Brihanmumbai Municipal Corporation

MCGM CENTRE FOR MUNICIPAL CAPACITY BUILDING & RESEARCH

ज्ञानं परमं बलम्

MCMCR®

Reg. No. 1171/2019

MCMCR's Policy of GIS Implementation & Consultancy Services for BMC

BRIHNANMUMBAI MUNICIPAL CORPORATION

No. MGC / F / 8282 dtd. 12.12.2022

CIRCULAR

Sub. : Implementation of BMC's GIS Policy across BMC through Centralised GIS Facility developed at MCMCR.

The I.T. Dept. has prepared a GIS Policy document named as 'GIS Roadmap for BMC' in the year 2021 for sustainable implementation of GIS across BMC and is approved by Hon. M.C. u/No. MGC/ F/ 6733 dtd. 22.04.2022. The copy of the said document is attached herewith as 'Annexure - A'. The key features of the policy are establishment of Centralised GIS Cell, Steering Committee, Technical Committee and development of Protocol/ SOPs. The policy defines goals and objectives for its implementation and elaborates the requirements of GIS Infrastructure, GIS Data, GIS Applications and also provides guidelines for capacity building. The policy specifically emphasises the establishment of GIS Cell and formation of the Steering Committee & Technical Committee for guidance and implementation of the said policy. This GIS Policy is now to be implemented through 'MCGM Centre for Municipal Capacity Building and Research' (MCMCR) vide approval of Hon. M.C. u/ No. MGC / F/ 7815 dt. 06.10.2022.

MCMCR is an Institute established by the BMC vide Corporation's Resolution No.810 dtd.04.10.2018, for capacity building, providing consultancy services and to undertake practical research on the problems of the ULBs within Maharashtra State. A Centralised GIS Facility is developed at MCMCR for effective implementation of GIS across BMC departments and ULBs in Maharashtra. The MCMCR will undertake GIS related assignments of concerned departments of BMC as per the Consultancy Policy of MCMCR approved u/No.MGC/F/6862 dtd.02.08.2022 and circulated u/No.Ch.E./2065/CTI&RC dtd.21.09.2022.

Implementation of GIS in BMC departments shall be done through MCMCR as per its consultancy policy. The setup for GIS implementation shall be as follows -

a) GIS Cell (Centralised GIS Facility, MCMCR) :

The Centralized GIS Facility established at MCMCR shall work as a GIS Cell envisaged in the GIS Policy. Domain experts appointed at the facility shall provide GIS implementation support to all the departments of BMC. It will also facilitate the departments to maintain and update their GIS database. External specialized agencies for GIS application development and support will be

appointed by this facility as per the requirement. The facility shall also prepare and maintain Common Base Map for all the departments of BMC. The facility will guide and help the departments to set up departmental level Local GIS Centres & GIS web application. The capacity building of the BMC employees shall be done by providing training to BMC staff, related to GIS technology, at the Centralized GIS facility at MCMCR.

The services of concerned IT consultants and System Integrators already appointed by IT department of BMC shall be utilized with their respective roles for implementation of GIS across BMC by Centralized GIS facility, MCMCR.

b) Local GIS Centre :

The Local GIS Centres shall be established at department level. The Local GIS Centres shall have designated BMC staff having knowledge of the domain/ utility data of their respective department and basic knowledge of GIS. These Local GIS Centres shall communicate with Centralised GIS Facility for all the activities related to GIS implementation. The Local GIS Centre shall share existing GIS related data of their respective department, with the Centralized GIS Facility for database creation. The major activity of data collection and data conditioning will be carried out at department's Local GIS Centres. Their responsibility would be to collect site data, enter it in the given (prescribed) format and provide the same to Centralized GIS Facility for updation in the GIS database. Further, the Local GIS Centres shall perform day-to-day activities like generation of reports, offering of the remarks, planning of the works, monitoring of the assets, etc. for their respective departments, through a GIS web application.

c) Steering Committee :

A Steering Committee headed by Hon. M.C. with all the Addl. Municipal Commissioners, D.G., MCMCR & Director (I.T.) as members and Director, MCMCR Powai as member secretary is formed. The Steering Committee shall be responsible for policy approvals and decision making.

d) GIS Technical Committee :

GIS Technical Committee headed by Director, MCMCR Powai, all concerned head of the departments of BMC, Dy. Director (MCMCR) as members and Head (G.I.S.), MCMCR as member secretary is formed. The GIS Technical Committee shall be responsible for the Strategic Planning, Policy Formulation, etc. mentioned in GIS Policy.

e) GIS Core Team :

The GIS Core Team shall have GIS lead persons from department, academic institute, field experts, to work under guidance of Centralised GIS Facility at MCMCR. It shall be responsible for providing technical guidance and standards for implementation of the GIS policy. Further, the

GIS Core Team shall provide guidance in the technical issues arise before the department from time to time.

Guidance to the BMC departments for GIS implementation:

- All the BMC departments to establish Local GIS Centre at department level with designated staff in coordination with Centralised GIS Facility of MCMCR.
- All the BMC departments to share their existing GIS related data, consultancy reports, databases, base maps etc. with Centralised GIS Facility of MCMCR in requisite format for creation of Geo-database.
- All the BMC departments to provide their day-to-day GIS data generated to Centralised GIS Facility of MCMCR in prescribed format for its real time maintenance & updation.
- GIS software licenses, server space, facility management services (FMS) etc. available with I.T. Deptt., shall be utilized.
- All the data updation activities shall be done in the respective layers of the department at Centralised GIS Facility of MCMCR for which necessary manpower and resources would be deployed by MCMCR.
- Centralised GIS Facility of MCMCR shall provide necessary training to the staff of Local GIS Centre of the respective department as per the requirement.
- Centralised GIS Facility of MCMCR shall develop data updation protocol for the BMC department and maintain their data on the centralized server of BMC.
- The BMC departments not having GIS data, shall carryout survey departmentally or through MCMCR in consultation with Centralised GIS Facility of MCMCR. The BMC departments shall communicate their GIS development requirement to MCMCR and get the proposal for the same from MCMCR. The department shall obtain approval to MCMCR's proposal, of competent authority and the work order shall be placed to MCMCR for the execution of project.
- All the expenses towards GIS implementation shall be borne by the respective department for which necessary budget provision shall be made at the department level.
- The services related to GIS implementation shall be provided by MCMCR as per the existing MCMCR's consultancy policy and department shall make payment to MCMCR as per progress of work.
- All the on-going GIS projects shall be carried out till its completion by the respective department and the data shall be handed over to Centralised GIS Facility of MCMCR for further maintenance.

- All the requirement of new GIS projects shall be communicated to Centralised GIS Facility of MCMCR & no new GIS project shall be taken up by any department without consulting to Centralised GIS Facility of MCMCR.

All the BMC departments are directed to implement GIS through Centralised GIS Facility of MCMCR by following above-mentioned guidelines.

Sd/- 29.11.22	Sd/- 12.12.22
(Smt. Ashwini Bhide)	(Dr. I. S. Chahal)
A.M.C.(E.S.)	**Municipal Commissioner**

No. Director / 1062 / MCMCR dtd.: 19.12.2022

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Ch. Officer (enquiry) / TAVO / GM (BEST)

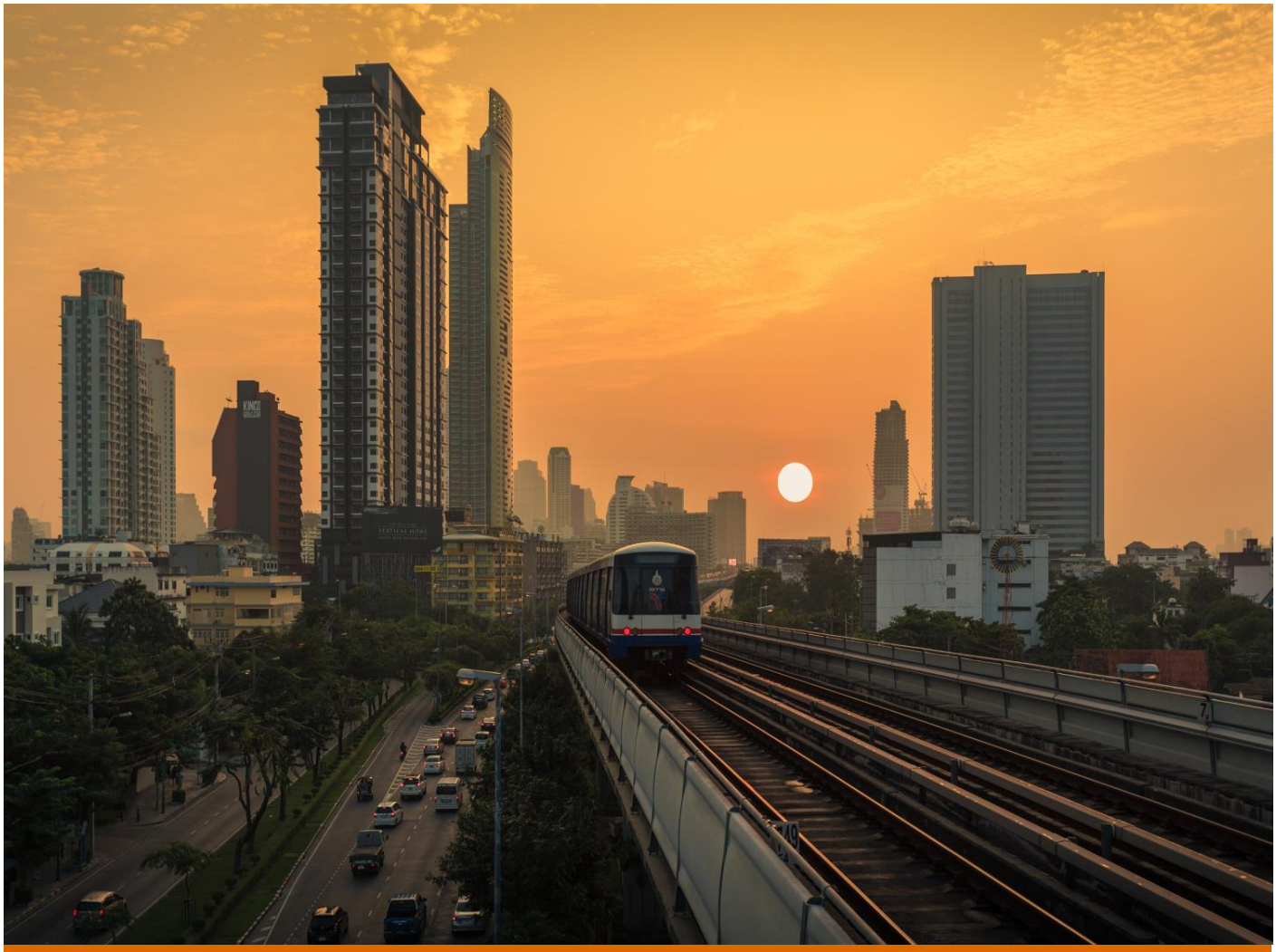
Forwarded for information and necessary action by the concerned departments.

Encl. : 1) 'GIS Roadmap for BMC' (Page No. 5 to 36)

2) 'Consultancy Policy' of MCMCR (Page No. 37 to 49)

19/12/22

(Shri Vivek More)
Director, MCMCR



GIS Roadmap for BMC

2021-2023

PwC

Contents

1 Introduction

The Brihanmumbai Municipal Corporation (BMC) is the governing civic body of Mumbai, of the capital city of Maharashtra. Brihanmumbai Municipal Corporation (BMC) is a Local Self Government, governed by M.M.C. Act 1888 and providing various services to Citizens of Mumbai including water supply, sanitation, roads, storm water drains and many other services.

BMC has been proactive in the use of technology, through various ICT interventions, to continuously improve the quality-of-service delivery to the citizens. BMC has been using Geographic Information System (GIS) since 2005 for planning, operation, maintenance, citizens related services, etc. The usage of GIS based tools; applications have seen phenomenal changes from Desktop based GIS to Web based GIS applications & now to Mobile based GIS applications. While there have been consistent efforts in building different GIS based decision support and operational system, these systems majorly focused on specific departments or specific use-cases. Their applicability and their usage were limited to department use cases and the possibility of augmenting existing GIS applications to an Integrated GIS platform needed to be explored. This document defines a roadmap and establish a mutual framework for BMC departments to efficiently and effectively use and improve the city's use of GIS technology.

1.1 Importance & Relevance of GIS

Applications of GIS can be critical to many aspects of governance and a city's development and can help citizens which are distributed across in different parts of the city in the most scientific and transparent manner. Thus, GIS can power and support open-governance methods by involving citizens, enabling information in an easy-to-understand map formats and assist to bring in accountability and responsibility of public and governance activities. Citizens can benefit from the GIS maximally by enabling the mapping of their aspirations, demands, complaints, suggestions and become important stakeholders in a city's development. While different departments in BMC can represent their asset in digital maps, plan their operations & maintenance effectively & monitor critical assets in order to deliver better services to citizens.

1.1.1. Planning

1. Structurally, the ULB is organized in zones and wards for the purpose of administration. GIS based maps can act as common denominator for urban planning, city operations, emergency services, asset management, disseminating citizens services data, etc.

2. GIS based maps can integrate data from existing IT systems and can be plotted on map easily, super-imposed and correlated to bring to fore new geographical-data relationships and patterns, not just bring scientific perspective of decisions but also help determine the right decision alternatives right down to grass-roots level.

3. Urban Planning, Development Planning and town planning related planning operations are truly spatial (geographic) in nature and GIS applications plays an important role to conducts these planning using GIS based tools.

4. Utility asset planning, expansion of utility network in city, repair/ maintenance and retirement of broken or faulty assets are some of the planning operations which could be effectively done on a map-based interface.

5. Emergency services like Mumbai Fire brigade, Disaster Management Unit, etc. monitor different environmental parameters on digital maps. The planning, response strategy, preparedness & post-event operations are truly geographic in nature and should be carried out on accurate digital maps.

1.1.1 Operations & Maintenance

1. Accurate GIS based digital maps plays vital role in performing operations & maintenance activities of different assets of the Mumbai City.

2. Knowing the exact location of underground potable water pipeline is of prime importance to carry out any repair or maintenance activity. Similarly, after carrying out the schedule repair & maintenance work it is important to update the corresponding attributes like, maintenance date, work carried out, pipe diameter, etc. This will help the Hydraulic Engineering (HE) dept. not only to visually identify repaired pipelines but also to quickly search for repaired pipeline based on textual attributes & locate the same on map.

3. Road, Bridges, Flyovers & other transport amenities are repaired at regular intervals or as per the condition of the road/bridges. Plotting exact location of the road repair, stretch of the repaired roads along with key attributes like nature of repair, name of the vendor, cost of repair, defect liability period, etc. would help the Engineers to manage the repair works effectively. Engineer could check on map the proposed locations for repair & quickly check if the repair conducted at particular locations is under defect liability period or not.

1.1.2 Decision Support System

1. A single-window application for BMC's Government to Citizen (G2C) and Government to Business (G2B) services for generating/maintaining the NOCs, building approval of plans along with map/image and GIS data sets would be beneficial for Citizens of the City. This would eliminate the multiple efforts and can enable departments and users to avail the GIS decision support and would also ease out the entire business process.

2. Other critical emergency operations like flooding, fire incidents, other calamities could be easily supported by GIS based location-based services & can improve department's ability to take quicker & most appropriate decision.

1.2 Need for GIS Roadmap for BMC

1. GIS is becoming a critical capability that provides technological edge to Global cities throughout the world. In today's transforming world, cities or even the nations that possess an advanced and progressive system of GIS would lead and chart ways in their own national and in the international arena far ahead of those that would use more traditional forms of information management.

2. GIS technology is gaining critical importance in the international and multi-lateral frameworks like, addressing cross-cutting issues of environment, rivers/drainage, urban planning, encroachment monitoring, sewerage systems, borders and even climate change. Thus, it is essential that the BMC enables to enhance itself in GIS technology with a knowledge capability that will not only help bring benefits of GIS to its own city development efforts but also give it an edge in the national as well as international arena.

3. Presently, each department attempt to address on their own the GIS activity which is quite a technology-intensive activity and requires multiple resources & processes. As a result, multiple effort investments are happening in maintaining the GIS data capability by each department and the same GIS data is being generated/maintained by each of the department in an unstructured way. This leads to large-scale duplication and redundant efforts leading to data inconsistency.

4. In order to use GIS based applications for Decision support system it is important that the GIS data is updated/ refresh at regular intervals with all necessary attributes. Currently GIS data update policy & its benefits are not outlined, hence it is important to outline different aspects of GIS applications, data update policy, GIS data standardization & various other best industry practices to utilize the GIS based technological framework most effectively.

1.3 GIS Roadmap for BMC

Develop, Implement & maintain Geospatial information regime, promoting ease of doing business, good governance & citizen empowerment offering GIS based decision support system for government, private enterprise and citizens.

Implement seamless GIS technology framework that empowers users to efficiently access, manage, maintain, and share accurate, reliable and consistent geographic data. In order to achieve that objective as a mission, the Roadmap pillars are segregated into five goals and the five goals are then distilled into objectives. These objectives do not represent all that the city needs to do, but they do represent the immediate needs and first most logical steps based upon input from an operational perspective. These goals are all are significant and not in any order of importance:

Goals & Objective	
Goal 1 **Accurate and reliable GIS data**	**Objective 1.1:** Establish, implement, and maintain a system design for enterprise GIS architecture. **Objective 1.3:** Establish standards and procedures for the development and maintenance of data. **Objective 1.4:** Establish standardized methods and procedures for application acquisition and deployment.
Goal 2 **Optimise existing Enterprise GIS application framework**	**Objective 2.1:** Optimize, refresh & augment existing GIS applications as per user department's needs. **Objective 2.2:** Develop new GIS Web applications, assign them to different departments & user groups with different settings, roles & access rights. **Objective 2.3:** Use GIS as a tool to provide timely and accurate data to decision makers.
Goal 3	**Objective 3.1:** Integrate GIS applications with existing IT business systems.

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Integration with existing systems	**Objective 3.2:** Ensure that existing IT investments are leveraged, and that the technology is interoperable with existing business processes. **Objective 3.3:** Implement New/ Emerging GIS Technologies systematically in the existing Enterprise GIS framework.
Goal 4 **Capacity building for developing GIS skillset/ Knowledge.**	**Objective 4.1:** Provide GIS training and education to all staff and empower them to make full use GIS capabilities. **Objective 4.2:** Establish a GIS user group network within the organization to help facilitate growth. **Objective 4.3:** Continue to improve the GIS knowledge base within departments.
Goal 5 **Implement an optimal GIS governance model by constituting a GIS Cell**	**Objective 5.1:** Institute a GIS Cell with Steering & Technical Committee and define their role & responsibilities. **Objective 5.2:** Institute a clear and understandable strategy for effective management and utilization of GIS. **Objective 5.3:** Develop inter-governmental agreements to facilitate data sharing and cooperation among cities, state, and private interests
Goal 6 **Implement an optimal GIS infrastructure**	**Objective 6.1:** Implement infrastructure for an enterprise GIS initiative that will sustain growth and change. **Objective 6.2:** Implement the most optimum network and hardware for the GIS initiative. **Objective 6.3:** Implement networking infrastructure that creates an efficient technological teamwork environment for the GIS initiative.

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Objective 6.4: Ensure network connectivity and system architecture can handle all departmental and public-facing needs.

Objective 6.5: Develop data storage and distribution strategies that make effective use of current resources.

2 Implementation Framework for GIS Roadmap

2.1 GIS Infrastructure

GIS infrastructure is GIS technology deployed on standard IT infrastructure components. Based on a review of the current GIS architecture, it is evident that the BMC has a well-established Enterprise GIS System that makes good use of many traditional architecture patterns such as a centralized Enterprise GIS database that stores authoritative data, GIS services that serve information via multiple clients including GIS desktop, web and mobile applications; integration with third party systems; and security. However, with the Mumbai City's stated goals such as implementing GIS Cell which compliments the best in class GIS technology and has an enhanced GIS service delivery, the GIS Infrastructure would have to undergo structural & logical changes in the architecture.

2.1.1 Environment Isolation

Isolating computing environments is an approach to maintaining system reliability and availability. This approach involves creating separate systems for production, testing, and development activities. Organising an isolated environment reduces the risk and protects operational systems from unintentional changes that negatively impact the business.

Unintentional system changes can cause operational systems to fail to deliver the capabilities and performance that users expect. Environment isolation insulates different computing environments from the risk of unmanaged change, helping you better maintain their functionality, stability, and performance. Users within your organization have expectations for system reliability. In some cases, your users' expectations may be documented in a Service Level Agreement (SLA), a contract between business stakeholders and technology service providers that defines the level of reliability expected by stakeholders.

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To effectively manage enterprise systems and meet expectations for system reliability, BMC should typically implement at least three isolated computing environments

1. **Development**

   A development environment is a workspace where developers and analysts can manage content and make changes without impacting a large audience. This dedicated server environment is typically used for unit testing, constructing business workflows, or creating new capabilities such as applications, services, data models, or geoprocessing models. The size and complexity of the environment will depend on the level of risk generated by changes, the number of creators, and the potential impact of system outages and downtime.

2. **Staging**

   A staging environment is a mirror of the production environment that lets you vet system changes before deploying those changes to production. You can perform user acceptance testing, performance testing, load testing, and training in a staging environment to avoid risk to your production system. If needed, you can even implement multiple staging environments for different testing and training activities.

3. **Production**

   A production environment is the live system that supports end users. Uptime requirements are defined by an SLA and met through effective change management and governance. Software, application, configuration, or network changes should never be made to a production system without being tested in a staging environment.

2.1.2 High Availability

High availability is a design approach that helps a system meet a prearranged level of operational performance over a specific period. Highly available systems provide users with a reliable, high-performing environment that meets or exceeds their business requirements for service delivery.

High availability is a set of strategies for minimizing service downtime and maximizing system performance and reliability. Because GIS is part of critical business operations and workflows, it is essential for organizations to apply high availability strategies to GIS. By using high

availability designs for their GIS deployments, IT managers and system architects can mitigate the risk of system and component failures. Before designing a solution for high availability, it is necessary to determine your organization's acceptable level of system downtime. This information is typically described in a Service Level Agreement (SLA). An SLA quantifies the percentage of required service uptime (also known as the "number of nines"). For example, an organization may want their systems to be available at a rate of 99.9% (three nines), which equates to 8.76 hours of downtime annually or 10.1 minutes weekly. Your SLA will define the amount of uptime your high-availability design must support.

High availability should be implemented for Critical applications like GIS based Command & Control Centre for Disaster Management department. Dial 101 services for Mumbai Fire Brigade and similar mission critical response operation system.

Recommendations

To implement a high-availability design for Enterprise GIS:

1. Use duplication and load balancing to reduce the number of single points of failure.

2. Test the system regularly to assure that it can meet performance requirements.

3. Monitor your system to catch issues early and have a plan in place to address issues quickly when they arise.

2.1.3 Load Balancing

Load balancing is a technique for distributing client workloads across multiple computing resources, such as physical servers, virtual servers, or clusters. Load balancing helps you balance system utilization, reduce risk, simplify service delivery and growth, and improve backend server security.

Technology for Optimizing System Resource Utilization

The current Enterprise GIS platform in BMC: ArcGIS can scale to support both small and large deployments. As the number of users increases, so will the deployment size and the number of GIS servers. To accommodate this growth effectively, ArcGIS supports load balancing techniques and technologies. With load balancers in place, client workload traffic could be distributed across multiple server-based resources to optimize performance and

resource utilization. Load balancing algorithms, used to dispatch client requests, can vary from simple round-robin approaches to more complex algorithms that consider factors such as current connection counts, host utilization, or real-world response times.

The GIS system integrator should perform feasibility analysis of loads on various GIS environments & then implement appropriate load balancing techniques.

2.2 GIS Data

2.2.1 Existing GIS Data & applications in BMC

Geographic Information System (GIS) system has been in use in BMC since more than a decade. The journey of using GIS maps, tools and spatial analytics have been portrayed in Figure 1 below.

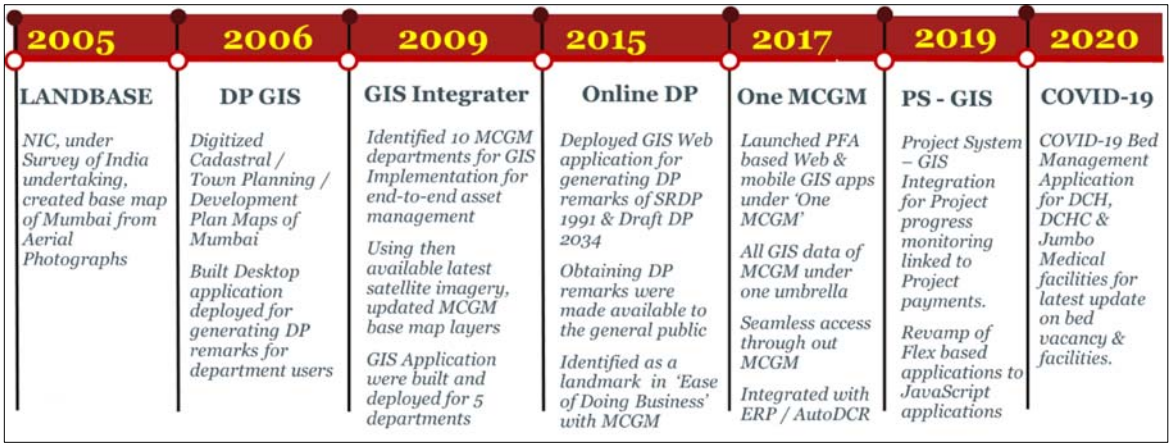

Figure 1: BMC GIS Journey

GIS basemap was prepared in 2005 by NIC under the Survey of India undertaking from Aerial Photographs. This basemap was then used for basic GIS mapping of important assets and primary for Town planning purpose. In 2006, Development Plan GIS application was built using Digitized cadastral data, town planning data and Development plan maps of Mumbai. The DP application was desktop-based application and it helped department users to generate DP remarks. GIS Integrater app was launched in 2009 where GIS application was built for majorly five departments like Education, Estate, Property tax, Sewerage operations and Disaster management. In 2015 BMC launched an Online DP remarks application under ease of doing business initiative. The application is open to all citizen and is integrated with payment gateway system, where citizen can get

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DP remarks of their property by paying online. In 2017, Web & Mobile based GIS application was launched under the name of OneMCGM. The purpose of OneMCGM was to bring all the GIS dataset, applications & tools which were working in silos on common platform & application. It provided seamless access to all the GIS datasets through BMC. OneMCGM was also integrated with ERP and AutoDCR system. Following are some of the GIS applications/ modules which are standalone/ Integrated with other IT systems:

1. OneMCGM application
2. Sewerage Operations & RWTS
3. Property Tax
4. Estate
5. Disaster Management Integrated CCS application
6. Education
7. SAP PS GIS Integration
    a. PS GIS Web Apps
    b. PS GIS Mobile Apps
8. Ward works application
9. Isarita MCGM Integration for Property Registration
10. COVID Web Applications
    a. Bed Management Dashboard
    b. COVID Ward works
    c. Cemetery Management
    d. COVID Dashboard application
11. Other ArcGIS Portal based Apps

2.2.2 Challenges & Mitigations in GIS Data

The GIS data in BMC runs into hundreds of layers which are managed by respective departments in centralised GIS database. Following are some of the challenges & mitigations with respect to GIS data management:

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#	Challenges for GIS data management	Proposed Mitigation to improve GIS data management
1.	Most of the departmental GIS data layers are not updated with latest attributes.	Deploy a dedicated GIS Analyst who will carry out the GIS updating tasks.
2.	There is no policy about refreshing / updating of GIS datasets.	Prepare & implement GIS Data update policy
3.	The GIS layers does not have standard schema with list of mandatory & desired attributes.	Upgrade existing GIS data model for all GIS layers as per AMRUT and/or best industry standards/ practices.
4.	The GIS layers does not have any standard metadata to search or to find more information about the dataset.	Prepare & implement GIS metadata standards as per best industry standards / practices.
5.	Same GIS layer with different attributes are managed by different department as per their needs which leads to duplicity of the data.	Standard GIS database schema which can extended as per department's needs
6.	There is no awareness amongst different departments of BMC that the GIS dataset could be utilized for different operations & analysis.	Prepare & implement GIS Capacity building plan.
7.	Many departments have created GIS dataset of their assets under a particular project 4-5 years ago. However, due to lack of manpower & technical expertise they are not able to update the GIS dataset at regular intervals.	Deploy a dedicated GIS Analyst who will carry out the GIS updating tasks.
8.	Some department have CAD files, paper maps, KML files and non-spatial datasets which needs to be digitized and plotted in appropriate GIS format. However, due to lack of GIS expertise, they are not able to complete this exercise.	Deploy a dedicated GIS Analyst who will carry out the GIS updating tasks.

2.3 GIS Applications

The GIS applications are of different categories depending on the type of deployment (Desktop/ Web/ Mobile) or type of dataset or the purpose for which the application is used by the users.

2.3.1 Desktop Application

What is GIS Desktop Application?	It is standalone desktop application which runs on PC/ Laptop create, analyse, manage and share GIS data. The GIS desktop application is primarily used for creating accurate GIS datasets with full range of drafting, editing, analysing, geoprocessing and publishing tools.
Who will use GIS Desktop Application?	The GIS desktop application would be used by the users who are well versed with GIS concepts and can create, edit GIS dataset & publish GIS data so it can be used by a wider audience on Web & Mobile. Typically, GIS analyst would be using the GIS desktop application.
How users will use GIS Desktop Application?	The user needs to request the GIS Cell for installation of GIS desktop license and after appropriate administrative approval the user's PC would be installed with the GIS application document.
How to build the skillset for using GIS desktop application?	GIS Hands-on training & refresher course at regular intervals. The hands-on training can also be supported by providing training videos, help files, presentations, exercise books, etc.

2.3.2 Web Applications

What is GIS Web Application?	GIS Web application runs on Web/ Internet which are easier to use, easily accessible to larger audience and does not need high-end PC/laptop. The GIS Web application may have different geoprocessing tools, queries, reports,

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	workflow, which the users may use for planning, operation, maintenance, monitoring, service request, etc.
Who will use GIS Web Application?	GIS web application would be used by BMC departmental users & citizens.
How users will use GIS Web Application?	All the users will use the GIS web application by accessing it over web using URL. The citizen-based GIS website/ portal would be accessible to everyone, while the departmental based GIS web applications would be accessible to BMC departmental user using appropriate authorization & authentications mechanism.
How to build the skillset for using GIS Web application?	Training using training videos, help files, presentations, exercise books, etc. will help the user navigate & use GIS web application effectively. GIS web application are relatively easier, intuitive and require lesser learning curve to use.

2.3.3 Mobile Applications

What is GIS mobile application?	GIS mobile application runs on mobile devices over Web/ Internet. The GIS mobile applications are primarily used for GIS data collection, field operation, GIS data verification, lodging complaints, service request, etc.
Who will use GIS mobile Application?	GIS mobile application would be used by BMC departmental users & citizens.
How users will use GIS mobile Application?	Users will use the GIS mobile application by accessing it from their mobile device. The citizen-based GIS mobile application would be accessible to everyone, while the departmental based GIS mobile applications would be

	accessible to BMC departmental user using appropriate authorization & authentications mechanism.
How to build the skillset for using GIS mobile application?	Training using training videos, help files, presentations, exercise books, etc. will help the user navigate & use GIS mobile application effectively. Departmental user would also be trained on field with hands-on training for field data collection use cases.

2.3.4 Dashboards

What is GIS Dashboard application?	GIS Dashboards enables users to convey information by presenting location-based analytics using intuitive and interactive data visualizations on a single screen.
Who will use GIS dashboard Application?	GIS dashboard application would be used by BMC departmental users, departmental HODs & senior leadership of BMC.
How users will use GIS dashboard Application?	GIS Dashboard application can be projected on Live monitor where BMC departmental users can continuously monitors assets & other KPIs.
How to build the skillset for using GIS mobile application?	GIS Dashboard are self-explanatory hence simple training videos, help files, etc. will help the user navigate the GIS dashboard effectively.

2.3.4.1 Types of Dashboard

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.

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b. Tactical Dashboard

Tactical dashboards help analysts and line-of-business managers analyse 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.

2.3.5 GIS applications Integrated with existing IT application

GIS Application integration helps deliver solutions that combine data and tools from disparate systems including GIS as well as business systems like permitting, licensing, and asset management systems. With integrated solutions, there are significant improvements in cross-functional business processes, and it provide decision-makers with integrated views of the organization's information.

The Enterprise GIS system can be integrated in different ways with the existing IT applications depend on which system is used as the hosting framework. Following are some of the integration patterns:

2.3.5.1 Geocentric applications

Geocentric applications enhance GIS applications with business data and capabilities to automate or inform location-centric activities. Geocentric applications are dominated by geospatial content and capabilities, while delivering business content and capabilities secondarily. This pattern typically uses a GIS application as the hosting framework. It is best suited for staff who are familiar with GIS applications, for situations where GIS activities are central, or for cases where a user-friendly GIS template or configurable app provides most of the needed functionality.

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2.3.5.2 Geoenabled applications

Geoenabled application helps enhance business applications with GIS data and capabilities to automate or inform business activities. Geoenabled applications are dominated by business system content and capabilities that are supplemented by GIS capabilities. This pattern typically uses the business system as the hosting framework. It is best suited for staff who are familiar with the business system that automates the related workflows, or when an extensible business system provides most of the needed functionality.

2.3.5.3 Composite applications

Composite applications integrate capabilities from multiple systems in situations where no existing system can or should serve as the hosting framework. This pattern typically uses web services to integrate data and logic from multiple systems to derive new functionality. Composite applications are conceptually comparable to mashups, and they represent a contemporary trend in enterprise application development.

2.3.6 Enterprise License Agreement for GIS Software

In order to implement the above-mentioned GIS application and to improve the existing Enterprise GIS system in BMC it is important that GIS Commercial Off the Shelf (COTS) based software platform used in implementation should be open, interoperable & scalable.

Currently there are multiple ArcGIS GIS desktop, extensions & GIS server license software which are procured, maintained by different departments in BMC. One of the major costs for Enterprise GIS system is software acquisition and maintenance. The procurement procedure of new GIS software & Annual Maintenance Contract (AMC) are maintained for different GIS projects & products across different department, which consumes lot of additional time & efforts. BMC should adopt Enterprise License Agreement (ELA) or individual level software licensing with GIS software Original Equipment Manufacturer (OEM). By subscribing to an ELA, scheduled payments could be made in exchange for a prescribed set of software, services, and training over the term of the agreement. This will also enable BMC to scale the use of GIS through the organization without licensing constrictions and enable the City to better utilize its GIS data as a resource to make improved data-driven decisions, improve customer service, and create efficiencies in staff time, saving the City money.

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Envisaged benefits of an ELA for BMC:

1. **One multi-year contract and fixed payments**: Saving in administrative costs incurred in processing of multiple orders. Easy to plan budget as the fee will be fixed for the term of the ELA. (generally, 3 years term)

2. **Huge deployment capabilities**: BMC may find this very attractive for a variety of reasons, not the least of which is avoiding the time-consuming processes of justifying and completing each GIS purchase.

3. **Architectural flexibility**: Choose to deploy software as required for most efficient architecture. Easy and unlimited access to desktop and server products will ensure that BMC can flexibly design their Solution architecture without cost overruns.

4. **Existing Licenses under maintenance**: Existing licenses of BMC will be merged into ELA and will be considered under maintenance till ELA term. The Licenses mentioned as part of ELA includes Existing licenses available with BMC.

5. **Technical support**: Esri India Enterprise Advantage program provides access to technical specialists and training services in a pre-defined manner.

6. **Technical Advisory**: Understand Organizational Vision and Goals, Vision Workshops with Business and Technical Users; Help in creating GIS Road Map; Insightful advice & advocacy; Draw High Level Implementation Plan; Quarterly Review of GIS Program.

2.4 Capacity building

Capacity-building and training plays very important role to make the GIS strategy & adoption widely used and get embedded into the Municipal corporation's governing, development and democratic processes. It is envisaged there would be a large number of professionals in BMC who will need to undergo customized and relevant orientation/training and outreach so as to become "GIS literate" and for being able to adapt and use Enterprise GIS solutions within their own work-practices or departments.

Considering GIS is a rapidly evolving technology, and organizational needs are ever changing, it is recommended that the BMC draft an on-going GIS Training Plan, approved by the GIS Operations and Leadership teams.

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A formal, ongoing GIS training plan should consist of an approved outline of steps, schedules, and costs for continuous training of the City's employees, as well as recommendations for classes, seminars, conferences, and workshops. The training plan must include multi-tiered GIS software training using a standardized process for training employees in the use of GIS technology.

2.4.1 GIS Training Model

Training will be an integral part of GIS implementation strategy and should revolve around a strategy that includes external training, internal training, and continuing education offerings. The training plan should follow the same levels of GIS users identified in the strategic plan.

2.4.1.1 Tier 1 GIS Users

Flagship GIS user who has access to a fully functioning GIS toolset including editing and complex analysis. Tier 1 GIS users are expert-level GIS users who use the entire GIS software suite. Their position titles may be GIS Manager/Coordinator, GIS Specialist/Developer or GIS Administrator.

2.4.1.2 Tier 2 GIS Users

Analytical user focused on data analysis, in addition to general mapping capabilities. Tier 2 GIS users conduct analytical tasks above and beyond what is offered at the Tier 3 level. They need applications that allows for robust flexibility and a host of analytical and geoprocessing tools such as those provided by desktop applications and extensions. Tier 2 users are professional-level GIS users with position titles such as GIS Analyst.

2.4.1.3 Tier 3 GIS Users

GIS Web / Portal user who requires only general browsing, simple cartographic output, and basic GIS data query functions. Generally, Tier 3 users can have most of their GIS needs met by internet and/or intranet browser-based map portals. Tier 3 users are casual-level users with position titles such as GIS Technician, but may also include any position which uses GIS as a tool in their daily job.

2.5 GIS Cell

2.5.1 GIS Steering Committee

To serve as the primary decision-making body to establish and implement GIS policies and standards. The Steering committee needs to be formed which would take into account needs and resources while seeking multilateral input, participation and support in setting priorities and working through timelines.

It is important to have a steering committee that is responsible for setting the policy for organization wide GIS coordination and implementation. These policy makers make decisions based on input and recommendations from technical and user staff and provide leadership and direction for the organization's GIS development. A policy committee with strong authority is particularly important in a large multiagency GIS implementation. In the absence of a steering committee whose decision making is binding upon all participating agencies, the process of coordinating GIS implementation is pushed down to the individual agency or department level. Individual agencies or departments, however, do not have the resources or the perspective to consider the organization wide consequences of their actions and certainly do not have the authority to require other agencies to follow their decisions.

Thus, without a steering committee, GIS implementations become much more fragmented, proceed more slowly, have a higher risk of failure, and do not yield the level of benefits experienced by coordinated efforts. The committee should include department HoDs, top-level administrators, or designated representatives from different departments of the city administration, for a much greater chance of success & impact.

The responsibilities of a steering committee generally include the following:

Strategic planning — Create and periodically review the GIS strategic plan for the organization(s) that embodies the mission, values, and goals of the organization.

Policy formulation — Set policies necessary to ensure a coordinated GIS implementation such as database standards, implementation priorities, and system standards. These policies are based on technical materials and recommendations provided by technical coordination committee(s).

General oversight — Monitor the overall GIS implementation to make sure progress is being made by each participating agency in general compliance with the adopted implementation strategy.

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Financial and budgetary decisions — Set annual budgets for GIS implementation activities that are part of building the enterprise GIS solution. While departmental GIS budgets may be coordinated with the enterprise GIS budget, the financial and budgetary decisions of individual departments usually are not part of the responsibilities of the GIS policy committee.

Growth and expansion of participant base — Expand the enterprise GIS to include additional departments or outside agencies.

Status review — Periodically check the progress of critical implementation activities, especially those activities that affect several agencies.

Approval of special license agreements — Approve agreements to purchase GIS resources and agreements to market and sell the GIS resources created by the organization.

Product pricing — Set pricing for GIS products and services provided to the public or other agencies. Pricing will be based on recommendations established by the technical coordination committee.

Direction to the GIS department — Provide direction in the form of priorities and schedules for GIS implementation tasks that are critical to building the enterprise GIS. In organizations that have a single GIS department, this direction is provided to that single agency. However, when no one department is responsible for GIS implementation, direction must be provided to all participating agencies through the technical coordination committee

Legal obligations — Provide direction regarding legal and policy issues related to data automation, data access, and other matters.

2.5.2 GIS Technical Committee

It is generally composed of the technical lead person from each department or agencies, depending on the type of organization. Responsibilities of the GIS Technical Committee generally include the following:

Provide technical direction and standards—Formulate technical requirements and standards for all components of an enterprise GIS implementation; when necessary, this information is submitted to the policy committee to establish the overall policy direction.

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Recommend projects and studies — Establish the annual work plan of implementation projects and studies needed to create the enterprise and individual agency GIS systems.

Recommend database/application development — Set annual priorities, identify common needs and requirements, and resolve conflicts related to database system and application development.

Address system integration/expansion issues — Identify and resolve technical questions regarding linking individual GIS implementations.

Conduct user training — Provide standard training courses through the purchase of training from vendors or through a GIS training center.

Implement and Operate — The GIS cell will implement and operate the policies, standards, and procedures adopted by the GIS steering committee.

Develop recommendations for technical direction and standards — Under the direction of the GIS technical coordinating committee, formulate draft technical requirements and standards for their GIS components. This information is fed to the GIS technical coordinating committee for consideration and decision making

Recommend database/application development — Develop draft recommendations, costs, priorities, needs, and requirements for their work areas

Address system integration/expansion issues — Assist with identifying and resolving technical questions in their areas regarding linking individual GIS implementations

Liaison with departments — Serves as liaison to other departments and outside agencies.

2.6 GIS Standards & Policies

2.6.1 GIS Database standards

The term “GIS database” can be used to describe many different parts of the spatial data elements of an overall GIS system – coordinates, spatial features, attributes, accuracies and limits etc. Database design and standardizing can be thought of as the logical design of the base data used for storage, access and rendering/ publishing. In the relational model, these could be the tables, views, stored procedures, triggers. In an object database, the entities and relationships map directly to object classes and named relationships. In

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GIS system, it is a combination of both that is linked to the spatial referencing system and characterises points, lines and polygons to user-defined features.

Some of the spatial components in the GIS database would be GIS vector datasets, GIS network for utilities, road network, raster datasets like satellite images, drone imagery, basemap, DEM, 3D vector models, photos of assets, etc.

GIS Cell should prepare a GIS database standard which would include physical, logical structure, database schema, other design parameters for creating, storing, managing, backing up & retrieving GIS database.

GIS database standards should be compliant with OGC standards. GIS database standards can be adapted from international standards like Federal Geographic Data Committee (FGDC). National widely used GIS standards like AMRUT GIS designs standards could also be adapted for including localization parameters which are more relevant for Indian cities.

2.6.2 GIS Metadata standards

Metadata is information about the data. Metadata records the - who, what, when, where, how & why of a data source. In case of geospatial data, it is very important to capture metadata which gives end-user clarity on different aspects about the geospatial data before using it. It is necessary to create, maintain & update metadata for all geospatial data like GIS flat files, GIS databases, GIS web services, Satellite imagery, Raster files, Ortho-rectified imagery, basemap, thematic maps, etc.

GIS Cell should prepare a GIS metadata standard which would include metadata structure, other design parameters for creating, storing, managing, viewing GIS metadata catalogue services. Metadata should also include:

a. Mandatory and conditional metadata sections, metadata entities, and metadata elements.

b. The minimum set of metadata required to serve the full range of metadata applications (data discovery, determining data fitness for use, data access, data transfer, and use of digital data).

c. Optional metadata elements - to allow for a more extensive standard description of geographic data, if required

d. A method for extending metadata to fit specialized needs.

Metadata standards should be in line with Content Standard for Digital Geospatial Metadata (CSDGM) standards which are defined by Federal Geographic Data Committee (FGDC) and/ or ISO 19115:2003 Metadata Standards.

2.6.3 GIS Survey Standards

The GIS survey standards would define the different types of GIS survey conducted for capturing GIS data in BMC and the standards which should be followed while conducting the survey, accepting the data & managing the GIS data which are generated from these surveys.

It is important to establish GIS Survey standards because there are different departments in BMC which may engage different vendors for carrying out GIS projects as per the department's project objectives. It is important that the data generated from such surveys should be compatible with existing GIS datasets, it should have appropriate scale, resolution, horizontal, vertical accuracy, Root Mean Square Error (RMSE), acceptable tolerance levels, etc.

GIS Cell should prepare a GIS survey standard which would include GIS survey standards should be prepared for geospatial drone surveys, total station survey, utility surveys, DGPS survey, mobile GIS data collection using accurate GNSS receivers, mobile GIS data collection using smartphones, etc.

2.6.4 GIS Standard Operating Procedures (SOP) for different departments

While the GIS Survey standards focusses on GIS data creation using different surveying techniques and different parameters which needs to be followed during creation of GIS data, this section describes the SOPs which needs to be followed for managing & updating the GIS data.

GIS Standards Operating Procedures (SOP) are divided primarily divided into two categories technical SOP and business SOP:

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2.6.4.1 Technical SOP

The technical SOPs would primarily comprise of technical parameters related to data creation and managing data. The technical SOPs for each department may be different as per the departmental objective & functions. Technical SOPs should also include parameters like GIS data update intervals, who would be responsible for updating GIS data, interval for updating GIS data, techniques to update GIS data.

2.6.4.2 Business SOP

Business SOPs would include different business operations or steps to be performed on spatial & non-spatial data of the department. The technical & operational standards to be followed while performing different business operations. The Business SOPs would also include Enterprise GIS integration with existing IT systems and the different parameters which are exchanged during integration between GIS & other IT systems.

The GIS Standard Operating Procedures (SOP) for different departments should be prepared by the GIS Cell by performing a through requirement gathering session with different departments. These business SOP would also include integration with financial system, release of payments of different projects based on evidence based mapping and other factual deliverables like geo-tagged photos, etc.

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3 Implementation Plan

This section focuses on a tactical plan of action for implementing the key elements that are identified and detailed throughout this document. Tactics are the specific actions that are taken to implement the strategy and needs identified in the previous section. These actions comprise what is to be done, in what order, and the tools to be used. Tactical implementation typically requires the involvement of the whole BMC for the successful implementation of GIS.

#	GIS Goal	Task / activities	Time Frame
1.	Implement an optimal GIS governance model by constituting a GIS Cell	Appointment of GIS System Integrator (SI) for managing all GIS related works to be supervised under IT dept & GIS Cell	0-1 Year
2.		Formation of GIS Cell (GIS Steering Committee & GIS Technical Committee)	0-1 Year
3.		Requirement gathering from different department in BMC about their GIS needs.	0-1 Year
4.	Implement an optimal GIS infrastructure	Implement Development, Staging & Production Environment for Enterprise GIS	1-2 Years
5.		Implement High availability & Load balancing deployment strategy for Enterprise GIS	1-2 Years
6.		Implement Enterprise License Agreement (ELA) for GIS COTS products	0-1 Year
7.	Accurate, reliable GIS data & GIS standards	GIS Digitization for BMC departments who wish to digitize their utility asset network using existing CAD, paper map files, etc.	0-1 Year
8.		Establish GIS Database standards	1-2 Years
9.		Establish GIS Metadata standards	1-2 Years

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#	GIS Goal	Task / activities	Time Frame
10.		Establish GIS Survey standards	1-2 Years
11.		Establish GIS Standard Operating Procedure (SOP)	2-3 Years
12.	Optimise existing Enterprise GIS application framework	Conceptualize Citizen facing GIS portal (Gather existing GIS data, Configure & Publish)	0-1 Year
13.		Optimize, refresh & augment existing GIS applications as per user department's needs.	1-2 Years
14.		Develop new GIS Web applications, Dashboard, mobile applications as per BMC department needs.	2-3 Years
15.	Integration with existing systems	Integrate GIS applications with existing IT business systems as per BMC department needs.	2-3 Years
16.		Implement New/ Emerging GIS Technologies systematically in the existing Enterprise GIS framework. (3D City Model)	2-3 Years
17.	Capacity building for developing GIS skillset/ Knowledge	Prepare GIS Capacity building & Training Need analysis document	0-1 Year
18.		Implement GIS training & Capacity building as per GIS Training calendar	1-2 Years
19.		Optimize GIS training calendar, courses & training deliver techniques as per feedback received by user group.	Continuous activity

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4 Immediate Next-Steps

This draft document shall undergo internal scrutiny with the IT Department and all other relevant stakeholders. Therein a new draft of the GIS Roadmap for BMC shall be prepared. Once approved, this final version of the GIS Roadmap for BMC shall be published to all departments of BMC and shall be implemented.

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BRIHANMUMBAI MUNICIPAL CORPORATION

No. MGC/F / 6862 dtd.02.08.2022

CIRCULAR

Sub.: Policy for providing consultancy services to the ULBs and departments of Brihanmumbai Municipal Corporation (BMC) by MCMCR.

BMC is a premier ULB in the country. In order to share the knowledge, technologies and resources of BMC with other ULBs, BMC has established 'MCGM Centre for Municipal Capacity Building and Research' (MCMCR). As per the Registered Memorandum of Association of MCMCR, the objectives of MCMCR are capacity building of employees of the ULB's in Maharashtra, providing consultancy services to them as per their requirements & undertaking practical research on various problems faced by the ULBs. The resources for achieving these objectives are retired BMC professionals, in-service BMC professionals, professionals from the academic institutes, private individual professionals and private professional firms.

The AMC(P), AMC(ES), AMC(WS), AMC(City) are members and Municipal Commissioner, BMC is the President of the Board of Governors of MCMCR. The second meeting of Board of Governors of MCMCR was convened on 17.01.2020. In this meeting, it was resolved to establish an "Urban Management Consultancy Services Cell" by MCMCR for providing consultancy services to BMC & other ULBs. Accordingly, MCMCR made various efforts to identify the professionals willing to work as a consultant.

As per the directives of the Board of Governors, MCMCR, a meeting of all the HoDs of engineering departments of BMC was held under the Chairmanship of Director (E.S. & P.) on 28.01.2020 to identify experienced retired professionals of BMC of the respective departments capable of undertaking consultancy services. Director, MCMCR published an advertisement on 29.02.2020 in reputed newspapers inviting expression of interest (EOI) from retired professionals of Government/ Semi Government organizations for working as consultant with MCMCR. Further, an interactive session of retired BMC professionals was arranged by MCMCR on 13.10.2021 to seek their willingness for working as consultant with MCMCR.

Hon. Standing Committee Chairman Shri. Yashwant Jadhav, in the Corporation's budget meeting held on 04.03.2021 suggested that BMC shall establish a consultancy cell of knowledgeable, experienced & competent retired professionals to provide consultancy services for BMC projects. Similar suggestions are given by corporator Smt. Pradnya T. Bhutkar vide Notice of resolution dated 09.03.2021. Councilor Shri Datta Pongde, vide notice in corporation dated 13.07.21 has proposed that the consultancy works for projects in BMC be got done through its own experienced Officers instead of appointing external consultants.

Considering above-mentioned facts, a policy is prepared for providing consultancy services to the ULBs and BMC departments by MCMCR and is attached as 'Annexure – A'. All the departments of BMC shall communicate their consultancy requirements to MCMCR and shall adopt the Consultancy Policy prepared for hiring consultancy services.

Sd/-
(Dr. I. S. Chahal)
Municipal Commissioner

No. Ch.E./2065 / CTI&RC dtd. 21 SEP 2022

Copy to :

AMC (P) / AMC (C) / AMC (ES) / AMC (WS) /

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DMC (CPD) / DMC (D.M.) / DMC (Z-I) / DMC (Z-III) / DMC (Z-IV) / DMC (Z-VI) / DMC (Z-VII)

CE / HE / Ch.E.(Vig)/ Ch.E.(Bridges)/ Ch.E.(SWD)/ Ch.E.(SP)/ Ch.E.(SO)/ Ch.E.(WSP)/ Ch.E.(Rds)

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Ch. E.(M&E)/ Dy.C.E.(BC) C/ Dy.C.E.(BC) WS/ Dy.C.E.(BC) ES/ Dy.Ch.E. (HIC)/ Dy.Ch.E.(SIC)

Dy.Ch.E. (Imp.) / Dy. Ch.E. (Env.) / Dy. Ch.E. (M&E) SP / CA(F)/ CA(T)/ CA(WSSD)/ CA(CPD)

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Dean (KEM) / Dean (LTMG) / Dean (Nair) / Dean (Nair Dental) /Dean (Cooper) / Law Officer

Ch. Officer (DM) / Dir (IT) / M.S. / M.C.A. / Ch.P&Lic. / Ch.Officer (BDO) / Dy.C.A.(F) Health

Asstt. Comm. – A/B/C/D/E/FS/FN/GS/GN/HE/HW/KE/KW/PS/PN/RS/RC/RN/L/ME/MW/N/S/T

Ch. Officer (enquiry) / TAVO / GM (BEST)

Forwarded for information and necessary action by the concerned departments.

Encl. : Annexure - A

21/09/22

Ch. Eng. (C.T.I.&R.C.)

Annexure – A

Policy for providing consultancy services to the ULBs and departments of Brihanmumbai Municipal Corporation (BMC) by MCMCR

A. Basic Concept for the Policy:

1. Since BMC is undertaking a wide range of works/ activities in Engineering, Architecture, Health, Fire, Disaster Management, Assessment (Property) Tax, I.T, Education, Garden & Zoo departments, etc., the services from a vast pool of Professionals available as retired/ in-service Engineers, Architects, Doctors, Administrators, Accountants, Fire Dept Officers etc. can be availed for the consultancy works at MCMCR.

2. The prime function of MCMCR is to share BMC's knowledge with ULBs. The BMC professionals through their long years of working in the corporation have developed in-depth understanding of ULB issues and technical challenges. They are, therefore, eminently equipped to advise ULBs through consultancies. Hence staff of BMC may generally be preferred. However, wherever BMC professionals are found wanting in experience of consultancy work such as specialized technological subjects not dealt with by BMC professionals, consultants with requisite competence from the market would be drawn.

3. There are few consultancy assignments which require individual expert input, like various design assignments, proof checking, etc. However, many consultancy assignments require collective inputs from the different field experts. For e.g., consultancy services for design and construction of sewage pumping station requires input from civil engineering expert for design and construction of the civil structure, mechanical engineering expert for selection of pumps and all other mechanical equipment, electrical engineering expert for design and installation of electrical panel, motor etc., electronics engineering expert for SCADA and automation part. Similarly, an example of consultancy proposal for preparation of Development Plan can be taken in which expertise from GIS, Drone and DGPS survey, Total Station survey, Town Planning, Regulations, etc. are required. To undertake such type of consultancy works, there shall be a team of experts headed by a Team Leader, who is having overall knowledge and experience of the work to be undertaken. To undertake the consultancy assignment, the Team Leader shall build his work team from professionals in the market/ or retired BMC professionals having requisite knowledge & experience of the desired consultancy work along with external academic

experts, private individual professionals & specialized external agencies as required. Whenever there is shortage of BMC expertise, external consultant in such cases would be drawn.

4. BMC, many times utilizes consultancy services of IIT/ ICT/ VJTI for various project works in different departments. These institutions undertake regular consultancy assignments of various government, public sector as well as private industries. Hence, the information about policy and procedure of undertaking consultancy services from IIT Bombay, Institute of Chemical Technology (ICT) and VJTI was gathered by contacting professors in these institutions. As per the information received, professors working in the institute are allowed to undertake the consultancies in their field of expertise by virtue of their academic qualification and research experience.

   The Procedure adopted for Consultancy Services by the Academic Institutions is as under: The consultancy proposals are either received by the professors directly or by the Dean of the institution, from the organizations. If received by the Dean, same is forwarded to the professor having expertise in the subject field. This professor communicates with the organization and further deal with the consultancy work. The professor appoints research assistant/ projects staff/ external agency needed for the consultancy work to be undertaken. The scope of the work and the fees for the consultancy services are finalized by the concerned professor with the consultancy awarding organization. The professor is responsible for execution and completion of the consultancy work as per the terms and conditions accepted by him. Since the consultancy assignments are of intellectual nature, the institution receives 25% to 33% (depending on the institution) share of consultancy fees for facilitating the consultancy work. The scope of the institution involves providing office space, use of laboratories, equipment, appointment of research assistant, appointment of external agencies, etc.

5. In a similar manner, it should be possible for MCMCR to provide consultancy services to the ULBs including departments of the BMC. As urbanization proceeds and there is more co-operation between private industries and urban local bodies, consultancy services could even be extended to industries whenever such assistance is sought. These could be in the area where MCMCR/ BMC have core competence, such as water/ wastewater treatment, environment, environment pollution, fire services and others. Since MCMCR is primarily charged with the responsibility of working for ULBs, it would be remembered at all times that ULBs are MCMCR's principal clients, and the others are secondary.

6. It is envisaged to utilize expertise of working and retired BMC professionals for providing consultancy services. There are chances that even though in-service & retired BMC employees have qualifications & experience for undertaking consultancy assignments, all of them may not have requisite professional experience/ capabilities to undertake particular consultancy assignments. As such, resources of BMC in terms of in-service & retd. BMC professionals may not be adequate for undertaking all types of consultancy assignments needed by the ULBs. In such a scenario, MCMCR will not be able to respond to all the consultancy requests received from the ULBs and BMC departments. Further, there are certain specialized fields where BMC professionals do not have exposure and expertise for undertaking such consultancy assignments. Hence, in order to undertake any type of consultancy assignment, that the ULBs and BMC departments refers to MCMCR, it would be essential to utilize external resources in addition to BMC resources like expertise from ULBs, State & Central Government, private individual professionals and private professional firms.

7. The basic conception behind preparation of the policy is:
   - *The institute shall facilitate the process of providing consultancy services to ULBs/ BMC departments by understanding their consultancy needs and providing them the services through various resources available.*
   - *The consultancy services are to be taken up on the basis of personal competencies of the professional undertaking the consultancy work.*
   - *The professionals undertaking the consultancy work are expert in the field and their consultancy services shall be remunerated reasonably.*

   It is essential to deliberate the following aspects for establishing the policy.
   - Categorization of consultancy work.
   - Selection and recommendation of consultant for consultancy assignments.
   - Consultancy fees.
   - Role of the MCMCR institution.
   - Role and responsibilities of the Consultant.
   - Role of BMC.

B. Elements of the Consultancy Policy:

1. Categorization of consultancy work and consultant database:

There are various types of works executed in the ULBs and different departments of BMC for which consultancy services are availed. On the basis of enquiries from ULBs and with the help of HoDs in BMC, the works where consultancy services are hired and also the resources capable of undertaking the consultancy work will be identified. Based on the qualifications, experiences & capabilities of the retired and in-service BMC professionals, the list of such professionals along with their fields of expertise will be prepared. This database will be periodically updated and will be referred for recommending them as a consultant to the ULBs/ BMC departments for a particular consultancy assignment.

The consultancy works shall be classified based on the expertise and input level required. This will help to understand the requirement of inputs for these consultancy works from retired BMC professionals, in-service BMC professionals, professionals from the academic institutes, expertise from ULBs, State & Central Government, private individual professional, private professional firms. The works requiring individual input and collective inputs can also be identified separately. Critical and large-scale projects may be taken up at later stage.

2. Selection and recommendation of the consultant for consultancy assignments:

As observed in IIT, ICT & VJTI the professors working in these institutes are considered eligible for undertaking consultancy work by virtue of their position, academic qualification and research experience. However, BMC professionals cannot be conferred with such prerogative by virtue of their designation, qualification or years of experience in the department. The major difference in the professors working in above mentioned Institutions and professionals working in BMC is that the professor in these Institutions continuously works in same field with regular updating of knowledge by research, whereas BMC professionals gets transferred periodically. Still there are BMC professionals who have acquired higher academic qualifications as well as have gained expertise in their field of work. Therefore, it is necessary to ensure explicit experience of the consultancy work to be undertaken and capabilities to handle the project by the selected professional or group of professionals. This can only be assured after having details of the consultancy assignment vis-a-vis qualification and experience of the professional opting for the consultancy work. The retired BMC professional may involve capable in-service BMC professionals in the consultancy assignment to be undertaken.

The consultant for MCMCR can be retired BMC professional/ in-service BMC professional/ expertise from ULBs, State & Central Government/ private individual professional/ private professional firm. The consultant can be a professional in capacity of Team Leader with involvement of other professionals, academic experts, external agencies. Since MCMCR's consultant would be out of any one of these categories, hereafter they will be referred as 'Consultant' in this Policy. Only in case of consultancy services to be provided to BMC, the in-service BMC Professional will be excluded from this term 'Consultant'.

The procedure for selection and recommendation of Consultant to the ULBs/ BMC departments is proposed as under:

- The selection of the Consultants will be done by MCMCR from the available database and recommendations of the concern department.
- MCMCR shall call for consultancy proposals for particular consultancy assignment from selected Consultants and scrutinize the proposals received with respect to the scope and requirements of the work.
- The name of competent Consultant will be recommended to the ULBs/ HoDs of BMC for undertaking the consultancies for the particular work.
- In case of more than one application is received, the most suitable Consultant will be recommended. A committee may be constituted involving retired/ working senior professional in the field and Director, MCMCR for recommending the names to the ULBs/ HoDs of BMC.
- While selection and recommendation of the Consultant, weightage shall be given to their technical competency, similar experience, availability for the project duration and capability to undertake consultancy assignment.
- The limit for assigning the maximum number of consultancy assignments to a particular Consultant at a time will be decided by MCMCR, considering the demand of consultancy assignments and availability of resources for the same.
- The MCMCR shall recommend the Consultant to the ULBs/ HoDs of BMC departments for all further correspondence.
- The Consultant shall communicate with the ULBs/ HoDs of BMC departments and shall finalize the scope of work, consultancy fees, terms and conditions of the work, etc. and intimate MCMCR for approval with all the details.

- The MCMCR shall then submit the proposal of Consultant to the ULBs/ HoDs of BMC departments.
- On acceptance of the proposal by the ULB/ BMC department, the Consultant shall sign the tri-party agreement with the concerned ULB / BMC department and MCMCR.
- After award of the consultancy work by the concerned ULB/ BMC Dept., the Consultant will execute the work independently, which will be reviewed periodically by the MCMCR.

3. Consultancy Fees and its sharing:

From the ongoing consultancy works in the different departments of BMC, it is observed that normally the consultancy charges for design category work are around 2% and for project management consultancy (PMC) work are around 3% of the estimated project cost. These percentages may vary as per the scope and scale of the project. Also, there are lumpsum consultancy fees structures for small scale works and design vetting activities.

- Similar to the prevailing practices in IIT, ICT & VJTI the MCMCR shall have stake of 20% in the consultancy fees for intellectual consultancies for facilitating consultancy services by selection of professionals, providing office space, admin services, BMC data as available, etc.
- However, it is expected that in addition to pure intellectual consultancies, MCMCR has to deal with the consultancy assignments which will be having contractual work component, involvement of external agencies/ expertise, etc. Hence in such cases to make the offers competitive, the share of MCMCR is proposed as per the following table.

Sr. No.	% Expenditure on External Agencies on Total Project Cost	% Share of MCMCR on Total Project Cost	% of Total Project Cost in which Team Leader has to complete entire work
	A	B	C
1	up to 20%	20%	C = 100% – B
2	20% to 40%	15%	
3	40% to 60%	10%	
4	60% to 80%	5%	

a) All the consultancy fees due for the project shall be received by MCMCR and shall be later transferred to beneficiary accounts as per the terms and conditions finalized with Consultant.

b) Whenever in-service BMC Professionals are working exclusively on consultancy services provided to the ULBs, then amount equal to their salaries shall be repaid to the BMC by MCMCR from the fee's receivable from ULBs.

4. Role of the MCMCR:

MCMCR shall perform following activities for undertaking consultancy assignments:

a. Identification and Classification of consultancy subjects for the ULBs and BMC department in consultation with HoDs.
b. Selection and recommendation of the Consultant for the consultancy assignment by scrutinizing the proposals.
c. Appointing qualified, experienced & capable Consultant for undertaking consultancy assignments from the ULBs/ BMC departments.
d. Engaging other government/ private professional institutes/ external agencies in the consultancy assignments as per the requirement of the work & request by the Consultant.
e. Making available BMC related data required for the consultancy work to the Consultant, (e.g. reports, draft tender, master plans etc.) as per the availability.
f. Providing space for office activities, meetings, presentation etc. to the Consultant and department representatives.
g. Making available library/ laboratory facilities to the Consultant, as per the availability.
h. Review of the submission/ recommendations of the consultants through Peer Review process for quality control and improvement, if required.
i. Periodic review of the consultancy work.
j. Intervention and correspondence with the ULB / BMC department in case of any major delay or variation in the contracts.
k. To take appropriate action against the non-performing/ unsatisfactory performance of the Consultant, including termination.
l. Approve replacement of Professional/ agency in case of any unavoidable conditions.
m. The payments shall be transferred to the Consultant only after receipt of the same from the ULB/ BMC department and settlement of the account.

5. Role and responsibilities of the Consultant:

Since a consultancy work gets awarded on the basis of knowledge and specific expertise of the Consultant, it is the responsibility of the Consultant to undertake and complete the consultancy work awarded with proficiency and integrity. The Consultant shall fulfill all

the required activities for successful completion of the task undertaken which shall not be limited to the following.

a. Consultant shall comprehensively understand the scope of the work and satisfy himself regarding the competency required for execution of the work before applying for the assignment.

b. While applying to MCMCR for a consultancy, details of his or her academic credentials, professional qualification and requisite expertise that fulfil the requirements of the consultancy work shall be provided.

c. Consultant shall communicate and discuss in detail with concerned ULB/ department of BMC and understand the TOR of the work, payment terms, time schedule, etc. and submit his/her readiness to undertake the consultancy work for the MCMCR.

d. Consultant shall submit the proposal to MCMCR incorporating requirement about engagement of other professionals/ academic experts/ institutions/ external agencies, etc. for the consultancy assignment along with his or her detailed scope of involvement, payment details, etc.

e. Consultant shall sign the tri-party agreement with ULB/ BMC department and MCMCR and shall execute the consultancy work awarded with honesty, proficiency and integrity and complete the work successfully as per the terms and conditions finalized.

f. Consultant shall inform progress of the work to MCMCR periodically & point out any variations/ delay from either side of the contract, if any.

g. Consultant shall submit the details of expenses made towards the consultancy project periodically to MCMCR.

h. Consultant shall submit copy of all the consultancy reports (interim/final) to the MCMCR for record.

i. Consultant shall be responsible for the designs and related decisions being expert in the field.

j. Consultant shall bear all the expenses towards the project and shall ensure that the same are included in the consultancy fees/ charges before submitting the proposal.

k. The Consultant shall receive payments from MCMCR only after receipt of the same from the ULB/ BMC department and settlement of the account.

6. Role of the BMC:

It is important to enhance the competencies of the BMC Professionals to cater the desired consultancy services to ULB's and BMC departments.

- To develop consultancy skills of the BMC employees, it is proposed to allow deserving in-service BMC employees to work under the guidance of the experienced retired BMC professionals so that they can acquire relevant consultancy work experience. This will certainly enhance competencies of the BMC professionals and quality resources shall be available for the consultancy cell at MCMCR which can be utilized for BMC projects as well.
- It is to point out that, Director (E.S. & P.) has already directed HODs in the meeting held on 28.01.2020 to identify the projects from each engineering departments as well as to identify retired BMC professionals capable of offering consultancy services. It was also envisaged to identify meritorious and dedicated engineering staff capable of developing as future consultants and provide them required training from institutions like IITs and project exposure by arranging field visits to prestigious projects in India and abroad. BMC shall proceed further on these lines.
- The MCMCR is established with the major objective of capacity building of the ULBs in Maharashtra for which the major resources are anticipated from BMC. The BMC shall allow their in-service professionals to work on the actual consultancy assignments to satisfy the consultancy requirements of ULBs/ BMC departments. Such experienced and competent resources will be available to BMC for their in-house projects. It is proposed to utilize the provisions of MSR Rule Nos.61 & 62 for allowing MCGM in-service professionals to work on consultancy assignments.
- If the retired municipal employees wish to undertake consultancy assignment with MCMCR within two years from their date of their retirement, they can do so with the approval of the Hon. M.C., MCGM, as per Rule No.87 of the Pension Rules, 1953.
- The consultancy policy of MCMCR shall be adopted by all the departments of BMC for hiring consultancy services. BMC departments shall first communicate their consultancy requirements to MCMCR. If MCMCR is not in a position to provide consultancy services for particular assignment, then only BMC departments shall approach private/ external consultant.

C. Flowchart:

A procedural flow chart for undertaking Consultancy Services by MCMCR for ULBs/ BMC departments is given below:

- Identification of consultancy subjects from ULBs/ BMC departments by MCMCR.
- Identification of consultant such as retired BMC professionals, in-service BMC professionals, expertise from ULBs, State & Central Government, private individual professionals, and private professional firms by MCMCR and to prepare a database.
- Enquiry/Receipt of request from the ULBs/ BMC department for the particular consultancy assignment to MCMCR.
- To communicate with the concern department of BMC for recommending the professional for a particular consultancy assignment.
- Selection of Consultant by MCMCR from the available database and recommendations of the concern department:
  - Selection criteria - Weightage to the technical competency, similar experience, and availability for the project duration and capability to undertake consultancy assignment.
  - In case of more than one proposal are received, the most suitable Consultant will be recommended. A committee may be constituted involving retired/ working senior professional in the field and Director, MCMCR for recommending the names to the ULBs/ HoDs of BMC.
  - The limit for assigning the maximum number of consultancy assignments to a particular Consultant at a time will be decided by MCMCR, considering the demand of consultancy assignments and availability of resources for the same.
- Recommendation of the selected Consultant by the MCMCR to ULBs/ BMC department.
- Consultant to approach the concern ULB/ BMC department for finalizing the proposal.
- Consultant to submit the detailed proposal along with the engagement of other professionals/ academic experts/ institutions/ external agencies, etc. and their detailed scope of involvement, consultancy fees, etc. to MCMCR for approval.
- MCMCR to scrutinize & approve the consultancy proposal and communicate the acceptance to the ULB/ BMC department.

- ULB/ BMC department to place Work Order to MCMCR and MCMCR to communicate the same to the Consultant along with T&C of MCMCR.
- Consultant to execute tri-party agreement with concern ULB/ BMC department and MCMCR.
- Execution of the project by the Consultant in coordination with concern ULB/ BMC department with periodic reporting to MCMCR.
- Submission of the interim/ final consultancy reports to MCMCR by the Consultant for peer review, before submission of the same to ULB/ BMC department.
- Periodic review of the consultancy work by MCMCR & resolution of issues, if any.
- Receipt of the payment to MCMCR by the ULB/ BMC department and transfer of the same to the Consultant as per T&C (Advance/Running Bill /Final Bill).
- Completion of the work by the Consultant and submission of the report to the ULB/ BMC department with copy to MCMCR.
- Confirmation of the successful completion of the project from ULB/ BMC department by MCMCR and settlement of final accounts with ULB/ BMC department as well as Consultant.
- Data updating & preservation of all the records/ reports of the project in safe custody/ library by the MCMCR.

Sd/-
(Dr. Ramanath Jha)
Director General, MCMCR

Sd/-
(Dr. I. S. Chahal)
Hon. Municipal Commissioner, BMC and President, Governing Body, MCMCR

Centralised GIS Facility

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