1	Aerial Survey	Fixation of ULBs boundary for aerial survey with the help of satellite imagery and States/ Uts ground support, establishment of Ground Control Points (GCPs), procuring of necessary clearances for aircraft/ drone flying, data acquisition, post processing generation of Ortho Rectified Imagery (ORI), Orthomosaic, (DEM, DSM & DTM), 3D textured model/3D reality model and QA/QC	Survey of India (SoI) through Third-Party agencies for selected packages and by three different proposed technologies including their QA/QC.
2	Feature Extraction	Generation of 2D/3D GIS dataset through feature extractions including all buildings and public utilities, etc., and generation of topographical layer including property markers and QA/QC asper standardized schema for the three methdologies.	Survey of India (SoI) through procurement of third-party agencies
3	Scanning, Digitization & Integration of existing records	Scanning, digitization of existing records & maps and integration of Record of Rights (RoRs) and other details details including property tax, layout plans, registration deeds etc. in attributes	States/UTs with assistance and guidance of Survey of India and MPSEDC.
4	Field Survey	Field survey of all land parcels and ground truthing of the properties with two permanent staff per team from Revenue Department and Urban Development Department which would be provided by the States/UTs. Cost of three hired staff including a surveyor, helper and a driver with vehicle per team will be provided under this Programme.	States/UTs with their own staff ior with help of Third-Party agencies by hiring or as a service. Hired staff (ie. surveyor, helper and driver) and vehicles could be taken as a service from a third party or internally by the department concerned.

5	Quality Assurance and Quality Control	Generated Land Parcel/Property layer from Field Survey and Ground-truthing/ Ground Validated data of ownership data and publishing after inquiry and claim grievances resolution	States/UTs with with technical assistance of Survey of India
6	Generation of Property layer from ground-truthing/ Ground Validated data	Generation of land Parcel/Property layer from ground-truthing/ Ground Validated data as per point 4 above. This will be Map 2.	States/UTs. SOI will assist technically.
7	Generation of Final Urban Revenue Records	Generation of Final urban Urban Property card (UrPro) after Publication, inquiry and claim and grievance settlement including QA/QC final Map 3 publication	States/UTs.
8	Cloud Space and Storage	Cloud Infrastructure, Storage space, Secure Sockets Layer (SSL), Disaster Recovery Site (DR), Audit, etc., and misc. expenditure as required	NICSI through NIC DoLR
9	IEC	Standard Operating Procedure (SOP), Manual Publication, IEC and awareness of all stakeholders, including urban committees at taluka/ ward level	States/UTs with their own staffs or with help of third party agencies
10	Training	Training & Capacity Building, Travel, Exposure Visits, Conferences etc.	DoLR will provide training to senior officers and Master trainers with assistance of SoI, MPSEDC, COEs. State/UTs will provide training to all concerned staff and ULBs based on prevailing legal provisions and methods at local ATIs/ State institutions.
11	Documentation	Documentation, Evaluation & Monitoring etc.	States/UTs through their Nodal Department and SPMU.
12	Survey Equipment	A) GNSS Rovers, Controllers, Hand Held Devices and Tablets , rugged laptops, ETS GNSS etc.	States/UTs in consultation with SoI and DoLR. The Rover could be procured or taken as a service from third party agencies.
		B) Continuously Operating Reference Stations (CORS): Permanent OR temporary.	SoI in consultation with States/UTs and DoLR, and as required for successful implementation of this programme.

13	Software Development	Development of Web-GIS & Mobile Apps, with Portal & Dashboard; Integration of Record of Rights (RoRs); Cadastral Maps; ORIs; Property Taxes database; Development Authority Layout plans; Ground Truthing Database, Hosting, Maintenance, Updation and Integration of Data on Web, APIs and Software Development along with National/State level Cloud Storage	DoLR, States/UTs through MPSEDC would develop end to end WebGIS platform and applications. The software services via Cloud infrastructure & storage space will be provided by NICSI.
14	National Level IEC, Training, Documentation		DoLR
15	National Programme Management Unit (NPMU) & Office Establishment		DoLR
16	State Programme Management Unit (SPMU) & Office Establishment for Large & Small States		States/UTs as per suggested by DoLR norms
17	Miscellaneous / Incidental Charges		DoLR

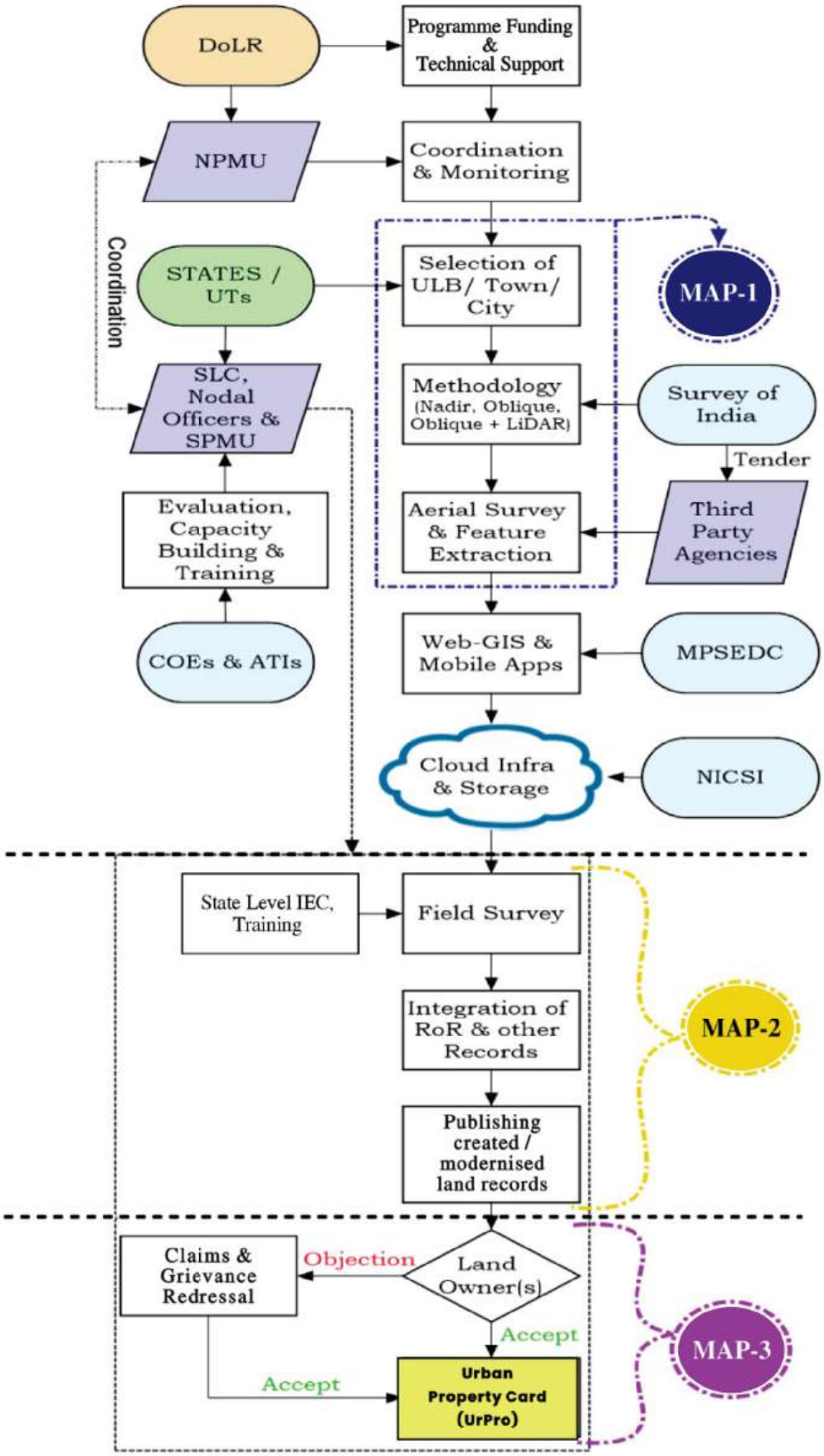


Figure 4.1: Stakeholder mapping for implementation of NAKSHA Programme

4.1 Department of Land Resources, MoRD Govt. of India

a. Provide strategic direction for the create of urban Land Record data under NAKSHA.

b. Coordination with and release of funds to SoI, States/UTs, MPSEDC, NICSI and COEs/ATIs for undertaking coardination with activities under various components of NAKSHA.

c. Establishment of National Programme Management Unit (NPMU) for effective coordination, monitoring, implementation of the NAKSHA Programme.

d. Coordination with SoI for completion of Aerial survey, Feature Extraction, QA/QC and creation of MAP-1.

e. Developing Web-GIS and Mobile application software for monitoring and data visualization of field survey activities with support of Madhya Pradesh Electronics Development Corporation (MPSEDC), Government of Madhya Pradesh.

f. Coordinating with National Informatics Centre Services Inc. (NICSI) a company under National Informatics Centre, Ministry of Electronics & Information Technology (Meity) Government of India for providing and procuring IT solutions for NAKSHA's Cloud Infrastructure and Storage Space.

g. Capacity building of stakeholders involved by developing training modules in consultation with SoI, MPSEDC, COEs/ATIs and Nodal department of States/UTs.

h. Conducting National IEC involves providing information, education to increase knowledge and awareness, and communication to disseminate messages through various channels such as newspaper, broadcasting through television, radio, organizing awareness camp, social media campaign etc., and documentation.

i. Organizing workshops, symposiums and conferences at the International / National / Regional level for sensitizing stakeholders from time to time.

4.2 States/Union Territories Nodal Department

1. Ensuring availability of enabling provisions

a. State/UTs are required to ensure availability of enabling provisions in relevant rules or guidelines, to facilitate aerial survey of lands and properties in urban areas, ground truthing & field surveys using modern technologies, disposal of claims and objections, creation/updation of urban land /property records and property maps and issuance of Urban Property Card (UrPro).

b. The provisions in respect of all or some of the under-mentioned steps/processes may already be existing in the relevant Rules/guidelines of the States/UTs concerned. It is suggested that the availability of the provisions may be examined and the provisions for the following steps /processes be ensured:

c. Provisions may be incorporated for the competent Authority for notifying the land survey in urban areas, inviting all persons having any interest in the land or in the boundaries of which the survey has been ordered, to attend either in person or by agent at a specified place and time and from time to time thereafter, when called upon, for the purpose of pointing out boundaries and supplying information in connection therewith, entering upon and conducting surveys on them.

2. **Provisions for the Authority for adjudication of claims and grievances** in respect of title, interest etc. The land and buildings which are to be surveyed under NAKSHA pilot program.

3. **Provisions for service of Notice, in writing, in respect of field survey** may be provided on the holder or occupier of the building site about to be surveyed and on the holder and occupier of coterminous building sites, calling upon them to attend either personally or by agent on such building site, before the ULB team or before such Officer as may be authorised in that behalf, within a specified time (which should not be less than three days after the service of such notice) for the purpose of pointing out boundaries and of affording such information as may be needed, and intimating that in the event of their failing to attend, he or ULB team will proceed with the survey in their absence.

   The notice may be served by delivering the same to such person, or when such person cannot be found, by affixing the same on a conspicuous part of the house in which such person usually resides or holds his office or carries on his business, or by delivering the same to an agent or servant of such person or to an adult, male member of his family; or by sending by registered post addressed to such person at the place where he usually resides.

4. **Provisions for adoption and use of the relevant technology for survey, ground truthing, field survey,** publication of various records and maps and issuance of the final Urban Property Card (UrPro) by using latest technologies, like Unmanned Aerial Vehicles and Continuous Operating Reference Stations (CORS) Network, software for measurements and processing the outputs of surveys, such as ORIs etc. The provisions may specify that Technology for creation, storage, updating and maintenance of land records, including maps should be harnessed in a cost-effective, scalable, accurate and sequar manner with necessary safeguards.

5. **Provisions for Administrative coordination** to ensure coordination and collaboration between the Survey & Settlement Departments and Urban Development & Housing Department/LSG Departments at State level with formation of SLC and SPMU; led by an appropriate committee and at ULB level by the team constituted.

6. **Provision for issuance of Urban Property Card ("UrPro") and maintaining** up-to-date details of ownership with associated spatial data pertaining to interest/title in the property. A model template has been provided at Appendix-2. It contains fields for attributes like administrative identification of land parcel/plot information, plot land ownership details,

building/structure information and ownership details, and property photographs. It is intended to be an integrated and updated version of the existing ownership records, replacing the earlier ones altogether.

7. **Provisions in respect of integration and synchronization of data across all the stakeholder departments** by seeding of mobile and Aadhar number in the UrPro and integration of the data maintained by all the relevant departments, authority & bodies like Revenue, Registration, Forest, Town Planning and Agriculture through web-based mechanisms to facilitate real time updates and reduce the need of manual intervention, while ensuring consistency between ownership and other datasets data. In States/UTs where the records are in physical form or real-time synchronization is not possible, it is suggested to make provisions to enable batch updates or scheduled uploads of offline records to Web-GIS platform to ensure that the system remains up to date.
8. **Other provisions as deemed fit,** The States / UTs may make any such other provisions as may be deemed necessary for implementation of NAKSHA pilot program.

9. **Issuance of an Order to direct survey,** It is suggested that the State/UT Government may issue an order in the prescribed manner, in respect of:

i. The intention to carry out survey of the land of their respective ULBs included under the NAKSHA Programme.

ii. The purpose of the survey (as defined by the DoLR).

iii. Obligation of all persons having any interest in the land or in the boundaries of which the survey has been ordered, to attend either in person or by agent at a specified place and time and from time to time thereafter, when called upon, for the purpose of pointing out boundaries and supplying information in connection therewith.

10. Other Responsibilities

a. Selection of Nodal Department for implementing NAKSHA Programme (Revenue/ Urban Development/ Local Self Government).

b. Nomination of Nodal officer for day-to-day coordination with DoLR, SoI, MPSEDC ULBs and third-party agencies.

c. Formation of State Level committee (SLC) under the chairmanship of the Chief Secretary for overall monitoring, evaluation, coordination with Urban Local Bodies (ULBs) with support from Nodal department for implementation of NAKSHA Programme.d. Representatives from the Board of Revenue,

e. Principal Secretary/Secretary of the Departments of Revenue, Registration, Urban Development, Local Self Government, Finance, Planning and Information Technology, etc

f. Survey & Settlement Commissioner/ Director of Land Records,

g. Any other expert/ Institution as decided by the States/ UTs should be its members.

h. State Nodal officer would be the convener of the SLC.

I. It is recommended to conduct at least four meetings in a year to monitor and review the NAKSHA Programme.

11. Constitute State Programme Management Unit (SPMU)

a. SPMU to be headed by a Senior Govt. officials/as nominated by respective State/UT.

b. Hiring experts/consultants including Project Manager and sufficient number of GIS experts, as per requirement of the States/UTs within the maximum sanctioned budget as indicated in the table below (eight experts/consultants for large States and four experts/consultants for smaller States)

c. One time cost for office establishment including procurement of computers/ laptops, printers, office chair, table, accessories, internet connectivity etc. and monthly cost for Manpower support is as per table below:

Table 4.2: Category of the States/UTs with their SPMU establishment and manpower cost

Category	States/UTs	Human Resource Recruitment Cost (Monthly)	One time office Establishment Cost
A (Large States)	Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, West Bengal (18 States)	Rs. 9.65 Lakh (Nine lakh Sixty-five thousand)	Rs. 8.0 Lakh (Eight Lakh)
B (Small States)	Arunachal Pradesh, Goa, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand, Andaman and Nicobar Islands, Chandigarh, Dadra and Nagar Haveli and Daman and Diu, Lakshadweep, Delhi, Puducherry, Jammu and Kashmir, Ladakh (18 States)	Rs. 6.0 Lakh (Six Lakhs)	Rs. 5.0 Lakh (Five Lakh)

12. Role of SPMU

a. SPMU would assist in formulating strategies, IEC plans, training and capacity building, and overall documentation of the NAKSHA Programme under the supervision of concerned State/UT Nodal Officer.

b. The SPMU team shall be the focal point for the NPMU and other stakeholders for implementation of the NAKSHA Programme.

c. SPMU would assist the Nodal Department in troubleshooting technical issues during the implementation phase in consultation with SoI, Third Party Agencies, NICSI, MPSEDC or any other agencies as and when required.

e. SPMU will be participating in all the review meetings scheduled by DoLR along with Nodal Officer. SPMU team members will be responsible for drafting the presentations on the progress made by the concerned ULB and share challenges, if any, in consultation with the nodal department of the State.

f. SPMU will be responsible for day-to-day coordination with the field teams of the concerned ULBs, survey agencies, DoLR and other stakeholders involved in the implementation of NAKSHA Programme.

g. Assist in determining the Area of Interest (AoI) of ULBs and assist in obtaining of required clearance.

h. Procure and Process existing digitized data on record of rights, property tax, cadastral maps, layout plans etc. in specified format for integration. State nodal department or SPMU shall carry out the integration with assistance of State/UTs.

i. Collection of ORI and extracted features from the third-party agency of SoI through the GDS.

j. Conduct Quality assurance and Quality check (QA/QC) for verification and report to SoI with any truth discrepancy initially during the ground truthing.

k. Constitution and coordinating of adequate number of teams for time bound completion of field survey including hiring/procuring of outsourced staff and vehicle and providing necessary training.

l. Procurement of survey instruments includes Rovers, Tablets/Mobiles, power back up and required software as per technical specification including RoR warranty, AMC cost etc. as per Govt. norms and procedures.

m. Report generation and final certification of every land parcel/ building/ plot shall be done by the designated officer of the State/UT at ULBs or SPMU level.

n. The State/UT nodal department would utilize the web GIS application developed by Madhya Pradesh Electronics Development Corporation (MPSEDC), Government of Madhya Pradesh for field survey and ground verification.

o. The State/UT would document the process followed and challenges faced in field survey activity, Web GIS application and ORIs data etc. and submit it to DoLR regularly for urgent resolution.

p. State should constitute a Supervisory Team at all the ULBs. The team may include District Commissioner or his representative, Municipal commissioner or his representative, District land records officer, and GIS survey expert as determined by State Level Committee (SLC).

4.3 Survey of India and Third-party agencies

a. The Survey of India (SoI) will hire the third-party agencies for the aerial survey and feature extraction, generation of Ortho Rectified Imageries (ORI) using three technologies i.e., 2D Nadir, 3D Oblique, 3D obliques + LiDAR and creation of 2D/ 3D virtual and reality model.

b. The Area of Interest (AoI) for aerial survey shall be jointly fixed by States/UTs Nodal Department, ULBs and the SPMU. SoI will assist technically in fixing the boundary of Towns/ULBs.

c. The Survey of India (SoI) through their Regional Offices and Geospatial Directorates (GDs) will also ensure and certify the quality of ORIs, features extracted and GIS database delivered by third party agencies. The certified data would be handed over to the State/UT Nodal department, SPMU for field survey well intrigated with the MPSEDC web GIS platform.

d. The delivered data by SoI may also be verified by the States/UTs Nodal department and SPMU level and if there is any mismatch or degradation of quality of data, the same shall be rectified by SoI through third-party agencies and resubmit the rectified data to concerned State/UT/SPMU.

e. SoI shall design the training and capacity building modules, videos, tutorials for field survey activities and use of aerial survey data for States/UTs. That would be implemented at NIGST Hyderabad. Further such traning would also be conducted at centre of excellence at other institutions.

f. SoI shall hand hold the third-party agencies, State /UT Nodal department, SPMU, MPSEDC in any technical challenge faced during aerial and field survey activities.

g. A Technical committee chaired by the Additional Surveyor General of India will advise and resolve the technical matters /issues related to various aspects of NAKSHA project.

h. Surveyor General of India will review the Regional vise and GD vise physical/financial progress of the NAKSHA programme by establishing Project Management Unit at SGO office etc.

4.4 Madhya Pradesh State Electronics Development Corporation (MPSEDC)

MPSEDC Ltd., is a Government of MP Undertaking. The MPSEDC shall develop a Web and Mobile GIS (Geographic Information System) application combining GIS data with modern web and mobile technologies. This application will provide users with tools to visualize, analyze, and interact with spatial information captured during the aerial and field survey on Web and mobile based platform with following responsibilities:

a. Customizing the Web-GIS application as per the existing system / requirement of all the State/UTs.

b. On-boarding the users into the Web-GIS system and User Role Management Integration (Web)

c. Assisting Survey of India (SoI) in uploading the ORI, feature extracted data base over the Web-GIS platform at all the Regal / GD level & at SPMUS;

d. Upload data utility (Desktop)

e. Download and Data Sync Module (Mobile & Web)

f. Ground Truthing and Data Verification Module (Mobile & Web)

g. Merge/Split Module (Mobile & Web)

h. Record of Rights (RoR) Module (Mobile & Web)

I. Survey Data Publication Module (Web)

j. Final Publication and Record Updated module

k. Dashboard for status monitoring

l. Imparting training to State agencies on use of NAKSHA GIS portal and operational manual onsite and off site at state /UT/ ULB and training institute

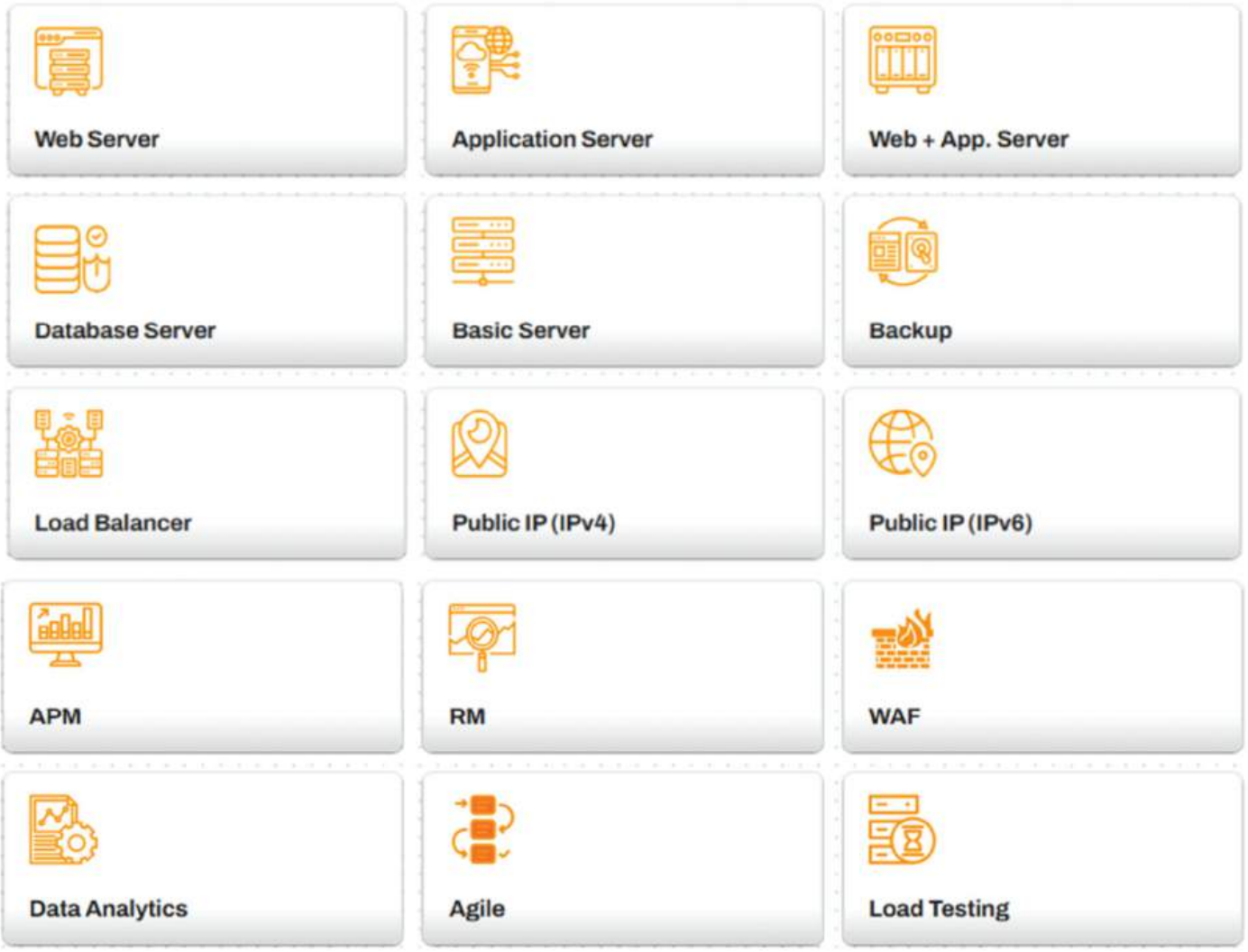
m. Creation of user Manual FAQ and Videos to training & capacity building.

n. Hand Holding during areal and field survey and post implementation support

4.5 National Informatic Centre Services Inc (NICSI)

National Informatics Centre Services Inc. (NICSI) was established as a company under National Informatics Centre, Ministry of Electronics & Information Technology, Government of India for providing and procuring IT solutions for multiple e-governance projects.

For NAKSHA, the NICSI is providing the cloud-based architecture, data storage, security and set up for maintaining and hosting the Web-GIS platform.

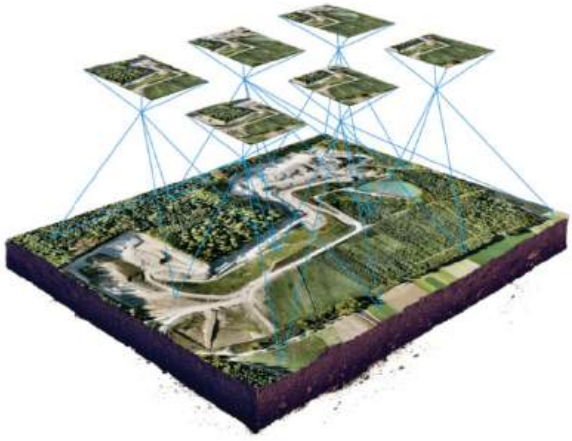


4.6 Centre of Excellence (CoE) & Administrative Training Institute (ATI)

Providing necessary training and support to respective State/UTs for NAKSHA Programme and also for DILRMP programme, five Centre of Excellence (CoE) have been established. Initially in the country the current list of COEs is as follows:

1. Centre for Rural Studies, Lal Bahadur Shastri National Academy of Administration (CRS-LBSNAA),Mussoorie,
2. Mahatma Gandhi State Institute of Public Administration (MGSIPA), Chandigarh,
3. Administrative Training Institute, Mysore,
4. Assam Survey and Settlement Training Institute, Guwahati, and
5. Yashwant Rao Chavan Academy for Development Administration (YASHADA) Pune

5. Activities involved in NAKSHA Programme



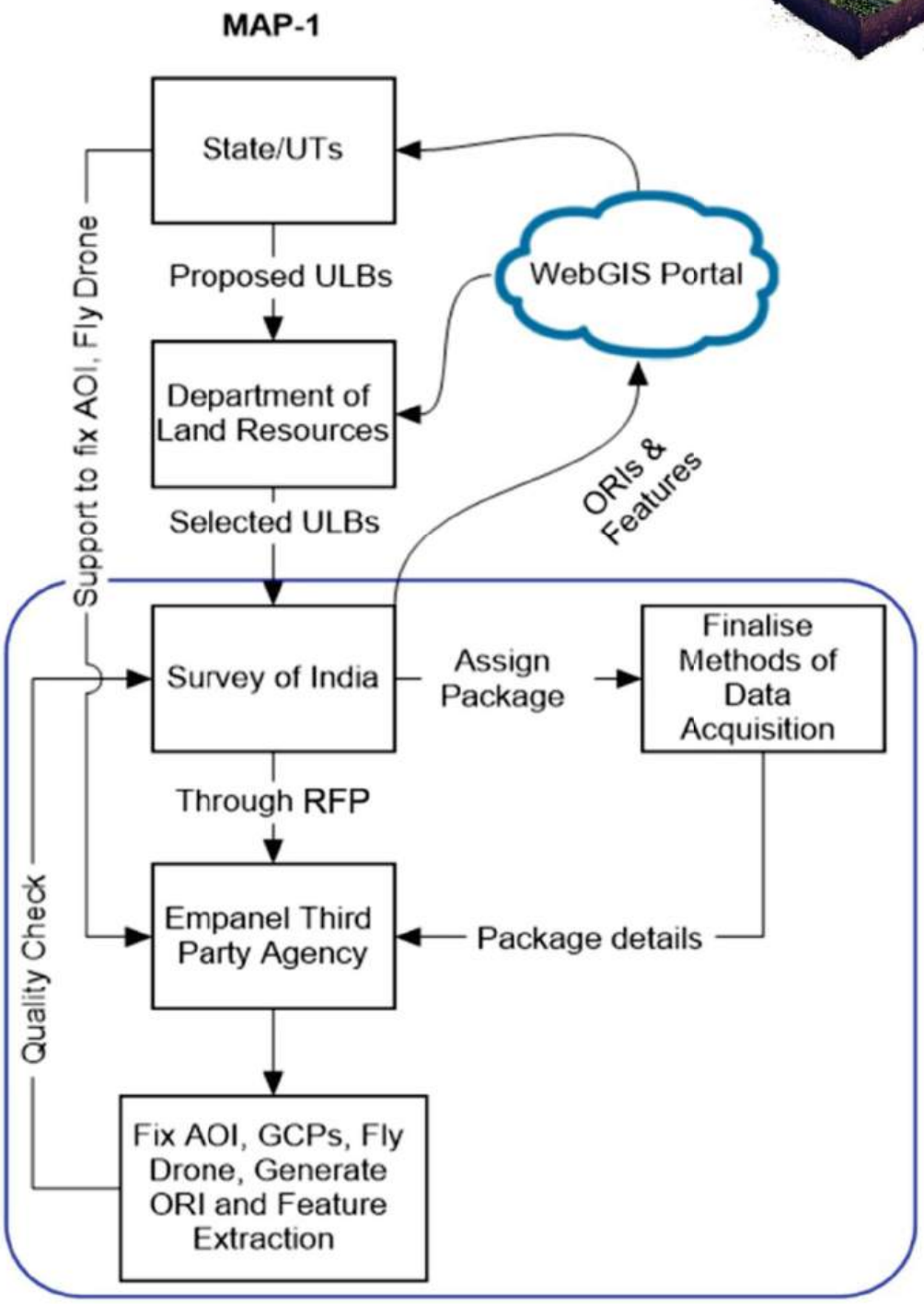


Figure: 5.1- Flowchart for Map-1

5.1 Map-1 : Aerial Surveying and Mapping including Feature Extraction

The one-year Pilot Programme NAKSHA would be implemented in 152 cities across the country with Survey of India (SoI) as a Technical Partner under Digital India Land Records Modernization Programme (DILRMP). It is also propossed that based on the learnings and outcomes of the pilot, a larger Programme covering all the cities and towns would be implemented across the country in a phase wise manner.

The cities where the pilot Programme NAKSHA would be carried out have been selected by the DoLR based on the proposals submitted by the States and UTs. From 26 States and 3 Uts, more than 220 ULBs were proposed for the pilot. After detailed consultation with concerned States/UTs, the DoLR shortlisted 152 ULBs for the pilot phase.

Out of 152 ULBs, 128 ULBs have been sanctioned for Aerial Survey under NAKSHA Project and for others the ORIs are already available with the State/UTs. The ULBs received from the States/UTs are based on the categories (a) A typical old city expanding horizontally, (b) A newly developed planned city with Peri-Urban areas, and (c) A city growing vertically at a rapid pace. There after the selected ULBs details were shared with SoI.

5.2 Survey of India (SoI)

The SoI is responsible for acquisition of high-resolution imagery, generation of Ortho Rectified Imagery (ORI) with the 5cm Ground Sample Distance (GSD), Digital Elevation Model (DEM) with both DSM and DTM, 3D reality Model, 2D/3D GIS dataset. The SoI is also responsible for the standardization of the process of data acquisition across the country by aircraft/drone survey with all three methods and sensors adopted for NAKSHA, image processing techniques and other salient features etc.

Based on three technologies being adopted, Survey of India has categorized the 128 ULBs into 17 packages. The Survey of India through RFP and bidding would select the third-party agencies to conduct the aerial survey followed by feature extraction based on technical, administrative and financial evaluation and the sehema and get all the term and conditions as in the RFP daily upload by DoLR implimented by the third party agencies.

5.3 Third-Party Agency

a) Conducting aerial surveys using aerial platforms (manned/unmanned) with three technologies for data acquisition: Nadir Sensor, Oblique Angle Camera Sensor (1 Nadir + 4 Oblique Cameras) and Oblique Angle Camera + LiDAR Sensor as per the package awarded by SoI.

b) Processing and delivering accurate geospatial data such as orthorectified images, elevation models, 3D reality Model, 2D/3D GIS dataset and other visible topographical features.

c) Ensuring adherence to defined technical standards as fixed by Survey of India (SOI) and project timelines.

5.4 Methodologies adopted for Aerial Data Acquisition

5.4.1 Nadir (Vertically Oriented) Imaging

Nadir imaging refers to capturing images by directly downward sensors, perpendicular to the ground. The camera's optical axis is aligned vertically with respect to the earth's surface.

Characteristics:

- Provides a "top-down" view of the ground.
- Ensures minimal perspective distortion, making it ideal for orthoimage generation.
- Best suited for mapping flat terrain and capturing large areas efficiently.

Applications:

- Orthoimage generation for accurate mapping.
- Urban planning and cadastral surveys.
- Land use classification and land use change monitoring.

Figure 5.2: Nadir Camera

(Source: www.phaseone.com)

5.4.2 Oblique (Angled) Imaging

Oblique imaging involves capturing images at an angle (typically between 30° to 60° from vertical) rather than straight down. These images provide a perspective view of features, including the sides of buildings and other vertical structures.

Characteristics:

- Provides a perspective view of the ground and vertical structures.
- Captures building facades and elevations, offering more context than vertical imagery.
- Useful for visual interpretation and 3D modeling due to the angular perspective.

Applications:

- 3D City modeling and visualization.
- Infrastructure inspection (e.g., bridges, towers, building facades).
- Emergency response and damage assessment.

Figure 5.3: oblique-camera

(Source: www.mavdrones.com)

5.4.3 Combined Oblique + LiDAR Systems

This system integrates oblique cameras with LiDAR (Light Detection and Ranging) sensors to capture both visual imagery and precise elevation data. LiDAR uses laser pulses to measure distances and generate high-resolution 3D point clouds.

Characteristics:

- Provides both textural detail from oblique imagery and accurate elevation data from LiDAR.
- Highly effective for mapping dense vegetation or rugged terrains where photographic imagery alone may not be sufficient.
- Enables the generation of Digital Surface Models (DSMs) and 3D models with enhanced accuracy.

Applications:

- Detailed 3D city modelling and infrastructure planning.
- Disaster management, including landslide risk assessment and flood modelling.

Figure 5.4: LiDAR Sensor
(Source: Zenmuse L1 – LiDAR Camera)

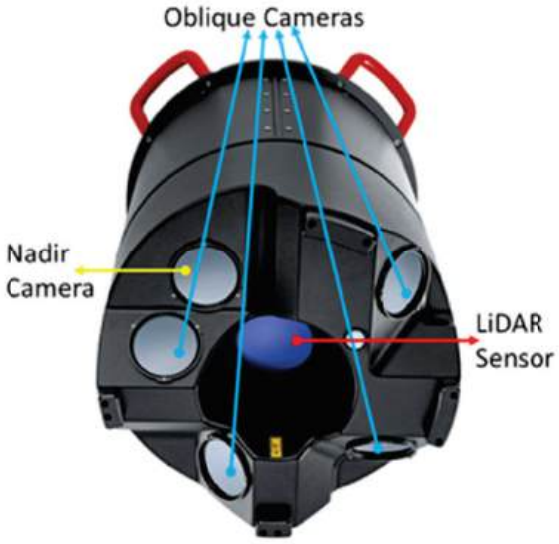


Figure 5.5: Combined Oblique + LiDAR Systems
(Source: Leica CityMapper Airborne Hybrid Sensor)

Table 5.1: Feature and difference between each methodology

Feature	Nadir Imaging	Oblique Imaging	Oblique + LiDAR Systems
Orientation	Vertical	Angled	Angled + Laser Scanning
Coverage	Top-down view	Side and angled views	Comprehensive (texture + elevation)
Data Type	2D imagery	2D imagery/ / 3D Model	2D imagery + 3D Model + elevation (LiDAR)
Applications	Mapping, agriculture	3D modelling, visualization	Advanced 3D mapping, terrain analysis

5.5 Fixing Area of Interest (AOI)

1. Initial shape file of the Area of Interest (AoI) shall be provided by the States/UTs to SoI and the same shall be shared with the third-party agencies
2. The Third-party agencies shall approach the States/UTs to fix the AoI
3. The Urban Local Bodies (ULBs) & State Project Management Units (SPMU) shall provide localized insights to refine the AOI, considering ground-level realities such as infrastructure, boundaries, or restricted zones and ensure AoI reflects the accurate on ground conditions.
4. Use advanced geospatial tools and techniques (DGPS, GNSS Receivers, Continuously Operating Reference Stations (CORS, and GIS software) to define and refine the AOI.
5. Validate the AOI's feasibility based on survey technology and operational requirements. This collaborative approach ensures that the AOI is accurate, practical, and fit for aerial surveying purposes.
6. The detailed work plan of aerial survey shall be submitted to SoI and States/UTs by third party agencies for the approval of concerned authorities.
7. 25% of the peri-urban areas depending upon the built-up scenario in the various ULBs beyond the ULB shapefile may also be included before aerial flying.

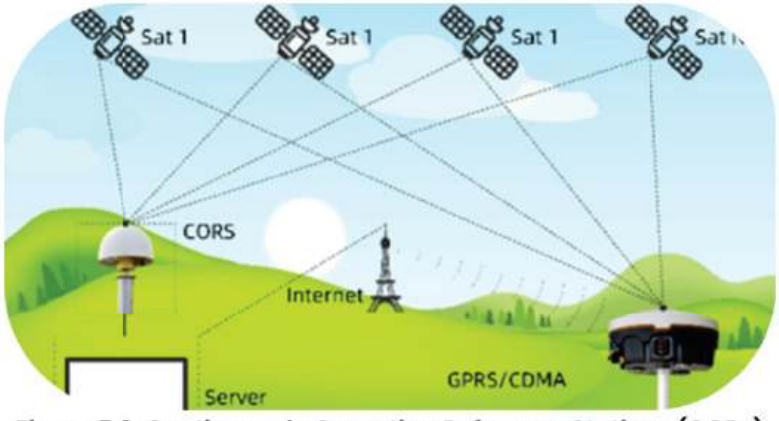


Figure 5.6: Continuously Operating Reference Stations (CORs)
[Source: en.harxon.com/about/news_detail/1222]

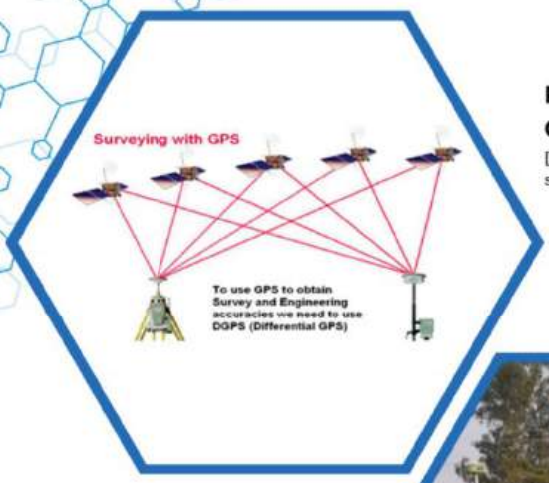


Figure 5.7: DGPS base / RTK Survey for Ground Control Points (GCP's)
[Source: prashantsurveys.com/dgps-base-rtk-survey-for-ground-control-points.php]

Figure-5.8: DGPS Survey
(Source: S.K Land Surveyors, Haryana)

Figure-5.9: Marking GCP
(Source: dronitech.com)

Figure-5.10: A sample of DGPS GCPs in AOI
DGPS Ground Control Point Survey Service

Figure-5.11: Final Area of Interest (AoI)
(Source: DoLR – Arunachal Pradesh)

5.6 Fixing Flight Plan

The flight plan shall be prepared by the SoI's third party agency as per the following

1. Define Survey Parameters: Set the Area of Interest (AOI) boundaries and altitude based on project requirements and terrain. Specify image resolution (e.g., 5 cm GSD) and overlaps (e.g., 70% - 80% forward, 60% - 70% side).
2. Assess Airspace Restrictions: Verify legal compliance, restricted zones, and permissions from the Directorate General of Civil Aviation (DGCA).
3. Drone/Flight Path: Use geospatial tools to create efficient flight paths with minimized gaps. Optimize coverage for data acquisition.
4. Validation: Approve the plan through SoI, State/UTs, and local authorities. Account for weather and field conditions.

Table 5.2: Task and Responsibility for flight plan

Task	Responsibility
Prepare flight plan	SoI and third-party Agency
Initial approval	Survey of India
Aviation clearance	Directorate General of Civil Aviation, Ministry of Defence, Airport Authority of India, local Authorities
On-field approval	States/UTs & ULBs/District Administration

Methodology	Forward Overlap	Side Overlap	Key Parameter	Flying Pattern
Nadir Camera	70–90%	60–70%	High overlap, fixed altitude	Cross Grid
Oblique Cameras (4 + 1)	85–90%	70–80%	Multiple angles, higher altitude	Longitudinal (Single Grid)
Oblique + LiDAR	80–85%	60–70%	Dense point cloud, multi-pass for shadows	Longitudinal (Single Grid)

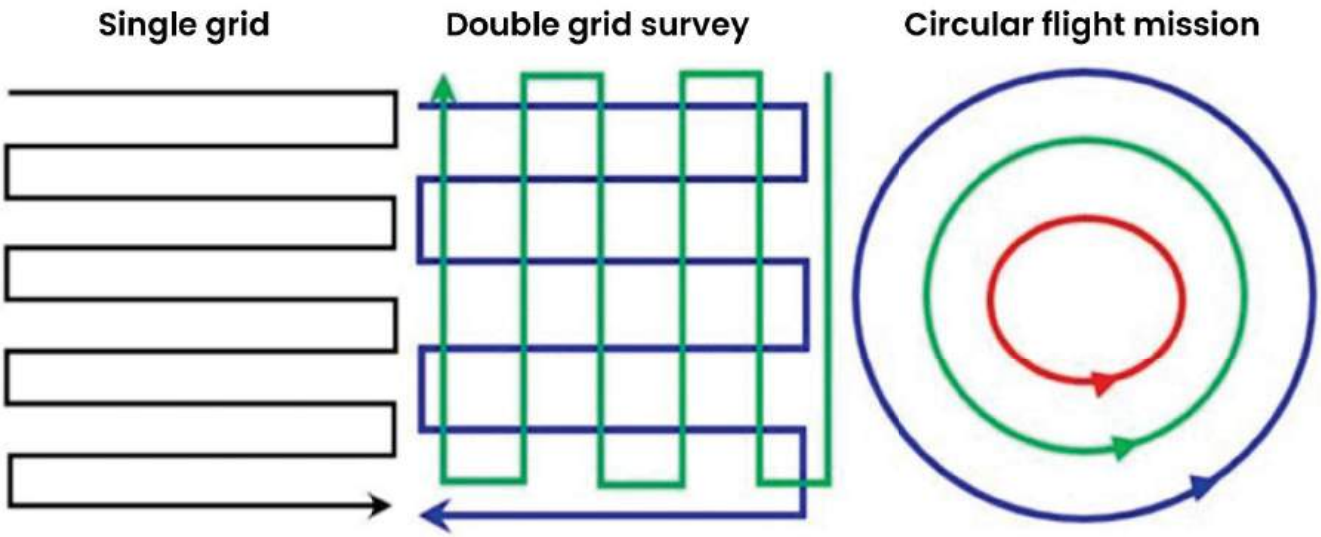


Figure-5.12: Sample of Single, double and circular surveys designed flight paths in data acquisition.

(Source: www.researchgate.net)

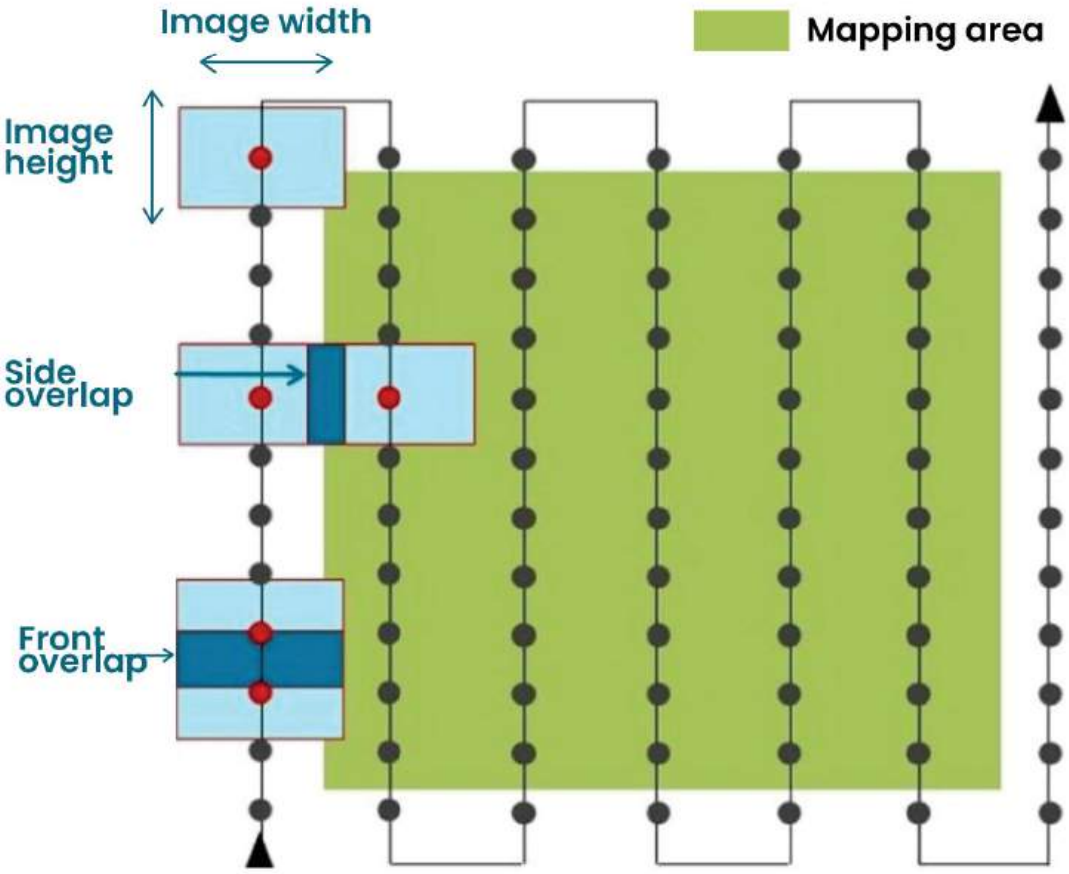


Figure-5.13: Sample flight plan to understand side & front overlap to get Nadir images

(Source: www.jouav.com)

5.6.1 Rationale in flight plan

a. High overlap ensures the generation of distortion-free ortho-rectified imagery.

b. Balance altitude based on GSD requirements (e.g., 5cm GSD).

c. However, based on terrain condition, tall building, trees, power lines or windmills, the above conditions of overlaps, flights patterns may change

5.7 Ortho Rectified Imagery (ORI)

a. Ortho rectified imagery also known as ortho image or ortho photo is a geometrically corrected aerial or satellite image whose distortions caused by terrain relief, sensor tilt and lens distortions are removed resulting in a uniform scale and accurate representation of the earth surface.

b. The raw imagery can not be used in GIS until processed by photogrammetry technique to generate accurate georeferenced image, referred to as orthorectified images or orhtoimages.

c. Any object's true shape and location can only be determined from ORI.

Figure 5.14: Difference between raw image and orthorectified image (ORI)

e. ORI creation involves transforming raw aerial imagery into a geometrically corrected format that accurately represents the Earth's surface. This process removes distortions caused by camera tilt, terrain elevation, and sensor irregularities.

f. ORI enables to have details of shadow area and corrects the distortion for correction of geo-location and measurements as in the raw images.

g. Georeferencing: Involves Aligning imageries with geographic coordinates using GPS and Ground Control Points (GCPs).

h. Digital Elevation Model (DEM) Integration: To adjust for terrain-induced distortions.

I. Orthorectification / Process involves application of mathematical models to correct image distortions by using specialized software like ERDAS IMAGINE, ArcGIS, or QGIS or any other required software.

j. Quality Assurance: Validate the output against reference datasets for accuracy (e.g., RMSE checks)

5.8 Quality Assurance and Quality Check

Survey of India (SoI) to do Quality Assurance (QA) to Quality Check (QC) to ensure that the third party agency provides the ORI/DEM/3D Models as per the standards mentioned in the Request For Proposal (RFP) and any further instructions.

5.8.1 Checking Quality of ORI

a. Checking the quality of orthorectified imagery is crucial to ensure its accuracy and usability for mapping, analysis, and other geospatial applications. Steps to evaluate the quality systematically should be ensured by SoI regional office at Geospatial Directorates (Gds).

b. Verify that the features (e.g., roads, buildings, rivers) align correctly with a trusted reference map or other high-accuracy datasets.

c. Look for visible seam lines, distortions, or artifacts that may indicate poor stitching or processing of ORI.

d. Check for uniformity in image brightness, contrast, and color balance across the entire dataset.

e. Compare control points from the imagery with ground control points (GCPs) from a reliable source, such as survey data or GPS measurements.

f. Measure the Root Mean Square Error (RMSE) to quantify positional accuracy. Ideally, the RMSE should be within the acceptable tolerance i.e. 2 cm (as per RFP)

g. Overlay the imagery on a known base layer (e.g., cadastral maps, GIS layers) and validate the alignment of features (buildings, roads) with the base layer.

h. Check if the Ground Sampling Distance (GDs) matches the project requirements i.e. 5 cm.

i. Verify details about the satellite or sensor that captured the imagery.

j. Evaluate the clarity of edges and features (e.g., roads, buildings) using zoomed-in views.

k. Test the imagery against scale-specific benchmarks to ensure the imagery meets required map scales for its intended use.

l. For tiled imagery, ensure seamless integration without misalignment or mismatched features at tile boundaries

m. Cross-check features on the imagery against field observations using check points (preferably pre-pointed) given by using SoI's CORS in Network Real Time Kinematic (NRTK) positioning mode for drone data validation.

5.8.2 Checking Quality of extracted features

Compare the spatial location of extracted features i.e. Road, Building, Land parcel, 3D files with high-accuracy reference dataset.

a. Ensure extracted features align with ORI

b. Verify that attribute data (e.g., name, type, classification) matches the real-world characteristics of the feature.

c. Ensure no missing or incorrect attribute values and validate attributes against predefined standards or schemas.

d. Ensure that all the visible features like land parcels, building footprints, roads, water bodies etc. within the area of interest are extracted.

e. Use overlays to identify missing features when compared to reference datasets

f. Confirm all mandatory attributes are populated for each feature.

g. Check for overlapping polygons, duplicate features, or gaps between polygons.

h. Validate connectivity for line features (e.g., road or river networks).

i. Ensure polygons are closed, lines are not self-intersecting, and points are not duplicated.

j. Compare 3D points (X, Y, Z coordinates) with ground control points (GCPs) or a trusted reference dataset.

k. Validate the relative height of features e.g., buildings on terrain against a Digital Elevation Model (DEM).

l. Test the file in the intended software environment (e.g., QGIS, Blender, AutoCAD) to confirm usability.

m. Render the vector file in 3D visualization software to identify anomalies like misplaced features, distorted geometries, or gaps.

n. Verify that the point density (e.g., points per square meter) meets project specifications.

o. Ensure uniform distribution of points across the area of interest; detect gaps or clustering.

p. Ensure all areas of the target region are covered without omissions.

q. Assess the accuracy of classified points like, ground, vegetation, buildings, water, noise).

r. Compare classified layers against reference datasets or manually inspect sections of the point cloud

s. Ensure features are consistently classified across the dataset, with no misclassification (e.g., buildings classified as vegetation).

t. Verify flight parameters such as altitude, speed, scan angle, and overlap meet specifications

u. Confirm that metadata includes processing details like, filtering methods, classification algorithms).

5.9 Deliverables by Third-Party Agencies to SoI

a. Refined AOI and buffer area in vector file (GIS OSC support format)

b. Detailed Flight plan with overlap details used during Data acquisition (All output deliverables with Projection & Datum-UTM & WGS-84.)

c. Digital True Ortho-imagery (R, G, B) or ORI of 5cm GSD or better in. GEOTIFF format.

d. Digital Stereo Pair Images (R, G, B) of 5cm GSD or better in. GEOTIFF format.

e. Horizontal Accuracy of Ground Control Points is to be 5cm RMSE or better and Check Points (duly processed) provided/used for Data Acquisition & Processing with descriptions and sketches.

f. DEM/DSM/DTM – Processed Digital Elevation data of 25cm vertical accuracy RMSE (for Indian vertical datum) at regular spacing of 0.50 meter in GEOTIFF and ASCII format.

g. Raw data captured by various sensors and instruments including camera calibration certificate, .CAM files etc.

h. All topographical 2D layers and vector layers including all buildings and public utilities, etc to generate 2D Property layer based on topographical markers in shape file format as well as in open format for geospatial information such as geo package etc.

I. City/Town Level of Detail (LoD)-2 detailing is to be realized for creating 3D city mesh & 3D vector Model. For each building or structure, the geometrically simplified external structure should be depicted through horizontal or vertical outer surfaces with vertical distribution of space (i.e. floors), along with simplified roof structures and permanent rooftop structure, based on topographical markers. This shall apply to buildings and other structures such as Roads, Bridges, Flyover, Tunnels, Railways, Mono, Metro Street lights, Traffic signals, Water bodies, Trees, Landscapes, Open spaces, Airports, Gardens, Slum and all other features having height with reference to Aerial data complying with LoD-2 specifications. All topographical 3D vector layers including all buildings and public utilities, etc. to generate 3D Property layers based on topographical markers in open file formats such as City GML format etc.

j. LiDAR data Processed DEM/DSM/DTM, 3D textured model/ 3D realty Model; and Generation of 3D GIS Dataset through feature extraction including all buildings and public utilities, etc. to generate 3D Property layer based on topographical markers. 3D urban data models should be delivered in LAS, LAZ, .OBJ, FBX, or .3DS format. All softcopy deliverables and raw data will be delivered to SOI and DoLR.

k. All salient reports generated including Survey report, Flight Plans, Photo-index, Aerial Flying Reports, AT (Aerial Triangulation) report, Block file, generation of 3D mesh model, QA/QC reports (QCRs), etc.

5.10 Deliverables by Survey of India to States/UTs

5.10.1 TECHNOLOGY-1

Aerial (manned/ unmanned) Data Acquisition using Nadir Camera

a. Digital True Ortho-imagery (R, G, B) or ORI of 5cm GSD or better in GEOTIFF format.

b. Digital Stereo Pair Images (R, G, B) of 5cm GSD or better in. GEOTIFF format.

c. Horizontal Accuracy of all output deliverables is to be 10 cm RMSE or better.

d. Horizontal Accuracy of Ground Control points is to be 5 cm RMSE or better.

e. Processed Digital Elevation Model (Bare Earth) data of 25cm vertical accuracy

f. All Ground control points (GCPs) & Check Points (duly processed) provided/used for Data Acquisition & Processing with descriptions and sketches.

g. Processed Digital Surface Model (DSM).

h. All topographical 2D (using a. ORI and b. digital stereo images) vector layers including all buildings and public utilities, etc. to generate 2D Property layer (using a. ORI and b. digital stereo images) based on topographical markers in shape file format as well as in open format for geospatial information such as geo package etc.

5.10.2 TECHNOLOGY-2

Aerial (manned/ unmanned) Data Acquisition using Oblique Angle (1 Nadir + 4 Oblique)

a. All deliverables mentioned in TECHNOLOGY-1 for Nadir (5.10.1. a to h) as in the preceding paragraph.

b. City/Town Level of Detail (LoD)-2 - For each building or structure, the geometrically simplified external structure should be depicted through horizontal or vertical outer surfaces with vertical distribution of space (i.e. floors), along with simplified roof structures and permanent rooftop structure, based on topographical markers. This shall apply to buildings and other structures such as Roads, Bridges, Flyover, Tunnels, Railways, Mono, Metro Street lights, Traffic signals, Water bodies, Trees, Landscapes, Open spaces, Airports, Gardens, Slum and all other features having height with reference to Aerial data complying with LoD-2 specifications.

c. All topographical 3D vector layers including all buildings and public utilities, etc to generate 3D Property layers based on topographical markers in open file formats such as City GML format etc and the capability for all the measurements.

5.10.3 Technology-3

Aerial (manned/ unmanned) Data Acquisition using Oblique Angle (1 Nadir + 4 Oblique) Camera and LiDAR.

a. All deliverables mentioned in TECHNOLOGY-1 for Nadir (5.10.1 a to h) and TECHNOLOGY - 2 for Oblique (5.10.2. b to c) as in the preceding paragraph.

b. LiDAR Data Processed Digital Elevation data of 25 cm or 20 cm vertical accuracy RMSE (for Indian vertical datum) at regular spacing of 0.5 meter– called DEM in GEOTIFF and ASCII format.

c. LiDAR data Processed Digital Elevation data (Bare Earth Model) of 25 cm or 20 cm vertical accuracy RMSE (for Indian vertical datum) at regular spacing of 0.5 meter– called DTM in GEOTIFF and ASCII format.

5.11 Training

a. The selected third party agencies will provide training to the State SPMU and to the ULB teams on how to use and interpret the delivered data and models, along with a formal handover of all project materials at the state / UT Headquarters ; ULB; ATI's etc.

b. State/UT must ensure the participation of designated officers in the training to be provided by selected third party agencies.

5.11.1 Post-Delivery Support

a. The selected third party agency will provide technical hand holding support to the State/ City ground truthing team after the handover of acquired and interpreted data through regional offices/ GDs of SOI.

b. If any issue is noticed in data quality, it must be communicated to SOI by the concerned State/ULB which will be rectified by the third party agencies.

5.11.2 Quality Assurance

The SoI shall review and certify the quality of all the processed data to ensure accuracy and consistency and their being completed as per the RFP duly approved by DoLR.

5.11.3 Data Sharing and dissemination

The SoI shall upload all the approved data (ORIs and extracted features) to the Web-GIS portal developed by MPSEDC. The same data shall be disseminated to relevant stakeholders including Revenue/Urban Development/Local Self Government Departments, SPMU, ULB team and other relevant departments of concerned States/UTs by providing login access at the WebGIS platform and hand holding support/ training at regional offices/ GD level and also at the ULB level required.

5.11.4 Validation

Validated findings with reference to ground truth data will be final and the same will be updated and approved.

6. MAP-2: Field Survey and Ground Truthing

6.1 Service of notice before field survey

Service of Notice by Survey Officer before entering on any building or plot site for the purpose of survey: The Survey Officer may cause a notice in writing on the holder or occupier of the building or plot about to be surveyed in urban and peri-urban area and on the holder and occupier of coterminous building sites, calling upon them to attend either personally or by agent on such site to be surveyed before the Survey Officer or before such Officer as may be authorised by him in that behalf, within a specified time (which should not be less than three days after the service of such notice) for the purpose of pointing out boundaries and of affording such information as may be needed, and intimating that in the event of their failing to attend, he or such Officer will proceed with the survey in their absence. The notice may be served (a) by delivering the same to such person, or when such person cannot be found, by affixing the same on a conspicuous part of the house in which such person usually resides or holds his office or carries on his business, or by delivering the same to an agent or servant of such person or to an adult, male member of his family; or by sending by registered post addressed to such person at the place where he usually resides.

6.2 Field Survey of Land Parcel

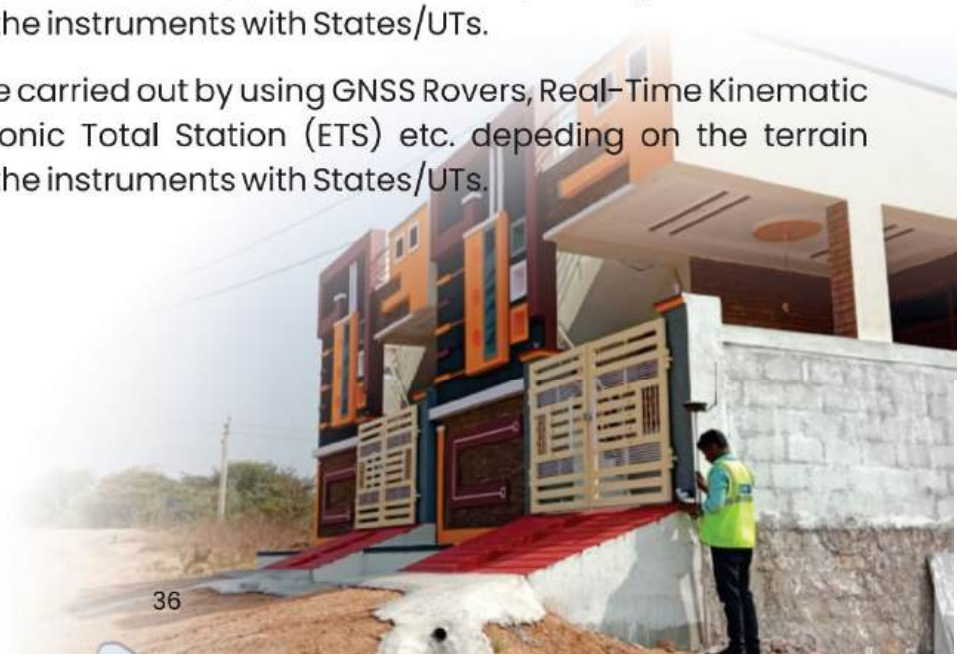
The field survey of land parcels/property boundary and cadastral information in urban and peri-urban areas is crucial for ensuring legal clarity, effective governance and sustainable development. It plays a key role in resolving ownership disputes and updating land records. In a country with outdated records, fragmented landholding and complex inheritance systems, field surveys provide the crucial foundation for digital transformation, sustainable growth and efficient land use. Conducting a field survey of a land parcel involves systematic steps to gather accurate data about the land's location, size, shape, boundaries and features. The input for Map-2 i.e. by Field Survey and Ground Truthing is on the output of Map-1. In Map-1, Boundary layers and polygon area and measurement are to be extracted based on topographical markers. Where aerial data acquisition is not being done under NAKSHA project, the already available data (ORIs) with respective states will act as inputs for Map -2. In Map -2, these layers will be ground validated and field survey will be conducted for ascertaining land parcel/property boundaries along with attribute data collection related to Cadastral information.

a. In most cases the property parcel/boundary will follow a topographical feature like boundary wall, fences, common junctions of adjacent buildings, hedges, bunds, etc. Such features will be visible in the hard/ soft copy of Map/ORI generated as the output of MAP-1. The same can be confirmed on the ground by field survey team and traced as part of land parcel/property boundary layer.

b. Some portion of the land-parcel/ property boundary may not be visible in the Map/ORI taken as input for Field Survey i.e. Map-2. These missing boundary vertices/portions will be surveyed on the ground using precise instruments like GNSS Receivers (also known as GNSS Rovers), Electronic Total Station integrated with GNSS, Laser Range Finder, etc. depending on the site conditions and availability of the instruments with States/UTs.

c. All field survey activities can be carried out by using field devices like survey grade (i) GNSS Receivers (also known as GNSS Rovers) in NRTK/Static Mode integrated with/without field data collector connected to Central Database through an enterprise GIS Server in online/offline mode, (ii) ETS GNSS etc. depending on the terrain conditions and availability of the instruments with States/UTs.

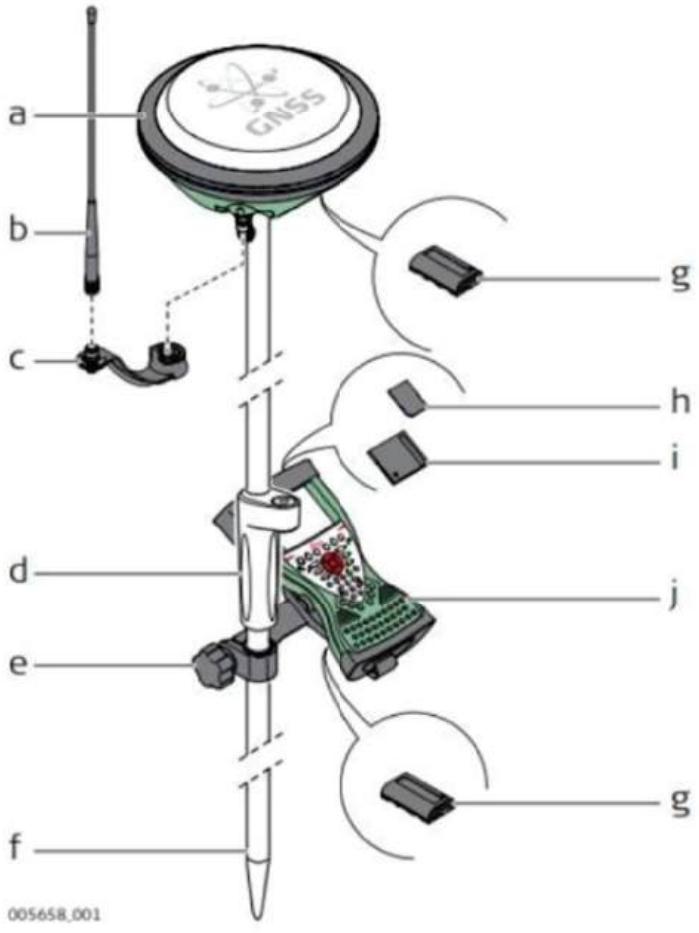
d. All field survey activities can be carried out by using GNSS Rovers, Real-Time Kinematic (RTK) positioning GPS, Electronic Total Station (ETS) etc. depeding on the terrain conditions and availability of the instruments with States/UTs.



6.3 Global Navigation Satellite System (GNSS) Rovers

a. GNSS Receivers (also known as GNSS Rovers) are devices that use the Global Navigation Satellite System (GNSS) to determine precise geographic locations on Earth. These are widely used in surveying & mapping, agriculture, construction, and other applications requiring high-accuracy positioning. GNSS rovers receive signals from multiple satellites in constellations like GPS (USA), GLONASS (Russia), Galileo (Europe), and BeiDou (China). These satellites transmit signals with information about their location and the time the signal was sent. By receiving signals from at least four satellites, the GNSS Rover calculates its position using a process called triangulation. The distance to each satellite is measured based on the time it takes for receiving the signal to the rover.

b. The positioning obtained from the GNSS receiver collects satellite signals and receives the correction data from the reference station in real-time through a communication link. By applying these corrections to its raw GNSS measurements, the rover achieves centimeter-level positional accuracy.



a) Gs14 GNSS antenna with integrated UHF radio modem
b) RTK antenna
c) GAD108 arm
d) Grip for pole
e) GHT62 holder
f) Pole
g) GEB211/GEB212 battery
h) SD card
I) CompactFlash card
j) CS field controller

Figure 6.1: GNSS Rover and its components

6.3.1 Key Component of GNSS Rovers

At its core is the GNSS Receiver, which processes signals from multiple satellite constellations (e.g., GPS, GLONASS, Galileo, BeiDou) to determine the Receivers (also known as GNSS Rovers)'s location. This is paired with a high-performance antenna that ensures clear and reliable signal reception, even in challenging environments like urban areas or dense forests. A data collector acts as the interface, storing and processing positional information and often running software for real-time mapping and analysis. To achieve high accuracy, GNSS Receivers (also known as GNSS Rovers) also feature a communication module, which connects to CORS correction services via radio or cellular networks, enabling techniques like Network Real-Time Kinematic (NRTK) for centimeter-level precision. Additionally, these systems are ruggedized for durability, with weather-resistant casings and ergonomic designs for fieldwork. Together, these components enable GNSS Receivers (also known as GNSS Rovers) to deliver reliable, precise, and efficient solutions for a wide range of applications.

6.4 Real-Time Kinematic (RTK) positioning GPS

Real-Time Kinematic (RTK) GPS is a high-precision positioning system that enhances the accuracy of standard GPS signals by using carrier-phase measurements and corrections from a reference station. It consists of a reference station and a rover unit. In reference station, a stationary GPS receiver at a known location, continuously monitors satellite signals and calculates correction data by comparing its actual position to the satellite-provided position. The rover unit, which is a mobile GPS receiver, collects satellite signals and receives the correction data from the reference station in real-time through a communication link. By applying these corrections to its raw GPS measurements, the rover achieves centimeter-level positional accuracy.

6.5 Electronic Total Station (ETS) GNSS

Electronic Total Station (ETS) GNSS combines the functionalities of a traditional Electronic Total Station (ETS) and Global Navigation Satellite System (GNSS) to deliver enhanced precision and versatility in surveying and geospatial applications. An ETS measures angles (both horizontal and vertical) and distances using laser or infrared technology, while GNSS provides accurate positional data by receiving signals from satellites. Integrating these systems enables surveyors to conduct precise measurements over long distances, even in challenging terrains where one system alone might be insufficient.

6.6 Field Data Collector (FDC) with a Web GIS software for Field Survey

A Field Data Collector refers to a device or system optimized for collecting and recording GIS data in the field, meaning outside of a laboratory or office setting. Typically, FDC is a rugged tablet that works with GNSS Receivers (also known as GNSS Rovers) / ETS, allowing surveyors to view and visualize ORIs and collect/extract features (including boundary points) in the field. Also, it can be linked with GNSS Receivers (also known as GNSS Rovers) for feature extraction and updation of land parcels. It also enables collection and linking of attribute data in the field. For end-to-end digital work flow, these field devices are connected to a central database through an enterprise GIS Server to enable transmission of field data to the central database server. In order to achieve field survey accuracies required for the NAKSHA Project through measurements, the FDCs should be integrated with CORS Network through a survey grade GNSS Receiver.

6.7 Distance-Distance measurement Laser Range Finder

A Distance-Distance Measurement Laser Range Finder is a specialized tool used to measure the distance between two points using laser technology. In Land Surveys, it can be used to measure distances between various points, such as corners of a property, slopes, and terrain features. The measurement of a point which is not visible on ORI by occupying at least two well identifiable points that can be related between ORI and Ground and measuring the distance from these points to the missing vertex on the property boundary. The exact position of the above-mentioned vertex can be marked in the GIS environment using tools for distance-distance arc intersection.

6.8 Reference Stations

The coordinates obtained from GPS/GNSS observations are burdened with many errors like Satellite Clock and orbit error, Ionospheric delay and Tropospheric delay, Receiver Noise, Multipath and Receiver Clock error. Due to the above errors the coordinates obtained are inaccurate and need to be corrected before use. To minimize the effect of these errors the GPS/GNSS data of observation points needs to be processed with reference to some known reference stations whose coordinates are accurately known to us. The reference stations are of two types which includes CORS Network established by SOI (Figure 6.1.2) GCPs (Passive Network of Reference Stations).

6.9 Continuously Operating Reference Stations (CORS)

Survey of India has established Continuously Operating Reference System across India as a part of India's National Geodetic Reference Frame. In total, SOI has established 1047 permanent CORS reference stations and is under active consideration of densifying the same. Also, as per the requirement of CORS densification under NAKSHA, SOI is actively engaged with DoLR, GoI for densification of CORS network in (Temporary and Permanent stations) Towns/ULBs. Currently about 37 CORS are being added to the already existing network as determined by SOI on the basis of the location of 152 ULBs vis-à-vis the 1047 CORS and the probable/possible signal issued during field survey.

CORS is a real time positioning service for accurate GNSS observations by general public. CORS services enables user to get the position data with 3-5 mins of observation with an accuracy of 2-3 cm. Earlier, to get a accurate position of a point, SOI's Ground control points were used and it took almost 2-3 days to get the precise location of a point. CORS is a system of interconnected, permanent GNSS (Global Navigation Satellite System) base stations that provide high- precision positioning data to users in real-time or post-processed modes.

Each reference station in the network is equipped with a high-precision GNSS receiver and antenna, continuously collecting satellite signals from constellations such as GPS, GLONASS, Galileo, or Bei Dou. The data is processed to generate corrections that compensate for errors caused by atmospheric interference, satellite orbit inaccuracies, and clock deviations. The network computers and distributes correction data to rover units (GNSS Rovers) via the internet, radio, or cellular networks. Users connect to the network through specialized software or hardware and receive these corrections to enhance their positional accuracy.

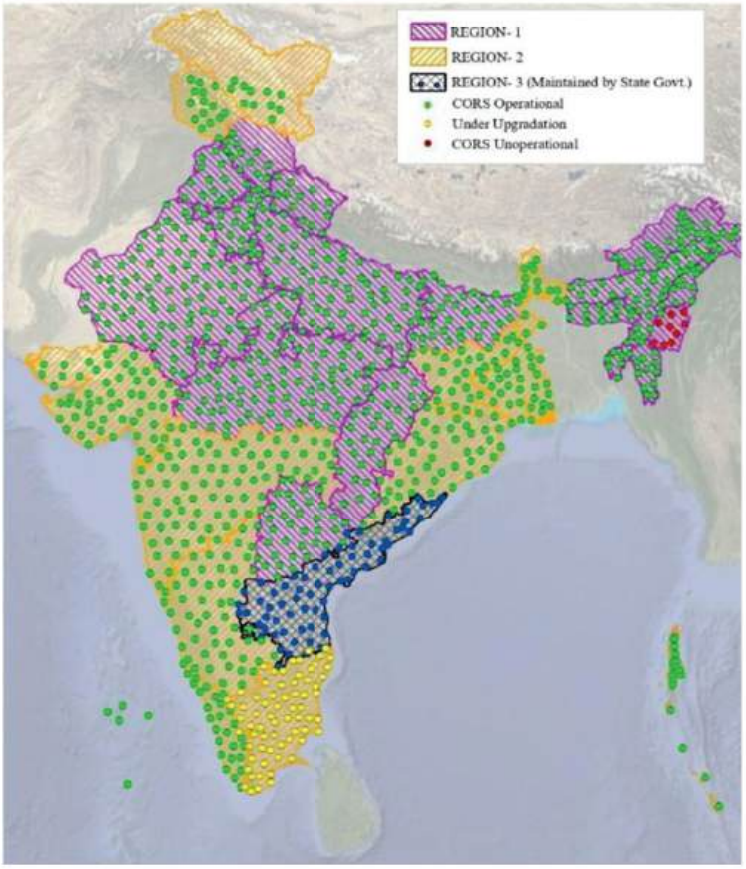


Figure-6.2: Spatial distribution of CORS network grid

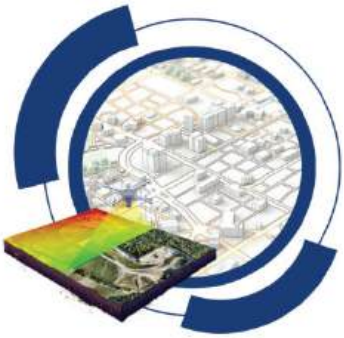
(Source: cors.surveyofindia.gov.in)

Figure-6.3: CORS station of Survey of India

(Source: cors.surveyofindia.gov.in)

6.10 Survey of India Ground Control Points

SOI GCPs also known as Passive Network of Reference Stations, are a network of established geodetic reference points used in India for high-precision surveys, mapping, and geospatial applications. These Ground Control Points (GCPs) are fixed physical locations with accurately determined coordinates (latitude, longitude, and elevation), typically obtained through precise geodetic measurements. These GCPs has cement concrete structure/Monumentation and can be located on the ground by their description which is available with SOI. The SOI has established a Ground Control Point (GCP) Library of about 2500 Ground Control Points in the entire country. These GCPs define the Horizontal datum of the country and can be used for various surveying, mapping and developmental activities.



6.11 ULB Field Survey Team Constitution

The team constitution for a land parcel survey typically involves a combination of skilled professionals who work together to ensure accurate data collection, analysis, and reporting. The state can choose any number of team within the budget allocation for each ULB, but the core team members generally will include the following:

1. One Permanent staff (equivalent to Patwari/Talati) from the State Revenue Department.
2. One Permanent staff (equivalent to Patwari/Talati/Inspector) from the State Urban Department.
3. One Department surveyor/hired surveyor for doing ETS survey
4. One helper to assist the surveyor
5. One vehicle with driver
6. One GNSS Rover

6.12 Public Meeting

1. Public awareness during field survey is an essential step in the land surveying process, especially when the land parcel has implications for public interest, urban development, infrastructure, or land rights. Public meetings serve as a platform for stakeholders—such as landowners, government representatives, urban planners, and the general public—to discuss and review the proposed survey, boundaries, and any issues related to land use or ownership. The goal of a public meeting is to ensure transparency, gather feedback, address concerns, and align the survey process with legal and community requirements.
2. Public meetings should be advertised in advance through newspapers, community bulletins, official government websites, and direct communication with affected parties.
3. Notifications should include details such as the time, location, purpose, and agenda of the meeting.
4. During public meetings state level officer(s) must present an overview of the land survey project and its importance and survey methods.

5. Land holders should be requested at the meeting to clear the boundaries of their properties and place survey marks before reaching of the surveyor for field demarcation work.
6. State level officer(s) must address any concerns raised by the attendees, offering clarifications and explanations about the survey and its impact.
7. Officer(s) must maintain official records of the meeting, including minutes, questions raised, and responses provided and note any issues, suggestions, or concerns raised by the public for further consideration.
8. Ensure that the survey complies with local government policies and that all stakeholders are informed of the legal implications.

6.13 Mutation Camps

1. The States Revenue Departments and ULBs could consider holding special camps to facilitate alignment of the possession status with the status in the ownership records in all the clear / undisputed cases, by way of mutation/ updation of records for ownership change, partitions/ divisions and amalgamations of properties, property tax liability.

2. Adequate publicity of the camp information as also the procedure, the documents required to be presented and the witnesses to be produced by the land holders at the camp shall have to be ensured.

3. During the intervening period before the survey teams commences their work in the field, the State / UT Governments could consider inviting online/ physical applications/ claims for updation of records and dispose them of in a time bound manner so that the information to be taken by the survey teams to the field is as accurate as possible.

4. The claims and objections should be disposed of by the competent Survey Authority in accordance with the provisions of the rules in a time bound manner and the status as per the decision should be updated in the attribute table in a separate column as much in online format as possible.

5. Help desks and help lines for the guidance of the stakeholders in the process of updation shall be set up to operate under the supervision of the State PMU

6.14 Title Documents as prescribed by States/ UTs Government

Title examination by field survey teams: The documents which establish clear title of the property shall only entitle the person in possession to get the Urban Property card (UrPro). The State/UT Governments shall prescribe the documents like RoR with cadastral map, Sale deed, Lease deed executed by the competent Government land owning Department/Body, Gift Deed, Relinquishment deed, Settlement deed, allotment letter etc to be accepted as valid documents of title. In addition, guidelines in respect of the authority and the process to deal with and decide the claims based on other documents like GPA/other unregistered documents may also be issued as required.

6.15 Field Survey

1. Before starting the field survey, the field survey team must collect the legal documents, existing maps, cadastral records, property tax details from the revenue and urban department of concerned ULBs. If state has online system (Web-GIS) for city survey, the API may be shared with Madhya Pradesh State Electronics Development Corporation (MPSEDC) GIS Platform for its seamless integration.
2. Wherever available, the cadastral plots, layout plans, etc., should be georeferenced for extraction of legacy attribute data.
3. The team must carry the ORIs and extracted features received from SOI both in hard and soft copy, preferably in Field Data Collector (FDC) with Web GIS Field Software enabled with NRTK receiver. In case it is not available, survey grade NRTK enabled GNSS Rovers along with rugged laptops with GIS software and internet connectivity may be used for plotting the position of surveyed boundary points and digitizing the property boundary in the field
4. The survey team should use the Web GIS application of MPSEDC for field survey work.
5. The Web GIS platform enables surveyors to view the ORIs and extracted features. It can also be linked with GNSS rovers for feature extraction and updation of land parcels.
6. Survey team goes to the field with the sketch and marks the boundaries of existing holdings and Identify and document boundary markers or any physical landmarks on the ground.
7. If the boundaries of any of the fields were not demarcated by the land holders, the boundaries of those fields must be demarcated by the surveyor and helper in the presence of the landowners and other ULB team member.
8. During demarcation of each holding, the surveyor will gather the name of registered holders of the plot, its classification, revenue number, etc. as per the latest revenue records and as per the present enjoyment, for writing up the land register.
9. For each land parcel survey team needs to collect information mentioned in the Urban Property Card (UrPro) such as obtaining of owner and plot address, Mobile number, Aadhaar number etc.
10. When there are bunds or hedges between holdings, the center of these will as a rule, be considered to be the true boundary, unless there is evidence to the contrary.
11. Survey team need to take the front view photographs of the building/parcel using a fairly high-resolution camera and ensure that it is geotagged.
12. Once all the boundaries of the land parcel are identified and confirmed by the landowner, the team can proceed for the GNSS Rover survey, as required.
13. Wherever distinguishing features of a property/land parcel appears on ORI, shall be vectorized with reference to such features and almost all the polygons should be closed.
14. Wherever property/land parcel boundaries are unable to be demarcated on the ORI, those shall be measured on ground with DGPS/CORS rovers along with all other land parcels.

15. Wherever the satellite signal is poor and it's not possible to collect the data with rover due to the dense structures, narrow roads, canopy areas, High Tension (HT) lines etc., the coordinate data shall be collected through ETS or measurements shall be taken up by tape and converted into coordinate data.
16. The vectorization of land/property parcel boundaries shall be drawn with a combination of above said data in GIS software.
17. During the Ground Truthing all land parcels including those belonging to the government shall be denoted with a temporary number after due measurement on the ground. Property ID/City survey number shall be allotted after completion of survey and vectorization of all land parcels and its approval by revenue/urban development officer of the ULB level team.

6.16 Field Survey: Salient Instructions

1. Survey team goes to the field with the ORI map and identifies as well as documents boundary markers or any physical landmarks on the ground and same should be correlated with ORI map.
2. Ground team to visit each plot or land parcel to verify urban land boundaries and the building footing Boundary points are to be noted by the ground truthing team using GNSS Rover, in presence of land owners, and neighbors. Field survey team to also ground validate the features extracted from the ORI such as utilities, buildings etc.
3. In case of variations in the details in the two sets of the record (one available with the survey team and the other presented by the land holder in possession at the site), due to transfer of the land parcel/plot/property, by way of succession, sale, gift, relinquishment, mortgage, partition and subdivision etc, not followed by updation, the land holder shall be advised to submit an application for updation of the ownership details. In case of disputes over the ownership/boundaries being raised before the survey team, also the parties shall be advised to submit applications in support of their respective claims.

6.17 Field Survey Methodologies

Following are the Methodologies for Property Boundary/Land Parcel Survey by State Authorities:

6.17.1 FDC integrated with CORS network through NRTK receiver

1. The property parcel boundaries can be demarcated on ground using a Network RTK (NRTK) enabled Rovers and Controller/Mobile application using the CORS network in the states where the CORS network is functional.

The desired positional accuracy could be achieved using the CORS network in the states where the CORS network is functional. The desired positional accuracy could be achieved using the CORS correction streams. Further, extraction of property parcel boundary can be done simultaneously on the ground since the ORI/ Map-1 can be visualized in the FDC and shape file of property boundary can be created.

Resources required:

i. CORS network

ii. NRTK enabled GNSS Receivers (also known as GNSS Rovers) having tilt sensors

iii. FDC integrated with CORS network NRTK rover.

iv. Laser Range Finder

v. Hardcopy of ORI with digitized features

vi. Trained manpower

6.17.2 GNSS Receiver integrated with CORS Network

The property parcel boundaries can be demarcated on ground using a Network RTK (NRTK) enabled Receivers (also known as GNSS Rovers) using the CORS network by taking observation of demarcated points (especially for missing vertices in ORI). The coordinates thus recorded in field can be parallelly plotted using rugged laptop with GIS Software to create the property boundary layer. This can be the alternate method of property demarcation in the States were the CORS network is functional.

Resources required:

i. CORS network

ii. NRTK enable GNSS Receivers (also known as GNSS Rovers) having tilt sensors

iii. Laser Range Finder

iv. Rugged Laptop with GIS Software

v. Hardcopy of Ortho plot

vi. Trained manpower

6.17.3 Electronic Total Station (ETS) in combination with GNSS

The demarcation of property parcel boundaries on ground can be done using 3. Electronic Total Stations in combination with GNSS. In order to demarcate the property parcel boundaries, Control Points (at least 2 no. GCPs) are to be established in field survey area using GNSS Receivers (also known as GNSS Rovers). Using these two GCPs, total station can be aligned and further the coordinates of the vertices of property parcels can be picked up. The coordinates thus recorded in field can be parallelly plotted using rugged laptop with GIS Software to create the property boundary layer.

Resources required:

I. GNSS instrument / CORS
ii. Total Station
iii. Rugged Laptop with GIS Software
iv. Laser Range Finder
v. Hardcopy of ORI with digitized features
vi. Trained manpower

6.18 GNSS Rover Survey

The Observation of land parcels should be done using the GNSS Receiver/Robotic Total Station, based on the GNSS network. In the case of RTS surveys each day, surveys should be started and ended at known value stations. When selecting a GNSS receiver it should be ensured that it supports CORS (Continuously Operating Reference Station) networks and must have a tilt sensor.

6.19 Equipment Preparation

1. GNSS Rover Setup: Ensure the GNSS receiver is functional, charged, and updated with the latest firmware.
2. Field Data Collector (FDC): Install survey software (e.g., Trimble Access) and check Bluetooth and Wi-Fi functionality.
3. Power Backup: Carry spare batteries and portable chargers.
4. Connectivity: Confirm reliable internet access for the CORS network.

6.20 Define Survey Parameters

1. Mount the GNSS receiver on a tripod or pole and position it vertically using the bubble level.
2. Power on the receiver and check for satellite lock (at least 5 satellites for a 3D fix).

6.21 Establish Connection to CORS

1. Primary ways to establish communication between the rover and CORS networks via internet Networked Transport of RTCM via Internet Protocol (NTRIP). This method allows the rover to connect to the CORS network through the internet.
2. Obtain NTRIP Access Information: Contact the CORS provider or use a public NTRIP service. You will need an NTRIP caster URL, a username, and password (if required), and the specific mount point of the CORS station.
3. Configure the Rover: In the rover's software or receiver settings, configure the NTRIP client by entering the caster URL, mountpoint, and login credentials.
4. Establish Connection: The rover will connect to the CORS network via the internet, receive RTK corrections, and apply them in real-time for improved accuracy.
5. Monitor the Connection: Ensure that the rover has an active connection to the CORS network and that it is receiving correction data

6.22 Pair the GNSS receiver with the Field Data Collector via Bluetooth

Open Bluetooth settings and pair with the GNSS receiver (default PIN: 0000).

Connect to the CORS network:

i. Enter the IP address and port of the CORS server.

ii. Input NTRIP credentials (username and password)

iii. Verify real-time corrections are active.

6.23 Establish Base Point (if required)

a. If a known control point is available, position the GNSS receiver over it.

b. Measure the point using RTK corrections to establish the reference for the survey.

6.24 Land Parcel Survey Execution - Boundary Point Measurement

1. Navigate to the first boundary point of the parcel.
2. Position the GNSS Rover precisely over the point
3. Ensure the receiver is stable and vertical.
4. Always hold the survey pole vertically using the built-in bubble level. Misalignment can cause positioning errors due to an incorrect offset from the true ground position.
5. Ensure the rover's antenna is pointing directly upward to receive satellite signals without obstruction.
6. Check antenna height and input the value in the Field Data Collector.
7. Ensure line-of-sight to the sky for uninterrupted GNSS signals.
8. Start measurement and wait for the solution to show the value.
9. Person holding a rover must go to each corner of the land parcel according to the shape and record the point coordinates (latitude, longitude, elevation). The surveyor should carefully survey to see that the common points or boundary between two land parcels is measured but once only so that there may be no difference between the measurements recorded for such common points or boundaries.

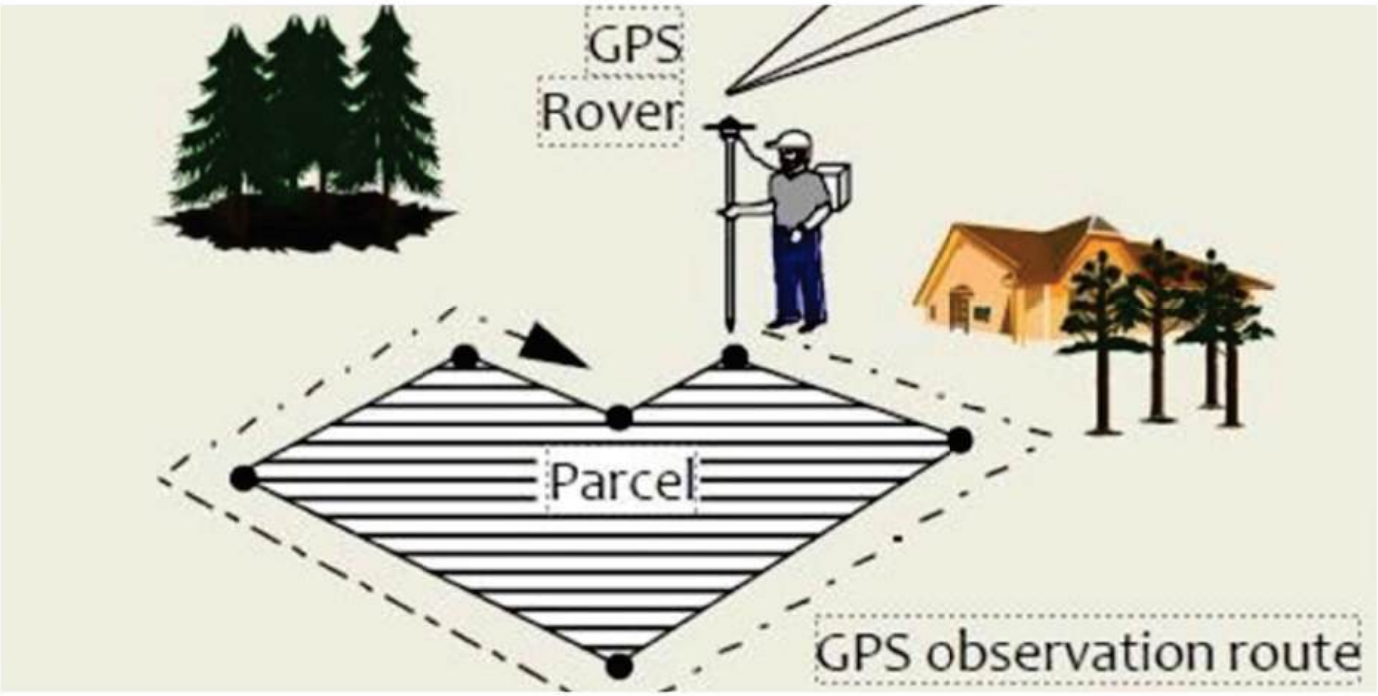


Figure-6.4: Illustration for land parcel survey

10. Special considerations need to be given for corner properties which are located at the intersection of two roads, having at least one vertex (or more) common with the road boundary. These properties are critical due to their visibility and potential for disputes; hence, they are always surveyed with special attention.
11. All road-facing sides of corner properties must be measured during the survey.
12. If property boundaries overlap with building structures (as seen in ORI), the case must be reviewed, and corrections certified by the survey supervisor.
13. Locate the corner vertices where property boundaries intersect with roads and use the rover to precisely record these vertices with centimeter-level accuracy.
14. Measure boundaries shared with neighboring properties, ensuring no overlap.15. Compare GNSS measurements with existing maps or property sketches and if variations exceed 5 cm adjust the boundary polygon of existing maps or property sketches.
16. Any variation of length between the lengths measured on the ground and as written in the sketch which is less than 10 cm, need not be incorporated. For example if length in digital sketch is 9.1 m and on the ground it is measured to be 9.17 m then the said 7 cm variation need not be incorporated and 9.1 m shall remain unchanged. The variation in excess of 10 cm shall be duly incorporated by rounding off to a single decimal place of meters.
17. Extreme variation in length which is more than 50 cm as compared to ORI determined length should be re-measured by Survey Supervisor. Similarly, any change in lengths of the side or otherwise which leads to drawing of the property boundary line over the building in the ORI image, should be re-checked by Survey Supervisor and correction certified with time stamp.
18. Use offset measurement techniques for inaccessible points (e.g., behind obstructions).
19. Re-measure points if positional accuracy exceeds project thresholds.
20. The area of each land parcel should be computed by the Surveyor in the prescribed Software.
21. Add attribute information of each parcel (Survey No., Owner Name, Property tax details etc.).
22. Take the front view photograph of the land parcel/building
23. Move to the next boundary point and repeat the measurement process.

6.25 Post-Survey Tasks - Data Export

1. Export the collected data from the Field Data Collector to the system
2. Format: CSV, DXF, or SHP (depending on project requirements).
3. Projection: UTM projection with datum WGS-84 or local coordinate system.
4. Save data securely in multiple locations (e.g., cloud storage, USB drives).

6.26 Surveyed Data Processing

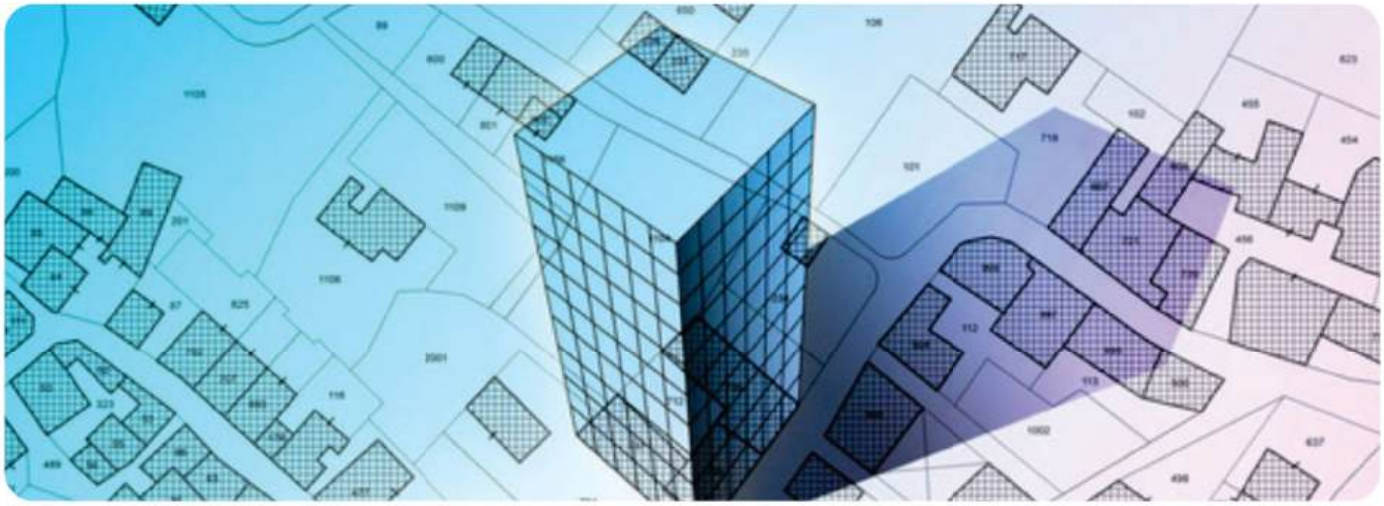
1. Import data into GIS or CAD software for analysis and mapping.
2. Process RTK and raw data in Trimble Business Center (TBC) or equivalent software:
3. Perform baseline processing and network adjustment.
4. Verify data consistency and accuracy.

6.27 Metadata Creation, Parcel Layout and Report Generation

1. Prepare detailed maps showing parcel boundaries, coordinates and area of the land parcel metadata.
2. Include metadata:
3. Coordinate system and datum.
4. Measurement accuracy (horizontal and vertical).
5. CORS network details and reference points used.
6. Area of the land parcel
7. ULPIN generation to every land parcel

6.28 Best Practices

1. Equipment Maintenance: Regularly calibrate GNSS receivers and ensure proper storage.
2. Signal Monitoring: Avoid surveying during high Position Dilution of Precision (PDOP) conditions or satellite outages.
3. Field Verification: Cross-check key points with existing boundary markers or legal records.
4. Safety Protocols: Follow safety guidelines in remote or hazardous survey areas.
5. Backup the data: Survey team must ensure that survey data is stored in proper devices



6.29 Government properties / land

1. Prepare detailed maps showing parcel boundaries, coordinates and area of the land parcel metadata.
2. Include metadata:
3. Coordinate system and datum.
4. Measurement accuracy (horizontal and vertical).
5. CORS network details and reference points used.
6. Area of the land parcel
7. Industrial estates managed by government agencies.
8. Roads, railways, and highways.
9. Airports and ports.
10. Public transportation hubs and utility corridors (electricity, water, gas etc.).
11. Public parks, green belts, and recreational spaces.
12. Land designated for afforestation or environmental preservation.
13. Government-owned land suspected to be encroached upon, especially in urban areas.
14. Government Land under litigation or dispute requiring clear boundaries.
15. Reserved/protected forests, wildlife sanctuaries, conservation zones, wetlands etc.
16. Land earmarked for biodiversity conservation and heritage sites.
17. Government-owned agricultural land leased or cultivated for public purposes.
18. Revenue land under the purview of district administration.
19. Land under defence establishments (to the extent permissible for civilian surveys).
20. Border and sensitive areas requiring specific permissions for surveying.
21. Land allocated for religious, cultural, or historical purposes.
22. Land under public healthcare facilities and community centers

6.30 Integration of property tax and RoR details with Land parcel data

1. Once all land parcel data are completed, it need to be integrated with property tax data sets or/and record of rights, if exists.
2. For integration purpose, the states should use NAKSHA Web-GIS Platform.
3. NAKSHA Web-GIS application will use API services for Property tax ownership data or other relevant information for RoR tagging etc. with respect to various State/UTs

a) Title confirmation guidelines and area mismatch guidelines

1. State Government shall define title enquiry and area mismatch reconciliation guidelines, in respect of the procedure and the documents to be relied upon for determination of ownership and disposal of claims and objections on the field.
2. Guidelines formulated by some states which have already undertaken the urban surveys, have been provided at Annexure-2. States can adopt these under stating guidelines with appropriate modifications or create their own Guidelines as required. Adherence to the applicable provisions under the relevant Revenue Acts /Municipal Acts shall have to be ensured when defining the Guidelines.

b) Updation of textual and spatial records

Updation of textual and spatial records prior to commencement of the process of disposal of claims and objections

1. In case of variations in the details in the two sets of the record (one available with the survey team and the other presented by the land holder in possession at the site), due to transfer of the land parcel/plot/property, by way of succession, sale, gift, relinquishment, mortgage, partition and subdivision etc, not followed by updation, the land holder shall be advised to submit an online application for updation of the ownership details. In case of disputes over the ownership/boundaries being raised before the survey team, also the parties shall be advised to submit online applications in support of their respective claims.
2. Special efforts shall be made by the Revenue/Settlement/Municipal Authority concerned to update the ownership details, decide the disputes received through the survey teams, in accordance with the provisions of the applicable law, so as to limit the claims and objections at the later stage after publication of MAP-2.

c) Recording of commonly held land in housing societies

1. Nodal departments of state/UTs would notify detailed Guidelines on how to record commonly held land in apartments complexes or colony/society land. If the state already has such Guidelines, the same may be used.

2. If applicable, the nodal department also prescribes Guidelines on how to note individual ownership in different types of housing societies, including leasehold allotment, group housing societies, cooperative societies, apartment owners' association, and others.

3. These should be in consultation with the Revenue and Urban development dept., and in conjunction with the new Urban Property Card (UrPro) format, prescribed in this SoP, to the extent possible.

d) Quality Checking of Ground Truthing

1. The supervisory/ Mandal Team (Dy.Tahsildar & Mandal Surveyor) may check ground truthing for at least 15% of parcels.

2. At the Tahsildar level the quality of records generated and resolution of claims to the prescribed percentage (to be decided by the state Government). Not less than 5% of the properties surveyed and 10% of the resolved applications shall be verified.

Recommended Additional Quality Checks:

Tahsildar (2%), Dy. Inspector of Survey (5%), Inspector of Survey (2%), RDO/Sub-Collector (1%), Assistant Director (random checks).

3. State-level teams/officers to undertake random checks on grounds in all the ULBs.

4. Upon verification, including random checks on the ground, the draft Urban Property card (UrPro) shall be ready for publication.

5. The draft Urban Property card (UrPro) of each land parcel must be assigned after the approval of Revenue/Urban officers not below the rank of Tahsildar/Naib Tahsildar, or as the case may be in various States/UTs.

6. A ULB-level committee may be constituted with members such as the local tahsildar, Sub-Divisional Magistrate, Executive Officer of Nagar Panchayat, GIS experts, etc. as appropriate.

e) Output (MAP-2)

1. Georeferenced map of the land parcel with attributes.

2. Property Parcel Maps with Geocode data, ULPIN and attribute data.

3. Accuracy report of surveyed points.

4. Linkage of property tax details and/or record of rights etc. with land parcel

5. Correlation statement w.r.t old survey record, if any.

6. Date and time of survey approvals.

7. Assign Urban Property Card (UrPro), with name of the land owner.

f) Enquiry into Titles, Rights etc

The Survey Officer or any other Officer appointed by the State Government shall enquire into the titles, rights, easements and any other rights in respect of all building sites and the lands, the area of which is determined under the MAP-II.

7. MAP-3: Disposal of claims and objections and map finalization

7.1 Online facility for Claims and Objections

While publishing the draft Urban Property card (UrPro) generated on completion of the MAP-2 processes, objections, if any, with regard to the title, area and/or boundary shown in the draft will be invited by the survey authority.

The Web-GIS platform of NAKSHA shall facilitate filing objections online by the public and other stakeholders and for adjudication & disposal thereof by the States/UTs competent survey authority.

7.2 Field Level Rechecking

a. A Special Team may be appointed constituting Revenue, Urban officers other than the initial survey Team for disposing of Claims & objections, if any or published Map-2.

b. The land parcel/ plot level/building spatial data shall be carried to field through a mobile app / hard copy.

c. The Survey team shall carry with them the plot wise information of ownership, as per revenue/municipal records, in respect of all the land parcels to be re-surveyed.

d. The land parcel /property details available with the survey team shall be tallied with the details contained in the ownership documents, as mentioned in para 7.1 presented by the land holder in possession of the plot/land parcel.

e. The Special Team shall conduct enquiry and issue speaking order regarding the claim/objection. If there arise any dispute between the parties, the special team shall decide the disputes in accordance with the provisions of the applicable law, so as to limit the claims and objections at the later stage after publication of map

7.2.1 Map Finalisation

Reference to the Title documents suggested at 6.14 may be made by the Survey authority for adjudication on the claims and objections.

The final property record (MAP-3) may be published after completion of the adjudication process. The stakeholders may be informed about the provisions of the appeal process as existing in the applicable survey and settlement Rules.

Urban Property cards (UrPro) should be issued on the basis of the finally published property record.

7.3 Format of Urban Property Card (UrPro)

A model format of the Urban Property card (UrPro) to include required attributes of land and building, including apartments in multi-ownership complexes, with the aim to suggest a provision for a comprehensive tool for transparency, accuracy and legal compliance, is given at Annexure-3. The State/UT may modify the format, if required, and notify it as part of their respective Revenue/Survey Rules and Manuals.

7.4 Integration of existing databases with UrPro

a. To ensure accuracy of the Land and Property Ownership data and its synchronization with property tax data, an automated mutation trigger mechanism is necessary. This mechanism will automatically update NAKSHA records including property tax data whenever there is a change in the land ownership, land-use categorization, or other property-related attributes.

b. The integration of the data maintained by all the relevant departments like Revenue, Registration, Forest, Town Planning and Agriculture can be done through Web-based mechanisms. It will facilitate automatic updation of the changes made in one system to instantly reflect in the other, reducing/ obviating the need of manual intervention with ensured consistency between ownership and tax data. This facility will trigger auto-mutations in real-time providing accurate, up-to-date information on urban land transactions, ownership changes, and tax implications.

c. In the cases where the data are still in physical form and real-time synchronization is not possible, the interim solutions, such as batch updates or scheduled uploads of offline records on WebGIS to ensure that the system remains up-to-date, should be considered. While automation of the mutation process is key to streamlining land administration, these temporary measures will help maintain data accuracy during the transition from offline to fully online systems.

7.5 Key Components of the UrPro

The Model Format is annexed (Annexure-3) which contains details to facilitate Administrative Identification, Land Parcel/ Plot information including land ownership details, building/ structure details and building/ structure ownership details and property photograph.

7.5.1. A sample guide to filling the details in various of Urban Property Card (UrPro) are given below:

1. Plot Details

i. State/UT Name: New Delhi
ii. District Name: Delhi
iii. Town/City Name: Delhi
iv. City Survey No: 478
v. Ward Name & Number: Kailashpuri-32
vi. Year of Commencement of Ownership: 2023
vii. Property Type (Private/Government): Private (In case of property type as Government then mention the property type cases such as Central Govt., State Govt., Local Body, or Govt. Undertaking whichever is applicable)
viii. ULPIN: 79PYQ GYZ30 XXXX
ix. Plot ID: ABCD12345
x. Plot Area: 445.94 sq. m
xi. Plot Address with PIN code: Plot No. 87, Mira Road, Kailashpuri, New Delhi, Delhi 110011
xii. Plot Owner/s Name with Father/Guardian Name: Mohal lal Verma S/O Jetha Ji Verma
xiii. Aadhar Number and Mobile Number of Owner: 7850 6983 XXXX; (+91) 98587888XX
xiiv. Ownership/lease Hold/ Other rights: Owner (To be selected accordingly)

2. Building details in respect of individual buildings in UrPro

I. Municipal ID: KA10EC1234
ii. Property type (Private/Government): Private
iii. Purpose of Usage (Residential, Commercial, Industrial, etc.): Residential (To be selected accordingly)
iv. Name of the Building: Krishna Kunj
v. Total Number of floors: 02
vi. Owner's floor number: 01
vii. Name of the Owner: Rajeev Shukla
xiii. Super-Built-up Area: 445.94 sq. m
ix. Parking Area: 12.5 sq. m
x. Garage Area: 11.76 sq. m
xi. Property Address: Krishna Kunj, M. G Road, New Enclave Colony, New Delhi, Delhi 11001

3. Building details in respect of multi-ownership buildings in UrPro

i. Municipal ID: To be mentioned
ii. Property type (Private/Government): Private (To be selected accordingly)
iii. Purpose of Usage (Residential, Commercial, Industrial, etc.): Residential (To be selected accordingly)
vi. Apartment Name/No.: Ashoka Apartments/D-01(where 'D' indicate block and '01' indicates its sequencing)
v. Floor No.: 03
vi. Flat No.: 021
vii. Name of the Owner: Mrs. Sunitha Gandhi
viii. Super-Built-up Area: 900.24 sq. m
ix. Parking Area: 12.5 sq. m
x. Garage Area: 11.76 sq. m
xi. Property Address: Flat No. 21, 3rd Floor, Ashoka Aprtments, Malviya Road, Amirpur Colony, New Delhi, Delhi 110011

4. Details to be filled in respect of Single Owner /Joint Owner/ Multi-Ownership Group Housing Society in UrPro

i. Name of Owner(s): Mr. Suresh Mittal
ii. Guardian/Spouse Name: Mr. Ajit Mittal / Mrs. Anita Mittal
iii. Ownership Share: 100%
iv. Owner's identity document: Aadhar/ PAN/ Govt. ID Card Number
v. Owners Communication Address: H No. 21, Akbar Road, Lajpat Nagar, New Delhi, Delhi 110011
vi. Owner's Photograph: latest Photograph of the owner
vii. Mutation Number and Date of Mutation: 356/2023 dated 15 October 2023
viii. Title document number: Conveyance Deed No, dated

5. Encumbrance/ Mortgage/ Other rights and Remarks in UrPro

Records of any Encumbrance, Mortgage, Lease, Easement, or Other Rights associated with the property includes identifying and verifying information from reliable sources, defining and consistently using specific data fields, establishing clear data entry and verification procedures, outlining procedures for updating records, and specifying methods for secure storage and retrieval of property records. These procedures ensure accurate and complete records, facilitate smooth property transactions, minimize legal risks, and ensure compliance with legal requirements.

6. Supporting Information in UrPro

Additional elements such as Location Map, Overview Map, Photograph of the Building and in case if it is a land then the photograph to be taken with neighboring structures and Digital Signature to authenticate. In similar way the required information can be incorporated in UrPro by States/UT's in given Annexure-3.

7.6 Issuance of notice and notification

7.6.1 Claim finalization and dispute resolution

a. Claims and objections should be invited, through issues of notice and notification

b. The claims and objections should be disposed of by the competent Survey Authority in accordance with the provisions of the rules in a time bound manner and the status as per the decision should be updated in the attribute table in a separate column

c. For smooth passage of the survey process, the provisions which have worked well in the states of Andhra Pradesh, Kerala, Karnataka and Madhya Pradesh may mutatis mutandis, be adopted by other states through the appropriate process of amendment in the revenue / survey rules

7.6.2 Final MAP-3 publication with Urban Property Card (UrPro) and register

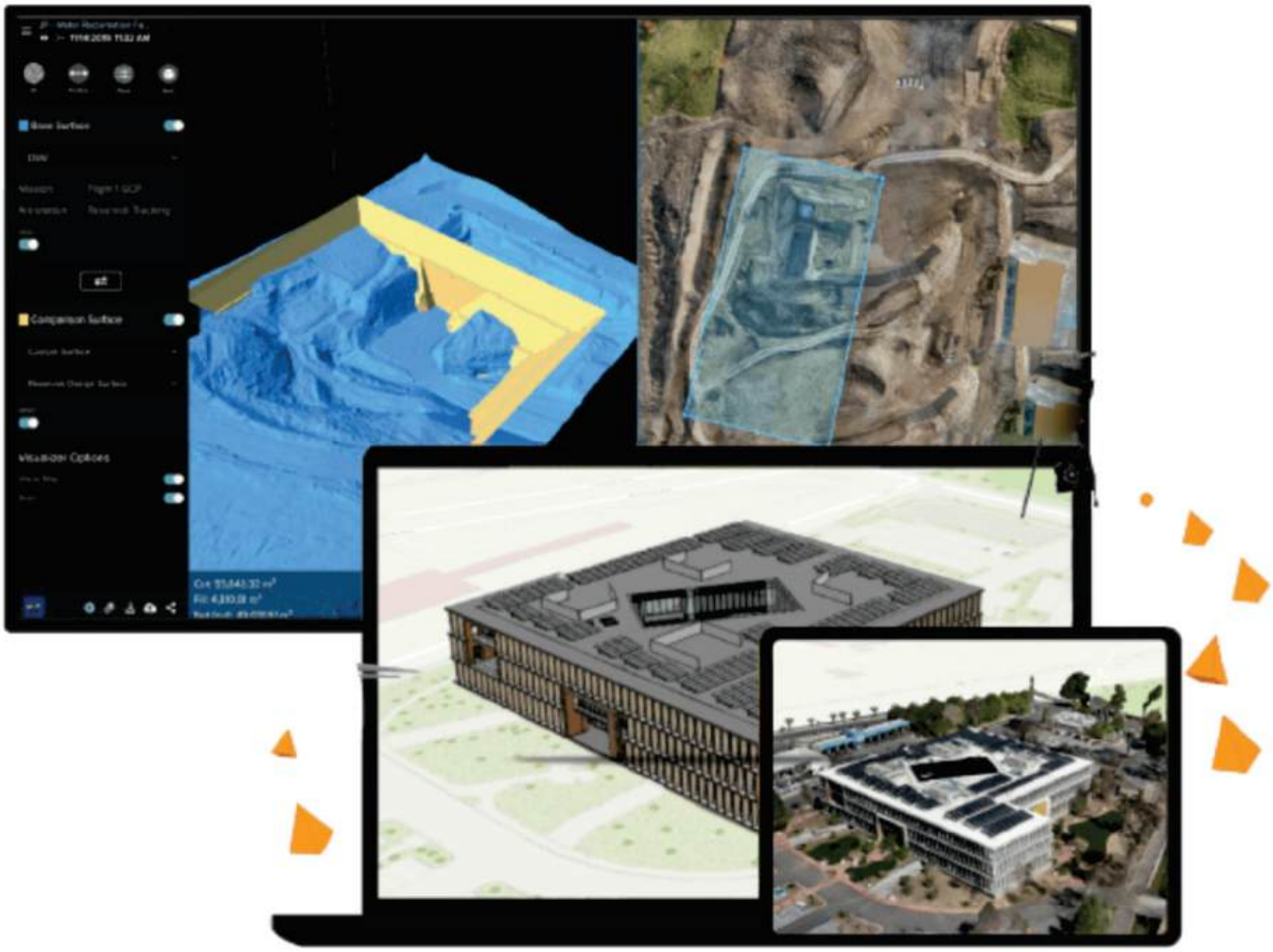
Random checks on ground by the State Level Committee assigned Officer(s). For unresolved disputes, provide a pathway for escalation to civil courts, with a standardized timeframe (e.g., within 60 days after final publication or as per States/UTs norms)

7.7 Updation and maintenance of database

It is important to keep the database generated through NAKSHA up to date. On completion of the NAKSHA project, the state shall be responsible for maintenance of a web portal with finalized survey information at plot level. The state shall formulate processes for updation of the ownership data (on death or transfer of property) through offline or online means. Linking the NAKSHA data to registration software of states for automatic updates can be considered.

7.8 Monitoring

1. States are encouraged to document the process, learnings and best practices, so that the documents may be utilized for a state-wide exercise undertaken on a later date and may benefit from these experiences. The documentation may be undertaken by the state government itself, or by third parties.
2. Such documentation shall include technological challenges (if any), public response, challenges faced at field level, institutional coordination mechanisms, effectiveness of title enquiry guidelines, and others as relevant. It may also make suggestions for improvements, and highlight innovative mechanisms and good practices.
3. For real time monitoring of the desired activities and recording the progress, SPMU is responsible for compiling the data from the concerned Urban Local bodies and feeding the data on the formats and portal prescribed by Department of Land Resources, Government of India.
4. SPMU along with Nodal officers of the respective State/UT will be participating in all the review meetings scheduled by DoLR.



8. Capacity Building and Knowledge Management

8.1 Capacity Building Programme

The Capacity Building Programme (CBP) under NAKSHA is an initiative under the Department of Land Resources (DoLR) aimed at improving urban land record management across 26 States and 3 Union Territories (UTs) in India. This CBP equips government officials, planners, and surveyors with technical knowledge in geospatial technology, land mapping, and data validation techniques. Given the scale of urban development across 26 States and 3 Union Territories (UTs) in India, the programme follows a multi-tiered approach, training officials at different levels, ensuring that every level of governance is equipped with the right knowledge, tools and skills to implement NAKSHA effectively.

1. The key focus areas of the CBP include:

a) Giving a strategic understanding of NAKSHA and an overview of geospatial tools to senior officials.

b) Train middle- and field-level officers using lecture-based sessions and hands-on exercises to use GIS software, drones, and data validation methods.

c) Ensuring knowledge transfer at all levels through a structured Train-the-Trainer approach.

d) Creating a sustainable learning system where trained officials further train local teams.

2. The key stakeholders involved in the CBP are:

a) Department of Land Resources: Overall programme management and training master trainers

b) Survey of India: Technical training

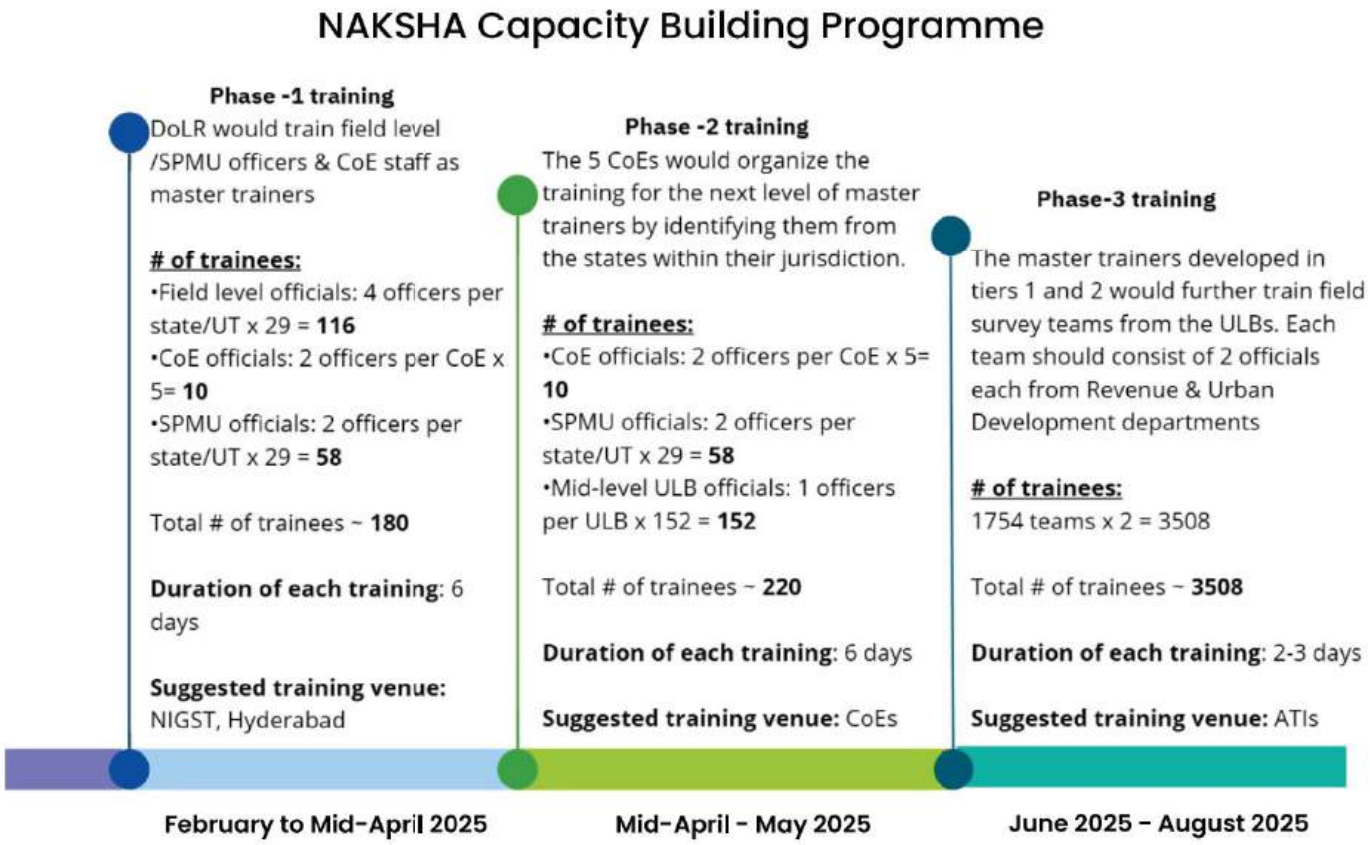
c) MPSEDC: Training on Web GIS portal

d) Centres of Excellence (CoEs): Regional training hubs to develop next level master trainers

e) SPMUs and ULBs: Identifying and nominating members for master trainer training. The ULBs would also nominate mplementation-level officials for further training on ground truthing, field survey, web GIS software handling, dispute resolution, etc.

f) Rover provider companies: They provide rovers and comprehensive user manuals on using rovers for survey work.

Diagrammatic representation of multi-tiered approach in CBP



8.1 Figure-6.5: Multi-Tiered Approach in CBP

The diagrammatic representation above highlights the multi-tiered approach of the CBP under the NAKSHA programme.

In phase-1 training, DoLR would train field-level officials, SPMU officials from each of the 29 states/UTs participating in the NAKSHA programme and CoE officials as Master Trainers. Four officials from each state/UT (Total = 116), two officials from each CoE (Total = 10), and two officials from each SPMU (Total = 58) will be trained in this phase. Overall, this phase of training master trainers would cover around 180 trainees.

3. Objectives of Phase-1 training

The 6-day Master Trainer training programme is designed to build technical expertise, operational proficiency, and hands-on experience in geospatial surveys, Web GIS applications, and urban land record management.

4. By the end of this training, participants will be able to:

a. Develop a comprehensive understanding of the NAKSHA Programme, its objectives, and its role in urban land governance.

b. Apply core principles of surveying and geospatial mapping using GNSS and CORS technologies to improve accuracy in land records.

c. Demonstrate expertise in Web GIS platforms, including data integration, analysis, and digital mapping techniques for urban land records.

d. For accurate geospatial data collection, perform hands-on aerial and field surveys using GNSS rovers, drones, and Electronic Total Stations (ETS).

e. Validate and finalize land parcel data layers for seamless urban land record system integration.

f. Understand and apply legal and administrative procedures related to land surveys, including public grievance redressal and conflict resolution.

g. The trainees should be able to train and mentor other officials in their respective states and Urban Local Bodies (ULBs), ensuring standardized and effective implementation of the NAKSHA Programme.

Table 8.1: An indicative list of topics and sessions for master trainer training

Day	Topics	Resource Person
Day 1	• Introduction and overview of NAKSHA • Basic concepts of surveying • Methodologies of Aerial Data Acquisition • Introduction, Demo and Hands on GNSS Rover with CORS	DoLR and NIGST
Day 2	• Introduction to GIS, Overview of WEBGIS tools & its modules • Demo on WEBGIS tools (Desktop & Mobile) • Hands on WEBGIS tools (Desktop & Mobile) • Preparation for Ground Surveying using GNSS Rovers	NIGST and MPSEDC
Day 3	• Ground Survey using GNSS rovers with CORS	NIGST
Day 4	• Preparation and Finalization of Land parcels data layer • Demo on Drone Instrument & Payloads and MAP-1 deliverables • Demo and Hands on with ETS • Preparation for Ground survey using GNSS Rovers and/or ETS	NIGST and MPSEDC
Day 5	Ground Survey using GNSS rovers and /or ETS	NIGST
Day 6	•Experience sharing on legal and Administrative procedures involving Objection and conflict Resolution • Group Activity – Field Survey exercise Test followed by objective Assessment • Course wrap-up, Course Feedback and Valedictory	NIGST and MPSEDC

5. Phase 2 training

In phase 2 of training and capacity building, the 5 CoEs would anchor the training for the next level of Master Trainers by identifying them from officials within their respective jurisdictions. A suggested list of trainees for this phase should include 2 officials from the CoE (Total = 10), 2 officials from every SPMU (Total = 58), and 1 mid-level official from each ULB (Total = 152). Therefore, this phase should train around 220 trainees as Master Trainers.

The training design should ideally follow the structure suggested in the Phase 1 training. However, Centres of Excellence (CoEs) may modify the overall duration of the training (which is currently 6 days) as needed, provided that all learning outcomes are achieved and all topics are comprehensively covered. This flexibility ensures that trainees are fully equipped with the necessary skills and knowledge to effectively train field-level survey staff under the NAKSHA Programme.

6. Objectives of Phase 2 training

The phase 2 training is designed to equip participants with technical expertise, operational proficiency, and instructional skills in geospatial technologies, land surveying, and digital urban land record management. This training ensures that Master Trainers can effectively implement and disseminate knowledge across States, Union Territories (Uts), and Urban Local Bodies (ULBs).

By the end of this training, participants will be able to:

a. Explain the NAKSHA Programme framework and its significance in urban land governance, focusing on digitization, transparency, and efficient land management.

b. Demonstrate operational proficiency in geospatial technologies, including GIS integration, Web GIS platforms, and digital mapping techniques.

c. Apply aerial and field survey techniques, including drone-based mapping, GNSS, CORS, and DGPS surveying, for accurate geospatial data collection.

d. Perform hands-on ground surveys using GNSS rovers, Electronic Total Stations (ETS), and GIS tools to enhance land parcel accuracy and validation.

e. Validate and finalize land parcel data layers, ensuring seamless integration into urban land records and digital geospatial databases.

f. Understand and apply legal and administrative procedures related to land mapping, dispute resolution, and public grievance handling.

g. Effectively train and mentor master trainers at the state and ULB levels, ensuring standardized knowledge transfer and consistent implementation of NAKSHA across India.

Note: For the indicative list of topics and training design, refer to the table in phase 1 training.

7. Phase 3 training

This phase of training would train field survey teams from all the ULBs participating in the NAKSHA programme. The Master Trainers trained in phase 1 and 2 training and capacity building would anchor these trainings for the field teams. Each team should consist of 2 officials each from the Revenue & Urban Development departments. For the implementation of field surveys, 1754 field teams have been identified from the ULBs, therefore a total of around 3500 trainees would be trained in this phase.

8. Objectives of phase 3 training

By the end of this training, ULB-level field officials responsible for ground-level implementation will be able to:

a. Demonstrate a comprehensive understanding of the NAKSHA Programme, including its objectives, components, and role in urban land record management.

b. Apply geospatial survey techniques using GPS, CORS, and DGPS tools for accurate land mapping and field data collection.

c. Utilize Web GIS platforms for data integration, spatial analysis, and real-time urban planning applications.

d. Validate and process geospatial data to ensure accuracy, consistency, and compliance with mapping standards.

e. Conduct field surveys and ground-truthing exercises, verifying urban land records with high precision.

f. Manage public grievances and objections related to land records, ensuring transparency and dispute resolution.

g. Implement best practices for urban mapping and digital record management, contributing to efficient land governance and planning.

Table 8.2 An indicative list of topics and sessions for field team training

Day	Topics	Resource Person
9:30 - 10:00 AM	Inaugural	Organizing ATI
10:00 - 11:00 AM	Overview of NAKSHA and Role of Geospatial Technology	Master Trainers
11:00 - 11:30 AM	Overview on operation of Rover /DGPS for Ground Truthing	Master Trainers
11:30 - 12:00 PM	Overview of Web GIS Application developed for NAKSHA	Master Trainers
1:30 - 2:30 PM	Lunch Break	
2:30 - 3:15 PM	Demonstration on Use of Rovers for Survey Work and basics of DGPS surveying	Master Trainers
3:15 – 4:00 PM	Survey Demonstration Using Web GIS Platforms and grievance redressal	Master Trainers
4:00 – 5:00 PM	Q&A session and open discussion	
5:00 - 5:30 PM	Feedback	ATI

9. Training evaluation

All phases of the training will undergo a comprehensive evaluation process to assess effectiveness, trainee engagement, and learning outcomes. Structured feedback mechanisms, including surveys, assessments, and interactive discussions, will be incorporated to capture trainees' reactions and insights. This feedback will be systematically analyzed to identify areas for improvement, ensuring that the training remains relevant, impactful, and responsive to the needs of participants. Based on the evaluation results, necessary iterations and refinements will be made to enhance the training design, content delivery, and hands-on exercises, ensuring continuous improvement in the NAKSHA Capacity Building Programme.

8.2 Information, Education, and Communication (IEC) Plan

This outlines the Information, Education, and Communication (IEC) activities for the NAKSHA program per ULB in the local languages of the States/UTs. Numbers listed under actionable items are a general indication of expectations, and aren't absolute

Activity	Description	Key Usage Locations	Actionable Items
Development of IEC Materials			
	Visual communication tools to convey NAKSHA's benefits, steps to update land records, and the relevance of the program. Display engaging videos, infographics, and scrolling messages.	Key urban junctions (3 per ULB), high-traffic areas like main roads, markets, and public squares.	Urban banners at 3 high-traffic junction locations per ULB.
	Small, portable displays at land record offices, municipal corporations, and government buildings.	Land offices, municipal corporations, ward offices, local government buildings.	- Standees at all land and municipal offices in each ULB.
Wall Paintings and Murals	Large-scale artwork placed at key urban locations to reinforce NAKSHA's message of transparency, ownership, and security.	1 mural at a key urban location within each ULB (e.g., community centers, central market areas).	- 1 mural per ULB at a key urban location.
Rickshaws and Branded Autos for Audio Campaigns	Use rickshaws and branded autos equipped with sound systems to broadcast audio messages across neighbourhoods.	High footfall areas like markets, bus stations, parks, local streets, and migrant colonies.	Equip 30 rickshaws/ autos per ULB with sound systems.

Community Engagement Strategies			
Interactive Workshops and Public Meetings	Workshops to explain the NAKSHA program and answer citizen queries.	Community centers, schools, local halls. Residential colonies, gated communities.	Hold 2 workshops per month.
Feedback Forums	Platforms for citizens to share their feedback on NAKSHA and ask questions.	Community centers, schools, local halls. Residential colonies, gated communities.	1 feedback forum per person/meeting.
Public Festivals and Roadshows	Platforms for citizens to share their feedback on NAKSHA and ask questions.	Local fairs, cultural festivals, street markets. High-traffic roadsides and shopping streets.	Organize 2 roadshows/ festivals per year.
Collaborations with the state RERA sites and creating a joint campaign	Integration of NAKSHA programme Information with the website of state RERA	Online collaboration	Send Letter to Real Estate Regulatory Authority of all state
Text Message & IVR-Based Awareness Campaigns		Send short, actionable SMS tips and use IVR systems for easy information access.	For Rural & Low-Income Urban Areas
Mobile IEC Vans & LED Vehicles	Equip vehicles with LED screens and speakers for audiovisual campaigns.	Municipal office, Hospitals, Schools, colleges, Public places like Gym, Parks, community Center	Cover multiple locations daily, especially rural and semi-urban areas. Conduct live interactions, distribute pamphlets, and play recorded messages
Branded Public Transport (Buses, Metro, Cycle Sharing Stations)	Metro Stations, Public Bus Stops, High Traffic Areas	Display moving IEC messages on public transport to maximize audience reach.	
Organizing Press Conference	A press brief on the Subject matter before the field activity to carried by the Local Media through PIB/ Information & Publicity Department		By State PIB officers & Information & Publicity Department

Publishing of opinion Articles	Articles creating impact as per the sentiment of the audience of the ULB's to be drafted and published accordingly in the newspapers	National & Local Newspapers	By State PIB officers & Information & Publicity Department with the help of Media agency empaneled by DoLR
Organizing Ward-Level Citizen Meetings	Community Engagement and Confidence-Building: Organize ward-level meetings to explain NAKSHA's objectives, benefits, and process. Address concerns and build trust in the program.		Involve Local Leaders: Engage local leaders to encourage participation and lend credibility to the program.

Use of Media			
Local Media Outreach	Partner with local radio stations, TV, and newspapers to broadcast NAKSHA - related content.	- Radio stations, local TV channels.	- Partner with 3-5 media outlets. SOI will reach out to public through media outlets
		- Local newspapers and community magazines.	
Social Media Campaigns	Utilize social media platforms to share updates, engage with citizens, and address concerns.	- Facebook, Instagram, WhatsApp.	- 10-12 posts per week. SOI will actively post on Social Medial
		Mygov.in Collaboration with each State division	
		Develop AR filters or experiences on Instagram/ Facebook	
		- Interactive posts, videos, live Q&A sessions.	- Host 1 live Q&A per month through state handles.
Community Radio	Use local community radio to broadcast updates, interviews, and information in regional languages.	- Community radio stations.	- Broadcast 1 update per week on community radio.

8.3 Documentation Plan at Ground Level for ULBs

This documentation plan outlines the procedures and requirements for Urban Local Bodies (ULBs) to effectively implement NAKSHA IEC activities at the ground level. The state government is responsible for overseeing the implementation, ensuring that documentation is thorough, consistent, and aligned with the overall program objectives. This plan will ensure that each ULB captures the necessary data and provides regular updates for monitoring and evaluation.

Activity	Description	Documentation Requirements	Responsibility
IEC Materials Development and Distribution	Development and distribution of posters, banners, standees, and other communication materials to inform citizens.	Material Inventory Records: Maintain detailed list of IEC materials (posters, banners, standees, leaflets, rickshaws)	ULB IEC Coordinator Distribution Staff, Field Staff
		Distribution Tracking: Record distribution dates, areas covered, and number of materials distributed.	
		Photo Documentation: Capture photographs of materials placed at different locations for visual evidence.	
Community Engagement and Public Awareness	Conducting workshops, meetings, and festivals to educate citizens about NAKSHA.	Workshop and Meeting Records: Document event title, date, location, number of participants, topics covered, key takeaways.	- Standees at all land and municipal offices in each ULB.
		Feedback Collection Forms: Collect structured feedback from participants after workshops and meetings.	
		Rickshaw/Auto Campaign Logs: Track deployment, routes, number of audio messages delivered, areas covered.	

Media and Social Media Outreach	Broadcasting NAKSHA content through local media (radio, TV) and engaging citizens on social media platforms.	Media Outreach Logs: Record media type (radio, TV, print), date of coverage, and audience reach.	ULB Media Relations Officer, Social Media Manager, Media Coordinator
		Social Media Analytics: Track engagement metrics (likes, shares, comments, overall engagement).	
		Mygov.in Collaboration with each State division	
		Develop AR filters or experiences on Instagram/ Facebook	
Feedback, Surveys, and Continuous Improvement	Collecting feedback through surveys, focus groups, and community forums to improve IEC strategies.	Survey Data Collection Forms: Collect structured feedback from citizens via surveys or focus groups.	ULB Survey Team, Field Staff, Event Coordinator
		Community Forum Records: Document forum date, location, participants, and key discussions.	
Performance Evaluation and Impact Assessment	Monitoring and evaluating the effectiveness of IEC activities and their impact on public engagement and awareness.	Quarterly Monitoring Reports: ULBs to submit quarterly progress reports summarizing activities, metrics, challenges, and adjustments.	ULB Program Monitoring Officer, Impact Evaluation Officer
		End-of-Program Impact Report: Comprehensive evaluation of IEC activities' long-term impact on public awareness, engagement, and participation.	

9. Annexure

9.1 Annexure-1: List of 152 ULBs

S No.	State/UTs	District	Name ULB/Town/ City	Population	Aerial Survey (sq.Km)	Field Survey (sq.Km)
1	Andhra Pradesh	Ananthapur	Anantapuramu	2,61,004	0	16.31
2		Chittor	Kuppam	46,598	0	34.55
3		Eluru	Eluru	2,00,000	46.05	46.05
4		Guntur	Guntur	2,00,000	38.05	38.05
5		Guntur	Mangalagiri-Tadepalli	2,00,000	150.86	150.86
6		Kakinada	Kakinada	2,01,955	20	20
7		Kurnool	Kurnool	2,00,000	48.67	48.67
8		Prakasam	Ongole	2,00,000	0	101.43
9		SPSR Nellore	Nellore	2,00,000	51.04	51.04
10		Tirupati	Tirupati	2,49,423	20	20
11	Arunachal Pradesh	Namsai	Namsai	20,000	10	10
12	Assam	Barpeta	Barpeta Road	35,571	0	4.09
13		Bongaigaon	Abhayapuri	15,847	0	5.28
14		Bongaigaon	Bongaigaon	67,322	0	11.89
15		Darrang	Mangaldoi MB	25,989	0	5.31
16		Golaghat	Golaghat MB	41,989	0	14.33
17		Hojai	Hojai MB	36,638	0	4.77
18		Nagaon	Nagaon MB	1,17,722	0	12.56
19		Nalbari	Nalbari MB	27,839	0	13.59
20		Sivsagar	Sivsagar MB	50,781	0	7.3
21		Sonitpur	Dhekiajuli MB	21,579	0	4.35

22	Bihar	Banka	Banka Nagar Parishad	55,048	21.42	21.42
23		Buxar	Buxar Nagar Parishad	1,84,674	26.5	26.5
24		Munger	Tarapur Nagar Parishad	30,546	10.23	10.23
25		Nalanda	Rajgir Nagar Parishad	72,752	61.61	61.61
26		Rohtas	Dehri Nagar Parishad	1,49,908	13.18	13.18
27		Sonpur	Sonpur Nagar Parishad	43,293	7.73	7.73
28	Chandigarh	Chandigarh	Sarangpur, Burail, Kajheri, Palsora, Attawa and Sector 2 to 17	1,47,945	30.61	30.61
29	Chhattisgarh	Dhamtari	Dhamtari Nagar Palik Nigam	89,860	23.4	23.4
30		Jagdalpur (Bastar)	Jagdalpur (Bastar) Nagar Palik Nigam	1,77,000	50.49	50.49
31		Sarguja	Ambikapur Nagar Nigam	1,25,392	35.36	35.36
32	Goa	North Goa	Corporation of the City of Panaji	1,31,431	37.86	37.86
33		South Goa	Cuncolim M.Cl	19,476	33.57	33.57
34		South Goa	Margao M.Cl	1,45,078	54.68	54.68
35	Haryana	Gurugram	Manesar	2,00,000	138.18	92.12
36		Narnaul	Narnaul	2,00,000	63.36	63.36
37		Panchkula	Panchkula	2,00,000	96.21	64.14
38	Himachal Pradesh	Hamirpur	Nadaun MC	7,392	5.93	5.93
39		Kangra	Palampur MC	40,385	31.58	13.59
40		Mandi	Mandi MC	41,375	28.66	28.66
41		Solan	Solan MC	47,418	11.62	11.62
42	Himachal Pradesh	Baramulla	Pattan (Municipality)	19,538	4.28	4.28
43		Jammu	Bishnah (Municipality)	10,719	2.05	2.05
44		Pulwama	Awantipora (Municipality)	12,647	9.46	9.46
45		Reasi	Katra (Municipality)	9,008	4.15	4.15

46	**Jharkhand**	Lohardaga	Lohardaga Nagar	57,411	35.2	35.2
47		Palamu	Bishrampur Nagar Parishad	42,925	40	40
48		Ranchi	Ranchi MC (Ward 20&6)	41,210	3.47	3.47
49		Simdega	Simdega Nagar Parishad	42,944	36	36
50	**Karnataka**	Bagalkote	Bagalkote MC	1,53,935	61	70.47
51		Ballary	Siraguppa MC	64,617	0	29.88
52		Belagavi	Boragav TP	21,125	34.01	38.2
53		Belagavi	Gokak MC	1,04,398	32.05	21.02
54		Bidar	Basavakalyan MC	91,990	36	26.36
55		Chikkamag-aluru	Chikkamagaluru MC	1,25,000	35.5	31.36
56		Kolar	Kolar MC	1,59,785	0	18.1
57		Koppal	Bhagyanagara TP	25,054	0	7.76
58		Mysore	Bogadi TP	27,715	32.35	30.25
59		Shivamogga	Anavatti TP	23,334	35.02	35.16
60	**Kerala**	Alappuzha	Harippad	30,977	19.24	19.24
61		Kannur	Thalassery	92,558	23.96	23.96
62		Kasaragod	Kasaragod	54,172	16.7	16.7
63		Kollam	Punalur	46,702	34.35	34.35
64		Kottayam	Vaikom	23,234	12.63	12.63
65		Kozhikode	Vadakara	75,295	23.33	23.33
66		Malappuram	Perinthalmanna	49,723	34.41	34.41
67		Malappuram	Ponnani	90,491	24.82	24.82
68		Thiruvanan-thapuram	Attingal	37,648	16.87	16.87
69		Thiruvanan-thapuram	Neyyattinkara	70,850	29.5	29.5

70	Madhya Pradesh	Alirajpur	Alirajpur (Palika)	28,000	0	15.44
71		Indore	Depalpur (Parishad)	17,000	0	3.19
72		Indore	Residency Area (Nagar Nigam)	5,452	0	3.5
73		Jhabua	Meghnagar (Parishad)	13,000	0	8.15
74		Khandwa	Channera [Naya Harsood] (Parishad)	22,000	0	16.71
75		Narmadap-uram	Makhan Nagar (Babai)	17,000	0	3.56
76		Raisen	Sanchi	8,000	0	4.83
77		Sehore	Shahganj (Parishad)	9,000	0	6.42
78		Ujjain	Unhel	15,000	6.2	6.2
79		Vidisha	Vidhisha (Palika)	1,56,000	28.67	28.67
80	Maharashtra	Ahmednagar	Shirdi (Tq. Rahata)	45,000	12.64	12.64
81		Akola	Murtizapur	55,000	5.5	5.5
82		Buldhana	Buldhana	91,000	9.6	9.6
83		Chandrapur	Ghuggus (Tq. Chandrapur)	57,150	12.25	12.25
84		Chh.Sambh-ajinagar	Kannad	46,864	6.93	6.93
85		Jalgaon	Varanganv (Tq. Bhusaval)	33,000	23.3	23.3
86		Pune	Baramati	1,24,375	54.93	54.93
87		Raigad	Khopoli council	88,905	30.22	30.22
88		Solapur	Pandhapur	1,22,000	19.38	19.38
89		Thane	Kulgaon Badalapur (Tq.Ambarnath)	1,79,000	30.59	30.59
90	Meghalaya	East Khasi Hills	Shillong	1,43,229	10.23	10.23
91	Mizoram	Aizawl North	Aizawl MC 11-19	1,78,000	97.17	72
92	Nagaland	Dimapur	Dimapur	1,72,000	18	18
93	Odisha	Jharsuguda	Jharsuguda Municipality	97,730	74.87	74.87
94		Khorda	Khorda Municipality	46,205	25.84	25.84
95		Khordha	Jatni Municipality	55,925	25.74	25.74
96		Mayurbhanj	Baripada Municipality	1,09,743	45.15	45.15

97	Puducherry	Murungapa-kkam	Murungapakkam	25,209	4.87	4.87
98	Punjab	Barnala	Barnala	1,16,449	37	37
99		Ludhiana	Khanna	1,28,137	27.38	27.38
100		Patiala	Rajpura	92,301	21.29	21.29
101		SAS Nagar	Banur	18,775	22.69	22.69
102		SAS Nagar	Derabassi	26,295	45.4	45.4
103		SAS Nagar	SAS Nagar	1,66,864	32.15	32.15
104	Rajasthan	Ajmer	Kishangarh	1,54,886	97.91	97.91
105		Ajmer	Pushkar	21,625	9.39	9.39
106		Beawar	Beawar	1,92,000	48.64	48.64
107		Jaipur Rural	Bagru	47,826	30.37	30.37
108		Jaisalmer	Jaisalmer	82,000	46.19	46.19
109		Khairthal Tijara	Bhiwadi	1,04,921	50	50
110		Kotputali-Behror	Behror	41,000	48	48
111		Rajsamand	Nathdwara	44,523	25.9	25.9
112		Sawai Madhopur	Sawai Madhopur	1,21,106	31.39	31.39
113		Sikar	Nawalgarh	62,079	22.39	22.39
114	Sikkim	Sikkim (East)	Gangtok (M.Corp)	1,00,000	19.02	19.02
115	Tamil Nadu	Ariyalur	Ariyalur	31,729	7.62	7.62
116		Chengalpattu	Maraimalai Nagar	1,10,592	58.08	58.08
117		Coimbatore	Coimbatore (7 Wards)	1,23,314	10.44	10.44
118		Dindigul	Dindigul	2,26,294	14.01	14.01
119		Kanchipuram	Kanchipuram	2,00,141	35.58	25
120		Sivagangai	Karaikudi	1,22,714	13.75	13.75
121		Thanjavur	Thanjavur	2,45,795	36.31	36.31
122		Tiruvannam-alai	Tiruvannamalai	1,65,025	13.64	13.64
123		Tuticorin	Kovilpatti	1,07,050	9.62	9.62

124		Virudhunagar	Virudhunagar	72,468	6.6	6.6
125	Telangana	Bhadradri Kothagudem	Manuguru	32,091	27.28	24.86
126		Jagityal	Jagityal	1,05,735	28.03	29.55
127		Mahabuba-bad	Mahabubabad	53,891	36.37	35
128		Mahabub-nagar	Jacherla	52,128	35.24	35.24
129		Nalgonda	Miryalguda	1,08,781	28	28
130		Rajanna Siricilla	Vemulawada	46,438	62.68	62.68
131		Siddipet	Husnabad	22,082	25	25
132		Vikarabad	Kodangal	14,294	36.02	36.02
133		Warangal Rural	Wardhannapet	13,732	41.43	41.43
134		Yadadri Bhuvanagiri	Yadagirigutta	15,661	16.88	16.88
135	Tripura	West	Agartala (M.Corp)	2,00,000	90.21	31.05
136	Uttar Pradesh	Ambedkar Nagar	Tanda	95,516	10.45	10.45
137		Barabanki	Nawabganj	1,79,468	30.3	30.3
138		Bulandshar	Anupshahr	42,000	10.03	10.03
139		Chitrakoot	Chitrakoot Dham	87,612	31.68	31.68
140		Gorakhpur	Gorakhpur	2,00,000	91.95	91.95
141		Hardoi	Hardoi	1,26,851	11.05	11.05
142		Jhansi	Jhansi	2,00,000	160.39	67.13
143		Mirzapur	Chunar	37,185	14	14
144		Pilibhit	Puranpur	40,007	4	4
145		Shajanpur	Tilhar	61,444	3.48	3.48
146	Uttarakhand	Almora	Almora (Nagar Palika)	39,627	9.25	9.25
147		Haridwar	Bhagwanpur (Nagar Palika)	17,179	4.52	4.52
148		Tehri Garhwal	Narendra Nagar (Nagar Palika)	6,613	13.36	13.36
149		Udham Singh Nagar	Kitcha Nagar Palika	74,357	28.96	28.96

150	West Bengal	Hooghly	Chandannagar M.Corp	2,07,632	22.4	22.4
151		North 24 Parganas	Ashokenagar Kalyangarh Municipality	1,51,383	21.5	21.5
152		North 24 Parganas	New Town (NKDA)	2,60,000	50.26	50.26
	Grand Total			1,35,12,638	4,110.76	4,148.51

9.2 Annexure-2: Guidelines Formulated by Some States for Urban Surveys

9.2.1 SOP on Survey of Government Land (Andhra Pradesh)

a. Notice/ intimation to be issued to the Departments and neighbouring Private Property Owners.

i. Notice shall be issued regarding intimation about identification and demarcation of the Government Land/Institutional Land/Properties to the Departments concerned and neighbouring Private Property Owners. And shall obtain acknowledgement from the authorized person from the concern department and neighbouring private property owners.

ii. Public notice shall be issued for survey of the Government/Institutional / ULB/ Municipal land/properties in the notice boards of the respective Government offices and notice boards of the ULB and other prominent places like Ward Secretariats, Post Offices, and Banks, MRO/RDO offices, etc.,

b. ULB/District level team(s) shall address all the departments concerned to nominate one nodal officer duly authorizing him to attend for re-survey with relevant documents and also finalizing the demarcation of the Government / Municipal / Endowments Lands/Properties of the outcome of the Survey.

c. In order to fix the boundaries both ULB as well as Government/Institutional /Municipal properties have to keep ready for the functioning of CORS network and GNSS Rover synchronizing to AP CORS by the Ward Planning & Regulation Secretary (WP&RS) and Operators.

d. All Government/Institutional/Municipal properties/lands shall be identified and boundary demarcation shall be done in presence of respective department's authorized personnel and neighbouring private property owners by planting the stones (wherever required).

e. In cases of encroachment on government land, or unauthorised construction by private parties, the state rules regarding the same shall apply, for recording of ownership and boundaries.

9.2.2 Title Enquiry Guidelines for Government Land (Karnataka)

Title Enquiry Guidelines for Government Land in case of land grants/ allotment or layout development (Karnataka)

1. In case the property on "government land" was issued in the name of a private person(s) in the Revenue records, and the private person (or their successors) are in possession of the said land, then such revenue records shall be accepted and accordingly the owner therein or his legal successors through registered deed or inheritance/succession, shall be accepted as the owner. The revenue records shall override the municipal records in case there is a conflict between the two.

2. In general, in absence of Revenue Records, for the properties on "government land" the document of grant of the said government land or revenue survey number to the private person is mandatory. Thereupon the flow of ownership of the granted land, or a piece thereof, from the grantee to the present claimant of property should be there to accept the present claimant and record him as owner leading to issuance of Urban Land Record. Provided that in case there is a proper document of grant of government land to a private person but subsequent documents creating a clear chain of flow of ownership is missing, then the municipal ownership records can be relied on to issue the Urban Land Record.

3. For the properties on the layouts of government agencies on the government land, the allotment letter of the agency develops the layout, registered deed from such an agency to a person is the primary document of ownership. In case such a document is given by a citizen or otherwise available, the same shall be the basis of recording the property owner. Provided that in case of subsequent transfer of property or inheritance or succession of such property by the original owner, the latest owner shall be recorded. The municipal ownership records in such layouts shall be given due value in accepting the present owner of the property.

4. In absence of a government land grant or recording of property as private property in any revenue record, and the property is not part of the layout of a government agency, then the Urban Land Record shall not be issued to private persons on government land. Provided the Urban Land Records to Government Agencies and departments can be issued.

5. In case the government land grant document for the concerned land in favour of a private person is available or the grant is proved as per Government procedure, then apart from chain of documents proving flow of ownership of present claimant from the original grantee of land; the ownership/title as per municipal records shall also be accepted. The Urban Land Record may be accordingly issued.

6. In accepting and recording the ownership of any property on a granted Government land where the land grant document is available or layout on government is done by a government agency, any documents or records that are received /obtained from the citizen or any other authority should be duly considered as per their legal value. In this regard, the following broad principles shall be adopted

a. The revenue records are primary and shall override municipal records in case of contradiction.

b. The allotment letter or registered deeds from government agencies that developed layout on the government land are also primary documents and shall override municipal records in case of contradiction.

9.2.3 Good Practice on Simplified and Standardized Forms

The Andhra Pradesh SOP for urban resurvey specifies forms for all stages of the survey process. This enables efficient scaling up of the survey across the state, brings in standardization in operations, and transparency and convenience for both officers and citizens.

Some of the key forms used in the state for the purpose of resolving disputes regarding the boundary inaccuracies have been presented. Specific forms are utilized at different stages of the survey, during ground truthing and appeals. These forms serve as official documentation for addressing the objections, verifying and correcting the discrepancies.

Similar forms may be adapted by states for their own purposes. The forms regarding various stages of the urban survey process in Andhra Pradesh can be retrieved from the SOP document of the state.

9.3 Annexure-3: A model format of Urban Property Card (UrPro)

State Govt. logo

Dept. logo

Revenue/UD/LSG Department

Urban Property (UrPro) Card Number.....

(Issued under the rule of _____ of _____ Rules 19**)

FORM NO _____ Date: _____

Owner/s Name: _____

1. Plot Details			
State/UT Name		ULPIN	
District Name		Plot ID.	
Town/City Name		Plot Area (sq. m)	
City Survey No.		Plot Address with PIN Code	
Ward Name & No.			
Year of Commencement of Ownership		Plot Owner/s Name with Father/ Guardian Name	
Property Type (Private/ Government)		Aadhaar No. and Mobile No. of the owner/s	
a. Central Govt. b. State Govt. c. Local body d. Govt. Undertaking		Ownership/ Lease Hold/ Other Rights	

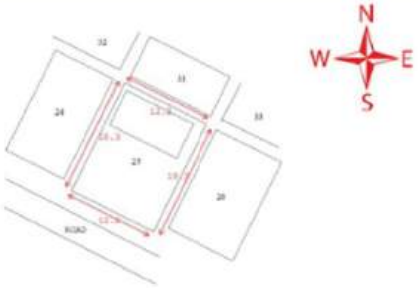
2. (a) Building Details in respect of individual buildings				
Municipal ID	Property Type (Private/Government)	Purpose of Usage (Commercial/Residential/Industrial/Institutional/Mixed)		
		Name of the Building	Total No. of Floors	Owner's Floor No.
Name of the Owner	Super Built-up Area (sq. m)	Parking Area (sq. m)	Garage Area (sq. m)	Property Address

2. (b) Building Details in respect of multi-ownership buildings				
Municipal ID	Property Type (Private/Government)	Purpose of Usage (Commercial/Residential/Industrial/Institutional/Mixed)		
		Apartment Name/No.	Floor No.	Flat No.
Name of the Owner	Super Built-up Area (sq. m)	Parking Area (sq. m)	Garage Area (sq. m)	Property Address

3. (a) Owner details in respect of single/joint owners in individual buildings						
Title document No.						
Sl.	Name of the Owner	Guardian/ Spouse's Name	Ownership Share	Owner's identity document	Owner's Communication Address	Owner's Photograph

3. (b) Owner details in respect of single flat in multi-ownership Group Housing Society						
Title document No.						
Sl.	Name of the Owner	Guardian/ Spouse's Name	Ownership Share	Owner's identity document	Owner's Communication Address	Owner's Photograph

4. Mutation No. with Date of Mutation	5. Encumbrances/Mortgage/ Other rights	6. Remarks

7. Location Map	8. Overview Map
 OLC: 7J4VXFHH+2V To the scale (all the dimensions are in meters), Land Record Area = _____sq. m or _____sq. feet	 Not to the Scale

9. Photo of the Building /If Land then with Neighbouring Structures	10. Digital Signature
	Enquiry Officer City/District/State Generated on date: 22.11.2024
Note: This is a digitally signed document does not require physical signature.	

Note: The Urban Property card (UrPro) format has minimum basic details, the States/UTs may add or remove the fields to align the format with the provision of their respective legal framework and the requirement of data to be maintained.

9.3.1. Notes for the Survey Department

1. Plot No: In case of planned colonies, Plot Nos are assigned by the Development Bodies/Authorities concerned. Plot Ids are not in practice and should be assigned by the said bodies/authorities. Property IDs are assigned by the Property Tax Authorities.
2. City Survey No: This is urban equivalent of the Rural land Survey No/Khasra No.
3. Details of the plot of a land are to be filled in the part 1 of the Property Card.
4. In case of lease hold property, date on which lease ends should be filled in the relevant field in part 1.
5. Either Part 1 & 2(a) or Part 1 & 2(b) will be applicable in case of individual buildings and or multi-ownership buildings respectively.
6. In case of a standalone / independent plot, the details of the plot are to be included in the Part 1 whereas the details of the building are to be filled in the Part 2(a).
7. In case of a multi-ownership buildings, the details of the plot are to be filled in the Part 1 and the details of the building to be filled in the Part 2(b).
8. Details of the owner and his/her communication address in respect of single/joint ownership in individual buildings are to filled in 3(a).
9. Details of the owner and his/her communication address in respect of flat in multi-ownership group housing society are to filled in 3(b).
10. The photograph of the property (Part 9) is proposed to be captured at the time of field survey. A sketch of the Tower with its details. with a highlight on the flat No described in the property card should be given in this part.
11. Ownership data should to be compiled and maintained in excel sheets, for reference and for generation of the property card.
12. An example for compiling (in case of group Housing multi-story Apartments/flats Societies is given below:

i. Name of the Society: Shramjeevi Co operative Group Housing Society Ltd., Dwarka sector-5, New Delhi-110075.

ii. No of Towers: 5

iii. Tower wise No of flats:

(1) Tower A: 15, (2) Tower B: 20, (3) Tower C: 20, (4): Tower D: 15, (5) Tower E: 15

Flat Layout plan of Tower A:

51	52	53
41	42	43
31	32	33
21	22	23
11	12	13

Names of owners (As available in property tax data): Tower A:

Flat No	Name of the owner
11	AAA
12	BBB
13	CCC
21	DDD
22	EEE
23	FFF
31	GGG
32	HHH
33	III
41	JJJ
42	KKK
43	LLL
44	MMM
51	NNN
52	OOO
53	PPP

13. Real time updated data by Integration and synchronization of data across all the stakeholder departments:

(i) It is helpful to seed mobile and Aadhar number in the data base and integrate the data maintained by all the relevant departments like Revenue, Registration, Forest, Town Planning and Agriculture through web-based mechanisms so as to facilitate real time updation for ensuring consistency between ownership and tax data.

(ii) The States/UTs where the records are in physical form or real-time synchronization is not possible, batch updates or scheduled uploads of offline records on property data Web-GIS platform should be carried out to maintain the data up to date.

9.4 Annexure-4: NAKSHA Components and Funds

NAKSHA Components and Budget allotted		
S NO.	**Component**	**Items and calculation**
1	Aerial Survey & Feature Extraction	Survey of India
2	Field Survey	per team* (80,000*4month)
3	Quality Check	Survey of India
4	Cloud Space and Storage	NIC/NICSI Cloud Storage
5	IEC	₹10,000*per.sq.Km
6	Training	₹4.000*per.sq.Km
7	Documentation	₹1,500*per.sq.Km
8	Survey Equipments-One Time Cost (OTC)	₹6L*per.Rovers
9	Survey Equipments (CORS)(OTC)	Survey of India
10	Software Development- (OTC)	M.P. State Electronics Development Corporation
11	National Level IEC, Training, Documentation	Department of Land Resources
12	NPMU Establishment	Department of Land Resources
13	a. SPMU Manpower Large States	8 Manpower@₹9.56L per.month *1 year *18 State
	b. SPMU Establishment Large States	Office Establishment@ ₹8L*18 States (OTC)
14	a. SPMU Manpower Small States	4Manpower @₹6L per.month*1 year *18 States/UTs
	b. SPMU Establishment small States	Office Establishment@₹5L*18 States (OTC)
15	Other Miscellaneous / Incidental Charges	Department of Land Resources

Team and Rover Calculation

The number of teams was calculated based on population with the following calculation

a. Population/3.5 = Average No. of Households

b. 1 team surveys 25 households per day and works for 22 days = 25x 22 = 550 households/month

c. Avg. No. of household/550 households = No. of months to complete the survey work

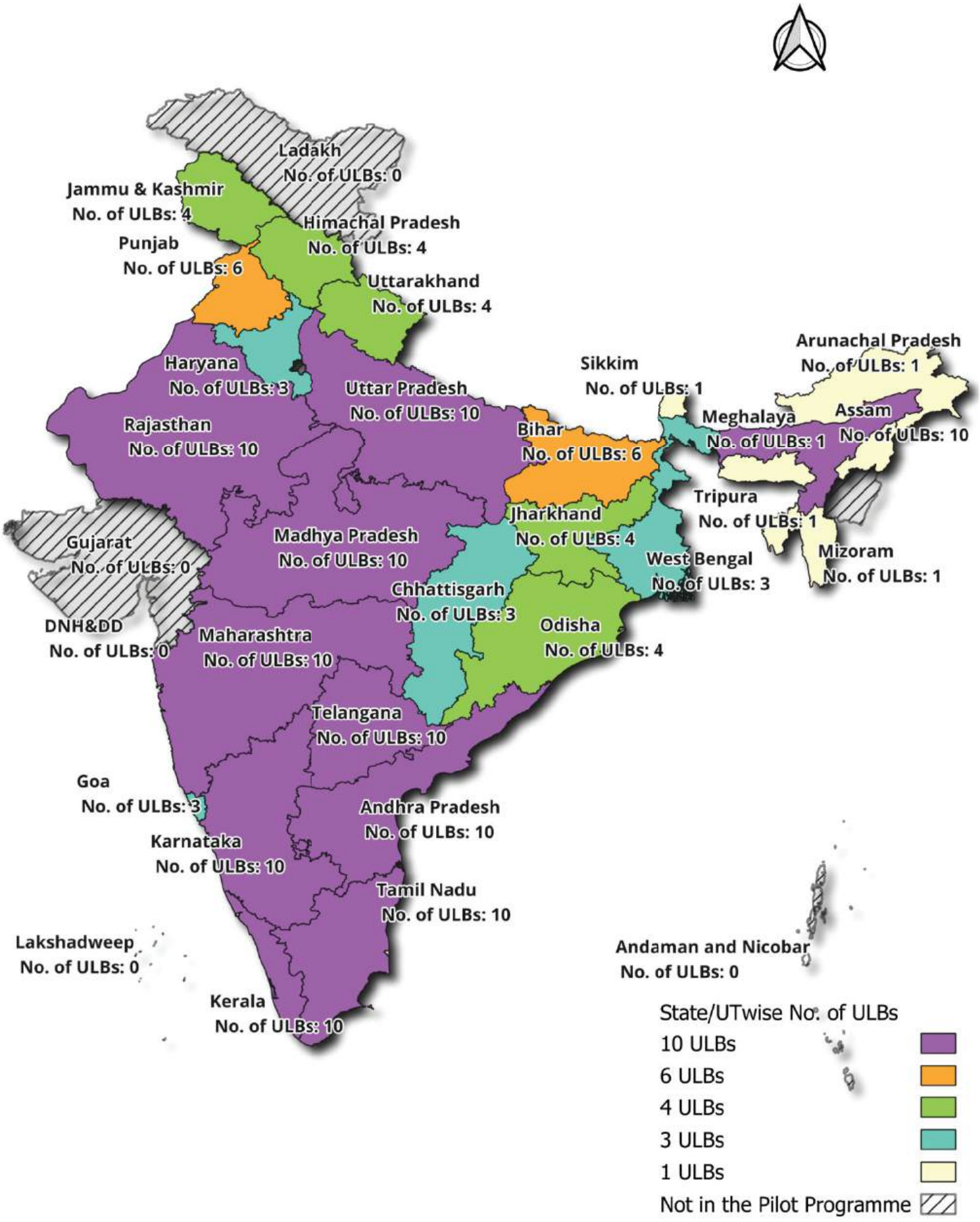
d. No. of months to complete the survey work/4 months = No. of teams required to complete the survey work in 4 months. (Roundup)

Team = ((Population/3.5)/550)/4

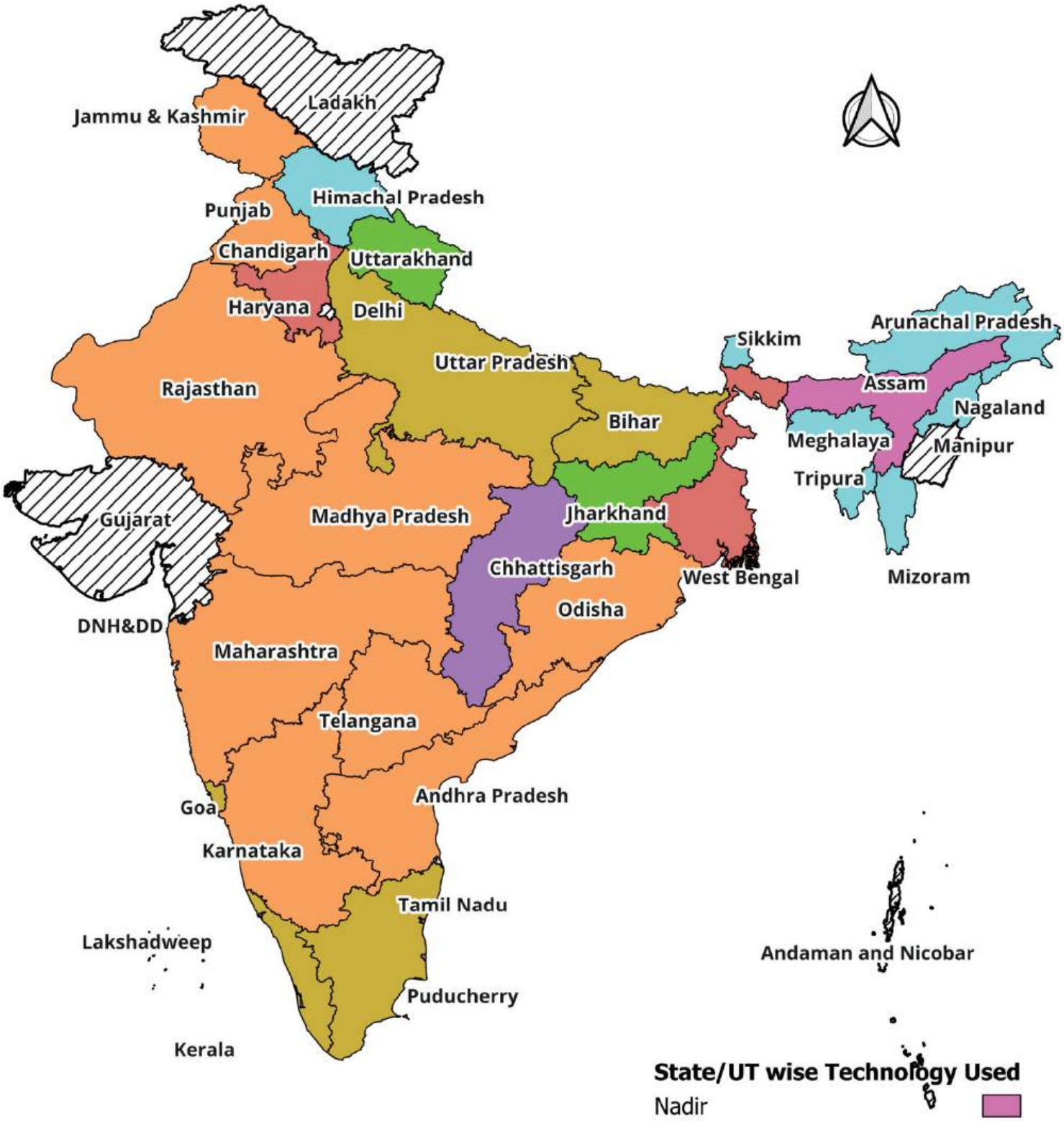
Note: Some States/UTs may have rovers, for them the number of rovers may reduced or removed from funding.

Suggestive Designation	Nos. of Post	Suggestive Remuneration (Rs. Per Month)
Vehicle with Driver	1	44,000
Field Surveyor	1	16,000
Helper	1	10,000
Miscellaneous		10,000
Total		80,000

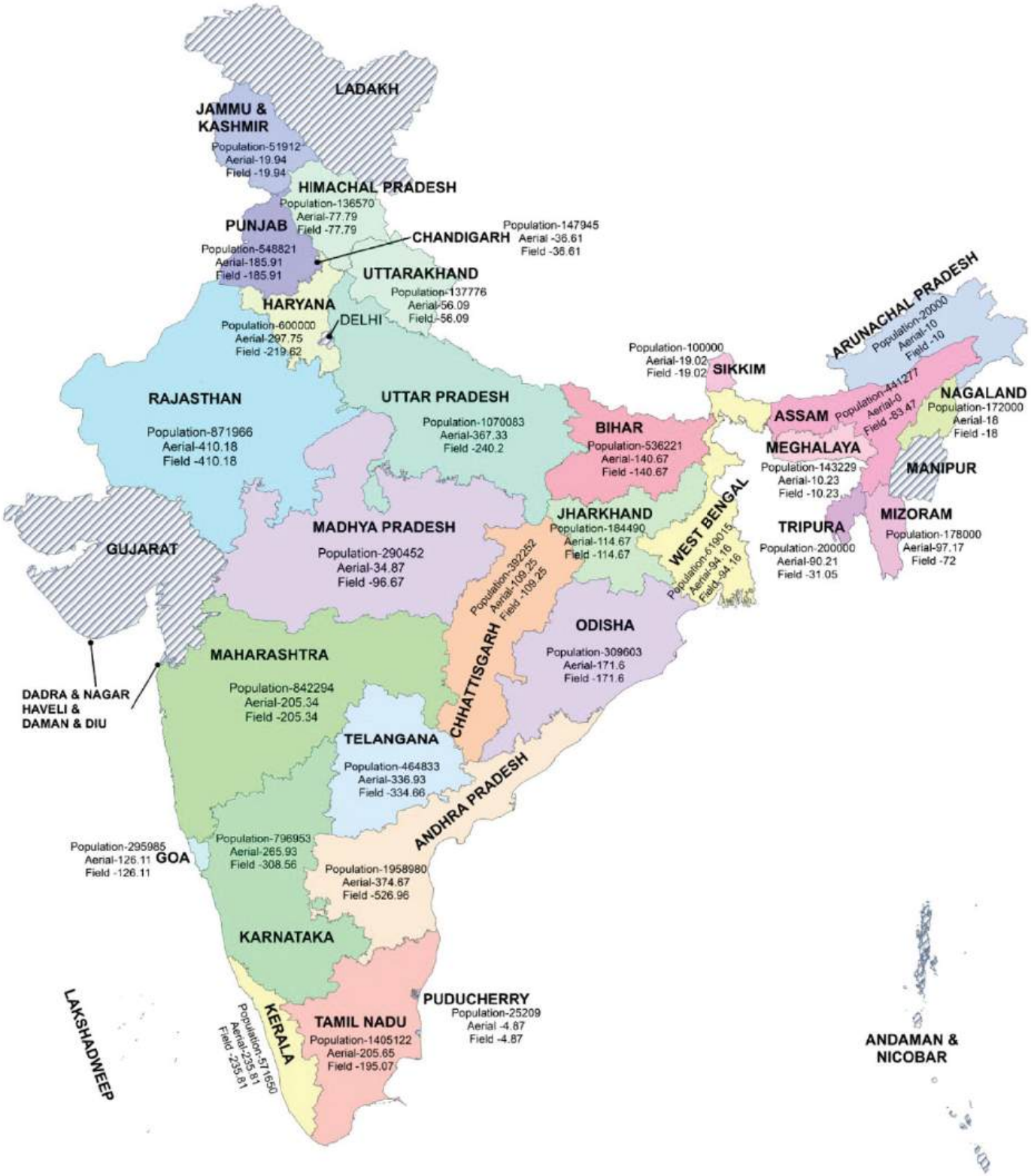
9.5 Annexure-5: NAKSHA State/UT wise ULBs



9.6 Annexure-6: Districts wise Technology Map



9.7 Annexure-7: NAKSHA - Map showing States/UTs Population, Aerial survey Area, Field Survey Area as on 21.03.2025



10. LIST OF ABBREVIATIONS

AMC- Annual Maintenance Contract

AoI- Area of Interest

API- Application Programming Interface

CoE- Centre of Excellence

CORS- Continuously Operating Reference Stations

CRS- Centre for Rural Studies

DEM- Digital Elevation Model

DGPS- Differential Global Positioning System

DILRMP- Digital India Land Records Modernization Programme

DoLR- Department of Land Resources

DSM- Digital Surface Model

DTM- Digital Terrain Model

EA- Empanelled Agency

GCPs- Ground Control Points

GIS- Geographic Information System

GNSS- Global Navigation Satellite System

GoI- Government of India

GSD- Ground Sample Distance

IEC- Information Education and Communication

LBSNAA- Lal Bahadur Shastri National Academy of Administration

MGSIPA- Mahatma Gandhi State Institute of Public Administration

MoHUA- Ministry of Housing and Urban Affairs

MoRD- Ministry of Rural Development

MPSEDC- Madhya Pradesh State Electronics Development Corporation

NAKSHA- National geospatial Knowledge based land Survey of urban Habitations

NIC- National Informatics Centre

NICSI- National Informatics Centre Services Incorporated

NPMU- National Programme Management Unit

NRTK- Network Real Time Kinematic

NSSO- National Sample Survey Office

OGC- Open Geospatial Consortium

ORI- Ortho Rectified Imagery

QA- Quality Assurance

QC- Quality Control

RFP- Request For Proposal

RoRs- Record of Rights

SDGs- Sustainable Development Goals

SLC- State Level committee

SoI- Survey of India

SOP- Standard Operating Procedure

SPMU- State Programme Management Unit

SVAMITVA- Survey of Villages Abadi and Mapping with Improvised Technology in Village Areas

UAV- Unmanned Aerial Vehicle

ULB- Urban Local Body

ULPIN- Unique Land Parcel Identification Number

UNFCCC- United Nations Framework Convention on Climate Change

YASHADA- Yashwant Rao Chavan Academy for Development Administration

भूमि संसाधन विभाग
DEPARTMENT OF
LAND RESOURCES
Government of India

सत्यमेव जयते

NBO Building, 'G'-Wing Nirman Bhawan, Maulana Azad Rd,
New Delhi, Delhi- 110011

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