



महाराष्ट्र MAHARASHTRA

2024

14AB 490363



**Addendum 1**  
to the Agreement signed between  
Settlement Commissioner and Director of Land Records, Government of Maharashtra  
AND  
Indian Institute of Technology Bombay  
RD/0122-GOMLR19-001  
**TECHNOLOGICAL INTERVENTIONS FOR MODERNIZATION OF LAND RECORDS  
MAINTAINED BY SC & DLR, GOVERNMENT OF MAHARASHTRA**

This Addendum is made on 14th October 2024 to the Agreement executed by and between Settlement Commissioner and Director of Land Records having registered office at Pune (First Party) hereinafter referred as "Department" or "SC&DLR" and Indian Institute of Technology Bombay located at Powai, Mumbai 400076 (Second Party) hereinafter referred as "IITB".

It is mutually understood and agreed by and between the undersigned parties to amend Details of Deliverables to the previously executed Agreement as below.

**WHEREAS**

IITB and Department entered into an agreement dated 20<sup>th</sup> April 2023 (the "Agreement") regarding undertaking of research activities as described therein.



1

WVB

IITB and Department now desire to amend the terms of the Agreement for project extension and expansion in scope of work for Technological interventions for modernization of land records maintained by SC & DLR, Government of Maharashtra, as more particularly set forth below:

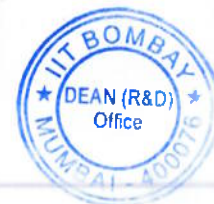
**WITNESSETH:**

1. Scope of Project as per Clause 1 and Annexure of the Agreement hereby stands extended as stated as follows –

**Description of Scope of Work**

The scope of work for the project extension is to be broken up into 3 modules. These modules may be described as follows:

1. Production of Accurate Georeferenced Maps for 6 Talukas (773 Villages)
  - ❖ Objective: To produce GIS maps and a rating of survey plots that maximize the number of survey plots in a village survey map with less than 3-5% area difference from textual records (when appropriate), using possession boundaries derived from farm plots generated by MRSAC or other relevant parties for reference. Similarly, the accuracy in terms of dimensions and boundary shape of survey number and/or cadastral map shall be taken into account while producing Accurate Georeferenced Maps. This accuracy can be quantified by the metric called shape deviation. Given these constraints, an attempt to align maps with ground reality using the metrics developed previously, as far as possible, will be made.
  - ❖ Technical Aspects: The local georeferencing module developed in Phase 3, with some improvements as required, shall be used to prepare the survey maps. Moreover, other relevant methods will also be tested and deployed. These maps will be produced by executing the software through collaboration between the DLR and IIT teams. The GIS maps produced can be validated on the field for each village through a mutually agreed process, including the collection of field coordinates for a collection of designated points on the maps. The Department shall coordinate with MRSAC or other relevant parties for providing farm plots, and the same can be incorporated by IITB during the development of software. These farm plots should match general quality and accuracy requirements of software developed earlier.
2. Development of Land Record Rating for Individual Survey Plots based on available land record data for villages in Pilot talukas
  - ❖ Objective: To devise a rating for survey plots based on the existence and correlation of textual (RoR/akarbandh) area, GIS map area, satellite-based far plot area, and other relevant land records data. This rating will assist DLR in reconciliation of GIS maps and textual records, and be useful to assess land parcels through propagation of ratings from survey plots to individual parcels.
  - ❖ Technical Aspects: Using software developed in Module 1, GIS maps will be prepared and compared for individual villages. Available land record data will be reconciled to create a conclusive metric basis for each land parcel. This rating will be validated and tested in the field. Based on the outcomes, a final rating is to be incorporated.





3. Fixing of Village Boundaries for Pilot talukas

- ❖ Objective: To develop a module that creates a village-level area partition, along with incorporation of the fixed boundaries produced into the current software for accurate georeferencing.
- ❖ Technical Aspects: GIS software must be devised to reconcile internal incoherence between village boundaries (gaps and overlaps) as well as external incoherence at the boundary (mismatch with possession and land-use). Constraints such as the area on ground exceeding the village map area must be taken into account, as well as the fact of likely changes at the boundary. The outputs generated will be provided as per Survey of India (SOI) requirements.

**Outcomes and Deliverables**

Module 1: Production of Accurately Georeferenced Maps for 6 identified pilot Talukas (773 villages)		
	Deliverables: IIT Bombay	Responsibilities: DLR
Phase 5 (5 months)	<ul style="list-style-type: none"> <li>• SOPs and scripts for data validation, and error detection and resolution</li> <li>• Rolling improvements and support in execution of input villages: generation of basemaps (version 1)</li> <li>• Scripts for automatic generation of reports that detail the proximity to validation points (GCPs) and assess overall village map and GCP quality</li> <li>• Impart training to the DLR IT team on running software validation of input data</li> <li>• Intermediate outputs are to be provided for validation periodically</li> <li>• Semi-automatic GCP marking and label verification process with GIS software</li> </ul>	<ul style="list-style-type: none"> <li>• Provide necessary IT infrastructure on ESDS cloud or another provider, as mutually agreed</li> <li>• Hire 4-5 IT team members or more to run IIT's pipeline and validate outputs</li> <li>• Finalize farm plot data source, derived from satellite images by MRSAC or other relevant parties, that match general and accuracy requirements</li> <li>• Execution of transferred software modules for available input villages</li> <li>• Preparation of input data: labeled GCPs, maps and textual data</li> <li>• Quality checking of inputs and outputs with the help of relevant scripts and SOPs</li> <li>• Field validation and relaying validation points and general feedback from SOI</li> </ul>



UVB.

<p>Phase 6 (4 months)</p>	<ul style="list-style-type: none"> <li>• Analysis and rectification strategies of version 1 basemaps, centred around subdivision maps and improvements in existing processes</li> <li>• Rolling support in the execution of input villages: generation of basemaps version 2</li> </ul>	<ul style="list-style-type: none"> <li>• Execution of software for input villages</li> <li>• Provision of additional datasets as required</li> <li>• Management of IT team to run and maintain IIT's pipeline on DLR systems</li> </ul>
-------------------------------	---	---

**Risks and Limitations:** Some of the boundaries of the village maps produced may intersect with each other. Misalignment of roads and streams with ground reality is plausible. Some of these issues are addressed by other modules. Processing of non-agricultural land may be a problem area, due to lack of a reliable source of ground truth. A larger number of GCPs may be required for optimal results. The software will use dimensions and boundary lines of the survey number map as well as the area measures from RoR (akarbandh) and GIS, and shall be affected by the deviation between them. It will also depend on original survey boundary shapes, and hence will be limited by their accuracy. The schedule assumes that the relevant input data and of the required quality is made available to IITB on a timely basis. Failing that, the software generated will be run by the DLR team as and when appropriate data is available. The schedule also assumes timely response to emails and feedback on reports and presentations.

Module 2: Develop Land Record Rating for Individual Survey Plots based on available land record data for villages in Pilot talukas		
	Deliverables: IIT Bombay	Responsibilities: DLR
<p>Phase 5 (5 months)</p>	<ul style="list-style-type: none"> <li>• Develop rating metric based on comparative analysis of quality of record, cadastral map boundaries, satellite-based farm plot, and/or their extent of matching, along with other relevant data</li> <li>• Prototype scripts for production of GIS heatmaps for pilot villages</li> <li>• Report on devised rating and analysis of survey plot rating</li> </ul>	<ul style="list-style-type: none"> <li>• Provide relevant data in suitable formats for target villages.</li> <li>• Provide inputs on the development of rating metric and preparation of relevant data</li> <li>• Study of generated heatmaps and procurement of feedback from the field</li> <li>• Designate IT staff to liaison with the IITB team</li> </ul>
<p>Phase 6 (4 months)</p>	<ul style="list-style-type: none"> <li>• Analysis of field report and incorporation of</li> </ul>	<ul style="list-style-type: none"> <li>• Assistance in planning and arranging joint field</li> </ul>



4  
LVB

	<p>developed metric</p> <ul style="list-style-type: none"> <li>• Addition of developed rating as a highlighted attribute in Module 1 software</li> <li>• Software for production of GIS heatmaps for input villages with developed rating</li> </ul>	<p>visit</p> <ul style="list-style-type: none"> <li>• Conduct field testing and validation, producing report</li> <li>• Incorporation of generated rating heatmaps for taluka-level decision making</li> </ul>
--	--	--

**Risk and Limitations:** The effectiveness of the Land Record Rating depends on quality and availability of data, to some extent of assignment of possession based on the software developed in Module 1, and farm plot outputs, as provided by MRSAC or other relevant parties. Actual field boundaries may differ. The schedule assumes that the relevant input data and of the required quality is made available to IITB on a timely basis. Failing that, the software generated will be run by the DLR team as and when appropriate data is available. The schedule also assumes timely response to emails and feedback on reports and presentations.

Module 3: Fixing of Village Boundaries for Pilot talukas		
	Deliverables: IIT Bombay	Responsibilities: DLR
Phase 5 (5 months)	<ul style="list-style-type: none"> <li>• Report on the internal and external incoherence for existing village boundaries and area gaps between villages</li> <li>• Release of alpha version of module: reconciliation of village boundaries</li> <li>• Intermediate outputs made available from the end of third month onwards</li> <li>• Outputs and statistics produced for 2 talukas</li> </ul>	<ul style="list-style-type: none"> <li>• Preparation of relevant input data (original village boundary data)</li> <li>• Assistance with phrasing rules to be followed when facing issues such as (i) road networks spread over multiple villages, (ii) missing village boundary roads on the survey map, (iii) overlapping road and stream polygons, and (iv) problems of a similar nature</li> <li>• Designate IT staff to liaison with the IITB team</li> <li>• To liaison with SOI for validation purposes of outputs</li> </ul>



Phase 6 (4 months)	<ul style="list-style-type: none"> <li>• Release of beta version of module as per SOI recommendations and feedback</li> <li>• Incorporation of developed pipeline into Module 1 software</li> <li>• Rolling improvements and support in execution of module</li> </ul>	<ul style="list-style-type: none"> <li>• Field validation of maps and relaying feedback from the field</li> <li>• Quality checking of inputs and outputs with the help of relevant scripts and SOPs</li> </ul>
-----------------------	--	--

**Risks and Limitations:** The base maps generated by Module 1 may overlap. Resolution of this will need cross-village data sets such roads and streams etc. The schedule assumes that the relevant input data and of the required quality is made available to IITB on a timely basis. Failing that, the software generated will be run by the DLR team as and when appropriate data is available. The schedule also assumes timely response to emails and feedback on reports and presentations.

## Budget

The budget details below are for Phases 5 and 6.

	Item	Amount (Rs.)
<i>Module 1</i>	2 software developers @90k per month x 9 months	16,20,000
	2 students @50k per month x 9 months	9,00,000
<i>Module 2</i>	1 field engineer / project research associate @60k per month x 9 months	5,40,000
	1 student @50k per month x 9 months	4,50,000
<i>Module 3</i>	1 software developer @90k per month x 9 months	8,10,000
	1 student @50k per month x 9 months	4,50,000
<i>Overall Project</i>	1 delivery lead @135k per month x 9 months	12,15,000
	1 technical lead @135k per month x 9 months	12,15,000
	1 senior software consultant @175k per month x 9 months	15,75,000
	2 faculty @135k per month x 9 months	24,30,000
	Consumables	1,50,000
	Travel	3,00,000

*SI*





	Contingencies (5% of sum of above items)	5,82,750
	Overheads (20% of non-faculty fees and 30% of faculty fees)	26,90,550
	<b>Total Phase 5 and Phase 6 cost</b>	<b>1,49,28,300*</b>

\* Plus applicable GST and taxes

The costs listed under the "Overall Project" heading above can be distributed among the three modules based on their approximate individual costs: 60% to Module 1, 20% to Module 2, and 20% to Module 3. Payments can be made upon completion of each module or phase, with amounts aggregated as appropriate.

The positions and emoluments of the resources involved in this Project are indicative and subject to Institute norms in effect from time to time. The salary/positions will be based on experience and will match prevalent norms. The budget estimates above are indicative. The actual expenditure, and its heads, and schedule of expenses may change from time to time as per project requirements subject to the overall limit of total **Phase 5 and Phase 6 cost of Rs. 1,49,28,300/-** (Plus applicable GST and taxes).

#### Schedule of Delivery and Payments

The payments will be made against deliverables organized in phases. The schedule is indicative.

	Deliverables	After Addendum Start	Amount (excluding GST and taxes)
Phase 4	<ul style="list-style-type: none"> <li>Completion of Phase 4 as per original MoU</li> </ul>	0 months	Rs. 12,00,000
	<ul style="list-style-type: none"> <li>Advance on Phase 5</li> </ul>	0 months	Rs. 30,00,000
Phase 5	<ul style="list-style-type: none"> <li>Completion of Phase 5 deliverables for Modules 1 to 3</li> </ul>	5 months*	Rs. 52,62,000
	<ul style="list-style-type: none"> <li>Advance for Phase 6</li> </ul>	5 months	Rs. 20,00,000
Phase 6	<ul style="list-style-type: none"> <li>Completion of Phase 6 deliverables for Modules 1 to 3</li> </ul>	9 months	Rs. 46,66,300



7

UVB.

\* There is 1 month during the summer where IIT Bombay faculty, students and project staff are generally unavailable due to prior commitments. Less work is expected to be done in this period.

2. Clause 10 of the Agreement, titled "Intellectual Property Rights", remains unchanged, and is reproduced here for completeness.

All rights pertaining to any intellectual property generated / created / invented in the due course of the project, will be the joint property of IIT Bombay and Department.

SC&DLR shall have a non-exclusive right to use all software which has arisen out of or in connection with the course of implementation of this project, including but not limited to all processes, products, specifications, Source codes (programs/Applications developed), reports, drawings and other documents which have been developed by IIT Bombay during the performance of services under this Project.

Notwithstanding anything mentioned above, IIT Bombay shall not be liable for any damages arising due to the fault of SC&DLR during its usage of once product delivered.

3. Except as provided in this Addendum, all terms used in this Addendum that are not otherwise defined shall have the respective meanings ascribed to such terms in the Agreement.
4. This Addendum embodies the entire agreement between IITB and Department with respect to the Addendum of the Agreement. If any terms in the Agreement conflict with any terms in this Addendum, the terms in this Addendum shall govern regarding the subject matter herein.
5. Except as specifically modified and amended herein, all of the terms, provisions, requirements and specifications contained in the Agreement dated 20th April 2023 remain in full force and effect.





IN WITNESS WHEREOF, the authorized representatives of IITB and Department have executed and delivered this Addendum on the date given above.

Settlement Commissioner and  
Department of Land Records  
Govt. of Maharashtra



By: [Signature]

Name: Sachindra Pratap Singh (I.A.S.)

Title: S.C. & D.L.R. (MAH)

Date: 14<sup>th</sup> October 2024

I

IN THE PRESENCE OF  
WITNESS

[Signature]

NAME: KAMLAKAR S. HATTEKAR

DATE: 14/10/2024

Indian Institute of Technology Bombay

By: [Signature]

Name: Prof. Upendra Bhandarkar

Title: Associate Dean R&D

Date: 14<sup>th</sup> October 2024

सह संकायाध्यक्ष, शोध एवं विकास  
Associate Dean, Research and Development  
कृते निदेशक, आय आय टी मुंबई  
For Director, IIT Bombay

IN THE PRESENCE OF  
WITNESS

[Signature]

NAME: MILIND SOHONI

DATE: 14/10/2024