Brihanmumbai Municipal Corporation

RFP for Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC

Bid No.: 2023_MCGM_951482

Issued By

Director, Information & Technology Department
Brihanmumbai Municipal Corporation

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1 Glossary

Abbreviations and Acronyms	Description
AAI	Airport Authority of India
ATC	Air Traffic Control
AMC/CMC	Annual Maintenance Contract/ Comprehensive Maintenance Contract
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AOI	Area of Interest
API	Application Programming Interface
AWS	Automatic Weather Station
BEC	Bid Evaluation Committee
BMC	Brihanmumbai Municipal Corporation
BoM	Bill of Material
BoQ	Bill of Quantity
BPP	Bits per pixel
CCN	Change Control Notice
Cert-In	(The Indian Computer Emergency Response Team) is a government-mandated information technology (IT) security organization
CMMi	Capability Maturity Model Integration
CORS	Continuously Operating Reference Station
COTS	Commercial Off the Shelf Solution
CSP	Cloud Service Provider
DC	Data Centre
DoS	Denial of Service
DdoS	Distributed Denial of Service
DGCA	Directorate General of Civil Aviation
DGPS	Differential Global Positioning System
DP	Development Planning
DRC	Disaster Recovery Centre
DSC	Digital Signature Certificate

DEM	Digital Elevation Model
DSM	Digital Surface Model
DTM	Digital Terrain Model
ELA	Enterprise License Agreement
EMD	Earnest Money Deposit
E.P.F	Employees' Provident Funds
FMS	Facility Management Services
FRS	Functional Requirement Specification
GoI	Government of India
GIS	Geographical Information System
GIGW	Guidelines for Indian Government Websites
GCP	Ground Control Points
GCN	Ground Control Network
GNSS	Global Positioning Navigation
GSD	Ground Sample Distance
GST	Goods and Service Tax
HoD	Head of Department
IMU	Inertial Measurement Unit
IOPS	Input Output Per Second
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITS	Intelligent Transportation System
ISMS	Information Security Management System
KPI	Key Performance Indicators
LDAP	Lightweight Directory Access Protocol
LiDAR	Light Detection and Ranging
LOA	Letter of Approval/Acceptance
LoD	Level of Detail
LoI	Letter of Intent
LULC	Land Use Land Cover

Last five financial years	2017-18, 2018-19, 2019-20, 2020-21, 2021-22
MCE	Multiple Criteria Evaluation
MeitY	Ministry of Electronics and Information Technology
MMR	Mumbai Metropolitan Region
MoD	Ministry of Defense
M.P Act	Miscellaneous Provisions Act
NUIS	National Urban Information System
OGC	Open Geospatial Consortium
OEM	Original Equipment Manufacturer
O&M	Operation and Maintenance
OWASP	Open Web Application Security Project
PDC	Primary Data Center
PO	Purchase Order
POC	Proof of Concept
PBG	Performance Bank Guarantee
QA/QC	Quality Assurance / Quality Check
RAM	Random Access Memory
RDBMS	Relational Database Management System
RGB	Red Green Blue
RPO	Recovery Point Objective
RTO	Recovery Time Objective
SDD	Software Design Document
SI	System Integrator
SLA	Service Level Agreement
SOI	Survey of India
SOP	Standard Operating Procedure
Sf	Score Financial
St	Score Technical
SPOC	Single Point of Contact
Ns	Net Score

SRM	Supplier Relationship Module
SRS	System / Software Requirement Specification
STLC	Software Testing Life Cycle
SQTC	Software Quality Testing and Certification
UAT	User Acceptance Testing
ULB	Urban Local Body
UTM	Universal Transverse Mercator
VAPT	Vulnerability Assessment and Penetration Testing
VPC	Virtual Private Cloud
VLBS	Virtual Load Balancer Services
WDC	Worli Data Centre
WFS	Web Feature Service
WMS	Web Map Service
WMTS	Web Map Tile Service

BRIHANMUMBAI MUNICIPAL CORPORATION

Information Technology Department

No. Dir/ IT / 491405 dated 10.10.2023

E-TENDER NOTICE

Subject: RFP for Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC

1. The Commissioner of Brihanmumbai Municipal Corporation invites e-bids for the work mentioned below. The bid copy can be downloaded from Mahatenders portal (https://mahatenders.gov.in) -> "Tenders by Organisation" tab -> Municipal Corporation of Greater Mumbai.
2. All interested Bidders, whether already registered or not registered in BMC, are mandated to get registered with Mahatenders for e-Tendering process and obtain Login Credentials to participate in the Online bidding process. The details of the same are available on the above-mentioned Mahatenders portal under 'Help For Contractors'.
3. The Bidders can get digital signatures from any one of the certifying Authorities (CA's) licensed by the Controller of Certifying Authorities namely Safescrypt, IDRBT, National Informatics Centre, TCS, Customs, MTNL GNFC and e-Mudhra. A list of CAs is available on https://cca.gov.in/licensed_ca.html
4. The technical and commercial bids shall be submitted online up to the end date & time mentioned below.

#	Description	Scrutiny Fee	EMD	Start date & Time for online Bid Downloading	End date & Time for online Bid Submission
1	Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC	Rs. 25,000/- + 9% CGST 9% SGST	Rs. 2,28,12,040/-	10.10.2023 at 11.00 hrs	23.11.2023 at 16.00 hrs
Note: Last date for online payment of Bid Security / Earnest money Deposit (EMD) is before due / end date & time for online Bid Submission prescribed above.					

5. The pre-bid meeting will be held on 26.10.2023 at 15.00 hours, at venue – Office of Director (IT), Worli Data Center, Engineering Hub Building, Dr. E. Moses Road, Worli, Mumbai-400018.
6. The prospective Bidder(s) should submit their suggestions/observations, if any, by email to director.it@mcgm.gov.in with a copy to ae01.it@mcgm.gov.in & se01.it@mcgm.gov.in before 2 days of Pre-bid meeting. Only suggestions / observations received by email will be discussed and clarified in pre-bid meeting and any modification of the bidding documents, which may become necessary as a result of pre-bid meeting, shall be made by BMC exclusively through the issue of an addendum/corrigendum and shall be published on https://mahatenders.gov.in.

7. Bidders shall note that any corrigendum issued regarding this E-Procurement notice will be published on the https://mahatenders.gov.in portal only. No corrigendum will be published in the local newspapers.
8. The Bid document uploaded shall be read in conjunction with any addendum / corrigendum. A maximum of two authorized representatives of prospective Bidder(s), who have an authorization letter to attend the pre-bid meeting, can attend the pre-bid meeting and obtain clarification regarding specifications, works & Bid conditions.
9. The Bidder shall have to pay "Scrutiny Fee" through offline payment via challan to CFC (Citizen Facilitation Center) of BMC before refund of Bid Security or may request BMC to deduct from the amount of Bid Security at the time of refund of Bid Security.
10. The Bidder shall have to pay **Bid Security / Earnest Money Deposit (EMD)** through online payment only. N**ote: - No Exemption will be allowed for the Bidders having a standing deposit with BMC.**
11. Bidder agencies are advised to study this bid document carefully before submitting their bids in response to the Bid Notice. Submission of a bid in response to this notice shall be deemed to have been made after careful study and examination of this document with full understanding of its terms, conditions and implications.
12. This bid document is non-transferable.
13. A three-envelope (prequalification, technical qualification and commercial offer) selection procedure shall be adopted.
14. Bidder (authorized signatory) shall submit their offer online in electronic formats of technical (including prequalification documents) and financial proposal.
15. BMC will not be responsible for delays in online submission due to any reason. For this, bidders are advised to upload the complete bid proposal well in advance before the due date and time so as to avoid issues like slow speed, choking of web site due to heavy load or any other unforeseen problems.
16. Bidders are also advised to refer to “Bidders Manual Kit” and Help for Contractors available at https://mahatenders.gov.in for further details about the e-tendering process.
17. For any assistance on use of eTendering system, kindly contact helpdesk number 022-24811275, Email: etendering.it@mcgm.gov.in
18. The Authority (BMC) shall not be liable for any omission, mistake or error in respect of any of the above or on account of any matter or thing arising out of or concerning or relating to the Bid or the Bidding Process, including any error or mistake therein or in any information or data given by the Authority.

Sd/-

Director (IT)

2 Invitation of Bid

Brihanmumbai Municipal Corporation (BMC) invites RFP for "Development, Implementation, and Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC" as per the terms and conditions attached with this document and as per the provisions of the M.M.C. Act 1888 as amended till date.

Note: Bidder/ Agencies are advised to study this RFP document carefully before submitting their proposals in response to the RFP Notice. Submission of a proposal in response to this notice shall be deemed to have been done after careful study and examination of this document with full understanding of its terms, conditions and implications.

2.1 Project Background

While the world we live in is 3Dimensional in nature, planning and development activities encompassing urban governance, city infrastructure upgrades, etc. are still being carried out on 2D maps. To meet the demands of cities in the 21st Century, it is imperative that urban governments can visualize their cities in 3D for getting comprehensive 360° views, undertake simulations and conduct detailed analysis on the data, etc. all of which is inefficient and close to impossible on archaic 2D maps. To overcome this, major developed cities in the world have adopted City Centric Digital Twins. These provide unsurpassed assistance in improving critical city focused activities such as emergency and disaster management, citizen engagement, simulation, planning, zoning and development. They have the potential to assist planners in reaching local climate resilience, economic development and housing goals.

Leveraging these international best practices, Brihanmumbai Municipal Corporation (BMC) intends to develop, implement & maintain 3D city model of Mumbai and perform change detection on 3D city model year-on-year.

2.2 Project Objective

BMC has set following objectives of the Project:

1. Setting up permanent Continuously Operating Reference Station (CORS) network in Mumbai, get the CORS network validated & certified by Survey of India (SOI).
2. Survey for capturing Ground Control Points (GCPs) using DGPS instruments & setting up Ground Control Network (GCN), if required. The available GCPs with BMC will be provided to SI.
3. Aerial Photogrammetry & LiDAR survey
4. Survey for capturing Terrestrial LiDAR & 360 degrees Panoramic Street View Imagery
5. Survey for capturing LiDAR data & 360 degrees Panoramic Street View Imagery using mobile backpack device

6. Bathymetric Survey of water bodies like River, lakes & ponds (one-time)
7. Following Geospatial deliverables are expected from the survey conducted:
    a. 2D basemap Orthomosaic using Aerial imagery of Mumbai
    b. Land Use Land Cover (LULC) map of Mumbai
    c. 3D basemap (True Orthophoto) of Mumbai
    d. DSM & DTM of Mumbai
    e. Contour data of Mumbai
    f. 360 degrees Panoramic Street View Imagery of Mumbai
    g. Terrestrial & Mobile LiDAR Data of Mumbai
    h. Bathymetric data of water bodies in Mumbai (one-time)
    i. 3D reality mesh model of Mumbai using aerial photogrammetry, LiDAR, terrestrial & mobile LiDAR & 360 degrees Panoramic Street View Imagery
    j. 3D LoD 3 vector model consisting of Buildings, Roads, Bridges, Flyover, Tunnels, Railways, Mono, Metro, Street lights, Traffic signals, Water bodies, Trees, Landscapes, Open spaces, Airports, Gardens, Slum and all other features having height with reference to Aerial data complying with LoD3 specifications
8. Change detection Map of Mumbai capturing all changes every year for three years after Go-Live
9. Development Implementation of Enterprise Geospatial Applications
    a. 3D GIS web application with different use cases mentioned in the scope of work section
    b. 3D GIS Android & iOS mobile app
    c. 3D GIS Dashboards
    d. Integration of 3D GIS web application & services with existing IT & GIS applications
10. Security testing, VAPT & Load testing by CERT-IN empaneled agency at Go-Live & then every year for 3 years
11. Supply installation of High-end workstation (5 nos.), Color printers (2 nos.), 3D Projector (1 nos.) with 3D glasses (5 nos.) as per specifications mentioned in scope of work
12. Annual Maintenance Contract of all hardware, software, data, applications & services provided under the scope of work for 3 years after Go-Live.

The SI has option available to integrate and use Google's Street View.

The details of each objective are explained in the scope of work section.

2.3 Bid Invitation

Director, Information Technology, Brihanmumbai Municipal Corporation invites bidders to submit their technical bids and financial offers for the selection of System Integrator (SI) for **Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC** in accordance with conditions and manner prescribed in this bid document.

3 Pre-Qualification Criteria

A firm or an individual sanctioned (blacklisted/debarred) by BMC in accordance with BMC Guidelines shall be ineligible to be awarded a BMC-financed contract, or to benefit from a BMC-financed contract, financially or otherwise, during such period of time as BMC shall determine. System Integrators should have office in Mumbai Metropolitan Region (MMR - Mumbai / Navi Mumbai / Thane). If not, it should open office in the MMR region within 3 months of award of contract. The bidder should be an Indian company only.

Only System Integrators complying the Pre-qualification Criteria shall be eligible to participate in the tender process. The minimum eligibility criteria that should be satisfied by the System Integrators are mentioned below. The formats for the Pre-qualification documents are given in Annexures of this tender, unless specified otherwise.

Note: Projects submitted by the System Integrator as part of experience towards eligibility and technical evaluation should have been done by the bidding entity as a sole System Integrator or as a consortium member responsible for specific work. The System Integrator must submit the documentary evidence/agreement showing roles and responsibilities division among consortium members

#	Qualification Criteria	Applicability	Documentary Evidence
1.	The Bidder must be a company registered under Indian Companies Act, 2013 or a Partnership Firm registered under Indian Partnership Act, 1932 or Limited Liability Partnership Firm under Limited Liability Partnership Firm Act 2008.	Bidder	Copy of Certificate of Incorporation signed by Authorized Signatory of the Bidder / Certified deed of partnership
2.	The Bidder should have an average annual turnover of at least ₹ 170 Crore from Remote Sensing/ Photogrammetry/ GIS services/ Aerial Aircraft LiDAR survey over five financial years.	Bidder	Copy of the audited Balance Sheet and Profit & Loss Statement of the company and/or Certificate from the Chartered Accountant clearly stating the average annual turnover Remote Sensing/ Photogrammetry/ GIS services/ Aerial Aircraft LiDAR survey over five financial years.

3.	The bidder should have positive net worth in last five financial years and should not have incurred losses.	Bidder	Audited balance sheet, profit & loss statement and certificate from certified Chartered Account mentioning positive net worth.
4.	The bidder must have executed or currently executing national or international project(s) containing similar works* of below mentioned value in last five financial years: 1. At least one project with a value not less than ₹ 35 Crore **OR** 2. At least two projects with a value not less than ₹22 Crore each **OR** 3. At least three projects with a value not less than ₹17 Cr-ore each	Bidder	1. Valid Work Order/PO issued by the client 2. Completion certificate issued by the client for projects that are completed 3. For on-going projects, work progress certificate issued by the client certifying 75% payment of the total contract value has been released by the client. 4. The certificates should be issued by the competent authority clearly stating the scope, current status and the contact details of the reference person. 5. The work orders should have been issued in the last five years from the date of the submission of the bid. (For international projects, to convert project value into INR, exchange rate will be referred from RBI's web site www.fbil.org.in for respective year)
5.	The Bidder should have executed or currently executing development, implementation & maintenance of Enterprise GIS projects* of below mentioned value in last Five financial years in India: • At least one project with a value not less than ₹3 crore **OR**	Bidder	1. Valid Work Order/PO issued by the client 2. Completion certificate issued by the client for projects that are completed 3. For on-going projects, work progress certificate issued by the client certifying 75% payment of

	• At least two projects with a value not less than ₹2 crore each **OR** • At least three projects with a value not less than ₹1 crore each		the total contract value has been released by the client. 4. The certificates should be issued by the competent authority clearly stating the scope, current status and the contact details of the reference person. 5. The work orders should have been issued in the last five years from the date of the submission of the bid. (For international projects, to convert project value into INR, exchange rate will be referred from RBI's web site www.fbil.org.in for respective year)
6.	The bidder should have at least 500 sq. km of total experience of Aerial aircraft LiDAR survey & data processing from multiple projects in last five years	Bidder	1. Valid Work Order/PO issued by the client 2. Completion certificate issued by the client for projects that are completed
7.	The bidder must possess the below certification: • CMMi level 3 or higher • ISO 9001:2015 certification. • ISO 27001:2013 certification	Bidder	Self-attested Copy of valid certificate of CMMI Level 3 or Higher, ISO 9001:2015 certification and ISO 27001:2013 certification
8.	The bidder should have or shall be ready to set up a project office in Mumbai Metropolitan Region (MMR).	Bidder	Rental Agreement/ Utility Bill in the name of the company/Sale Deed or Declaration that the office will be set-up within a period of 90 days from the date of issuance of Letter of Intent/Letter of Award/Work Order.
9.	The bidder must have GST registration number.	Bidder	Copy of GST registration cerificate

10.	The bidder must have Income Tax Returns for the last five assessment years, PAN card and valid GST registration number	Bidder	Copy of Income Tax returns for the last five assessment years, valid GST registration number document and PAN Card
11.	The bidder must not have been blacklisted or debarred by any Central/State Government Organization in India at the time of submission and at the stage of signing the contract.	Bidder	Declaration by the Bidder as per format given in the bid document
12.	The Bidder must have registration certificate under E.P.F. and M.P. Act 1952	Bidder	Copy of registration of E.P.F. and M.P.
13.	The bidder should have at least 30 technical resources on its payroll in India as on date of bid with more than 8 years of industry experience in GIS & Remote Sensing domain and their certifications should be valid till the submission of this bid. Following are the types of profile: a. 3 Photogrammetry Experts b. 3 Image Processing Experts c. 3 GIS Analysts d. 3 Business Analysts e. 3 Solution Architects f. 3 GIS Application developers g. 3 Software Testers h. 3 Database Administrators i. 3 Project Managers j. 3 Technical Support staff	Bidder	Certificate from HR for the overall count of resources. Complete resumes of the resources proposed for Selection Copies of Certification in specific domain/technology

*__Similar Works__: Should include projects involving Aerial LiDAR Survey/ Terrestrial LiDAR with 360° Panoramic images/ Mobile LiDAR with 360° Panoramic images along with creation of 3D City model, implementation & maintenance of Enterprise GIS application.

*__Enterprise GIS based Projects__: Projects involving GIS data migration, data conversion, data modelling, Satellite/ Drone image acquisition & processing with development, implementation & maintenance of Enterprise GIS solution for sectors like Municipal corporation, ULBs, Smart City, AMRUT, Water Resource department, Property tax, Land Cadastral mapping, Town/ Regional Planning Authorities, Utilities, Disaster Management, Roads & Highways, or similar.

Consortiums are not allowed for this tender.

4 Instructions to Bidder

4.1 Bid Data Sheet

#	Information	Details
A. Introduction		
1.	Project Name	Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC
2.	Bid Document reference No and Start Date	2023_MCGM_951482 10.10.2023
3.	Bid Type	Open Tender via e-Tendering system
4.	Bid Download Due Date	23.11.2023
5.	Earnest Money Deposit (EMD)	INR 2,28,12,040/-
6.	EMD Submission Due Date & Time	23.11.2023
7.	Addressee & Address for EMD to be submitted	To be paid Online
8.	Bank Solvency Certificate	INR 8,00,000/- (As per the latest circular issued by BMC)
9.	Performance Bank Guarantee	10% of the contract value within one month from the date of issue of Letter of Acceptance.
B. Preparation of Bids		
10.	Language of Bid	English
11.	Bid Validity Period	180 Calendar Days from the Date of Opening of Bid
12.	Performance Security Validity Period	Valid up to the entire contract period + 3 months or payment of final bill whichever is later.
C. Bid Presentation		
13.	Last date for submission of written queries for clarifications	23.10.2023
14.	Query Submission	To be submitted via E-mail to director.it@mcgm.gov.in with Copy to ae01.it@mcgm.gov.in , se01.it@mcgm.gov.in only. Kindly refer Annexure X for query format.
15.	Place, Date and Time of pre-bid meeting (Online/ Onsite)	26.10.2023 at 1500Hrs. Office of Director, Information Technology,

#	Information	Details
		Worli Data Center, opposite Furniturewala, Dr. E. Moses Road, Worli, Mumbai - 400018
16.	Contact Person for clarification of Queries	Shri Sharad Ughade Director (IT), Information Technology Department, Worli Data Center, Engg. Hub Bldg., Dr. E. Moses Road, Worli, Mumbai – 400018.
17.	Contact Information	ae01.it@mcgm.gov.in, se01.it@mcgm.gov.in 022-24811254/ 022-24811289
18.	Last date (deadline) for receipt of proposals in response to Bid Document notice	To be submitted Online by 23.11.2023, 1600Hrs
19.	Place, Time and Date of opening of Technical proposals (Packet A & B) received in response to the Bid Document notice	24.11.2023, 1600Hrs Office of Director (IT), Information Technology Department, Worli Data Center, Engg. Hub Bldg., Dr. E. Moses Road, Worli, Mumbai – 400018
20.	Place, Time and Date of technical presentations by qualified bidders.	Will be informed to qualified bidders through e-mail
21.	Place, Time and Date of opening of Financial proposals received in response to the Bid Document notice	Will be informed to qualified bidders through e-mail
D. Evaluation of Bids and Awarding of Contract		
22.	Signing of Contract Agreement with BMC	Within 30 days after issuing LOA/LoI

4.2 Purpose of Bid Document

The purpose of this Bid Document is to select Agency for Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC as per the scope defined in the subsequent sections. This document provides information to enable the bidders to understand the broad requirements to submit their 'Bids'.

4.3 Scrutiny Fees

Scrutiny fees to be paid by following due process as mentioned in the e-Tender Notice.

4.4 Bidder Registration and Instructions

As mentioned in the e-Tender Notice

4.5 Bid Preparation Cost

1. The Bidder is responsible for all costs incurred in connection with participation in this process, including, but not limited to, costs incurred in the conduct of informative and other diligence activities, participation in meetings/discussions/presentations, preparation of bid, in providing any additional information required by BMC to facilitate the evaluation process, and in negotiating a definitive Contract or all such activities related to the bid process. BMC will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
2. This bid does not commit BMC to award a contract or to engage in negotiations. Further, no reimbursable cost may be incurred in anticipation of award. All materials submitted by the Bidder shall become the property of BMC and may be returned at its sole discretion.

4.6 Pre-bid Meeting

1. BMC will host a Pre-bid Meeting for queries (if any) by the prospective bidders. Details regarding the date, time and place of the meeting are provided in Section 4.1. A maximum of two representatives of each of the bidder may attend the pre-bid meeting on the production of authority letter from the applicant at their own cost. The pre-bid meeting may be conducted On-site. The purpose of the pre-bid meeting is to provide a forum to the bidders to clarify their doubts / seek clarification or additional information, necessary for them to submit their bid.
2. All enquiries from the bidders relating to this bid must be submitted to the designated contact person as mentioned in section 4.1 of this bid document. The queries should necessarily be submitted in the format as given in Annexure-X as a Microsoft Word/Spreadsheet document.
3. Authorisation letter in the name of the person attending the pre-bid meeting needs to be submitted on the letterhead of the Bidder during the pre-bid meeting in the format specified in Annexure VI.
4. Queries submitted post the specified deadline, or which do not adhere to the specified format may not be responded to. Any modification of the bidding documents, which may become necessary as a result of pre-bid meeting, shall be made by BMC exclusively through the issue of an addendum/corrigendum and shall be published on https://mahatenders.gov.in.

4.7 Amendment of Bid Document

1. At any time prior to the deadline for submission of Bids, BMC may amend the bidding document by issuing addenda\ corrigendum.

2. BMC shall publish the addendum\ corrigendum on eTendering website and any addendum\ corrigendum issued shall be part of the bidding document.
3. To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the BMC may, at its discretion, extend the deadline for the submission of Bids

4.8 Rights to Terminate the Process

1. BMC may terminate the bid process at any time and without assigning any reason. BMC makes no commitments, express or implied, that this process will result in a business transaction with anyone.
2. This bid document does not constitute selection offer by BMC. The Bidder's participation in this process may result in BMC selecting the Bidders to engage in further discussions and negotiations towards execution of a contract. The commencement of such negotiations does not, however, signify a commitment by BMC to execute a contract or to continue negotiations. BMC may terminate negotiations at any time without assigning any reason.

4.9 Earnest Money Deposit (EMD) and Refund

1. Bidders shall pay, along with their Bids, EMD amount as mentioned in Section 4.1, and it shall be paid online only.
2. In case a bid is submitted without the EMD as mentioned above then BMC reserves the right to reject the bid without providing opportunity for any further correspondence to the Bidder concerned.
3. The EMD shall be denominated in Indian Rupees only. No interest shall be paid by BMC towards the deposited EMD.
4. EMD of the successful bidder will be discharged when the bidder has signed the agreement and furnished the required Security Deposit/ Performance Bank Guarantee (PBG) and compliance of contractual formalities as per format. EMD of L-2 and other bidders shall be refunded immediately after award of contract in eTendering System. In case, the successful bidder becomes non-responsive or successful bidder withdraws the bid or is unwilling to extend the bid validity period, in such circumstances, if L-2 bidder is agreeable to extend the bid validity period and ready to deposit the requisite amount of EMD to the department within the stipulated time period i.e. 15 days, the department will process further as per normal procedure.
5. The entire EMD may be forfeited in any of the following cases:
    i. If a Bidder withdraws its bid or increases its quoted prices during the period of bid validity or its extended period, if any

ii. In the case of all successful Bidders, if the Bidders fails to sign the Contract or to furnish Performance Bank Guarantee within specified time in accordance with the format given in this bid document

iii. During the bid process, if a Bidders indulges in any such deliberate act as would jeopardize or unnecessarily delay the process of bid evaluation and finalization

iv. During the bid process, if any information is found wrong / manipulated / hidden in the bid

6. The decision of BMC regarding forfeiture of the EMD and rejection of bid shall be final and shall not be called upon question under any circumstances.
7. EMD of Successful bidder will be returned after the award of contract and submission of the performance Bank Guarantee within specified time.
8. No rejections and forfeiture shall be done in case of curable defects. For non-curable defects the bid will be liable for rejection.

Note:

1) Curable Defect shall mean shortfalls in submission such as:
   a. Non-submission of following documents
      i. Valid Registration Certificate
      ii. Valid Bank Solvency
      iii. GST Registration Certificate
      iv. Certified Copies of PAN documents and photographs of individuals, owners, etc.
      v. Partnership Deed and any other documents
      vi. Undertakings as mentioned in the tender document.
2) Non-Curable Defect shall mean
   a. In-adequate submission of EMD amount,
   b. In-adequacy of technical and financial capacity with respect to Eligibility criteria as stipulated in the tender
   c. Wrong calculation of Bid Capacity
   d. No proper submission of experience certificates and other documents, etc.

4.10 Solvency Certificate

A valid Bank Solvency Certificate of amount as mentioned in Section 4.1 has been issued not more than six months prior to the date of submission of bid needs to be submitted in the Pre-Qualification folder (Packet 'A').

4.11 Submissions of Bids

1. Complete bidding process will be online (e-Tendering) in Three packet system. All the notification and details regarding terms and conditions related to this bid notice hereafter will be published online on the eTendering website (https://mahatenders.gov.in)
2. Bidding documents can be seen, downloaded and submitted in electronic format on the Mahatenders portal (https://mahatenders.gov.in). The deadline for submission of bid is specified in section 4.1 of this document.
3. Technical bids will be opened as per the details found in section 4.1 of this document.
4. Bidders should submit information and scanned copies of all the documents in PDF format in Pre-Qualification folder (Packet 'A') as mentioned in the Bid Document. Bidder should submit information and scanned copies pertaining to technical offer in PDF format in (Packet 'B') as mentioned in the Bid Document.
5. Bidder may be requested to submit original documents for verification during evaluation of technical bids as and when required.
6. Time and date of opening of financial bid will be informed by Email to technically qualified bidders.
7. An authorized representative of the Bidder should have valid class III Digital Signature Certificate (DSC) with signing and encryption obtained from any Certifying Authority. The authorized representative of the Bidder shall digitally sign the bid wherever applicable. The authorization shall be in the form of a written power of attorney accompanying the bid or in any other form demonstrating that the representative has been duly authorized to sign.
8. On opening the Pre-Qualification cover (Packet A) or Technical Cover (Packet B), if it is found that the Bidder has not submitted required documents as per Pre-qualification Criteria and Technical Criteria (Curable Defects) then the Bidder shall be intimated to comply with the said documents within 3 working days from the intimation from BMC (through email), otherwise bid shall be treated as non-responsive.
9. BMC reserves the right to accept or reject any or all the Bids without assigning any reason. Moreover, if no intimation is provided by BMC then the documents submitted cannot be deemed as accepted.

4.12 Site Visit

Bidders are welcomed to visit the site(s) and obtain additional information at their own cost and responsibility. However, a prior appointment with the concerned officials is recommended.

4.13 Language of Bids

- The Application and all related correspondence and documents in relation to the Bidding Process shall be in English language. Supporting documents and printed literature furnished by the Applicant with the Application may be in any other language provided that they are accompanied by translations of all the pertinent passages in the English language, duly authenticated and certified by the Applicant. Supporting materials, which are not translated into English, may not be considered. For the purpose of interpretation and evaluation of the Application, the English language translation shall prevail.

4.14 Bid Submission Format

The entire bid shall strictly be submitted as per the formats specified in this bid.

4.15 Documents Comprising of Bids

1. Following table is provided as the guideline for submitting various important documents along with the bid.

#	Type of Envelope	Documents to be submitted
01	Pre-Qualification Folder (Packet A)	✓ Receipt of Tender Fee paid ✓ Cover Letter ✓ Bidder's Particulars as per specified format in Annexure I ✓ Board Resolution authorizing the Bidder to sign / execute the bid as a binding document and also execute all relevant agreements forming part of bid or Power of Attorney executed by the Bidder in favour of the Principal Officer or the duly Authorized Representative, certifying him/her as an authorized signatory for the purpose of this bid ✓ Copy of Certificate of Registration/Certificate of Incorporation/Latest Partnership Deed in case of Partnership ✓ Valid Solvency Certificate as specified ✓ All the documentary evidence required as per pre-qualification criteria mentioned in section 3 (Pre-Qualification Criteria) of this bid
02	Technical Bid Folder (Packet B)	✓ Technical Bid in the format specified in Annexure II ✓ Copy of the audited Profit and Loss Statements and Copy of Certificate from Chartered Accountant clearly stating the average annual turnover

		from Remote Sensing/ Photogrammetry/ GIS services over five financial years ✓ Completed Projects: Copy of Work Order & Work Completion certificate of the project from respective client clearly stating the scope, status of project and the contact details. ✓ Ongoing Projects: In case of an ongoing project, the project must have gone live, and bidder should submit such certificate from the respective client with contact details. (For international projects, to convert project value into INR, exchange rate will be referred from RBI's web site www.fbil.org.in for respective year). ✓ Copy of the Valid Certificate issued by CMMI institute partner (for CMMi certificate) / ISO accredited member (for ISO certificate) and renewal stage document in case the certificate has expired, and renewal is in-process. Validity of CMMi certificate shall be ascertained through the below given URL https://cmmiinstitute.com/pars/ ✓ Technical Proposal as mentioned in technical qualification criteria. ✓ Certificate from HR for all types of resources with experience and complete resumes of the proposed resources. Resources who have completed any certification should submit copy of certificate and link to verify their certification. ✓ All the documentary evidence required as per Technical qualification criteria mentioned in section 4.18 of this bid ✓ Technical Bill of Material (to be provided by the Bidder) ✓ Other Documents (as per requirements of the bid) ✓ Commercial Bid Cover Letter
03	Commercial Bid Folder (Packet C)	✓ To be submitted online. ✓ The Bidder should not quote his financial offer anywhere directly or indirectly in Packet-A/ Packet-B.

2. Bidders shall furnish the required information on their Pre-Qualification, technical and financial bids in enclosed formats only. Any deviations in format may make the bid liable for rejection. Disclosure of Commercial information of the bid in Pre-Qualification or Technical Envelope shall be enough grounds for rejection of the bid.
3. The bidders shall categorically provide their Email-ID in Packet-A.

4.16 Withdrawal of Bids

1. A Bidder wishing to withdraw its bid shall notify to BMC by e-mail prior to the deadline prescribed for bid submission. A withdrawal notice may also be sent by electronic means such as e-mail, but it must be followed by a signed confirmation copy, postmarked no later than the deadline for submission of bids.
   The notice of withdrawal shall be
   a) addressed to BMC at the address named in the Bid Data Sheet, and
   b) bear the Contract name, the <Title> and < Bid No.>, and the words "Bid Withdrawal Notice." Bid withdrawal notices received after the bid submission deadline will be ignored, and the submitted bid will be deemed to be a valid submitted bid
2. No bid should be withdrawn in the interval between the bid submission deadline and the expiration of the bid validity period specified in the Bid Data Sheet. Withdrawal of a bid during this interval may result in the forfeiture of the Bidder's EMD

4.17 Evaluation Process

1. The evaluation process of the bid proposed to be adopted by BMC is indicated in this section. The purpose of this section is to provide the Bidder an idea of the evaluation process that BMC may adopt.
2. BMC shall appoint a Bid Evaluation Committee (BEC) to scrutinize and evaluate the technical and commercial bids received. The BEC will examine the Bids to determine whether they are complete, responsive and whether the bid format conforms to the bid requirements. BMC may waive any informality or non-conformity in a bid which does not constitute a material deviation according to BMC.
3. There should be no mention of bid prices in any part of the bid other than the Commercial Bid (Packet C).
4. Any attempt by a bidder to influence the bid evaluation process may result in the rejection of Bid.

4.18 Evaluation of Technical Bids

1. The Technical Bids of only those Bidders, who qualify in the Pre-Qualification stage, shall be considered and will be evaluated as per the evaluation criteria in this clause. The Bid Evaluation Committee (BEC) shall invite each Bidder to make a presentation-cum-demonstration as part of the technical evaluation.
2. BMC shall appoint a Bid Evaluation Committee (BEC) to scrutinize and evaluate the technical and commercial bids received. The BEC will examine the Bids to determine whether they are

complete, responsive and whether the bid format conforms to the bid requirements. BMC may waive any informality or non-conformity in a bid which does not constitute a material deviation according to BMC.

3. There should be no mention of bid prices in any part of the bid other than the Commercial Bid. Presence of details regarding commercials in any other section or document would lead to disqualification of the bidder.
4. Bidders should not submit physical copies of the bid to the IT Department. Submission of the same would lead to disqualification of the bidder.
5. The BEC may require written clarifications from the Bidders to clarify ambiguities and uncertainties arising out of the evaluation of the Bid documents (to be stated precisely as it should be in BMC's interest). In order to qualify technically, a Bid must secure a minimum of 70% of total marks in technical evaluation after summing up. Only those Bids which have a minimum score of 70% of total marks in technical evaluation will be considered for opening of their Commercial Bid. However, the BEC reserves the right to lower the minimum required marks if none of the Bidders achieves 70% of the total marks. Only the Bids qualifying the technical evaluation will be considered for commercial evaluation.
6. The bidders' technical solutions proposed in the bid document will be evaluated as per the requirements specified in the Bid document and adopting the evaluation criteria spelt out is below.
7. Technical Evaluation of the bids would be carried out on following broad parameters:

#	Parameter	Maximum Marks
A	Financial Capability of the Bidder	10
B	Bidder's Competence and Similar Project Experience	40
C	Quality of Technical Proposal	10
D	Quality of Human Resources	20
E	Presentation on Proposal	20
	Total	**100**

The five evaluation parameters would be divided into various sub-categories as mentioned below:

A. Financial Capability of the Bidder – Total 10 marks

#	Evaluation Criteria	Maximum Marks	Criteria	Supporting Documents
A1	Financial Capability of the bidder	10	Average Annual Turnover of Bidder from Remote Sensing / Photogrammetry / GIS /IT services for the last five financial years: • **>= ₹ 170 Crore and <= ₹ 200 Crore – 07 marks** • **> ₹ 200 Crore – 10 marks**	Copy of audited Balance sheet

B. Bidder's Competence and Similar Project Experience - Total 40 marks

#	Evaluation Criteria	Maximum Marks	Criteria	Supporting Documents
B1	Bidder's Competence for execution of similar projects	15	The bidder must have executed or currently executing national or international project(s) containing similar works* of below mentioned value in last five financial years: • **One project with a value more than ₹ 35 crore – 8 marks** • **Two projects with a value more than ₹22 crore each – (2 mark per project) total 4 marks** • **Three projects with a value more than ₹17 Crore each – (1 mark per project) total 3 marks**	1. Valid Work Order/PO issued by the client 2. Completion certificate issued by the client for projects that are completed 3. For on-going projects, work progress certificate issued by the client certifying 75% payment of the total contract value has been released by the client. 4. The certificates should be issued by the competent authority clearly stating the scope, current status and the contact details of the reference person. 5. The work orders should have been issued in the last five years from the date of the submission of the bid. (For international projects, to convert project value into INR, exchange rate will be referred from RBI's web site www.fbil.org.in for respective year) **Out of consideration:** ➢ Those projects with scope only for supply of COTS GIS software / Remote Sensing products like Satellite imagery / Hardware surveying products will not be considered.

B2		20	• Integrated Aerial optical and LiDAR sensor (as per the Specification in Annexure XII) **1 quantity – 5 marks** **2 quantity – 10 marks** • Terrestrial Mobile LiDAR systems integrated with 360-degree Panoramic Imaging Systems (as per the Specification in Annexure XIII) **2 quantity – 2.5 marks** **3 quantity – 5 marks** • Backpack LiDAR system (as per the Specification in Annexure XIII) **2 quantity – 2.5 marks** **3 quantity – 5 marks**	Original Copy of the Invoice of the equipment, Original specification sheet of the equipment, calibration report (if any), etc.
B3		2.5	Total experience of Aerial aircraft LiDAR survey & data processing from multiple projects in last five years • **500 sq km – 1 mark** • **>500 sq km to 1000 sq km – 1.5 marks** • **1000 sq km to 5000 sq km – 2 marks** • **>5000 sq km – 2.5 marks**	1. Valid Work Order/PO issued by the client 2. Completion certificate issued by the client for projects that are completed
B4		2.5	Experience in procuring clearances from DGCA / MoD for Aerial Data acquisition in India (DGCA flying permit) in last five years • **2 Permit – 1.5 marks** • **>2 Permits – 2.5 Marks**	Valid copy of DGCA flying permit

C. Quality of Technical Proposal - Total 10 marks

#	Evaluation Criteria	Maximum Marks	Criteria	Supporting Documents
C1	Bidder's Solution Approach offered in the Technical Proposal	1	Overall approach of the bidder for implementation of 3D city mapping and using change detection technique and Enterprise Geospatial system, Integration with existing GIS applications and data mentioned in this RFP: ➢ Project Management methodology covering milestone timelines, envisaged risks and mitigation plan, deployment plan, maintenance & support plan	Technical Proposal

C2		2	➢ Methodology for creating & processing following: • Digital Aerial aircraft Imagery • LiDAR point cloud (Manned aerial aircraft) • Terrestrial LiDAR mounted on vehicle at street-level • Mobile backpack LiDAR at street-level • 360° Panoramic street view	
C3		2	➢ Methodology for creating 3D reality city model using above mentioned datasets.	
C4		1	➢ Suggest use cases for different BMC departments	
C5		1	➢ Creation/ Update of Land-base map & ground truthing	
C6		1	➢ Methodology for detecting changes (horizontal & vertical) among two different datasets captured at regular intervals.	
C7		1	➢ Approach for design, development, hosting & maintenance of Enterprise Geospatial applications (Web, Mobile & Dashboards) and integration with existing GIS applications and existing data	
C8		1	➢ Use of Innovative technology like AI techniques/ ML techniques/ automated / semi-automated classification, automated / semi-automated feature extraction, etc.	

D. Quality of Human Resources – Total 20 marks

#	Evaluation Criteria	Maximum Marks	Criteria	Supporting Documents
D1	Minimum manpower of the bidder	10	The bidder should have at least 30 technical resources on its payroll in India as on date of bid with more than 8 years of industry experience in GIS & Remote Sensing domain and their certifications should be valid till the submission of this bid. Following are the types of profile: 1) Photogrammetry Experts 2) Image Processing Experts 3) GIS Analysts 4) Business Analysts 5) Solution Architects	Certificate from HR as per Annexure XIII

			6) GIS Application developers 7) Software Testers 8) Database Administrators 9) Project Managers 10) Technical Support staff • **Three resources for each profile (total 30 resources) – 5 marks** • **Four resources for each profile (total 40 resources) – 7 marks** • **Five resources for each profile (total 50 resources) – 10 marks**	
D2	Quality of Project Manager, Photogrammetry, Image processing, GIS and IT Manpower to be Involved and Proposed for the project Implementation & support of the Bidder	03	Suitability of the proposed Project Manager: • **Work experience above 15 years – 2 marks** • **A valid PMP/ Prince 2 Practitioner/ CAPM certification – 1 mark**	
D3		07	Experience of three resources for each profile such as Photogrammetry Experts, Image Processing Experts, GIS Analysts, Business Analysts, Solution Architects, GIS Application developers, Software Testers, Database Administrators: • **Minimum experience for each resource 8 to 10 years – 5 marks** • **Minimum experience for each resource >10 years – 7 marks**	

E. Presentation and Demonstration – Total 20 marks

#	Evaluation Criteria		Maximum Marks	Criteria	Supporting Documents
E1	Technical Presentation and Demonstration of the capability to the Bid Evaluation Committee		10	Demonstration of 3D city model created/ delivered by the bidder and its streaming on web with use cases covering following areas • Disaster Management – 1 mark • Fire brigade – 1 mark • Roads & Bridges – 1 mark • Property Tax – 1 mark	Technical presentation & demonstration to be given to BEC as per the schedule provided by BMC.

				• Development Planning – 1 mark • Renewable Energy – 1 mark • Encroachment – 1 mark • Environment – 1 mark • Garden & Trees – 1 mark • Utilities – 1 mark	
E2			2	➢ **Demonstration of horizontal & vertical change detection in the building structure – 2 marks**	
E3			1	➢ **Demonstration of 3D city model on Mobile device iOS & Android – 1 marks**	
E4			2	➢ **Quality of response against queries raised by the committee – 2 marks**	
E5			5	➢ **Presentation –5 Marks** **Broad Outline of Presentation** • Overall understanding of project - Scope, objectives, outcome • Detailed solution coverage and Web portal features • Overall Approach & Methodology to achieve the project objective • Work Plan Assessment • Capacity Building, Maintenance, Support & compliance monitoring	

*__Similar Works__: Should include projects involving Aerial LiDAR Survey/ Terrestrial LiDAR with 360° Panoramic images/ Mobile LiDAR with 360° Panoramic images along with creation of 3D City model, implementation & maintenance of Enterprise GIS application.

Evaluation shall be done based on the information provided in the technical proposal (and subsequent clarification, if any) **and Clarifications / Answers given to the BEC during the Presentation by the bidders**.

4.19 Opening of Technical Bid

1. BMC shall open the Technical Bids in public, in the presence of Bidders' designated representatives and anyone who chooses to attend, at the address, and at the date and time specified in Section 4.1.
2. Only bids that are opened and read out at the bid opening and whose EMD has been paid online through the e-Tendering Application shall be considered further.
3. All the bids shall be opened one at a time, reading out the name of the Bidder, the presence of an EMD, and any other details as BMC may consider appropriate.
4. BMC shall prepare a record of the bid opening that shall include, at a minimum: the name of the Bidder and the presence or absence of EMD. The Bidders' representatives who are present shall be requested to sign the attendance sheet.
5. Authorization letter in the name of the person attending bid opening meeting needs to be submitted on the letterhead of the Bidder during bid opening in the format specified in Annexure VI.
6. Once the bids are opened each bid will be checked for pre-qualification criteria.

4.20 Opening of Financial Bid

1. The financial bids shall not be opened by BMC until the evaluations of the Pre-qualification and Technical Bids have been completed.
2. After the technical evaluation is completed and BMC has issued its no objection (if applicable), BMC shall notify those Bidders whose proposals did not pass the technical evaluation or were considered as non-responsive to the Bid Document and scope of work, that their Financial Proposals will not be opened.
3. BMC shall simultaneously notify in writing to bidders who have cleared the technical evaluation, the date, time and location for opening the Financial Proposals. The opening date would allow Bidders enough time to make arrangements for attending the opening. Bidders' attendance at the opening of Financial Proposals is optional.
4. BMC shall prepare a record of the bid opening that shall include, at a minimum: the name of the Bidder and the bid Price, and any other details as BMC may consider appropriate. The Bidders' representatives who are present shall be requested to sign the attendance sheet. A copy of the record shall be distributed to all Bidders.
5. Financial Proposals shall be opened publicly in the presence of the Technically Qualified Bidders' representatives who choose to attend. The name of the Technically Qualified Bidders shall be read aloud.

6. Commercial (Financial) Bids from bidders who have failed to qualify in evaluation of the technical bid will not be opened.
7. Only bids that are opened and read out at the bid opening shall be considered further.
8. Authorization letter in the name of the person attending bid opening needs to be submitted on the letterhead of the Bidder during bid opening in the format specified in the bid document.
9. The Commercial Bids will be evaluated by BMC for completeness and accuracy.
10. Activities and items described in the Technical Proposal but not priced, shall be assumed to be included in the prices of other activities or items.
11. Based on the technical evaluation criteria, only those bidders scoring 70% in the technical evaluation will be shortlisted for commercial evaluation.

4.21 Selection Method

1. Based on the technical evaluation criteria, only those bidders scoring **70%** in the technical evaluation will be shortlisted for commercial evaluation.
2. The Technical Score of the bid under consideration will be noted as **St** where it represents the net marks scored in the technical evaluation by the bid under consideration.
3. The formula for determining the financial scores is as follows:
   Sf = 100 x Fm/F in which **Sf** is the financial score of the bid under consideration, **Fm** is the lowest price across all received bids and **F** is the price quoted for the bid under consideration.
4. The weights given to the **Technical and Financial aspects are 0.7 and 0.3**
5. The formula for determining the **Net Score (Ns)** of each bid under consideration would be **Ns = (St*0.7) + (Sf * 0.3)** where **St** and **Sf** are the technical and financial scores of the respective bids
6. The bidder attaining the **highest Net Score**, i.e. **Ns** would be awarded the contract.

4.22 OEM / Implementation Partner Participation Criteria

1. In the case of non-proprietary and proprietary solution, the Bidder will be required to submit a Manufacturer's Authorization Form from the OEM stating that the Bidder in concern would be bidding for <implementation/supply>.
2. Firms with common Proprietor/Partner or connected with one another either financially or as principal and agent or as master and servant or with proprietor/partners closely related to each other such as husband, wife, father/mother and minor son/daughter and brother/sister and minor brother/sister, shall not tender separately under different names for the same contract.
3. If it is found that firms have tendered separately under different names for the same contract, all such tender(s) shall stand rejected and EMD of each such firm/establishment shall be

forfeited. In addition, such firms/establishments shall be liable, at the discretion of the Municipal Commissioner, for further penal action including blacklisting.

4. If it is found that close relatives (as described above) have uploaded separate tenders/quotations under different names of firms/establishments but with common address for such establishments/firms and/or if such establishments/ firms, though they have different addresses, are managed or governed by the same person/persons jointly or severally, such tenders shall be liable for penal and legal action including blacklisting.
5. If after awarding the contract it is found that the accepted tender violated any of the directions pertaining to participation as stated above, the contract shall be liable for cancellation at any time during its validity in addition to penal action including blacklisting against the contractors as well as related firm/establishment.

4.23 Rights to Accept/Reject any or all Bids

Notwithstanding anything contained in this TENDER, BMC reserves the right to accept or reject any Application and to annul the Bidding Process and reject all Applications / Bids, at any time without any liability or any obligation for such acceptance, rejection or annulment, and without assigning any reasons therefore. In the event that the Authority rejects or annuls all the Bids, it may, in its discretion, invite all eligible Bidders to submit fresh Bids hereunder.

BMC reserves the right to reject any Application and / or Bid if:

(a) At any time, a misrepresentation is made or uncovered, or

(b) The Applicant does not provide, within the time specified by the Authority, the supplemental information sought by the Authority for evaluation of the Application.

In case it is found during the evaluation or at any time before signing of the Agreement or after its execution and during the period of subsistence thereof including the concession thereby granted by BMC, that one or more of the pre-qualification conditions have not been met by the Bidder, or the Bidder has made any misrepresentation or has given any incorrect or false information, the Bidder shall be disqualified forthwith if not yet appointed as the Successful Bidder(s) either by issue of the LOA (Letter of Approval/Acceptance) or entering into of the Agreement, and if the Bidder(s) has already been issued the LOA or has entered into the Concession Agreement, as the case may be, the same shall, notwithstanding anything to the contrary contained therein or in this TENDER, be liable to be terminated, by a communication in writing by BMC to the Bidder, without Bidder being liable in any manner whatsoever to the Bidder and without prejudice to any other right or remedy which BMC may have under this TENDER, the Bidding Documents, the Concession Agreement or under applicable law. BMC reserves the right to verify all statements, information and documents submitted by the Bidder in response to the TENDER. Any such verification or lack of such verification by BMC shall not relieve Bidder of its obligations or liabilities hereunder nor will it affect any rights of BMC there under.

The bid shall be rejected if the bidder-

a. Stipulates the validity period less than 180 days.
b. Stipulates own condition/conditions.
c. Does not fill and (digital) sign undertaking forms, which are incorporated, in the document.

4.24 Clarification

Bidder requiring any clarification on the tender may notify BMC in writing or e-mail. They should send in their queries before the date specified in Section 4.1. BMC shall Endeavour to respond to the queries within the period specified therein. The responses will be sent by Email. BMC will forward all the queries and its responses thereto, to all purchasers of the TENDER without identifying the source of queries.

BMC shall Endeavor to respond to the questions raised or clarifications sought by the Bidder. However, the BMC reserves the right not to respond to any question or provide any clarification, in its sole discretion, and nothing in this Clause shall be taken or read as compelling or requiring the BMC to respond to any question or to provide any clarification, but not later than the date provided in Section 4.1.

BMC may also on its own motion, if deemed necessary, issue interpretations and clarifications to all Bidders. All clarifications and interpretations issued by BMC shall be deemed to be part of the tender. Verbal clarifications and information given by BMC or its employees or representatives shall not in any way or manner be binding on the BMC.

4.25 Notifications of awards (LOA) and Signing of Contract

1. Prior to the expiration of the period of bid validity, the Bidder will be notified in writing or by Email that their bid has been accepted.
2. At the time BMC notifies the successful Bidder that their bid has been accepted, BMC will send the Bidders the proforma for Contract, incorporating all clauses/agreements between the parties. The successful Bidder(s) shall sign and date the Contract and return it to BMC. Draft Format of the contract has been included in the bid document. Final Contract agreement will be provided after due verification from BMC's legal department.
3. Penalty of Rs.5000/- per day will be applicable in case of no submission of contract agreement within stipulated period.
4. In case of pending execution of contract agreement, Payment of 10% of Total contract value will be withheld.

4.26 Performance Bank Guarantee

1. The Bidder shall at his own expense, deposit with Corporation, within thirty (30) working days of the notification of award of the contract an unconditional and irrevocable Performance Bank Guarantee (PBG) from the list of approved banks (specified in the bid document) as per the format given in this bid, payable on demand, for the due performance and fulfilment of the contract by the Bidder.
2. This Performance Bank Guarantee will be for an amount equivalent to 10% of the total contract value. All charges whatsoever such as premium, commission, stamp duty etc. with respect to the Performance Bank Guarantee shall be borne by the Bidder.
3. Details of validity of the performance bank guarantee are specified under section 4.1 of this document. The Performance Bank Guarantee letter format can be found in this document.
4. The Performance Bank Guarantee may be discharged / returned by Corporation upon being satisfied that there has been due performance of the obligations of the Bidder under the contract. However, no interest shall be paid on the Performance Bank Guarantee.
5. In the event of the Bidder being unable to service the contract for whatever reason, BMC would evoke the PBG. Notwithstanding and without prejudice to any rights whatsoever of BMC under the Contract in the matter, the proceeds of the PBG shall be payable to BMC as compensation for any loss resulting from the Bidder's failure to complete its obligations under the Contract. BMC shall notify the Bidder in writing of the exercise of its right to receive such compensation within 14 days, indicating the contractual obligation(s) for which the Bidder is in default.
6. The 30 days' notice period shall be considered as the 'Cure Period' to facilitate the System Integrator to cure the breach. The PBG shall be evoked only if the breach is solely attributable to the bidder and the bidder fails to rectify the breach within the 'Cure Period'.
7. BMC shall also be entitled to make recoveries from the Bidder's bills, performance bank guarantee, or from any other amount due to the Bidder, the equivalent value of any payment made to the Bidder due to inadvertence, error, collusion, misconstruction or misstatement.

4.27 Failure to agree with the Terms and Conditions of the Bid/Contract

Failure of the Bidder to agree with the Terms and Conditions of the bid/Contract shall constitute sufficient grounds for the annulment of the award of contract, in which event the contract may be awarded to the next most responsive Bidder which means the bidders who has score second highest as per evaluation method. In such a case, BMC shall invoke the PBG of the most responsive Bidder.

4.28 Terms and Conditions of the Bid

Bidder is required to refer to the draft Contract Agreement, provided in this bid, for all the terms and conditions (including project timelines) to be adhered by the successful Bidder(s) during contract period. Please note that one needs to read the Contract Agreement as a whole document.

4.29 Legal and Stationery Charges

As per BMC Legal Department Circular No 010539 of dated 28.03.2023 with effect from 01.04.2023, the successful bidder will have to bear the legal & Stationery charges at revised rates for preparing contract documents against each individual order as specified below:

Contract Value	Legal Charges + Stationery Charges
Up to INR 50,000 /-	Nil
From INR 50,001/- To INR 1,00,000/-	INR 6,920/-
From INR 1,00,001/- To INR 3,00,000/-	INR 11,420/-
From INR 3,00,001 /- To INR 5,00,000 /-	INR 13, 270/-
From INR 5,00,001 /- To INR 10,00,000 /-	INR 15,970/-
From INR 10,00,001 /- To INR 20,00,000 /-	INR 18,230/-
From INR 20,00,00,01/- To 40,00,000/-	INR 20,530/-
From INR 40,00,001 /- To INR 1,00,00,000 /-	INR 22,800 /-
From INR 1,00,00,001 /- To 10,00,00,0000/-	INR 26,900 /-
From INR 10,00,00,001/- To 20,00,00,000/-	INR 31,050/-
From INR 20,00,00,001/- To 30,00,00,000/-	INR 35,180/-
From INR 30,00,00,001/- To 40,00,00,000/-	INR 39,320/-
From INR 40,00,00,001/- To 50,00,00,000/-	INR 43,420/-
From INR 50,00,00,001/- To 1,00,00,00,000/-	INR 51,700/-
From INR 1,00,00,00,001/- To 2,00,00,00,000/-	INR 64,100/-
From INR 2,00,00,00,001/- To 3,00,00,00,000/-	INR 72,350/-
From INR 3,00,00,00,001/- To 4,00,00,00,000/-	INR 82,640/-
From INR 4,00,00,00,001/- To 5,00,00,00,000/-	INR 92,970/-
From INR 5,00,00,00,001/- to any limit	INR 1,03,320/-

In case of revision of the above mentioned legal and stationary charges, bidder shall pay revised legal and stationary charges.

The tenderers are requested to note that stationary charges as given in the table above will be recovered from the successful tenderer for supply of requisite prescribed forms for preparing certificate bills in respect of the work.

4.30 Stamp Duty

1. The stamp duty payable for the contract shall be borne by the selected System Integrator IN WITNESS whereof the parties hereto have signed this on the day, month and year written as part of the agreement.
2. As per the provision made in Article 63, Schedule I of Bombay Stamp Act 1958, stamp duty is payable for "works contract" that is to say, a contract for works and labor or services involving transfer of property in goods (whether as goods or in some other form) in its execution, as under:

Contract Value	Stamp Duty
1. Where the amount or value set forth in such contract does not exceed rupees ten lakh.	Five Hundred rupees stamp duty
2. Where it exceeds rupees ten lakhs maximum	Five hundred rupees plus 0.1% of the amount above rupees ten lakh subject to the maximum of rupees twenty-five lakh stamp duty.

3. The successful bidder shall pay stamp duty on BG as well as extended BG @0.5% of the BG amount as per circular no Ch.E/BM/17800/II dated 07/01/2016.
4. The successful Bidder shall enter into a contract agreement with BMC within 30 days from the date of issue of LoA/LoI and the same should be adjudicated for payment of Stamp Duty by the successful Bidder.
5. Further shortfall if any, in amount of stamp duty paid as against prescribed amount for the documents executed in Mumbai City and Mumbai Suburban District be recovered from the concerned work contractors and to deposit the deficit or unpaid Stamp Duty and penalty by two separate Demand Draft or Pay Order in favour of "Superintendent of Stamp, Mumbai" within 15 days from intimation thereof.
6. All legal charges and incidental expenses in this respect shall be borne and paid by the successful Bidder(s).

4.31 Grievance Redressal Mechanism

BMC has formed a Grievance Redressal Mechanism for redressal of Bidder's grievances. Any Bidder or prospective bidder aggrieved by any decision, action or omission of the procuring entity being contrary to the provisions of the tender or any rules or guidelines issued therein, in Packet 'A', 'B' & 'C' can make an application for review of decision of responsiveness in Packet 'A', 'B' & 'C' within a period of 7 days or any such other period, as may be specified in the Bid document.

While making such an application to procuring entity for review, aggrieved Bidders or prospective bidders shall clearly specify the ground or grounds in respect of which he feels aggrieved.

Provided that after declaration of a bidder as a successful in Packet 'A' (General Requirements), an application for review may be filed only by a bidder who has participated in procurement proceedings and after declaration of successful bidders in Packet 'B' (Technical Bid), an application for review may be filed only by successful bidders of Packet 'A'. Provided further that, an application for review of the financial bid can be submitted, by the bidder whose technical bid is found to be acceptable / responsive.

Upon receipt of such application for review, BMC may decide whether the bid process is required to be suspended pending disposal of such review. The BMC after examining the application and the documents available to him, give such reliefs, as may be considered appropriate and communicate its decision to the Applicant and if required to other bidders or prospective bidders, as the case may be.

BMC shall deal and dispose of such applications as expeditiously as possible and in any case within 10 days from the date of receipt of such application or such other period as may be specified in pre-qualification document, bidder registration document or bid documents, as the case may be.

Where BMC fails to dispose of the application within the specified period or if the bidder or prospective bidder feels aggrieved by the decision of the procuring entity, such bidder or prospective bidder may file an application for redressal before the "Internal Procurement Redressal Committee" within 7 days of the expiry of the allowed time or of the date of receipt of the decision, as the case may be. Every such application for internal redressal before Redressal Committee shall be accompanied by fee of Rs. 25,000/- and fees shall be paid in the form of D.D. in favour of BMC.

1st Appeal by the bidder against the decision of C.E. / HOD / Dean can be made to concerned DMC / Director who should decide appeal in 7 days.

If not satisfied, 2nd Appeal by the bidder can be made to concerned A.M.C. for decision.

Grievance Redressal Committee (GRC) is headed by concerned D.M.C. / Director of particular department for the first appeal / grievances by the bidder against the decision for responsiveness / non responsiveness in Packet 'A', Packet 'B' or Packet 'C' and if not satisfied, concerned A.M.C. will take decision as per second appeal made by the bidder. This Grievance Redressal Committee (GRC) will be operated through DMC (CPD) office where appeals of aggrieved bidder will be received with fee of Rs. 25,000/- from aggrieved bidder. The necessary correspondence in respect of said applications to the aggrieved bidder & concerned department, issuing notices, arranging of Grievance Redressal Committee (GRC) with D.M.C. and further proceeding will be carried out through registrar appointed by BMC.

No application shall be maintainable before the redressal committee in regard of any decision of the BMC relating to following issues

- Determination of need of procurement
- The decision of whether or not to enter into negotiations

- Cancellation of a procurement process for certain reasons

On receipt of recommendation of the committee, it will be communicating his decision there on to the Applicant within 10days or such further time not exceeding 20 days, as may be considered necessary from the date of receipt of the recommendation and in case of non-acceptance of any recommendation, the reason for such non acceptance shall also be mentioned in such communication.

Additional Municipal Commissioner and / or Grievance Redressal Committee, if found, come to the conclusion that any such complaint or review is of vexatious, frivolous or malicious nature and submitted with the intention of delaying or defeating any procurement or causing loss to the procuring entity or any other bidder, then such complainant shall be punished with fine, which may extend to Five Lac rupees or two percent of the value of the procurement, whichever is higher.

5 Scope of Work

5.1 Area of Interest (AOI)

Brihanmumbai Municipal Corporation is approximately 480 sq. kms. There are 24 wards in Mumbai. The total approximate length of the roads is 4800 kms in Mumbai. For this project the area of the Mumbai may be approximated to **500 sq. kms**. for along with necessary buffer for aerial & terrestrial surveys. Useful vital statistics about BMC is available in BMC 2022 diary https://portal.mcgm.gov.in/irj/portal/anonymous/qlmcgmDairyBooks and on BMC portal under about BMC header.

5.2 Project Life Cycle

1. Requirement Gathering – Inception report (As-is study of all GIS data & applications in BMC) – FRS, SRS, Project plan, installation of Project Management tool – Project Kick-off meeting & presentation to Key departments of BMC	**2. Setting up permanent Continuously Operating Reference Station (CORS) network in Mumbai** – Installation, commissioning & testing of CORS – Certification by SOI	**3. DGPS survey for collection of GCPs (If required)** – Setting up primary GCN with permanent monumentation – Setting up secondary GCN
4. Permissions for Aerial, Terrestrial, Mobile & Bathymetry survey – Preparation of necessary documents, compliance required for obtaining permissions for different surveys in Mumbai – Sending letter, emails, physical visits to central, state & local authorities for obtaining survey permissions	**5. Different Survey to carried out** – Aerial Photogrammetry & LiDAR survey – Survey for capturing Terrestrial LiDAR & 360˚ Panoramic street view imagery – Survey for capturing LiDAR data & 360˚ Panoramic street view imagery using mobile backpack device – Bathymetric Survey of water bodies like River, lakes & ponds (one-time)	**6. Survey data Processing** – Processing of Aerial Imagery & LiDAR datasets – Processing of Terrestrial LIDAR & 360˚ Panoramic street view – Processing of Mobile LIDAR & 360˚ Panoramic street view – Processing of Bathymetric datasets
7. Survey data deliverables – 2D basemap Orthomosaic using Aerial imagery & vectorization of all layers – Land Use Land Cover (LULC) map of Mumbai – DSM, DTM & Contours of Mumbai – 3D basemap (True Orthophoto) of Mumbai – Terrestrial & Mobile LiDAR data with 360˚ Panoramic street view imagery of Mumbai – Bathymetric data of water bodies in Mumbai (one-time) – 3D reality mesh model of Mumbai using aerial photogrammetry, LiDAR, terrestrial & mobile LiDAR & 360˚ Panoramic street view imagery	**8. Ground Truthing & correction in final deliverables** – Ground Truthing 10% of all deliverables & 10% of total area of Mumbai	**9. Delivery & installation of various devices** – Delivery & installation of High-end workstations for viewing, editing LiDAR, Orthomosaic, etc. as per specifications – Delivery & installation of Color printers as per specifications – Delivery & installation of One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph) as per specifications

– 3D LoD 3 vector model consisting of Buildings, Roads, Bridges, Flyover, Tunnels, Railways, Mono, Metro, Street lights, Traffic signals, Water bodies, Trees, Landscapes, Open spaces, Airports, Gardens, Slum and all other features having height with reference to Aerial data complying with LoD3 specifications		– Publish 3D reality mesh on 3D projector & showcase demo
10. Development, Implementation of Enterprise Geospatial Application Cloud & Security Audit Certification from CERT-IN empaneled agency for the enterprise Geospatial application – Supply & Installation of 360˚ Panoramic street view imagery publishing Server software compatible with ArcGIS Enterprise suite – Supply & Installation of Enterprise Oracle database – Development & implementation of Web GIS application for 3D City model & change detection with use cases mentioned in the scope of work – Development & implementation of Android & iOS application for 3D City model & change detection – Development & implementation of Dashboard application for 3D City model & change detection – Integration of Enterprise GIS application with existing IT & GIS application – Testing of Enterprise GIS application & bug fixing – Comprehensive audit including security Certification, VPAT & load testing from CERT-IN empaneled agency for all applications developed as per the scope of work – UAT, Training & Go-Live	**11. Hosting of all deliverables, raw datasets & Enterprise Geospatial Application on Virtual Cloud (Cloud Services will be provided by BMC)** – Hosting of deliverables & raw datasets – Hosting of Enterprise Geospatial Application for 3D City model & change detection	**12. Annual Maintenance Contract of all hardware, software, data, applications & services provided under the scope of work for 3 years after Go-Live** – Change detection Map of Mumbai capturing all changes every year for 3 years after Go-Live – AMC of all hardware, software & applications delivered as part of the scope of work – Bug fixing, issue resolution & enhancements of the Enterprise Geospatial applications. – Hosting of data & applications on Virtual Cloud

5.3 Project Plan

Following table provides project plan that is envisaged for development, implementation & maintenance of 3D City model & change detection project using geospatial technology.

The **development & implementation** period is **1.5 years (18months)**. The **Annual Maintenance Contract (AMC)** after Go-Live is **3 years. The total duration of the project is 4.5 years**. For the 1st year of the project, all necessary hardware/software/network etc. arrangement for development and staging will be done by the SI.

The SI may suggest modifying the timelines of different sub-modules during the development & implementation period, however all modules should be covered as mentioned in the scope of work.

#	Category of Work	Detailed tasks/ activity	Development & Implementation period (months)																	Annual Maintenance Contract (AMC)		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Year 1	Year 2	Year 3
1	**Requirement Gathering**	Inception report (As-is study of all GIS data & applications in BMC)																					
2		FRS, SRS, Project plan, installation of Project Management tool																					
3		Project Kick-off meeting & presentation to Key departments of BMC																					
4	**Setting up permanent Continuously Operating Reference Station (CORS) network in Mumbai**	Installation, commissioning & testing of CORS																					
5		Certification by SOI																					

#	Category of Work	Detailed tasks/ activity	Development & Implementation period (months)																	Annual Maintenance Contract (AMC)		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Year 1	Year 2	Year 3
6	**DGPS survey for collection of GCPs (If required)**	Setting up primary GCN with permanent monumentation																					
7		Setting up secondary GCN																					
8	**Permissions for Aerial, Terrestrial, Mobile & Bathymetry survey**	Preparation of necessary documents, compliance required for obtaining permissions for different surveys in Mumbai																					
9		Sending letter, emails, physical visits to central, state & local authorities for obtaining survey permissions																					
10	**Different Survey to carried out**	Aerial Photogrammetry & LiDAR survey																					
11		Survey for capturing Terrestrial LiDAR & 360˚ Panoramic street view imagery																					
12		Survey for capturing LiDAR data & 360˚ Panoramic street view imagery using mobile backpack device																					
13		Bathymetric Survey of water bodies like River, lakes & ponds (one-time)																					

#	Category of Work	Detailed tasks/ activity	Development & Implementation period (months)																	Annual Maintenance Contract (AMC)		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Year 1	Year 2	Year 3
14	Survey data Processing	Processing of Aerial Imagery & LiDAR datasets																					
15		Processing of Terrestrial LIDAR & 360˚ Panoramic street view																					
16		Processing of Mobile LIDAR & 360˚ Panoramic street view																					
17		Processing of Bathymetric datasets																					
18	Survey data deliverables	2D basemap Orthomosaic using Aerial imagery & vectorization of all layers																					
19		Land Use Land Cover (LULC) map of Mumbai																					
20		DSM, DTM & Contours of Mumbai																					
21		3D basemap (True Orthophoto) of Mumbai																					
22		Terrestrial & Mobile LiDAR data with 360˚ Panoramic street view imagery of Mumbai																					
23		Bathymetric data of water bodies in Mumbai (one-time)																					
24		3D reality mesh model of Mumbai using aerial																					

#	Category of Work	Detailed tasks/ activity	Development & Implementation period (months)																	Annual Maintenance Contract (AMC)		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Year 1	Year 2	Year 3
		photogrammetry, LiDAR, terrestrial & mobile LiDAR & 360˚ Panoramic street view imagery																				
25		3D LoD 3 vector model consisting of Buildings, Roads, Bridges, Flyover, Tunnels, Railways, Mono, Metro, Street lights, Traffic signals, Water bodies, Trees, Landscapes, Open spaces, Airports, Gardens, Slum and all other features having height with reference to Aerial data complying with LoD 3 specifications																				
26	**Ground Truthing & correction in Final deliverables**	Ground Truthing 10% of all deliverables for 10% of total area of Mumbai & correction in final deliverables																				
27	**Delivery & installation of various devices**	Delivery & installation of High-end workstations for viewing, editing LiDAR, Orthomosaic, etc. as per specifications																				
		Delivery & installation of Color printers as per specifications																				

#	Category of Work	Detailed tasks/ activity	Development & Implementation period (months)																Annual Maintenance Contract (AMC)		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Year 1	Year 2	Year 3
		Delivery & installation of One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph) as per specifications																					
28		Publish 3D reality mesh on 3D projector & showcase demo																					
29	**Development, Implementation of Enterprise Geospatial Application & Security Audit Certification from CERT-IN empaneled agency for the enterprise Geospatial application**	Supply & Installation of 360˚ Panoramic street view imagery publishing Server software compatible with ArcGIS Enterprise suite																					
30		Supply & Installation of Enterprise Oracle database																					
31		Development & implementation of Web GIS application for 3D City model & change detection with use cases mentioned in the scope of work																					
32		Development & implementation of Android & iOS application for 3D City model & change detection																					

#	Category of Work	Detailed tasks/ activity	Development & Implementation period (months)																	Annual Maintenance Contract (AMC)		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Year 1	Year 2	Year 3
33		Development & implementation of Dashboard application for 3D City model & change detection																					
34		Integration of Enterprise GIS application with existing IT & GIS application																					
35		Testing of Enterprise GIS application & bug fixing																					
		Comprehensive audit including security Certification, VPAT & load testing from CERT-IN empaneled agency for all applications developed as per the scope of work																					
36		UAT, Training & Go-Live																					
37	**Hosting of all deliverables, raw datasets & Enterprise Geospatial Application on Virtual Cloud**	Hosting of deliverables & raw datasets (Cloud Services will be provided by BMC)																					
38		Hosting of Enterprise Geospatial Application for 3D City model & change detection (Cloud Services will be provided by BMC)																					

#	Category of Work	Detailed tasks/ activity	Development & Implementation period (months)																	Annual Maintenance Contract (AMC)		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Year 1	Year 2	Year 3
42	**Annual Maintenance Contract of all hardware, software, data, applications & services provided under the scope of work for 3 years after Go-Live**	Change detection Map of Mumbai capturing all changes every year for 3 years after Go-Live																					
43		AMC of all hardware, software & applications delivered as part of the scope of work																					
44		Bug fixing, issue resolution & enhancements of the Enterprise Geospatial applications.																					
45		Hosting of data & applications on Virtual Cloud (Cloud Services will be provided by BMC)																					

5.4 Requirement Gathering

The requirement gathering is the phase where SI is expected to get maximum information, data & current status of existing system from BMC user departments. The SI is expected to deploy Project Manager & Business Analysts to meet different stake holders & BMC user departments. The SI is expected to deploy Project Manager & two Business Analyst onsite for the entire duration of the project and AMC period which is 4.5 years. These three resources are expected to attend all meetings related to 3D City model & change detection project. These resources are expected to brief the backend development & implementation team of client's requirements, expectations & decisions made with respect to the project.

5.4.1 Inception report (As-is study of all GIS data & applications in BMC)

SI is expected to study the existing GIS data & GIS applications in BMC. Existing BMC's GIS system is Desktop, Web and Mobile GIS - based for interactive map display, editing, query, integration and analysis. The environment is a combination of ArcGIS and SAP software products. Following are some of the GIS applications/ modules which are standalone/ Integrated with other IT systems:

1. One BMC application
2. Sewerage Operations & RWTS
3. Development Planning (DP) remarks website
4. Different applications under DP-GIS
5. Property Tax
6. Estate
7. Disaster Management Integrated CCS application
8. Education
9. SAP PS GIS Integration
    a. PS GIS Web Apps
    b. PS GIS Mobile Apps
10. Ward works application
11. Isarita BMC Integration for Property Registration
12. COVID Web Applications
    a. Bed Management Dashboard
    b. COVID Ward works
    c. Cemetery Management
    d. COVID Dashboard application
13. BMC on Maps
14. My BMC ID
15. GIS Dashboards

16. Integration services of BMC on Maps with BMC WhatsApp Chatbot
17. Other ArcGIS Web applications & services

All the GIS applications in BMC has been developed & implemented on ESRI's ArcGIS Enterprise platform. The centralised GIS database (Enterprise Geodatabase) houses all the GIS data from different BMC user departments. BMC has signed an Enterprise License Agreement (ELA) with ESRI India, which entitles BMC access to different ArcGIS desktop, server, extensions, mobile, ArcGIS online, ArcGIS runtime & other products. There are multiple licenses of ArcGIS products available under the ELA. The SI is expected to use necessary ArcGIS desktop, server, extensions, etc. products for development & implementation of the 3D Enterprise GIS applications, mobile applications & Dashboards. The SI should submit the Inception report which will contain the As-is state of BMC GIS systems, data & applications.

5.4.2 FRS, SRS, Project plan, installation of Project Management tool

The System Integrator should carry out detailed requirement gathering with IT Department and other concerned departments to detail out all the requirements in Functional Requirement Specifications (FRS) towards creation of Software Requirement Specifications (SRS) and Standard Operating Procedures (SOPs) to be designed for the proposed solution. The System Integrator should study and collect the existing spatial and non-spatial datasets as per the requirements furnished in the scope. The SI prepare a revised project plan as per their understanding, interaction with BMC stakeholders & their experience in delivering similar projects. The SI should deploy Project Management tool with Project management plan embedded in it. The SI should provide user credentials to different stakeholders in BMC for the project management tool. This project management tool is to be used throughout the entire contract of 4.5 years of the project. Hence, it is very important to include all necessary details of the project in the project management tool. The reporting of the project can be initiated through the same tool. The SI is free to propose propriety or open-source project management tool. The proposed project management tool should be scalable, allow quick development & should have easy-to-use interactive dashboard & reporting mechanism to check the progress of the project.

5.4.3 Project Kick-off meeting & presentation to Key departments of BMC

The SI should conduct the project kick-off meeting at the start of the project to understand the key stake holders, client's expectations and other necessary details about the project & BMC stakeholders. The SI should conduct presentation to key departments of the BMC. The presentation may be designed for different audience depending upon their hierarchy. SI should prepared one presentation targeted to Senior leadership & Head of the department (HODs) and other presentation should be targeted towards BMC workforce mainly Sub-Engineer, Assistant Engineers, etc.

5.5 Setting up permanent Continuously Operating Reference Station (CORS) network in Mumbai

Survey of India (SOI) have recently set up Continuously Operating Reference Station (CORS) network in Maharashtra, we suggest SI to verify & validate the details of the CORS network from Survey of India (SOI). Currently BMC owns legacy Continuously Operating Reference Station (CORS) within BMC area. There are total two CORS operating in Mumbai first CORS is located at Dadar sewage pumping station office, Dadar (West) and the second CORS is located at Trauma Hospital, Jogeshwari (East). SI is expected to study the existing CORS network set up by Survey of India (SOI) & two CORS setup by BMC, note all the necessary details, specifications, SOPs & nos. of users who are actively using this CORS. If the current CORS network is not sufficient to cater entire BMC area SI may take up setting the new CORS. As part of this project the SI should conduct a Geodetic study to identify total nos. CORS which will be required to appropriately cover entire area of BMC.

SI to study existing CORS network and quote the price accordingly.

5.5.1 Installation, commissioning & testing of CORS

The SI should procure necessary CORS devices as per the specifications provided in Annexure XIV. The SI is expected to propose BMC offices, Hospitals & other important BMC buildings where such CORS can be commissioned. The civil structure needed to setup the CORS shall be taken care by the SI. The necessary Air conditioner (if required) for the AC environment for the control centre, UPS, Internet and all other materials mentioned in the specifications should be installed, commissioned & maintained by the SI.

After the CORS network is commissioned the testing of CORS should be carried out by SI with BMC team. The SI should devise scientific & mathematical methodology which should be vetted by Survey of India (SOI) for testing the accuracy of CORS network. The results of the testing will be digitally stored & should be presented in a report format to BMC.

The access to the CORS network would be initially provided to BMC user departments. After successful usage of CORS for six months, the CORS will be extended to other state & central government departments. If the CORS is used diligently by different stakeholders & is popular amongst different stakeholders, then the CORS network may be provided to all citizens subsequently.

The SI should develop website/ service to use this CORS network. The website/ service should have access control mechanism with ability to Register, Login with OTP & password. It should have features like CAPTCHA, forget password, other standard guidelines mentioned in GIGW standards. The website should also support payment mechanisms for users/ organizations. BMC may monetize the usage of CORS service to different stakeholders.

5.5.2 Certification by Survey of India (SOI)

After successful installation, commissioning & testing the accuracy of CORS network, the SI should obtain a certificate from Survey of India (SOI) stating that the CORS network is functional, accurate & can be used for surveying of all major infrastructure, land, plots, assets, etc. GIS surveys in Mumbai. The certificate should also mention the accuracy levels, co-ordinate system, projection system & other geodetic parameters along with date & time of certification. If there are any major changes in the CORS network like adding of new CORS station or decommissioning it due to any reasons, the re-certification from SOI will be required.

BMC will provide necessary letters stating that SI is onboarded by BMC for the said work of setting up CORS network in Mumbai. The SI will coordinate with the SOI for the necessary certification & re-certification.

5.6 Differential Global Positioning System (DGPS) survey for collection of Ground Control Points (GCPs), If required

Brief Scope of Activities for this contract shall include Provision of Ground Control Points (GCP) as per requirements of project. This shall include planning, observations, computation and signalling as necessary. The SI is required to establish a grid of high precision Ground Control Points (GCP) or Ground Control Network (GCN). BMC already have 1000 GCPs collected for another project. Details will be provided to the SI.

5.6.1 Setting up primary GCN with permanent monumentation

The SI shall establish required to establish a Ground Control Network (GCN) through capturing number of ground control points (GCP) on the ground using DGPS method at regular/random interval throughout the project area under BMC. Control chart shall be prepared choosing Ground Control Points with easy access as well as easy identification on aerial image. Control points shall be established on ground based on the control chart preferably on permanent structure, culvert corner, Road barrier, bridge corner, rock-in-situ, field bunds and other definable points like tri- junctions, road-junctions. This will enable to co-register both Aerial and Terrestrial Mobile LiDAR point clouds thereby increase the accuracy of the datasets.

A detailed survey report needs to be prepared consisting of GCPs parameters and pictures. Sample template is provided below for reference. The SI may add more parameter if necessary

DGPS POINT ID	GCP 1 (Near Worli Naka)			**WARD NAME**	G-South	
DATE OF ACQUISION (dd/mm/yyyy): 06.06.2022				**SURVEYOR'S NAME:**		
DURATION	2 Hrs	**PDOP (Start Time)**	2.4	**PDOP (End Time)**	2	
COORDINATES						

WGS84 (Degre Decimal) [Upto 3 decimal places]		WGS84(Deg-Min-Sec)		UTM_WGS84 (m) [Upto 5 decimal places]	
LATITUDE	22.498	**LATITUDE**	22° 29' 52.707" N	**NORTHING**	2503386.75351
LONGITUDE	88.372	**LONGITUDE**	88° 22' 17.955" E	**EASTING**	640246.48412
ELEVATION (m)	6.060	**PROJECTION**	WGS 84	**UTM ZONE**	45 N

IMAGE: GCP POSITION

DESCRIPTION OF POINT

The point located on the crossing Worli Naka and MN Chowdhury Street.

DESCRIPTION OF ACCES POINT

50 meters Eastern side of Worli Naka

PHOTOGRAPHY: GCP POSITION

1. **GCP requirements**

i. SI shall identify in their proposal the approximate number of ground control points to meet project accuracy requirement. Actual location and number of ground control points shall be mutually discussed and decided at the time of project execution.

ii. To further meet the specific need of the current Project, it is required to establish 2 levels of system namely Level 'A' & Level 'B'. The grid shall also be established using DGPS survey and using BMC CORS network.

iii. The SI is encouraged to plan the monumentation of the GCPs mostly on BMC owned properties, building, premises, ward offices, BMC hospitals, etc. This will ensure smooth commissioning and the monumentation can be maintained effectively.

2. Specifications of the GCN shall be as per below:

i. Proposed GCN shall be as per
   a. Level 'A' of 8x8 Km
   b. Level 'B' of 4x4 Km
ii. The selected SI shall perform monumentation for Level 'A' & Level 'B' GCP by fixing a standard size metal plate at suitable location on ground.
iii. The SI will place the targets and measure the ground control required for the project.
iv. The GCPs should be placed homogeneously in the area of interest.
v. In complex topographical areas, additional GCPs should be taken keeping in account the accurate reconstruction
vi. Monumentation with 1X1X1 meter blocks should be engraved with BMC name on metallic plates on it for the Geodetic Base station network that should be built. Remaining GCP's needs to be marked with metallic plates on permanent physical objects as temporary benchmarks.
vii. The SI shall ensure that GCP's should be clearly visible in the aerial imagery to be acquired
viii. Minimum observation time for base station shall be 8-12 hrs. and 1 hr. for each GCP.

5.6.2 Setting up secondary GCN

i. For Level 'B' GCP monumentation shall be done as per the feasibility and conditions of the location identified for GCP establishment. For level 'B', the selected bidder may establish temporary GCP with help of paint, checkerboards, etc. where monumentation is not feasible.
ii. The GCPs shall be placed homogeneously in the area of interest.
iii. Additionally, the selected bidder may place one GCP in the centre of the area in order to further increase the quality of the reconstruction
iv. In complex topographical area, additional GCPs shall be taken keeping in account the accurate reconstruction
v. The successful bidder shall ensure that GCP's are clearly visible in the aerial imagery to be acquired.
vi. The selected bidder may also take additional points to meet the specific requirement of the project at no additional cost to BMC.

5.7 Permissions for Aerial, Terrestrial, Mobile & Bathymetry survey

The SI is expected to broadly know about various permissions/ approvals required to carry out activities of the project and shall place a list of all such permissions/ approval requirements along with information about approving authorities. BMC shall provide Letter of Intent (LOI) & Work Order to the SI. BMC shall also provide necessary letter mentioning the scope of the work of the SI for this project.

5.7.1 Preparation of necessary documents, compliance required for obtaining

permissions for different surveys in Mumbai

The SI should prepare detailed list of necessary documents, compliance required for obtaining necessary permissions with state & central government agencies. The SI should reach out to BMC in case any documentation needs to be sent from BMC office.

5.7.2 Sending letter, emails, physical visits to central, state & local authorities for obtaining survey permissions

Following is the tentative list of state & central government agencies from which survey permissions neds to be obtained:

1. Directorate General of Civil Aviation (DGCA)
2. Ministry of Defense (MoD)
3. Mumbai Police department
4. Indian Army
5. Indian Navy
6. Indian Airforce
7. Airport Authority of India (AAI)
8. Air Traffic Control (ATC)

This list may not be exhaustive in nature. The SI needs to check the latest rules, regulations & compliance for different kinds of survey & seek appropriate permissions from necessary state & central government agencies.

The SI is also expected to visit offices of above-mentioned authorities to expediate the process of seeking permissions.

5.8 Different Survey to carried out

Different surveys need to be carried out as part of the scope of work of this project. The details of each survey are mentioned in the sections below. The SI needs to pay special attention to safety of the citizens of Mumbai, pilot, surveyor & other staff involved in the survey. BMC will not be responsible for any accidents, mishaps, theft of survey equipment if they occur during the entire contract period of the project.

5.8.1 Aerial Photogrammetry & LiDAR survey

Total area to be captured in Aerial survey using photogrammetry & LiDAR sensor is **500 sq. km**.

General requirements

For 3D city model, base map should be prepared by data acquisition using manned aircraft with RGB Sensor (Nadir + Oblique) integrated with LiDAR sensor. The data collection would include but not limited to

1. Image Acquisition with specified resolution (5cm Nadir) using Aerial technology as specified above

2. Acquisition of overlap images (Minimum 80 % Forward and 60% Side)
3. Post Processing and Ortho Rectification of Aerial Imagery
4. Creation of geospatial layers for the features that are of interest of BMC
5. Aerial images need to be taken maintaining a GSD (Ground Sample Distance) of 5cm or better.
6. The correctness of image is to be checked with respect to any issues in the coverage, and file format.
7. Only the Aircraft based data captured must be used by the selected bidder for the preparation of base data.

The data should have following:

a. Projection: Universal Transverse Mercator (UTM), Spheroid: WGS 84, Zone: 43N. Minimum observation time for base station shall be 8-12 hrs. and 1 hr. for each GCP using DGPS & CORS.
b. The horizontal accuracy of GCPs should be 0.20 meters.

- Raw Data Acquisition & Pre-processing: Acquisition of Raw Digital Data by Aerial Platform for generating Digital Elevation Model (DEM) better than 30 cm and Digital Ortho-imagery of 5cm GSD.
- This shall also include Flight Planning, Sensor Calibration, Flight Execution as per plan, QA/QC for review of flight line alignment, raw data validation for completeness, no data voids, strip matching, pre-processing of onboard GNSS/IMU data for trajectory file and other pre-processing steps needed for point cloud extraction/preparing data for post-processing stage.
- The SI shall acquire aerial data viz. Aerial Imagery & Airborne LiDAR point clouds of the BMC project area. Aerial imagery shall be used for defining the geometry and facades of cityscape including all visible sides of buildings and rooflines whereas the Airborne LiDAR shall be used to improve accuracy as well as for generating high precision DEM.
- For the requirement of the current 3D City Modelling project, the SI shall deploy manned aircraft for aerial data acquisition.
- SI shall obtain necessary clearances, permissions from appropriate authorities for aerial data acquisition, BMC will provide necessary documentation, letters for obtaining permissions to the SI.
- SI shall mobilize all necessary equipment, software and hardware at site location required for carrying out project activities
- Both aerial and the data acquired using Terrestrial LiDAR shall be in Sync with each other.

5.8.1.1 Aerial Photography

The SI shall acquire new, natural color aerial photography in RGB and along with LiDAR Data of the project area during the Project Execution. This photography will primarily be used to produce true orthophoto. LiDAR Data will be used to produce High Resolution Digital Elevation Model. Subsequently these data sets will be used to support computerized Geographic Information Systems and other government mapping applications.

5.8.1.2 Aerial Vehicles and Crew

- The SI shall be responsible for operating and maintaining aircraft used in conformance with all governing authority's regulations.
- All respondents must identify the firm that will be acquiring the aerial photography, the relationship that firm has with the SI, and the ownership of the aircraft and camera equipment to be used.
- Individual resumes of flight crew members must be included with the technical proposal.

- The aircraft furnished shall be capable of stable performance and shall be equipped with essential navigation and photographic instruments and accessories, all of which shall be maintained in operational condition during the period of the contract.
- The SI shall be responsible for insurance of the aircraft & the aircraft crew.

5.8.1.3 Acquisition Delays

The Bidder should inspect and constantly monitor the photographic coverage and image quality and should undertake immediate re-flights of areas wherein coverage does not meet specifications.

5.8.1.4 Weather and Environmental Conditions during Image Acquisition

The following weather conditions are a minimum that should be met or exceeded during the photo missions:

- **Cloud cover:** Images should be free of clouds and cloud shadows. No photography will be accepted with clouds or cloud shadows appearing on more than 5 percent of the area in any one final ortho-rectified image tile.
- **Ground conditions:** Weather conditions (such as smoke) that might obscure ground detail should be avoided.

5.8.1.5 Aerial Sensor

i. The aerial hybrid sensor (Optical RGB and LiDAR) should have high throughput and accuracy. The most current manufacturer's calibration report shall be submitted with the response to these specifications for each camera system to be used on this project. The absence of a calibration report may be cause for disqualification of the Bidder.
ii. A report detailing the calibration of the sensor system shall be submitted covering each of the following topics:
    a. System calibration (focal length, lens distortion, principal point location, and radiometric calibration etc.),
    b. Bore sight calibration values
    c. Sensor-to-GPS-antenna offset determinations.
iii. Digital sensor systems must be compatible with precision stereoscopic mapping or softcopy systems and with measurement procedures used in photogrammetric surveys and in preparing accurate orthophotos.
iv. Bidders not conforming to the specifications of the aircraft sensors shall be subjected to disqualification.
v. Refer Annexure XII for Aerial Data Acquisition Guidelines and Aerial Sensors specifications.

5.8.1.6 Image and LiDAR Data Acquisition

- The SI shall prepare a flight plan and include the flight plan with their response to the RFP. In addition to the flight plan, SI shall include a Digital Image Collection Survey Plan that lists the specific data collection parameters to be used.
- The photographic survey areas of the project shall be stereoscopically covered by way of maintaining required forward and side overlaps of photographs. Bidder has to maintain minimum 80% forward and 60% side overlap.
- Solar angle should be greater than 30°.
- The aircraft being used for this contract shall be a twin engine capable of altitudes up to 5000 Feet.

- Lack of acceptable stereoscopic coverage shall be corrected by re-flights at the Bidder's own expense.
- Any exposures within the project area with a color balance shift compared to the remainder of the flight line will result in unacceptable exposures.
- Digital sensor shall be capable of simultaneous capture of red, green, blue, and near-infrared bandwidths for each exposure.
- Captured radiometric resolution shall be at least 12 bits/pixel (bpp) for each band/channel
- The photo missions shall be executed within the shortest possible timeframe to insure consistent ground and lighting conditions

5.8.1.7 Re-flights

Unacceptable aerial photography shall be re-flown at the earliest opportunity, weather permitting by the SI at no additional cost to BMC, with the re-flight coverage overlapping the accepted photography.

5.8.1.8 Deliverables

Flight Photo Index

i. A flight photo index shall be delivered in an Esri shape file (including. prj file) file format. Photo center point locations (derived from the airborne GPS/IMU survey) and image footprints or edge of image swath shall be included. The photo center locations shall be attributed with the latitude, longitude, elevation, time, and flight line. The flight lines shall be attributed with the acquisition date, time, flight height, line number, camera s/n, and direction of flight.
ii. A Collection Report detailing the mission planning and including the flight logs shall be provided with the Flight Photo Index.
iii. A digital copy of the Flight Photo Index and the Collection Report shall be delivered to BMC for review immediately after the acquisition of the aerial imagery and prior to beginning the ortho-rectification process.

5.8.2 Survey for capturing Terrestrial & mobile backpack LiDAR & 360°Panoramic street view imagery

Total length to be captured in Terrestrial LiDAR & 360°Panoramic street view imagery survey is **4800 km**.

Total length to be captured in Mobile backpack LiDAR & 360°Panoramic street view imagery survey is **480 km**.

Apart from Aerial Imagery and LiDAR point clouds, Bidder shall collect Street Level imagery for all motorable roads using Mobile mapping systems as per the specifications in the Annexure XIII.

- The selected bidder is required to perform LiDAR Survey of all highways, roads, streets, flyover, each deck in case of double decker flyover, bridges, service roads, falling in the BMC project Area.
- The selected bidder shall submit its plan for Street LiDAR Survey for selected part / Ward/zone of the City depending upon the requirement, specifying the road length, type of LiDAR equipment's (Vehicle based / Backpack / terrestrial) and obtain approval for the same from time to time.
- Length of road with divider shall be considered twice if vehicle is required to travel both side of the road.
- The mobile LiDAR equipment shall be accompanied with compatible Cameras for 360-degree view of the location and should be aligned properly with the system.

- GPS Time stamp shall be recorded and delivered for each point
- Mobile LiDAR Track Adjustment should be carried out
- To augment the gaps in data collection in narrow lanes and inaccessible areas that can be covered with vehicles, usage of Terrestrial LiDAR and backpack LiDAR system should be used.

5.8.3 Bathymetric Survey of water bodies like River, lakes & ponds (one-time)

SI needs to capture the bathymetric data using single beam echo sounder system of all the waterbodies in Mumbai like river, lakes, ponds. Some of the water bodies are Mithi river, Dahisar river, Poisar river, Oshiwara river, Bandra talao, Powai lake, Tulsi lake, Vihar lake, etc. The SI needs to perform requirement gathering with BMC user departments to understand all the water bodies in Mumbai which needs to be captured in the survey. To estimate the size of the water bodies, the SI may take help of Google Earth tool & calculate the approximate size of the above water bodies & other water bodies in Mumbai.

The SI shall perform a bathymetric survey utilizing the most cost-effective technology available to identify the reservoir bottom surface and any obstructions in the areas identified. Elevation contours every 0.5 m, shall extend from the lowest elevation within the survey area to maximum available relative to MSL, India. The topographic survey above FRL shall extend to the west and to the north of the bathymetric survey. The results shall be presented as a seamless DEM for the survey(s).

Survey Equipment

The SI shall mobilize required number of survey equipment and survey vessel(s) with all necessary equipment for obtaining sediment core samples, side-scan sonar, and sub-bottom profile studies. SI should use appropriate and adequate number of precision instruments as required for the successful execution of the work as defined in scope of work.

Suitable survey boat with shallow draft which should be capable of cruising in waterway and recording echo sounding profiles. This boat, or another vessel, shall have all necessary equipment installed on it for handling systems to obtain sediment cores, deploying current meters and water sample collectors. The boat should have good steering control and with OBM engine, proper fuel enough to move at regular speed up to 4 Knots against wind, waves and current.

Single beam frequency echo sounders and digital output system a range up to 30 m (or more than the max. depth of water) having adequate resolution, should be used for conducting Bathymetric and/or Hydrographic survey.

There shall be adequate backup power spares and other consumables for uninterrupted survey operations. Side-scan sonar equipment (used on separate voyages to single beam bathymetry). Sub-bottom profiling system (may be used simultaneously with single beam bathymetry). For conducting survey DGPS /RTK / equivalent position fixing equipment with digital output having sub–meter accuracy.

At a minimum, a single beam echo sounder system with suitable software shall be used for the below water bathymetry. A multibeam unit should be considered. Preferably side-scan sonar should be used in addition to the single or multibeam echo sounder. Side-scan sonar provides the ability to rapidly assess the impact of any obstructions to mooring and anchoring on the Lakebed, such as tree stumps, submerged buildings and foundations, pipelines, cables, rock outcrops, depressions, mounds, wrecks, other debris, etc.

The grid spacing for Bathymetry total reservoir area spacing will be at 5.0M.

The vessel shall be positioned by using state of the art global positioning system like DGPS. Vessel track and offset positions shall be recorded digitally using survey data acquisition software. The echo sounder and sub bottom profiler shall be operated simultaneously, and data logged digitally as well as in analogue format.

Positioning shall be carried out by the DGPS system. This shall be calibrated against an established point in the field, e.g., platform or jacket.

The positioning system shall be interfaced to the navigation system as well as the digital data acquisition system.

The echo sounder shall be calibrated before the start of the survey. Sound velocity checks shall be made. The paper record of the echo sounder shall be annotated with line name, heading, fix number, time, date, etc. the data shall also be logged digitally in the navigation software for postprocessing and reporting. Necessary tide corrections shall be applied by measuring tide. Data shall be processed after the end of survey. The bathymetry data shall be reduced to chart datum using observed tide. The report along with charts at requisite scales shall be submitted after completion of survey.

5.9 Survey data Processing

The survey data will be processed at SI office premises. The SI to create an isolated environment (office space) within their office. This isolated environment will be dedicated environment where SD cards, High speed media, potable hard disks & all storage media which is used to capture different kinds of survey will be securely stored. The access to this dedicated environment will be given to employees/ resources of the SI who are working on BMC project only. Digital access control mechanism needs to be commissioned in the dedicated environment. All media should be digitally labelled using bar code with details like type of survey, survey start date, end date, name of surveyor, name of person who copied the data from media to central GIS/ Remote sensing data storage on cloud. SI should deploy necessary high-end workstation, photogrammetry software for processing the survey data. These workstations will only by connected to Virtual cloud where all GIS/ RS data will be stored. These workstations should not be connected to SI's Office LAN.

BMC may visit this premises at any time during the contract period of the project. If there are any security breaches, loopholes found in managing, handling & access control of the dedicated

environment, the SI will be penalised as per the terms & conditions mentioned in SLA section. The SI shall keep this dedicated office space active till the end of contract period of this project.

5.10 Survey data deliverables

5.10.1 2D basemap Orthomosaic using Aerial imagery & vectorization of all layers

a. General

Post Processing for generation of DTM, DSM & Digital Ortho-Imagery. This activity shall include:

- Planning
- Setting up of Production Centre in the Bidders own office which is expected to be equipped with required storage systems, servers, workstations, software, peripherals, etc. to handle/store raw data, intermediate data, data under process and processed data/deliverables.
- Generation of Digital Surface Model (DSM) from raw/pre-processed data.
- Necessary editing/filtering of non-ground points (vegetation, built-up areas, bridges, elevated structures, etc.) to generate bare-earth DEM of better than 40cm accuracy
- QA /QC at various stages of Project including validating horizontal and vertical accuracy as per specifications laid down in RFP. Proper versioning and management of data in various Production Cycles. This shall include carrying out corrections as per Quality Audit Report and security vetting report provided by BMC
- Facilitating quality audit, stage approvals, security vetting and final acceptance tests by BMC
- Generation of Digital Ortho-Imagery

b. Project Diagrams

Digital Maps showing the Area of Coverage shall be provided in Shape file format to BMC, on request.

c. Horizontal Positional Accuracy Specifications

The digital orthophotos shall be compiled to meet 1:500 scale mapping with horizontal accuracy at 95% confidence level.

d. Aero-triangulation

- **General:** The selected Bidder may use fully automated aerial triangulation techniques. The use of airborne GPS/IMU technology is recommended in lieu of conventional aerial triangulation as long as project accuracy standards are maintained. The Bidder shall provide a complete description of their methodology for performing the aerial triangulation adjustment including the equipment and software used.
- **Software:** Industry-standard software program shall be used for aerial triangulation computations. The package used must be capable of strip adjustments, as well as large bundle (blocks of photos and strips) adjustments and shall also have gross error detection facilities. The software must be capable of processing the thousands of points generated in the softcopy process and be able to adjust large blocks of photos. The proposal shall describe the package used for adjustment computations on this project.

e. Ortho-rectification

i. Bidders shall describe in detail the technical procedures, equipment, and software to be used for the production of digital orthophotos. A complete description of the digital orthophoto

technical methodology shall include but not be limited to compilation of the terrain model, ortho rectification process, image mosaicking, radiometric accuracy, estimated file size, and all quality control procedures. Bidders shall provide any relevant detail about image processing techniques that they propose to use to enhance the usefulness of the digital image.

ii. The ortho-photography produced shall be mosaicked with consistent tonal and color scale ranges within and between images. Match lines created for mosaicking shall be selected interactively. Match lines shall only be allowed where adjacent images lie at the surface of the DEM used to create the orthorectified images and are at the same elevation.

iii. Mosaic lines shall not cross through buildings, bridges, or other fabricated structures not at ground level. Join lines between overlapping images shall be interactively selected by the Bidder to minimize tonal variations and visible join lines.

iv. Buildings, bridges, and overpasses must be spatially correct and not contain bends, breaks, or discontinuities.

v. To minimize distortion of above ground features, the Bidder shall restrict ortho-rectification primarily to neat model areas, using the centers of each photograph rather than every other photograph.

vi. The images shall be edge matched so that tonal values are consistent across the edges and there is minimal evidence of the join. Radiometry must be balanced between neighboring tiles. The final ortho-rectified tiles shall tile together seamlessly.

f. Aerial Triangulation Report

Upon completion of aerial triangulation work, the Bidder shall prepare a formal aerial triangulation report for delivery to BMC.

g. Surface Model

i. Proposals shall include a complete description of the procedure for collecting and developing the surface model. The Bidder shall describe the quality assurance measures used to verify the accuracy of the surface model.

ii. The surface model must contain mass elevation points taken at uniform grid spacing and 3D break lines as required.

iii. The grid spacing of the mass points and collection of break lines shall be designed to produce ortho-rectified imagery that meets or exceeds the ortho accuracy standards as specified in this proposal.

iv. The vertical accuracy of the surface model shall be sufficient to achieve the specified horizontal accuracies of the ortho-rectified imagery.

5.10.2 Land Use Land Cover (LULC) map of Mumbai

Land Use / Land Cover (LULC) is referred to the classification of human activities and natural elements on the landscape within a specific time frame based on established method of analysis of source material. Within the scope of this RFP, requirement of LULC map is specified below.

(1) The System Integrator should create the LULC maps minimum as per the National Urban Information System (NUIS) Design and Standards 2008 guidelines or AMRUT or latest.

(2) The System Integrator shall be able to create LULC maps using Supervised as well as Object Oriented Classification algorithms provided as a part of software module. It will bring about classification of man-made and natural features.

(3) Complex areas with intermittent spatial regularity can be mapped on case-by-case basis.

(4) LULC map should also be supported with accuracy assessment report.

5.10.3 Generation of Digital Surface Model & Digital Terrain Models

- **Process for Generation of DEM**

  The selected Bidder is required to generate Digital Elevation Model (DEM). The selected Bidder is required to use available/ advanced technologies to generate the DEM. The selected Bidder shall generate the DEM using LiDAR data. Wherever required, the selected Bidder may also use other available data like GCP, Stereo Model, etc.

- **Specifications of the DEM**

The selected Bidder shall generate DEM for the identified BMC project area. The DEM generated shall be of the below specifications:

i. Grid interval of the DEM shall be 50cm or better.
ii. DEM shall be delivered in an industry-standard, GIS-compatible, 32-bit floating point raster format.
iii. Geo-reference information should be in or accompanying each raster file.
iv. Void areas (for example, areas outside the BMC project Area but within the project tiling scheme) coded using a unique "NODATA" value. This value will be identified in the appropriate location within the raster file header or external support files (for example: aux)
v. Permanent water bodies like lakes, ponds, reservoir, etc. shall be Hydro-flattened whereas linear water bodies like river, streams, etc. shall be Hydro-enforced.
vi. Bridges shall be removed from the DEM.
vii. Road or other travel ways over culverts intact in the surface.
viii. QA/QC analysis materials shall be delivered for the absolute vertical accuracy assessment.
ix. DEM shall be rigorously corrected for different categories of vegetation, different heights of built-up areas, etc.
x. Break lines shall be properly incorporated on the edges of the river, water bodies and hilly area.
xi. DEM data shall be seamless across edges.
xii. Contour Specification shall be as per below:
    1) Contours shall be generated at 20 cm interval
    2) Every Tenth contour line shall be an Index Contour, distinguished using a heavier line style to enhance identification.
    3) Contour shall not be closed on road & building
    4) There shall not be any sharp edges on contour
    5) Contours shall be aligned with surface data
    6) Contours shall be free from spikes
    7) Contours shall be topologically correct

5.10.4 Generation of 3D Base Map (True Orthophoto)

The selected bidder shall create 3D Base Map of the identified BMC Project Area. Plotting/feature extraction/vector compilation shall be done at 1:500 scale as per the List of Spatial Features in Land Base Maps as mentioned in Annexure XIX.

- The final list of feature datasets shall be finalized during SRS stage.
- The successful bidder shall generate high resolution 3D City model and Create 3D GIS Base Map for BMC area of 500 Sq Km using high resolution aerial imagery (Nadir + Oblique) and LiDAR Point Cloud.
- Data Model for storing the spatial & Non-Spatial data shall be decided in consultation with the BMC in accordance with the National Large Scale Mapping Policy. Need to finalize data model for creating/populating data in base map as well as providing intended outcome of GIS enables web applications.
- GIS Base Map shall consist of all relevant and important physical, geographic and administrative features in the BMC Project Area such as existing administrative boundaries, slum boundaries, building footprints, property boundaries, roads, contours (at least 0.5 meter interval), natural features such as water bodies etc. to create a comprehensive GIS database.
- The base maps shall be prepared in various layers for ease of operation in GIS. The bidder is required to generate all the GIS data set as per the standardized GIS data / layer structure.
- Simultaneously, along with the above-mentioned activities, the bidder shall also study the existing maps and data available with BMC for integration.
- The base map data created shall be consumed directly on 3D GIS Platform supplied by the BMC. There should be a facility where 2D data can consume directly and overlap with other 3D features. Only those features will be capture in 2D whose 3D mapping is not possible rest of all the features would be as 3D and 2D objects.
- Field verification of features shall be done to ensure complete accuracy.

5.10.5 Generation of 360° Street view Panoramic Imagery

- SI is required to capture panoramic image data along the streets of BMC jurisdiction area by survey activity using modern, state-of-the-art GIS enabled photographic equipment mounted on the vehicles.
- During imaging, all possible attempts should be made to capture images of the assets along the streets with least obstructions from parked vehicles or traffic. All such congested locations should be preferably imaged during early morning hours, when traffic is less.
- SI should take all possible precautions while carrying out such survey and ensure not to create any traffic inconvenience, as well as inconvenience to the Public at large and avoid any survey to be carried out in restricted areas to the best of our knowledge.
- SI is expected to coordinate with all the concern organizations to get the required field survey permissions. In case of impedance, SI will inform BMC who in turn shall provide support by communicating with the concerned organization to seek required survey

permission. The final decision would be of BMC in case both can't get the required field survey permission.

- SI should acquire and deliver 360-degree street level panoramic imagery using Mobile Terrestrial Panoramic Imaging system within the BMC project Area with spherical imagery captured at 5 meter interval.
- SI shall integrate the street level panoramic imagery with updated base map in 3D city model and provide access to the system as per Application development and Deployment section in this RFP.
- ***SI to explore the feasibility of integration with Google Street View instead of capturing the 360 degrees Street view Panoramic Imagery.***

Data Privacy

- The street view & all its final product/ deliverable should have faces of all humans smudged (anonymised).
- Similarly, all the vehicles nos. plates in the images should smudged (anonymised).
- If any images, photos are captured with inside view of any residential unit, they should be permanently deleted & grey areas can be inserted as masks in such places in the imagery.
- If any intimate moments are captured in any street view imagery they should be permanently deleted immediately.

5.10.6 Generation of Terrestrial Mobile LiDAR Data

- SI is required to capture LiDAR data of BMC Project Area using Mobile terrestrial LiDAR scanning equipment along the streets.
- SI will take all possible precautions while carrying out such survey and will ensure not to create any traffic inconvenience, as well inconvenience to the Public at large and avoid any survey to be carried out in restricted areas to the best of our knowledge.
- SI should acquire and deliver street level Terrestrial LiDAR point cloud data of area within BMC project Area with relative positional accuracy of ±0.40 meters for X and Y Coordinates.

5.10.7 Generation of 3D Reality Mesh Model

The SI should prepare 3D reality mesh model of Mumbai using aerial photogrammetry, LiDAR, terrestrial & mobile LiDAR & 360° Panoramic street view imagery. ***Integration with Google's Street View to be explored by SI.*** The Successful bidder shall prepare photorealistic 3D City models by using aerial imagery, point cloud data and photogrammetric techniques. The specifications/ features of same shall be:

i. Shall be geo-referenced with the GCN.
ii. Shall be seamless in nature.
iii. Shall depict all visible structure, asset, road, vegetation, etc.
iv. Shall have realistic view \ textures.
v. The 3D reality mesh should be accessible using Web or Mobile application.

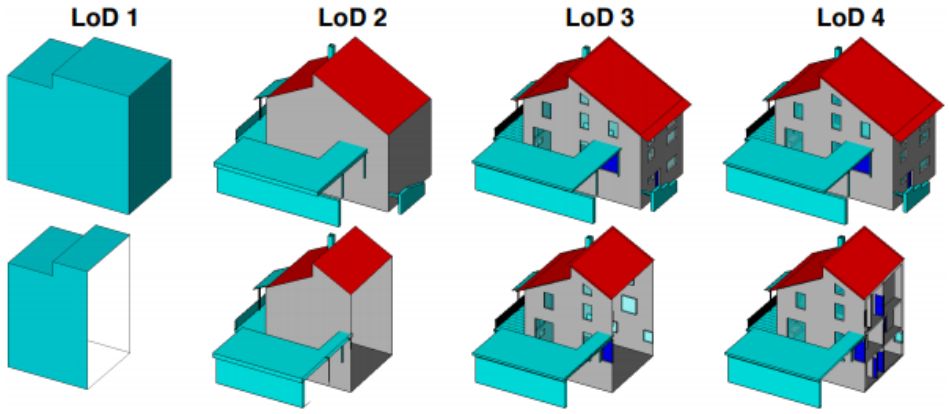
vi. The application showing 3D reality mesh should have feature/ buttons to switch view from 2D maps, 3D maps, LiDAR dataset & 360˚panaromic street view imagery in an intuitive manner.

vii. The application should support zoom-in, zoom-out, pan & other functionalities for 3D reality mesh model, 360˚panaromic street view imagery & LiDAR dataset.

5.10.8 Generation of 3D City Model

The SI should prepare 3D LoD 3 vector model consisting of Buildings, Roads, Bridges, Flyover, Tunnels, Railways, Mono, Metro, Street lights, Traffic signals, Water bodies, Trees, Landscapes, Open spaces, Airports, Gardens, Slum and all other features having height with reference to Aerial data complying with LoD3 specifications. The output from 3D mapping/modelling should be engineering grade. Every feature created in 3D map/model should be highly precise with respect to horizontal and vertical accuracy of 30cm. 3D Models should be as per LOD 3 standard which must include 3D buildings and Super structures like Overhead water tank, Chimney etc. covered in the model. 3D Models should be realistic and having accurate exterior 3D representation. The 3D LOD 3 vector data must be light weight and should be work on mobile phone / 4G for operational purpose.

1) Within the scope of this RFP, 3D city model to be created complying with LoD 3 specifications as explained below:



Sr. No.	Level of Details	Description
1.	LoD0	For every building or building part the footprint or roof outline is represented by a horizontal polygon with a well-defined absolute and constant height.
2.	LoD1	For every building or building part the generalized outer shell is represented by exactly one prismatic extrusion solid. Ground, floor and roof surfaces must be horizontal, lateral boundary surfaces must be vertical
3.	LoD2	For every building or building part the geometrically simplified outer shell is represented by horizontal resp. vertical outer surfaces and simplified roof shapes.

		All kinds of surfaces e.g. ground surfaces, wall surfaces, roof surfaces, outer ceiling surfaces, outer floor surfaces, virtual closure surfaces and additional building elements e.g. building installations like balconies, dormers and chimneys may be represented as semantic objects.
4.	LoD3	For every building or building part the geometrically detailed outer shell is represented by detailed outer surfaces and detailed roof shapes. All kinds of surfaces e.g. ground surfaces, wall surfaces, roof surfaces, outer ceiling surfaces, outer floor surfaces, virtual closure surfaces and additional building elements e.g. building installations like balconies, dormers and chimneys may be more detailly represented as semantic objects. In respect to LoD2 doors and windows can be modelled as planar thematic objects.
5.	LoD4	For every building or building part the geometrically detailed outer shell and interior is represented by detailed outer and inner surfaces and detailed roof shapes. All kinds of surfaces e.g. ground surfaces, inner and outer wall surfaces, inner and outer roof surfaces, outer ceiling surfaces, outer floor surfaces, virtual closure surfaces and additional movable and non-movable building elements e.g. building installations like balconies, dormers, chimneys, interior and furniture may be represented with greater detail as semantic objects.

i) 3D city model should consist of minimum Buildings, Roads, Bridges, Flyover, Tunnels, Railways, railway stations Mono, Metro, Street lights, Water bodies, Trees, Slum, and all other features having height.

ii) The 3D city model should be developed using stereo Aerial Images /LiDAR (including Terrestrial vehicle mounted/backpack LiDAR). 3D model must be realistic and have accurate exterior 3D representation.

iii) The 3D output should be OGC complied (Vector Model).

iv) 3D city model must be produced with Level of Detail – LoD0 to LoD3 for all structures and assets. It must be mapped taking into consideration, all sides of the existing structure and assets. The models must have all the details including all the visible superstructures such as overhead tanks, rooftop structures, parapet walls, windows etc. The output of the 3D model should be very clean and with appropriate details.

v) To visualize the growth of the city, it is needed to detect changes over a span of time and compare with the previous data are represent the change on the map over a period.

vi) The 3D city model vector data should be light weight and should be accessible on any device like laptops, desktop machines, mobile phones and tablets.

vii) 3D city models should be accessed and streamed on the internet using 4G/LTE or Wi-Fi for different kinds of users through web and mobile/tablet platforms.

viii) Every 3D building model should be clickable, with an automated attribute table pop-up providing information such as building ID, dimensions (length, breadth, height) and date of

capture through web and mobile platforms. Also, the user should be able to measure dimensions of the 3D objects as per requirement.

ix) The System Integrator should be able to update 3D model once a year for next 3 years during operation and maintenance phase using Lidar (terrestrial and/or aerial).

x) Minimum LoD 3 specification for creating virtual 3D city model includes:

- ✓ Representation of the structure / object in actual shape and size as per resolution
- ✓ Representation of Buildings (all types) with all walls, openings/wall fittings, rooftops, water tanks and parapet walls with clear details
- ✓ Modeling of Roads and associated assets, Bridges, Flyovers, Tunnels, Railways with stations, Monorail with stations, Metro Rail with stations, Water Bodies/Rivers/Nallas, Overhead water tanks, Trees, Street lights, Hoardings, Bus Stops, Fuel/Gas station, Boundary walls, Open Spaces, Airports, Stadiums, Play grounds, Landscapes and all other features deemed necessary
- ✓ Modeling of the 3D objects with corresponding individual feature with real texture
- ✓ Capturing all the individual building objects in 3D in all possible directions with best available data
- ✓ Hutments within slum should be modeled with LOD2 with rooftop and walls considering the best available data

xi) Acceptance of 3D city model through POC:

The methodology that will be adopted for acceptance of 3D city model will be as described below as a proof of concept:

- ✓ Select an area of approx. 5 Sq. Km. within BMC jurisdiction having most of the 3D features to be modelled mentioned in this section above. The area shall be selected by the department and System Integrator
- ✓ Post collection and pre-process of input data through Aerial and Satellite platforms, build the 3D city model for the selected area
- ✓ Error free product should be delivered after due QC / QA process
- ✓ Perform User Acceptance Testing on the system and on field
- ✓ Incorporate all suggestions noted during acceptance and field testing, finalize the approach and methodology for execution of the project along with acceptance criteria

5.11 Ground Truthing & correction in Final deliverables

This is one of the most important phases of the project. The process for ground truthing will be as follows:

1. Ground truthing will be done ward-wise.
2. Ground truthing will be done for 10% of all deliverables for 10% of total area of Mumbai.

3. Any discrepancies found in any deliverables in the ground truthing phase should be immediately corrected & submitted as final deliverables.
4. Ground truthing will be a joint activity where SI team would be accompanied by the BMC team during ground truthing. BMC team & SI team will jointly select areas to be visited ward-wise for ground truthing.
5. When both teams visit the actual locations, SI shall use appropriate equipment & technique or equipment with better specifications & measure the feature, assets which needs to be verified. The accuracy of the assets, feature should be withing the acceptable limits defined in the RFP.
6. If discrepancies are found in the feature, assets which are captured then the appropriate SLAs will be applicable to the SI as per SLA section mentioned in the RFP.

5.12 Delivery & installation of various devices

5.12.1 Delivery & installation of High-end workstations for viewing, editing LiDAR, Orthomosaic, etc. as per specifications

The SI should install & commission the five High-end workstations for viewing, editing LiDAR, Orthomosaic and all the deliverables & raw data which are part of the scope of work this project. The specifications of the High-end workstations are mentioned in Annexure XVI.

Any ArcGIS products which need to be installed in these workstations will be provided by BMC from BMC pool of ESRI licenses. Any other software other than ESRI suite which is required to view, edit & process any of the raw & final deliverables which are mentioned in the scope of work needs to be installed & maintained by the SI. BMC will provide necessary office space, electricity, LAN, Internet, Desks & chairs to install & commission these high-end workstations at any of the BMC office locations.

5.12.2 Delivery & installation of Color printers as per specifications

The SI should install & commission two color printer as per the specifications mentioned in Annexure XVII. BMC will provide necessary office space, electricity, LAN, Internet, Desks & chairs to install & commission these color printers at any of the BMC office locations.

5.12.3 Delivery & installation of One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph) as per specifications

The SI should install & commission One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph) as per the specifications mentioned in Annexure XVIII. Any other software other than ESRI suite which is required to view & interact with the 3D data which are mentioned in the scope of work needs to be installed & maintained by the SI. BMC will provide necessary office space, electricity, LAN, Internet, Desks & chairs to install & commission these of One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph) at any of the BMC office locations.

5.12.4 Publish 3D reality mesh on 3D projector & showcase demo

After successful installation & commissioning of the wall mounted 3D projector, the SI needs to publish the 3D reality mesh & other 3D products mentioned in the scope of work of the RFP & showcase the demo to BMC team. If there are any observations, glitches, errors, slowness in the 3D experience the same has to be corrected by the SI.

5.13 Development, Implementation of Enterprise Geospatial Application & Security Audit Certification from CERT-IN empanelled agency for the enterprise Geospatial application

5.13.1 Supply & Installation of 360˚ Panoramic street view imagery publishing Server software compatible with ArcGIS Enterprise suite

The SI should supply, install & commission 360˚ Panoramic street view imagery publishing Server software compatible with ArcGIS Enterprise suite. The preferable software which meets the requirements of the scope of work of this project is Orbit GT Suite by Bentley. The SI should supply, install & commission necessary 3D Orbit GT suite of applications as per the requirements of the project. The necessary plugins required for integration with ArcGIS suite of products should be included in the Orbit GT suite. The quantity of the products should be estimated by the SI depending upon the scope of work of the project. The Orbit GT suite will be installed on the Virtual cloud which will be provided by BMC. The SI should take into consideration that there are three environments in the cloud namely Production, Staging & Development. The sizing of the 3D Orbit GT suite should be made accordingly to comply with all three environments.

5.13.2 Supply & Installation of Enterprise Oracle database

The SI needs to supply, install & commission Enterprise Oracle database as per the scope of work of this project. The Oracle database suite will be installed on the Virtual cloud which will be provided by BMC. The SI should take into consideration that there are three environments in the cloud namely Production, Staging & Development. The sizing of the Oracle database suite should be made accordingly to comply with all three environments. Oracle RAC should also be included in the Oracle database licenses. The SI should also suggest appropriate & most stable version of the Oracle database which is compatible with latest Linus OS, ArcGIS Enterprise suite of products and 3D orbit GT suite.

5.13.3 Development & implementation of Web GIS application for 3D City model & change detection

As part of the development, implementation & maintenance of this project, the SI should develop, implement & maintain **3D Web GIS application, Android & iOS application, Dashboard and integration of 3D Web GIS application with existing IT & GIS systems/ applications** in BMC. All the applications mentioned above should support 3D City model & change detection maps.

Collectively all the applications will be called **"3D Enterprise GIS application"** for ease of use & understanding in this RFP.

The proposed solution includes activities from data creation to the development of web GIS applications according to the defined use cases and integration with existing applications. The enterprise geospatial solution design should be scalable and robust to address the future needs.

BMC already has Enterprise GIS on ArcGIS platform in place which can be leveraged while designing the data models considering base map layers and services.

Following are the estimates of the approximate usage of the envisaged 3D Enterprise GIS application:

a. Approximate number of users (viewer) over Intranet – 1000
b. Approximate number of users (editor) over Intranet – 50

Specified above are the indicative number of users, given to get a fair idea to the prospective System Integrators on overall usage of the envisaged solution. System Integrators are required to propose the system which can be scaled up to higher usage in future. Initially the 3D Enterprise GIS application will be used by the BMC staff, after Go-Live BMC may extend this application to other state & central government bodies for viewing purpose. Some parts of the application/ web services may also be extended to citizens of Mumbai after Go-Live. The application will be deployed on cloud, the details of the cloud are mentioned in the Cloud section below. The 3D Enterprise GIS solution will be deployed in multi-tier architecture which will be conceptualized by the SI in consultation with BMC team. Each tier in the multi-tier architecture will be commissioned in high availability. There will be total three environment in the cloud namely Production, Staging & Development.

For design and Development of the 3D City Model, it is essential to establish the basic framework on the Data, Model and Visualization so that the end users can essentially perform measurements on the features and models, query on the digital replicas and also generate reports.

3D City Model will enable more effective use of spatial and non-spatial data to understand location-based policy and planning issues, test potential interventions, and deliver more sustainable planning and development for BMC. This in-turn will improve the decision-making efficiency and effectiveness thereby improving the governance, social, economic and environmental outcomes.

This component covers all software, applications, operating systems, hardware and other related components which are required for implementation of the system. Bidder is expected to design a comprehensive solution, implement & manage the project with consent of BMC. The basic objective of the 3D City Modelling is to establish a framework for visualization of the 3D models in browser environment and perform basic measurements and query on the database. The details mentioned in the Scope are as per the high-level understanding of the department. The department reserves the right to amend change in the scope as required for Government process, till the UAT is complete. The application should be cloud ready & should abide as per the latest state cloud GR.

The SI should follow all government web application standards including GIGW while development, implementation & maintenance of 3D Enterprise GIS application. Other technical standards like OGC standards for Geospatial data interoperability should also be followed.

5.13.3.1 Solution Design

The Bidder would prepare and submit the Software Requirement Specification document (SRS), Design Document, Software Design Document (SDD) for review and sign-off. Once the Design Document and SDD is signed-off, the bidder is expected to provide clickable and interactive wireframes, sample reports, sample dash boards, etc. for approval before proceeding to final development. The Bidder would then carry out the further activities of software development / customization and UAT.

- The Bidder must ensure that the solution technology components adhere to flexibility, usability, availability, manageability, security and integration standards. Design should make use of common government components wherever possible. Design should comply with minimum functional requirements. Design should be flexible to adapt to changes required as per directives from BMC
- The Bidder shall build a complete audit trail of all transactions (for e.g. add, update and delete) using transaction log reports, so that errors in data, intentional or otherwise, can be traced and reversed. The most appropriate level of security commensurate with the value to that function for which it is deployed must be chosen. Access Controls must be provided to ensure that the datasets are not tampered with or modified by the system operators. Implement data security to allow for changes in technology and business needs. Based on the requirements analysis conducted above, the Bidder must develop a comprehensive system.
- Design, development, testing and implementation of the Solution Design: The Bidder shall be entirely responsible for the architecture of the system implementation to satisfy all features, functions, performance and security as described in this document including sizing of the required hardware and software. Solution description provided in this document is for reference only.
- The Bidder should ensure all possible and required improvements. The Bidder shall consider users' inputs when they are finalizing all design components including user interfaces, mode of data entry, storage and retrieval, outputs reports, queries and the application design. All changes being done will be mutually discussed with concerned officials.
- System should have capability to integrate with external IT Systems of BMC such as BMC Portal.

5.13.3.2 Features and Functionalities

The following features and functionalities are envisaged to be developed using the data that will be generated from the project to support better governance and offering better citizen centric services:

- **Features of 3D Enterprise GIS Application (Basic Framework):**
  A customized solution should be developed on a BMC provided industry standard enterprise geospatial server software so as to provide users with rich features of 2D and 3D environment. Being a part of the spatial Digital Twin System, it should help user with location awareness for better decision making. The whole platform should consist of subcomponents as described below.
  - **Map and 3D Reality Mesh Model layers:** Map module should provide access to published layers and allow the user to view, navigate and analyze the map data. Map module should be able to display:

- Tile layer
- Feature layer
- Raster layer
- Image services
- Graphic layers

- **Map navigation:** Map navigation should allow user to navigate the map contents using navigations features lie, Pan, Zoom, interactive Overview maps etc.

- **Measurement:** Measurement allows user to measure distance, area and parameters on maps
  - Measure Distance / measure area
  - Change measurement units
  - Display measured distance/perimeter/area
  - Features information
  - Features information allows user to the features details associates with features
  - Identify features single or multiple to get the information
  - Navigate through the identified result

- **Table of contents:** Table of content should allow the user to navigate through published layers

- **Web Map-LiDAR Point cloud-Panorama-3D Model synchronization:** This should allow synching location of map, LiDAR point cloud (acquired from multiple sources), 360 degree panoramic images and 3D Building Models. It will be a bi-directional synching, which means any navigation on panoramic view will be identified on map. In the same way if panoramic location is identified on map the panoramic view of the same location will be displayed.

- **360° HD Panoramic Imagery Component:** This core component should be integrated on Web Applications which should help corresponding users to view and navigate real world ground realties / building properties in 360° panoramic images on Web platforms

- **Search:** Should assist user to find the desired location using area, locality, place name, latitude, longitude and/or feature attribute information

- **Geospatial Analysis:** Geospatial analysis allows user to find the features around and along a particular location or features. Further to help make business decision on the result opted.
  - Proximity Analysis to find the features around the selected location
  - Buffer analysis to find the features around or along the selected features
  - Distance and layers in the analysis will be parameterized
  - The geometry required to perform analysis can be user drawn or can be taken from existing features

- **Reports:** With extensive data that will be rendered on a daily basis, the platform's reports are designed to be which should be customizable to suit a wide range of client specific queries and requirements

- **User Management:** Should Consist of Rights allocation to various users or stakeholders of the system. A few of the functionalities are as follows
  - Add, update and delete users
  - Assign roles to the user
  - Activate, de-activate users
  - Search users

- **Audit trails:** Should help maintain audit trials for each and every user who logs in the system. Systems should l record user's activities as well as all the logs for tag manipulation undertaken

- **Web User Authorization:** This module should allow user with secured access to the application.
  - Allow user to login into the system and allow secured access
  - Authenticate and authorize the user and allows appropriate control over their access
  - Allow change of password
  - Help user to retrieve the password, if forgotten

5.13.3.3 Expected Project Outcomes and Use cases for Government Departments

High quality, reliable, geo-spatial information is critical to most of BMC governing activity and decision making process such as urban planning, land management, infrastructure development, disaster management and forestry etc, Currently geographical (2d spatial) data is being mostly used across various BMC government agencies and departments, however these 2d spatial data is complex, often duplicated, inconsistently created in multiple data formats, and it needs to be updated regularly, which makes it difficult to share between departments and often not accessible to the broader community to improve planning decisions, the 3D GIS is expected to overcome these issues.

3D GIS is also expected to provide opportunities for spatial data sharing and providing opportunities for most of the planning, decision-making activities and use cases in the BMC departments. The rapid growth of city area under BMC emphasis the need for futuristic land planning, development and management. 3D GIS is expected to deliver cutting edge solutions for assessing, preparing for and meeting the demands of rapid urbanization. The traditional form of 2D-based land cadastre might not be sufficient to provide the required clarity about Rights, Restrictions and Responsibilities (RRRs). 3D GIS is expected to overcome these issues and provide information required about different types of land tenure, property valuation and taxation, possibilities of physical extensions, etc.

Use cases for the following BMC departments are expected to be developed from the implementation of this project-

1. Development Plan
2. Roads, Bridges & traffic
3. Disaster Management
4. Mumbai Fire brigade

5. Assessment & Collection: responsible for collecting property tax from residential & commercial properties.
6. Removal of Encroachment
7. Garden & trees
8. License dept for providing hoarding licenses & management

The 3D GIS Platform is expected to serve for visualizing the best possible replica of the real city conditions as it helps to virtually view, plan, simulate, query and manage the real-life scenarios. The successful bidder is required to create various department specific use cases to showcase the capability of the platform in solving Urban/ City problems. The below mentioned department specific use-cases (but not limited to these) needs to be demonstrated / performed using available/ real/ accurate/ live data. In case of non-availability of relevant data, the successful bidder shall create mock cases to showcase the usability of 3D data.

The table below shows the brief details on the expected use cases and the corresponding functionalities to be developed from this project

Department name -Development Plan				
Use case type and Core Functionalities	**Sub Functionalities**	**Functionality description**	**GIS Layers required**	**Applications**
Urban Planning & Development Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE)	Spatial Overlay of existing Development Plan/ Master Plan for 3D data site selection, land suitability analysis, land use and transport modeling, the identification of planning action areas, and impact assessments. Smart urban planning, smart utilities, smart transportation, smart public works and citizen engagement Dashboard for classification of buildings based on their height Multiple Criteria Evaluation (MCE) to check urban sprawl directions Smart Urban Planning: land-use density, and transportation network	Spatial Queries, measurements, transformations, descriptive summaries, optimization, and hypothesis testing. Overlay 3D GIS data on existing Development Plan/ Master Plan for getting As-Built insights of what is existing on ground as per the DP reservations, this will help the Town/Urban Planner plan better. Visualize and Manage community infrastructure and assets. Estimate future growth demands.	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to Development Plan, Urban Planning & Development like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing

Location optimisation	3D Modelling to check the following planning and development criteria's – Amount of land to be left undeveloped to provide green space, cluster development and storm water drainage The density of development in relation to the existing and planned infrastructure The amount of land needed for parking, given a particular land use The proportion of land set aside for various uses, zoning classifications or design standard requirements Land uses within zoning classifications (e.g., amount of green or open space per residential unit within residential zones) The minimum/maximum size for parks and their ideal Locations The length of city blocks and the buffering of sidewalks (e.g., to encourage sidewalk use)	Optimize public safety information and reporting. Expand public engagement opportunities and platforms. Share, collect, and analyze critical physical and cultural municipal data	Placenames Cadastral	Structure Conversion Generalization and Classification Integrations Map Enhancement Data Interpolation Buffer Generation
City Infrastructure Asset Management and City planning Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE) Location optimization	Visualize 3D spatial data related to assets and infrastructure in different categories. Modelling the process of planning, designing, constructing, operating, and maintaining the city public Infrastructure and assets Reporting infrastructure defects Managing city assets (road conditions, utilities, billboards, and sign inventories) with mobile LiDAR to inventory and ensure safety standards. Analyzing city constructs such as crossing guards, phone boxes, and electricity boxes, curb cuts, utility poles, waste collection, fire hydrants, speed limits, road closures, potholes 3D city models, city planning, architecture, and overall design. Incident Mapping, City VR/AR Modeling, Heat Island Mapping Spatial Overlay of existing	Spatial Queries, measurements, transformations, descriptive summaries, optimization, and hypothesis testing. Click on different GIS layers in 3D like Buildings, Trees, Roads, Street lights, Furniture, Roads, etc. to visualize/ select & then view Geometrical attributes like length, width, height, volume, etc. zoom, pan, move over any area on the Web application 'Assessing feasibility and plan implementation of City development plans to improve urban planning, architecture, and overall design.	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to City Infrastructure Asset Management and City planning like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification

	2D GIS vector layer with 3D data 3D city zoning	- Overlay 3D data on existing 2D GIS data like, building footprints, roads, streetlights, etc. - Since the 2D GIS data is old, 3D data would be updated. - So the new features/ assets which are not present in 2D can be added/exported in 2D GIS data as part of update activity. Model to be used to visualize urban planning scenarios using 3D swipe view		Integrations Map Enhancement Data Interpolation Buffer Generation.
Change detection and Analysis of building construction and other major structures Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE) Location optimization	Preliminary Site Investigation Building information modeling Line of Sight analysis Geo designing/ Conceptualizing building plans, 3D Fences Access Limitation Building Regulations and Permits, Analyzing Building Constraints Line of Sight and Building Obstruction Evaluation 3D city models, city planning, architecture, and overall design. Incident Mapping, City VR/AR Modeling, Spatial Overlay of existing 2D GIS vector layer with 3D data Dashboard for classification of buildings based on their height	Using 3D GIS classified data, classify the building according to their heights (floors) in different classes. Classify the 3D building in different colors according to their height range for planning, analysis & safety compliance 3D Mapping and Modelling Building Constraints Automatic object extraction and segmentation using high resolution satellite data for structural change mapping and 3D modelling. Using 3D GIS classified data, classify the building according to their heights	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to Change detection and Analysis of building construction and other major structures like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification Integrations & Map Enhancement Data Interpolation Buffer Generation.

		(floors) in different classes.		
Management of over ground / underground utilities Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE) Location optimization **Public Utility and Infrastructure** **Solid Waste Management**	3D Mapping of Utility facilities such as utility Poles, cabins, corridors etc. 3D mapping and Modelling of affection and encroachment plans from overhead and underground utility features 3D Utility Network Management Subsurface 3D Utility Model Utility Pole Replacement Mapping street view assessment of Utility features 3D utility Topology modeling Mapping Inventory of roads, sidewalks, bridges and utility networks with all utility assets Mapping and identification of sanitation truck routes, capacities, and staffing by area Identification of landfill and recycling sites Analysis of potential capacity strain considering development in certain areas Analysis of sanitation truck routing in relation to area pickup needs, routing efficiency, and destination sites Mapping and analysis to identify ideal high-density solid waste disposal areas	Classify the 3D building in different colors according to their height range for planning, analysis & safety compliance 3D Mapping of existing and Proposed Utility corridors and connected networks in BMC Power Outage management 3Dmapping of Telecommunicatio n networks Optimize asset inspection and maintenance 3D PowerGrid Mapping and networking Integrating Utility Attribute information including name, location, condition with smart city models Analysis of infrastructure conditions by demographic variables such as income, population change Analysis to plan and schedule proactive maintenance and expansion based on estimated future load		
Department name - Roads, Bridges & traffic				
Use case type and Core Functionalities	**Sub Functionalities**	**Functionality description**	**GIS Layers required**	**Applications**

Road Traffic Management / Navigation Systems, Tracking & Route Finding Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE) Location optimisation Road widening impact analysis	3D Road Network Mapping, Routing shortest path, Optimum and least cost travel mapping 3D Spatial analysis of traffic patterns, road closures, venue access points, criminal activity, and protest areas. 3D Modeling of volumes of automobile and foot traffic flow. 3D Models for Intelligent Transportation System (ITS) Real-time 3D spatial data feeding to provide each stakeholder with situational awareness 3D Smart Logistics Management Pedestrian Walkability analysis 3D Sidewalk Inventory and mapping Transit Ridership checking 3D models to check Traffic Congestion 3D Inter-modal Transportation and Infrastructure Life Cycle 3D modelling and spatial Analysis of road infrastructure conditions by demographic variables such as income, population change 3D mapping of Roads and bridge's Chokepoints inside BMC Using 3D GIS classified data, classify the roads & extract them as layer. As per the proposed plan of road widening create buffer of required width & length. Ex. 1meter width	Multimodal Road network Mapping and Analysis such as Turn Restrictions, Parking Demand, Spatial A/B Testing, Closest Facility, Intersection Analysis, Tracking Modeling and Mapping the following functionalities- Road Network and Travel Costs Road Asset Management Active Transportation Planning Highway Asset Management 3D Mapping of Public Road Utility and Infrastructure Mapping Inventory of roads, sidewalks, bridges and utility networks Analyzing utility assets Integrated with Utility Attribute information including name, location, condition in relation with smart city models Analysis to plan and schedule proactive maintenance and expansion based on estimated future load Mapping and Modelling - Road closures during emergency	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to Roads, Bridges & traffic like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification Integrations Map Enhancement Data Interpolation Buffer Generation

		Creating buffer of required width around the existing road. New road with semi-transparent color will show existing structures which will be impacted. Use intersects tool & extract all the structures which are impacted by road widening		
Department name - Disaster Management and Fire Brigade				
Use case type and Core Functionalities	**Sub Functionalities**	**Functionality description**	**GIS Layers required**	**Applications**

Emergency / Disaster Management Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE) Location optimization	3D Modelling and Mapping of Threats and Hazards like Natural Hazards, Seismic zones, Coastal zones, Landslide-prone areas, Areas prone to wildfire, Rivers, Areas prone to hurricanes and similar weather events 3D Mapping and Modelling Manmade and other Technological Hazards 3D Mapping and Modelling Fuel and other Power plants, Facilities with hazardous materials 3D Mapping and Modelling Shelter suitability and evacuation 3D Mapping and Modelling for risk Reduction and Prevention	3D Modelling and Mapping for Site suitability and selection of best transportation delivery method during a disaster such as air, land, and sea Routing based on shortest path, Site selection for the distribution of supplies during an emergency, Optimal locations for staging areas and shelters Closest locations of business to provide equipment and supplies, Dynamic monitoring and surveillance of the transportation network, Tracking and security of vehicles carrying supplies Shelter locations, Alerts such as evacuation notifications and routing instructions Law enforcement alerts such as crime activity in an area Amber alerts Overall incident status and progress Mapping	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to Disaster Management and Fire Brigade like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification Integrations Map Enhancement Data Interpolation Buffer Generation
Department name - Disaster Management and Fire Brigade				
Use case type and Core Functionalities	**Sub Functionalities**	**Functionality description**	**GIS Layers required**	**Applications**

Security planning and management, Planning & Simulation of VVIP Safety, Law & Security Arrangements Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE) Location optimization	3D Fences for building and facility security Tracking and predicting mobility of people, means, and sources 3D Mapping of emergency services, law enforcement, military, intelligence services, as well as central and local governance, researchers, and society 3D Mapping for Planning and analysis, Logistics, Command, Operations and Outreach of Security services 3D Modelling and Mapping of Values and Assets and Critical Infrastructure like Government facilities, Commercial utilities, Hospitals GIS Platform for National Security, Schools, Public assemblies, Transportation networks and hubs, Economic values, Cultural values, Cybersecurity network 3D Mapping and Modelling of Special Needs of Vulnerable Populations, Elderly, Low income Transportation routes (rail, other), Transporting hazardous materials, Deliberate Attacks and Hazards, Border enforcement and protection, Crime, Gang areas or areas of historic civil unrest, Cyber attacks 3D Mapping of Historical Risks, Previous events and frequency and the likelihood of an occurrence, Projections of risk based on trends, developments, or population shifts GIS Platform for National Security Intelligence Gathering and Analysis, Modelling Threats and warnings, Interagency collaboration, Mobile data in 3D space	Assess threats and vulnerabilities to critical infrastructure and the population. Develop mitigation and protection options for protecting critical infrastructure. Maintain shared situational awareness across multiple groups for daily operations. Support response and incident management workflows. Support damage assessment using all types of mobile devices. Incident management and reporting, Staff deployment and workflow, Search and rescue, Damage assessment, Debris removal, Law enforcement field interviews, Cyber supply line monitoring and adjustment Modeling 3D spatial data related to- Resource staging area identification Security posturing assessments Traffic routing and road closure assessments, VIP routing and security Analyze where roadblocks would be required; and,	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to Disaster Management and Fire Brigade like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral Classified 3D data Automatic Weather Station (AWS) data Drainage network Storm water drainage Network Tide data DSM, DTM, Contours Historic flooding spots & areas in Mumbai	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification Integrations Map Enhancement Data Interpolation Buffer Generation. Model Stimulator- The user should be able to enter rainfall data, tide data & simulate the estimate flooding in different areas in Mumbai.

	Simulation of Urban flooding model	through line-of-sight analysis identifying potential dangers spots such as a shooter could be located. Etc. Using 3D GIS classified data, automatic weather station (AWS) data, drainage network, storm water drainage network, tide data, DSM, DTM, contours, historic flooding spots & areas in Mumbai conceptualize Urban flooding model		
Crime mapping Spatio-Temporal analysis, 3D modeling	3D Modeling of Crime Patterns, Incident Map, Auto Theft and Recovery Mapping Emergency Calls and Dispatch Modeling Law Enforcement Operations Mapping Predictive Policing Inventory of location of police stations, crimes, arrests, convicted perpetrators, and victims Plotting of police beats and patrol car routing Security system locations Analysis of police visibility and presence	Mapping Officers and police stations available in relation to density of criminal activity Mapping Victim profiles in relationship to residential populations Location Location allocation to Reallocate police sources and facilities to areas where they are likely to be most effective	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to Disaster Management and Fire Brigade like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery, Placenames Cadastral	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing, Structure Conversion Generalization and Classification Integrations & Map Enhancement, Data Interpolation Buffer Generation.
Department name -Disaster Management and Fire Brigade				

Use case type and Core Functionalities	Sub Functionalities	Functionality description	GIS Layers required	Applications
Pollution and environment monitoring Spatio-Temporal analysis, 3D modeling	Quantifying all sources of Pollution in 3D space Land and Air Pollution 3D Modeling & Identifying city noise pollution 3D Mapping of pollution risk areas and pollution zoning. 3D Pollution Modelling and Assessment of economic Costs of Pollution Analyzing Non-point Source Pollution in 3D Space Develop plans for pollution control systems in 3D environment Mapping vulnerability of pollution in land, water and Air Measuring stormwater pollution IN 3D 3D modelling of Urban Traffic Air Pollution Modeling and calculation of Pollution emission Modelling 3D GIS data on monitored air pollution levels, road network, traffic volume, land cover, altitude assessed predicted pollution levels etc. Modelling Noise Pollution 3D mapping Propagation of Noise in Urban Environments	Measuring stormwater pollution by estimating runoff and sources Assessment of pre monsoon and post monsoon distribution of selected gaseous pollutants like SO2 , NO2 and RSPM and investigate the seasonal variation of ambient air quality status in BMC area in 3D space. Analyze new procedures to integrate an air dispersion 3D model and simulate air dispersion from stationary sources for major air pollutants like PM10, PM2.5, NOX, CO and SO2. Develop a framework for integrating land use, transport and airshed models for evaluating the effect of city form on air quality. The identification of hazards, threats, and vulnerabilities, Examine the spatial point pattern of industrial toxic substances and problem of non-point sources with an analysis of	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to Disaster Management and Fire Brigade like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery, Placenames Cadastral 3D Map urban mobility plans with special consideration for the impact environmental noise	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing, Structure Conversion Generalization and Classification Integrations & Map Enhancement, Data Interpolation Buffer Generation.

	3D mapping Airport Sound Exposure	the street network Modelling Urban Exposure to Noise modeling 3D data to answer how urban citizens are harmed by noise pollution, and how to mitigate it with noise barriers. 3D modelling the relationship between aircraft-generated noise levels and land uses, noise receptors, and demographics in the airport environment.		
Department name - Assessment & Collection: responsible for collecting property tax from residential & commercial properties				
Use case type and Core Functionalities	**Sub Functionalities**	**Functionality description**	**GIS Layers required**	**Applications**
Property tax/other revenue collection, Updating property records Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE)	3DProperty Tax Management System 3D Real estate Management system Tax Parcel and Property Viewer, Parcel fabric Map Property Tax records Tax Rate Zone Mapping in 3D 3d Cadastral information system Develop 3D Area Coding System for tax collection 3D routing for revenue collection. Property and Parcel Dimensioning Analyzing Property 3D Viewsheds Analyzing Property Appraisals in 3D platform	3D Mapping of property-related data such as the number of floors in each building, the total constructed area of each building, individual plot areas, details of locality, and road facing details for Tax calculation. Mapping tax amount based on changing urban development plan and new construction Assembling tax parcels, zoning information with color schemes on a web viewer. Increasing tax revenue by updated land and	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to collecting of property tax from residential & commercial properties like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification

Location optimisation **Deciding the Title of Land/building by judiciary** and **Land Management** Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE) Location optimisation	Property price rise valuation 3D Mapping of Tax havens 3D Mapping of Tax Evaders identifying real property units or "tax parcels in 3D Digital tax parcel mapping Mapping Equitable Property Value Mapping land ownership, value, and use Land Administration and Management System Mapping land parcels graphically, legal survey and resurvey measurement analysis for new parcel boundaries Mapping to manage judicial programs and evaluate policy outcomes related to land records 3D Cadastral Mapping 3D Land Inventory Management 3D Archaeological and cultural Site Mapping and analysis. 3D Tangible city Landscape Modelling 3D Territorial planning and operating 3D land use planning and development zoning maps	building property records, new construction records, and integrated departmental data into a single cadastral information system Catching tax evaders by recognizing areas of wealth Tax Havens – Sheltering tax through tax havens then putting it all on 3D map Digital tax maps to be overlaid with other planning layers such as land use planning zones, new road openings, buildings footprints Unlawful Landlords – Capturing thermal signatures of illegal tenants in sheds 3D Land-use Conflict Identification (LUCIS) Model – Making smart land-use decisions with a model-builder framework land-use conflict identification strategy. 3D Mapping Land Use Change – Summarizing statistics, graphs and tables in 3D spatial units	Toposheet, Tax Zone Map, Digital Elevation Model Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to collecting of property tax from residential & commercial properties like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral Toposheet, Tax Zone Map, Digital Elevation Model	Integrations Map Enhancement Data Interpolation Buffer Generation Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification Integrations Map Enhancement Data Interpolation Bur Generation
Department name - Removal of Encroachment				
	Sub Functionalities	**Functionality description**	**GIS Layers required**	

Use case type and Core Functionalities				Applications
3D Mapping of Encroachments Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE) Location optimisation	3D Mapping of Encroachments in territories of the Schools, hospitals, playgrounds, parks, cultural buildings, fire stations, vegetable markets, ward office buildings, water supply centers, cemeteries, drainage projects, amenity spaces, chawls, community temples and study halls. 3D modelling and Mapping of complete LULC and corresponding parcels and properties across the BMC area Mapping Magnitude, Growth and Trend of Encroachments in 3D Urban Encroachment pattern recognition in 3D 3D Modeling encroachment in relation with Land use 3d Mapping of Land encroachments of Agricultural and wetlands Integrate Satellite data with Elevation models to identify directions of Urban encroachments. Modelling and Mapping Parcel and property affection plans to identify unauthorized encroachments using 3D overlay of masterplan data 3D modelling of encroachment direction and pattern Mapping land ownership, value, and use Land Administration and Management System Mapping land parcels graphically, legal survey and resurvey measurement analysis for new parcel boundaries	Map and assess the pre- and post-encroachment scenario. Map and notify the areas of the land encroachments. Quantifying areas covered under encroachments Modelling the direction of Land and water encroachments Examine the encroaching activities impact on the environment; and explore the suitable strategies for redevelopment. Mapping population density and its relation to encroachment Mapping networks (urban transport, water, sanitation, electricity, etc.) Monitoring urban expansion and create zoning regulations to provide for the possible extension of the city Spatio Temporal change detection analysis of masterplan and cadastral datasets. Unlawful Landlords – Capturing thermal signatures of illegal tenants in sheds	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to Removal of Encroachment like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to Removal of Encroachment like the following- Topography	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification Integrations Map Enhancement Data Interpolation Buffer Generation Change detection Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services)

Management of over ground / underground utilities Spatio-Temporal analysis, 3D modeling Network and Topology Modelling	Mapping to manage judicial programs and evaluate policy outcomes related to land records 3D Cadastral Mapping 3D Land Inventory Management 3D Archaeological and cultural Site Mapping and analysis. 3D Tangible city Landscape Modelling 3D Territorial planning and operating 3D land use planning and development zoning maps 3D Mapping of Utility facilities such as utility Poles, cabins, corridors etc. 3D mapping and Modelling of affection and encroachment plans from overhead and underground utility features 3D Utility Network Management Subsurface 3D Utility Model Utility Pole Replacement Mapping and street view assessment of Utility feature	3D Land-use Conflict Identification (LUCIS) Model – Making smart land-use decisions with a model-builder framework land-use conflict identification strategy. 3D Mapping Land Use Change – Summarizing statistics, graphs, and tables in 3D spatial units 3D utility Topology modeling 3D Mapping of existing and Proposed Utility corridors and connected networks in BMC areas Power Outage management 3Dmapping of Telecommunicatio n networks Optimize asset inspection and maintenance 3D PowerGrid Mapping and networking	Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral	WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification Integrations Map Enhancement Data Interpolation Buffer Generation Change detection
Department name - Garden & trees				
Use case type and Core Functionalities	**Sub Functionalities**	**Functionality description**	**GIS Layers required**	**Applications**
Urban green space Modelling, Mapping and Analysis Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations	3D mapping of the following green infrastructure elements- Tree species richness Urban canopy cover Urban tree native species ratio and cultural point density inside the BMC area Modelling the heat islands and zoning green areas within BMC area	3D Mapping and modelling effect of Urban green infrastructure on mitigating the effects of urban sprawl and social inequalities, reducing stormwater runoff and water management costs, moderating	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to Garden & trees like the following- Topography	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services)

Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE) Location optimisation NDVI Analysis	Measuring and modelling NDVI Spatio temporally across the BMC area Mapping and inventory framework creation of urban forest benefits calibrated for BMC Area 3d modelling relationship between spatial positioning of green infrastructure and its proximity to certain land-use classes 3D Urban green infrastructure mapping model for planning, maintaining, tracking, learning, and sharing information related to green areas in the entire BMC area 3D mapping of relationship between green areas and pollution reduction, carbon storage, UHI reduction, energy savings within BMC area 3D mapping of publicly and privately owned green areas and trees for managing green infrastructure resource inventory to identify the following tree parameters- 1. Botanical name 2. Common Greek name 3. Family classification 4. Evergreen / Deciduous 5. Maximum height 6. Canopy shape 7. Growing care 8. Water requirements 9. Climate requirements 10. Soil requirements 11. Potential allergies 12. Leaf density 13. Envi-met code 14. Environmental utility	microclimates, calming traffic, stabilizing, and denaturing air and soil pollutants, and reducing noise Systematic comprehensive inventory system of entire urban green areas with information prepared to various users and supported by 3D mapping in city wide GIS System. Mapping and monitoring tree health and growth, schedule trimming and treatment and set policies for environmental development Map Urban tree data such as tree location, species, diameter breast height (DBH), canopy width, condition, and growth recordings Mapping and corelating green area data with city's other spatial database such as streets, curb lines, building footprints, overhead and underground utilities, workforce areas, pest/disease quarantine zones, parks, and pending construction areas etc.	Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral Soil quality Air pollution data Flood hazard zone data Water pollution data Baseline records (tree inventory)	WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification Integrations Map Enhancement Data Interpolation Buffer Generation Change detection

Department name - License dept for providing hoarding licenses & management				
Use case type and Core Functionalities	**Sub Functionalities**	**Functionality description**	**GIS Layers required**	**Applications**

3D Mapping areas for Trades, storages, and Advertisement/ Hoardings Spatio-Temporal analysis Proximity Analysis Buffering and Interpolations Density and Heatmaps Digital Elevation and Terrain Models 3D modeling and mapping Multiple Criteria Evaluation (MCE) Location optimization	Map, geo-tag, and capture data related to complete trade, storage, and Advertisement hoardings within BMC area. 3D modelling of Trading and storage Area within BMC area. 3D modelling for trade site evaluation, customer profiling, and trade area market analysis. 3Mapping of Logistics related to goods and services served to the trading and storage areas Map and Model Existing and new store locations, Evaluate storage sites. Trading Territory design, Reveal untapped markets in 3D environment 3D Mapping of projections and Boards Mapping Squatters and Hawkers	3D Buffering and Mapping of Trading and Storage areas within BMC. Mapping and analyzing the following parameters related to an Advertisement/ hoarding Location of the Hoarding Photograph of the Hoarding. Dimensions of Hoarding Type of Hoarding Land Ownership. Details of Advertising Agencies Validity/License of Hoarding 3D Mapping of Stall Boards, showcases, projections localized on showcases, over hanging awning, rolling shutter, door etc.	Classified 3D data Existing Development Plan/ Master Plan in GIS format. Complete 3D and 2D spatial data related to dept for providing hoarding licenses & management like the following- Topography Utility Transportation and Communication Hydrography Aviation Elevation and bathymetry Imagery Placenames Cadastral	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification Integrations Map Enhancement Data Interpolation Buffer Generation Change detection
Common for all departments				
Use case type and Core Functionalities	**Sub Functionalities**	**Functionality description**	**GIS Layers required**	**Applications**

3D data display Dashboard for Government departments	Visualize 3D data by different categories Overlay existing 2D GIS vector layer with 3D data Dashboard for classification of buildings based on their height	Click on different GIS layers in 3D like Buildings, Trees, Roads, Street lights, Furniture, Roads, etc. to visualize/ select & then view Geometrical attributes like length, width, height, volume, etc. zoom, pan, move over any area on the Web application Overlay 3D data on existing 2D GIS data like, building footprints, roads, streetlights, etc. - Since the 2D GIS data is old, 3D data would be updated. - So, the new features/ assets which are not present in 2D can be added/exported in 2D GIS data as part of update activity.	Classified 3D data Classified 3D data - Existing 2D GIS layers like building footprints, roads, streetlights, etc. Classified 3D building and structure data	Read/Write/Edit in the following Offline and Online platforms GIS Web application (SOAP & REST Services) WMTS, WMS, WFS, etc. GIS Cloud and Desktop applications GIS Mobile Applications Enable/Disable Geoprocessing Applications like Data Validation and Editing Structure Conversion Generalization and Classification Integrations Map Enhancement Data Interpolation Buffer Generation Change detection

5.13.4 Development & implementation of Android & iOS application for 3D City model & change detection

The SI should conceptualize, develop & implement the Android & iOS application for 3D City model & change detection in consultation with BMC team. The application should have following features:

1. The Android & iOS application should be compatible with at least n-3 versions android & iOS where n stands for latest version of both OS.
2. The application should be able to load the 3D city model & change detection maps of the Mumbai.
3. The SI should manage all the compliances required for hosting the application on Android & iOS app store.

4. The app should feature response design and should be compatible with all form factors of Android & iOS mobile phones & tablets.
5. Basic features like viewing the 3D & 2D maps, attributes, measure tool are expected in both Android & iOS app.
6. Other features expected in the mobile apps will be elaborated in the requirement gathering phase of the project. The SI should proactively gather all the necessary information about features, functionalities, tools which are needed in the app.

5.13.5 Development & implementation of Dashboard application for 3D City model & change detection

The SI should conceptualize, develop & implement Dashboard application for 3D City model & change detection in consultation with BMC team. The SI may use ArcGIS Dashboards which are easily configurable, customizable and already part of the ArcGIS Enterprise suite available at BMC. Alternatively, SI may also any other open-source platform/ tool for development of Dashboards. Following are some of the features envisaged in the Dashboard:

1. GIS Dashboards will enable users to convey information by presenting location-based analytics using intuitive and interactive data visualizations on a single screen.
2. GIS dashboard application would be used by BMC departmental users, departmental HODs & senior leadership of BMC.
3. GIS Dashboard application can be projected on Live monitor where BMC departmental users can continuously monitor assets & other KPIs.
4. Type of Dashboards
    a. Strategic Dashboard: Strategic dashboards help executives track key performance indicators (KPIs) and make strategic decisions by evaluating performance based on their organization's goals or departmental goals.
    b. Tactical Dashboard: Tactical dashboards help analysts and line-of-business managers analyze historical data and visualize trends to gain deeper understanding.
    c. Operational Dashboard: Operational dashboards help operations staff understand events, projects, or assets by monitoring their status in real time.
    d. Informational Dashboard: Informational dashboards help organizations inform and engage their audiences through community outreach.
5. The dashboard should mainly contain following panes map, tabular data, drop down list, radio buttons, graphs, charts, etc.
6. On selection of any option from drop down list, radio button, etc. the associated other panes like tabular data, maps, charts, graphs should get updated.
7. Similarly zooming or panning on map should refresh the associated panes where tabular data or other information, graphs, charts are displayed.

8. The dashboard should be responsive design & should open on all browsers like Chrome, IE, Safari, etc. on all major OS like Windows, iOS, Android, Mac, Linux, etc,
9. Other features expected in the Dashboard will be elaborated in the requirement gathering phase of the project. The SI should proactively gather all the necessary information about features, functionalities, tools which are needed in the dashboard.

5.13.6 Integration of Enterprise GIS application with existing IT & GIS application

10. The 3D Enterprise GIS application should be integrated with existing & proposed IT, GIS system & application in BMC. The list of existing IT & GIS applications is mentioned in the section Inception report. Actual integration requirements will be elaborated in the requirement gathering phase of the project. The SI should proactively gather all the necessary information about integration of 3D Enterprise GIS application with existing & proposed IT & GIS applications.

5.13.7 Testing of all GIS application & bug fixing

The selected System Integrator shall undertake the following activities:

1. Outline the methodology that will be used for testing the system
2. Define the various levels or types of testing that will be performed for system
3. Provide necessary checklist/documentation that will be required for testing the system
4. Describe any techniques, test cases/ scenarios / scripts that will be used for testing the system
5. Describe how the testing methodology will conform to requirements of each of the functionalities
6. Indicate/demonstrate to the department that all applications installed in the system have been tested
7. The selected System Integrator shall provide a workflow for sign-off on test deliverables that will be mutually agreed upon by both the parties

Competent Authority from BMC may issue appropriate acceptance certificate to the selected System Integrator for stabilization of all modules and successful operationalization of the application.

The selected System Integrator shall conduct various types of testing on the new build/package before releasing it for deployment on the production environment according to standard Software Testing Life Cycle (STLC). The testing levels shall include: Unit Testing, Integration Testing, System Testing and Acceptance Testing. These tests levels shall be included such: as security testing, performance testing, Usability testing, Concurrency testing, etc.

In view of the above, different types of testing followed generally as a part of typical Software Development Life Cycle have been mentioned below to understand the exact testing requirements for this project:

- **Unit testing** - Testing of individual software components or modules. Typically done by the programmer and not by testers, as it requires detailed knowledge of the internal program design and code.
- **Integration testing** - Integration testing shall be amongst the modules to verify the functionality of data sharing within the application. This shall include integration testing with external applications to verify the combined functionality after integration.
- **Regression testing** – After implementing a bug fix or new change request, the system shall be tested again by the SI to check whether any new bug has been introduced or not. Here the application shall be tested as a whole after each update or change in the software. The cost of any automation tools used in this testing shall be borne by the System Integrator.
- **Acceptance testing** - Normally this type of testing is done to verify if system meets the customer specified requirements. The department will conduct this testing based on the documents submitted by selected agency to determine whether to accept application.
- **Usability testing** – This is for the User-friendliness check. In this, following areas shall be tested: Application flow, for a new user understand the application easily, proper help documented whenever a user is stuck at any point, minimum keyboard entry and maximum use of drop-downs/auto-prompt feature, etc. Basically, system navigation shall be checked in this testing.
- **Security testing** – This test shall be conducted to check if the system can be penetrated by any hacker. The selected SI shall conduct security testing to check how well the system protects against unauthorized internal or external access and to check if system database is safe from external attacks.
- **Performance testing** – This term often used interchangeably with 'stress' and 'load' testing to check whether system meets performance requirements under different levels of loads and to check the maximum load at which the system performance degrades. For this testing, selected SI are expected to use different performance and load tools.
- **Concurrency testing** - Concurrency testing is also known as multi-user testing, performed to identify the defects in an application when multiple users login into the application. It helps in identifying and measuring the problems in system parameters such as response time, output, locks/dead locks or any other issues associated with concurrency. The SI shall carry out proper testing as required to meet the stated performance criteria.

The selected System Integrator shall ensure that the test documentation including test procedures, test data and test results are shared with the department for approval before the testing begins. The selected System Integrator shall also submit Requirement Traceability Matrix (mapping of test cases to requirements) and test plan for approval before testing. The selected System Integrator shall use an

open source defect tracking tool and submit a defect workflow that shall be followed for all defects logged into that system.

Errors / bugs detected during testing are expected to be logged, classified, reviewed, and resolved prior to release of the software. Software error data that is collected and analysed during a development/customization life cycle may be used to determine the suitability of the software product for release and installation. Test reports shall comply with the requirements of the corresponding test plans.

The Acceptance Tests shall demonstrate that the System Integrator has met each requirement specified in the FRS and SRS documents and has delivered an effective operational system.

5.13.8 Comprehensive audit including security Certification, VAPT & load testing from CERT-IN empanelled agency for all applications developed as per the scope of work

The SI shall conduct comprehensive audit including security Certification, VAPT & load testing from CERT-IN empaneled agency for all applications developed as per the scope of work. The comprehensive audit, VAPT & load testing should be done before Go-Live.

Whenever, there are any major changes in the applications like addition of workflow, new tools, features, functionalities, then all audit & certifications mentioned above should be done.

All Certifications & audit should also be conducted every year once till the contract period of the RFP. SI to provide safe to host certificate every year.

5.13.9 UAT, Training & Go-Live

5.13.9.1 User Acceptance testing (UAT)

The department shall form different user groups for the purpose of UAT. These user groups would test the application and the results of all the above-mentioned tests submitted by the selected System Integrator will be considered to ascertain the functionality of the application. Once the defined acceptance criteria are completely met, selected System Integrator shall take a formal sign off from the group for acceptance of each module. Based on the sign off and user feedback, department would issue UAT certification to the selected System Integrator for that module / sub-module. The selected System Integrator shall submit the Test Strategy, Test Plan and test Metrics to BMC.

The Test Strategy document (prepared once for the project) shall include –

i. Objectives of testing and the activities that will serve to meet these objectives
ii. Contents of the tests (which characteristics are to be tested and which are not)
iii. Defining priority levels and severity levels
iv. Associated documents (such as the project plan, overall quality assurance strategy, other

project documents) being referenced

v. Resource staffing and allocation (hardware/software/personnel) for testing
vi. Test stages and cycles
vii. Selection of suitable testing methods
viii. Test management (defect reporting, defect management & triaging)
ix. Release environments and test tools used for testing.

The Test Plan document (prepared for every change/enhancement/patch) shall include –

i. Scope of testing within the context of the project
ii. Test systems and objects to be tested with priority levels
iii. Impact analysis in the system landscape – This shall include the identification of risks, either positive or negative, analyze the risk, the probability of the risk occurrence and its impact and the plan to control or mitigate the risk
iv. Criteria for interrupting and terminating testing, as well as acceptance criteria for each test stage i.e. Entry / Exit Criteria
v. Testing roles and responsibilities

5.13.9.2 Training

The SI should study the training requirements of the BMC during the requirement gathering phase in detailed. The SI should prepare a training calendar for different types of users in BMC. Following are the main types of users in BMC:

1. **Tier 1 users**: These users would mainly consist of experts & matured users in Geospatial technology from BMC & its existing IT & GIS vendors who will either perform editing of geospatial data, configuration of GIS applications, publishing of GIS application, integrations of IT & GIS applications with 3D Enterprise GIS application. This will be relatively smaller (around 50) group of users. These users need to be trained on Web application, Mobile application, Dashboard, 3D Enterprise GIS application architecture, available APIs, integration touchpoints, GIS databases, GIS services, etc.
2. **Tier 2 users**: There users would mainly consist of all BMC users from all user departments from different hierarchies mainly Analyst, junior engineer, sub-engineer, assistant engineer, executive engineer, system analyst, ward officers, etc. This will be relatively larger (1000) group of users. These users need to be trained on 3D GIS Web application, Mobile application and Dashboard.
3. **Executive users**: These users would mainly consist of HoDs, DMC and AMC of BMC. This would be special training conducted by senior leadership of the SI. This will be relatively smaller (around 20) group of users. These users need to be trained on 3D GIS Web application, Mobile application and Dashboard. Overall benefits of 3D Enterprise GIS applications, current trends in 3D & Geospatial technology in the world. Best use cases of 3D GIS in different sectors/

verticals like development plan, property tax, roads & bridges, construction, utilities, disaster management, fire brigade, etc. implemented in the world.

Audio Visual Training system and Online Help

1. The SI should develop training manuals of 3D Enterprise GIS applications in English & Marathi.
2. In order to assist the users in operating / navigating through the applications and processes, module wise/ section wise training material, Audio-Visual clips may be created for required modules / sub-modules / sections of the concerned application which can be played at any given point of time through the browser.
3. Also, information in the form of a downloadable PDF format shall be provided to the user who may refer / download it for their own personal reference as and when needed.
4. It is required that the downloadable training content shall have proper indexing and internal references, mapped with key words, in order to allow any user to search and reach the desired content with the help of those key words.
5. Any user shall be able to search and read the directions / information for only the part required by him/her rather than looking through the entire PDF document and manually searching for the right content.

5.13.9.3 Go-Live

The Go-Live will be provided by BMC team to the SI on successfully completion of development, installation, testing, bug-fixing, comprehensive audit, UAT and training.

5.13.10 Source Code Rights

The rights of the source code of the customized version of the COTS product and/or the bespoke application shall lie with BMC. In case any subsystem is completely developed, the rights of the source code shall also be with BMC. The source code needs to be transferred within three months of successful Operational Acceptance. All the costs associated with the transfer of source code shall be borne by the System Integrator. This shall also include customs or any other applicable taxes to be paid for import/export of software. The following protocol shall be followed for the transfer of source code to BMC:

a. The System Integrator shall submit detailed documentation for each module of the application to the department. This includes all the modules deployed. The list of the documents to be submitted are as follows:
    i. Functional Specification Document
    ii. Technical Specification Document
    iii. Software architecture Documentation
    iv. User Manuals

v. Training Manuals
vi. Test Plan , Test Cases and Results
vii. Release Notes
viii. User Guide to install, configure and use the module

All the documents shall be updated as per the last release of that module. The documents shall be reviewed by the department or agency appointed by the department. System Integrator shall ensure that any disparity / lacunae found in the documents are rectified and revised documents are submitted for further review. The transfer of documentation to be considered as complete after the department issues the completion certificate for the task.

b. Transfer of all the source code files, supporting libraries, database scripts, libraries and metadata dictionary, procedures and supporting software components. Source Code to be exact replica of the department application live on the production server.

c. Documentation of step-by-step procedure for recompilation of the application shall be submitted by System Integrator. The documentation shall enable BMC (or any third party appointed by BMC) to install, configure and recompile the application.

d. While submitting the Source Code files, System Integrator shall submit the declaration that the Source code is of the same version which is on Production Environment and used for live operations. SI shall provide the environment to recompile the source code and provide access to the application to confirm that the Source Code is of the latest version and is same as that on the Production Environment.

e. System Integrator shall conduct the necessary Knowledge Transfer sessions to the technical staff provided by the BMC. The success criterion of training will be that IT team provided by BMC is able to recompile successfully the entire application on the test server independently.

f. The transfer of source code shall be an on-going exercise. As and when, a new version of the application is deployed in production; the source code of the changed modules shall be transferred as per the above protocol to the department. At the end of contract period or at the end of the complete development and deployment of all the change requests provided by the department within the contract period or whichever is later, the entire source code shall be transferred in the same way.

g. The SI should conduct (a) Software architecture and code review and (b) Security Audit of the application, and necessary compliances before handing over the source code during exit management. Timelines for this compliance shall be jointly decided between the department and System Integrator.

5.14 Hosting of all deliverables, raw datasets & Enterprise Geospatial Application on Virtual Cloud

The Cloud Services will be provided by BMC. As per the Project Plan, the same will be required from 13th Month onwards of Project Period. ***All the necessary Hardware / Software / Networking etc. arrangement for Development and Staging environment for the first year will be done by the SI.***

At present BMC's GIS system are hosted on ESDS cloud infrastructure. Selected SI should host the 3D Enterprise GIS applications on Cloud Services provided by BMC. Specifications and other necessary details for hosting of applications will be provided by the SI. It is envisaged that around 1000 BMC users will access 3D Enteprise GIS applications. Post go live the necessary GIS systems will be accessed by BMC users and Citizens. Hence SI must ensure providing appropriate bandwidth requirement for smooth functioning and access of GIS applications. The SI also need to consider scalability depending on the user load before providing requirement. Apart from the **Production Environment, System Integrator shall maintain the Staging & Development environment**. The software application shall be developed / customized in a suitable environment as per agreement with the BMC. The SI shall justify the choice of development environment. The applications shall be developed/customized and hosted utilizing ArcGIS standards with commercially available tools. The SI shall list and make provision for all the tools to be used to develop, customize and maintain the application, as well as the hosting platform, hardware and software for first twelve months of the Project Period.

The SI shall be responsible for providing the Backup, Business Continuity Plan, Disaster recovery for the application and Disaster Recovery Operational Plan.

The SI to provide the Cloud Services Requirement (From 13th Month onwards) as per below table. SI may add more columns to specify technical requirements, type or sub-type of components.

Production Environment for 3.5 years (42 months)

#	Components	Server/ Application name	OS	Nos. of CPU core	RAM in GB	GPU in GB	Hard disk in GB
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							

9.							
…							
	Total						

Staging Environment for 3.5 years (42 months)

#	Components	Server/ Application name	OS	Nos. of CPU core	RAM in GB	GPU in GB	Hard disk in GB
1							
2							
3							
4							
5							
6							
7							
8							
9							
…							
	Total						

5.14.1.1 Development Environment for 3.5 years (42 months)

#	Components	Server/ Application name	OS	Nos. of CPU core	RAM in GB	GPU in GB	Hard disk in GB
1							
2							
3							
4							
5							
6							
7							
8							
9							
…							
	Total						

SI should also consider Database growth while and hence scalability of the GIS system in terms of compute, infrastructure Sizing (Hardware, network, bandwidth, firewall, webserver, application server, database server, IOPs, CPU, Memory, Storage) while submitting the requirement.

5.14.2 Hosting of deliverables & raw datasets

All the important & final deliverables will be deployed on regularly accessible storage & applications on the cloud. The raw datasets generated while LiDAR, photogrammetry survey, bathymetry, 360° Panoramic survey, etc. can be stored in cold storage or inexpensive storage on the cloud. This raw data will not be used regularly & may be retrieved occasionally on demand. SI to take this into consideration when submitting the requirement for Cloud Services.

5.14.3 Hosting of Enterprise Geospatial Application for 3D City model & change detection

The 3D Enterprise GIS applications with all geospatial data will be hosted on the cloud during the implementation period for six months as mentioned in the section project plan.

5.15 Annual Maintenance Contract of all hardware, software, data, applications & services provided under the scope of work for 3 years after Go-Live

5.15.1 Change detection Map of Mumbai capturing all changes every year for 3 years after Go-Live

The change detection Map of Mumbai should be generated by using aerial survey with photogrammetry sensor & LiDAR sensor, Terrestrial & mobile backup LIDAR & 360° Panoramic sensor. The data generated from above surveys should be processed & respective outputs, deliverables as mentioned in scope of work should be delivered as change detection map. Sensor with same or better specification is to be used which was used during implementation period (1st survey of the project).

This change detection maps with have swipe function, where users can select two images of different years of the same area overlay them & swipe horizontally to view the change. Similar intuitive timeline-based interfaces can also be suggested by SI & then finalized by BMC for implementation of change detection maps.

Following are the conditions & approx. areas where **change detection** needs to be carried out per year during AMC period:

#	Type of Survey	Maximum area in percentage or Sq. km. or km.	Condition when survey needs to be carried out

1	Aerial Survey of Mumbai using Photogrammetry & LiDAR sensor	500 sq. km.	**After one year for every year during AMC period** full survey needs to be carried out
2	Terrestrial LiDAR & 360˚Panoramic street view imagery survey	25% of 4800 km (1200km)	**After one year for every year during AMC period conditional survey needs to be carried out:** If there are major changes in the area which includes construction of more than 2 buildings/ houses, bridges, flyovers, metro, mono-rails, redevelopment of buildings/ houses, completion of construction of any civil structures, etc.
3	Mobile backpack LiDAR & 360˚Panoramic street view imagery survey	25% of 480 km (120km)	
4	Bathymetric survey	To be calculated by SI	**To be carried out only once during implementation period**

The SI needs to calculate approximate terrestrial & mobile backup survey quantity & get it approved from BMC during AMC period for every cycle. The SI needs to mention areas, their wards names & approx. areas and the developments which have occurred at that location in a report format. The report should also have delineation of areas ward-wise for easy understanding which are proposed for change detection survey. Maximum area specified in the above table should not exceed in each cycle of change detection survey. If there are less areas where changes have occurred in Mumbai the BMC, make take decision to do survey of less quantity as mentioned in the above table. The excess quantity from previous year of change detection survey may be used in the next year subject to approval from BMC team.

5.15.1.1 Ground truthing for change detection during AMC period

The requirements of Ground truthing for change detection during AMC period would be same as mentioned in Ground truthing section above.

5.15.2 AMC of all hardware, software & applications delivered as part of the scope of work

The Annual Maintenance Contract (AMC) period is for three years after Go-Live.

The AMC is to be carried out for following hardware, software & applications:

#	Item	Quantity	AMC Year 1	AMC Year 2	AMC Year 3
1.	Continuously Operating Reference Station (CORS)	5	Yes	Yes	Yes

2.	High-end workstations for viewing, editing LiDAR, Orthomosaic, etc.	5	Yes	Yes	Yes
3.	Color printers	2	Yes	Yes	Yes
4.	One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph)	1	Yes	Yes	Yes
5.	360˚ Panoramic street view imagery publishing Server software compatible with ArcGIS Enterprise suite	To be decided by SI	Yes	Yes	Yes
6.	Oracle Database licenses with RAC	To be decided by SI	Yes	Yes	Yes
7.	Development of Enterprise Web Geospatial application as per requirement	Lumpsum	Yes	Yes	Yes
8.	Development of Mobile GIS App (Android and iOS)	Lumpsum	Yes	Yes	Yes
9.	Integration of the Enterprise web Geospatial and Mobile GIS app with external GIS applications and data of BMC	Lumpsum	Yes	Yes	Yes
10.	Comprehensive audit including security Certification, VPAT & load testing from CERT-IN empaneled agency for all applications developed as per the scope of work	Lumpsum	Yes	Yes	Yes

5.15.3 Bug fixing, issue resolution & enhancements of the Enterprise Geospatial applications.

The selected SI shall be responsible for the Operation and maintenance (O&M) support of the 3D Enterprise GIS applications during the contract period. During Operation and Maintenance, selected SI are required to ensure.

i. Necessary measures for the smooth operation of all applications
ii. Transfer of necessary know-how to the departmental support team in an effective manner
iii. Adherence to baseline performance Service Level Agreement (SLA) matrix as defined in this document
iv. Bug-fixing & issue resolutions as & when required.
v. Implement approved changes in the system as per requirement
vi. Other technical & operational maintenance of the Applications, databases, etc.

5.15.3.1 Minimum Application Maintenance and Monitoring Activities to be performed during engagement

The application maintenance and monitoring include:

a. Compliance to the Functional and Technical Requirements
b. Compliance to SLA
c. Application Software Maintenance, Problem identification and Resolution
d. Software Change and Version Control as per industry standards
e. Technical Support for operation and maintenance of the applications

The selected SI shall provide:

a. Updated system design documents, specifications, etc.
b. Recent source code, application deployment files, configuration files for entire solution
c. Updated user manuals, administration manuals, training manuals etc.

The average application response time(s), application availability and other performance parameters are given in the SLAs. The application software shall be designed to cater to the required load without any degradation of performance as explained below:

a. The database schema and design shall be capable of handling current and future loads without any degradation of performance.
b. System shall be upwardly scalable in the event of increased usage of the system or new business requirements.
c. The selected SI shall provide comprehensive report every month on the performance of the application and infrastructure
d. Departments may initiate, with prior notice, the audit of such measurements to their satisfaction.

The application maintenance activities shall include, but not be limited to the following:

a. Performance Bottleneck Checks

The selected SI shall monitor and check the system regularly for performance bottlenecks, and resolve the issues, if SLAs are not being met, with the dedicated component(s) without impacting the overall system at no extra cost.

b. Security

The selected SI shall take rigorous provisions to prevent unauthorized alteration or damage to the application and all related applications and databases. Also, shall provide basic level of security by providing the end users with username and password to access the applications. It shall also deploy the application only after it has undergone User Acceptance Testing (UAT) and is security audited by the department for Vulnerability Assessment (VA) and Penetration Testing (PT). The UAT shall also include assessment and evaluation of all application SLA's. However, selected SI shall undertake and conduct all sorts of testing and follow a standard Software Testing Life Cycle approach (STLC) before deployment of application in a Production Environment in addition to assessment and certification

through BMC.

c. Backup Policy

The selected SI shall design and successfully test backup and recovery capabilities for the application. It shall also finalise the functionality and the frequency of backup in consultation with the department and should be documented and signed off.

d. IT Refresh Policy

The selected SI shall follow the guiding principles for Refresh / Replace policy of components that are given below, which would be valid for the entire contract duration as:

i. Replace / refresh the components during those instances which may have an impact on the overall performance and accordingly may trigger SLA breach.

e. Software Updates

Any required version/software, patch management, etc. shall be the responsibility of the selected SI along with respective OEM of the software for the entire contract period at no extra cost to BMC. The required upgrades for the entire stack have to be implemented within six months of release/general availability including –

i. Supply, installation and maintenance of the updated/upgraded versions of software along with the respective OEMs
ii. Rectification of bugs/ defects if any
iii. Fine tuning of the application, as and when required
iv. Maintenance of the application
v. Re-installation of software/application/database whenever required along with the respective OEMs

f. Monitoring Tool

The selected SI shall ensure the deployment of management and monitoring tools for Application Performance Monitoring, version control (software as well as document) and bug tracking. It shall use a proper project management tool for monitoring the implementation of project at no extra cost to BMC. The selected SI also shall provide access of the tool to the high-level officials of the department. All necessary training regarding the use of the tool should be provided by the selected SI.

5.15.3.2 Change Control Process

In the event of any proposed change to the agreement, scope of work and SLAs, the selected implementation agency shall follow the procedure as described below. The change shall include, but may not be limited to, changes in the scope of services as mentioned under various categories from time to time. The selected SI shall provide a change management system for monitoring change requests implementation, bug tracking and production support services.

Change Control Notice ('CCN')

Change Request can be raised by any BMC application user / stakeholder who shall be responsible for obtaining approval for the change and shall complete the CCN Initiation part of the form. The SI and BMC shall consider the change in the context of the following parameter, namely whether the change is beyond the scope of Services and is suggested and applicable only after the testing, commissioning and certification of the Operational Acceptance. The payment for the changes brought in after project operational acceptance date shall be calculated on the basis of man-month rate quoted by the SI in its bid and estimated man-month effort to be submitted by the SI prior to taking up the change of control event and accepted by BMC. Change requests and CCNs shall be reported monthly/fortnightly to the department which shall prioritize and review progress.

a. Change Control Note (Sample)

The SI shall assess the CCN and complete the CCN, on completing the CCN the SI shall provide as a minimum:

a. Description of the change
b. List of deliverables required for implementing the change
c. Timetable for implementation
d. Estimate of any proposed change
e. Relevant acceptance criteria
f. Assessment of the value of the proposed change
g. Material evidence to prove that the proposed change is not already covered within the Agreement and the scope of work

Prior to submission of the completed CCN to the BMC, or its nominated agency, the selected SI shall undertake its own internal review of the proposal and obtain all necessary internal approvals. As a part of this internal review process, the selected SI shall consider the materiality of the proposed change in the context of the SLA and the Project Implementation affected by the change and the total effect that may arise from implementation of the change.

The selected SI shall be obliged to implement any proposed changes once approval in accordance with above provisions has been given, with effect from the date agreed for implementation and within an agreed timeframe. SI shall not be obligated to work on a change until the parties agree in writing upon its scope, price and/or schedule impact. A sample change control note is given under Annexure VIII.

This process will be applicable while initiating any change during Operation and Maintenance of the existing system as well during implementation of additional requirements.

5.15.4 Hosting of data & applications on Virtual Cloud

The SI should host all the GIS data & 3D Enterprise GIS applications on Virtual Cloud The cloud services will be provided by BMC.

6 Annexure I: Instructions for Pre-Qualification Bid

6.1 Pre-Qualification Cover Letter

Date: dd/mm/yyyy
To
<Insert complete postal address>

Sub : Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC
Ref : Bid No: <No> Dated <DD/MM/YYYY>

Dear Sir,

Having examined the bid, the receipt of which is hereby duly acknowledged, we, the undersigned, offer to provide the professional services as required and outlined in the bid for the '*Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC*'

We attach hereto our responses to pre-qualification requirements and technical and commercial bids as required by the bid. We confirm that the information contained in these responses or any part thereof, including the exhibits, and other documents and instruments delivered or to be delivered to Brihanmumbai Municipal Corporation, are true, accurate, verifiable and complete. This response includes all information necessary to ensure that the statements therein do not in whole or in part mislead the Corporation in its short-listing process.

We fully understand and agree to comply that on verification, if any of the information provided here is found to be misleading the selection process, we are liable to be dismissed from the selection process or termination of the contract during the project, if selected to do so.

We agree for unconditional acceptance of all the terms and conditions set out in the bid document and also agree to abide by this bid response for the bid validity period as mentioned in the RFP. We hereby declare that in case the contract is awarded to us, we shall submit the contract performance guarantee bond in the form prescribed in the bid.

We agree that you are not bound to accept any bid response you may receive. We also agree that you reserve the right in absolute sense to reject all or any of the products/ services specified in the bid response.

It is hereby confirmed that I/We are entitled to act on behalf of our company/ corporation/ firm/ organization and empowered to sign this document as well as such other documents, which may be required in this connection.

Signature of Authorized Signatory (with official seal)
Name :

Designation :
Address :
Telephone :
Email address :

6.2 Format to share SI's Particulars

Sr. No.	Description	Details (to be filled by the responder to the Bid)
1.	Name of the company	
2.	Official address	
3.	Phone No.	
4.	Corporate Headquarters Address	
5.	Phone No.	
6.	Web Site Address	
7.	Details of Company's Registration (Please enclose copy of the company registration document)	
8.	Name of Registration Authority	
9.	Registration Number and Year of Registration	
10.	ISO/CMMi certifications and its validity	
11.	CST/LST/VAT registration No.	
12.	Service Tax /GST Registration No.	
13.	Permanent Account Number (PAN)	
14.	Company's Revenue for last 3 years (Year wise)	

Please submit the relevant proofs for all the details mentioned above along with your bid response.

Contact Details of officials for future correspondence regarding the bid process:

Details	Authorized Signatory	Secondary Contact
Name		
Title		
Company Address		
Phone		
Mobile		
Email		

6.3 Format for Declaration by the SI for not being Blacklisted / Debarred

(To be submitted on Stamp Paper of ₹ 500)

DECLARATION CUM-INDEMNITY BOND

Date: dd/mm/yyyy

I,_____of _____,do hereby declared and undertake as under.

1) I declared that I have submitted certificates as required to Executive Engineer (Monitoring) at the time of registration of my firm / company _____ and there is no change in the contents of the certificates that are submitted at the time of registration.

2) I declared that I _____ in capacity as Manager / Director / Partners / Proprietors of _____ has not been charged with any prohibitory and /or penal action such as demotion, suspension, black listing / de-registration or any other action under the law by any Government and / or Semi Government and/ or Government Undertaking.

3) I declared that, I have perused and examined the tender document including addendum, condition of contract, specification, drawings, bill of quantity etc. forming part of tender and accordingly, I submit my offer to execute the work as per tender documents at the rates quoted by me in capacity as _____ of _____.

4) I further declared that if, I am allotted the work and I failed to carry out the allotted work in accordance with the terms and conditions and within the time prescribed and specified, BMC is entitled to carry out the work allotted to me by any other means at my risk and cost, at any stage of the contract.

5) I also declared that I will not claim any charge / damages / compensation for non-availability of site for the contract work at any time.

6) I Indemnify Municipal Commissioner and the other officers of BMC or their agents for any Damages, Loss, or Injury, any legal suit, proceeding or legal action whatsoever that may be caused at any time by me or any other staff of_____ company, for the work undertaken and all such damage, damages, injury or loss, legal suit, legal action, I shall be solely responsible in individual as well as official capacity and such loss, damages, injury shall be made good and/ or as the case may be shall be paid immediately by me / Company to the satisfaction of the BMC.

Dated _____ day of _____, 20__

Identified by me

Before me

Advocate

6.4 Performance Bank Guarantee Format

(For a sum of 10% of the value of the contract With Stamp duty of 0.5 % on the total amount)

Ref. No. :
Date :
Bank Guarantee No. :

To
<Insert complete postal address>

THIS INDENTURE made this ---------- day of ---------20---- BETWEEN THE ---------- (Name of the Bank and address) BANK incorporated under the English / Indian Companies Acts and carrying on business in Mumbai (hereinafter referred to as 'the bank' which expression shall be deemed to include its successors and assigns) of the first part ----------

---

----------(Name of the Bidder)
inhabitants carrying on business at ----------

---------- (Bidders address)
in Mumbai under the style and name of Messers ----------

---------- (Name of the Bidder)
(hereinafter referred to as 'the contractors') of the second part Shri----------

---

<Dr. I. S. Chahal>, THE MUNICIPAL COMMISSIONER FOR GREATER MUMBAI (hereinafter referred to as 'the Commissioner' which expression shall be deemed, also to include his successor or successors for the time being in the said office of Municipal Commissioner) of the third part and THE BRIHANMUMBAI MUNICIPAL CORPORATION (hereinafter referred to as 'the Corporation') of the fourth part WHEREAS the contractors indemnify and keep indemnified the

Corporation against any loss or damage that may be caused to or suffered by the Corporation by reason of any breach by the contractors of any of the terms and conditions of the contract that will be entered subsequently (within 15 days) and/or in the performance thereof against Letter of Intent number ---------- dated ---------- for the project 'Development, Implementation, Maintenance of 3D city model and change detection using Geospatial Technology for BMC' of ---------- department having tender No. <<>> tender amount ₹---------- and the terms of such tender / contract require that the contractors shall deposit with the Commissioner as earnest money and/ or the security a sum of ₹---------- (Rupees----------) AND WHEREAS if and when any such tender is accepted by the Commissioner, the contract to be entered into in furtherance thereof by the contractors will provide that such deposit shall remain with and will be appropriated by the Commissioner towards the Security Deposit to be taken under the contract and be redeemable by the contractors, if they shall duly and faithfully carry out the terms and provisions of such contract and shall duly satisfy all claims properly chargeable against them thereunder AND WHEREAS the contractors are constituents of the Bank and in order to facilitate the keeping of the accounts of the contractors, the Bank with the consent and concurrence of the contractors has requested the Commissioner to accept the undertaking of the Bank hereinafter contained, in place of the contractors depositing with the Commissioner the said sum as earnest money and/or the security as aforesaid AND WHEREAS accordingly the Commissioner has agreed to accept such undertaking. NOW THIS AGREEMENT WITNESSES that in consideration of the premises, the Bank at the request of the contractors (hereby testified) UNDERTAKES WITH the Commissioner to pay to the Commissioner upon demand in writing, whenever required by him, from time to time, so to do, a sum not exceeding in the whole ₹---------- (Rupees----------)

under the terms of the said tender and/or the contract. The B.G. is valid upto----------

---

We agree that the decision of the Corporation, whether any breach of any of the terms and conditions of the contract and/or in the performance thereof has been committed by the SI and the amount of loss or damage that has been caused or suffered by the Corporation shall be final and binding on us and the amount of the said loss or damage shall be paid by us forthwith on demand and without demur to the Corporation.

"Notwithstanding anything what has been state above, our liability under the above guarantee is restricted to ₹---------- only and guarantee shall remain in force upto ----------unless the demand or claim under this guarantee is made on us in writing on or before----------all your right under the above guarantee shall be forfeited and we shall be released from all liabilities under the guarantee thereafter".

IN WITNESS WHEREOF

WITNESS (1) ----------
Name and ----------
Address ----------

WITNESS (2) ----------
Name and ---------- the duly constituted Attorney Manager
Address ----------
----
the Bank and the said Messrs----------

----------(Name of the bank)

WITNESS (1) ----------
Name and ----------
Address ----------

WITNESS (2) ---------- for Messrs ----------
Name and ---------- (Name of the contractor)
Address ----------

Have here into set their respective hands the day and year first above written.

7 Annexure II: Instructions and Technical Bid Document Formats

7.1 General Instructions for the Technical Bid

SIs have to submit a very structured and organized technical bid, which will be analysed by the Technical Evaluation Committee for different compliances with regards to the requirements of the project. Since the cut-off marks for Technical bid Score is 70, the quality and completeness of the information submitted by the SI will matter a lot.

SI is expected to divide its Bid in following sections / documents:

A) SI's Competence to execute the project

This document should bring about the capability of the firm to execute this project. Some of the required documents are as follows:

- Financial Capability of the SI in required formats and supporting documents
- Experience of SI of implementing similar/same applications or in supply of similar/same hardware components if applicable
- Experience of SI in India in required formats and supporting documents
- Quality of GIS + IT and domain experts available with the firm

B) Proposed Team to be deployed at BMC for maintenance

As specified in the Technical Bid Evaluation Framework, the department would like to give importance to the desired / right people proposed for deployment. SI may propose different people for different skill-sets required and different responsibilities (during Maintenance Support and Project Implementation). Following documentation is expected in this section:

- Overall Project Team (for both Project Implementation and Support phases)
- Summary Table giving Qualification, Experiences, Certifications, Relevance
- Detailed CVs in the format attached
- Escalation Chart for the entire Project Duration

C) Technical Solution Proposed for the Project

Broad areas to be covered in the Technical Solution documentation are given below:

1. Clearly articulate the Strategy and Approach and Methodology for the work to be executed by the resources in line with the scope of services expected.
2. Approach and Methodology for Management of SLA Requirements specified in the bid. SI is required to clearly articulate how the SLA requirements would be adhered to.
3. Detailed Project Plan with timelines, resource allocation, milestones etc.
4. Clearly mention the risk and mitigation plan.

7.2 Format to share Project Details

Name of the Project	
General Information	
Client for which the project was executed	
Name of the client contact person(s)	
Designation of client contact person(s)	
Contact details of the client contact person(s)	
Project Details	
Description of the project	
Scope of work of the SI	
Deliverables of the SI	
Technologies used	
Current Status of the project	
Other Details	
Total cost of the project	
Total cost of the services provided by the SI	
Duration of the project (number of months, start date, completion date, current status)	
Other Relevant Information	
Mandatory Supporting Documents: • Work order / Purchase order / Contract for the project • Client Certificate giving present status of the project and view of the quality of services by the SI	

Note: The SI is required to use above format for all the projects referenced by the SI for the pre-qualification criteria and technical bid evaluation.

7.3 Details of Manpower Resources Proposed

#	Name of the Resource	Proposed Role	Highest Qualification	Total Experience (in years)	Total Relevant Experience for the proposed position (in years)

CV of the Manpower proposed to be submitted in the following format:

<table>
<tr><td>1</td><td>Name of the Staff</td><td></td></tr>
<tr><td>2</td><td>Current Designation in the Organisation</td><td></td></tr>
<tr><td>3</td><td>Proposed Role in the Project</td><td></td></tr>
<tr><td>4</td><td>Proposed Responsibilities in the Project</td><td></td></tr>
<tr><td>5</td><td>Date of Birth</td><td></td></tr>
<tr><td>6</td><td>Education</td><td>▪ Degree / Diploma, College, University, Year of Passing
▪ Degree / Diploma, College, University, Year of Passing</td></tr>
<tr><td>7</td><td>Summary of Key Training and Certifications</td><td>▪
▪</td></tr>
<tr><td>8</td><td>Language Proficiency</td><td><table><tr><td>Language</td><td>Reading</td><td>Writing</td><td>Speaking</td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>9</td><td>Employment Record (For the total relevant experience)</td><td><table><tr><td>From / To:</td><td></td></tr><tr><td>Employer:</td><td></td></tr><tr><td>Position Held:</td><td></td></tr><tr><td>From / To:</td><td></td></tr><tr><td>Employer:</td><td></td></tr><tr><td>Position Held:</td><td></td></tr><tr><td>From / To:</td><td></td></tr><tr><td>Employer:</td><td></td></tr><tr><td>Position Held:</td><td></td></tr></table></td></tr>
<tr><td>10</td><td>Total No. Of Years of Work Experience</td><td></td></tr>
</table>

11	Total No. Of Years of Experience for the Role proposed		
12	Highlights of relevant assignments handled and significant accomplishments (Use following format for each project)	Name of assignment or project:	
		Year:	
		Location:	
		Client:	
		Main project features:	
		Positions held:	
		Activities performed:	

Important Note:

SIs need to submit the soft copies of following along with the complete resume:

1. Certificates of educational qualifications
2. Experience certificates issued by all their employers
3. Copies of professional certificates such as PMP, TOGAF, ArcGIS Enterprise, etc. as per respective profile.
4. Authorized person submitting the bid needs to sign the above as in the case of other bid submission related documents.

8 Annexure III: Commercial Bid Formats

8.1 Commercial Bid Cover Letter

Date: DD/MM/YYYY

To

<Insert complete postal address>

Sub :

Ref : Bid No: <No> Dated <DD/MM/YYYY>

Dear Sir,

We, the undersigned SIs, having read and examined in detail all the bidding documents in respect of **Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC** do hereby propose to provide services as specified in the bid referred above**.**

1. PRICE AND VALIDITY

- All the prices mentioned in our bid are in accordance with the terms as specified in the bid documents. All the prices and other terms and conditions of this bid are valid for a period of 180 calendar days from the date of opening of the Bids.
- We hereby confirm that our bid prices include all taxes. Taxes are quoted separately under relevant sections, as specified in the bid formats.
- We have studied the clause relating to Indian Income Tax and hereby declare that if any income tax, surcharge on Income Tax, Professional and any other Corporate Tax in altercated under the law, we shall pay the same.

2. UNIT RATES

We have indicated in the relevant schedules enclosed, the unit rates for the purpose of payment as well as for price adjustment in case of any increase to / decrease from the scope of work under the contract.

3. DEVSITIONS

We declare that all the services shall be performed strictly in accordance with the bid documents and there are no deviations.

4. QUALIFYING DATA

We confirm having submitted the information as required by you in your Instruction to SIs. In case you require any other further information/documentary proof in this regard before evaluation of our bid, we agree to furnish the same in time to your satisfaction.

5. BID PRICE

We declare that our Bid Price is for the scope of the work as specified in the bid document. These prices are indicated in the subsequent sub-sections of this Section.

6. CONTRACT PERFORMANCE GUARANTEE BOND

We hereby declare that in case the contract is awarded to us, we shall submit the contract Performance Bank Guarantee in the form prescribed in the bid.

We hereby declare that our bid is made in good faith, without collusion or fraud and the information contained in the bid is true and correct to the best of our knowledge and belief.

We understand that our bid is binding on us and that you are not bound to accept a bid you receive. We confirm that no Technical deviations are attached here with this commercial offer.

Thanking you,

Yours faithfully,

(Signature of the Authorised Signatory)
Name:

Designation:

Seal.

Date:

Place:

Business Address:

8.2 Commercial Bid Format and Instructions

SI are required to quote the rates of items of work exclusive of all taxes in the commercial offer of online bid submission. The SI must quote the rate in the BoQ Spreadsheet available online with this bid. Details to be filled up for price bid are as below. Should there be a change in applicable taxes, the actual taxes on the date of billing would prevail.

Please note that the SI needs to quote only the Total cost in the BMC online e-tendering system. The signed & stamped cost break-up (in PDF) of each component in format provided in section 8.2.1 to 8.2.7 should be uploaded in the attachment section of Financial Packet.

Total Cost

Summary of all Components

#	Item	Total Price in INR
1	CAPEX	
	Total of 8.2.1 CAPEX Hardware & Software Cost	
	Total of 8.2.3 CAPEX Survey Cost & Data processing	
	Total of 8.2.5 CAPEX Software development	
	Total of 8.2.77 Miscellaneous Bill of Material	
2	OPEX	
	Total of 8.2.2 OPEX Hardware & Software Cost	
	Total of 8.2.4 OPEX Survey Cost (Change detection) & Data processing	
	Total of 8.2.6 OPEX Software development	
Grand Total [1 + 2]		

8.2.1 CAPEX Hardware & Software Cost

#	Item	Unit Quantity	Unit Rate	Minimum Proposed Quantity	Total Cost in INR
1.	Commissioning & Deployment of CORS	1		5	
2.	High-end workstations for viewing, editing LiDAR, Orthomosaic, etc.	1		5	
3.	Color printers	1		2	
4.	360˚ Panoramic Street view imagery publishing Server software compatible with ArcGIS Enterprise suite	1		To be proposed by SI	
5.	One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph)	1		1	
6.	Oracle Database licenses with RAC	1		To be proposed by SI	
	Total				

8.2.2 OPEX Hardware & Software Cost

#	Item	Unit Quantity	AMC cost per unit	Minimum Proposed Quantity	AMC cost for Year 1	AMC cost for Year 2	AMC cost for Year 3	Total Cost in INR
1.	Commissioning & Deployment of CORS	1		5				
2.	High-end workstations for viewing, editing LiDAR, Orthomosaic, etc.	1		5				
3.	Color printers	1		2				
4.	360˚ Panoramic Street view imagery publishing Server software compatible with ArcGIS Enterprise suite	1		To be proposed by SI				
5.	One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph)	1		1				
6.	Oracle Database licenses with RAC	1		To be proposed by SI				
	Total							

8.2.3 CAPEX Survey Cost & Data processing

#	Item	Unit Quantity	Unit Rate	Minimum Proposed Quantity	Total Cost in INR
1.	Establishing & monumentation of Ground Control Points (GCP) in Mumbai	1		100	
2.	Manned Aircraft survey with LiDAR & Photogrammetry sensor	1 Sq. Km		500 sq. km	
3.	Terrestrial Vehicle survey with LiDAR & 360˚ Panoramic Street view imagery sensor	1 km		4800 km	
4.	Mobile LiDAR backpack survey for narrow streets or places which are not accessible using above two surveys	1 km		480 km	
5.	Creation of 3D City reality model of Mumbai using Aerial survey LiDAR, photogrammetry, Terrestrial LiDAR, 360˚ Panoramic Street view & Mobile LiDAR backpack survey	1 Sq km		500 sq. km	
6.	Bathymetric survey of major rivers, nallas, lakes, ponds in Mumbai.	1 Sq km		To be proposed by SI	
7.	Base map creation & digitization of all vector layers mentioned in the Scope of Work	1 Sq km		500 sq. km	
8.	Ground truthing 10% of total area of Mumbai (500sq. km)	1 sq km		50 sq. km	
	Total				

8.2.4 OPEX Survey Cost (Change detection) & Data processing

#	Item	Maximum area in percentage or Sq. km. or km.	Change detection cost for Year 1	Change detection cost for Year 2	Change detection cost for Year 3	Total Cost in INR
1.	Manned Aircraft survey with LiDAR & Photogrammetry sensor	**500 sq. km.**				
2.	Terrestrial Vehicle survey with LiDAR & 360˚ Panoramic street view imagery sensor	25% of 4800 km **(1200km)**				
3.	Mobile LiDAR backpack survey for narrow streets or places which are not accessible using above two surveys	25% of 480 km **(120km)**				

4.	Updating the 3D City reality model of Mumbai using Aerial survey LiDAR, photogrammetry, Terrestrial LiDAR, 360° Panoramic street view & Mobile LiDAR backpack survey	As per actuals				
5.	Updating of Base map & all vector layers mentioned in the Scope of Work	As per actuals				
6.	Ground truthing 10% of total area of the change detection covered	As per actuals				
Total						

8.2.5 CAPEX Software development

#	Item	Unit Rate	Quantity	Total Cost in INR
1.	Development of Enterprise Web Geospatial application as per requirement		Lumpsum	
2.	Development of Mobile GIS App (Android and iOS)		Lumpsum	
3.	Integration of the Enterprise web Geospatial and Mobile GIS app with existing GIS applications and data of BMC		Lumpsum	
4.	Comprehensive audit including security Certification, VAPT & load testing from CERT-IN empaneled agency for all applications developed as per the scope of work		Lumpsum	
Total				**0**

8.2.6 OPEX Software development

#	Item	AMC Cost of Year 1	AMC Cost of Year 2	AMC Cost of Year 3	Total Cost in INR
1.	Development of Enterprise Web Geospatial application as per requirement				
2.	Development of Mobile GIS App (Android and iOS)				
3.	Integration of the Enterprise web Geospatial and Mobile GIS app with external GIS applications and data of BMC				
4.	Security Audit Certification, VAPT & load testing from CERT-IN empaneled agency for all applications developed as per the scope of work				
Total					**0**

8.2.7 Miscellaneous Bill of Material

#	Item	Unit Rate	Quantity	Total Cost in INR
1.	Item 1			
2.	Item 2			
3.	Item 3			
4.	Item ..n			
	Total			

Note:

- The tenderer shall quote excluding GST but inclusive of all other taxes (except GST), Levies, Duties, Cess etc. as applicable at the time of bid submission.
- GST as applicable shall be paid separately on submission of bills/invoice. Input Tax Credit of GST as available with the bidder will not be claim separately by BMC. However, while quoting the rates benefit of Input Tax Credit or Exemptions shall be passed on to the BMC by way of equivalent reduction in quoted price.

Instructions:

1. The SI should submit only the 'Summary of the Commercial Format' on the e-Tendering portal. The formats for detailed commercial bids to be as per formats defined in his RFP.
2. The SIs may visit the site and obtain additional information at their own cost and responsibility.
3. The Agency will quote total man month rate for the desired resources as per the details given in the Bid Document.
4. BMC to scale up and scale down resources based on requirements. Any line items may be removed from the scope based on BMC's discretion.
5. All the prices are to be entered in Indian Rupees ONLY.
6. Prices indicated in the schedules shall be exclusive of GST but inclusive of all taxes (except GST), levies, duties etc. It is mandatory to provide breakup of all Taxes, Duties and Levies wherever asked for.
7. During the payment stage, BMC reserves the right to ask the SI to submit proof of payment against any of the taxes, duties, levies indicated.
8. The SI needs to account for all Out-of-Pocket expenses due to Boarding, Lodging and other related items. No additional/separate payment shall be made regarding the same.
9. For the purpose of evaluation of Commercial Bids, BMC shall make appropriate assumptions to arrive at a common bid price for all the SIs. This however shall have no co-relation with the Contract value or actual payment to be made to the SI.
10. The Contract Price shall be firm and not subject to any alteration.

11. The System Integrator should be deemed to have satisfied itself as to the correctness and sufficiency of the resource's contract price, which shall, except as otherwise provided for in the contract, cover all its obligations under the contract.
12. Wherever present, the items mentioned as Lump Sum in above table will have quantity as 1 in the BoQ available online via e-tendering. However, the SI should consider the same as Lump Sum and submit the commercials.

9 Annexure IV: Draft Contract Agreement

On a Stamp Paper of Rs.500/- for contract value up to Rs.10,00,000/- and 0.1% of the amount above Rs.10 lakh subject to maximum Rs.25 Lakhs)

CONTRACT AGREEMENT

Bid No :- _____

Sanction No. & Date:_____

Contract Cost :_____

This Contract Agreement (hereinafter referred to as "CA") is made and entered into at Mumbai this _____ day of _____ Two Thousand Nineteen

BETWEEN

The Brihanmumbai Municipal Corporation, a body corporate having perpetual succession and common seal constituted by the Mumbai Municipal Corporation Act, 1888, hereinafter referred to as **"The BMC"**

REPRESENTED BY

Shri. _____, Director (Information Technology), having its office at _____, hereinafter referred to as **"Director(IT)"** (which expression shall unless repugnant to the context or meaning thereof be deemed to mean and include the successor or successors for the time being holding the office of the Director (IT) of the First Part;

AND

M/s. _____, a company incorporated under the provisions of the Companies Act, 1956 and having its registered office at _____ through Shri. _____, (Authorized Signatory); hereinafter referred to as "**the Consultant**" (which expression shall unless repugnant to the context or meaning thereof be deemed to mean and include its successor or successors and assigns) of the Second Part;

WHEREAS the Municipal Commissioner of BMC has inter alia deputed under Section 56 of the Mumbai Municipal Corporation Act, 1888 his powers, functions and duties to the Director(IT) / AMC(ES) for signing and executing this Contract Agreement on behalf of BMC.

AND WHEREAS M/s. _____, by its Resolution under No._____ dated _____ have authorised Shri _____ (Authorized Signatory), to sign the present Contract Agreement, on behalf of the said Company.

AND WHEREAS the BMC has invited Tender for Selection of Agency to **Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC**; hereinafter referred to as "the contract work". The System Integrator has submitted the Tender for the said contract work.

AND WHEREAS the Standing Committee vide its Resolution under no. _____ dtd.

_____ has accorded sanction to _____, as Implementation Agency for **Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC,** for a period of _____ years, at total cost of Rs. _____/- (including 18% GST) on the terms and conditions mentioned therein.

AND WHEREAS the Implementation Agency has agreed to comply with the terms and conditions hereinafter appearing and are desirous of recording the same subject to compliance of which the contract as aforesaid has been agreed to be granted by the BMC in favour of the Implementation Agency.

NOW THIS CONTRACT AGREEMENT WITNESSETH AND IT IS HEREBY AGREED BY AND BETWEEN THE PARTIES HERETO AS FOLLOWS:

1. The parties hereto agree that the recitals enumerated herein above shall be deemed to form an integral and operative part of this Contract Agreement as if the same were specifically set out and incorporated herein.

2. The following documents are and shall be deemed to form part of this Contract Agreement and shall be read and construed to be part of this Contract Agreement as if they were incorporated in this Contract Agreement.

(i) Corrigendum document published by BMC subsequent to the Bid for this contract work.

(ii) Bid Document of BMC issued for this contract work under no. _____

(iii) Standing Committee Resolution no. _____ dtd. _____

(iv) Letter of Acceptance issued under no. _____ dtd. _____

(v) Special Conditions of Contract

(vi) General Conditions of Contract

9.1 Definitions, Interpretations and Other Terms

a. ***"Bid"*** means the bid process conducted by BMC including all clarifications/addendums, explanations and amendments issued by the Corporation in respect thereof and the technical and commercial bids submitted by the successful SI, along with the subsequent clarifications and undertakings, if any.

b. The ***"Contract"*** shall mean the tender and acceptance thereof and the formal Agreement if any, executed between the SI, Commissioner and the Corporation together with the documents referred to therein including these conditions and appendices and any special conditions, the specifications, designs, drawings, price schedules, bills of quantities and schedule of rates. All these documents taken together shall be deemed to form one Contract and shall be complementary to one another**.**

c. The **"SI"** shall mean a person or corporate body who has desired to submit Bid to carry out the Works, including routine maintenance till the tender process is concluded.

d. **"Arbitrator"** means the person or persons appointed by agreement between BMC and the SI to make a decision on or to settle any dispute or difference between the BMC and the SI referred to him or her by the parties pursuant to General Conditions of Contract amended up to date.

e. **"Contract Cost"** means the Contract Sum plus Price Variation. This cost shall be included in the letter of acceptance.

f. **"Excepted risks"** are risks due to riots (otherwise than among SI's employees) and civil commotion (in so far as both these are uninsurable), war (whether declared or not), invasion, act of foreign enemies, hostilities, civil war, rebellion, revolution, insurrection, military or usurped power, any act of government, damage from aircraft, acts of god, such as earthquake, lightning and unprecedented floods and other causes over which the SI has no control and accepted as such by the Commissioner or causes solely due to use or occupation by the Municipal Corporation of the works in respect of which a certificate of completion has been issued or a cause solely due to faulty municipal design of work.

g. The **"Corporation"** or the **"Municipal Corporation"** shall mean the Brihanmumbai Municipal Corporation, constituted under the M.M.C. Act 1888 as amended up to date.

h. The **"Annexure"** referred to in these conditions shall means the relevant annexure appended to the tender papers issued by the Municipal Corporation.

i. The **"Works"** shall mean the Permanent Works and the Temporary Works or either of them as appropriate to be executed in accordance with the contract or part(s) thereof, as the case may be and shall include all extra or additional, altered or substituted works as required for performance.

j. **"Temporary Works"** shall mean all Temporary Works of every kind required in or about execution, completion or maintenance of the work also Temporary Works are works designed, constructed, installed, and removed by the Service Provider that are needed for construction or installation of the Works of the contract as found necessary as per suggestion of the BMC.

k. **"Permanent Works"** means the permanent works to be executed and installation of machineries in accordance with the Contract at specified required site and location.

l. **"Drawings"** means all the drawings, calculations and technical information of a like nature provided by the BMC to the Service Provider under the Contract and all drawings, calculations, samples, patterns, models, operation & maintenance manual and other technical information of like nature submitted by the Service Provider and approved by the BMC.

m. **"Approved"** shall mean approved in writing including subsequent confirmation of previous verbal approval and "approval" shall mean approval in writing including as aforesaid.

n. **"Specification"** means the specification referred to in the tender and any modification thereof or addition or deduction thereto as may from time to time be furnished or approved in writing by the BMC.

o. **"Tender"** means the SI's priced offer to the BMC for the execution and completion of the Works and the remedying of any defects therein in accordance with the provision of the Contract, as accepted by the Letter of Acceptance.

p. **"Commencement Date"** means the date upon which the SI receives the notice to commence, issued by the BMC.

q. **"Time for Completion"** means the time for completing the execution of and passing the Tests on Completion of the Works or any Section or part thereof as stated in the Contract calculated from the Commencement Date.

r. **"Certificate of Taking-Over/ Take-over Certificate"** shall mean the certificate issued by BMC after completion of Works in all respects.

s. **"Letter of Acceptance"** means the letter of formal acceptance, signed by BMC, of the Letter of Bid, including any annexed memoranda comprising agreements between and signed by both Parties. If there is no such letter of acceptance, the expression "Letter of Acceptance" means the Contract Agreement and the date of issuing or receiving the Letter of Acceptance means the date of signing the Contract Agreement.

t. **"Cost"** means all expenditure properly incurred or to be incurred whether on or off the site including overheads and other charges properly allocable thereto but does not include any allowance for profit.

u. ***"Confidential Information"*** means all information including BMC Data (whether in written, oral, electronic or other format) which relates to the technical, financial, business affairs, customers, suppliers, products, developments, operations, processes, data, trade secrets, design rights, know-how and personnel of each Party and its affiliates which is disclosed to or otherwise learned by the other Party in the course of or in connection with this CA (including without limitation such information received during negotiations, location visits and meetings in connection with this CA).

v. ***"Customers"*** mean all citizens and business organization and users who use the BMC services.

w. ***"Deliverables"*** means all the activities related to the setting up and operations of the infrastructure, technical documents, Software Applications, customized Source Codes, as defined in the bid and subsequent Corrigendum (if any), based on which the technical bid and commercial bid was submitted by the SI and as required as per this CA.

x. ***"Effective Date"*** means the date on which the Purchase Order or Letter of Intent is issued to System Integrator.

y. ***"CA"*** means this Contract Agreement, together with the recitals and all schedules and the contents, requirements, specifications and standards of the bid (as may be amended, supplemented or modified in accordance with the provisions hereof) and the bid**. In the event of a conflict between this CA and the Schedules, the terms of the CA shall prevail; with overriding effect**.

z. ***"Performance Security"*** means the irrevocable and unconditional Bank Guarantee provided by the System Integrator from by any of the approved banks as specified in Annexure V of this RFP document in favour of "Brihanmumbai Municipal Corporation" for an amount equivalent to 10% of the total contract value i.e. ₹.....(Rupees.....only) for due and faithful compliance of the contract work during the contract period.

aa. ***"Proprietary Information"*** means processes, methodologies and technical and business information, including drawings, designs, formulae, flow charts, data and computer programs already owned/licensed by either Party or granted by third parties to a Party hereto prior/ subsequent to the execution of this CA.

bb. ***"Required Consents"*** means the written consents, clearances and licenses, rights and other authorizations as may be required to be obtained by the System Integrator, for all tasks/activities/software/hardware and communication technology for this project; from all the concerned departments/agency, etc. as the case may be.

cc. ***"Bid Document"*** means the Request For Proposal released vide Bid document number specified under section 4.1, and include all clarifications/ addendums, explanations and amendments issued by the BMC in respect thereof;

dd. ***"Service Level(s)"*** means the performance standards, which will apply, to the services delivered by selected System Integrator.

ee. ***"Service Level Requirement(s)"*** means the timelines and the quality levels to be adhered to by the System Integrator for delivering various services under the contract.

ff. ***"Services"*** means the content and services delivered and to be delivered to the customers or the offices of BMC by the System Integrator, and includes but not limited to the services specified in the bid document or as may be specified and incorporated in the subsequent Agreement(s) under Contract Agreement.

gg. ***"Users"*** means the departmental staffs or any other BMC officials having access to application including its System Integrator, technology vendors, corporations and agency and their employees, as the context admits or requires.

hh. ***"Day"*** means Calendar day.

ii. ***"Month"*** means Calendar month of the Gregorian calendar.

jj. **"GCC"** means General Conditions of Contract.

kk. **"Foreign Currency"** means currency of a country other than that in which the works are to be located, approved by Govt. of INDSI/Reserve Bank of INDSI.

ll. **"Writing"** means any hand written, type-written, or printed communication including telex and facsimile transmission, electronic and digital media.

mm. **"Country"** means the country in which the Site is located.

nn. **"Variation"** means a change to the:-

i. Specification and /or Drawings (if any) which is instructed by the BMC

ii. Scope in the Contract which is instructed by the BMC

iii. Price in the Contract which is instructed by the BMC

oo. **"Specification"** shall mean the specification referred to in the tender and any modification thereof or addition or deduction thereto as may from time to time be furnished or approved in writing by the BMC.

pp. **"The Start Date/Commencement Date"** is given in the Contract Data. It is the date when the Service Provider shall commence execution of the Works. It does not necessarily coincide with any of the Site Possession Dates.

9.2 Interpretations

a. References to any statute or statutory provision include a reference to that statute or statutory provision as from time to time amended, extended, re-enacted or consolidated and to all statutory instruments made pursuant to it.

b. Words denoting the singular shall include the plural and vice-versa and words denoting persons shall include firms and corporations and vice versa.

c. Unless otherwise expressly stated, the words "herein", "hereof", "hereunder" and similar words refer to this CA as a whole and not to any particular Article, Schedule. The term Articles, refers to Articles of this CA. The words "include" and "including" shall not be construed as terms of limitation. The words "day" and "month" mean "calendar day" and "calendar month" unless otherwise stated. The words "writing" and "written" mean "in documented form", whether electronic or hard copy, unless otherwise stated.

d. The headings and use of bold type in this CA are for convenience only and shall not affect the interpretation of any provision of this CA.

e. The Schedules to this CA form an integral part of this CA and will be in full force and effect as though they were expressly set out in the body of this CA.

f. Reference at any time to any agreement, deed, instrument, license or document of any description shall be construed as reference to such agreement, deed, instrument, license or other document as the same may be amended, varied, supplemented, modified or suspended at the time of such reference.

g. References "roll out" includes, unless the context otherwise requires, design, development, implementation, engineering, procurement, delivery, transportation, installation, processing, fabrication, acceptance testing, certification, commissioning and other activities incidental to the construction or roll out, and "construct" or "roll out" shall be construed accordingly.

h. Any word or expression used in this CA shall, unless defined or construed in this CA, bear its ordinary English language meaning.

i. The damages payable by a Party to the other Party as set forth in this CA, whether on per diem basis or otherwise, are mutually agreed genuine pre-estimated loss and liquidated damages likely to be suffered and incurred by the Party entitled to receive the same and are not by way of penalties.

j. This CA shall operate as a legally binding agreement specifying the master terms, which apply to the Parties under this agreement and to the provision of the services by the System Integrator,

k. The Corporation may nominate a technically competent agency/individual(s) for conducting acceptance testing and certification of the various requisite infrastructure to ensure a smooth, trouble free and efficient functioning of the Scheme or carry out these tasks itself.

l. The agency/individual nominated by the Corporation can engage professional organizations for conducting specific tests on the software, hardware, networking, security and all other aspects.

m. The agency/individual will establish appropriate processes for notifying the System Integrator of any deviations from the norms, standards or guidelines at the earliest instance after taking cognizance of the same to enable the System Integrator to take corrective action.

n. Such an involvement of and guidance by the agency/person will not, however, absolve the System Integrator of the fundamental responsibility of designing, installing, testing and commissioning the application and the infrastructure for efficient and effective delivery of services as contemplated under this bid.

o. The following documents forming this Contract Agreement are to be taken as mutually explanatory of one another. The following order shall govern the priority of documents constituting this Contract Agreement, in the event of a conflict between various documents, the documents shall have priority in the following order:

   i. This Contract Agreement;

   ii. Standing Committee Resolution No. ____ dtd. _____; (hereby annexed as Annexure I)

   iii. Purchase Order or Letter of Acceptance issued under no. _____dtd. _____issued by BMC to the System Integrator; (hereby annexed as Annexure II)

   iv. Clarification & Corrigendum Documents published by BMC subsequent to the Bid Document for this work (hereby annexed as Annexure III)

   v. Bid Document of BMC for this work (hereby annexed as Annexure IV)

   vi. System Integrator's "Technical Proposal" and "Commercial Proposal" submitted in response to the Bid

9.3 Term of the Contract Agreement

(a) The term of this CA shall be a period of 4.5 (four & half) years from the date of issue of Letter of Acceptance/ Purchase Order i.e. _____. This includes the time required for Development, Implementation, Maintenance of 3D City model & Change Detection using Geospatial Technology for BMC.

(b) In the event of implementation period getting extended beyond the stipulated time, for reasons not attributable to the System Integrator, BMC reserves the right to extend the term of the Agreement by corresponding period to allow validity of contract from the date of successful go live.
(c) BMC also reserves the right to extend the contract at its sole discretion, beyond the initial four & half (4.5) years contract period with approval of the competent authority, and not otherwise.

9.4 BMC's Decision

Except where otherwise specifically stated, the Director IT, BMC will decide contractual matters between BMC and the SI in the role representing the BMC. However, if BMC's representative is required under the rules and regulations and orders of the BMC to obtain prior approval of some other authorities for specific actions, he will so obtain the approval, before Communicating his decision to the SI.

Except as expressly stated in the Contract, BMC's representative shall not have any authority to relieve the Contractor of any of his obligations under the contract.

9.5 Delegation

BMC's representative, with the approval of the BMC Authority, may delegate any of his duties and responsibilities to other person(s), except to the Adjudicator, after notifying the SI, and may cancel any delegation after notifying the SI.

9.6 Scope of Work

As mentioned in Section 5.0 Scope of Work

9.7 Communication

All certificates, notices or instructions to be given to the SI by BMC shall be sent on the address / Email Address or contact details given by the SI of Bid. The address and contact details for communication with the BMC shall be as per the details given in Contract Data. Communications between parties that are referred to in the conditions shall be in writing. The Notice sent by electronic means shall be effective on confirmation of the transmission. The Notice sent by Registered post or Speed post shall be effective on delivery or at the expiry of the normal delivery period as undertaken by the postal service.

9.8 Personnel

The Service Provider's personnel shall appropriately be qualified, skilled and experienced in their respective trades or occupations. BMC shall have authority to remove, or cause to be removed, any person employed on the site or works, who carries out duties incompetently or negligently.

If BMC asks the Service Provider to remove a person who is a member of the Service Provider's staff or work force, stating the reasons, the Service Provider shall ensure that the person leaves the Site within seven days and has no further connection with the Works in the Contract.

9.9 BMC's and Service Provider's Risks

BMC carries the risks which this Contract states are BMC's risks, and the Service Provider carries the risks which this Contract states are Service Provider's risks.

9.10 BMC's Risks

The BMC is responsible for the excepted risks which are:

a. in so far as they directly affect the execution of the Works, the risks of war, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot, commotion or disorder (unless restricted to the Service Provider's employees) and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive, or
b. a cause due solely to the design of the Works, other than the Service Provider's design.

9.11 Service Provider's Risks

All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks, are the responsibility of the Service Provider.

9.12 Management Meetings

BMC may require the Service Provider to attend a management meeting. The business of a management meeting shall be to review the plans for progress of the Works.

BMC shall record the business of management meetings and provide copies of the record to those attending the meeting. The responsibility of the parties for actions to be taken shall be decided by BMC either at the management meeting or after the management meeting and stated in writing to all those who attended the meeting.

9.13 Tests

The Service Provider will have to perform the mandatory tests as prescribed in the specifications. The Service Provider shall be solely responsible for:

a. Carrying out the mandatory tests prescribed in the Specifications, and
b. For the correctness of the test results, whether preformed

If BMC instructs the Service Provider to carry out a test not specified in the Specification / Quality Assurance Handbook to check whether any work has a Defect and the test shows that it does, the Service Provider shall pay for the test and any samples. If there is no defect, the test shall be a compensation event.

The cost of testing shall be borne by the Service Provider even if the result of the sample confirm or do not confirm to the relevant specifications.

All expenditure required to be incurred in testing shall be borne by the Service Provider himself.

9.14 Variations

BMC shall, having regard to the scope of the Works and the sanctioned estimated cost, have power to order, in writing, Variations within the scope of the Works he/she considers necessary or advisable during the progress of the Contract. Such Variations shall form part of the Contract and the Service Provider shall carry them out and include them in updated Programmes produced by the Service Provider. Oral orders of BMC for Variations, unless followed by written confirmation, shall not be taken into account.

9.15 Payment for Variations

If rates for Variation items are specified in the Bill of Quantities, the Service Provider shall carry out such work at the same rate.

9.16 Operation and Maintenance Manuals

If Drawings and /or operation and maintenance manuals are required, the Service Provider shall supply them by the dates stated in the Contract Data.

If the Service Provider does not supply the Drawings and /or manuals by the dates stated in the contract Data, or they do not receive the BMC's approval, BMC shall withhold the amount stated in the Contract Data from payments due to the Service Provider.

9.17 Compliance with Labour Regulations

During continuance of the Contract, the System Integrator shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority.

Furthermore, the System Integrator shall keep BMC indemnified in case any action is taken against the BMC by the competent authority on account of contravention of any of the provisions

of any Act or rules made there under, regulations or notifications including amendments. If BMC is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/ bye laws/ Acts/ Rules/ regulations including amendments, if any, on the part of the System Integrator, BMC shall have the right to deduct any money due to the System Integrator including his amount of performance guarantee. The BMC shall also have right to recover from the System Integrator any sum required or estimated to be required for making good the loss or damage suffered by BMC.

The System Integrator shall require his employees to obey all applicable laws, including those concerning safety at work. The entire responsibility of the employees of the System Integrator, shall be of the System Integrator alone and under no circumstances the employees of the System Integrator shall be treated as the employees of the BMC at any point of time.

9.18 Official Secrecy

The Service Provider shall of all the persons employed in any works in connection with the contract that the India Official Secrets Act 1923 (XIX of 1923) applies to them and will continue to apply even after execution of the said works and they will not disclose any information regarding this contract to any third party. The Service Provider shall also bring into notice that, any information found to be leaked out or disclosed the concern person as well as the Service Provider will be liable for penal action; further the Corporation will be at liberty to terminate the contract without notice.

9.19 Subsequent Legislation

If on the day of submission of bids for the contract, there occur changes to any National or State stature, Ordinance, decree or other law or any regulation or By-laws or any local or other duly constituted authority or the introduction of any such National or State Statute, Ordinance, decree or by which causes additional or reduced cost to the Service Provider, such additional or reduced cost shall, after due consultation with the Service Provider, be determined by the concerned authority of BMC and shall be added to or deducted from the Contract Price with prior approval of competent authority and BMC shall notify the Service Provider accordingly. BMC reserve the right to take decision in respect of addition/reduction of cost in contract.

9.20 Patent, Rights & Royalties

The Service Provider shall save harmless and indemnify the Corporation from and against all claims and proceedings for or on account of infringement of any Patent rights, design trademark or name of other protected rights in respect of any constructional plant, machine work, or material used for or in connection with the Works or any of them and from and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation

thereto. Except where otherwise specified, the Service Provider shall pay all tonnage and other royalties, rent and other payments or compensation, if any, required for the works.

9.21 Payment, Taxes & Claims

- **The limit for unforeseen Risks**

  Under no circumstances whatever the Service Provider shall be entitled to any compensation from BMC on any account unless the Service Provider shall have submitted a claim in writing to BMC within One (1) month of the case of such claim occurring.

- **No interest for delayed payments due to disputes, etc.**

  It is agreed that the Brihanmumbai Municipal Corporation or its representative or Officer shall not be liable to pay any interest or damage with respect of any money or balance which may be in its or its representative's or officer's hands owing to any dispute or difference or claim or misunderstanding between the Municipal Corporation of Greater Bombay or its representative or Officer on the one hand and the Service Provider on the other, or with respect to any delay on the part of the Municipal Corporation of Greater Bombay or representative or Officers in making periodical or final payments or in any other respect whatever.

9.22 Proprietary data

All documents and other information supplied by the Authority or submitted by a Service Provider to BMC Authority shall remain or become the property of BMC Authority. Service Provider to treat all information as strictly confidential and shall not use it for any purpose other than for preparation and submission of their Application. BMC Authority will not return any Application or any information provided along therewith.

9.23 Taxes

a) The tenderer shall quote inclusive of all taxes other than GST (Excluding GST), Levies, Duties, Cess etc as applicable at the time of bid submission.

b) GST as applicable shall be paid separately on submission of bills/invoice. Input Tax Credit of GST as available with the bidder will not be claim separately by BMC. However, while quoting the rates benefit of Input Tax Credit or Exemptions shall be passed on to the BMC by way of equivalent reduction in quoted price.

9.24 Contract Execution

All required documents for execution of the contract shall be submitted within 30 days from the date of issue of letter of acceptance. If the documents are not submitted within the stipulated time a penalty of ₹ 5000/- per day will be applicable to the SI. All contract documents need to be duly

affixed with stamp duty properly signed along with evidence/proof of payment of security/contract deposit/ within 30 days from the date of letter of acceptance received by him.

If the amount of the Contract Deposit to be paid above is not paid within 30 days from the date of issue of Letter of Acceptance, the Tender / Contractor already accepted shall be considered as cancelled and legal steps be taken against the SI for recovery of the amounts.

The amount of Performance Bank Guarantee (PBG) retained by the BMC shall be released after expiry of period up to which the contractor has agreed to maintain the work in good order is over. In the event of the contractor failing or neglecting to complete the rectification work within the period up to which the contractor has agreed to maintain the work in good order, the amount of Performance Bank Guarantee (PBG) retained by BMC shall be adjusted towards the excess cost incurred by the Department on rectification work.

In case of pending execution of contract agreement, Payment of 10% of Total contract value will be withheld.

9.25 Contract may be rescinded and Performance Bank Guarantee (PBG) forfeited for bribing a public officer or if contractor becomes insolvent

If the contractor assigns or sublets his contracts or attempt so to do, or become insolvent or commence any proceeding to get himself adjudicated and insolvent or make any composition with his creditors, or attempt so to do or if bribe, gratuity, gift, loan, perquisite, reward or advantage, pecuniary or otherwise, shall either directly or indirectly be given promised or offered by the contractor or any of his servants or agents through any public officer, or person in the employ of BMC / Govt. in any way relating to his office or employment, or if any such officer or person shall become in any way directly or indirectly interested in the contract the Engineer In-charge may thereupon, by notice in writing rescind the contract and the Performance Bank Guarantee (PBG) of the Contractor shall thereupon stand forfeited and be absolutely at the disposal of BMC and the same consequences shall ensure as if the contract had been rescinded under above clause hereof; and in addition the contractor shall not be entitled to recover or be paid for any work therefore actually performed under the contract.

9.26 Work Completion Timelines and Payment Terms

The total duration of the project is 4.5 years.

The SI is free to modify the timelines of different sub-modules during the development & implementation period, however all modules should be covered as mentioned in the scope of work. The payment terms are to be read as percentage payment of the commercial bid section nos. (item nos.)

#	Category of Work	#	Activity/ Deliverables	Timelines in months (From - To)	Commercial Bid section nos.	Percentage of payment
1	**Requirement Gathering**	a.	Inception report (As-is study of all GIS data & applications in BMC)	Month 1 – Month 2	8.2.5 (1)	0
		b.	FRS, SRS, Project plan, installation of Project Management tool	Month 1 – Month 2	8.2.5 (1)	0
		c.	Project Kick-off meeting & presentation to Key departments of BMC	Month 1 – Month 2	8.2.5 (1)	0
2.	**Setting up permanent Continuously Operating Reference Station (CORS) network in Mumbai**	a.	Installation, commissioning & testing of CORS	Month 1 – Month 2	8.2.1 (1)	80%
		b.	Certification by SOI	Month 2	8.2.1 (1)	20%
3.	**DGPS survey for collection of GCPs**	a.	Setting up primary GCN with permanent monumentation	Month 1 – Month 2	8.2.3 (1)	80%
		b.	Setting up secondary GCN	Month 1 – Month 2	8.2.3 (1)	20%
4.	**Permissions for Aerial, Terrestrial, Mobile & Bathymetry survey**	a.	Preparation of necessary documents, compliance required for obtaining permissions for different surveys in Mumbai	Month 1	8.2.3 (2)	0
		b.	Sending letter, emails, physical visits to central, state & local authorities for obtaining survey permissions	Month 1 – Month 3	8.2.3 (2)	0

#	Category of Work	#	Activity/ Deliverables	Timelines in months (From - To)	Commercial Bid section nos.	Percentage of payment
5.	**Different Survey to carried out**	a.	Aerial Photogrammetry & LiDAR survey	Month 4 – Month 9	8.2.3 (2)	50%
		b.	Survey for capturing Terrestrial LiDAR & 360˚ Panoramic street view imagery	Month 4 – Month 9	8.2.3 (3)	50%
		c.	Survey for capturing LiDAR data & 360˚ Panoramic street view imagery using mobile backpack device	Month 4 – Month 9	8.2.3 (4)	50%
		d.	Bathymetric Survey of water bodies like River, lakes & ponds (one-time)	Month 4 – Month 9	8.2.3 (6)	50%
6.	**Survey data Processing**	a.	Processing of Aerial Imagery & LiDAR datasets	Month 7 – Month 12	8.2.3 (2)	30%
		b.	Processing of Terrestrial LIDAR & 360˚ Panoramic street view	Month 7 – Month 12	8.2.3 (3)	30%
		c.	Processing of Mobile LIDAR & 360˚ Panoramic street view	Month 7 – Month 12	8.2.3 (4)	30%
		d.	Processing of Bathymetric datasets	Month 7 – Month 12	8.2.3 (6)	30%
7.	**Survey data deliverables**	a.	2D basemap Orthomosaic using Aerial imagery & vectorization of all layers	Month 9 – Month 14	8.2.3 (2)	20%
		b.	Land Use Land Cover (LULC) map of Mumbai	Month 9 – Month 14		
		c.	DSM, DTM & Contours of Mumbai	Month 9 – Month 14		
		d.	3D basemap (True Orthophoto) of Mumbai	Month 9 – Month 14		
		e.	Terrestrial & Mobile LiDAR data with 360˚ Panoramic street view imagery of Mumbai	Month 9 – Month 14	8.2.3 (3+4)	20%
		f.	Bathymetric data of water bodies in Mumbai (one-time)	Month 9 – Month 14	8.2.3 (6)	20%
		g.	3D reality mesh model of Mumbai using aerial photogrammetry, LiDAR, terrestrial & mobile LiDAR & 360˚ Panoramic street view imagery	Month 9 – Month 14	8.2.3 (5)	100%

#	Category of Work	#	Activity/ Deliverables	Timelines in months (From - To)	Commercial Bid section nos.	Percentage of payment
		h.	3D LoD 3 vector model consisting of Buildings, Roads, Bridges, Flyover, Tunnels, Railways, Mono, Metro, Street lights, Traffic signals, Water bodies, Trees, Landscapes, Open spaces, Airports, Gardens, Slum and all other features having height with reference to Aerial data complying with LoD3 specifications	Month 9 – Month 14	8.2.3 (7)	100%
8.	**Ground Truthing & correction in Final deliverables**	a.	Ground Truthing 10% of all deliverables for 10% of total area of Mumbai & correction in final deliverables	Month 12 – Month 15	8.2.3 (8)	100%
9.	**Delivery & installation of various devices**	a.	Delivery & installation of High-end workstations for viewing, editing LiDAR, Orthomosaic, etc. as per specifications	Month 13 – Month 14	8.2.1 (2)	100%
		b.	Delivery & installation of Color printers as per specifications	Month 13 – Month 14	8.2.1 (3)	100%
		c.	Delivery & installation of One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph) as per specifications	Month 13 – Month 14	8.2.1 (5)	80%
		d.	Publish 3D reality mesh on 3D projector & showcase demo	Month 13 – Month 14	8.2.1 (5)	20%
10.	**Development, Implementation of Enterprise Geospatial Application & Security Audit Certification from CERT-IN empaneled agency for the enterprise**	a.	Supply & Installation of 360˚ Panoramic street view imagery publishing Server software compatible with ArcGIS Enterprise suite	Month 13 – Month 14	8.2.1 (4)	100%
		b.	Supply & Installation of Enterprise Oracle database	Month 13 – Month 14	8.2.1 (6)	100%
		C.	Development & implementation of Web GIS application for 3D City model & change detection with use cases mentioned in the scope of work	Month 10 – Month 15	8.2.5 (1)	70%
		d.	Development & implementation of Android & iOS application for 3D City model & change detection	Month 10 – Month 15	8.2.5 (2)	70%
		e.	Development & implementation of Dashboard application for 3D City model & change detection	Month 10 – Month 15	8.2.5 (1)	70%

#	Category of Work	#	Activity/ Deliverables	Timelines in months (From - To)	Commercial Bid section nos.	Percentage of payment
	Geospatial application	f.	Integration of Enterprise GIS application with existing IT & GIS application	Month 14 – Month 15	8.2.5 (3)	70%
		g.	Testing of all GIS application & bug fixing	Month 16 – Month 18	8.2.5 (1+2+3)	20%
		h.	Comprehensive audit including security Certification, VPAT & load testing from CERT-IN empaneled agency for all applications developed as per the scope of work	Month 16 – Month 18	8.2.5 (4)	100%
		i.	UAT, Training & Go-Live	Month 16 – Month 18	8.2.5 (1+2+3)	10%
11.	**Annual Maintenance Contract of all hardware, software, data, applications & services provided under the scope of work for 3 years after Go-Live**	a.	Change detection Map of Mumbai capturing all changes every year for 3 years after Go-Live	Month 19 – Month 54	8.2.4 (Quarterly billing)	As per actuals
		b.	AMC of all hardware, software & applications delivered as part of the scope of work	Month 19 – Month 54	8.2.2 (Quarterly billing)	As per actuals
		c.	Bug fixing, issue resolution & enhancements of the Enterprise Geospatial applications.	Month 19 – Month 54	8.2.6 (Quarterly billing)	As per actuals
		d.	Hosting of data & applications on Virtual Cloud	Month 19 – Month 54	Not Applicable	Not Applicable

Notes:

- Month 1 is considered to be the date of award of work order from BMC.
- Performance of work undertaken by the System Integrator will be diligently monitored by the IT Consultant and IT Department and it will be evaluated with respect of success of the contract from time to time. The System Integrator shall submit the requisite deliverables and satisfactorily perform work as specified under the contract to the BMC. The requisite payment will be released by the BMC upon acceptance of the deliverables and satisfaction with work performed by the System Integrator and submission of acceptance report/ satisfaction certificate.

- If the deliverables submitted/ work performed by the System Integrator is not acceptable to the BMC, payments shall not be released to the System Integrator. This is without prejudice to the BMC's right to levy any Penalties based on the Service levels agreed between the BMC and the System Integrator. In such case, the payment will be released to the System Integrator only after it re-submits the deliverable/ performs work and which is accepted by the BMC.
- The System Integrator shall mark the Attendance in the Attendance Register kept at the office of Director (IT), Information Technology Department, situated at Worli Data Centre, Engg. Hub Bldg., Dr. E. Moses Road, Worli, Mumbai – 400018, which will be considered while processing the payments.
- Adherence to timelines is critical for the success of the assignment
- No advance payment shall be made for any activity
- If the selected System Integrator is liable for any penalty as per the SLA (refer to the related clause of this agreement), the same shall be adjusted from payments due to the selected System Integrator
- Information Technology department will release the payment within 30 days of submission of valid invoice subject to the condition that invoice and all supporting documents produced are in order and work is performed as per the scope of the project and meeting the SLA Criteria. BMC shall be entitled to delay or withhold the payment of a disputed invoice or part of it delivered by selected System Integrator, when BMC disputes such invoice or part of it, provided that such dispute is bonafide.
- Payment will be made by Information Technology department
- It is mandatory for the successful selected SIs to open a bank account in any of the banks approved by BMC (Specified in Annexure V of the bid document) for easy and quick payments. All payments under the contract will be made only in this bank account through Electronic Clearing System/RTGS/NEFT/CBS
- BMC at its own discretion may decide to release the partial payment (up to 30%) for specific milestones, acceptance of which got delayed for reasons not attributable to the selected System Integrator. In such cases the remaining 70% shall be released on full acceptance of that particulars milestone by BMC
- No leaves are permitted within the scope of this tender

9.27 Service Level Agreements

(a) The purpose of this Service Level Requirements/ Agreement (hereinafter referred to as SLR/ SLA) is to clearly define the levels of service which shall be provided by the System Integrator to the BMC for the duration of this contract period of the Project.

(b) Timelines specified in the above section (Work Completion Timelines and Payment Terms) shall form the Service Levels for delivery of Services specified there-in.

If the total penalty goes beyond 10% of the contract value, the contract may be terminated.

9.27.1 Requirement Gathering

#	Detailed tasks/ activity	Penalty
1	Inception report (As-is study of all GIS data & applications in BMC)	Rs. 10,000/- per day beyond the mentioned timeline
2	FRS, SRS, Project plan, installation of Project Management tool	Rs. 10,000/- per day beyond the mentioned timeline
3	Project Kick-off meeting & presentation to Key departments of BMC	Rs. 10,000/- per day beyond the mentioned timeline

9.27.2 Setting up permanent Continuously Operating Reference Station (CORS) network in Mumbai

#	Detailed tasks/ activity	Penalty
1	Installation, commissioning & testing of CORS	Rs. 10,000/- per day beyond the mentioned timeline
2	Certification by SOI	Rs. 10,000/- per day beyond the mentioned timeline

9.27.3 DGPS survey for collection of GCPs

#	Parameter	Penalty
1	The designated number GCPs should be captured within the stipulated timelines as mentioned in the work order	Rs.500/- per day beyond the mentioned timeline
2	The accuracy of GCP should be less than 0.1 meter	Rs. 5000/- for every inaccurate point and a resurvey.

9.27.4 Permissions for Aerial, Terrestrial, Mobile & Bathymetry survey

#	Parameter	Penalty
1	Preparation of necessary documents, compliance required for obtaining permissions for different surveys in Mumbai	Rs. 5,000/- per day beyond the mentioned timeline

2	Sending letter, emails, physical visits to central, state & local authorities for obtaining survey permissions	Rs. 5,000/- per day beyond the mentioned timeline

9.27.5 Different Survey to carried out

9.27.5.1 Aerial Survey and Deliverables

#	Parameter	Penalty
1	The aerial survey for capturing RGB and Lidar data should be carried out within the timelines mentioned in the work order	Rs.5000/- per day beyond the mentioned timeline.
2	The raw images, lidar data, processed outputs like orthorectified images, DTM, DSM, processed and classified Lidar point clouds should cover the entire area of interest. Penalty will be calculated on total ground area missed during the survey.	i) Rs.5000/- per sq.m (approx.) for area upto 500 sq,m and resurvey of the missed area. ii) Rs.5000/- per sq.m for the missed area and resurvey of the entire area of interest if missed area more than 500sq.m.
3	The quality of orthorectified image, DTM and DSM should be maintained and should not contain any distortions and deviations from ground reality.	Rs. 10,000/- per incident. The bidder should resurvey and /or correct the distortions/deviations in the deliverables.

9.27.5.2 Terrestrial and Mobile Lidar Survey and Deliverables

#	Parameter	Penalty
1	The LiDAR survey should be carried out within the timelines mentioned in the work order	Rs.5000/- per day beyond the mentioned timeline
2	The raw lidar data and processed Lidar point clouds should cover the entire area of interest. Penalty will be calculated on total ground area missed during the survey.	i) Rs.5000/- per sq.m (approx.) for area upto 500 sq,m and resurvey of the missed area. ii) Rs.5000/- per sq.m for the missed area and resurvey of the entire area of interest if missed area more than 500sq.m.
3	The quality of processed and classified LiDAR point cloud and 360˚ panoramic images should be maintained and should not contain any distortions and deviations from ground reality.	Rs. 10,000/- per incident. The bidder should resurvey and /or correct the distortions/deviations in the deliverables.
4	The faces of people, images showing inside view of residential premises and number plates of vehicles in all the	Rs.500/- for every non smudged face or vehicle number plates or images showing inside view of residential premises.

	360˚ panoramic street view imagery should be smudged/ made unidentifiable.	

9.27.5.3 Bathymetric Survey of water bodies like River, lakes & ponds

#	Parameter	Penalty
1	The Bathymetry survey should be carried out within the timelines mentioned in the work order	Rs.5000/- per day beyond the mentioned timeline

9.27.6 Survey data Processing

9.27.6.1 Processing of Aerial Imagery & LiDAR datasets

#	Parameter	Penalty
1	The aerial survey for capturing RGB and Lidar data should be carried out within the timelines mentioned in the work order	Rs.5000/- per day beyond the mentioned timeline.
2	The raw images, lidar data, processed outputs like orthorectified images, DTM, DSM, processed and classified Lidar point clouds should cover the entire area of interest. Penalty will be calculated on total ground area missed during the survey.	i) Rs.5000/- per sq.m (approx.) for area upto 500 sq,m and resurvey of the missed area. ii) Rs.5000/- per sq.m for the missed area and resurvey of the entire area of interest if missed area more than 500sq.m.
3	The quality of orthorectified image, DTM and DSM should be maintained and should not contain any distortions and deviations from ground reality.	Rs. 10,000/- per incident. The bidder should resurvey and /or correct the distortions/deviations in the deliverables.

9.27.6.2 Processing of Mobile LIDAR & 360˚ Panoramic street view

#	Parameter	Penalty
1	The LiDAR survey should be carried out within the timelines mentioned in the work order	Rs.5000/- per day beyond the mentioned timeline
2	The raw lidar data and processed Lidar point clouds should cover the entire area of interest. Penalty will be calculated on total ground area missed during the survey.	i) Rs.5000/- per sq.m (approx.) for area upto 500 sq,m and resurvey of the missed area. ii) Rs.5000/- per sq.m for the missed area and resurvey of the entire area of interest if missed area more than 500sq.m.
3	The quality of processed and classified LiDAR point cloud and 360˚ panoramic images should be maintained and	Rs. 10,000/- per incident. The bidder should resurvey and /or correct the distortions/deviations in the deliverables.

	should not contain any distortions and deviations from ground reality.	
4	The faces of people, images showing inside view of residential premises and number plates of vehicles in all the 360˚ panoramic street view imagery should be smudged/ made unidentifiable.	Rs.500/- for every non smudged face or vehicle number plates or images showing inside view of residential premises.

9.27.6.3 Processing of Bathymetric datasets

#	Parameter	Penalty
1	The Bathymetry survey should be carried out within the timelines mentioned in the work order	Rs.5000/- per day beyond the mentioned timeline

9.27.7 Survey data deliverables

9.27.7.1 2D basemap Orthomosaic using Aerial imagery & vectorization of all layers

#	Parameter	Penalty
1	The 2D basemap map should be delivered within the mentioned timelines in the work order	Rs.5000/- per day beyond the mentioned timeline
2	The basemap should consist of vector layers covering the entire area of interest	i) Rs.5000/- for each missed feature
3	The basemap should be void of any topological errors	Rs.5000/- for each identified error.
4	10% of total number of features will be selected randomly for ground verification.	i) Rs.5000/- for each error and correction of basemap with respect to identified errors for up to 50% of the total features selected for ground truthing. ii) Rs.5000/- for each error and re generation of the entire basemap if errors found is more than 50% of the total features selected for ground truthing.

9.27.7.2 Land use / Land cover (LULC) map

#	Parameter	Penalty
1	The land use/land cover map should be delivered within the mentioned timelines in the work order	Rs.5000/- per day beyond the mentioned timeline
2	Ground truthing will be carried out by the department for validation of the land use/ landcover features. 10% area will be randomly selected by the department out of the total area for ground verification.	i) Rs.5000/- for each wrong classification of Land use in the output map and re classification.

9.27.7.3 DSM, DTM & Contours of Mumbai

#	Parameter	Penalty
1	The DSM, DTM & Contours should be carried out within the timelines mentioned in the scope of work.	Rs.5000/- per day beyond the mentioned timeline

9.27.7.4 3D basemap (True Orthophoto) of Mumbai

#	Parameter	Penalty
1	The 3D reality mesh model should be delivered within the mentioned timelines in the work order	Rs.5000/- per day beyond the mentioned timeline
2	The 3D reality mesh model shall be checked for quality with respect to completeness of the features. Data at any point like Terrestrial, mobile LiDAR & 360˚ panoramic imagery should be complete & accurate.	Rs.5000/- for each error and correction of models
3	10% of total number of 3D reality mesh model will be selected randomly for ground verification. The ground truthing will be done by the department or vendors under the supervision of the department officials using appropriate equipment and methods.	i) Rs.5000/- for each error/s per 3D reality mesh model for upto 50% of the total models selected for ground truthing and correction of models. ii) Rs.5000/- for each error and re generation of the entire 3D reality mesh model if errors found is more than 50% of the total features selected for ground truthing.

9.27.7.5 Terrestrial & Mobile LiDAR data with 360˚ Panoramic street view imagery of Mumbai

#	Parameter	Penalty
1	The LiDAR survey should be carried out within the timelines mentioned in the work order	Rs.5000/- per day beyond the mentioned timeline
2	The raw lidar data and processed Lidar point clouds should cover the entire area of interest. Penalty will be calculated on total ground area missed during the survey.	i) Rs.5000/- per sq.m (approx.) for area upto 500 sq,m and resurvey of the missed area. ii) Rs.5000/- per sq.m for the missed area and resurvey of the entire area of interest if missed area more than 500sq.m.
3	The quality of processed and classified LiDAR point cloud and 360˚ panoramic images should be maintained and should not contain any distortions and deviations from ground reality.	Rs. 10,000/- per incident. The bidder should resurvey and /or correct the distortions/deviations in the deliverables.

4	The faces of people, images showing inside view of residential premises and number plates of vehicles in all the 360˚ panoramic street view imagery should be smudged/ made unidentifiable.	Rs.500/- for every non smudged face or vehicle number plates or images showing inside view of residential premises.

9.27.7.6 Bathymetric Survey of water bodies like River, lakes & ponds

#	Parameter	Penalty
1	The Bathymetry survey should be carried out within the timelines mentioned in the work order	Rs.5000/- per day beyond the mentioned timeline

9.27.7.7 3D reality mesh model of Mumbai using aerial photogrammetry, LiDAR, terrestrial & mobile LiDAR & 360˚ Panoramic street view imagery

#	Parameter	Penalty
1	The 3D reality mesh model should be delivered within the mentioned timelines in the work order	Rs.5000/- per day beyond the mentioned timeline
2	The 3D reality mesh model shall be checked for quality with respect to completeness of the features. Data at any point like Terrestrial, mobile LiDAR & 360˚ panoramic imagery should be complete & accurate.	Rs.5000/- for each error and correction of models
3	10% of total number of 3D reality mesh model will be selected randomly for ground verification. The ground truthing will be done by the department or vendors under the supervision of the department officials using appropriate equipment and methods.	i) Rs.5000/- for each error/s per 3D reality mesh model for upto 50% of the total models selected for ground truthing and correction of models. ii) Rs.5000/- for each error and re generation of the entire 3D reality mesh model if errors found is more than 50% of the total features selected for ground truthing.

9.27.7.8 3D LoD 3 vector model consisting of Buildings, Roads, Bridges, Flyover, Tunnels, Railways, Mono, Metro, Street lights, Traffic signals, Water bodies, Trees, Landscapes, Open spaces, Airports, Gardens, Slum and all other features having height with reference to Aerial data complying with LoD3 specifications

#	Parameter	Penalty
1	The 3D vector models should be delivered within the mentioned timelines in the work order	Rs.5000/- per day beyond the mentioned timeline

2	The vector models shall be checked for quality with respect to completeness of the features, texturing, solid geometry, and properly defined edges.	Rs.5000/- for each error and correction of models
3	10% of total number of models will be selected randomly for ground verification with respect to dimensions. The ground truthing will be done by the department or vendors under the supervision of the department officials using appropriate equipment and methods.	i) Rs.5000/- for each error/s per model for upto 50% of the total models selected for ground truthing and correction of models. ii) Rs.5000/- for each error and re generation of the entire vector model if errors found is more than 50% of the total features selected for ground truthing.

9.27.8 Ground Truthing & correction in Final deliverables

#	Parameter	Penalty
1	The Ground truthing & correction should be delivered within the mentioned timelines in the work order	Rs.5000/- per day beyond the mentioned timeline

9.27.9 Delivery & installation of various devices

9.27.9.1 Delivery & installation of High-end workstations for viewing, editing LiDAR, Orthomosaic, etc. as per specifications

#	Parameter	Penalty
1	Delivery & installation of High-end workstations for viewing, editing LiDAR, Orthomosaic, etc. as per specifications	Rs.10,000/- per day beyond the mentioned timeline

9.27.9.2 Delivery & installation of Color printers as per specifications

#	Parameter	Penalty
1	Delivery & installation of Color printers as per specifications	Rs.10,000/- per day beyond the mentioned timeline

9.27.9.3 Delivery & installation of One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph) as per specifications

#	Parameter	Penalty
1	Delivery & installation of One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph) as per specifications	Rs.10,000/- per day beyond the mentioned timeline

9.27.9.4 Publish 3D reality mesh on 3D projector & showcase demo

#	Parameter	Penalty
1	Publish 3D reality mesh on 3D projector & showcase demo	Rs.10,000/- per day beyond the mentioned timeline

9.27.10 Development, Implementation of Enterprise Geospatial Application & Security Audit Certification from CERT-IN empanelled agency for the enterprise Geospatial application

9.27.10.1 Supply & Installation of 360˚ Panoramic street view imagery publishing Server software compatible with ArcGIS Enterprise suite

#	Parameter	Penalty
1	Supply & Installation of 360˚ Panoramic street view imagery publishing Server software compatible with ArcGIS Enterprise suite	Rs.10,000/- per day beyond the mentioned timeline

9.27.10.2 Supply & Installation of Enterprise Oracle database

#	Parameter	Penalty
1	Supply & Installation of Enterprise Oracle database	Rs.10,000/- per day beyond the mentioned timeline

9.27.10.3 Development & implementation of Web GIS application for 3D City model & change detection with use cases mentioned in the scope of work

#	Parameter	Penalty
1	The development of enterprise web application should be as per the milestones and timelines decided at the time of project kick-off	Rs.10,000/- per day for each milestone beyond the mentioned timeline

9.27.10.4 Development & implementation of Android & iOS application for 3D City model & change detection

#	Parameter	Penalty
1	The development of Mobile GIS application iOS & Android application should be as per the milestones and timelines decided at the time of project kick-off	Rs.10,000/- per day for each milestone beyond the mentioned timeline

9.27.10.5 Development & implementation of Dashboard application for 3D City model & change detection

#	Parameter	Penalty
1	The development of Dashboard application should be as per the milestones and timelines decided at the time of project kick-off	Rs.10,000/- per day for each milestone beyond the mentioned timeline

9.27.10.6 Integration of Enterprise GIS application with existing IT & GIS application

#	Parameter	Penalty
1	The development of Integration of Enterprise GIS application with existing IT & GIS application should be as per the milestones and timelines decided at the time of project kick-off	Rs.10,000/- per day for each milestone beyond the mentioned timeline

9.27.10.7 Testing of all GIS application & bug fixing

- This SLA is valid for development of web as well as mobile applications.
- Any patch released by the OEM needs to be applied to the corresponding product within 30 working days. Any delay in applying the patch will attract penalty of Rs. 5000/-per day.
- Any Software bug identified by BMC and stakeholders will be classified in ty pes:

i. Critical: Having bearing on the day -to-day functioning of the respective system / availability of application (full functionality or part functionality) for the users

ii. Non-critical: Not-having bearing on the day-to-day functioning of the respective system

- In case of dispute between BMC and the successful Bidder with respect to classification of bugs as Critical or Non-Critical, decision of the General Manager, IT, shall be final and binding on the Successful Bidder.
- Resolution time & the penalty component for the bug fixing is given below (applicable on 24 * 7 basis):

Type of Bug	Resolution Time	Penalty
Critical	2 hours 1 hour if the bug / problem has re occurred within 7 days of the earlier resolution	i) Rs. 2000/- (per hour) ii) Rs. 2500/- per hour beyond 8 hours iii) Rs. 4000/- per hour beyond 24 hours
Non-Critical	3 working days	i) Rs. 500/- (per day) ii) Rs. 2000/- per day beyond 7 days iii) Rs. 2000/- per day beyond 10 days

9.27.10.8 Comprehensive audit including security Certification, VPAT & load testing from CERT-IN empanelled agency for all applications developed as per the scope of work

#	Parameter	Penalty
1	The comprehensive audit should be as per the milestones and timelines decided at the time of project kick-off	Rs.10,000/- per day for each milestone beyond the mentioned timeline

9.27.10.9 UAT, Training & Go-Live

#	Parameter	Penalty
1	The UAT, Training & Go-Live should be as per the milestones and timelines decided at the time of project kick-off	Rs.10,000/- per day for each milestone beyond the mentioned timeline
2	Training Feedback from Participants and training completion certification. 75% of the participants in a batch to offer a feedback rating of 3 or above on a scale of 1 to 5.	Rs. 1,000 per breach per batch.

Security Audit and ISO Certification				
#	Parameter	Target	Basis	Penalty
1.	Third Party Security Audit Certificate for the entire application and the action taken report by the System Integrator	Once every year (first Security Audit to be done Before GO Live)	Per occurrence	Rs. 5,000 for delay of each week

Helpdesk Support/Issue Response and Resolution				
#	Parameter	Target	Basis	Penalty
1.	Severity 3 Issue (Low)	Response Time<= 2 hours from the time the call is logged by the end user. Resolution Time <= 4 daysfrom the time the complaint/query is allocated for resolution by the helpdesk.	Per Incident	Rs. 1,000 for delay of every additional day Rs. 1,000 for every additional hour delay in resolution time
2.	Severity 2 Issue (Medium)	Response Time <= 1 hour from the time the call is logged by the end user.	Per Incident	Rs. 2,500 for delay of every additional day

		Resolution Time <= 2 day from the time the complaint/query is allocated for resolution by the helpdesk.		Rs. 2,500 for every additional day delay in resolution time
3.	Severity 1 Issue (Critical)	Response Time <= 30 minutes from the time the call is logged by the end user. Resolution Time <= T (As agreed up on by BMC and SI) from the time the complaint/query is allocated for resolution by the helpdesk.	Per Incident	Rs. 5,000 for delay of every additional hour Rs. 5,000 for every additional hour/day (as agreed up on by BMC and SI) delay in resolution time
4.	Average Call Lost Rate (Total No. Of calls lost because they were not attended by an operator / Total incoming calls) *100	<=1%	Per Month	Rs. 1000 for every additional 1% call lost

9.28 Professional Project Management

1. The selected System Integrator shall deploy resources / execute the project with complete professionalism and full commitment to the scope of work and the prescribed service levels. System Integrator shall attend regular Project Review Meetings scheduled by BMC and shall adhere to the directions given during the meeting. Following responsibilities are to be executed by the System Integrator in regular manner to ensure the proper management of the project:
   - Finalization of the Project plan in consultation with BMC and its consultant. Project Plan should consist of Work plan, Communication matrix, Timelines, Quality Plan, Configuration Management Plan, etc.
   - Plan and deploy the resources in conjunction with the Project Plan and to execute roles and responsibilities against each activity of the project plan
   - Preparation and regular update of the Risk Register and the Mitigation Plan. Timely communication of the same to all the identified project stakeholders
   - Submission of Weekly Project Progress Reports
   - Monthly Compliance report, which will cover compliances to Project Timelines, Project Team, Hardware (if applicable) and Software delivered, SLAs, etc.

9.29 Use and Acquisition of Assets during the term

The selected System Integrator shall:

1. Take all reasonable and proper care of the entire hardware and software, network or any other information technology infrastructure components used during the project and other facilities leased/owned by the System Integrator exclusively in terms of the delivery of the services as per this CA (hereinafter the "Assets") in proportion to their use and control of such Assets which will include all upgrades/enhancements and improvements to meet the needs of the project arising from time to time
2. Term "Assets" also refers to all the hardware / Software / furniture / data / documentations / manuals / catalogues / brochures / or any other material procured, created or utilized by the System Integrator.
3. Keep all the tangible Assets in good and serviceable condition (reasonable wear and tear excepted) suitably upgraded subject to the relevant standards as stated in the bid to meet the SLAs mentioned in the contract and during the entire term of the Agreement
4. Ensure that any instructions or manuals supplied by the manufacturer of the Assets for use of Assets and which are provided to the System Integrator will be followed by the System Integrator and any person who will be responsible for the use of the Asset
5. Take such steps as may be recommended by the manufacturer of the Assets and notified to the System Integrator or as may be necessary to use the Assets in a safe manner
6. To the extent that the Assets are under the control of the System Integrator, keep the Assets suitably housed and in conformity with any statutory requirements from time to time applicable to them
7. Not, knowingly or negligently use or permit any of the Assets to be used in contravention of any statutory provisions or regulation or in any way contrary to law
8. Use the Assets exclusively for the purpose of providing the Services as defined in the contract
9. Ensure the integration of the software with hardware to be setup and the current Assets in order to ensure the smooth operations of the entire solution architecture to provide efficient services to BMC of this Project in an efficient and speedy manner
10. System Integrator shall not use BMC data to provide services for the benefit of any third party, as a service bureau or in any other manner.

9.30 Security and safety

1. The System Integrator will comply with the directions issued from time to time by BMC and the standards related to the security and safety in so far as it applies to the provision of the Services
2. Adherence to basic eGovernance Guidelines and Standards for data structure (if any) shall be adhered to.

3. System Integrator shall also comply with BMC / Government of Maharashtra's / Government of India's information technology security and standard policies in force from time to time as applicable. BMC shall share the relevant guidelines and standards to the System Integrator upon signing of the CA.
4. System Integrator shall use reasonable endeavors to report forthwith in writing to all the partners / contractors about the civil and criminal liabilities accruing due to any unauthorized access (including unauthorized persons who are employees of any Party) or interference with BMC's data, facilities or Confidential Information.
5. The System Integrator shall upon reasonable request by BMC or his/her nominee(s) participate in regular meetings when safety and information technology security matters are reviewed.
6. System Integrator shall promptly report in writing to BMC any act or omission which they are aware that could have an adverse effect on the proper conduct of safety and information technology security at BMC.

9.31 Indemnity

The System Integrator agrees to indemnify and hold harmless BMC, its officers, employees and agents (each an "Indemnified Party") promptly upon demand at any time and from time to time, from and against any and all losses, claims, damages, liabilities, costs (including reasonable attorney's fees and disbursements) and expenses (collectively, "Losses") to which the Indemnified Party may become subject, in so far as such losses directly arise out of, in any way relate to, or result from:

1. Any miss-statement or any breach of any representation or warranty made by the System Integrator or
2. The failure by the System Integrator to fulfill any covenant or condition contained in this Agreement, including without limitation the breach of any terms and conditions of this Agreement by any employee or agent of the System Integrator. Against all losses or damages arising from claims by third Parties that any Deliverable (or the access, use or other rights thereto), created by System Integrator pursuant to this Agreement, or any equipment, software, information, methods of operation or other intellectual property created by System Integrator or sub-contractors pursuant to this Agreement, or the SLAs:
   i) infringes a copyright, trade mark, trade design enforceable in India,
   ii) infringes a patent issued in India, or
   iii) constitutes misappropriation or unlawful disclosure or use of another Party's trade secretes under the laws of India (collectively, "Infringement Claims"); provided, however, that this will not apply to any Deliverable (or the access, use or other rights thereto) created by:
   (A) Selection of GIS Services Provider Agency to Offer GIS based Services in BMC by itself or through other persons other than System Integrator or its sub-contractors;

(B) Third Parties (i.e., other than System Integrator or sub-contractors) at the direction of BMC, or

3. Any compensation / claim or proceeding by any third party against BMC arising out of any act, deed or omission by the System Integrator or
4. Claim filed by a workman or employee engaged by the System Integrator for carrying out work related to this Agreement. For the avoidance of doubt, indemnification of Losses pursuant to this section shall be made in an amount or amounts enough to restore each of the Indemnified Party to the financial position it would have been in had the losses not occurred.

Any payment made under this Agreement to an indemnity or claim for breach of any provision of this Agreement shall include applicable taxes.

9.32 Third Party Claims

1. Subject to Sub-clause (2.) below, the System Integrator (the "Indemnified Party") from and against all losses, claims litigation and damages on account of bodily injury, death or damage to tangible personal property arising in favor or any person, corporation or other entity (including the Indemnified Party) attributable to the Indemnifying Party's performance or non-performance under this Agreement or the SLAs.
2. The indemnities set out in Sub-clause (1.) above shall be subject to the following conditions:
   i) The Indemnified Party, as promptly as practicable, informs the Indemnifying Party in writing of the claim or proceedings and provides all relevant evidence, documentary or otherwise;
   ii) The Indemnified Party shall, at the cost and expenses of the Indemnifying Party, give the Indemnifying Party all reasonable assistance in the defense of such claim including reasonable access to all relevant information, documentation and personnel. The indemnifying party shall bear cost and expenses and fees of the Attorney on behalf of the Indemnified Party in the litigation, claim.
   iii) If the Indemnifying Party does not assume full control over the defense of a claim as provided in this Article, the Indemnifying Party may participate in such defense at its sole cost and expense, and the Indemnified Party will have the right to defend the claim in such manner as it may deem appropriate, and the cost and expense of the Indemnified Party will be borne and paid by the Indemnifying Party.
   iv) The Indemnified Party shall not prejudice, pay or accept any proceedings or claim, or compromise any proceedings or claim, without the written consent of the Indemnifying Party.
   v) System Integrator hereby indemnify and hold indemnified BMC harmless from and against any and all damages, losses, liabilities, expenses including legal fees and cost of litigation in connection with any action, claim, suit, proceedings as if result of claim made by the third party directly or indirectly arising out of or in connection with this agreement.

vi) All settlements of claims subject to indemnification under this Article will:

(a) be entered into only with the consent of the Indemnified Party, which consent will not be unreasonably withheld and include an unconditional release to the Indemnified Party from the claimant for all liability in respect of such claim; and

(b) include any appropriate confidentiality agreement prohibiting disclosure of the terms of such settlement.

vii) The Indemnified Party shall take steps that the Indemnifying Party may reasonably require to mitigate or reduce its loss as a result of such a claim or proceedings and

viii) In the event that the Indemnifying Party is obligated to indemnify an Indemnified Party pursuant to this Article, the Indemnifying Party will, upon payment of such indemnity in full, be subrogated to all rights and defenses of the Indemnified Party with respect to the claims to which such indemnification relates.

ix) In the event that the Indemnifying Party is obligated to indemnify the Indemnified Party pursuant to this Article, the Indemnified Party will be entitled to invoke the Performance Bank Guarantee, if such indemnity is not paid, either in full or in part, and on the invocation of the Performance Bank Guarantee, the Indemnifying Party shall be subrogated to all rights and defenses of the Indemnified Party with respect to the claims to which such indemnification relates.

System Integrator will defend or settle third party claims against BMC solely attributable to the System Integrator's infringement of any copyrights, trademarks or industrial design rights alleged to have occurred in respect of System Integrator branded hardware/software/deliverables etc. (together "deliverables") supplied by the System Integrator. The System Integrator shall pay all costs, damages and attorney's fees that a court finally awards.

BMC shall provide the System Integrator with prompt notice of such claim and extend full cooperation and assistance, information and authority reasonably necessary to defend or settle such claim. The System Integrator will have adequate opportunity to control the response thereto and the defense thereof.

Further as an exclusion, the System Integrator shall have no obligation for any claim of infringement to the extent arising from use of the deliverables in a way not indicated in the statement of work or in any specifications or documentation provided with such deliverable.

9.33 Publicity

Any publicity by the System Integrator in which the name of BMC is to be used should be done with the explicit written permission of The Municipal Commissioner, Director (IT), Brihanmumbai Municipal Corporation.

9.34 Warranties

1. The System Integrator warrants and represents to BMC that:
   i) It has full capacity and authority and all necessary approvals to enter into and to perform its obligations under this Agreement.
   ii) This Agreement is executed by a duly authorized representative of the System Integrator.
   iii) It shall discharge its obligations under this Agreement with due skill, care and diligence so as to comply with the service level agreement.
2. In the case of the SLAs, the System Integrator warrants and represents to BMC, that:
   i) The System Integrator has full capacity and authority and all necessary approvals to enter into and perform its obligations under the SLAs and to provide the Services
   ii) The SLAs shall be executed by a duly authorized representative of the System Integrator
   iii) The Services will be provided and rendered by appropriately qualified, trained and experienced personnel as mentioned in the bid
   iv) System Integrator has and will have all necessary licenses, approvals, consents of third Parties free from any encumbrances and all necessary technology, hardware and software to enable it to provide the Services
   v) The Services will be supplied in conformance with all laws, enactments, orders and regulations applicable from time to time
   vi) System Integrator will warrant that the solution provided under the contract is new, of the most recent higher version /models and incorporate all recent improvements in design and materials unless provided otherwise in the contract
   vii) The System Integrator shall ensure defect free operation of the entire solution and shall replace any such components, equipments, software and hardware (if applicable) which are found defective and during the entire contract period the System Integrator shall apply all the latest upgrades / patches / releases for the software after appropriate testing. No additional costs shall be paid separately for the warranty other that what are the costs quoted by the System Integrator and as specified in the contract.
   viii) If the System Integrator uses in the course of the provision of the Services, components, equipments, software and hardware manufactured by any third party and which are embedded in the Deliverables or are essential for the successful use of the Deliverables, it will pass through third party manufacturer's Warranties relating to those components, equipment, software and hardware to the extent possible.

The System Integrator will repair/correct the warranty defect in the System Integrator branded hardware/software, or correct a material non-conformance to specifications in accordance with the terms and conditions mutually agreed between the parties during the agreed warranty period and in accordance with the terms of the respective OEMs/Software vendors. Further, System

Integrator will not be responsible for any breach of warranty or support resulting from unauthorized changes made to the software/hardware supplied by it.

Notwithstanding what has been stated elsewhere in this Agreement and the Schedules attached herein, in the event the System Integrator is unable to meet the obligations pursuant to the Implementation of the project, Operations and Maintenance Services and any related scope of work as stated in this Agreement and the Schedules attached herein, BMC will have the option to invoke the Performance Guarantee after serving a written notice of thirty (30) days to the System Integrator.

9.35 Force Majeure

The System Integrator shall not be liable for forfeiture of its Performance Guarantee, imposition of liquidated damages or termination for default, if and to the extent that it's delay in performance or other failure to perform its obligations under the contract is the result of an event of Force Majeure. For purposes of this Clause, "Force Majeure" means an event beyond the "reasonable" control of the System Integrator, not involving the System Integrator's fault or negligence and not foreseeable. Unforeseen circumstances or causes beyond the control of the System Integrator include but are not limited to acts of God, war, riot, acts of civil or military authorities, fire, floods, accidents, terrorist activity, Epidemic, Pandemic, strikes or shortages of transportation facilities, fuel, energy, labor or material.

For the System Integrator to take benefit of this clause it is a condition precedent that the System Integrator must promptly notify BMC, in writing of such conditions and the cause thereof within five calendar days of the arising of the Force Majeure event. BMC, or the consultant / committee appointed by BMC shall study the submission of the System Integrator and inform whether the situation can be qualified one of Force Majeure. Unless otherwise directed by BMC in writing, the System Integrator shall continue to perform its obligations under the resultant Agreement as far as it is reasonably practical, and shall seek all reasonable alternative means for performance of services not prevented by the existence of a Force Majeure event.

In the event of delay in performance attributable to the presence of a force majeure event, the time for performance shall be extended by a period(s) equivalent to the duration of such delay. If the duration of delay continues beyond a period of 30 days, BMC and the System Integrator shall hold consultations with each other in an endeavor to find a solution to the problem.

Notwithstanding anything to the contrary mentioned above, the decision of BMC shall be final and binding on the System Integrator.

9.36 Resolution of Disputes

BMC and the System Integrator shall make every attempt to resolve dispute amicably, by direct information, negotiations of any disagreement or dispute arising between them under or in connection with this Agreement. All differences disputes arising under and out of these present, or in connection with this Agreement shall be referred to the Municipal Commissioner of BMC and the decision of the Municipal Commissioner shall be final and binding on both the Parties.

9.37 Risk Purchase Clause

In the event, selected System Integrator fails to execute the project as stipulated in the CA, or as per the directions given by BMC from time to time, BMC reserves the right to procure similar services from the next selected / eligible SI or from alternate sources at the cost of the System Integrator. Before taking such a decision, BMC shall serve a notice period of one month to the System Integrator.

The 30 days' notice period shall be considered as the 'Cure Period' to facilitate the System Integrator to cure the breach. The provision for Risk Purchase shall be evoked in the event the System Integrator fails to correct the breach within the 'Cure Period'. Further, the System Integrator's liability to pay shall be set as 25% of the value of the undelivered services.

9.38 Limitation of Liability towards BMC

The System Integrator's liability under the resultant Agreement shall be determined as per the Law in force for the time being. The System Integrator shall be liable to BMC for loss or damage occurred or caused or likely to occur on account of any act of omission on the part of the System Integrator and its employees, including loss caused to BMC on account of defect in goods or deficiency in services on the part of System Integrator or his agents or any person / persons claiming through or under said System Integrator.

selected System Integrator's aggregate liability in connection with obligations undertaken as a part of this contract regardless of the form or nature of the action giving rise to such liability, shall be at actual and limited to the amount paid by BMC for:

i) services provided during the twelve (12) months immediately preceding the date of the claim that in each case is the subject of the claim.

This limit shall not apply to damages for bodily injury (including death) and damage to real property and tangible personal property for which the System Integrator is legally liable.

9.39 Conflict of Interest

The System Integrator shall disclose to BMC in writing, all actual and potential conflicts of interest that exist, arise or may arise (either for the System Integrator or its team) in the course of performing the Services as soon as it becomes aware of such a conflict. System Integrator shall hold BMC's interest paramount, without any consideration for future work, and strictly avoid conflict of interest with other assignments.

9.40 Data Ownership

All the data created within the scope of this contract shall be owned by BMC. The System Integrator shall take utmost care in maintaining security, confidentiality and backup of this data. Access to the data / systems shall be given by the System Integrator only to the personnel working on the projects and their names and contact details shall be shared with BMC in advance. BMC / its authorized representative(s) shall conduct periodic / surprise security reviews and audits, to ensure the compliance by the System Integrator to data / system security.

The ownership of the application and the data shall rest with BMC.

9.41 Fraud and Corruption

BMC requires that System Integrator must observe the highest standards of ethics during the execution of the contract. In pursuance of this policy, BMC defines, for the purpose of this provision, the terms set forth as follows:

i) "Corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of BMC in contract executions.
ii) "Fraudulent practice" means a misrepresentation of facts, in order to influence a procurement process or the execution of a contract, to BMC, and includes collusive practice among SIs (prior to or after bid submission) designed to establish bid prices at artificially high or non-competitive levels and to deprive BMC of the benefits of free and open competition.
iii) "Undesirable practice" means:
    (a) establishing contact with any person connected with or employed or engaged by BMC with the objective of canvassing, lobbying or in any manner influencing or attempting to influence the Selection Process; or
    (b) having a Conflict of Interest; and
iv) "Restrictive practice" means forming a cartel or arriving at any understanding or arrangement among SIs with the objective of restricting or manipulating a full and fair competition in the Selection Process.
v) "Coercive Practices" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the execution of contract.

If it is noticed that the System Integrator has indulged into the Corrupt / Fraudulent / Undesirable / Coercive practices, it will be an enough ground for BMC for termination of the contract and initiate black-listing of the vendor.

9.42 Exit Management

i. Exit Management Purpose

This clause sets out the provisions, which will apply during Exit Management period. The Parties shall ensure that their respective associated entities carry out their respective obligations set out in this Exit Management Clause.

The exit management period starts, in case of expiry of contract, at least 6 months prior to the date when the contract comes to an end or in case of termination of contract, on the date when the notice of termination is sent to the System Integrator. The exit management period ends on the date agreed upon by BMC or three months after the beginning of the exit management period, whichever is earlier.

ii. Confidential Information, Security and Data

System Integrator will promptly, on the commencement of the exit management period, supply to BMC or its nominated agency the following:

a. Information relating to the current services rendered and performance data relating to the performance of the services; documentation relating to the project, project's customized source code; any other data and confidential information created as part of or is related to this project;
b. Project data as is reasonably required for purposes of the project or for transitioning of the services to its replacing successful SI in a readily available format.
c. All other information (including but not limited to documents, records and agreements) relating to the services reasonably necessary to enable BMC and its nominated agency, or its replacing vendor to carry out due diligence in order to transition the provision of the Services to BMC or its nominated agency, or its replacing vendor (as the case may be).
d. The System Integrator shall retain all of the above information with them for 30 days after the termination of the contract, post which the provider has to wipe/purge/delete all information created or retained as part of this project.
e. System Integrator will sign a Non-Disclosure Agreement with BMC IT Department. The format for the same has been included in Annexure VII.

iii. Rights of Access to Information

At any time during the exit management period, the System Integrator will be obliged to provide an access of information to BMC and / or any Replacing Vendor in order to make an inventory of the Assets (including Hardware / Software / Active / passive), documentations, manuals, catalogs, archive data, Live data, policy documents or any other material related to implementation of the application for BMC.

iv. Exit Management Plan

Successful selected agency shall provide BMC with a recommended "Exit Management Plan" within 90 days of signing of the contract, which shall deal with at least the following aspects of exit management in relation to the SLA as a whole and in relation to the Project Implementation, the Operation and Management SLA and Scope of work definition.

a. A detailed program of the transfer process that could be used in conjunction with a Replacement Vendor including details of the means to be used to ensure continuing provision of the services throughout the transfer process or until the cessation of the services and of the management structure to be used during the transfer
b. Plans for the communication with such of the successful SI, staff, suppliers, customers and any related third party as are necessary to avoid any material detrimental impact on Project's operations as a result of undertaking the transfer
c. Plans for provision of contingent support to the implementation of hosted Project and Replacement Vendor for a reasonable period (minimum one month) after transfer
d. Exit Management Plan shall be presented by the System Integrator to and approved by BMC or its nominated agency
e. The terms of payment as stated in the Terms of Payment Schedule include the costs of the System Integrator complying with its obligations under this Schedule
f. During the exit management period, the System Integrator shall use its best efforts to deliver the services
g. Payments during the Exit Management period shall be made in accordance with the Terms of Payment Schedule

9.43 Termination of contract

BMC may, without prejudice to any other remedy under this Contract and applicable law, reserves the right to terminate for breach of contract by providing a written notice of 30 days stating the reason for default to the System Integrator and terminate the contract either in whole or in part:

- If the System Integrator fails to deliver any or all of the project requirements / operationalization / Operational Acceptance of project within the time frame specified in the contract, or
- If the System Integrator fails to perform any other obligation(s) under the contract.

Prior to providing a notice of termination to the System Integrator, BMC shall provide the System Integrator with a written notice of 30 days instructing the System Integrator to cure any breach/ default of the Contract, if BMC is of the view that the breach may be rectified.

On failure of the System Integrator to rectify such breach within 30 days, BMC may terminate the contract by providing a written notice of 30 days to the System Integrator, provided that such termination will not prejudice or affect any right of action or remedy which has accrued or will accrue thereafter to BMC. In such an event the System Integrator shall be liable for penalty imposed by BMC.

In the event of termination of this contract for any reason whatsoever, BMC is entitled to impose any such obligations and conditions and issue any clarifications as may be necessary to ensure an efficient transition and effective continuity of the services which the System Integrator shall be obliged to comply

with and take all available steps to minimize the loss resulting from that termination/ breach, and further allow and provide all such assistance to BMC and/ or succeeding vendor, as may be required, to take over the obligations of the System Integrator in relation to the execution /continued execution of the requirements of this contract.

9.44 Miscellaneous

a. Confidentiality

"Confidential Information" means all information including Project Data (whether in written, oral, electronic or other format) which relates to the technical, financial and operational affairs, business rules, citizen information, design rights, know-how and personnel of each Party and its affiliates which is disclosed to or otherwise learned by the other Party or its subcontractors (whether a Party to the contract or to the SLA) in the course of or in connection with the contract (including without limitation such information received during negotiations, location visits and meetings in connection with the contract or to the SLA) or pursuant to the contract to be signed subsequently.

Except with the prior written permission of BMC, the System Integrator (including all partners) and its Personnel shall not disclose such confidential information to any person or entity not expected to know such information by default of being associated with the project, nor shall the System Integrator and it's Personnel make public the recommendations formulated in the course of, or as a result of the project. In matters pertaining to privacy of data, the System Integrator (including all partners) shall not use any data for analytical/commercial reasons whatsoever.

The System Integrator recognizes that during the term of this Agreement, sensitive data will be procured and made available to it, its Sub contractors and agents and others working for or under the System Integrator. Disclosure or usage of the data by any such recipient may constitute a breach of law applicable causing harm not only to the Department whose data is used but also to its stakeholders. The function of BMC requires the System Integrator, its Subcontractors and agents to demonstrate utmost care, sensitivity and strict confidentiality. Any breach of this Article will result in BMC and its nominees receiving a right to seek injunctive relief and damages, from the System Integrator.

The restrictions of this Article shall not apply to confidential information that:

i. Is or becomes generally available to the public through no breach of this Article by the Recipient; and
ii. Was in the recipient's possession free of any obligation of confidence prior to the time of receipt of it by the Recipient hereunder; and
iii. Is developed by the Recipient independently of any of discloser's Confidential Information; and
iv. Is rightfully obtained by the Recipient from third Parties authorized at that time to make such disclosure without restriction; and
v. Is identified in writing by the Discloser as no longer proprietary or confidential; or
vi. Is required to be disclosed by law, regulation or Court Order, provided that the recipient gives prompt written notice to the Discloser of such legal and regulatory requirement to disclose so as to allow the Discloser reasonable opportunity to contest such disclosure.

To the extent that such disclosure is required for the purposes of this Agreement, either Party may disclose Confidential Information to:

i. Its employees, agents and independent contractors and to any of its affiliates and their respective independent contractors or employees; and
ii. Its professional advisors and auditors, who require access for the purposes of this Agreement, whom the relevant Party has informed of its obligations under this Article and in respect of whom the relevant Party has informed of its obligations under this Article has used commercially reasonable efforts to ensure that they are contractually obliged to keep such Confidential Information confidential on terms substantially the same as set forth in this Article. Either Party may also disclose confidential Information or any entity with the other Party's prior written consent.

The provisions of this Article shall survive the expiration or any earlier termination of this Agreement.

b. Standards of Performance

The System Integrator shall provide the services and carry out their obligations under the Contract with due diligence, efficiency and professionalism/ethics in accordance with generally accepted professional standards and practices. The System Integrator shall always act in respect of any matter relating to this contract. The System Integrator shall abide by all the applicable Provisions / Acts / Rules / Regulations, Standing orders, etc. of Information Technology as prevalent in the country. The System Integrator shall also conform to the standards laid down by Government of Maharashtra or Government of India from time to time. Such standards and guidelines shall be shared with the System Integrator by BMC up on signing of the Contract.

c. Sub Contracts

Sub-contracting is permitted to up to 25% of contract value. The System Integrator shall intimate BMC with all the details of sub-contractor for sub-contracting any work, if not already specified in the bid. However, such sub-contracting shall not relieve the System Integrator from any liability or obligation under the Contract. The System Integrator shall be solely responsible for the work carried out by subcontracting under the contract. Care to be taken while working at BMC Office.

System Integrator should follow instructions issued by concerned Competent Authority from time to time for carrying out work at designated places. System Integrator should ensure that there is no damage caused to any private or public property. In case such damage is caused, System Integrator shall immediately bring it to the notice of concerned organization and BMC in writing and pay necessary charges towards fixing of the damage. System Integrator shall ensure that its employees/representatives don't breach privacy of any citizen or establishment during the course of execution or maintenance of the project.

d. Care to be taken while working at BMC Office

System Integrator should follow instructions issued by concerned Competent Authority from time to time for carrying out work at designated places. System Integrator should ensure that there is no

damage caused to any private or public property. In case such damage is caused, System Integrator shall immediately bring it to the notice of concerned organization and BMC in writing and pay necessary charges towards fixing of the damage. System Integrator shall ensure that its employees/representatives don't breach privacy of any citizen or establishment during the course of execution or maintenance of the project.

e. Compliance with Labour regulations

The System Integrator shall pay fair and reasonable wages to the workmen employed, for the contract undertaken and comply with the provisions set forth under the Minimum wages Act and the Contract Labour Act 1970. The salary of the manpower working on BMC project should be paid using ECS / NEFT / RTGS. A record of the payments made in this regard should be maintained by the System Integrator. Upon request, this record shall be produced to the appropriate authority in BMC and/or Judicial Body. If complaints are received by BMC (or any appropriate authority) appropriate action (Liquidation of Security Deposit, Blacklisting, etc.) may be initiated as deemed necessary against the System Integrator (SI). The employees of the System Integrator in no case shall be treated as the employees of the BMC at any point of time. Since the employee working on project are employee s of the System Integrator, the payment of salary/ compensation if any shall be entire responsibility of SI. Under no circumstances the BMC shall be liable to pay the same.

f. Independent Contractor

Nothing in this Agreement shall be construed as establishing or implying any partnership or joint venture or employment relationship between the Parties to this Agreement. Except as expressly stated in this Agreement nothing in this Agreement shall be deemed to constitute any Party as the agent of any other Party or authorizes either Party:

(i) to incur any expenses on behalf of the other Party,
(ii) to enter into any engagement or make any representation or warranty on behalf of the other Party,
(iii) to pledge the credit of or otherwise bind or oblige the other Party, or
(iv) to commit the other Party in any manner whatsoever in each case without obtaining the other Party's prior written consent.

g. Waiver

A waiver of any provision or breach of this Agreement must be in writing and signed by an authorized official of the Party executing the same. No such waiver shall be construed to affect or imply a subsequent waiver of the same provision or subsequent breach of this Agreement.

h. Notices

Any notice or other document, which may be given by either Party under this Agreement, shall be given in writing in person or by pre-paid recorded delivery post. In relation to a notice given under this Agreement, any such notice or other document shall be addressed to the other Party's principal or registered office address as set out below:

BMC:

Municipal Commissioner,
Brihanmumbai Municipal Corporation, Municipal Head Office,
Mahapalika Marg, Fort, Mumbai – 1

Tel: ----------

System Integrator:

Tel: ----------

Any notice or other document shall be deemed to have been given to the other Party when delivered (if delivered in person) between the hours of 9.30 A.M and 5.30 P.M. at the address of the other Party set forth above or on the next working day thereafter if delivered outside such hours, and seven calendar days from the date of posting (if by letter).

i. Personnel/Employees

i. Personnel/employees assigned by selected System Integrator to perform the services shall be employees of System Integrator, under no circumstances will such personnel be considered as employees of BMC. selected System Integrator shall have the sole responsibility for supervision and control of its personnel and for payment of such personnel's employee's entire compensation, including salary, legal deductions withholding of income taxes and social security taxes, worker's compensation, employee and disability benefits and the like and shall be responsible for all employer obligations under all laws as applicable from time to time. BMC shall not be responsible for the above issues concerning to personnel of System Integrator.

ii. Selected System Integrator shall use its best efforts to ensure that enough System Integrator personnel are employed to perform the Services, and that, such personnel have appropriate qualifications to perform the Services. BMC or its nominated agency shall have the right to require the removal or replacement of any System Integrator personnel performing work under this Agreement. In the event that BMC requests that any System Integrator personnel be replaced, the substitution of such personnel shall be accomplished pursuant to a mutually agreed upon schedule and upon clearance of the personnel based on profile review and personal interview by BMC or its nominated agency as per defined SLAs. The System Integrator shall depute quality team for the project and as per requirements BMC shall have the right to ask System Integrator to change the team.

iii. Management (Regional Head / VP level officer) of System Integrator needs to be involved in the project monitoring and should attend the review meeting at least once in a month.

iv. The profiles of resources proposed by System Integrator in the technical bid, which are considered for Technical bid evaluation, shall be construed as 'Key Personnel' and the System Integrator shall not remove such personnel without the prior written consent of BMC. For any changes to the proposed resources, System Integrator shall provide equivalent or more experienced resources in consultation with BMC.

v. Except as stated in this clause, nothing in this Agreement will limit the ability of System Integrator freely to assign or reassign its employees; provided that System Integrator shall be responsible, at its expense, for transferring all appropriate knowledge from personnel being replaced to their replacements. BMC shall have the right to review and approve System Integrator's plan for any such knowledge transfer. System Integrator shall maintain the same standards for skills and professionalism among replacement personnel as in personnel being replaced.

vi. Each Party shall be responsible for the performance of all its obligations under this Agreement and shall be liable for the acts and omissions of its employees and agents in connection therewith.

j. Variations and Further Assurance

a. No amendment, variation or other change to this Agreement or the SLAs shall be valid unless made in writing and signed by the duly authorized representatives of the Parties to this Agreement.

b. Each Party to this Agreement or the SLAs agree to enter into or execute, without limitation, whatever other agreement, document, consent and waiver and to do all other things which shall or may be reasonably required to complete and deliver the obligations set out in the Agreement or the SLAs.

k. Survivability and Waiver

i. If any provision of this Agreement or the SLAs, or any part thereof, shall be found by any court or administrative body of competent jurisdiction to be illegal, invalid or unenforceable the illegality, invalidity or unenforceability of such provision or part provision shall not affect the other provisions of this Agreement or the SLAs or the remainder of the provisions in question which shall remain in full force and effect. The relevant Parties shall negotiate in good faith in order to agree to substitute for any illegal, invalid or unenforceable provision a valid and enforceable provision which achieves to the greatest extent possible the economic, legal and commercial objectives of the illegal, invalid or unenforceable provision or part provision within seven working days.

ii. No failure to exercise or enforce and no delay in exercising or enforcing on the part of either Party to this Agreement or the SLAs of any right, remedy or provision of this Agreement or the SLAs shall operate as a waiver of such right, remedy or provision in any future application nor shall any single or partial exercise or enforcement of any right, remedy or provision preclude any other or further exercise or enforcement of any other right, remedy or provision.

l. Survivability

The termination or expiry of this Agreement or the SLAs for any reason shall not affect or prejudice any terms of this Agreement, or the rights of the Parties under them which are either expressly or by implication intended to come into effect or continue in effect after such expiry or termination.

9.45 Bank Guarantee

The System Integrator shall furnish a Bank Guarantee of Rs. _____/- (Rupees _____ only) on the execution of these presents as Security Deposit for due performance of the terms and conditions of this Contract Agreement and the same shall remain with the BMC as a deposit until the expiry of the term of this Contact Agreement. This Bank Guarantee shall be forfeited by the BMC, in the event of the System Integrator committing any breach in the observance and performance of these terms and conditions and this Contract Agreement which shall then stand terminated automatically. If the System Integrator shall have duly and faithfully observed the terms and conditions of this Contract Agreement and have satisfied all claims properly chargeable against them hereunder up to the date of completion of Contract Agreement, the said Bank Guarantee will be released to the System Integrator. The System Integrator shall not be entitled to any interest on the said Bank Guarantee. If the PBG is not submitted within the stipulated time EMD will be forfeited of the SI.

9.46 Applicable Law

The contract shall be governed by the laws and procedures prescribed by the Laws prevailing and in force in India, within the framework of applicable legislation and enactment made from time to time concerning such commercial dealings/processing. All legal disputes are subject to the jurisdiction of Mumbai courts only.

9.47 Jurisdiction of Courts

In case of any claim, dispute or difference arising in respect of this contract, the cause of action thereof shall be deemed to have arisen in Mumbai and all legal proceedings in respect of any such claim, dispute or difference shall be referred to the Competent Court in the City of Mumbai.

9.48 Stamp Duty Payment & Legal charges

The Legal Charges and Stamp Duty including incidental expenses and charges of this Agreement shall be borne and paid by the System Integrator.

Signed, sealed and delivered
By ----------
----------,
For and on behalf of Brihanmumbai Municipal Corporation

Signed, sealed and delivered
By ----------
For and on behalf of the “System Integrator”,

Witnesses:

(1)

(2)

Attachments to the Agreement:

i. Scope of Services for the System Integrator
ii. Detail Commercial bid of the System Integrator accepted by BMC
iii. Corrigendum Document(s) published by BMC subsequent to the bid for this work
iv. Bid Document of BMC for this work
v. LoI issued by BMC to the successful SI
vi. The successful SI's "Technical Bid" and "Commercial Bid" submitted in response to the bid

10 Annexure V: List of Approved Banks

The Earnest Money Deposit (EMD) / Performance Bank Guarantee (PBG) issued by branches of approved Banks beyond Kalyan and Virar can be accepted only if the said EMD / PBG is countersigned by the Manager of a Branch of the same Bank within the Mumbai City limit categorically endorsing thereon that the said EMD / PBG is binding on the endorsing Branch of the Bank within Mumbai limits and is liable to be enforced against the said Branch of the Bank in case of default by the System Integrator furnishing the Banker's guarantee.

State Bank of India and its subsidiary Banks		
1. State Bank of India.		
Nationalized Banks		
2. Allahabad Bank.	3. Andhra Bank.	4. Bank of Baroda.
5. Bank of India.	6. Bank of Maharashtra.	7. Canara Bank.
8. Central Bank of India.	9. Corporation Bank.	
10. Indian Bank.	11. Indian Overseas Bank.	12. Oriental Bank of Commerce.
13. Punjab National Bank.	14. Punjab and Sind Bank.	15. Syndicate Bank.
16. UCO Bank.	17. Union Bank of India.	18. United Bank of India.
Private Sector Banks		
19. Axis Bank Ltd.	20. Bank of Rajasthan Ltd.	21. Catholic Syrian Bank Ltd.
22. City Union Bank Ltd.	23. Development Credit Bank Ltd.	24. Dhanalakshmi Bank Ltd.
25. Federal Bank Ltd.	26. HDFC Bank Ltd.	27. ICICI Bank Ltd.
28. IndusInd Bank Ltd.	29. ING Vysya Bank Ltd.	30. Jammu and Kashmir Bank Ltd.
31. Karnataka Bank Ltd.	32. Karur Vysya Bank Ltd.	33. Kotak Mahindra Bank Ltd.
34. Lakshmi Vilas Bank Ltd.	35. Nainital Bank Ltd.	36. Ratnakar Bank Ltd.
37. SBI Commercial International Bank Ltd.	38. South Indian Bank Ltd.	39. Tamil land Mercantile Bank Ltd.
40. Yes Bank Ltd.		
Scheduled Urban Co-op. Banks Licensed to issued Bankers Guarantee		
41. Abhyudaya Co-Op. Bank Ltd.	42. Bassein Catholic Co-Op. Bank Ltd.	43. Bharat Co-Op. Bank Ltd.
44. Bombay Mercantile Co-Op. Bank Ltd.	45. Citizen Credit Co-Op. Bank Ltd.	46. Dombivli Nagari Sahakari Bank Ltd.
47. Greater Mumbai Co-Op. Bank Ltd.	48. Janakalyan Sahakari Bank Ltd.	49. Janata Sahakari Bank Ltd.
50. Kalyan Janata Sahakari Bank Ltd.	51. Kapol Co-Op. Bank Ltd.	52. Mahanagar Co-Op. Bank Ltd.
53. Mumbai District Central Co-Op. Bank Ltd.	54. NKGSB Co-Op. Bank Ltd.	55. New India Co-Op. Bank Ltd.
56. Parsik Janata Sahakari Bank Ltd.	57. Punjab & Maharashtra Co-Op. Bank	58. Rupee Co-Op. Bank Ltd.
59. Sangli Urban Co-Op. Bank Ltd.	60. Saraswat Co-Op. Bank Ltd.	61. Thane Bharat Sahakari Bank Ltd.

62. Thane Janata Sahakri Bank Ltd.	63. The Cosmos Co-Op. Bank Ltd.	64. The Shamrao Vitthal Co-Op. Bank Ltd.

65.The Zoroastrian Co-Op. Bank.		
State Co-op. Banks		
66. The Maharashtra State Co-Op. Bank.		
Foreign Banks		
67.ABN Amro Bank N. V.	68. Abu Dhabi Commercial Bank Ltd.	69. American Express Banking Corporation.
70. Antwerp Diamond Bank N. V.	71.Arab Bangladesh Bank.	72.Bank International Indonesia.
73.Bank of America.	74.Bank of Bahrain and Kuwait BSC.	75.Bank of Ceylon.
76.Bank of Nova Scotia.	77. Bank of Tokyo-Mitsubushi Ltd.	78.Barclays Bank Plc.
79.BNP Paribas.	80. China Trust Commercial Bank.	81. Shinhan Bank.
82.Citi Bank N.A.	83. Calyon Bank.	84.Deutsche Bank.
85.DBS Bank Ltd.	86. The Hongkong and Shanghai Banking Corporation Ltd. (HSBC)	87.J.P. Morgan Chase Bank N.A.
88. Krung Thai Bank Public Company Ltd.	89.Mashreq Bank psc.	90.Mizuho Corporate Bank Ltd.
91. Oman International Bank S.A.O.G.	92. Societe Generale.	93. Sonali Bank.
94.Standard Chartered Bank.	95.State Bank of Mauritius Ltd.	

11 Annexure VI: Authorization letter for attending pre-bid meeting / bid opening

(to be provided on the letter head of SI)

No.....
Date.....

To

The.....
Brihanmumbai Municipal Corporation,
Mumbai.

Sub: Bid No..... due date.....

Sir,

We here by authorize Mr. / Ms. .....as our authorized representative, to represent us on the following occasion: -

- Pre-bid Meeting to be held on.....at.....A.M./P.M.
- Bid Opening on..... At..... A.M. /P.M.

Kindly permit him/her to attend the same.

Yours faithfully,

Signature:

Name of signatory:

Designation:

Rubber Stamp:

12 Annexure VII: Draft Non-Disclosure Agreement

(To be submitted on a ₹ 100 Stamp Paper)

This Non-Disclosure Agreement ("Non-Disc") is made and entered into_____day of_____month_____year (effective date) by and between _____ ("Department") and _____ ("Company").

Whereas, Department and Company have entered into an Agreement ("Agreement") _____ effective _____ for _____;

and

Whereas, Each party desires to disclose to the other party certain information in oral or written form which is proprietary and confidential to the disclosing party, ("CONFIDENTSIL INFORMATION").

NOW, THEREFORE, in consideration of the foregoing and the covenants and agreements contained herein, the parties agree as follows:

1. **Definitions.** As used herein:

a) The term "Confidential Information" shall include, without limitation, all information and materials, furnished by either Party to the other in connection with citizen/users/persons/customers data, products and/or services, including information transmitted in writing, orally, visually, (e.g. video terminal display) or on magnetic or optical media, and including all proprietary information, customer and prospect lists, trade secrets, trade names or proposed trade names, methods and procedures of operation, commercial or marketing plans, licensed document know-how, ideas, concepts, designs, drawings, flow charts, diagrams, quality manuals, checklists, guidelines, processes, formulae, source code materials, specifications, programs, software packages, codes and other intellectual property relating to the disclosing party's data, computer database, products and/or services. Results of any tests, sample surveys, analytics, data mining exercises or usages etc. carried out by the receiving party in connection with the Department's information including citizen/users/persons/customers personal or sensitive personal information as defined under any law for the time being in force shall also be considered Confidential Information.

b) The term, "Department" shall include the officers, employees, agents, consultants, contractors and representatives of Department.

c) The term, "Company" shall include the directors, officers, employees, agents, consultants, contractors and representatives of Company, including its applicable affiliates and subsidiary companies.

2. **Protection of Confidential Information:** With respect to any Confidential Information disclosed to it or to which it has access, Company affirms that it shall:

a) Use the Confidential Information as necessary only in connection with Project and in accordance with the terms and conditions contained herein;

b) Maintain the Confidential Information in strict confidence and take all reasonable steps to enforce the confidentiality obligations imposed hereunder, but in no event take less care with the Confidential Information that the parties take to protect the confidentiality of its own proprietary and confidential information and that of its clients;

c) Not to make or retain copy of any commercial or marketing plans, citizen/users/persons/customers database, Bids developed by or originating from Department or any of the prospective clients of Department except as necessary, under prior written intimation from Department, in connection with the Project, and ensure that any such copy is immediately returned to Department even without express demand from Department to do so;

d) Not disclose or in any way assist or permit the disclosure of any Confidential Information to any other person or entity without the express written consent of the other party; and

e) Return to the other party, or destroy, at Department's discretion, any and all Confidential Information disclosed in a printed form or other permanent record, or in any other tangible form (including without limitation, all copies, notes, extracts, analyses, studies, summaries, records and reproductions thereof) immediately upon the earlier to occur of (i) expiration or termination of either party's engagement in the Project, or (ii) the request of the other party therefore.

f) Not to discuss with any member of public, media, press, any or any other person about the nature of arrangement entered between Department and Company or the nature of services to be provided by the Company to the Department.

3. **Onus.** Company shall have the burden of proving that any disclosure or use inconsistent with the terms and conditions hereof falls within any of the foregoing exceptions.

4. **Exceptions.** These restrictions as enumerated in section 1 of this Agreement shall not apply to any Confidential Information:

a) Which is independently developed by Company or lawfully received from another source free of restriction and without breach of this Agreement; or

b) After it has become generally available to the public without breach of this Agreement by Company; or

c) Which at the time of disclosure to Company was known to such party free of restriction and evidenced by documentation in such party's possession; or

d) Which Department agrees in writing is free of such restrictions.

e) Which is received from a third party not subject to the obligation of confidentiality with respect to such Information;

5. **Remedies.** Company acknowledges that:

a) Any actual or threatened disclosure or use of the Confidential Information by Company would be a breach of this agreement and may cause immediate and irreparable harm to Department;

b) Company affirms that damages from such disclosure or use by it may be impossible to measure accurately; and

c) Injury sustained by Department may be impossible to calculate and remedy fully.

Therefore, Company acknowledges that in the event of such a breach, Department shall be entitled to specific performance by Company of Company's obligations contained in this Agreement. In addition Company shall indemnify Department of the actual and liquidated damages which may be demanded by Department. Moreover, Department shall be entitled to recover all costs (including reasonable attorneys' fees) which it or they may incur in connection

with defending its interests and enforcement of legal rights arising due to a breach of this agreement by Company.

6. **Need to Know.** Company shall restrict disclosure of such Confidential Information to its employees and/or consultants with a need to know (and advise such employees of the obligations assumed herein), shall use the Confidential Information only for the purposes set forth in the Agreement, and shall not disclose such Confidential Information to any affiliates, subsidiaries, associates and/or third party without prior written approval of the disclosing party.
7. **Intellectual Property Rights Protection.** No license to a party, under any trademark, patent, copyright, design right, mask work protection right, or any other intellectual property right is either granted or implied by the conveying of Confidential Information to such party.
8. **No Conflict.** The parties represent and warrant that the performance of its obligations hereunder do not and shall not conflict with any other agreement or obligation of the respective parties to which they are a party or by which the respective parties are bound.
9. **Authority.** The parties represent and warrant that they have all necessary authority and power to enter into this Agreement and perform their obligations hereunder.
10. **Dispute Resolution.** If any difference or dispute arises between the Department and the Company in connection with the validity, interpretation, implementation or alleged breach of any provision of this Agreement, any such dispute shall be referred to the Hon. Municipal Commissioner, BMC.
    a) The arbitration proceedings shall be conducted in accordance with the (Indian) Arbitration and Conciliation Act, 1996 and amendments thereof.
    b) The place of arbitration shall be Mumbai.
    c) The arbitrator's award shall be substantiated in writing and binding on the parties.
    d) The proceedings of arbitration shall be conducted in English language.
    e) The arbitration proceedings shall be completed within a period of 180 days from the date of reference of the dispute to arbitration.
11. **Governing Law.** This Agreement shall be interpreted in accordance with and governed by the substantive and procedural laws of India and the parties hereby consent to the exclusive jurisdiction of Courts and/or Forums situated at Mumbai, India only.
12. **Entire Agreement.** This Agreement constitutes the entire understanding and agreement of the parties, and supersedes all previous or contemporaneous agreement or communications, both oral and written, representations and under standings among the parties with respect to the subject matter hereof.
13. **Amendments.** No amendment, modification and/or discharge of this Agreement shall be valid or binding on the parties unless made in writing and signed on behalf of each of the parties by their respective duly authorized officers or representatives.
14. **Binding Agreement.** This Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective successors and permitted assigns.
15. **Severability.** It is the intent of the parties that in case any one or more of the provisions contained in this Agreement shall be held to be invalid or unenforceable in any respect, such

provision shall be modified to the extent necessary to render it, as modified, valid and enforceable under applicable laws, and such invalidity or unenforceability shall not affect the other provisions of this Agreement.

16. **Waiver.** If either party should waive any breach of any provision of this Agreement, it shall not thereby be deemed to have waived any preceding or succeeding breach of the same or any other provision hereof.
17. **Survival.** Both parties agree that all of their obligations undertaken herein with respect to Confidential Information received pursuant to this Agreement shall survive till perpetuity even after any expiration or termination of this Agreement.
18. **Non-solicitation.** During the term of this Agreement and thereafter for a further period of two (2) years Company shall not solicit or attempt to solicit Department's employees and/or consultants, for the purpose of hiring/contract or to proceed to conduct operations/business similar to Department with any employee and/or consultant of the Department who has knowledge of the Confidential Information, without the prior written consent of Department. This section will survive irrespective of the fact whether there exists a commercial relationship between Company and Department.
19. **Term.** Subject to aforesaid section 17, this Agreement shall remain valid up to ..... years from the "effective date".

IN WITNESS HEREOF, and intending to be legally bound, the parties have executed this Agreement to make it effective from the date and year first written above.

For Department

Name:

Title:

WITNESSES:

1.

2.

For Company

Name:

Title:

WITNESSES:

1.

2.

13 Annexure VIII: Sample Change Control Note

Change Control Note Initiation	**CCN Number**
Details of proposed change:	
Title: Originator: Date of Initiation:	
(To include reason for change and appropriate details/specifications. Please append attachments if any)	
Authorized by BMC Name: Signature: Date:	Received by SI Name: Signature Date:
Change control note evaluation and acceptance	**CCN Number**
To include the following: 1. A description of the change; 2. A list of deliverables required for implementing the change; 3. A timetable for implementation; 4. An estimate of any proposed change; 5. Any relevant acceptance criteria; 6. An assessment of the value of the proposed change; 7. Material evidence to prove that the proposed change is not already covered within the scope of the project, SLAs.	
Request for Authority to proceed	
Approved	
Rejected	
Requires Further Information	
(as follows or as attachments)	
For BMC	**For** selected **SI**
Signature	Signature
Name	Name
Title	Title
Date	Date

14 Annexure IX: RACI Matrix

The RACI matrix for various activities to be performed in the project is as given below.

Sr. No.	Activity	Selected Vendor	Consultant	BMC	Survey of India	Respective Govt. Authorities
1	**Requirement Gathering** – Inception report (As-is study of all GIS data & applications in BMC) – FRS, SRS, Project plan, installation of Project Management tool – Project Kick-off meeting & presentation to Key departments of BMC Creation / updation of GIS data	R&A	C	A & I	Not Applicable	Not Applicable
2	**Setting up permanent Continuously Operating Reference Station (CORS) network in Mumbai** – Installation, commissioning & testing of CORS – Certification by SOI	R&A	C	I	A	Not Applicable
3	**DGPS survey for collection of GCPs** – Setting up primary GCN with permanent monumentation – Setting up secondary GCN	R&A	C	I	Not Applicable	Not Applicable
4	**Permissions for Aerial, Terrestrial, Mobile & Bathymetry survey** – Preparation of necessary documents, compliance required for obtaining permissions for different surveys in Mumbai – Sending letter, emails, physical visits to central, state & local authorities	R&A	C	A, & I	Not Applicable	A, C&I

	for obtaining survey permissions					
5	**Different Survey to carried out** – Aerial Photogrammetry & LiDAR survey – Survey for capturing Terrestrial LiDAR & 360˚ Panoramic street view imagery – Survey for capturing LiDAR data & 360˚ Panoramic street view imagery using mobile backpack device – Bathymetric Survey of water bodies like River, lakes & ponds (one-time)	R&A	C	I	Not Applicable	Not Applicable
6	**Survey data Processing** – Processing of Aerial Imagery & LiDAR datasets – Processing of Terrestrial LIDAR & 360˚ Panoramic street view – Processing of Mobile LIDAR & 360˚ Panoramic street view – Processing of Bathymetric datasets	R&A	C	I	Not Applicable	Not Applicable
7	**Survey data deliverables** – 2D basemap Orthomosaic using Aerial imagery & vectorization of all layers – Land Use Land Cover (LULC) map of Mumbai – DSM, DTM & Contours of Mumbai – 3D basemap (True Orthophoto) of Mumbai – Terrestrial & Mobile LiDAR data with 360˚ Panoramic street view imagery of Mumbai – Bathymetric data of water bodies in Mumbai (one-time)	R&A	C	I	Not Applicable	Not Applicable

	– 3D reality mesh model of Mumbai using aerial photogrammetry, LiDAR, terrestrial & mobile LiDAR & 360° Panoramic street view imagery – 3D LoD 3 vector model consisting of Buildings, Roads, Bridges, Flyover, Tunnels, Railways, Mono, Metro, Street lights, Traffic signals, Water bodies, Trees, Landscapes, Open spaces, Airports, Gardens, Slum and all other features having height with reference to Aerial data complying with LoD3 specifications					
8	**Ground Truthing & correction in final deliverables** – Ground Truthing 10% of all deliverables & 10% of total area of Mumbai	R&A	C	I	Not Applicable	Not Applicable
9	**Delivery & installation of various devices** – Delivery & installation of High-end workstations for viewing, editing LiDAR, Orthomosaic, etc. as per specifications – Delivery & installation of Color printers as per specifications – Delivery & installation of One 3D Wall mounted projector with 5 nos. of 3D glasses (Anaglyph) as per specifications – Publish 3D reality mesh on 3D projector & showcase demo	R&A	C	I	Not Applicable	Not Applicable
10	**Development, Implementation of Enterprise Geospatial**	R&A	C	I	Not Applicable	Not Applicable

	Application Cloud & Security Audit Certification from CERT-IN empaneled agency for the enterprise Geospatial application – Supply & Installation of 360˚ Panoramic street view imagery publishing Server software compatible with ArcGIS Enterprise suite – Supply & Installation of Enterprise Oracle database – Development & implementation of Web GIS application for 3D City model & change detection with use cases mentioned in the scope of work – Development & implementation of Android & iOS application for 3D City model & change detection – Development & implementation of Dashboard application for 3D City model & change detection – Integration of Enterprise GIS application with existing IT & GIS application – Testing of Enterprise GIS application & bug fixing – Comprehensive audit including security Certification, VPAT & load testing from CERT-IN empaneled agency for all applications developed as per the scope of work – UAT, Training & Go-Live					

11	**Hosting of all deliverables, raw datasets & Enterprise Geospatial Application on Virtual Cloud** – Hosting of deliverables & raw datasets – Hosting of Enterprise Geospatial Application for 3D City model & change detection	R&A	C	I	Not Applicable	Not Applicable
12	**Annual Maintenance Contract of all hardware, software, data, applications & services provided under the scope of work for 3 years after Go-Live** – Change detection Map of Mumbai capturing all changes every year for 3 years after Go-Live – AMC of all hardware, software & applications delivered as part of the scope of work – Bug fixing, issue resolution & enhancements of the Enterprise Geospatial applications. – Hosting of data & applications on Virtual Cloud	R&A	C	I	Not Applicable	Not Applicable

For the above table:
R= Responsible, A= Accountable, C= Consulted and I= Informed.

15 Annexure X: Pre-Bid Query Format

SI requiring specific points of clarification may communicate with Home Department during the specified period using the following format:

SI 'S REQUEST FOR CLARIFICATION	
<<Name of Organization submitting query / request for clarification>>	
<<Full formal address of the Organization including phone and Email points of contact>>	Tel:
	Email:

Sr. No.	**Page No.**	**Section No.**	**Point No.**	**Existing Clause**	**Clarification/Query of SI**

Please prepare the table in Excel Format as shown above. Any other form shall not be entertained.

16 Annexure XI: Irrevocable Undertaking regarding GST

(On INR 500/- stamp paper)

I Shri / Smt. ..... aged, ... years Indian Inhabitant.

Proprietor/ Partner /

Director of M/s..... resident at do hereby give Irrevocable undertaking as

under;

1. I say & undertake that as specified in section 171 of CGST Act, 2017, any reduction in rate of tax on supply of goods or services or the benefit of input tax credit shall be mandatorily passed on to BMC by way of commensurate reduction in prices.
2. I further say and undertake that I understand that in case the same is not passed on and is discovered at any later stage, BMC shall be at liberty to initiate legal action against me for its recovery including, but not limited to, an appeal to the Screening Committee of the GST Counsel.
3. I say that above said irrevocable undertaking is binding upon me / my partners / company / other Directors of the company and also upon my / our legal heirs, assignee, Executor, administrator etc.
4. If I fail to compliance with the provisions of the GST Act, I shall be liable for penalty / punishment or both as per the provisions of GST Act.

Whatever has been stated here in above is true & correct to my / our own knowledge & belief.

Solemnly affirmed at DEPONENT

This day of BEFORE ME

Interpreted Explained and Identified by me.

17 Annexure XII: Specifications of Aerial Survey

The specification/ procedure/ mechanism for aerial data capture shall be as under:

1) For data acquisition using fixed-wing Aircraft:

i. Flight lines shall not be single flight lines/ strips and must be as straight and parallel as possible.

ii. Photographic strips shall be flown East-West or North-South direction or combination of the two.

iii. The Forward overlap shall be 80% whereas the Side overlap shall be 60%.

iv. Flying height should be in the range of 1000m to 2500m AGL

v. Solar angle should be greater than 30°.

vi. Photography shall be undertaken only when lighting and weather conditions are acceptable for photograph and not to be attempted during haze, smoke or dust, or clouds.

vii. The aircraft shall be equipped with a calibrated altimeter for determination of flight altitude.

2) Digital Camera specification for fixed-wing Aircraft:

i. Sensor pixel size should be 3.76 µm or higher

ii. GSD/ pixel size of the Aerial Image shall be +/- 5 cm.

iii. 1 Nadir RGB Camera & 4 Off-Nadir (Oblique) RGB Camera system shall be available.

iv. 1 Nadir NIR Camera shall be available.

v. The size of sensor (resolution) shall be 150 Mega Pixel or better.

vi. Off Nadir Camera angle shall be from 30° to 60°.

vii. Focal length for Nadir RGB camera shall be more than or equal to 140 mm to enable higher resolution image capture at higher flying heights.

viii. Focal length for Off Nadir RGB cameras shall be more than or equal to 180 mm to enable higher resolution image capture at higher flying heights.

ix. All raw images captured during the process shall be geo-tagged to allow easy identification and searching of same for future reference.

3) Airborne LiDAR Specification for fixed-wing Aircraft:

i. Data collection shall be capable of multiple returns per pulse.

ii. LiDAR Pulse repetition frequency Up to 2 MHz

iii. Scan speed 60 – 150 Hz (120-300 scan lines/sec)

iv. System shall have one or more on board (roving) Global Navigation Satellite System (GNSS) dual frequency receivers capable of real-time kinematic (RTK) data, and kinematic data that can be post processed

v. Data shall be collected in cloud/fog free weather.

vi. LiDAR system shall be certified for safety issues (eye safe)

vii. GPS Time stamp shall be recorded and delivered for each point.

viii. Reference measurement unit shall be in meters.

ix. Airborne LiDAR system shall be capable of 10 or better points/m2

x. The GNSS employed in the LIDAR system shall meet or exceed the following performance specifications:
- Update rate of minimum 10 Hz
- Track minimum 555 individual channels over multiple constellations

xi. The Inertial Measurement Unit (IMU) employed in the LIDAR system shall meet or exceed the following performance specifications:
- Accuracy in roll and pitch (RMS): 0.003°
- Accuracy in heading (RMS): 0.004°
- Class 5, Minimum 500 Hz Fiber-Optic Gyro (FOG) based IMU

xii. Airborne LiDAR system shall be capable of data capturing in between 20°-40° FOV.

xiii. Data voids within a single swath shall not be acceptable, except in the below mentioned cases:
- Water bodies
- Areas of low near infrared (NIR) reflectivity, such as asphalt
- Object shadowing (e.g., buildings, towers, vertical cliffs)

xiv. No point shall be deleted or added in the processing of the data.

xv. No point shall be classified in raw and default/never classified class

18 Annexure XIII: Specifications of Terrestrial, Mobile LiDAR Data, Backpack LiDAR and Panoramic Imaging Sensors

1) Specifications of Terrestrial, Mobile LiDAR shall be as per below:

1) Mobile LiDAR Scanner (MLS) shall have one or more onboard (roving) Global Navigation Satellite System (GNSS) dual frequency receiver supporting dual antenna configuration.
2) Base Station shall have one or more Static GNSS dual frequency receivers, capable of simultaneous collection and storage of real-time kinematic (RTK) data, and kinematic data that can be post processed.
3) MLS should have tight integration with an IMU (Inertial measurement unit) and distance measurement instrument (DMI).
4) MLS shall be capable of data capturing in 360° coverage angle.
5) System should include multiple sensors mounted in different directions covering 360 Degree view (90% of a sphere) for street view mapping.
6) Minimum resolution for each individual sensor should be 12 megapixel or better.
7) LiDAR scanner used with the system shall be certified for safety issues (eye safe)
8) The GNSS/IMU employed in the system shall meet or exceed the following performance specifications:
   - Frequency rate of minimum 200 Hz
   - Track multiple constellations
   - Accuracy in roll and pitch (RMS): 0.004°
   - Accuracy in heading (RMS): 0.013°
9) Data shall be collected in the time periods with minimum obstacles/traffic present such as early mornings.
10) There shall be minimum of 5 satellites required for data collection. However, wherever this is not possible, the bidder shall establish temporary GCPs as necessary.
11) Data shall be collected in weather free from cloud/fog.
12) GPS Time stamp shall be recorded and delivered for each point
13) Reference measurement unit shall be in meters.
14) MLS shall be capable of 300 or better points per Square Meters.
15) Mobile LiDAR shall be capable to cover 75-meter range on each side of the road.
16) Data voids within a single swath shall not be acceptable, except in the below mentioned cases:
   - Water Bodies
   - Areas of low near infrared (NIR) reflectivity, such as asphalt
   - Object shadowing (e.g., buildings, towers, vertical cliffs)
17) No point shall be deleted or added in the processing of the data.
18) No point shall be classified as raw/ default/never.
19) All LAS files header should include geo-referenced information as WKT (well-known text).

19 Annexure XIV: Specifications of Continuously Operating Reference Station (CORS)

1) GNSS Receiver

#	Name of the Item	Required Specification
1	**GNSS**	**Measuring Mode**
	receiver	Static
		Fast or Rapid Static
		Real Time Kinematic (RTK)
		Horizontal Accuracy 3mm + 0.1 ppm RMS Static (long) 0.5cm ± 0.5ppm RMS (Static & Fast Static) or better 1cm ± 1ppmRMS (Real Time Kinematic) or better
		Vertical Accuracy
		3.5mm + 0.4 ppm RMS Static (long)
		1.0cm±0.5ppm RMS (Static & Fast Static) or better
		2 cm±1ppm RMS (Real Time Kinematic) or better
		The offered receiver shall have 400+ physical channels
		Multiple frequency and supporting the following simultaneous signal tracking:
		- GPS: L1 C/A; L2E/L2P; L2C; L5
		- GLONASS: L1 C/A; L1P; L2 C/A; L2P; L3 CDMA
		- GALILEO: L1 CBOC; E5A; E5B; E5AltBoc
		- BEIDOU: B1; B2; B3
		- SBAS: L1 C/A (EGNOS/MSAS/WAAS); L5 (WAAS)
		- L-Band
		- NavIC (IRNSS) L band signals
		Receiver must be capable of tracking all satellites in view, even if unhealthy, to an elevation angle of 0°.
		The receiver shall support real time kinematic positioning using industry standard formats
		The receiver shall support onboard worldwide, real-time positioning
		The offered receiver shall offer a minimum of two power inputs supporting both AC and DC operation.
		The offered receiver shall contain an internal battery (Li-Ion) and with battery charger. The internal battery shall be capable of operating the unit standalone for up to 12 hours. The offered receiver shall contain capability to Automatic swapping between power sources without affecting data recorded.
		Internal battery must be capable of operating as an internal battery backup system (UPS) with user configurability to enable/disable this functionality.
		Receiver must be capable of charging from PoE input.
		The receiver must automatically restart after loss of power and must power up in the same configuration when powered down (or loss of power).

		The receiver must have LED indication/LCD screen to view satellite tracking, Memory, Network connectivity, Bluetooth/Wi-Fi, Battery status.
		The receiver shall offer an automatic shutdown and wakeup routine to allow the receiver to power down when not needed and wake up at a predetermined time and continue the configured activity.
		Support of logging rates from 50Hz to 600 seconds
		Must contain removable memory of 32 GB, That should be able to maintain operation and logging during high motion events such as earthquake.
		The receiver should have internal GSM slot for data pooling/streaming redundancy.
		Must support a minimum of 8 independent and concurrent logging sessions.
		Must be capable of producing RINEX file formats internal to the receiver without the need for external tools/converters.
		Must be capable of pushing logged and converted data files to three separate FTP servers.
		Receiver must support both a configurable ring buffer style memory deletion scheme as well as session specific “pools” with similar functionality.
		Receiver must support the configurable input, output and logging of Met/Tilt measurements.
		The receiver must have an integrated RJ45 connector, two serial ports, USB, and an external frequency input. RJ45 connector should be enabled for server feature
		A minimum of 6 unique TCP/IP ports. Unique meaning one multicast TCP/IP port (allows multiple connections) only counts as 1 TCP/IP port. Each port must be fully configurable independent of the other ports and outputs.
		In addition to the 6 TCP/IP ports, the receiver shall support a minimum of 1 NTRIP Caster, 1 NTRIP Client, and 1 NTRIP Server ports
		Receiver must support IP filtering restricting IP packet access to and from the receiver for enhanced access control security based on individual IP addresses or subnets based on a user specified netmask.
		The receiver must support one Bluetooth/Wi-Fi connections or greater.
		The receiver must support FTP downloads as well as the FTP.
		The receiver must support the following streaming data types: CMR, CMR+, RTCM v2.x, RTCM v3x, BINEX, and NMEA. Proprietary message types will be considered in addition to (not in replace of) the before mentioned formats.
		The receiver shall support email alerts for various functions such as tracking, power, reboots, logging, status, etc.
		The receiver shall support dynamic domain name system (DDNS).
		Receiver must implement a secure network connection (secure means via an encrypted, authenticated session) as well as provide various access levels to the receiver controls.
		Receiver must meet the following environmental specification: Operating temperature: -40° C + 65° C, Humidity: 100%, fully sealed with IP67 certification, Shock: 1m drop to hard surface. Equipment must have Compliance to Vibration / Shock test of MILSTD-810 G or equivalent.
2	**GNSS Antenna**	Chock Ring tracking GPS, GLONASS, Galileo, BeiDou, SBAS, L-Band,
		Technology that minimizes multi-path interference.

		Phase center stability better than 2 mm and repeatability less than 2 mm
		Antenna gain 40dB or more
		Supply current 125 mA maximum
		Minimum tracking elevation = 0 degrees
		Absolute calibration file from IGS must be available. For antenna calibrations to be valid the GNSS antenna must be orientated to within ±5° of True North while installation at site.
		Powered by receiver (supply voltage 3.5 to 20VDC)
		Antenna shall operate in humidity, high winds, sandstorm and blowing rain
		Temperature range is –40°C to +65°C
		Humidity up to 100, fully sealed
		Shock rating 1m drop
		The antenna should be delivered with an external radome. Antenna + radome combination must have a valid antenna calibration.
3	**Antenna cable**	All CORS cabling is vulnerable to vandalism, weather, pests and fire. External cabling should be protected by secured conduits. Cable connectors are potential points of failure when stressed, corroded, or infiltrated by water, dust and pests. Self-amalgamating ultra-violet stabilized tape shall be used to protect cable connections. A short loop of excess cable at the antenna and receiver connections should be provided to avoid tension in cable. A grounded lightning protector in the antenna cable should be provided, especially in lightning prone areas. In lightning prone areas, the horizontal cable-run length should be as less as possible to minimize the risk of signal induction from nearby lightning strikes. If this is not possible, lightning arrestor should be fitted toward the receiver end of the cable. The Supplied cables and components should have a total signal loss of less than 9 dB over the length of the cable run.
4	**Warranty**	Four and half year's comprehensive on-site warranty support, including post deployment driver & firmware updates.

2) Control Center

#	**Requirement at each location**	**Specifications**
1	Civil and Electrical:	· Approx. 600 sq. Feet built up area will be provided by purchaser) All civil works (with False ceiling and flooring) for cable routing, fitting Precision ACs and de- humidifier etc. need to be carried out by supplier. · All Electrical works (incl. Earthing) for installing the Control center with power back-up
2	Power Back-up	Seven (07) days 24X7 Un-interrupted power back-up arrangement with N+1 redundancy This may be achieved through UPS, Gen set or equivalent. (Detailed power calculation sheet is to be submitted with the bid)."
3	Precision AC & De-humidifier	Seamless AC environment in the Control Centre
4	Lightening Conductor And Surge protection	Lightening Conductor and Surge protector of reputed brand as per the UNAVCO specs

5	Racks	Racks for housing the Servers, Switches, Router, KVM, Firewall etc.
6 7	Server with N+1 redundancy capable of handling 500 concurrent user	Standard 42U Rack mountable chassis based following servers of reputed make DELL/IBM/HP etc. with fault tolerant architecture: (i) Control Server: For processing the Network corrections (ii) Site Server: Secure interface to receive CORS data (iii) Web server: User Interface (iv) FTP server: for raw CORS data Refer Section VI (4): Drawing Servers should be 64 bit, at least 24.75 MB cache or higher, Multi core (at least 2X12 core) 3.5 Ghz or better base frequency Gold processor, atleast 128 GB Ram (with spare sockets for scalability), Server OS with modules for Clustering, Virtualization, Remote server management etc., At least3TB useable raid 5 SSD, Fiber Channel and Fast Ethernet connectors, Graphic Card supports above 1 Gbps, etc. Server shall support up to minimum of 120 connected receiver stations and 2000 users with at least 500 concurrent users with approximately 500 bytes per second traffic per node with latency better than 200 milliseconds. Architecture of server should be such that its capabilities can be enhanced in future with expansion of CORS network (i.e. increase in number of reference station and concurrent user etc.), without changing basic architecture of server.
8	Other hardware components	All hardware components viz load balancer (s), hardware Firewall (s), dedicated Web application firewall, L3 switches, Other Switches, Routers etc. or any other hardware / software required as part of the solution for requisite architecture with details of all sub-components in detail with the bid.
9	Desktop computer with Display	One high end system with Dual core i9 or latest processor with at least 16 GB or higher RAM, Good cache at least 8M, Graphics card, 1.2 TB HDD SAS 2.5" 12 Gbps 10K rpm with one no. 22" TFT Monitor of reputed brand at Control Centre for monitoring of the CORS network at control center. Two Nos of 56-inch TFT Display unit of reputed brand
10	Redundancy	No single point of failure configuration for all components like controllers, fans, disks and power supplies.
11	OS Support	Windows Server OS (Version 2019 or later) with modules for Clustering, Virtualization, Remote server management etc.,
12	Management	· GUI & CLI based remote management. · Management host must be provided with the solution. · Periodical online firmware upgrades.
13	Warranty	Four & half years comprehensive on-site warranty support including post deployment driver & firmware updates.

3) Receiver Station

#	Requirement at each location	Specifications
CORS stations should be as per UNAVCO specifications for size, design, operation and quality to house GNSS receiver system and other peripherals (including power back-up systems.		

1	Civil and Electrical Works (Monumentation):	Design, quality and specifications of reference pillars should generally meet **UNAVCO** guidelines for **Ground Mount or Roof Mount** on suitability at a particular station as decided by the SOI (a) **Ground Mount** pillar pedestal of 1.2 m X 1.2 m should be 2 to 3 m below ground level depending on soil type. Dimension of pillar above pedestal will be 55 cm X 55 cm. Height of pillar of reference station should be 3 m above ground level. Reference station Pedestal, footing and Pillar should be a RCC structure with M20 grade concrete and reinforcement grade Fe500. Appropriate reinforcement should be provided. The RCC structure design with detail drawings of pedestal (designed to support the enclosure) should be submitted by bidder for approval by the purchaser. (b) **Roof Mount** pillar pedestal should be 1.2 m X 1.2 m with thickness 25 cm. Dimension of pillar above pedestal will be 25 cm X 25 cm. Height of pillar of reference station should be 1.2 to 1.7 m above pedestal top. Reference station Pedestal and Pillar should be a RCC structure with M20 grade concrete and reinforcement grade Fe500. Roof mounted should be properly anchored to building structure. (c) The ground mounted reference pillar and equipment housing should be fenced with iron fencing with one door, lock and key. All equipment except antenna, antenna radom, and solar panels should be encased in antistatic, weatherproof, temper proof steel housing of NEMA 4/IP54 type enclosure. Housing shall have door on front to accesses equipment for maintenance etc. Access through Door shall be restricted by bolt secured by lock. Steel Housing shall have internal fan to facilitate proper ventilation and temperature control of electronic components within. Enclosure shall be installed on a separate Pedestal. The design with detail drawings of pedestal (designed to support the enclosure) should be submitted by bidder for approval by the purchaser All Electrical works (incl. Earthing) at reference station site for installing all components including power back-up
2	Lightening Conductor& Surge protection	Lightening Conductor and Surge protector of reputed brand as per the UNAVCO specs
3	Power Back-up	Seven (07) days 24X7 Un-interrupted power back-up arrangement with N+1 redundancy (Detailed power calculation sheet is to be submitted with the bid) Power connection at each reference station is to be taken by bidder on behalf of purchaser.
4	Solar Panel	Industry grade solar panels capable of supporting minimum 10 days uninterrupted power supply for reference station is to be installed at each reference station site. Design of solar panels & solar charge controller should be proposed for approval by the purchaser based on the power calculation as given above. The solar charge controller should be part of supply.
5	Interoperability	With all Industry standard RTK Rovers
6	Accessories	AC, DC power cables, Batteries, Connectors, Rack mounting kit, Antenna adaptor (as per UNAVCO specs), Industry grade flash and SD cards, battery chargers (one extra), Fuses etc.
7	Memory	Internal Memory of GNSS receiver should be 24 GB or more and 1 Terabyte auxiliary USB supported storage device.
8	Data Logging	Maximum logging rate 50 Hz.

9	Communication line:	Between Receiver Stations and Control Centre: a) External Primary: ADSL/ Broadband or equivalent b) External Secondary: Wireless cellular i.e., GSM/CDMA 3G and 4G), Provision for Dual SIM shall be provided to increase reliability. ADSL/ Broadband or equivalent and Wireless cellular connection at each reference station is to be taken by bidder on behalf of purchaser. Each receiver station shall be equipped with 2 GSM/CDMA SIMs to increase reliability. Both SIMs shall not be from same Network/Service provider. Irrespective of the communications method used, the data latency between the CORS site and the network control center should be designed to be less than half a second. In both a) and b) a secure VPN communication shall be created using IPsec VPN Tunnel using compatible VPN router c) Internal GSM redundant communication
10	Warranty	Four & half years on-site comprehensive warranty support including post deployment driver & firmware updates.
11	Comprehensive Insurance	Comprehensive insurance of equipment's against theft, fire and vandalism from date of installation till end of contractual period of shall be taken by supplier on behalf of purchaser

4) GNSS Software specification

#	Parameter	Minimum Specifications
1	**Control center Software with perpetual license**	Software should be capable to facilitate Purchaser to provide services for online license based real-time corrections to users, using Network RTK solution on their RTK enabled GNSS devices. Software should be able to communicate with all type of Industry standard RTK Rovers via secure web connection using non propriety or published communication strings and send them real time corrections independent of their Make and model.
	Client/Server Architecture	Must run automatically and continuously as a windows service under Windows™ 2016 Server and 64bit operating system supported
		Software Services shall start automatically with other services when booting.
		The software must support installation in virtual environments including Microsoft Hyper-V and VMWare
		The operator does not need to be logged into Windows.
		If power fails, the software will restart immediately when the power returns and the computer reboots
		Shall have fast and efficient multiple-user access to its own database
	Graphical User-Interface	The client application shall have a "graphical use interface", with typical Windows™ look and feel, that controls the server. It should be able to be installed o remote PC's as well as on the server:
		Easy to learn and use and Self-explanatory panels, boxes, windows, toolbars
		Map-views must include background map for a better visibility of the network.
		Graphical UI with drop-down menus for better configuration and organization of system setup in UI and to select receiver hardware type, antenna type, tectonic plate and datum per station.

		Software must run independently from the GUI and software must run as a Windows Service
		The software must provide user interface for a complete redundant system installation over all servers used within the setup. It shall provide health status information on the functionality of the software as well as on the underlying services. The Administrator should be able to restart services through this common user interface
	Security	The Software shall have two-access level Administrator and User:
		Administrators must be able to start and stop the various operations, create and change configurations, set parameters and modes etc.
		The User security level allows the modification and configuration of operation relevant settings through administrator privilege
		Viewers should only be able to inspect the operation of the software, configuration parameters, system and receiver status, etc. and not be able control the software and its operation
	System monitoring	The software shall Monitors the various communication links and the operation of the entire system
		The software must provide one view with offers the health status of all modules in the system.
		The software shall remotely control the GNSS receivers
		Generates event logs, alarms & warnings on receiver status, network status and data quality status
		Check all downloaded data for completeness and retrieve missing data automatically from the internal receiver memory and retry it till complete data downloading is successfully completed.
		The Software must be able to monitor the stations coordinates in real time and post processing though relative position monitoring based on fixed stations
		inside the Network with the possibility to configure alarms and reports. The results shall be presented in a graphical way and shall allow a system administrator to view time series on the integrity checks.
	System processing	The GNSS Software Shall Computes in real-time a global adjustment of the network for best estimation of all GNSS errors
		Allows the Network RTK solution to be valid even outside the polygon of Reference Stations up to 20km
		The software must be capable to operate and process Network-RTK corrections for at least 40 reference stations on one single standard-industrial server within one single instance/process of the software and within one module with scalability option upto 50 reference stations. The software must be capable to handle at least 200 concurrent users at the same time on one single standard-industrial server within one single instance/process of the software and within one module.
		The software must create full constellation
		Network-RTK corrections for at least 500 users with at least 200 concurrent users.
		The software must be capable to send GLONASS, BeiDou and Galileo corrections in case of multi- constellation-capable receivers are not deployed on all reference stations. The bidder shall explain the used methodology for this solution.

		The GNSS Software shall generate different type of corrections to allow different kind of services:
		Network-RTK corrections of the following satellite systems, frequencies and signals: GPS (L1, L2, L2C, L5), Glonass (G1, G2), QZSS, Galileo (E1 and E5 AltBoc (pilot and data)) and BeiDou (B1, B2) (all together)
		RTCM MSM input and output
		DGPS corrections in RTCM v2.x, RTCM v3.x format
		Single RTK corrections from specific stations
		Single RTK corrections from nearest station (requires user's position via NMEA string).
		All Real-time corrections shall be given in the International Recognized Standard called RTCM. RTCM messages in version 2.x and 3.x only are allowed. Any deviation to this standard is not recommended.
		Any one of the following Network-RTK standard method (RTCM standard) should be supported - Concept of Virtual Reference Stations (VRS) - MAC (Master Auxiliary Concept) iMAX
		The software should support GNSS Augmentation with SSR (State Space Representation)
	Distribution channels	The GNSS Software shall provide access to the following communication channels:
		Provisional dial-up via individual land-line modems,
		Provisional dial-Up via cellular/GSM modems and a multiplexer.
		Provisional Radio modems (Satel, Pacific Crest) in
		case of one-way corrections like single base RTK.
		Internet, intranet, local or wide area networks (TCP/IP) or with Mobile Cellular GPRS or Wireless technology using RTCM standard NTRIP 1.0 or higher.
	Web Interface	The Software shall include a web server part to provide:
		- Management and control of end users access: - Clients can register online - Once the registration is accepted by the administrator, clients can access the web server services according to their specific authorization
		The Software shall allow the downloading of Rinex files. Data should be available for downloading at least for three months from date of observation. After which data will be made available for download through FTP server.
	Availability and compatibility	High Availability of Network RTK service for user of specified accuracy and precision on an average > 95 % computed on monthly basis
		The Network should be compatible will all industry standard RTK Rovers
		The Network should allow users to access a range of GNSS accuracy levels on their RTK enabled GNSS device, from 1 meter to a few centimeters, on-demand.
	Client/Server Architecture	Must run automatically and continuously as a windows service under Windows™ 2019 Server and
		64bit operating system supported

	Warranty	The most current version of software required to support the performance of Services, including anti- virus and other security software shall be used. Software solution will be provided with four & half year comprehensive onsite warranty. Supplier will regularly review its software applications and systems for bugs & errors, and in light of new products or software releases providing enhanced functionality and replace or "patch" existing software required for fixing bugs and error corrections or as enhancements become available, without any additional cost.

20 Annexure XV: Specifications of Bathymetric Survey

The Contractor shall perform a bathymetric survey utilizing the most cost-effective technology available to identify the reservoir bottom surface and any obstructions in the areas identified. Elevation contours every 0.5 m, shall extend from the lowest elevation within the survey area to maximum available relative to MSL, India. The topographic survey above FRL shall extend to the west and to the north of the bathymetric survey. The results shall be presented as a seamless DEM for the survey(s).

Survey Equipment

The Contractor shall mobilize required number of survey equipment and survey vessel(s) with all necessary equipment for obtaining sediment core samples, side-scan sonar, and sub-bottom profile studies. He shall use appropriate and adequate number of precision instruments as required for the successful execution of the work as defined in scope of work.

Suitable survey boat with shallow draft which should be capable of cruising in waterway and recording echo sounding profiles. This boat, or another vessel, shall have all necessary equipment installed on it for handling systems to obtain sediment cores, deploying current meters and water sample collectors. The boat should have good steering control and with OBM engine, proper fuel enough to move at regular speed up to 4 Knots against wind, waves and current.

Single beam frequency echo sounders and digital output system a range up to 30 m (or more than the max. depth of water) having adequate resolution, should be used for conducting Bathymetric and/or Hydrographic survey.

There shall be adequate backup power spares and other consumables for uninterrupted survey operations. Side-scan sonar equipment (used on separate voyages to single beam bathymetry). Sub-bottom profiling system (may be used simultaneously with single beam bathymetry). For conducting survey DGPS /RTK / equivalent position fixing equipment with digital output having sub– meter accuracy
At a minimum, a single beam echo sounder system with suitable software shall be used for the below water bathymetry. A multibeam unit should be considered. Preferably side-scan sonar should be used in addition to the single or multibeam echo sounder. Side-scan sonar provides the ability to rapidly assess the impact of any obstructions to mooring and anchoring on the Lakebed, such as tree stumps, submerged buildings and foundations, pipelines, cables, rock outcrops, depressions, mounds, wrecks, other debris, etc.

The grid spacing for Bathymetry total reservoir area spacing will be at 5.0M.

The vessel shall be positioned by using state of the art global positioning system (example- DGPS system). Vessel track and offset positions shall be recorded digitally using survey data acquisition software. The echo sounder and sub bottom profiler shall be operated simultaneously, and data logged digitally as well as in analogue format.

Positioning shall be carried out by the DGPS system. This shall be calibrated against an established point in the field, e.g., platform or jacket.

The positioning system shall be interfaced to the navigation system as well as the digital data acquisition system.

The echo sounder shall be calibrated before the start of the survey. Sound velocity checks shall be made. The paper record of the echo sounder shall be annotated with line name, heading, fix number, time, date, etc. the data shall also be logged digitally in the navigation software for postprocessing and reporting. Necessary tide corrections shall be applied by measuring tide. Data shall be processed after the end of survey. The bathymetry data shall be reduced to chart datum using observed tide. The report along with charts at requisite scales shall be submitted after completion of survey.

21 Annexure XVI: Specifications of High-End Workstation

#	Parameter	Minimum Specifications
1.	Form Factor	All-in-One (AIO)
2.	Processor	3 GHz (8 core, 12 MB Cache or better) 9th Gen. Intel Core i7 or latest generation
3.	Memory	32 GB DDR4 RAM @ 2666 MHz. with additional DIMM Slot expandable to 128 GB
4.	Chipset	Compatible Chipset
5.	Graphics	Dedicated Graphics card with RAM 4 GB or more
6.	Hard Disk	2 TB or higher
7.	Audio	High-Definition Integrated Audio with combo headphone, Mic jack (Audio In & Out)
8.	Network port	10/100/1000 Mbps on-board integrated RJ-45 Ethernet Port
9.	Wireless Connectivity	Wireless LAN – 802.11 a/b/g/n/ac & Bluetooth
10.	USB Ports	Minimum 5 USB ports
11.	Display Port	1 Display, HDMI Port, 1 VGA
12.	Power supply	120 Watt with required cables and other accessories
13.	Keyboard	USB 104 Keys Keyboard of same make as PC
14.	Mouse	Optical mouse with USB interface of same make as PC
15.	Display	23” or above non-touch Full HD (1920 x 1080) resolution, integrated speakers (2 Numbers) with dedicated height adjustable stand and other accessories
16.	Web Camera	Inbuilt HD web camera with mic

17.	Operation System and Support	Pre-loaded Windows 11 (or latest) Professional 64 bit, licensed copy, Recovery media/partition
18.	Security	TPM 2.0
19.	Certification for Desktop	Energy Star 7 / BEE star, EPEAT, UL/FCC, CE, RoHS, Windows 11 certified
20	Other pre-loaded software (open source/ free)	Latest version of MS-Office, Latest version of Adobe Acrobat Reader

22 Annexure XVII: Specifications of Color Ink-tank Printer

#	Parameter	Minimum Specifications
1.	Make	Must be specified
2.	Model	Must be specified. All relevant technical brochures must be submitted.
3.	Printer type	Color Multi-Function Ink-Tank
4.	Printer speed	25 ppm
5.	Duplex Printing	Yes, Auto
6.	Input Tray Capacity	150 or above
7.	Output Tray Capacity	30 or above
8.	Paper size	A4, Letter, Legal
9.	Paper Types	Plain paper, envelopes
10.	Interface/Connectivity	USB 2.0 and 10/100 Fast Ethernet, Wifi
	Copier/Scanner	
11.	Copy resolution	600 dpi
12.	Maximum copies	Up to 99 copies
13.	Scanner type	Flatbed
14.	Color Depth	24-bit
15.	OS Compatibility	Mac, Windows 8, 8.1, 10, 11

23 Annexure XVIII: Specifications of 3D Holographic Projector (Wall mounted)

Parameter	Minimum Specifications
Physical Dimensions:	
Viewing Area	3.6m x2.0m
Physical Structure	Wall mountable wooden or metal structure
Deployment	Indoor use only
Software:	
Software	Bundled Professional & Tour software
File Formats Supported	.uds, .obj, .fbx, .dae, .las, .laz, .dxf, .ply, .stl
Number of users	1 host and 10-15visitors
Projection:	
Projectors	Full HD 1080p Ultra Short Throw lens 3D ready projector
3D Holography Projection Distance	1 meter away from wall& 1 meter into the wall
Projection Surface	White flat surface
Accessories:	
Tracked Glasses	5
Untracked Glasses	4
Control Wands	2
Tracking Components	Tracking Domes, Cables, RF Dongles, RFID Readers, IR Sync Devices
Frames	Wooden or Metal
Audio	Inbuilt Speaker
Power:	
Wattage	1000W
Voltage	110-240V
Network:	
Network requirement	LAN (Recommended) and Wi-Fi

24 Annexure XIX: Specifications of 3D Holographic Projector (Wall mounted)

- **Boundary**
- **Building**
- **Transportation layers**
  - Road
  - Railway
  - Airport
  - Metro Rail
- **Utility layers**
  - Power
  - Sewerage
  - Water Supply
  - Gas & Oil Supply
  - Communication (Telephone, Mobile, etc.)
  - Mark Stone

- **Landuse / Landcover**
- **Cadastre**
- **Hydrography**
- **Hypsography**
- **Image**
- **DEM**
- **3D GIS Layers**

❖ **Details Spatial Layers**

- **Spatial Content - Boundary**
  - BMC Ward
  - Census Ward
  - Locality
  - Sub Locality
  - Assembly Constituency
  - Parliamentary Constituency
  - PIN Code Area
  - Police Station Boundary
  - PCR Beat Area
  - Industrial Zone
  - Main Administrative Division
  - Secondary Administration Division

- **Spatial Content - Buildings**
  - Residential
  - Commercial
  - Mixed
  - Industrial
  - Government
  - Religious
  - Health
  - Monuments

- **Spatial Content - Transport**
  - Road Center Line
  - Road Edge
  - Sidewalk
  - Flyover
  - Traffic Island
  - Road Crossing Junction
  - Median Strip or Divider
  - Footpath
  - Retaining Wall
  - Vehicle Parking Area
  - Pavement /Paved Area
  - Traffic Light Post

- Bridge
- Culvert
- Causeway
- Subway
- Foot Over Bridge
- Signage Line
- Signage Point
- Statues
- Embankment
- Tollgate
- Bus Stop
- Bus Queue Shelter
- Bus Depot
- Bus Terminal
- Truck Terminal
- Taxi & Auto Stand
- Railway Line
- Platform Crossing Bridge
- Railway Level Crossing
- Railway Embankment
- Railway Cutting
- Railway Platform
- Railway Signal Cabin
- Railway Station Enclosure
- Landing Ground Strip
- Aerodrome
- Helipad
- Metro Line Network
- Metro Station
- Metro Tunnel
- Metro Depot
- Metro Bridge

➢ **Spatial Content - Utilities**

- Mark Stone
- Power-Line EHV
- Power-Line HT
- Power-Line LT
- Cable Joint Chamber Power
- Power Cable Joint
- High Mast Light
- Lamp Post
- Power Plant
- Grid Sub-Station
- Sub-Station

- Transformer
- Pylon
- Electric Pole
- Electric Junction Box
- Sewerage Man Holes
- Sewerage Treatment Plant
- Common Effluent Treatment Plant
- Sewage Pumping Station
- Storm-water Drain Surface Center Line
- Storm-water Drain Surface Edge
- Sewerage Chimney
- Solid Waste Dump
- Solid Waste Collection Point
- Public Convenience
- Dustbin
- Water Treatment Plant Poly
- Pumping Station
- Fountain
- Overhead Tank
- Main Well
- Filling Station
- Gas Stations
- Gas Pipeline Junction
- Telephone Network Junction
- Tele Cable Joint Chamber
- Telephone Junction Box
- Telephone Poles
- Telephone Exchange
- Mobile Phone Communication Towers
- Letter Box

➢ **Spatial Content – Land use and Land cover**

- Open Land
- Forest Area
- Nursery
- Major Trees along Road
- Gardens Parks
- Cultivation Area
- Plantation Area
- Scrub Area
- Marshy Swamp
- Broken Rocky Ground
- Cliff Scarp
- Isolated Rock Masses
- Sheet Rock/ Mountain Side

- Rocky Knob
- Boulder Spread Area
- Stony Waste Area
- Rock Pinnacle
- River Gorge
- Sand Area
- Barren Land
- Fire Line
- Quarries
- Stadium
- Sitting Parameter
- Golf Course
- Permanent Market Area
- Race Course
- Sports Center
- Sports Complex
- Play Ground
- Swimming Pool
- Crematoriums Graveyards

- **Spatial Content – Cadastre**

- **Spatial Content - Hydrography**
  - River Center Line
  - River Bank
  - Stream
  - River Island
  - Dam
  - Jetty
  - Reservoir
  - Lake
  - Pond
  - Canal Bank
  - Canal Center Line
  - Water Channel
  - Water Limit
  - Water Harvesting Structures
  - Trench

- **Spatial Content - Hypsography**
  - Contours
  - BreakLine
  - Contours Depression

- **Spatial Content - Hypsography**

- Orthophoto

➢ **Spatial Content - Hypsography**
- Digital Elevation Model

25 Fraud and Corrupt Practices

The SI and their respective officers, employees, agents and advisers shall observe the highest standard of ethics during the Bidding Process. Notwithstanding anything to the contrary contained herein, the Authority may reject an Application without being liable in any manner whatsoever to the SI if it determines that the SI has, directly or indirectly or through an agent, engaged in corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice in the Bidding Process.

Without prejudice to the rights of the Authority under relevant Clause hereinabove, if an SI is found by the Authority to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice during the Bidding Process, such SI shall not be eligible to participate in any tender or RFQ issued by the Authority during a period of 2 (two) years from the date such SI is found by the Authority to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice, as the case may be.

For the purposes of this clause, following terms shall have the meaning hereinafter respectively assigned to them:

A. "corrupt practice" means
the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence the actions of any person connected with the Bidding Process (for avoidance of doubt, offering of employment to, or employing, or engaging in any manner whatsoever, directly or indirectly, any official of the Authority who is or has been associated in any manner, directly or indirectly, with the Bidding Process or the LOA or has dealt with matters concerning the Concession Agreement or arising there from, before or after the execution thereof, at any time prior to the expiry of one year from the date such official resigns or retires from or otherwise ceases to be in the service of the Authority, shall be deemed to constitute influencing the actions of a person connected with the Bidding Process) or
save and except as permitted under the relevant sub clause, engaging in any manner whatsoever, whether during the Bidding Process or after the issue of the LOA or after the execution of the Concession Agreement, as the case may be, any person in respect of any matter relating to the Project or the LOA or the Concession Agreement, who at any time has been or is a legal, financial or technical adviser of the Authority in relation to any matter concerning the Project,

B. "fraudulent practice" means a misrepresentation or omission of facts or suppression of facts or disclosure of incomplete facts, in order to influence the Bidding Process,

C. "coercive practice" means impairing or harming or threatening to impair or harm, directly or indirectly, any person or property to influence any person participation or action in the Bidding Process,

D. "undesirable practice" means (i) establishing contact with any person connected with or employed or engaged by the Authority with the objective of canvassing, lobbying or in any manner influencing or attempting to influence the Bidding Process or (ii) having a Conflict of Interest; and

E. "Restrictive practice" means forming a cartel or arriving at any understanding or arrangement among SI with the objective of restricting or manipulating a full and fair competition in the Bidding Process.

F. If BMC determines that the SI has engaged in corrupt, fraudulent, collusive, coercive or obstructive practices, in competing for or in executing the Contract, then BMC may, after giving 14 days' notice to the SI, terminate the SI employment under the Contract and expel him from the Site, and the provisions of relevant Clause shall apply as if such expulsion had been made.

G. Should any employee of the SI be determined to have engaged in corrupt, fraudulent, collusive, coercive, or obstructive practice during the execution of the Works, then that employee shall be removed in accordance with relevant Clause.

For the purposes of this Sub-Clause:

i. "corrupt practice" is the offering, giving, receiving to soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party,

ii. "another party" refers to a public official acting in relation to the procurement process or contract execution. In this context, "public official" includes Financer staff and employees of other organizations taking or reviewing procurement decisions,

iii. "fraudulent practice" is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation,

iv. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party,

v. "coercive practice" is impairing or harming, or threatening to impair or harm.

26 Disclaimer

The information contained in this e-tender document or provided to SI(s), whether verbally or in documentary or any other form, by or on behalf of the Brihanmumbai Municipal Corporation (BMC), hereafter also referred as "The BMC Authority ", or any of its employees or advisors, is provided to SI(s) on the terms and conditions set out in this e-tender and such other terms and conditions subject to which such information is provided.

This e-tender includes statements, which reflect various assumptions and assessments arrived at by the Brihanmumbai Municipal Corporation (BMC) in relation to the Project. Such assumptions, assessments and statements do not purport to contain all the information that each SI may require. This e-tender may not be appropriate for all persons, and it is not possible for the Brihanmumbai Municipal Corporation (BMC), its employees or advisors to consider the investment objectives, financial situation and particular needs of each party who reads or uses this e-tender. The assumptions, assessments, statements and information contained in this e-tender may not be complete, accurate, adequate or correct. Each SI should therefore, conduct its own investigations and analysis and should check the accuracy, adequacy, correctness, reliability and completeness of the assumptions, assessments, statements and information contained in this e-tender and obtain independent advice from appropriate sources.

Information provided in this e-tender to the SI(s) is on a wide range of matters, some of which may depend upon interpretation of law. The information given is not intended to be an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law. The Brihanmumbai Municipal Corporation (BMC) accepts no responsibility for the accuracy or otherwise for any interpretation or opinion on law expressed here.

The Brihanmumbai Municipal Corporation(BMC), its employees and advisors make no representation or warranty and shall have no liability to any person, including any SI or SI, under any law, statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in this e-tender or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of the e-tender and any assessment, assumption, statement or information contained therein or deemed to form part of this e-tender or arising in any way with pre-qualification of SIs for participation in the Bidding Process. The Brihanmumbai Municipal Corporation (BMC) also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance of any SI upon the statements contained in this e-tender.

The Brihanmumbai Municipal Corporation (BMC) may, in its absolute discretion but without being under any obligation to do so, update, amend or supplement the information, assessment or assumptions contained in this e-tender.

The issue of this e-tender does not imply that the Brihanmumbai Municipal Corporation (BMC) is bound to select and short-list pre-qualified Applications for Bid Stage or to appoint the selected SI or Concessionaire, as the case may be, for the Project and the Brihanmumbai Municipal Corporation (BMC) reserves the right to reject all or any of the Applications or Bids without assigning any reasons whatsoever.

The Applicant shall bear all its costs associated with or relating to the preparation and submission of its Application including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by The Brihanmumbai Municipal Corporation (BMC) or any other costs incurred in connection with or relating to its Application. All such costs and expenses will remain with the Applicant and the Brihanmumbai Municipal Corporation(BMC) shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by an Applicant in preparation or submission of the Application, regardless of the conduct or outcome of the Bidding Process.