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City Survey in Maharashtra using Drone Technology

JULY 2020

This work has been carried out by the Centre for Land Governance (CLG) at IIHS. It is based on primary and secondary research (2018-2019) conducted in the state of Maharashtra.

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whatever may be the mode or form of its expression including digital form, such as a book, pamphlet and other writing; a work of drawing, painting, architecture, sculpture, engraving or lithography; a photographic work to which are assimilated works expressed by a process analogous to photography; a work of applied art; an illustration, map, plan, sketch or three-dimensional work relative to geography, topography, architecture or science; a performance; a broadcast; a phonogram; a compilation of data to the extent it is protected as a copyrightable work.

CONTENTS

LIST OF FIGURES:

LIST OF MAPS:

LIST OF TABLES:

LIST OF ABBREVIATIONS:

3D	Three-Dimensional
AoI	Area of Interest
ETS	Electronic Total Station
DC	District Collector
GCP	Ground Control Points
GIS	Geographic Information System
GoM	Government of Maharashtra
DGPS	Differential Global Positioning System
GPS	Global Positioning System
HRSI	High-Resolution Satellite Imagery
LIDAR	Light Detection and Ranging
MLRC	Maharashtra Land Revenue Code
SC & DLR	Settlement Commissioner & Director of Land Records
SOI	Survey of India
NLRMP	National Land Records Modernization Programme
UAV	Unmanned Aerial Vehicle

INTRODUCTION

Since the launch of the National Land Records Modernisation Programme (NLRMP, now DILRMP[1]) by the Government of India in August 2008, land and property records have gained a lot of attention and have been a part of important administrative discussions. Numerous state governments are struggling in land-related matters because of the unavailability of accurate land records. In general, state governments possess land records, but these are mostly limited to agricultural areas. Built-up areas have often been left as composite large plots in the rural records, and the details of the buildings or individual plots within the inhabited area do not exist. Unlike many other states, Maharashtra has a formal system under the Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969 to conduct surveys for built-up areas. For inhabited or *abadi* areas, termed as '*gaothan*' in Maharashtra, out of total 43,665 villages, only around 3,800 have been surveyed since the time of the British rule.[2]

To survey the remaining villages, the Government of Maharashtra (GoM) decided to initiate a state-wide campaign of 'city surveys'[3], to map ownership titles in *gaothan* areas and to incorporate both spatial and non-spatial records. This report outlines the process and procedure that was used to conduct a city survey using drone technology, in two pilot areas in Maharashtra, and suggests recommendations for the same.

Gaothan areas are different from the surrounding agricultural land parcels in terms of usage, built-up area and size. In Maharashtra, around 3,800 gaothan areas are surveyed since the process was first started during British rule. This was based on ground survey methods, which is a time-consuming method to capture data, physically traverse the survey area and carry out ground verification. The high degree of human interventions in the survey process can lead to errors. On an average, a ground survey takes over three months of time to capture the data of a single village (consisting approximately 300-500 properties), and can cost around INR 3,00,000[4]. Given the sheer size of the un-surveyed area in Maharashtra—*gaothan* areas of approximately 40,000 villages—conducting the survey in a timely manner is essential and using only a ground survey technique would require decades to complete the exercise.

Selecting a suitable survey technique is a key component of conducting surveys in a campaign mode. At present, the range of available survey techniques are as follows[5]:

[1] Digital India Land Records Modernisation Programme
[2] Based on field visits by IIHS during field surveys and discussion with officials from the Revenue Department, GoM.

[3] Under the provisions of Section 126 of Maharashtra Land Revenue Code, 1966, surveys of *gaothans* (residential areas in any village, town or city) are considered once they cross a threshold population of 2,000 and called a city survey

[4] Based on field visits by IIHS and discussion with officials from the Revenue Department, GoM.
[5] The first three methods were originally listed in the NLRMP/ DILRMP guidelines. Drone surveys and LIDAR survey are relatively new surveying technologies which are being considered by various states.

a) Ground method using Electronic Total Station (ETS) and Differential Global Positioning System (DGPS)
b) Hybrid methodology using High-Resolution Satellite Imagery (HRSI) and ground truthing by ETS and DGPS
c) Aerial photography/ drone (UAV-Unmanned Aerial Vehicle) and ground truthing by ETS and DGPS
d) LIDAR[6] and DGPS.

Selection of a survey method depends upon a few parameters like the extent of the survey area, the built-up density, vegetation cover, desired data accuracy, available budget, and time frame. For this survey, drone technology with ground truthing by ETS and DGPS was selected as the survey method by the Government of Maharashtra, Revenue Department (SC & DLR), and the Survey of India[7]. Drone technology is considered an efficient and effective technology to capture high resolution and accurate data sets. The GoM has also signed a Memorandum of Understanding on 3 March 2019 with the Survey of India to get technical support in drone survey, which includes processing of the images captured by the drone[8].

In general, a city survey consists of preparing spatial and textual records. With the help of drone technology, a city survey can be done in around 15 to 20 days and at a cost of INR 1, 50,000 for a village with around 300-500 properties.[9]

Given that technology is a pivotal component of any survey exercise, a team of researchers from the Indian Institute for Human Settlements (IIHS) visited the sites during the surveys to document the entire survey process, and understand 'good practices' and 'gaps' of the survey process and the technology used. The team further suggested recommendations that can be implemented in similar future projects.

THE MAHARASHTRA LAND REVENUE (VILLAGE, TOWN AND CITY SURVEY) RULES, 1969

The powers were delegated to the Government of Maharashtra (GoM) by Section 328 of chapter XVI of the Maharashtra Land Revenue Code, 1966 to make the Maharashtra Land Revenue (village, town and city survey) Rules, 1969 to conduct the city survey in Maharashtra. It elaborates on the methodological procedure of city surveys and the roles and responsibilities of the officials involved in the process. Further, the city survey manual 1918, illustrates the detailed procedure to conduct this in Maharashtra through the plane table and minor triangulation.
In the current scenario, the GoM follows the same methodological procedure to conduct the city survey, adding the technological advancement to the survey process. Therefore, the Maharashtra Land Revenue

[6] LIDAR technology works on laser & point cloud-based technique. It is a combination of 3D spatial and spectral information to give high resolution and accurate images.
[7] The national survey and mapping organisation of the country under the Department of Science & Technology, Government of India.
[8] Image processing techniques are an aid to interpret the captured images, and to extract as much information as possible from the images. Prior to data analysis, image processing on the raw data is usually carried out to correct for any distortion due to the characteristics of the imaging system and imaging conditions.
[9] These estimates are based on discussion with officials from the Revenue Department, GoM and the Survey of India.

Code, 1966 and the city survey manual 1918, provides the legal strength for conducting city surveys in the gaothan areas of Maharashtra.

STUDY AREA

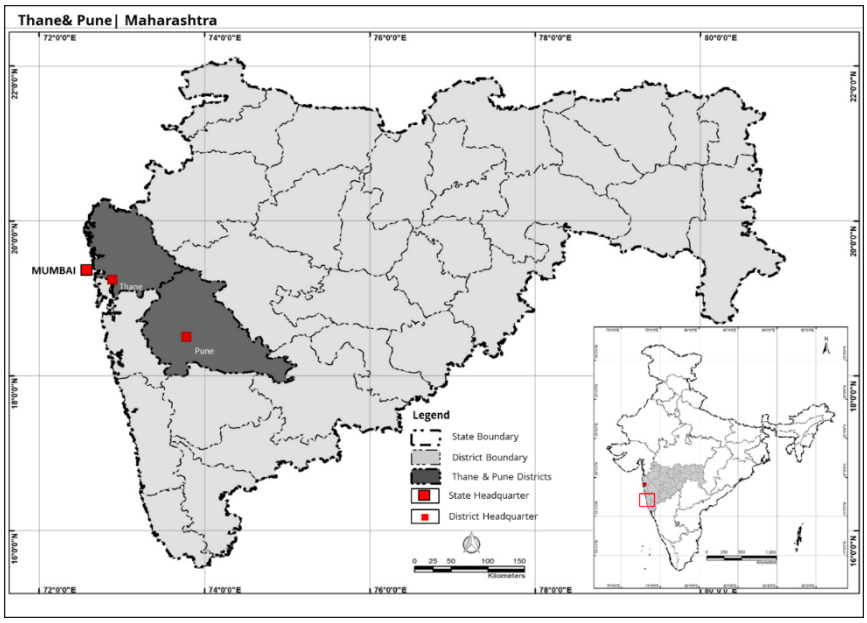
Two survey sites were selected by GoM as a pilot project based on their varied characteristics in two regions: Sonori village from the Pune district for the rural characteristics, and Vashi village in Navi Mumbai, Thane district for an urban perspective. The surveys were conducted in March and August 2018 for respective villages. The SoI provided the technical support to GoM to operate drone, image process and feature extraction in these surveys.

Table 1: Details of surveyed villages are listed below:

S.No.	Name of village	Nature of village	Location	Area (hec.)
1	Sonori	Rural	Purandar taluka, Pune district	6.25
2	Vashi	Urban	Navi Mumbai, Thane district	0.93

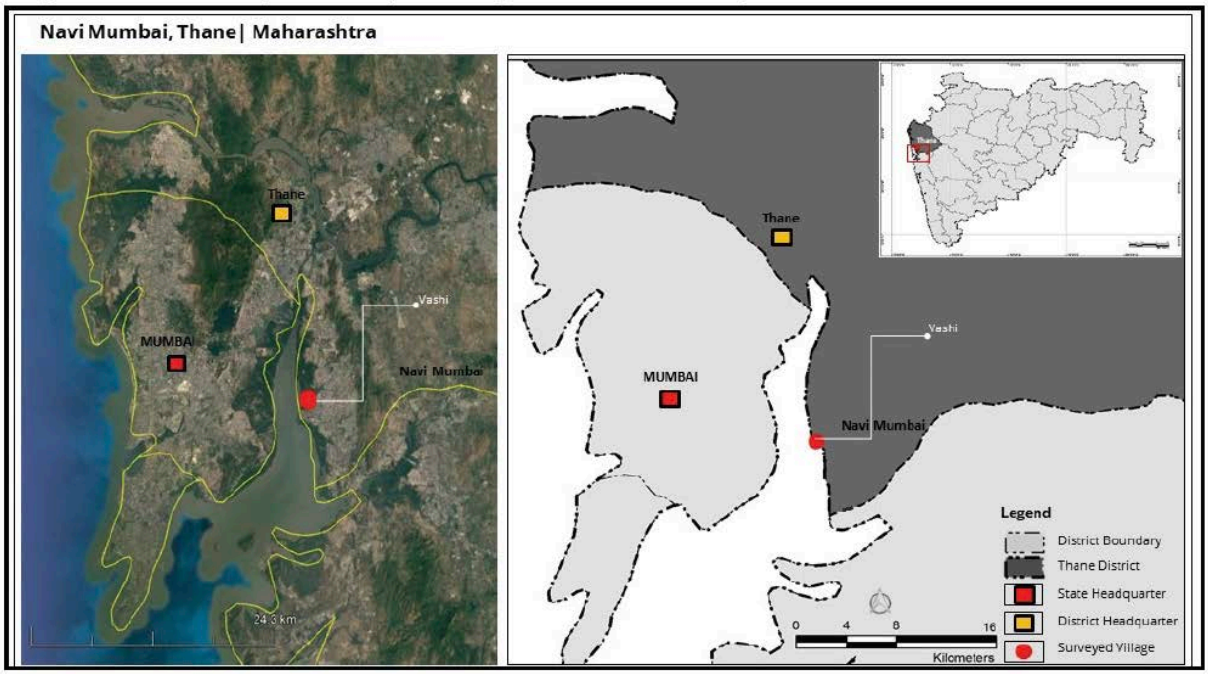
Source: Discussion with official from Revenue Department, GoM

Map 1: Location map of surveyed districts in Maharashtra



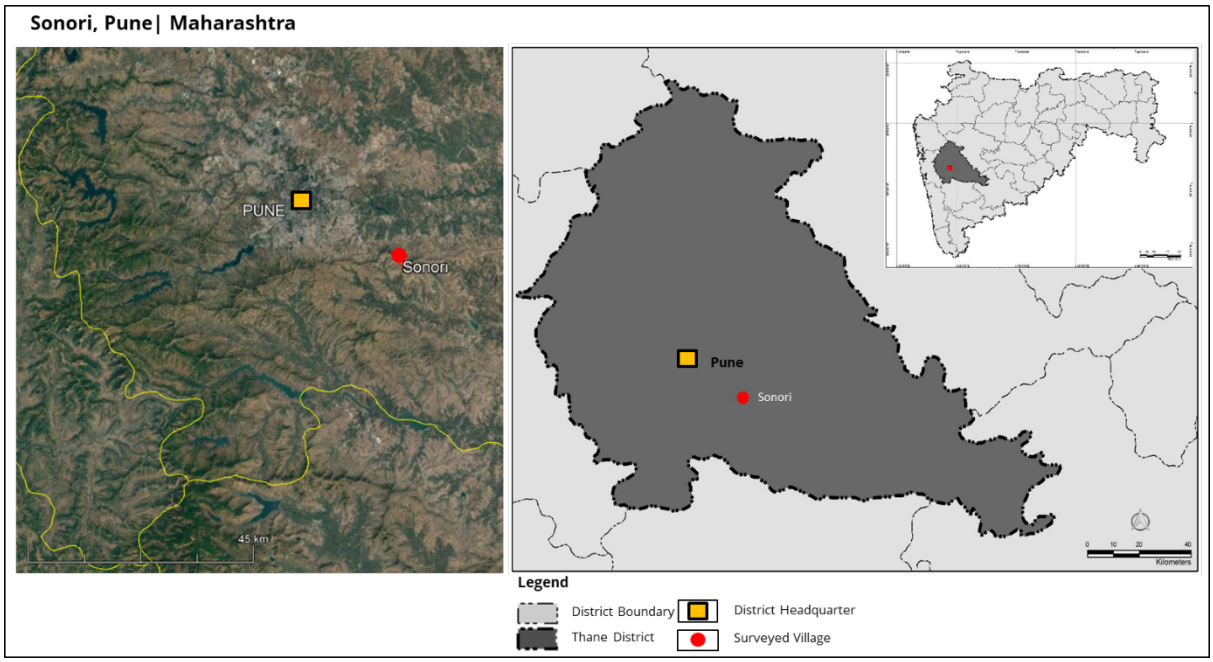
Source(s): Survey of India (1999) & IIHS analysis, 2018

Map 2: Location map of surveyed village in Navi Mumbai, Thane district



Source(s): Survey of India (1999) & IIHS analysis, 2018

Map 3: Location map of the surveyed village in Pune district



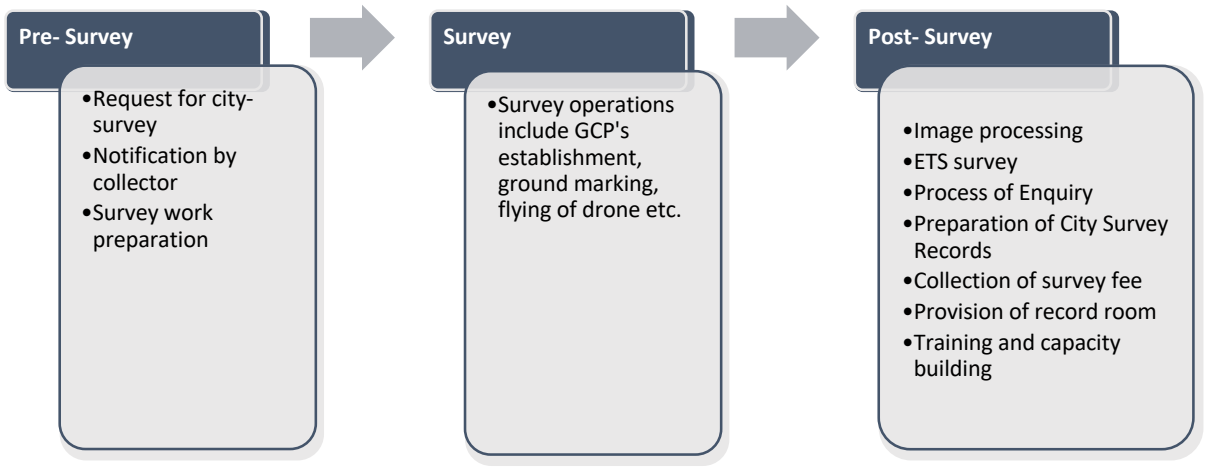
Source(s): Survey of India (1999) & IIHS analysis, 2018

METHODOLOGY

The city survey was conducted as per the Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969. Surveys of gaothans (residential areas in villages) are considered once they cross a threshold population of 2,000[10]. In the absence of minimum required population, the request for the city survey is generally put up either by local body (such as the village panchayat) or the Rural Development Department to the Settlement Commissioner, which is followed by final approval from District Collector (DC). In Maharashtra, as per Census of India 2011, the total number of census villages are 43,665, of which only 8,654 villages have crossed the threshold population of 2,000. For the remaining villages approvals have been taken to conduct the city survey.

For the pilot projects, the city survey was divided into three major stages—pre-survey, survey and post-survey.
The figure below illustrates the process that was carried out for conducting this city survey.

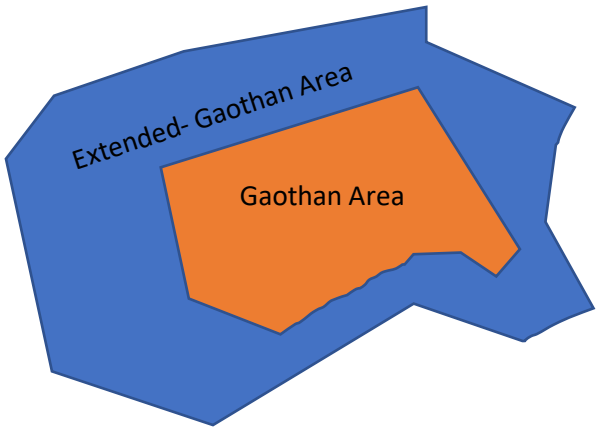
Figure 1: Methodology to conduct city- survey using drone technology:



Source: IIHS analysis, based on field visits by IIHS during drone survey, Maharashtra.

[10] Under the provisions of Section 126 of Maharashtra Land Revenue Code, 1966

Figure 2: Graphical representation of gaothan and extended- gaothan area



Source: IIHS analysis, 2018

Pre- survey

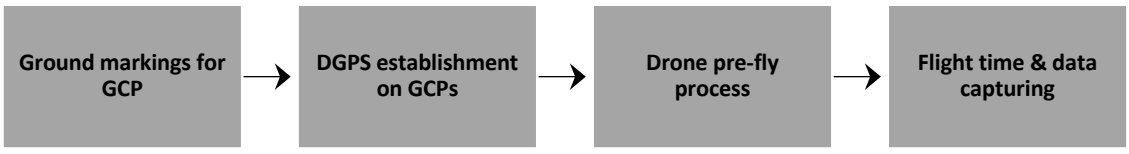
This pilot city survey included *gaothan* areas based on permission from the DC. Based on the prior permission from DC, extended *gaothan* areas (agriculture land outside the Goathan boundary) could also be included in the survey. At this stage, the necessary flying permission for flying a drone was requested from the Commissioner of Police, which was granted in about two weeks.

Survey

This stage includes on-ground preparation for the survey, such as ground marking and establishing Ground Control Points (GCPs), followed by the flying of the drone and data capturing. In this case, the Survey of India was engaged as a technical support to GoM to capture the drone image and its processing.

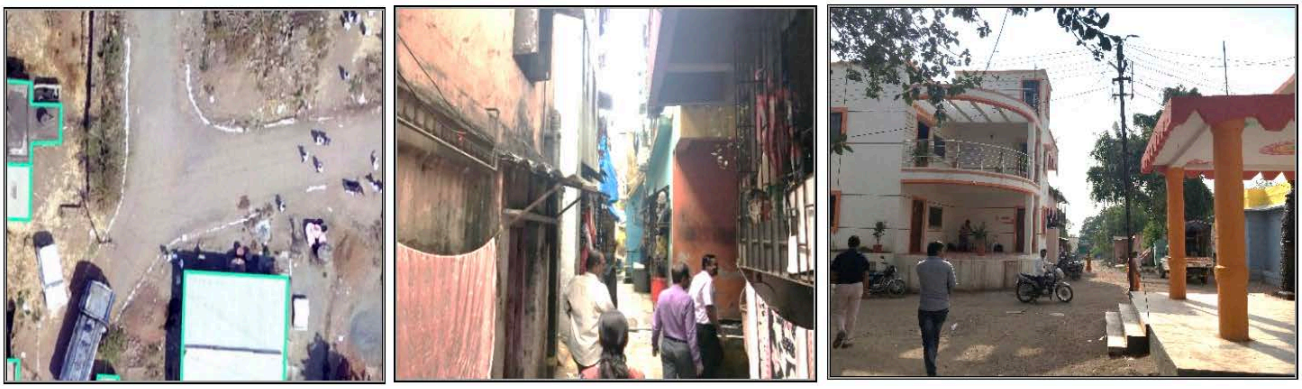
The entire survey operation was divided into four steps as mentioned below:

Figure 3: Methodology of Drone survey process



Source: IIHS analysis, based on field visits by IIHS during drone survey, Maharashtra

Figure 4: Photographs showings markings and gaothan areas during the survey process



Source: Field visits by IIHS during drone surveys, August 2018 and the Revenue Department, GoM

The survey process started with the placement of the GCP points within the Area of Interest (AOI), with clear visibility from the drone sensor. These points were used as a reference point to geo-reference the drone image through DGPS instrument. Once these reference points were fixed, the gram sabha and villagers were involved in the identification and demarcation of the region into government land, gram sabha land parcels, individual properties, roads, open plots etc. This practice helped to reduce property disputes. In case of multiple partitions of any constructed property, marking was done on the rooftop to get the partition captured in the drone image.

The pre-fly process included determining the flying height of drones, expected spatial resolution of the image, flight angle, numbers of the path, forward and side overlaps etc. These can be customised based on the survey requirements and scope of work. Before the drone flies, a technical expert check is essential along with a check of the immediate weather and surrounding conditions.

Figure 5: Photographs showings Ground Control Point markers; Ground Positioning System and Ground Control Point

Source: IIHS field visits to Vashi, Navi Mumbai, August 2018.

Figure 6: Photographs showings Drone fly operations

Source: IIHS field visits to Vashi, Navi Mumbai, August 2018.

For cases where the built-up area is too high, the drone must fly perpendicular to the first path to provide the complete accurate image. Drones fly in a pattern with around 60 – 80 percent forward, and 30 - 60 percent side overlap to get a stereo or three-dimensional image[11].

The field preparation process including GCP establishment and ground marking requires the most time of the survey process. In these two sites, the drone flying itself took a total of around 2-3 hours.

Post- survey

This stage included data processing, geo-referencing and rectification of captured images, followed by ETS survey (if required), ground verification, incorporation of textual records, inquiry proceedings and distribution of *sanad*.[12]

In data processing, a critical task is the orthophoto mosaic process which defines the accuracy and spatial resolution of the image. The time required for this process depends upon the total number of images that have been captured to cover the extent.

In this survey, the process took two days for Sonori and four days for Vashi.

After the data processing was completed, the ETS survey and ground truthing was done. Based on the nature of the area and characteristics like vegetation, coverage of ETS can be determined. If the area is entirely built up or has thick vegetation, then a complete ETS is recommended. If not, the ETS can be done for specific dense pockets, or any property covered under dense vegetation.

In Sonori, around 3 per cent of the properties were covered under the ETS survey, while in Vashi, all the properties were covered in an ETS survey, taking a total of 20 days owing to its high density and built up area. During this period, the team conducted ground truthing based on visual parameters, measurements with tape, and ETS data sets to physically verify and demarcate the property on the base map. (Refer figure 7).

[11] Pepe, M., Fregonese, L. and Scaioni, M., (2018). Planning airborne photogrammetry and remote-sensing missions with modern platforms and sensors. European Journal of Remote Sensing, 51(1), pp.412-435, DOI: 10.1080/22797254.2018.1444945

[12] *Sanad* refers to authority given in writing by the government to hold land/ property. It includes name of owner, address, property area, dimensions and scaled layout of property.

The process of mapping through the drone technique is quick and efficient. However, this exercise also revealed that if a 100 per cent ETS survey is required for ground verification, as in the case of Vashi, then drone survey may not be the most effective method.

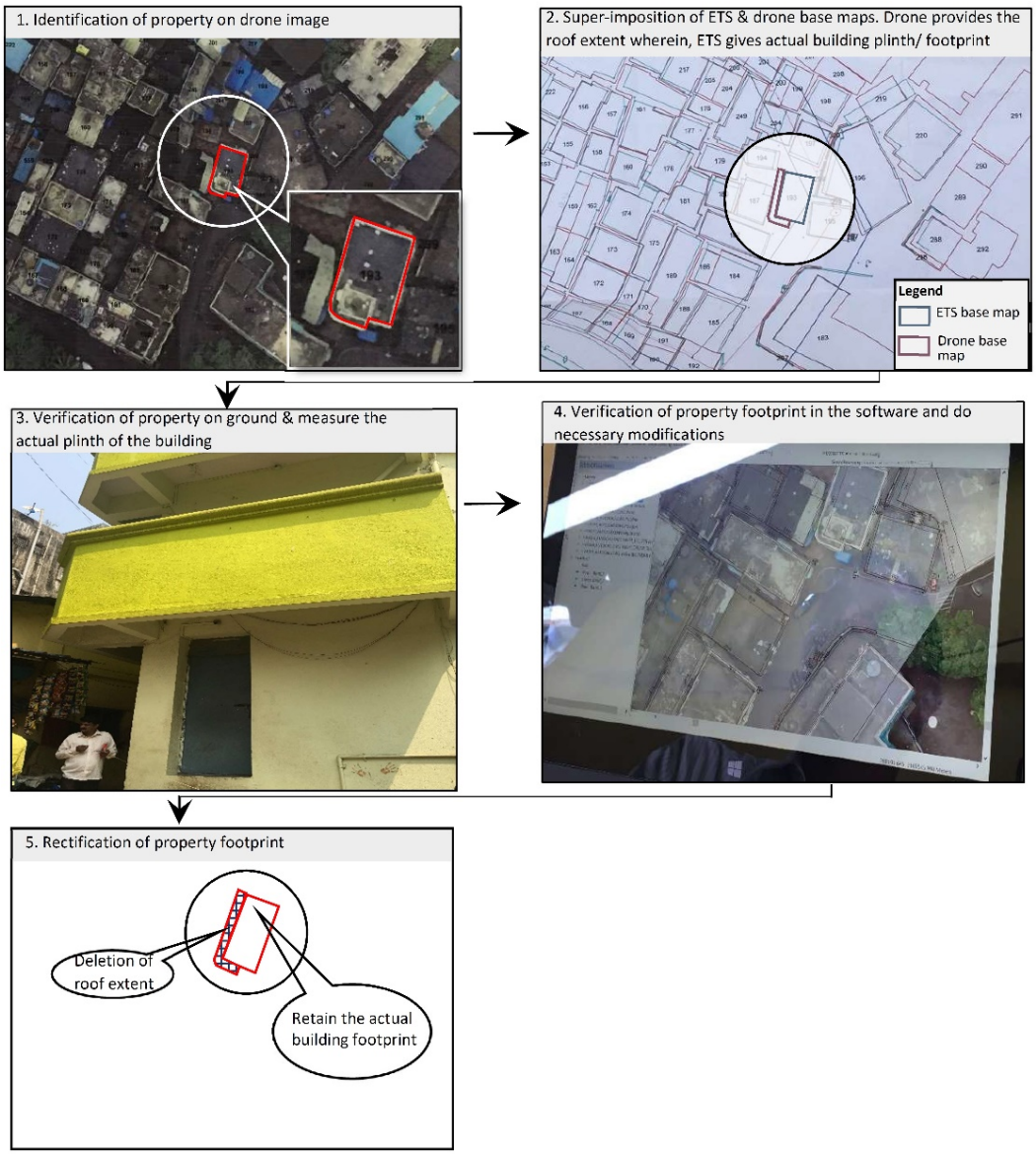
Figure 7: Photographs showing ground truthing

Source: IIHS field visits to Vashi, Navi Mumbai, October 2018.

Ground verification and collection of textual records gets carried out by Village Development Officer (Gram Sevak from Rural Development department) and Talathi (from Revenue Department) For the preparation of the textual record which includes owner details, use of property etc.; the Revenue Department mainly referred to gram panchayat repositories and updated its revenue records accordingly (refer the form 'B' Inquiry Register of Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969). Along with the other details, property ownership gets also mapped i.e. whether this property belongs to gram panchayat, government, public, private property etc.

The inquiry officer then determined the information about each property in inquiry register, including ownership details, the size and dimensions of the properties, details of encumbrances or legal liabilities, the city survey number and survey fee charges. Further, the final map and inquiry register with all the details was displayed in the village to invite objections.

Figure 8: Methodology to conduct ground truthing/ verification



Source: Based on field visits by IIHS during surveys to Vashi, October 2018 and discussion with officials from the Revenue Department, GoM.

During this investigation, it was found that open land plots are generally the most disputed areas. Many of these plots belonged to the government and the gram panchayat. The base map and the inquiry register were corrected in accordance with the decision of the inquiry officer. In case appeals were filed, they were corrected in accordance with the final order passed by the competent authority.

After the completion of the inquiry stage, the survey officer prepared the *sanad* and 'record-of-rights'[13]. *Sanad* contains details such as the name of the owner, village, tehsil, city survey number, scaled map showing dimensions and area of the property, adjacent survey numbers/ roads/ landmarks etc. In city survey, a Record of Rights is prepared in the form of a 'Property Card'[14].

In the case of Sonori, it took two weeks after the drone survey to prepare textual records and complete the inquiry process. The process of preparation of textual records had not yet begun in Vashi village when this report was drafted.

The survey fee (which includes the cost of the survey) was then defined based on the location, value and total area of the property and collected from the property owners by the competent authority. In Sonori, it was found that people were willing to pay the fee without any protest in order to get the most updated and legal property record.

In case of future updation of textual and spatial records, an application must be submitted to the regional revenue office. Updation of spatial records requires the revenue officer to visit the village for measurement and demarcation, and survey fees will be required for such updation. These updated records, then accordingly, get incorporated into the village records.

STAKEHOLDERS INVOLVED

Stakeholder involvement signifies the role of interest groups (i.e. national or local government authorities, citizen, political parties, civil society, private parties, other organizations etc.) in a decision-making process based on the desired outcome. In the case of city-surveys in Maharashtra, individual stakeholders have their specific roles and responsibilities to achieve the final outcome, and these are described in table2:

[13] Record of Right is the land record where right and liabilities in respect of every piece of land are noted.

[14] Sanad is a one-time static document, granted to the landowner at the end of the survey process. In contrast, the property card can be updated multiple times to reflect the names and rights of the latest landowners and other details, similar to Record of Rights.

Table 2: List of stakeholders involved and their roles & responsibilities

Stakeholders	Roles & responsibilities
Rural Development Department	• In many cases, the department raises the request to conduct the city-survey. • To provide funds for the project based on repayment basis.
District Collector (DC)	• Based on the Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969, DC notifies the gaothan area for the survey. • DC defines the survey fee based on the location, value and total area of the property.
Revenue Department (Settlement Commissioner and the Director of Land Records)	• Department of revenue does all coordination for the Survey of India to get the permissions from competent authorities to fly the drones at local level. This helps in getting the required permissions in a more efficient way. • Department conducts the survey preparation and survey operations like delineation of gaothan area, ground marking, marking of GCP's, establishment of DGPS, ground truthing, etc. • It also conducts the enquiry process and preparation of sanad and property card.
Survey of India	• The Survey of India acquires all the required permissions from competent authorities to conduct the city- survey. • The Survey of India provides entire services on drone technology in city survey, which includes drone flying, data processing, feature extraction and image production.
Local bodies (Gram Panchayat)	• Conducts awareness programmes for villagers to make them aware of the city- survey and its benefits. • Gram panchayat provides their support in gaothan area identification & delineation, ground marking, property demarcation, and other survey operations.
Villagers	• Villagers provide their support in gaothan area identification & delineation, ground marking, property demarcation, and other survey operations. • To extend their co-operation in inquiry process and deposition of survey fee to get the sanad.

Source: IIHS analysis, 2018

GOOD PRACTICES AND GAPS

Based on this survey process, a list of 'good practices' and 'gaps' were identified by IIHS for future improvements.

a) 'Good practices'

- The Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969 provides the legal basis for conducting city surveys in gaothan areas.
- GoM's initiative to conduct the city-survey will help in the consolidation of unclaimed government properties.
- Using drone technology is a time-effective and cost-effective method to conduct the city survey with high accuracy and resolution data.
- To geo- reference the drone clicked images, use of DGPS technology to capture the Ground Control Point (GCP) was an efficient mechanism[15].
- Involvement of senior level officials from Revenue Department, to conduct public meetings and to convey the benefits of city- survey to villagers. This provides an open platform for villagers to raise their queries.
- Involvement of gram sabha and villagers during the survey exercises like demarcation of *gaothan* area, ground marking and resolving disputed parcels was helpful for closure of disputes.
- Involvement of the Survey of India (SoI) as technical advisor to GoM was useful during drone fly, data capturing, feature extraction and image processing.
- The project is funded by the Rural Development department, based on re-payment model. This will get re-funded to the department through the collection of survey-fee.
- The aforesaid mechanism to collect survey fees was a good way to recover survey expenses.
- The city survey could help improve the collection of property tax and hence, contribute to the fiscal prosperity of local body.

b) 'Gaps'

- To conduct property mapping, the dimensions of the plinth or footprint of the built-up area is required. In dense areas with built-up parts or with vegetation, the plinth of the building was not visible from the drone lens, reducing the accuracy of the image. Similarly interior roads, drains and other physical infrastructure that was not visible from the sky could not be captured.
- In case of high built-up or vegetation area, ETS survey and ground truthing was necessary to verify the data set which is time consuming, as seen in the case of Vashi.
- Drone surveys are subject to weather conditions and cannot be conducted when visibility is poor, such as during rains, cloudy or foggy weather. In the case of Vashi in Navi Mumbai, repetitive survey

[15] Wang, H. and Ellis, E., (2005). Spatial accuracy of orthorectified IKONOS imagery and historical aerial photographs across five sites in China. International Journal of Remote Sensing, 26(9), pp.1893-1911.

attempts due to weather constraints were time-consuming.

- Currently, the Survey of India provides full technical support to the Government of Maharashtra, which includes drone flying and data processing. But for regular data updation, trained and equipped manpower and familiarity with modern techniques shall be necessary required at the Revenue Department, which is not there at present.

RECOMMENDATIONS

Based on the survey exercise in Sonori and Vashi, a few recommendations were framed by IIHS.

a) Drone survey can be an efficient survey technique for small and sparsely developed areas to get high accuracy and resolution data.

b) A swath[16] of a drone is still relatively small when compared to other aerial survey techniques; the drone method increases the number of images to cover the area of interest. In the Sonori village which is 6.25 hectares of area, the drone captured over 700 images to cover the entire geographical extent of the village[17], taking a substantial amount of time to create an orthophoto mosaic. Therefore, drone technique is most efficient and suitable in spatially small *goathan* areas.

c) Drone technology is not effective to survey high built-up areas because of its limitation to capture the plinth dimensions of a building. Therefore, if 100 per cent ETS is required for ground verification which requires time and effort, a drone survey is not suitable. Instead, LIDAR (aerial or mobile) could be the chosen method for high density areas, which uses laser & point cloud-based technique. It is an effective technology to conduct survey in dense vegetation and built-up areas[18]. In the survey of 40,000 villages, the government can identify and survey the dense and larger villages by LIDAR technique and use drones for the remaining sparsely developed areas. This strategy of parallel survey can be quick, efficient and accurate.

d) Strategic use of LIDAR technology can help the government to balance the cost of the project while selecting the specific high built-up pockets and survey in one go and not in a piecemeal manner. According to estimates, LIDARs costs same as aerial photography i.e. around Rs. 18,000 to 20,000 per sqkm.

e) A common approval method for the entire state can be a time-efficient

[16] The swath of an instrument is the width of the area on the surface of the Earth, which is imaged by the sensor/ lens during the survey.

[17] Based on field visits by IIHS during surveys and discussion with officials from the Revenue Department, GoM

[18] Kondo, H., Toda, S., Okumura, K., Takada, K. and Chiba, T., (2008). A fault scarp in an urban area identified by LiDAR survey: A Case study on the Itoigawa–Shizuoka Tectonic Line, central Japan. Geomorphology, 101(4), pp.731-739.

strategy to speeden up the process of mandatory permissions and approvals from the Commissioner of Police and Ministry of Civil Aviation. This shall minimise the time duration between survey, inquiry and *sanad* distribution. This will also retain the interest of property owners towards the process which is required by the government in tackling the issues with advanced technology in an efficient manner.

f) The process of inquiry should be conducted without any breaks and lapses, to accomplish the project within the time frame.

g) The form for inquiry (form 'B' Inquiry Register of Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969) contains information about the area measurement, owner and encumbrances, but no details on the possession holder and present use of property[19]. This can be included to record tenancies, get information on any violation, assist in property taxation and to reduce the scope for litigation.

h) Existing details exhibited in a property card need revision to capture more extensive details of built up property, use and ownership on the surveyed numbers.

i) Survey fees are a useful way to recover the cost of surveying. However, it needs to be ensured that the fee is affordable for owners. In the future, gains to the state from a good property record can even result in considering the idea of waiving off survey fees completely.

j) Training and capacity building of government officials in modern survey techniques such as drone, LIDAR etc. is needed for real time updation of property records.

CONCLUSION

Drones can be an efficient and useful technique for small and medium dense areas. The drone can prepare a base map of 300 to 500 properties in 15-20 days at the cost of INR 1,50,000, which would take three months and around double the cost using plane table and ETS technology. The high level of maneuverability makes it easy to update the map, unlike ground-based survey, and it also gives easy accessibility to unapproachable areas with less manpower. The final drone image has 2.5 cm of spatial resolution and 1.2 cm of accuracy, making it unique and more efficient technique in the spatial survey in comparison to other ground survey techniques.

[19] The Revenue Department mainly referred to gram panchayat or local body repositories regarding use of property.

However, selection of technology and survey method has to be based on the characteristics of the area and requirement of the project. In the above exercise, two villages of varied characteristics were identified for the pilot project to check the technique's efficiency and effectiveness. It was found that in Sonori village, which is primarily a sparsely developed area, the drone was an effective and efficient technique but in the dense, heavily built up and more urbanised area of Vashi, the drone was not an efficient technique. Thus, a combination of survey techniques like LIDAR (aerial/ mobile) for highly built-up areas and drone for the sparsely developed area can be explored as an optimal, cost-effective and quick survey method.

ANNEXURES:

1. Form A: The Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969

FORM A

(*See* Rule 3)

Public Notice

All inhabitants of the village, town/city of ..... are hereby informed that the State Government has, by its Order No. , dated directed under section 126 of the Maharashtra Land Revenue Code, 1966, the survey of lands (other than those used ordinarily for the purposes of agriculture only) within the site of the said village, town/city. Accordingly the survey officer will start work from*

All house-owners in the said village/town/city are hereby informed that they should be present on the date which will hereafter be fixed by the survey officer for the measurement of their houses and other property and should give all possible information to the survey officer to enable him to measure their properties correctly.

Mortgagors, mortgagees, absentee owners and other persons having interest in the land to be surveyed are also hereby informed that they should remain present on the date which will hereafter be fixed by the survey officer and should ensure that their rights are recorded correctly. After completion of the survey, their rights over property in the land will be fixed permanently by issue of a *sanad*.

Where it is necessary to enter any premises for purposes of internal measurement, no surveyor shall enter therein unless prior notice of not less than twenty-four hours has been given to the occupier thereof.

†The cost incurred, if any, for employing hired labour for measurement or classification of the lands to which the survey extends or for objects incidental to the survey shall be recoverable from the land holders as revenue demand. If the holders render more assistance, the survey work will be expedited and the cost of survey will be less.

Given under my hand and the seal of this office.

Dated: Collector of .....

Seal of office

2. Form B: The Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969

FORM B
(See Rule 5)
Inquiry -Register

City Survey
Peth or Ward Tikka or Sheet No.

Serial No. or Chalta No.	Old city Survey, Municipal or Village panchayat or Survey and Sub-Division of Plot No.	Area	Supposed name of holders (a) as in Municipal Records or otherwise and other interested or claiming parties (b), (c), (d) etc.	Date of service of notice (a) upon the occupant etc. (b) upon the property issued under Rule 2 (1) of the Maharashtra Land Revenue (Inquiry into Title of Land) Rules, 1967.	Who of (a) (b), (c), etc. column 4 were present	Is the plan prepared and measurements taken by the survey or accepted by the party confirmed or corrected by Inquiry Officer	Final City Survey No.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

FORM 'B' (Contd.)

Classification under Rule 8 (2) for survey fee	Amount of survey fee fixed by the Collector (with notes of any additional fees for Sanad under proviso to Section 129)	Receipt No. for fees paid	Tenure and rent or assessment with date on which it is due for revision	Decisions in respect of name of holder, mortgagee in possession, lessee or encumberance holder and attached easement	Reference to the file of proceedings when contested	Date of service of decision order issued under Rule 2(3) of the Maharashtra Land Revenue (Inquiry into Title of Land) Rules, 1967	Appeal Order if any	Remarks
(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)

3. Form C : The Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969

FORM C

[*See* Rule 6 (3)]

Public Notice

(to be affixed on open land).

The plot of waste land described below is claimed by the State Government. If any person has a right of ownership or any other right over it, he should appear with any documentary or other evidence which he may possess regarding his right over the said land, before the survey officer at his office situated in within ten days from the date of this notice. If no person having right of ownership or any other right over the land appears before the survey officer at his office within the said period, the said land will be treated as Government property.

Given under my hand and the seal of this office.

Dated:—

Collector.

Seal of office

Description of land.

Street House No.

(in the Municipal Register) or otherwise, known as the boundaries of which are as under:—

To the North To the East

To the South To the West

4. Form D: The Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969

FORM D

(*See* rule 7)

Property Card.

Survey No.	Area	Tenure	Particulars of assessment or rent paid to Government and when due for revision

Easements :—

Holder in origin of the title (so far as traced).

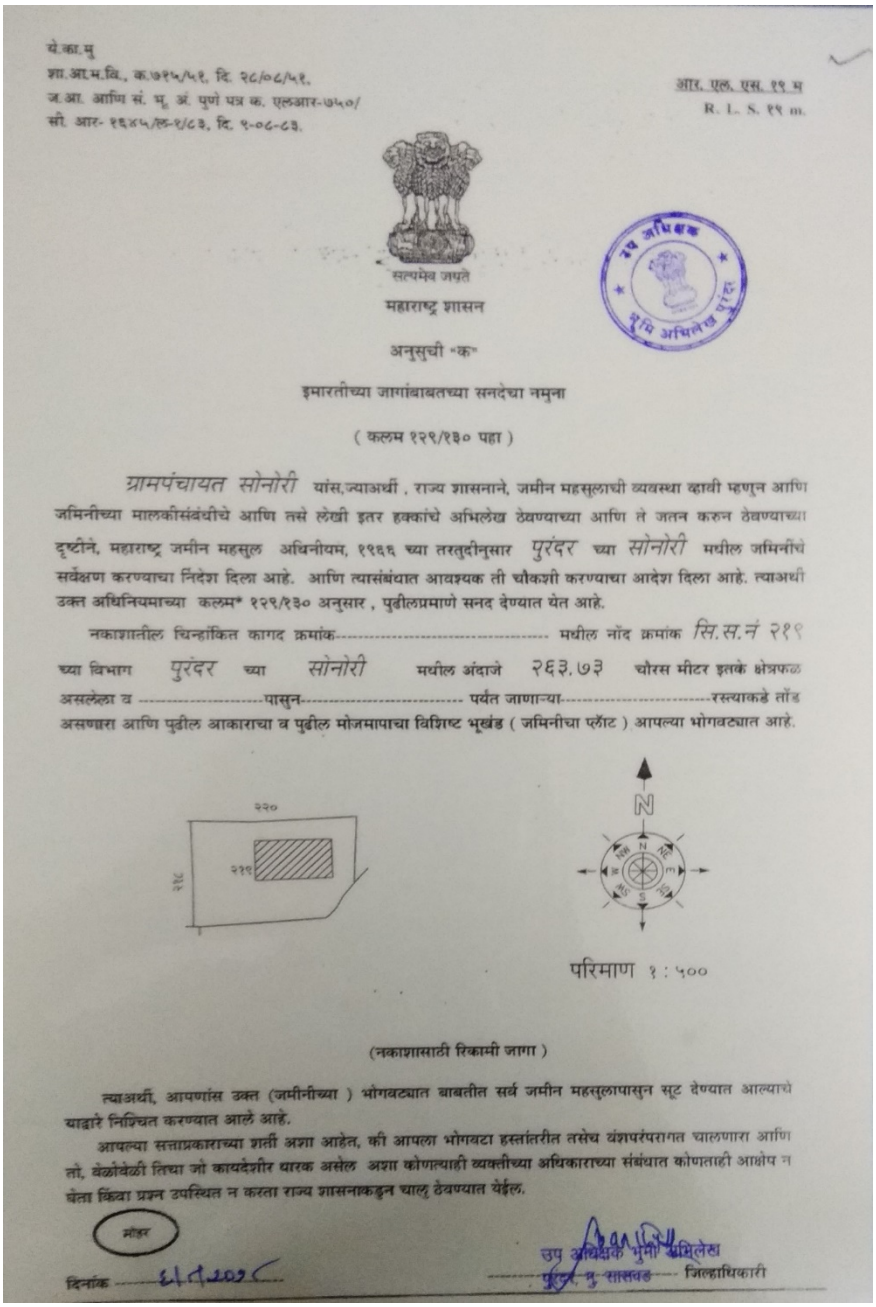
Lessee—

Other encumbrances—

Other remarks :

Date	Transaction	Volume No.	New Holder (H) Lessee (L) or Encumbrances (E)	Attestation

5. Copy of Sanad: The Maharashtra Land Revenue (Village, Town and City Survey) Rules, 1969



ये.का.मु
शा.आ.म.वि., क.७१५/५१, दि. २८/०८/५१.
ज.आ. आणि सं. मु. अ. पुणे पत्र क्र. एलआर-७५०/
सी. आर- १६४५/ल-१/८३, दि. १-०८-८३.

आर. एल. एस. १९ म
R. L. S. १९ m.

सत्यमेव जयते
महाराष्ट्र शासन

अनुसूची "क"

इमारतीच्या जागांबाबतच्या सनदेचा नमुना

(कलम १२९/१३० पहा)

ग्रामपंचायत सोनोरी यांस,ज्याअर्थी , राज्य शासनाने, जमीन महसुलाची व्यवस्था व्हावी म्हणून आणि जमिनीच्या मालकीसंबंधीचे आणि तसे लेखी इतर हक्कांचे अभिलेख ठेवण्याच्या आणि ते जतन करुन ठेवण्याच्या दृष्टीने, महाराष्ट्र जमीन महसुल अधिनीयम, १९६६ च्या तरतुदीनुसार पुरंदर च्या सोनोरी मधील जमिनींचे सर्वेक्षण करण्याचा निदेश दिला आहे. आणि त्यासंबंधात आवश्यक ती चौकशी करण्याचा आदेश दिला आहे. त्याअर्थी उक्त अधिनियमाच्या कलम* १२९/१३० अनुसार , पुढीलप्रमाणे सनद देण्यात येत आहे.

नकाशातील चिन्हांकित कागद क्रमांक---------- मधील नोंद क्रमांक सि.स.नं २१९ च्या विभाग पुरंदर च्या सोनोरी मधील अंदाजे २६३.७३ चौरस मीटर इतके क्षेत्रफळ असलेला व ----------पासुन---------- पर्यंत जाणाऱ्या----------रस्त्याकडे तोंड असणारा आणि पुढील आकाराचा व पुढील मोजमापाचा विशिष्ट भूखंड (जमिनीचा प्लॉट) आपल्या भोगवट्यात आहे.

परिमाण १ : ५००

(नकाशासाठी रिकामी जागा)

त्याअर्थी, आपणांस उक्त (जमीनीच्या) भोगवट्यात बाबतीत सर्व जमीन महसुलापासुन सूट देण्यात आल्याचे याद्वारे निश्चित करण्यात आले आहे.

आपल्या सत्ताप्रकाराच्या शर्ती अशा आहेत, की आपला भोगवटा हस्तांतरीत तसेच वंशपरंपरागत चालणारा आणि तो, वेळोवेळी तिचा जो कायदेशीर धारक असेल अशा कोणत्याही व्यक्तीच्या अधिकाराच्या संबंधात कोणताही आक्षेप न घेता किंवा प्रश्न उपस्थित न करता राज्य शासनाकडुन चालु ठेवण्यात येईल.

मोहर

दिनांक 21.1.2015

उप अधिक्षक भूमी अभिलेख
पुरंदर पु. सासवड जिल्हाधिकारी

6. Glimpse of city survey held at Vashi (Navi Mumbai)

Source: Field visits by IIHS during surveys in Vashi August- October 2018

7. Glimpse of city survey at Sonori (Pune)

Source: Field visits by IIHS during drone surveys in Sonori, October 2018 and discussion with officials from the Revenue Department, GoM.

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