



GOVT. OF ODISHA

**TECHNICAL MANUAL
FOR
CADASTRAL SURVEY
USING
MODERN TECHNOLOGY**

**Director
Land Records & Surveys,
Board of Revenue, Odisha, Cuttack**



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P R E F A C E

This Technical Manual for Cadastral Survey in the state using Modern Technology is an outcome of Odisha Special Survey and Settlement Act and Rules-2012 which is designed to emphasize upon all the stages of Cadastral Survey and Settlement Operations in the State using Hybrid Modern Methodology. With the advancement of Science & Technology, the Survey and Settlement operation in the State will enable Survey beyond 30° slope with the adoption of Hi-Tech Methodology and with the help of Total Ground Method using **Electronic Total Station (ETS), Differential Global Positioning System (DGPS) or Hybrid Method using Aerial Photography and High Resolution Satellite Imaging (HRSI) as well as Ground Truthing with ETS and DGPS.** The Traditional Method of Survey using Plain Table or Theodolite was not capable of surveying the area having slopes beyond 10° and 30° respectively. But using Hi-Tech Methodology, it is possible to survey an area having slopes up to any degree and having tree cover and high-rise building etc with accuracy.

National Land Records Modernization Programme (NLRMP) envisages deployment of such modern *equipment and methodology to bring efficacy in survey and creation and updation of Land Records with shorter time span with perfection and accuracy compared to old method of survey and record preparation. The Odisha Special Survey and Settlement Act – 2012 has been enacted by Govt. for such Hi-Tech Survey to minimize the time span without compromising quality, transparency and grievance redressal with involvement of lesser manpower.*

The Odisha Special Survey and Settlement Act, 1958 recommended for Survey and Settlement Operation in the State through 4 methods of survey namely, (a) Theodolite Traverse (b) Prismatic Compass Traverse (c) Plane Table Traverse (d) Chain Triangulation Method. These processes are Resource hungry (Time, Cost and Manpower) commensurate with NLRMP Guidelines. The Odisha Special Survey and Settlement Act-2012 has envisaged the following 3 Hi-Tech Survey

Methods for Cadastral Map preparation and consequential generation of RoR.

Method I : *Pure Ground Method using ETS and DGPS.*

Method II : *Hybrid Method using Aerial Photographs supported by Ground Truthing using Differential Global Positioning System (DGPS) and / or Total Station.*

Method III : *Method using High Resolution satellite Imagery supported by Ground Truthing using Ground Truthing using Differential GPS and I or Total Station.*

Using of Hi-Tech Survey Methodology shall be with reference to Global position of the villages of the State, i.e. by way of geo-referencing and is always flawless. The records and the maps prepared through Hi-Tech Survey Methodology is permanent and can be stored in soft and hard copies with backup in central server.

Hi-Tech Methodology of Survey is most transparent and accessible to public once it is web-hosted in public domain. The land Owners have the opportunity to voluntarily declare his possessed Land parcels during preparation of map and records under the Odisha Survey and Settlement Act, 2012.

This Technical manual have been prepared providing in greater detail the process and steps to be followed for guidance of Revenue Officials and vendors associated in Cadastral Survey using Hi-Tech Methodology for preparation of map and records.

The technical Manual contains 6 Chapters in toto commencing from Introduction to Preparation and Publication of Records and Map. Different stages of Survey and Settlement Operations in the Manual beginning from Primary Stage of establishment of Ground control Points (GCPs) to the web-hosting of Record of Rights are elaborated in a very systematic and orderly manner.

In order to facilitate fundamental knowledge on modern techniques of Survey and Settlement Operations, different technical specifications and

details alongwith use of Survey Equipments are elaborated separately through **Annexure-1** to **Annexure-3**.

Besides, different **Technical Forms** from **No. 01 (T)** to **08(T)** have been prescribed and incorporated in the Manual for maintaining records and registers in the Revenue Office with the help of vendors associating land owners, local bodies in a systematic and flawless manner.

The manual has been prepared by the Directorate of Land Records & Surveys under the supervision and guidance of Sri Raj Kishor Choudhury, IAS , Director of Land Records & Surveys and Director, Consolidation, Odisha with tangible contributions from Sri Amiya Kumar Mohapatra, IFS, Chief Executive, ORSAC and Sri Subhadarshi Mishra, Managing Director, SPARC. The thorough review of the draft with the valuable guidance and approval of Member, Board of Revenue, Odisha, Sri Aurobinda Behera, IAS has made this Technical Manual Finally possible.

The forms cited in each volume of these rules have been collected in an appendix to the volume and numbered in a single serial with the word “technical” before the number to distinguish them from the forms cited in the Survey and Settlement Manual. Many of the forms are peculiar to particular Settlements and may require slight modification to suit other settlements.

The Manual may be cited as Technical Manual for Cadastral Survey using Modern Technology for preparation of Map and Land Record. It is issued under the authority of Director, Land Records and Surveys to whose notice errors and omissions should be brought.

R.K. Choudhury, IAS,
Director of Land Records & Surveys
And Consolidation, Odisha, Cuttack

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CHAPTER-1

Introduction

- 1.1** Government of Odisha have taken a policy decision to adopt Modern Technology¹ for cadastral survey and map preparation and to phase out the traditional methods.
- 1.2** Government of Odisha has also enacted legislations titled "**The Odisha Special Survey and Settlement Act and Rules**" thereunder to facilitate adoption of Modern Technology in survey methods for cadastral mapping.
- 1.3** In this context, it is felt necessary to prescribe a Technical Manual for guidance of Revenue Officials involved in Survey, Settlement and Land Administration to carryout cadastral survey using Modern Technology



1. Modern Technology means Differential GPS, Electronic Total Station, Aerial Photography, High Resolution Satellite Imagery, etc.

CHAPTER-2

Establishment of State Network of GCPs

2.1 Before commencement of survey using Modern Technology, Ground Control Points (GCP) are to be established for geo-referencing of the Spatial Datasets. 4 (four) types of GCPs are envisaged in Survey using Modern Technology:

- i. Primary Control Points
- ii. Secondary Control Points
- iii. Tertiary Control Points
- iv. Auxiliary Control Points

2.2 Horizontal Datum will be WGS-84 (i.e., the Latest Version of the World Geodetic System Standard for use in Cartography) and Vertical Datum will be MSL, i.e., the Mean Sea Level.

2.3 Primary and Secondary Control Points shall be established in the state linking to the International Geodetic Stations (IGS) established by Survey of India.

2.4 Location of Ground Control Points :

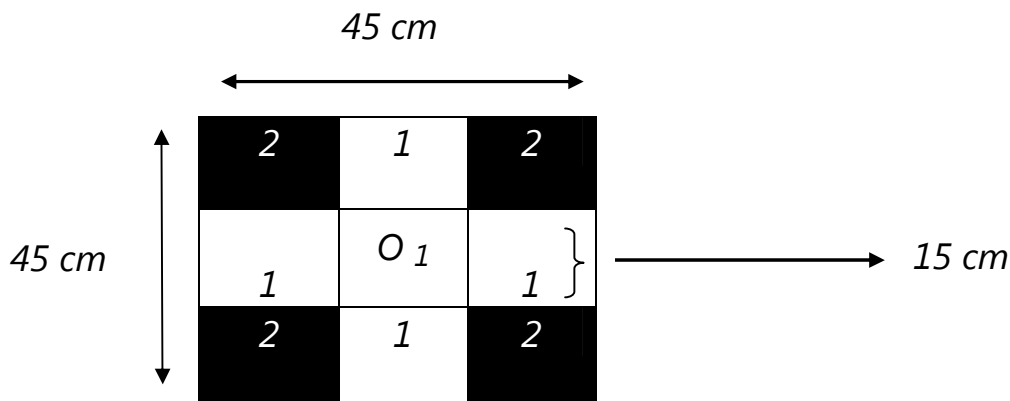
The GCPs are to be located in premises of Government offices such as Revenue offices, Block offices, Forest offices, GP offices, Schools and similar protected premises.

The selected site should be open and clear to sky with a cut off angle of 15° . High-tension power lines, transformers, electric sub-stations, microwave towers, high-frequency dish antennas, radars, jammers, etc., which interfere with GPS signals, should be strictly avoided.

2.5 Monumentation of Ground Control Points:

Pre-cast RCC pillars (15 cm x 15 cm x 75cm) engraved with pillar codes shall be fixed at every GCP with 60 cm in ground and 15 cm above ground. Each GCP shall be supported with a brick mortar of 45 cm x 45 cm dimension platform of 30 cm depth, with 15 cm in the ground and 15 cm above ground. The quality of construction shall not be compromised. The pre-cast RCC pillar shall be fixed exactly in the centre

of the platform. The platform shall be cement plastered. The middle portion of the platform, both horizontal and across, shall be painted with white colour in 15 cm strip and remaining portion of the platform shall be black painted as shown in the picture next page. Both (black and white) paint shall be selected in such a way that the mark of the paint should sustain for a period of six months to have an impact on the aerial photograph while conducting aerial survey.



Quadrants marked as '1' are to be white painted while quadrants marked as '2' to be black painted.

Each quadrant is of dimension 15cm x 15cm.

Construction of RCC pillars : RCC pillars of size 75 cm x 15 cm X 15 cm shall be constructed using 4 pieces of 8 mm steel rod with 6 mm stirrup at 15 cm c/c engraved with an alphabet on the top and a unique code. Top of the pillar will be painted in white colour and engraved alphabet and digits in black colour. The RCC pillars shall be sufficiently cured before use.

Fixation of RCC pillars : After the GCP location is finalized, a pit of dimension of 45 cm x 45 cm x 75cm shall be dug. 10 cm thick cement concrete base will be laid at the bottom of the pit. The pre-cast pillar will be set up in the pit in vertical position. Thereafter the base of the pillar will be strengthened with cement concrete up to 15 cm thickness. The rest of the pit will be filled up with dug out soil. The perpendicular positioning of the pillar will be verified with the help of spirit level placed on the top of the pillar.

2.6 Schedule of Observations :

Observations should be scheduled with proper Mission Planning, considering the optimum availability and Geometric Dilution of Precision (GDOP) of Satellites (i.e., Geometric Strength of Satellite Configuration on GPS Accuracy).

2.7 Primary Control Points :

The I.G.S. co-ordinate of the Survey of India (Sol) should be/ has been used to establish state wide network of Primary Control Points (PCP) in a 16km grid. DGPS observation, occupying 2 IGS or independently observed 72 hour points or 2 known PCPs should be made to establish new PCPs through triangulation method by 8 hour simultaneous uninterrupted observation.

2.8 Secondary Control Points :

The Secondary Control Points should be / has been established in a 4km grid, extending the PCP network through triangulation method, occupying 2 PCPs and the new SCP simultaneously for 1 hour in static mode of observation.

2.9 Tertiary Control Points :

Tertiary Control Points are to be established by occupying nearby PCP or SCP in RTK or Static mode of observation (continuous and uninterrupted observation of minimum 30 minutes in Static mode). Densification of TCPs shall be 1km with at least 3 TCPs in a village. The TCPs are to be located at Tri-junction points/ protected premises close to the settlement. TCPs may be established using single/ dual frequency DGPS or ETS.

Note :

- i. The co-ordinate list and description of the location of all the control points shall be maintained by State Land Records and Survey authorities. The locations and IDs of all the control points should be maintained in GIS form.
- ii. The co-ordinate list should be supplied both for geodetic system (Lat/Long) and Projected System - Universal Traverse Mercator, i.e., the UTM projection of the respective zone.
- iii. In case a village tri-junction has not been marked and monumented by a primary, secondary or tertiary control point, the same should be monumented as per prescribed specification.

2.10 General Requirements :

- a) The (X, Y) co-ordinates shall be recorded both in Lat-Long and UTM with reference to WGS 84 datum.
- b) Specifications of the instruments used for GCP surveys shall be recorded.
- c) DGPS/ ETS equipment shall be calibrated prior to survey with respect to established base lines.
- d) A sketch for each category of the Control Points shall be prepared, showing the location of the Control Points along with their description for easy identification.
- e) A District Map showing all the Primary, Secondary and Tertiary Control Points along with their Co-ordinates shall be maintained by State Land Records and Survey authorities.

CHAPTER-3

Survey Methods

3.1 Survey Methods :

The following are recognized as Modern Technology Methods :

- a) Pure Ground Survey Method using ETS and DGPS
- b) Survey Method using Aerial Photographs supplemented with Differential GPS and/or ETS survey.
- c) Survey Method using High Resolution Satellite Imagery supplemented with Differential GPS and/or ETS survey.

The method or methods to be adopted for survey of any unit area will be decided after evaluation of the terrain condition, extent of area proposed for survey/ re-survey and status of built-up space.

CHAPTER-4

Work Process

4.1 PURE GROUND SURVEY METHOD USING ETS AND DGPS

This model is suitable for survey/ re-survey of areas with undulated topography having moderate to dense vegetation. The technical details are also applicable to ground truthing in the Hybrid Methodology involving Aerial Photography or HRSI. The major steps involved are as follows :

4.1.1 Awareness and Publicity :

- a) Publication of Notifications under Section 04 of O.S.S & S Rules, 2012.
- b) Opening of a Publicity Cell at the District Level. The establishment of the Publicity Cell shall be the responsibility of the Collector of the District.
- c) The Publicity Cell shall sensitize the functionaries concerned at District/ Tahasil levels and generate awareness among the Owner(s) / Enjoyer(s) in the area notified for survey by conducting village level meetings, emphasizing the need for them to be present at the time of visit of the Survey Team, participate in the Survey and Settlement process and to show the boundaries of their Land-Parcels.
- d) The Survey Team shall prepare detailed Tahasil wise Survey Schedule in **Form No. 01(T)** with approval of the Collector for publication at the District, Tahasil and Village levels. The Programme shall be given wide publicity.
- e) Village wise Survey Plans shall be notified, showing day wise detail programme in **Form No. 02 (T)** in the concerned Tahasil / Village at least 10 days before commencement of Field Survey. Village shall be taken as the unit for Survey.

4.1.2 Survey Plan :

- (a) Survey Team shall submit detailed Programme for survey including number of Survey Team to be engaged after being supplied with existing Cadastral Maps from the Director, Land Records and Surveys.
- (b) Each Survey Team may comprise at least one Operator and one Assistant Operator.
- (c) Survey Team shall be assisted by one Amin / Asst. Revenue Inspector (ARI) of local tahasil. The assistance of land owners of the programmed village will be sought for easy identification of each land parcel.
- (d) A meeting at the level of Village (Palli Sabha)/ cluster of villages shall be arranged by the local Tahasildar. Local officers of the land owning departments such as Forest, Water Resources, etc. and the Panchayat level representatives shall be invited to the meeting.
- (e) The details of the schedule of the visits of the Survey Team shall be circulated among the local officials of the land owning departments, so that the officials from those Departments help the survey agency in the identification of the boundaries of the land-parcels owned by those Departments.
- (f) Tahasildar shall maintain record of meetings held in different villages/ cluster of villages.

4.1.3 Self-Declaration of Land owners in respect of their ownership :

Land Owners are required to submit their land-particulars in shape of self-declaration in **Form No. 02** as per Rules 6 of O.S.S & S Rules, 2012 to the Tahasildar within thirty working days from the date of Survey Notification. In special cases, 15 additional working days may be allowed. The Camp Officer shall maintain a Register of self-declaration land holding-wise in **Form No.03 (T)**.

A Register is to be maintained by the Camp Officer/ Tahasildar for unverified/ disputed lands in **Form No. 04** prescribed under Rules-6(7) of O.S.S & S Rules, 2012.

4.1.4 Identification of Parcels at Village Boundary :

The Revenue Field Officer(s) concerned shall identify the plots occurring at the village boundary. In case of ambiguity, boundary confirmation shall be made by Revenue Field Officer(s) with the help of village elders and concerned land owners.

4.1.5 Preparations for the survey work in pure Ground Method using TS and DGPS :

- (a) A well-equipped Survey Centre shall be established for a cluster of villages. The Survey Centre must have electricity, water and sanitation facility.
- (b) Each survey team shall be provided with all necessary Equipment and Supplies. These shall be stored in an organized and easily accessible manner. The minimum equipment inventory required is enumerated at **Annexure-1**.

4.1.6 Participatory Field Survey :

- a) The Surveyor with Total Station shall start the work from a Tertiary Control Point, using the Auxiliary Control Point for back-sighting. The vertices/ bends of the land parcel shall be surveyed as offsets from various traverse stations. The traverse shall finally be closed on the Second Tertiary Point for checking the accuracy of the traverse. (General steps adopted for setting up of Total Station is enumerated at **Annexure-2**. The specifications may however vary from equipment to equipment).
DGPS can also be used for surveying land parcels by occupying any available GCP in the nearby area.
The survey work shall be carried out as per existing demarcations on the ground. The observed points are to be joined in the field itself to avoid any ambiguity later.
- b) The Revenue Officials/ RIs/ ARIs/ Amins have to identify and show the Vertices/ Plot corners of which DGPS/ETS observations are to be taken.

- c) Wherever there is Reserved Forest/ Land transferred to government departments or community, the concerned officials / local people should be involved in identifying the relevant parcel boundaries.
- d) In cases where boundaries are not demarcated, the parcel boundaries should be surveyed only after their demarcation on the ground has been carried out by concerned RI/ ARI/ Amin, in the presence of the concerned Owner(s)/ Enjoyer(s).
- e) All land parcels surveyed should be given a unique ID which shall be used for linking the attribute data collected in respect of the land-parcel.
- f) The current land use, irrigation status and other land attribute data shall be collected by the Khanapuri Party and supplied to the survey team for integration.

4.1.7 Back-up :

Daily back-up from Instruments are to be taken at the end of the Survey. New files are to be created, after surveying 500 to 600 nodes by ETS/ DGPS.

4.1.8 Integration of Sabik RoR, Mutation Data, etc. with Parcel ID :

- a) Tahasildar shall provide the R.O.R. data to the survey team for linking with the surveyed map (HAL).
- b) Parcel numbers from SABIK map shall be transferred to the HAL map adopting GIS process. When more than one parcel is found in the HAL map with the same Sabik plot number, these shall be assigned bata number consistent with the mutation record.
- c) The village boundary generated from the HAL map after dissolving all individual parcels in the GIS shall be treated as the Village boundary.
- d) The newly created village boundary and area should be authenticated by competent authority.
- e) Decision on inclusion / exclusion of disputed plots on the village boundary shall be based on the Sabik map/ record.

- f) GIS data layers are to be provided as per Technical Specifications enumerated at **Annexure-3**.

4.1.9 Generation of Land Parcel Map (LPM) :

LPM of HAL plots shall be generated and supplied to the land owner in **Form 4(T)** with proper receipt in **Form No. 7** as per Rules 9(6) of O.S.S & S Rules, 2012 inviting objections, if any, from the land owner.

4.1.10 Filing of Objections by the Land Owners :

Any objection on Survey Records shall be filed by the Land Owner/ any Person/ Government Officials having interest in the same Land to Camp Officer/ Tahasildar within fifteen days from the date of receipt of the LPM in **Form No. 8** in duplicate as per Rules 9(8) of O.S.S & S Rules, 2012.

4.1.11 Dispute Settlement by Tahasildar :

On receipt of objection from the Land Owner/ any other person having interest, the Adjudicator/ Tahasildar shall give an acknowledgement with dated signature to the objector in **Form No. 9** as per Rules 9(8) of O.S.S & S Rules, 2012 and maintain a Register in **Form No. 05 (T)** for the purpose.

The Tahasildar concerned shall be assisted by an Amin, one Surveyor with ETS / DGPS and support staff for disposal of objection cases.

The Tahasildar shall maintain the Objection Case Records and Register with Dispute Case Number and conduct field inquiry referring to self-declaration as submitted by the Land Owner, and with reference to records available in his office with the assistance of the Amin and Surveyor and dispose of the Objection Case within 30 (thirty) days from the receipt of objection, which shall be entered in the Register in **Form No. 05 (T)**.

4.1.12 Incorporation of Dispute Settlement Order in the Land Record and Map :

After disposal of Objection case, the map and record of the concerned plot shall be corrected as per the orders of the Camp Officer/ Tahasildar.

After the HAL map and record are finally approved, the parcels will be assigned fresh unique numbers in a sequential manner beginning from the north-west corner of the village.

4.1.13 Generation of Draft Village Map and RoR :

After compliance of the orders of the Camp Officer/ Tahasildar relating to one Village, the survey team shall furnish Village Map complete with integration of Textual Data, Plot Schedule with area and corresponding Sabik reference in **Form No. 06 (T)** to the Tahasildar.

4.2 SURVEY METHOD USING AERIAL PHOTOGRAPHY SUPPLEMENTED WITH DGPS and/or ETS.

4.2.1 Awareness and Publicity (District, Tahasil, PRIs and Village level) :

- a) Publication of Notifications under Section 04 of O.S.S & S Rules, 2012.
- b) Opening of a Publicity Cell at the District Level, which will generate awareness among the Land Owner(s) / Enjoyer(s) in the area notified for Survey, emphasizing the need for land parcel demarcation prior to Aerial Photography and to remain present at the time of visit of the Survey Team for ground truthing, and to show the boundaries of obscure areas not interpretable from the image. The establishment of the Publicity Cell shall be the responsibility of the Collector of the District.

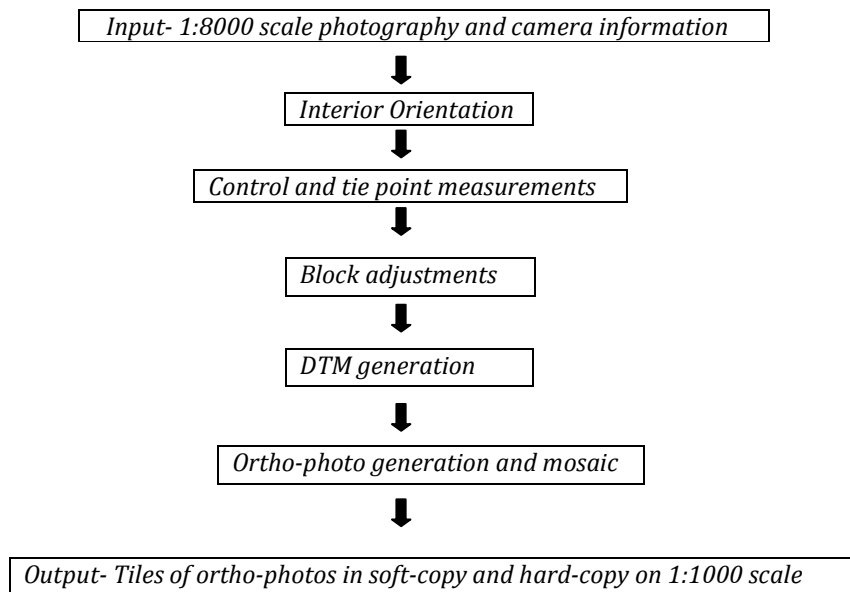
4.2.2 Aerial Photography :

Pre-pointing of Ground Control Points is to be made prior to Aerial Photography.

Aerial photographs with Ground Sampling Distance (GSD) 8cm or better are to be procured for the purpose.

4.2.3 Ortho-photo Generation :

Ortho-photos (terrain-corrected, digitally-rectified aerial photographs in softcopy by digital photogrammetric techniques) are to be generated by the technical agency/ vendor engaged for the purpose by DLR&S. The following flow chart indicates the technical process involved in generating ortho-photos:



Minimum 5 tie-lines are to be identified on the ortho-image (2 long distance diagonals, 1 long distance horizontal, 1 long distance vertical and 1 short distance tieline), and compared with their respective field measured lengths to check and validate the dimensional correctness of the ortho-image. For this purpose, the expertise available with ORSAC shall be utilized by DLR&S.

4.2.4 Geo-referencing of Sabik Digital Cadastral Map and delineation of Village boundary on the ortho-image :

- a) Cadastral vector files in **.dwg** format and corresponding image files in **.cal** format for the villages are to be made available by Deputy Director, Survey and Map Publication.
- b) The vector cadastral maps of a village shall be mosaiced and geo-referenced with the ortho-image by matching features such as Roads, Drainage, Water-bodies, etc.

- c) After geo-referencing of vector village map (Sabik), the survey team will merge all the land parcels to generate boundary polygon of the Village and compute the Village area.
- d) Delineation of HAL Village Boundary on Ortho-Image :
After completion of Geo-referencing, the Survey Team will delineate the Village Boundary on the ortho-image; adjust, if required, the boundary vector at, Edge Plots to ensure that it runs on the physical demarcation features and finalize the Village Boundary on the image. The area computed from the newly generated Village Boundary should be confirmed by the competent authority.
- e) Digitization of land parcels & map features should be carried out from the ortho-image on 'Mirror Principle'.
- f) A comparative statement of Image-derived Parcel area with RoR area, Parcelwise, will be made in **Form No. 6(T)**.
- g) Validation of image derived Parcel Vector :
5% plots shall be randomly selected. Their dimensions shall be field measured and compared with corresponding image derived dimensions. In case of measurement variation beyond 20cm, fresh look at the digitization of all the parcel is to be made, after which fresh 5 % plot will be taken for validation in the above manner. The process is to be repeated till desired level of accuracy is achieved.

4.2.5 Preparatory work for Ground truthing and Obscure Area Survey :

- a) The Survey Team shall prepare detailed Tahasil wise ground truthing/ obscure area survey and habitation area survey schedule in **Form No. 01(T)** with approval of the Collector for publication at the District, Tahasil and Village levels. The Programme, shall be given wide publicity.
- b) Village wise ground truthing/ obscure area/ habitation area survey schedule shall be notified, showing day wise detail programme in **Form No. 02(T)** in the concerned Tahasil / Village at least 10 days

before commencement of Field Survey. Village shall be taken as the unit for Survey.

4.2.6 Survey Plan :

- a) Survey Team shall submit detailed Programme for survey including number of Survey Team to be engaged after being supplied with existing Cadastral Maps from the Director, Land Records and Surveys.
- b) Each Survey Team may comprise at least one surveyor and one assistant surveyor.
- c) Survey Team is to be assisted by one Amin / Asst. Revenue Inspector (ARI) of Local Tahasil and land owners of the programmed Village during survey.
- d) A meeting at the level of Village (Palli Sabha)/ cluster of villages shall be arranged by the local Tahasildar. Local officers of the land owning Departments such as Forest, Water Resources, etc. and the Panchayat level representatives shall be invited to the meeting.
- e) The details of the schedule of the visits of the Survey Team shall be circulated among the Local officials of the Land-owning Departments, so that the Officials from those Departments help the survey agency in the identification of the boundaries of the Land-parcels owned by those Departments.
- f) Tahasildar shall maintain record of meetings held in different villages/ cluster of villages.

4.2.7 Survey of Gharabari Plots :

Obscured areas and Gharabari Plots are to be surveyed on Ground using ETS/ DGPS based on locally available GCPs after demarcation by concerned RI/ Amin in presence of land owners/ enjoyers.

Vectors generated from Ortho-Image & DGPS/ETS survey are to be integrated to prepare draft Village Map.

4.2.8 Integration of Sabik RoR, Mutation Data, etc. wit Parcel ID :

- a) Tahasildar shall provide the RoR data to the survey team for linking with the surveyed map (HAL).
- b) Parcel numbers from Sabik map shall be transferred to the HAL map adopting GIS process. When more than one parcel is found in the HAL map with the same Sabik plot number, these shall be assigned **bata** number consistent with the mutation record.
- c) The HAL plot area is to be computed in GIS for each land parcel and statement shall be prepared in **Form No. 4(T)**.
- d) The village boundary generated from the HAL map after dissolving all individual parcels in the GIS shall be treated as the Village boundary.
- e) The newly created village boundary and area should be authenticated by competent authority.
- f) Decision on inclusion / exclusion of disputed plots on the village boundary shall be based on the Sabik map/ record.
- g) GIS data layers are to be provided as per Technical Specifications enumerated at **Annexure-3**.

4.2.9 Generation of Land Parcel Map (LPM) :

LPM of HAL plots shall be generated and supplied to the land owner in **Form No. 4(T)** with proper receipt in **Form No.7** as per Rules 9(6) of O.S.S & S Rules, 2012 inviting Objections, if any, from the land owner.

4.2.10 Filing of Objections by the Land Owners :

Any dispute on Survey Records shall be filed by the Land Owner/ any Person/ Government Officials having interest in the same Land to Camp Officer/ Tahasildar within fifteen days from the date of receipt of the LPM in **Form No. 8** as per Rules 9(8) of O.S.S & S Rules, 2012 in duplicate.

4.2.11 Dispute Settlement by Tahasildar :

On receipt of objection from the Land Owner/ any other person having interest, the Adjudicator/ Tahasildar shall give an acknowledgement with dated signature to the objector in **Form No. 9** as per Rules 9(8) of

O.S.S & S Rules, 2012 and maintain a Register in **Form No. 05 (T)** for the purpose.

The Tahasildar concerned shall be assisted by an Amin, one Surveyor with ETS / DGPS and support staff for disposal of objection cases.

The Tahasildar shall maintain the Objection Case Records and Register with Dispute Case Number and conduct Field inquiry referring to self declaration as submitted by the Land Owner, and with reference to Records available in his Office with the assistance of the Amin and Surveyor and dispose of the Objection Case within 30 (thirty) days from the receipt of objection, which shall be entered in the Register in **Form No. 05 (T)**.

4.2.12 Incorporation of Dispute Settlement Order in the Land Record and Map :

After disposal of objection case, the map and record of the concerned plot shall be corrected as per the orders of the Camp Officer/ Tahasildar.

After the HAL map and record are finally approved, the parcels will be assigned fresh unique numbers in a sequential manner beginning from the north-west corner of the village.

4.2.13 Generation of Draft Village Map and RoR :

4.2.14 After compliance of the orders of the Camp Officer/ Tahasildar relating to one Village, the survey team shall furnish Village Map complete with integration of textual data, Plot Schedule with area and corresponding Sabik reference in **Form No. 06(T)** to the Tahasildar.

4.3 METHOD USING HIGH RESOLUTION SATELLITE IMAGERY SUPPORTED BY GROUND TRUTHING USING DGPS and/or TOTAL STATION.

4.3.1 Pre-pointing of Ground Control Points is to be made prior to obtaining High Resolution Satellite Image.

- 4.3.2** Satellite images with ground resolution of 0.5m or better are to be procured for the entire area of interest.
- 4.3.3** The images can be adjusted for parallax based on the Ground Control Points through Digital photogrammetric bundle block adjustment.
- 4.3.4** The final adjusted block is seamless. The photogrammetric processing will ensure perfect one-to-one correspondence between different data sets facilitating optimum utilization of Satellite Data set.
- 4.3.5** Tie-line measures are to be made using DGPS/ETS for checking ortho-image accuracy (minimum 5 cross tie-line measures to be made) : 2 long distance diagonals, 1 long distance horizontal, 1 long distance vertical and 1 short distance tie-line are to be measured using DGPS/ETS in the area of interest.
- 4.3.6** **Geo-referencing of Sabik Digital Cadastral Map and delineation of Village boundary on the ortho-image :**
- a) Cadastral vector files in **.dwg** format and corresponding image files in **.cal** format for the villages are to be made available by Deputy Director, Survey and Map Publication.
 - b) The vector cadastral maps of a village shall be mosaiced and geo-referenced with the ortho-image by matching features such as Roads, Drainage, Water-bodies, etc.
 - c) After Geo-referencing of vector village map (Sabik), the survey team will merge all the land parcels to generate boundary polygon of the Village and compute the Village area.
 - d) Delineation of HAL Village Boundary on Ortho-Image :
After completion of Geo-referencing, the Survey Team will delineate the Village Boundary on the ortho-image; adjust, if required, the boundary vector at Edge Plots to ensure that it runs on the physical demarcation features and finalize the Village Boundary on the image. The area computed from the newly generated Village Boundary should be confirmed by the

competent authority.

- e) Digitization of land parcels & map features should be carried out from the ortho-image on 'Mirror Principle'.
- f) A comparative statement of Image-derived Parcel area with RoR area, Parcel-wise, will be made in **Form No. 6(T)**.
- g) **Validation of image derived Parcel Vector :**
5% plots shall be randomly selected. Their dimensions shall be field measured and compared with corresponding image derived dimensions. In case of measurement variation beyond 20cm, fresh look at the digitization of all the parcel is to be made, after which fresh 5 % plot will be taken for validation in the above manner. The process is to be repeated till desired level of accuracy is achieved.

4.3.7 Preparatory work for Ground truthing and Obscure Area Survey :

- a) The Survey Team shall prepare detailed Tahasil wise ground truthing/ obscure area survey and habitation area survey schedule in **Form No. 01(T)** with approval of the Collector for publication at the District, Tahasil and Village levels. The Programme shall be given wide publicity.
- b) Village wise ground truthing/ obscure area/ habitation area survey schedule shall be notified, showing day wise detail programme in **Form No. 02(T)** in the concerned Tahasil / Village at least 10 days before commencement of Field Survey. Village shall be taken as the unit for Survey.

4.3.8 Survey Plan :

- a) Survey Team shall submit detailed Programme for survey including number of Survey Team to be engaged after being supplied with existing Cadastral Maps from the Director, Land Record and Surveys.
- b) Each Survey Team may comprise at least one surveyor and one assistant surveyor.
- c) Survey Team is to be assisted by one Amin / Asst. Revenue

Inspector (ARI) of Local Tahasil and land owners of the programmed Village during survey.

- d) A meeting at the level of Village (Palli Sabha) / cluster of villages shall be arranged by the local Tahasildar. Local officers of the land owning departments such as Forest, Water Resources, etc. and the Panchayat level representatives shall be invited to the meeting.
- e) The details of the schedule of the visits of the Survey Team shall be circulated among the Local officials of the Land-owning Departments, so that the Officials from those Departments help the survey agency in the identification of the boundaries of the Land-parcels owned by those Departments.
- f) Tahasildar shall maintain record of meetings held in different villages/ cluster of villages.

4.3.9 Survey of Gharabari Plots :

Obscured areas and Gharabari Plots are to be surveyed on Ground using ETS/ DGPS based on locally available GCPs after demarcation by concerned RI/ Amin in presence of land owners/ enjoyers.

Vectors generated from Ortho-Image & DGPS/ETS survey are to be integrated to prepare draft Village Map.

4.3.10 Integration of Sabik RoR, Mutation Data, etc. with Parcel ID :

- a) Tahasildar shall provide the R.O.R data to the survey team for linking with the surveyed map (HAL).
- b) Parcel numbers from Sabik map shall be transferred to the HAL map adopting GIS process. When more than one parcel is found in the HAL map with the same Sabik plot number, these shall be assigned bata number consistent with the mutation record.
- c) The HAL plot area is to be computed in GIS for each land parcel and statement shall be prepared in **Form No. 4(T)**.
- d) The village boundary generated from the HAL map after dissolving all individual parcels in the GIS shall be treated as the Village boundary

- e) The newly created village boundary and area should be authenticated by competent authority.
- f) Decision on inclusion / exclusion of disputed plots on the village boundary shall be based on the Sabik map/ record.
- g) GIS data layers are to be provided as per Technical Specifications enumerated at **Annexure-3**.

4.3.11 Generation of Land Parcel Map (LPM) :

LPM of HAL plots shall be generated and supplied to the land owner in **Form No. 4(T)** with proper receipt in **Form No. 7** as per Rules 9(6) of O.S.S & S Rules, 2012 inviting Objections, if any, from the land owner.

4.3.12 Filing of Objections by the Land Owners :

Any dispute on Survey Records shall be filed by the Land Owner/ any Person/ Government Officials having interest in the same Land to Camp Officer/ Tahasildar within fifteen days from the date of receipt of the LPM in **Form No. 8** as per Rules 9(8) of O.S.S & S Rules, 2012 in duplicate.

4.3.13 Dispute Settlement by Tahasildar :

On receipt of objection from the Land Owner/ any other person having interest, the Adjudicator/ Tahasildar shall give an acknowledgement with dated signature to the objector in **Form No. 9** as per Rules 9(8) of O.S.S & S Rules, 2012 and maintain a Register in **Form No. 05 (T)** for the purpose.

The Tahasildar concerned shall be assisted by an Amin, one Surveyor with ETS / DGPS and support staff for disposal of objection cases.

The Tahasildar shall maintain the Objection Case Records and Register with Dispute Case Number and conduct field inquiry referring to self declaration as submitted by the Land Owner, and with reference to Records available in his Office with the assistance of the Amin and Surveyor and dispose of the Objection Case within 30 (thirty) days from the receipt of objection, which shall be entered in the Register in **Form**

No. 05 (T).

4.3.14 Incorporation of Dispute Settlement Order in the Land Record and Map :

After disposal of objection case, the map and record of the concerned plot shall be corrected as per the orders of the Camp Officer/ Tahasildar.

After the HAL map and record are finally approved, the parcels will be assigned fresh unique numbers in a sequential manner beginning from the north-west corner of the village.

4.3.15 Generation of Draft Village Map and RoR :

4.3.16 After compliance of the orders of the Camp Officer/ Tahasildar relating to one Village, the survey team shall furnish Village Map complete with integration of textual data, plot schedule with area and corresponding Sabik reference in **Form No.06 (T)** to the Tahasildar.

4.4 QUALITY CHECKING :

The QC checks will be done by ORSAC QC team in following stages or as when required:

- After generation of ortho-image.
- After geo-referencing of 'Sabik' cadastral maps with the image: Geo-referencing of individual parcels and the village as a whole for delineation/demarcation of village boundary.
- After plot vector generation and prior to ground truthing/verification: The geometry of parcels, the village boundary, matched and mismatched plots as seen on the image.
- Before submission of Draft Map to Tahasil for verification: The village in completeness, correctness of matched and mismatched parcels as identified by the vendor.
- Before final submission: Village map as a whole and the statistics after RoR linkage and 'Khanapuri Operation'.
- Some of the bund dimensions will be verified by ORSAC for ensuring correctness and quality of survey by the vendor.



CHAPTER-5

Assessment and Incorporation of Rate of Rent

The assessment and incorporation of rate of rent shall be governed under the provisions of Chapter-IV of Odisha Survey and Settlement Act, 1958 read with Rule-21 of Odisha Survey and Settlement Rules, 1962.

CHAPTER-6

Preparation and Publication of Records and Map

The procedures for preparation of preliminary Record of Rights, publication of Draft Record of Rights, the Recess work and the Final Publication of Record of Rights shall be followed as provided in Chapter V, Chapter VI, Chapter VII and Chapter VIII respectively of the O.S.S & S Rules, 2012.

In addition, following provisions shall also be followed :

- a. A minimum of 25 claims/objection cases shall be disposed of daily by the Additional Sub-Collector.
- b. All the clerical and arithmetical mistakes noticed shall be corrected by the Additional Sub-Collector during the period of Final Publication.
- c. **Disposal of Appeal Cases** : The Appeal Cases filed after final publication of RoR & Maps and *suo-motu* Appeal Cases filed by the Notified Officer are to be disposed of in a summary manner with the help of the Field Staff and Survey Team within a maximum period of 90 days from the date of filing of such Appeals. Case Records shall have to be maintained for Appeal and suo-motu Appeals separately. For cross reference between existing and Current Records at a glance, a Register shall be maintained in **Form No. 7(T)**. Orders of the Appellate authority shall be communicated to the concerned Appellant/Tahasildar. Tahasildar shall effect necessary changes in the RoR both in hardcopy and softcopy and communicate the same to the concerned RI, Collector and DD, S&MP in **Form No. 8 (T)** for effecting necessary changes in the RoR at their level. The RI shall receive **Form No 8(T)** in duplicate and effect necessary changes in the Hardcopy of the RoR available with him within 7 days of the receipt of the same and the second copy of the **Form No 8(T)** shall be returned to the concerned Tahasildar so as to reach him within 10th day of the receipt of the same in token of the changes effected at his level.

- d. **Final Record of Rights** : After final publication of RoR and map, the soft copy and hard copy of RoR (Form 20, of O.S.S & S. Rules, 2012) shall be prepared by the Survey Team and handed over to the Tahasildar for distribution as mentioned below :
- i. Hard copy of RoR for Individual Land Owners.
 - ii. Softcopy and hardcopy of RoR and hardcopy of map to concerned RI.
 - iii. Softcopy and hardcopy of both RoR and map to concerned Tahsildar.
 - iv. Softcopy and hardcopy of both RoR and map to concerned Collector.
 - v. Softcopy and hardcopy of both RoR and map in duplicate to DD, S&MP, Odisha.
- e. Deputy Director, Survey and Map Publication, Odisha shall facilitate Web-hosting with the help of NIC.
- f. Deputy Director, Survey and Map Publication, Odisha shall also preserve the hard copy and softcopy of the Final RoR and Map in safe custody for future reference and -utilization.

ANNEXURE-1
MINIMUM EQUIPMENT REQUIREMENT FOR PURE GROUND SURVEY
USING ETS/ DGPS

1. Total Station Set:

- a. Total Station instrument in a hard case
- b. Battery charger
- c. Memory module/ card, serial cable
- d. Rain cover
- e. User manuals
- f. Tripod
- g. Tape Measure

2. Prism Set:

- a. Prism
- b. Prism holder
- c. Centering rod

3. Back sight set:

- a. Prism
- b. Prism holder
- c. Prism carrier (to be fixed on tribrach, with optical/ laser plummet)
- d. Tribrach(to exchange prism carrier and total station)

4. DGPS Set (pair of devices):

- a. Antenna with receiver
- b. Tripod with tribrach for base station
- c. Bi-pod for rover
- d. Battery with charger
- e. External battery for base station
- f. Extension rod
- g. Data cable

5. Data Processing

- a. Laptop computer with serial port or USB port
- b. Printer
- c. ETS/DGPS survey data management software
- d. Digital camera

ANNEXURE-2

Setting up of ETS

1. Setting up of Total Station :

(i) Following steps are adopted to set up a total station :

- a. While choosing an instrument station, make sure that an observer can safely operate the instrument without knocking it over. It is necessary to have the center of the instrument which is the point of intersection of the transverse axis (axis of the telescope) and the vertical axis of the total station directly over a given point on the ground (the instrument station).
- b. Open the legs of the tripod to set the tripod head at the level of the operator's upper chest. When the total station is set up on the head, the operator's eye should be slightly above the eyepiece. The instrument height is important for an effective and comfortable survey. One should not touch to the tripod during the survey.
- c. To fix the total station above a reference point (tertiary point or back site), first roughly level up the tripod head right above the point. To find out the center position of the tripod, see through the clamp screw/use a plumb bob or drop a stone through the hole in the tripod head.
- d. Once roughly leveled and centered, push each tip of the tripod leg firmly into the ground applying full weight of the observer on the step above the tip. Apply the weight along the tripod leg without bending it.
- e. Fix the tribrach on the tripod.
- f. Check the spirit level and center it again, by adjusting the length of the telescopic leg. Increase the length of the leg of the opposite direction in which direction the bubble is down.
- g. Once the bubble is inside the inner ring, adjust the three screws of the tribrach to center the bubble of the spirit level. Put the total station on the tribrach and tighten with the tribrach.

- h. Properly level the total station by following.
 - i. Power on the total station.
 - j. The electronic level window will appear.
 - k. Rotate the electronic level panel parallel to BC at the 1st position.
 - l. Turn the foot screws B and C in the opposite direction the same amount to move the bubble into the centre of the electronic level
 - m. Rotate the alidade approximately 90° .
 - n. Using leveling screw A move the bubble into the centre of the electronic level.
 - o. Repeat step C to E to centre the bubble in both position.
- (ii) Look at the laser point of the laser plummet of total station. Loosen the total station from tribrach and slide on the tribrach to focus the laser point on the station point if it is centered within 1 cm from the station point and repeat step C to G . If not, estimate the amount of offset and carefully move the entire tripod as much as the offset. Return to step 3 and try to level and center again. The total station on the tribrach head can be moved 1 cm from the center, therefore, rough centering within 1 cm is necessary. Be careful to see that the center of the laser point is on an axis perpendicular to the horizontal circle of the total station. If the total station is not level, the plummet line does not coincide with the plumb line.
- (iii) Rotate the total station by 180° . If the laser point goes away from the station point, slightly loosen the fixing screw and slide the total station halfway to the center.
- (iv) Tighten the fixing screw firmly without applying too much pressure. Never loosen the screw until all the measurements are finished.
- (v) Measure the instrument height. The centre of the total station is marked on the side of the alidade. The vertical distance between the mark and the ground is the instrument height.
- (vi) Check the plate level from time to time during measurement before the total station tilts beyond the automatic correction.

2. Setting up a Back Sight :

a) Using Tripod:

A back sight is a reference point for the horizontal angle. At the beginning of a new survey, a back sight can be set at a point an arbitrary point and marked. The best way to set up a back sight is to use a prism carrier and a tribrach on a tripod. The procedure for leveling up the prism is the same as that for the tribrach of total station. Centering of the prism is also same as total station but there is not any laser point on the tribrach of the prism so we have to use the optical plummet of the tribrach. A prism should be put right on the reference point when sighting is possible from the total station.

b) Using Bi-pod :

While taking the reading of back site never hold the prism in hand. We can use a bi-pod which gives stability to the prism pole. Keep the prism pole on the target and fix it to the bipod and tightened the screw. Press the leg release button using thumbs of both hands to release the legs to touch the ground. Push each tip of the bipod leg firmly into the ground applying full weight. Adjust the spirit level by pressing and holding the leg release buttons. Once the spirit level is centered relapse the buttons.

3. Measurement with Total Station :

When both the total station and back sight are finally leveled and centered, the hardware setup is over and the software setup is to be started. The software setup of a total station differs from one make to another. One has to follow the user's manual of each instrument. The list below gives common important settings for most instruments. Most total station memorizes these settings, but it is better to check through the setup menu in order to avoid a false setting.

1. System : Choose appropriate existing interface for data output
2. Angle Measurements : Tilt correction/ Tilt compensator (2 axis)
3. Horizontal angle increments : At right angles (clockwise)
4. Unit setting : Angle in degree/min/sec, distance in meters,

temperature in centigrade and pressure in hPa.

5. EDM Settings : Select DR/ IR laser, fine measuring mode, use RL with caution. Set appropriate value for the prism constant (from the user's manual of the equipment)
6. Atmospheric Parameters : Get ppm for the diagram from the manual of the equipment or let the total station calculate from hPa and degree centigrade.
7. Communications: Set all parameters the same for a total station and data logger/ PC. They are baud rate, data bits, parity, end mark and stop bits. Refer the manual for each device.

4. Field Book Maintenance :

The Survey officer can record all numerical data and a little text data in the total station, but descriptive information and graphic information should be recorded in the field book.

The following is a suggested list for the survey records.

1. Place, date and time
2. Surveyor's name
3. Temperature, atmospheric pressure
4. Station coordinate (E₀, N₀, H₀), as per co-ordinate of the survey station (TCP) and height of the instrument
5. Back sight coordination (slope distance, vertical and horizontal angles), (E, N, H), as per GPS co-ordinate TCP and height of the reflector.
6. Azimuth mark HZ, sketch of the telescope view.
7. Sketch map of the sight and measured objects.
8. Description of measurement. Point ID number (from-to), object, height of the reflector. Repeat this for each discrete object, or group of points measured with different prism height. This must be the input to the total station each time it changes.
9. Back sight coordinates measured again at the end.

5. Radial Shooting :

From a station, we measure as many objects as possible within the sight. This method is called radial shooting. The objects are classified as points. Each point is recorded as coordinates with a point ID number. A group of points on a discrete line should be measured consecutively for the sake of plotting. The pair of the first and the last point ID numbers is necessary to separate from the other ones. Smaller intervals of points result in more accurate records of the shapes. The balance between the scale of the map, importance of the objects, and time and purpose of the measurement determines the interval needed.

6. Plotting of Parcels :

Plotting of parcels can be done onsite by key-in line during survey. This methods may differ from instruments to instruments based on their manufacture.

For plotting the parcels can be done also in the lab by manually or automatically. Proper coding is required for plotting the parcels/ creating lines by joining the points. For automatically joins the field shots proper coding is required depending upon the software.

7. Survey Station Description (Codes) :

- a. Each survey station or shot location (point), must be described with respect to surveying activity station identification and other attribute data.
- b. Wherever there is reserved forest or land transferred to the Forest Department or Government/community land is involved, the concerned officials should be involved in identifying the relevant parcel boundaries.
- c. The survey team should take care that the ridges which are not actually boundaries of the parcels are not taken into account for delineation of the parcel boundaries.
- d. In cases where collective cultivation is done or where boundaries are not demarcated the parcel boundaries should be recorded only after their demarcation on the ground has been carried out

with reference to the existing land records and as per the procedure laid down in the relevant revenue laws in the presence of the concerned owner(s)/enjoyer(s).

- e. Each land parcel should be identified by its owner(s)/enjoyer(s) and should be given a unique ID which shall be used for linking the attributes data collected in respect of the land parcel.
- f. The land owner(s)/enjoyer(s) who intend to affix stones at their field junctions may be shown the points where stones can be affixed.
- g. The current land use, irrigation status and other land attributes data shall also be collected by the survey team..

ANNEXURE-3
TECHNICAL SPECIFICATION FOR ORTHO-IMAGE
AND GIS LAYERS

- a)** *Creation of some additional layer files described in the table below in the form of point/line/polygon other than Parcel Boundary required under this Project.*
- b)** *Creation of an arc GIS Symbology File for the Cadastral Symbols available in the Cadastral Map. Survey Team shall create an integer Field named as 'Sym-code" with field width depending upon the number of symbology to be created, if some Symbols will not be available in the Symbol Library of ARC GIS, then Symbols are to be created by scanning the Picture and that are to be added to the Library. Survey Team has to finalize the Symbols by consulting ORSAC/LRD QC Team.*

Attribute of the Plot Vector (.shp/arc coverage)

- *Img_Plot 66 i*
- *Map_Plot 50 50 c*
- *RoR_Plot 50 50 c*
- *Map_Area 10 10 f with three digit for decimal part.*
- *RoR_Area 10 10 f with three digit for decimal part.*
- *Img_Area 10 10 f with three digit for decimal part.*
- *Img_RoR_Df 10 10 f with three digit for decimal part.*

c) Deliverables :

The Survey Team has to submit the following deliverables :

- *Resurvey/ Updated Cadastral Village (Final Draft) Map in .shp File format in CD/DVD*
- *Updated and corrected RoR Data in excel/dbase format in CD/DVD*
- *Geo-referenced Cadastral files in .shp format*
- *Mosaic Re-Surveyed Villages file Thana /Tahasil-wise in .shp/dwg format*
- *Final Re-Surveyed updated Cadastral Map in .jpg or tiff and arc gismxd file*
- *Final RoR in excel format*

d) Standards :

Mapping Standards	1 : 1980
<i>Spatial Framework</i>	<i>NSF</i>
<i>Ortho rectification accuracy (RMS)</i>	<i>0.1 m</i>
<i>Projection</i>	<i>UTM</i>
<i>Datum</i>	<i>WGS 84</i>
<i>Map Frame Size</i>	<i>One village</i>
<i>Map (Planimetric) accuracy</i>	<i>0.1</i>
<i>Minimum Mappable Unit(MMU)</i>	<i>10X10 cm</i>
<i>Accuracy of Mapping</i>	<i>100/99</i>
<i>Map Format</i>	<i>Digital GIS compliance</i>
GIS Database Standards	1:1980
<i>Spatial Framework</i>	<i>Mouza</i>
<i>Tie point intervals for Spatial Framework</i>	<i>Meter grid</i>
<i>Projection</i>	<i>UTM</i>
<i>Datum</i>	<i>WGS 84</i>
<i>Minimum Frame Size</i>	<i>One village</i>
<i>Tie Registration Accuracy in Meters</i>	<i>0.001</i>
<i>Planimetric Accuracy (1 mm of scale) in m</i>	<i>0.01</i>
<i>Coordinate Movement Tolerance (CMT)</i>	<i>0.00001</i>
<i>Weed Tolerance (WT)</i>	<i>0.001</i>
<i>Silver Polygon Tolerance (SPT)</i>	<i><0.001 sq. m</i>
<i>Grid Size (for image/ Raster Layers)</i>	<i>100X100m</i>
Output Standards	1: 1980/ 1:3960
<i>Output Formats Digital</i>	<i>GIS Compliance</i>
<i>Output Framework</i>	<i>Admin Unit - Village</i>
	<i>User defined Region AOI</i>
	<i>Spatial Framework Grids</i>
<i>Output Media</i>	<i>CD-ROM/DVD/EHD</i>
<i>Output Projection</i>	<i>UTM/User Defined</i>
<i>Output Datum</i>	<i>WGS 84</i>
<i>Output Format</i>	<i>Geo-Tiff, shape File, dbase/excel</i>
<i>Output Symbology</i>	<i>As per Layer Legend/ DoLR Standards</i>

e) Scale & Accuracy :

Following scale for accuracy are to be maintained

Area	Scale	Accuracy
Urban Area	1:500	±5cm
Village Area	1:1000	±10cm
Agriculture Area	1:4000	±20cm

f) Quality Assurance :

Since these Survey Records will form the basis of the Conclusive Titling system, they must be prepared with utmost care and accuracy. Hence, the Survey Team shall put in place a strict & rigid internal system of quality check to ensure that Vector Data are accurate as per the standards mentioned above.

g) Quality Checking :

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

Physical Accuracy:

- **Point features:** *Location of a Feature with reference to a standard layer would be the same or within the area of the Plot.*
- **Line features:** *Variation in length of a line segment should be within the prescribed limit.*
- **Polygon features:** *Variation in the Area & Perimeter of any Polygon Feature should be within the prescribed limit (0.025%).*

Logical accuracy :

- *This accuracy corresponds to completeness and correctness of Data when a Data set is analyzed. Following tests would be performed to ensure the logical accuracy of the Data-sets :*
- *An attribute query run on the Datasets should give a consistent result in terms of*
 - ❖ *Number of Features selected;*
 - ❖ *The content of the Features selected.*

- Any Data-set resulting out of analysis of two or more Data-sets should be logical.
- Any Spatial query run on the Data-sets should give the same result in terms of
 - ❖ Number of Features selected;
 - ❖ The content of the Features selected

h) Quality Checks on Digital Terrain Database:

The elements of the Database are to be created as per the standards herein and the Bidder has to take care that Digitization is as per the Standards. The inputs are subject to validation at each stage and will include qualitative as well as quantitative checks for input and output accuracy. The creation of a clean Digital Database (Topologically-corrected and Geo-coded) is the most important and complex task upon which the usefulness of the Database lies. Two aspects need to be considered here.

- One is the Geographic Data necessary to define where the Parcel of Land or, for that matter, any other feature is located,
- Second is its unique identification for associating attributes that link to the Records.

At every stage, there should be necessary and proper Data verification to ensure that the resultant Database is as free as possible from error. Bidder will provide the code and description information in a separate file. The QC checks will be done by ORSAC QC Team in following stages or as when required:

- After Geo-referencing of Cadastral Maps with the image :
 - Geo-referencing of individual Parcels and the Village as a whole.
- After Plot Vector generation and prior to Ground Truthing verification :
 - The geometry of Parcels, the Village Boundary, matched and mismatched Plots as seen on the image.
- Before submission to Tahasil for verification :
 - The Village in completeness, correctness of matched and mismatched Parcels as identified by the Survey Team.
- Before Final Submission :
 - Village Map as a whole and the statistics after RoR linkage.

Table: Additional Layers

Layer Code	Layer Name	Sl	Feature Type	Geometry
1	Cadastral Details	1	North arrow	Point
		2	Spot height	Point
		3	Primary control point	Point
		4	Secondary control point	Point
		5	Tertiary control point	Point
		6	Auxiliary control point	Point
		7	Village tri-junction point	Point
		8	Village bi-junction point	Point
		9	Field survey stone	Point
		10	Bench mark (if available)	Point
		11	Village boundary (extracted from parcels)	Polygon
		12	Hill/Hillock	Polygon
		13	Limit of Rocky Area	Polygon
		14	Electrical Substation	Polygon
		15	Electrical Transformer	Point
		16	High Tension Line	Line
		17	HT Electrical Towers	Point
		18	Electric Power House	Point
Layer Code	Layer Name	Sl	Feature Type	Geometry
2	Water Bodies	19	River	Polygon
		20	Streams	
		21	Main Canal	Polygon
		22	Distributory Canal	Polygon
		23	Lake	Polygon
		24	Water Tank/Pond	Polygon
		25	Reservoir	Polygon
		26	Bore well/ Tube Well	Point
		27	Lift Irrigation Point	
		28	Well	Point
3	Roads	29	National Highway	Line
		30	State Highway	Line
		31	District Road	Line
		32	Other Road	Line

	<i>Railways</i>	33	<i>Railway Line</i>	<i>Line</i>
4	<i>Cultural & Public Utilities</i>	34	<i>Stadium</i>	<i>Polygon</i>
		35	<i>Park</i>	<i>Polygon</i>
		36	<i>Play Ground</i>	<i>Polygon</i>
		37	<i>Quarry</i>	<i>Point</i>
		38	<i>Police Station</i>	<i>Point</i>
		39	<i>Temple</i>	<i>Point</i>



FORM NO-8(T)
INTIMATION SLIP
CHANGES IN RoR AS PER MUTATION

Office of the Tahasildar

District

Case No.

The following changes in the Record of Rights have been ordered.

Name of Village

Name of Thana

Thana No

*Details of change

Tahasildar

** In case the change involves subdivision of plots, a sketch map indicating the subdivision shall be enclosed in the slip which is meant for the Addl.Tahasildar.*

Certified that, the changes, mentioned in the slip have been incorporated in all the relevant Registers on.....

Addl. Tahasildar

*All other formalities and maintenance of Registers for the purpose shall be made in accordance with the prescribed Forms/Appendix provided in **The Odisha Mutation Manual, 1962.***