Formulation of GIS based Master Plans for Small and Medium Towns

Design and Standards for Application of Drone/ UAV Technology

Town & Country Planning Organisation
Ministry of Housing and Urban Affairs
Government of India

October, 2020

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Department of Science and Technology
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ACRONYMS

2D	Two Dimensional
3D	Three Dimensional
AGL	Above Ground Level
AI	Artificial Intelligence
AIP	Aeronautical Information Publication
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AoI	Area of Interest
ASPRS	American Society for Photogrammetry and Remote Sensing
ATM	Automated Teller Machine
BRTS	Bus Rapid Transit System
BVLOS	Beyond the Visual Line of Sight
CAR	Civil Aviation Requirements
CI	Confidence of Interval
CNG	Compressed Natural Gas
cm	Centimeter
DEM	Digital Elevation Model
DSM	Digital Surface Model
DTM	Digital Terrain Model
DGCA	Directorate General of Civil Aviation
FDI	Foreign Direct Investment
GCP	Ground Control Point
GIS	Geographic Information System
GML	Geography Markup Language
GSD	Ground Sample Distance
GSR	General Statutory Orders
GNSS	Global Navigation Satellite System
IMU	Inertial Measurement Unit
IMW	International Map of the World
IT	Information Technology
ITES	Information Technology Enabled Service
LAC	Line of Actual Control
LIDAR	Light Detection and Ranging
LISS	Linear Imaging Self Scanner
LoC	Line of Control
LPG	Liquefied Petroleum Gas
MHA	Ministry of Home Affairs
MoD	Ministry of Defense
MoHUA	Ministry of Housing and Urban Affairs
MoM	Minutes of Meeting
MSL	Mean Sea Level
NUIS	National Urban Information System
NSSDA	National Standard for Spatial Data Accuracy
NVA	Non-Vegetated Vertical Accuracy
OLS	Obstacle Limitation Surfaces

ORI	Ortho-Rectified Imagery
PPK	Post Processed Kinematic
PANS-OPS	Procedure for Air Navigation Services-Aircraft Operations
RGBI	Red Green Blue Intensity
RMSE	Root Mean Square Error
RoW	Right of Way
RPAS	Remotely Piloted Aircraft System
SDMS	Spatial Data Model Structure
SoI	Survey of India
Sq. Km	Square Kilometer
SEZ	Special Economic Zone
TCPO	Town & Country Planning Organisation
TOR	Terms of Reference
TSA	Temporary Segregated Area
TRA	Temporary Reserved Area
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
ULB	Urban Local Body
URDPFI	Urban and Regional Development Plans Formulation and Implementation
UTM	Universal Transverse Mercator
VLOS	Visual Line of Sight
VTOL	Vertical Take-off and Landing
VVA	Vegetated Vertical Accuracy
WGS	World Geodetic System

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1. INTRODUCTION

1.1 Authority

The Ministry of Housing and Urban Affairs (MoHUA) has realized that since small and medium towns have limited extent, therefore to explore the accurate and cost effective technologies such as Drone/ Unmanned Aerial Vehicle (UAV); a 'Committee for Framing Design and Standards for Application of Drone/ UAV Technology for Formulation of GIS (Geographic Information System) based Master Plans for Small and Medium Towns' has been constituted under the Chairmanship of Surveyor General of India vide order no. K-14031/5/2016-AMRUT(CB)-Part(2) dated 26th September 2018 (Annexure- 1). In this endeavor, an Authoring Committee was constituted by Surveyor General of India vide letter no. T-501/1147-Project (UAV)/Coll.3 dated 12 Nov 2018 (Annexure-2) to prepare document for 'Design and Standards for Application of Drone/ UAV Technology for Formulation of GIS based Master Plans for Small and Medium Towns'. The approval of the document by the Chairman of the 'Committee for Framing Design and Standards for Application of Drone/ UAV Technology for Formulation of GIS based Master Plans for Small and Medium Towns' and MoHUA is at Annexure- 3A and Annexure- 3B respectively.

1.2 Brief on Committee Proceedings

In pursuance of broad Terms of Reference (TOR), a series of meetings were held in Town and Country Planning Organisation (TCPO) by the Authoring Committee during which discussions were held and presentations made to assess the exact requirements, firm up detailed scope, finalize the Design and Standards as per the requirements for master plan formulation. The data and experience from ongoing pilot survey using non-PPK and PPK (Post Processed Kinematic) drones by Survey of India (SoI) were also taken into account by the committee while framing the Design and Standards.

1.3 Scope of Document

It was agreed by the Authoring Committee that the detailed scope of document shall include the requirements for master plan formulation in view of possibilities available with technological advancements, positional accuracy standards in conformity with latest international standards for geospatial data and requirements of plan formulation, statutory requirements for compliance to Directorate General of Civil Aviation (DGCA) guidelines, critical design parameters to be adopted at various stages of survey to achieve the desired accuracy standards, Spatial Data Model Structure (SDMS) in conformity with SoI SDMS and those already adopted in the Sub-Scheme on 'Formulation of GIS based Master Plans for AMRUT (Atal Mission for

Rejuvenation and Urban Transformation) cities', limitations/ constraints of the document and the need for periodical review and update, future trends, etc.

1.4 Structure and Format

The details of requirements for Master Plan formulation, statutory requirements for compliance to DGCA guidelines, critical design parameters, Spatial Data Model Structure (SDMS), limitations/ constraints, future trends have been organized in the main body of the document in separate sections. The supporting documents have been attached as annexures to this document.

2. REQUIREMENTS FOR MASTER PLAN FORMULATION

2.1 Urban Growth and Demographic Profile

In 2011, India accounted for 11 per cent of the world's urban population; the United Nations projects it to be 15 per cent by 2030. The number of cities/ towns in India has increased from 5,161 in 2001 to 7,933 in 2011 comprising 4,041 statutory towns and 3,892 census towns, which accommodates around 376.40 million urban populations. These Urban settlements of the country have experienced relatively high rapid growth and percentage of urban population has increased more than double i.e. from 14 per cent at the time of Independence to 31.8 per cent in 2011 (Census of India). The urban population is estimated to increase more than 50 per cent by 2051. Such huge population growth will be accommodated in small and medium towns. As such these small and medium towns have been witnessing very high population growth since 2001. The share of urban population of Class I cities to total urban population has dropped from 68.61 per cent in 2001 to 60.35 per cent in 2011 while the share of urban population of small and medium towns to total urban population has scaled up from 31.39 per cent in 2001 to 39.65 per cent in 2011.

Besides, small and medium towns have been continually experiencing increase in share of employment and contribution to urban economy at much faster rate. In terms of population, the Class I cities account for 60.35 per cent of the total urban population whereas Class II, III, IV, V and VI towns account for 11.0 per cent, 15.5 per cent, 8.5 per cent, 4.2 per cent and 0.5 per cent respectively. Within the Class I category, 1-10 lakh population cities account for 29.71 per cent of the total urban population and cities with more than 10 lakh population account for 30.64 per cent of the total urban population as per Census 2011. The average decadal growth rate of population 2001-2011 is 31.6 per cent, whereas Class II to Class VI (small and medium towns) have registered very high growth rate ranging from 48.6 per cent to 185.7 per cent and needs focused planning interventions.

The class wise distribution of towns/ cities and population as per census 2001 and 2011 is as under:-

Table 1: Class-wise Distribution of Towns/ Cities as per Census 2001 and 2011

Sl. No	Class	Population Range	2001 Census		2011 Census		Decadal Pop. Growth Rate (%)
			No. of Towns	Population (millions)	No. of Towns	Population (millions)	2001-2011
1	Class I	1 lakh plus	441	196.3 (68.61%)	505	227.10(60.35%)	15.7
2	Class II	50,000 - 99,999	496	27.8 (9.72%)	605	41.3 (10.97%)	48.6
3	Class III	20,000 - 49,999	1,388	35.2 (12.30%)	1,905	58.2 (15.46%)	65.3
4	Class IV	10,000 -19,999	1,563	19.5 (6.81%)	2,233	31.9 (8.39%)	63.6
5	Class V	5,000 -9,999	1,041	6.7 (2.34%)	2,187	15.9 (4.22%)	137.3
6	Class VI	Below 5,000	232	0.7 (0.24%)	498	2.0 (0.53%)	185.7
	Total		**5,161**	**286.1**	**7,933***	**376.40**	**31.6**

* There were 7933 cities/ towns as per Census 2011, of which 4041 were Statutory Towns, i.e., towns with some form of municipal government. The rest were Census Towns, i.e., those that have been recognized as towns by Census of India on the basis of defined criteria.

A larger portion of the population is living in Class I cities (66.58 per cent), the number of Statutory Towns in small and medium towns is considerably high (Class II – Class VI) and there is a paradigm shift (Class II - 467 to 548, Class III – 1,162 to 1,315, Class IV 1,115 to 1,087, Class V – 502 to 473 and Class VI – 123 to 132) from a smaller class to higher class during 2001 – 2011; which calls for proper planning at a faster pace. The class wise distribution of Statutory towns/ cities and population as per census 2001 and 2011 is as under:-

Table 2: Class-wise Distribution of Statutory Towns/ Cities as per Census 2001 and 2011

	Class	2001			2011		
		No. of Towns	Population	Area (Sq.Km)	No. of Towns	Population	Area (Sq.Km)
1	Class-I	432	17,65,02,368 (66.58%)	2,4425.96	486	21,60,57,957 (68.63%)	29,669.6
2	Class-II	467	3,24,13,389 (12.23%)	9,701.17	548	3,76,17,782 (11.95%)	10,896.3
3	Class-III	1,162	3,55,95,317 (13.43%)	17,170.86	1,315	4,09,90,065 (13.02%)	19,376.4
4	Class-IV	1,115	1,62,78,446 (6.14%)	12,300.71	1,087	1,60,12,818 (5.08%)	11,565.3
5	Class-V	502	39,44,388 (1.48%)	4,346.94	473	37,36,710 (1.18%)	3,935.4
6	Class-VI	123	3,62,612 (0.14%)	550.88	132	3,89,275 (0.13%)	621.5
	Total	**3,801**	**26,50,96,520**	**68,496.52**	**4,041**	**31,48,04,607**	**76,064.5**

2.2 Need for Adoption of Unmanned Aerial System (UAS) Technology for Efficient Urban Planning and Management

Most of the urban settlements in India are characterized by haphazard and unplanned growth, non-conforming land uses, mushrooming unauthorized colonies, and land conversion from agriculture to urban resulting in environmental degradation, encroachments and poor quality of life. Thus as cities become large, the need for city planning and development, governance, tourism, regional development, disaster management, security issues, etc. intensifies and the necessity for updated spatial information to be made available, which can be integrated with socio-economic data for efficient governance. The proper management of urban areas calls for accurate and vital spatial information to be available to city administrators/ managers on a regular basis. This calls for spatial governance, which has been globally accepted as one of the key components in shaping the cities/ towns and regions through policies, plans and strategies.

Master Plan/ Development Plan is a major tool for urban land management, providing detailed land use allocation for the sustainable development of city/town. Master/ development plans are made for 20-year period, in phases of five years for periodic review and revision. Formulation of master plans start with base map preparation, existing land use surveys and collection of socio-economic data necessary for reviewing the existing situation and proposing the future land use plan. With the advances in Remote Sensing and Geographic Information System, the plan formulation process can be expedited with integration of both spatial and attribute data, which enables detailed assessment of spatial growth of towns/ cities, land use status, physical infrastructure facilities, etc. in anticipation of the projected population growth.

The momentum in master plan approach was generated during the Third Five Year Plan (1961-66) when Central Government provided hundred percent financial assistance to the State Governments to set up town planning departments for preparation of comprehensive master plan for fast growing cities and towns under a legislative framework based on the Model Law formulated by TCPO. Since then, process of Master Plans has picked up and concerted efforts were made for providing appropriate legislative support for formulation, enforcement and implementation of the Master Plans. Further, Ministry of Housing and Urban Affairs/ Town and Country Planning Organization have prepared ‘Urban and Regional Development Plans Formulation and Implementation (URDPFI)’ Guidelines in 2014 for formulating Master/ Development/ Regional plans.

However, the country has not been able to keep pace with the planned urban development. Even after more than 70 years of Independence. Out of 7,933 towns and cities in 2011, there are 2,631 urban settlements have approved master plans in force and 402 master plans are in the process of being formulated. This is as per information obtained from State Town and Country Planning Departments i.e. only 33.16 per cent of towns and cities have master plans/development plan.

The trend of growing urban issues calls for conception and for implementation of a proper plan/scheme for developing an Urban Information System in Towns/ Cities. The pre-requisite for formulation of Master Plan is an accurate and updated Base Map. Development of urban information system/ preparation of base maps using State-of-Art geospatial technologies with latest and efficient methods of data collection will provide updated information and spatial maps of all towns for channelizing future urban growth and attainment of urban sustainable goals in time and cost effective manner.

Most of the investments from Centre and State Governments, FDI, World Bank etc. come to Class I cities, especially to million plus cities. All these cities have Master/ Development Plans and capacity is also available for implementation of various schemes and projects, whereas the majority of small and medium towns neither have the capacity nor funding for formulation of Master/ Development Plans. Thus, in this critical situation the process of Master Plan formulation of Small and Medium Towns becomes more challenging.

These Small and Medium towns are emerging as future hubs of growth, with high consumer expenditure, real estate growth and to some extent, the Information Technology (IT) and Information Technology Enabled Service (ITES) sector has also penetrated into these towns. Therefore, in order to support such growth trends proper city/ town planning and management is very much necessary.

Urban planning, development and management require intense surveys, accurate measurements, change detection and timely implementation. Traditional survey techniques for huge areas for planning required use of large sensors, satellites, lot of manual work, manned aircraft etc. This is where city planners/ managers/ administrators/ tax collectors are finding the potential of Unmanned Aerial Vehicles (UAV) technology to transform planning and management; where the low-cost Drones/UAVs on as and when requirement could provide very detailed, up-to-date geographical information for small areas within limited resources and time frame. The geospatial technologies like Drone/ UAVs along with Geographic Information System (GIS) can provide input for the preparation of base maps, which are pre-requisite for

formulation of Master/ Zonal/ Local Area Plans especially for small and medium towns. Thus, Drone/ UAVs provide a much cheaper alternative to manned flight, and enable applications that were impossible earlier.

2.3 Need for Revision of Existing Design and Standards

Several initiatives have already been taken up by MoHUA/TCPO in utilizing State-of-the Art Technologies for generation of geospatial databases for efficient and speedy planning. The National Urban Information System (NUIS) database was the first National Level High Resolution Data obtained from Cartosat-1 + LISS-IV imagery and aerial photography for preparation of large-scale 1:10,000 and 1:2,000 scale geospatial data for Master Plan formulation.

The NUIS Standards were modified to meet the needs of mapping at 1:4,000 scale data for 'Formulation of GIS based Master/Development Plans for 500 AMRUT Cities'. However, there is a need to further improve the standards for obtaining geospatial data with help of UAS for reasons stated below:

- Due to technological constraints, in NUIS and AMRUT schemes, different standards were adopted to generate spatial data for local, zonal and city level plans which resulted in data inconsistencies. However, technological advancements like UAS/Drone have made it possible to obtain quality geospatial data of high accuracy and better spectral and spatial resolution at low cost and fast turn-around time. Thus, the same data acquired by UAS/Drone, can be used in a vertically seamless integration for Master/ Zonal/ Local as well as Regional Plans. Accordingly, the need has arisen for revising standards.

Table 3: Application of Drone/ UAV Technology at different Planning Levels

Sl.No	Level	Scale	Source of Data
1	Development Plan /Master Plan	1:4,000	Drone/ Aerial Photography
2	Zonal Plan	1:2,000	Drone/ Aerial Photography
3	Local Area Plan	1:1,000	Drone/ Total Station
4	Site Plan	1:500	Drone/ Total Station

- High accuracy in planimetry and height is now possible with use of on-board sensors like LIDAR and high resolution optical sensors, which have necessitated the revision of existing standards and design.
- New outputs like 3D models can now be generated with not much extra effort. There is a need to define standards and design for these products.

2.4 Limitations

a. Unmanned Aerial System (UAS) Technology is quite nascent and evolving at a rapid pace. Sensor technology and Unmanned Aerial Vehicle (UAV) platforms are constantly upgraded and improved. Application of AI/ machine learning in UAS survey operations are emerging. Hence, the Design and Standards cannot be frozen and will need constant updation.

b. Changes/ updation in statutory regulations as per Civil Aviation Requirements (CAR) will also affect the Design and Standards. In general, these regulations have huge impact on the UAS industries towards development of such products that are less bound by these regulations (eg. nano category). As of now, the statutory regulations addresses:
   i. Only basic framework established by CAR 1.0. and CAR 2.0 , is already seeking to develop a sound framework to address challenging frontier issues like 'Beyond the Visual Line of Sight (BVLOS)' and 'Autonomous Operations', which will allow use of medium/ large UAS thereby fostering the UAS capabilities like payload capacity, range, endurance, advancements in sensors etc. for geospatial operations
   ii. New principles of airworthiness, insurance, changes in safety/ security/ privacy norms, real time authentication and traceability, advanced UAS traffic management, Drone Corridors and Dynamic Zones, enabling infrastructures like Drone-ports, night time operations, relaxation in current limit of flying heights (120 m) etc. likely to change licensing, maintenance, operational approvals, selection of UAS and impact the associated geospatial design and standards.

c. Experience gained in varying topographical and demographical profiles likely to firm up the Design and Standards over a period of time.

d. As the Training Programs for Remote Pilots mature, the Design and Standards likely to improve.

Thus Design and Standards specified in this document are intended to be the initial component upon which future work can be built. Due to limitations of existing technology available at the disposal of SoI along with limited experience acquired in the UAS field, it is recommended (while keeping in view the ever-evolving UAS technology) that a mechanism may be formed to periodically review and revise the Design and Standards on a continuous basis to cater to flexible requirements of factors stated above.

3. STANDARDS

3.1 Statistical Assessment of Horizontal and Vertical Accuracies

Horizontal accuracy is to be assessed using Root-Mean-Square-Error (RMSE) statistics in the horizontal plane, i.e., RMSEx, RMSEy and RMSEr. Vertical accuracy is to be assessed in the 'z' dimension only for absolute and relative vertical accuracy using RMSEz for Non-Vegetated Area (NVA) and using 'Z' percentile statistics for Vegetated Area (VVA). Elevation data sets shall also be assessed for horizontal accuracy where possible, as outlined below:

- **Elevation data from UAS fitted with optical sensor:** For, the elevation data derived from photographs obtained from optical sensors fitted on UAS, the horizontal accuracy equates to the horizontal accuracy class that would apply to planimetric data or digital Ortho Rectified Imagery (ORI) produced from the same source imagery.
- **Elevation data from UAV fitted with LIDAR:** Horizontal error in LIDAR derived elevation data is largely a function of positional error as derived from the Global Navigation Satellite System (GNSS), altitude (angular orientation) error (as derived from the Inertial Measurement Unit (IMU) and flying altitude. Generally, the horizontal accuracy achievable for DEM data is more than (approx. 1.5 times) its vertical accuracy.

With the exception of vertical data in vegetated terrain, error thresholds stated in this standard are presented in terms of the acceptable RMSE value. Corresponding estimates of accuracy at the 95 per cent confidence level values are computed using National Standards for Spatial Data Accuracy (NSSDA) methodologies according to American Society for Photogrammetry and Remote Sensing (ASPRS) Positional Accuracy Standards for Geospatial Data, 2014.

3.2 Assumptions Regarding Systematic Errors and Acceptable Mean Error

With the exception of vertical data in vegetated terrain, the assessment methods outlined in this standard, and in particular those related to computing 95 per cent confidence level estimates, assume that the data set errors are normally distributed and that any significant systematic errors or biases have been removed. It is the responsibility of the data provider to test and verify that the data meet those requirements including an evaluation of statistical parameters such as the kurtosis, skew, and mean error, as well as removal of systematic errors or biases in order to achieve an acceptable mean error prior to delivery.

The exact specification of an acceptable value for mean error may vary by project and should be negotiated between the data provider and the client. As a general rule, these standards recommend that the mean error be less than 25 per cent of the specified RMSE value for the project. If a larger mean error is negotiated as acceptable, this should be documented in the metadata. In any case, mean errors that are greater than 25 per cent of the target RMSE, whether identified pre-delivery or post-delivery, should be investigated to determine the cause of the error and to determine what actions, if any, should be taken. These findings should be clearly documented in the metadata.

Where RMSE testing is performed, discrepancies between the x, y, or z coordinates of the ground point check survey and the data set that exceed three times the specified RMSE error threshold shall be interpreted as 'blunders' and should be investigated and either corrected or explained before the data is considered to meet this standard. Blunder may not be discarded without proper investigation and explanation in the metadata.

3.3 Horizontal Accuracy Standards for Geospatial Data

Table below specifies the primary horizontal accuracy standards for digital data (including digital ortho-imagery, digital planimetric data, and scaled planimetric maps) that will be generated for formulation of Master Plans and Local Area Plans. This standard defines horizontal accuracy classes in terms of their RMSEx and RMSEy values.

Table 4: Horizontal Accuracy Standards for Geospatial Data

Horizontal Accuracy class (cm)	**Absolute Accuracy**			**Ortho-Imagery Mosaic seamline mismatch(cm)**
	RMSEx and RMSEy (cm)	RMSEr (cm)	Horizontal Accuracy at 95% CI (cm)	
X	<= X	<=1.414* X	<=2.448*X	<=2*X
5	5	7.07	12.24	10
10	10	14.14	24.48	20
15	15	21.21	36.72	30
20	20	28.28	48.96	40
25	25	35.35	61.20	50

3.4 Vertical Accuracy Standards for Geospatial Data

The table below shows the vertical accuracy standards (absolute and relative) for digital data (such as Digital Terrain Model (DTM)/ Digital Elevation Model (DEM)/ Digital Surface Model (DSM)) that will be generated using digital data acquired via UAS for formulation of Master Plans and Local Area Plans:

Table 5: Vertical Accuracy Standards for Geospatial Data

Vertical Accuracy class	Absolute Accuracy			Relative Accuracy (cm)
	RMSEz, Non-Vegetated (cm)	NVA at 95% CI (cm)	VVA at 95th percentile (cm)	
Z-cm	<= Z	<=1.96* Z	<=3.00*Z	<=0.60*Z
5	5	9.8	15	3
10	10	19.6	30	6
15	15	29.4	45	9
20	20	39.2	60	12
25	25	49	75	15
50	50	98	150	30

For vertical accuracy testing, different methods are used in non-vegetated terrain (where errors typically follow a normal distribution suitable for RMSE statistical analyses) and vegetated terrain (where errors do not necessarily follow a normal distribution). When errors cannot be represented by a normal distribution, the 95^{th} percentile value more fairly estimates accuracy at a 95 per cent confidence level. For these reasons vertical accuracy is to be assessed using RMSE statistics in non-vegetated terrain and 95^{th} percentile statistics in vegetated terrain. Relative accuracy assessment characterizes the internal geometric quality of an elevation data set without regard to surveyed ground control.

Low Confidence Areas for Elevation Data

If the Vegetated Vertical Accuracy (VVA) standard cannot be met, low confidence area polygons shall be developed and explained in the metadata. For elevation data derived from optical sensors, the low confidence areas would include vegetated areas where the ground is not visible. For elevation data derived from LIDAR, the low confidence areas would include dense cornfields, mangrove or similar impenetrable vegetation. The low confidence area polygons are the digital equivalent to using dashed contours in past standards and practice.

3.5 Accuracy Requirements for Ground Control Used for UAS survey

Ground control points used for UAS survey should have higher accuracy than the expected accuracy of derived products according to the following two categories:

a. Accuracy of ground control designed for planimetric data (ORI and/ or digital planimetric map) production only:

$RMSE_X$ or $RMSE_Y$ = 1/4 * $RMSE_X$ (Map) or $RMSE_Y$ (Map),

$RMSE_Z$ = 1/2 *$RMSE_X$ (Map) or $RMSE_Y$ (Map)

b. Accuracy of ground control designed for elevation data, or planimetric data and elevation data production

RMSEx, RMSEy or RMSEz = 1/4 * RMSEx (Map), RMSEy (Map) or RMSEz (DEM)

3.6 Reporting

Horizontal and vertical accuracies shall be reported in terms of compliance with the RMSE thresholds and other quality and accuracy criteria outlined in this standard. In addition to the reporting stated below, additional reporting statements stating the estimated accuracy at a 95 per cent confidence level may be given.

If testing is performed, accuracy statements should specify that the data are "tested to meet" the stated accuracy.

If testing is not performed, accuracy statements should specify that the data are "produced to meet" the stated accuracy. The "produced to meet" method is appropriate for mature or established technologies where established procedures for project design, quality control and the evaluation of relative and absolute accuracies compared to ground control have been shown to produce repeatable and reliable results.

Since UAS technology is still evolving, "produced to meet….." should be avoided till sufficient experience is obtained from the statistical analysis of data from various projects in varying terrain/ weather/ flight conditions for optimizing the check point requirements.

3.7 Spatial Reference Frame

a. Horizontal Reference frame
   - Datum : WGS84
   - Projection : UTM

b. Vertical Reference Frame
   - Datum : WGS84

   Ellipsoidal height shall be converted into Mean Sea Level (MSL) Height with help of Geoid Model of Area of Interest (AoI).

3.8 Numbering System for Hard Copy

The international numbering system (i.e. International Map of the World (IMW)) shall be followed for hard copy prints of the map at various scales.

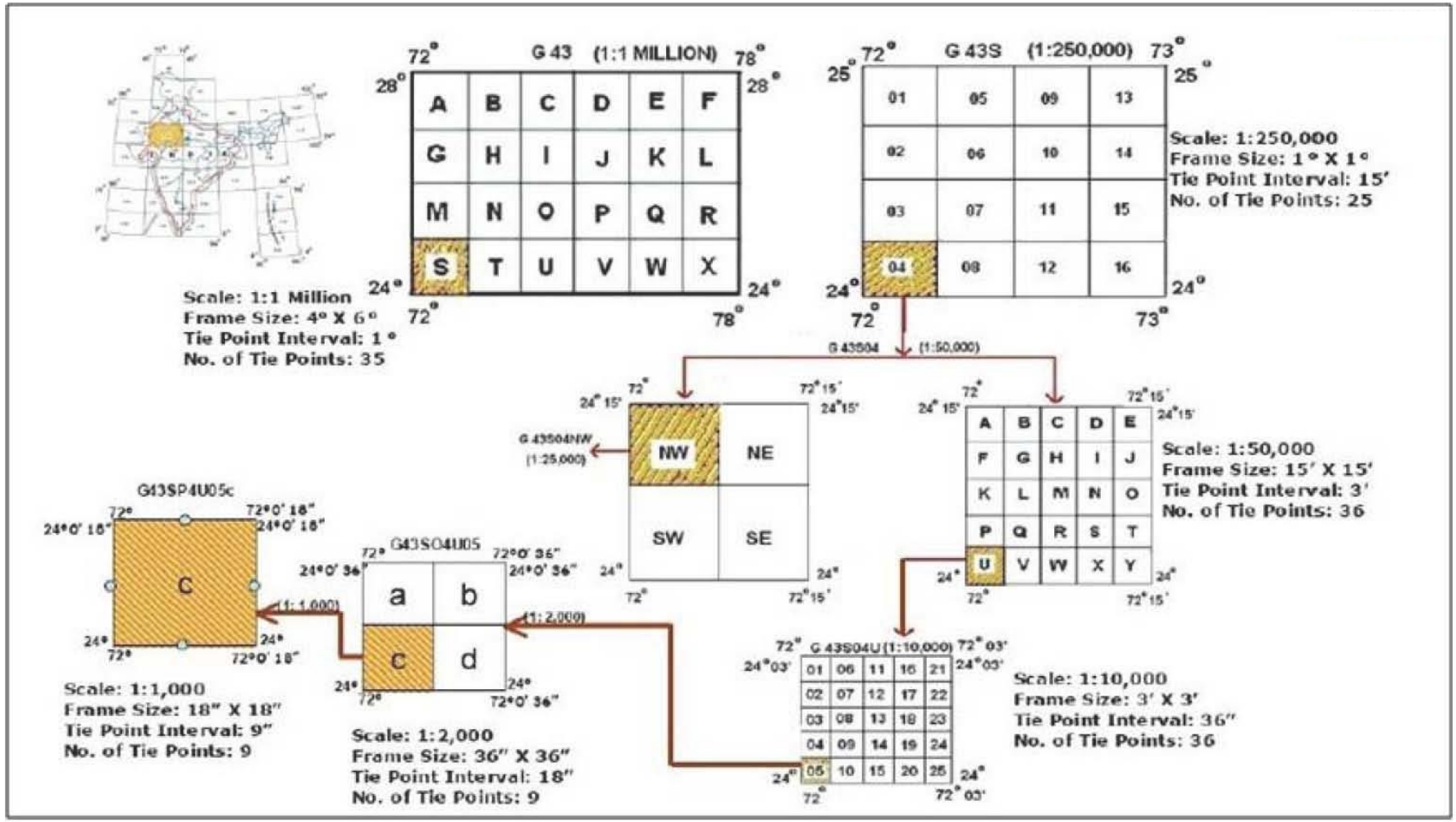


Figure 1: International Numbering System

4. DESIGN

Design parameters are recommended based on literature available in open domain and experiences of SoI while carrying out few pilot projects using UAS.

4.1 Flying Parameters from Technical Considerations

Ground Sample Distance (GSD), image overlaps, flying height, velocity, camera parameters are some of the key design parameters required for achieving the desired standards and quality of output. With use of suitable mission planning based on above key design parameters the most appropriate template/ pattern flight path, waypoints etc. are planned to achieve the objectives of the mission. Factors including type of terrain, object types of outputs desire, UAV type, battery life etc. Some of the guiding factors/ best practices to be adopted for deciding the Flying Parameters are given below:

a. UAV Specifications
   i. Recommendation on UAV Specifications that shall be utilized for maximum output and control.
   ii. Fixed wing UAV with Vertical Take-off and Landing (VTOL) - for better flight area coverage along with better control over during landing and take off operation.
   iii. On board GPS of UAV should be capable of PPK to enable direct sensor orientation leading to drastic reduction in GCP control.
   iv. Parachute landing to prevent damage in case of mid-flight failure.
   v. Gimbal system in UAVs for stable mounting of sensor for image capturing.

b. Payload/sensor

Following are the recommendations on type of payload/ sensors that can be utilized for better quality of data. Payload weight is one of the key factors affecting the cost of entire UAS. Heavier payload will require higher end UAVs capable of generating optimum thrust to lift and control the payload for proper data acquisition.

   i. Single Red-Green-Blue (RGB) sensors can be utilized for ORI generation and can be easily mounted on less costly UAVs.
   ii. Multiple sensors, like LIDAR and multi-spectral optical sensor (RGBI), would be desirable to leverage the benefits of photogrammetry and LIDAR technologies especially for areas where high quality DTM is required.
   iii. Multiple cameras (1 Nadir + 4 oblique) for photo realistic 3-D textured model.

c. Flight Plan

Flight plan should be formulated keeping in view the desired project accuracy and output to be generated.

i. Planned Ground Sample Distance (GSD) should be less than or equal to the desired accuracy in RMSE terms.
ii. Height above ground level should, as far as possible, be kept nearly constant for entire project area in order to maintain uniform Ground Sample Distance and Overlap Area.
iii. For 3D data (DSM/ DEM) should be made use of during mission planning in areas of varying terrain, high buildings. Mission planning software should have "terrain awareness" functionality for planning in areas with height fluctuations.
iv. The pitch of the camera should be oriented so that majority of image frames are filled with objects to be reconstructed and objects not to be reconstructed fall in the minority image frame.
v. For water bodies like rivers, lakes, ponds etc. the flight should be planned in such a way that all the photographs contain land features (desirably not less than 30 per cent).
vi. Flight Pattern, number of Flight Paths, overlaps should be planned considering the terrain type, height variation, type of object and output desired. This aspect is discussed in detail in next sub-section (i.e. 4.2).
vii. Start point should normally be planned at the highest point in the project area to ensure overlap does not fall below the designed requirement.
viii. UAS survey should be planned during daylight only (between sunrise and sunset).
ix. Project area should be planned keeping visual line of sight with a minimum ground visibility of 5 km and cloud ceiling not less than 1500 feet (450 m).
x. Project area should take into consideration the endurance of the UAV used.
xi. Refer section 4.3 for statutory requirements to be followed UAV flight.

4.2 Flying Pattern and Overlaps

The objective of current UAS survey is to prepare GIS based master plans for small and medium towns. Considering the mission objective, the flight patterns of interest are given below:

a. Grid pattern

This pattern should be adopted for relatively flat surface and is the most general case. Minimum frontal overlap of 75 per cent and side overlap of 60 per cent should be generally adopted. For forest and dense vegetation areas and flat terrain with agricultural fields, the minimum frontal and

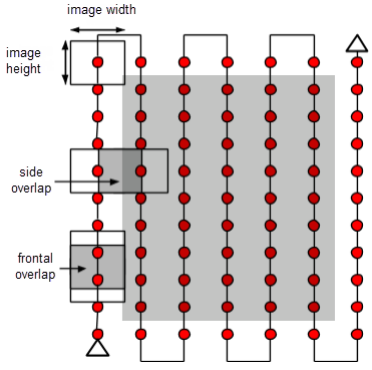


Figure 2: Grid Pattern

side overlaps should be increased to 85 per cent and 70 per cent respectively. The main outputs of interest are 2D outputs viz DSM, ORI etc.

b. Double grid pattern

This pattern should be adopted for very densely built up areas where there are great fluctuations of height. It ensures that images are taken from multiple sides, with the overlap required for optimal processing. Minimum frontal overlap of 75 per cent and side overlap of 60 per cent should be generally adopted. Apart from 2D outputs viz DSM/ ORI, the 3D model outputs (point cloud, mesh) are main outputs of interest.

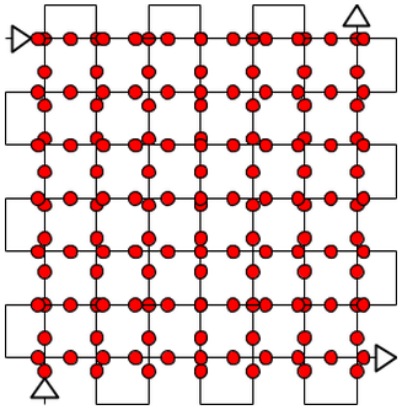


Figure 3: Double Grid Pattern

c. Polygon pattern

This pattern should be adopted for environments that require flexible boundaries for flying or with a complex mapping shape.

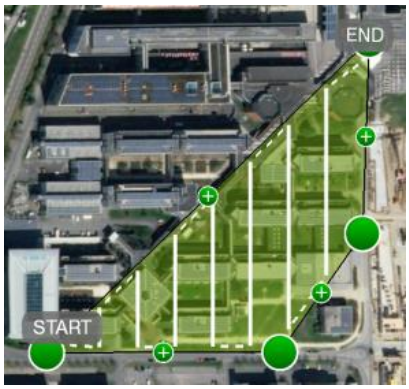


Figure 4: Polygon Pattern

d. Circular pattern

This pattern should be adopted for 3D reconstruction of isolated objects (eg specific tower, statue, and pylon) that are tall and slender requires a specific image acquisition plan. If the output of interest is a 2D object, this pattern is not required.

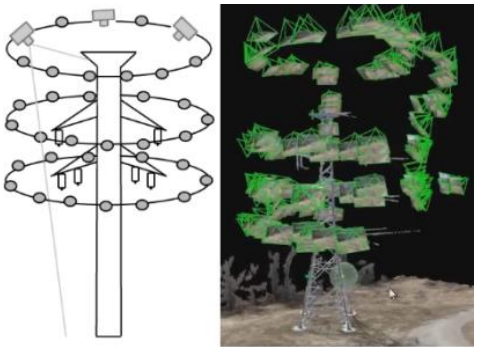


Figure 5: Circular Pattern

4.3 Flying Parameters from Statutory Considerations (Refer Section 5.)

Flying height shall not exceed 120 meters AGL for micro, small, medium and large UAS, as per existing DGCA Regulations.

Flight mission should be planned for daytime (between sunrise and sunset) and Visual Line of Sight (VLOS) only. The minimum ground visibility under visual meteorological conditions has been stipulated as 5 kms.

a. No Remotely Piloted Aircraft (RPA) shall be flown in restricted airspaces as notified in Civil Aviation Requirments1.0 (CAR 1.0) and given below:
   i. Within a distance of 5 kms from the perimeter of airports at Mumbai, Delhi, Chennai, Kolkata, Bengaluru and Hyderabad;
   ii. Within a distance of 3 kms from the perimeter of any civil, private or defence airports, other than those mentioned in point no. "i" above.
   iii. Above the Obstacle Limitation Surfaces (OLS) or PANS-OPS surfaces, whichever is lower, of an operational aerodrome, specified in Ministry of Civil Aviation (Height Restrictions for Safeguarding of Aircraft Operations) Rules, 2015 notified through Gazette of India notification GSR751(E) as amended from time to time;
   iv. Within permanent or temporary Prohibited, Restricted and Danger Areas including Temporary Reserved Area (TRA) and Temporary Segregated Area (TSA), as notified in Aeronautical Information Publication (AIP);
   v. Within 25 kms from international border which includes Line of Control (LoC), Line of Actual Control (LAC) and Actual Ground Position Line (AGPL);
   vi. Beyond 500 m (horizontal) into sea from coast line provided the location of ground station is on fixed platform over land;
   vii. Within 3 kms from perimeter of military installations/ facilities/ where military activities/ exercises are being carried out unless clearance is obtained from the local military installation/facility;
   viii. Within 5 kms radius from Vijay Chowk in Delhi. However, this is subject to any additional conditions/ restrictions imposed by local law enforcement agencies/authorities in view of the security.
   ix. Within 2 kms from perimeter of strategic locations/ vital installations notified by Ministry of Home Affairs unless clearance is obtained from Ministry of Home Affairs (MHA);
   x. Within 3 kms from radius of State Secretariat Complex in State Capitals;
   xi. From a mobile platform such as a moving vehicle, ship or aircraft;
   xii. Over eco-sensitive zones around National Parks and Wildlife Sanctuaries notified by Ministry of Environment, Forests and Climate Change without prior permission.

No Remotely Piloted Aircraft (RPA) shall carry out aerial photography/remote sensing survey over the areas specified in point no. 'c' of this section. However,

DGCA may authorize such_operations on case-to-case basis subject to approval of Ministry of Defense (MoD). In such a case, application shall be submitted to Director, Regulations and Information, DGCA (seven copies) in the prescribed format as indicated at Annexure-XI of CAR as per DGCA.

4.4 Density and Distribution of Ground Control Points (GCPs) for Control Point and Check Point

In addition to above flying parameters, the density and distribution of GCPs for control point and check point requirements are also very important.

a. GCP for control Points for UAS survey

- UAS without Post Processing Kinematics (PPK) capability: GCP controls should be provided every 500-700 metres apart. Above recommendations are based on SOI's experience with non-PPK enabled quad copter fitted with RGB camera.
- UAS with Post Processing Kinematics (PPK) capability: Pilot was carried out by SOI with help of PPK capable UAV with only 1 master Control Station in Project area of 25 km^2 without any additional GCP control. Horizontal Accuracy of class RMSEr = 3.8 cm and RMSEz = 13 cm was achieved on checking with 23 check points.

However, this result should be confirmed for various terrains, conditions in case desired accuracy is not achieved during mission, additional GCPs should be provided or the check points should be converted to GCPs to control the periphery of a processing block.

b. GCPs for Check Points

The independent source of higher accuracy for check points shall be at least three times more accurate than the required accuracy of the geospatial data set being tested.

Horizontal check points shall be established at well-defined points. A well-defined point represents a feature for which the horizontal position can be measured to a high degree of accuracy and position with respect to the geodetic datum. For the purpose of accuracy testing, well-defined points must be easily visible or identifiable on the ground, on the independent source of higher accuracy, and on the product itself. For testing ORI, well-defined points shall not be selected on features elevated with respect to the elevation model used to rectify the imagery.

Unlike horizontal check points, vertical check points are not necessarily required to be clearly defined or readily identifiable point features. Vertical check points shall be established at locations that minimize interpolation errors when comparing elevations interpolated from the data set to the elevations of the check points. Vertical check points shall be surveyed on flat or uniformly-sloped open terrain and with slopes of 10 per cent or less and should avoid vertical artifacts or abrupt changes in elevation.

In PPK enabled UAS, as no GCPs other than for master control station have been recommended based on pilot results, check points should be at least provided at the borders and sharp edges of every processing block so that there may be used as control GCP if necessary.

c. Check Points Density and Distribution

When testing is to be performed, the distribution of the check points will be project specific and must be determined by mutual agreement between the data provider and the end user. In no case shall the vertical accuracy or horizontal accuracy be based on less than 20 check points. Generally, the check points shall be uniformly distributed. However, additional points may be provided to check the accuracy at potentially error prone areas and/ or important areas.

5. REQUIREMENTS FOR OPERATION FOR CIVIL UAS/ RPAS AS PER DGCA REGULATIONS

India's Directorate General of Civil Aviation (DGCA) announced "Civil Aviation Requirements (CAR) Section 3 – Air Transport, Series X Part I, Issue I, Dated- 27th August, 2018 and effective from 1st December 2018" for regulation and requirements for operating of civil UAS/ RPAS in India. These statutory laws not only have strong implementations on the UAS design but also on the operation of UAS in India.

This CAR is issued under the provision of Rule 15A and Rule 133A of aircraft rules, 1937. It lays down operational requirements for civil RPAS, licensing process and its requirements, security/ safety requirements, remote pilot training requirements, RPAS maintenance requirements, equipment requirements, operating restrictions, general requirements, minimum standards for manufacturing of RPAS (both Indian and Foreign), legal obligations, insurance and enforcement action for violation/ breach of compliance. A copy of above notification "F. No. 05-13/2014-AED Vol. IV" dated 27th August, 2018 is attached as Annexure 4.

An understanding of provisions contained in above notification is very important because they directly or indirectly affect the design and standards of geospatial data acquisition.

6. SPATIAL DATA MODEL STRUCTURE (SDMS)

6.1 Geospatial Data Content and GIS Data Structure Standards for Mapping at Very Large Scale (1:1,000)

The standard Spatial Data Model Structure (SDMS) for large scale 2D feature extraction using UAV have been formulated to maintain consistency with SoI's SDMS as well as AMRUT's DMS. The feature layers are classified into Classes and Sub-classes for easy operation.

6.2 Feature Geometry

It is recommended that all features which are represented by double line on large scale and shall be represented by its center line. It is also recommended that all features which are represented as polygon features on large scale shall also be represented by centre point (centroid). It is also recommended that the attributes of such features which are attached to corresponding line/ point on small scale which should be attached to center line/ center point on large scale. SDMS has been modified accordingly to maintain compatibility at various scales.

6.3 Coding Scheme

Each GIS feature is assigned with a unique numeric code. The code is unique with respect to the feature, irrespective of its geometry and layer.

6.4 Layer-wise Data Content, Classification and GIS Data Structure

The layers are broadly classified into Eight Categories ie. Base Layers, Urban Land use/ Land cover, Building Footprints, Utilities, Hyspography, Cadastral Layer, Boundaries and Hazard Prone Areas. These categories are further subdivided into 69 major classes and 533 sub-classes for 1:1,000 scale urban geospatial data for GIS based Master Plan formulation using Drone Technology. The classification is given as under:

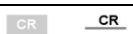
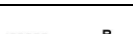
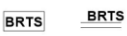
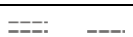
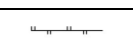
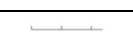
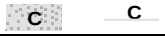
Table 6: Geospatial Data Content

Sl No.	Spatial Layers	Source For Spatial Data Generation	Classification Based On Use and Attributes	
			Classes	Sub Classes
I	Base Layers 1. Road 2. Rail 3. Bridges 4. Flyovers 5. Water Bodies	Drone/ UAS Data	5	50
II	Urban Land Use/Land Cover	Drone/ UAS Data	28	249
III	Building Footprints	Drone/ UAS Data	22	164
IV	Utilities			
	1. Water Supply Network	Urban Local Bodies	1	12
	2. Storm Water Drainage Network		1	2
	3. Sewerage Network		1	8
	4. Power Supply Network		1	8
	5. Gas Distribution Network		1	7
V	Hypsography			
	1. Digital Elevation Model (DEM) Type : Digital Terrain Model (DTM)	Topographic Survey; Existing DEMs or Contour Maps.	1	1
	2. Contour		1	1
	3. Ground Control Points		1	2
VI	Cadastral Layer	Urban Local Bodies/ State Revenue Department	1	-
VII	Boundaries			
	1. Administrative Boundaries	State Revenue Department	1	7
	2. Planning Boundaries	Urban Local Bodies	1	8
	3. Municipal Boundaries	Urban Local Bodies	1	4
	4. Other Boundaries – Enumeration Block (EB), Urban Framework Survey (UFS) and Mining Area	EB from Registrar General of India (RGI), UFS from National Sample Survey Organisation (NSSO) and Mining Area Boundary from Concerned State Departments.	1	4
VIII	Hazard Prone Areas	Information from NRSC, ISRO, GSI, NDMA, Other State and Central Government Dept.	1	4

I. BASE LAYERS:

The road feature will be captured as both Polygon and Line. Road area is represented as polygon and Road centerline as Line.

Table 7: Road Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
1	**01-01**	**Road**	*National Highway*	Polygon / Line	
	01-02		*State Highway*	Polygon / Line	
	01-03		*Major District Road*	Polygon / Line	
	01-04		*Other District Road*	Polygon / Line	
	01-05		*Expressway*	Polygon / Line	
	01-06		*Bypass*	Polygon / Line	
	01-07		*Ring Road*	Polygon / Line	
	01-08		*Service Road*	Polygon / Line	
	01-09		*Major City Road*[#]	Polygon / Line	
	01-10		*Minor City Road*[#]	Polygon / Line	
	01-11		*Other Public Road*	Polygon / Line	
	01-12		*Other Private Road*	Polygon / Line	
	01-13		*BRTS*	Polygon / Line	
	01-14		*Cycle Track*	Polygon / Line	
	01-15		*Village road*	Polygon / Line	
	01-16		*Foot path*	Line	
	01-17		*Cart track*	Line	
	01-18		*Ropeway*	Line	
	01-19		*Carriageway**	Line	
	01-20		*Right of way**	Line	
	01-21		*Cantonment Roads*	Polygon / Line	
	01-22		*Notified Industrial Area Roads*	Polygon / Line	
	01-23		*Public Staircase*	Polygon / Line	

[#]*Roads having width of 10.5m/ 11m and more will be called Major City Road and less than 10.5m/ 11m as Minor City Road(for information, the road widths mentioned are as per IRC standards)*

*****Source for Carriageway and Right of Way: Revenue records.*

Table 8: Road Line GIS Data Structure

Geospatial Layer Name: Road_Cline

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Road Id	**Rd_ID**	Alphanumeric	15	Unique Id
Survey Date	**SVY_Date**	Date		Date of Surveying
Code	**Code**	Alphanumeric	10	Code as given in Table 8
Sub-Class	**Sub_Class**	Text	20	Sub Class as given in Table 8
Length in kms.	**Length_kms**	Double	10 Up to 4 decimals	Length (in kms.)
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road Name	**Rd_Name**	Text	30	Specific Name if any
Road Construction Material	**Cons_Mat**	Text	10	Concrete/ Asphalt/ WBM/ Any Other
Carriage Width (in mt.)	**CW_Width**	Double	10 Up to 4 decimals	Carriage Width in metres
Right of Way Width (in mt.)	**ROW_Width**	Double	10 Up to 4 decimals	Right of Way Width in metres
Maintained By	**Maintain**	Text	15	Municipal body/NHAI/R and B Dept./Other
Foot Path	**FP**	Text	3	Yes/No
Foot path width(in mt.in case Yes)	**FP_Width**	Double	10 Up to 2 decimals	Footpath Width in metres
Foot Path Construction material	**FP_Cons_Ma**	Text	15	Shabad/Tiles/Concrete/Other Stone
Motorable Season	**Mot_Sea**	Text	50	Mention whether all-weather/ Motorable season
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 9: Road Polygon GIS Data Structure

Geospatial Layer Name: Road_Poly

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 8
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 8
Road Name	**Rd_Name**	Text	30	Specific Name of the road, if any
Survey Date	**SVY_Date**	Date		Date of Surveying

Rail Geospatial Data Content

All the railway lines will be captured as lines in Base layer and the railway track area shall be captured as polygon in Urban Land Use layer.

Table 10: Rail Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
2	**02-01**	**Rail**	*Broad Gauge*	Line	
	02-02		*Narrow Gauge*	Line	
	02-03		*Meter Gauge*	Line	
	02-04		*Metro/MRTS*	Line	
	02-05		*MMTS*	Line	

Table 11: Rail Line GIS Data Structure

Geospatial Layer Name: Rail_Line

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Rail Id	**Rail_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 9
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 9
Railway Line Name	**Rly_Name**	Text	30	Specific Name of the railway line, if any
Survey Date	**SVY_Date**	Date		Date of Surveying
Line Type	**Line_TYP**	Text	50	Type of Line (Single/Double)
Electric Status	**Electric**	Text	50	Whether Electrified (Yes/No)
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 12: Bridges and Flyovers Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
3	**03-01**	**Bridges**	*Culvert*	Line	
	03-02		*Tunnel*	Line	
	03-03		*Bridge across River*	Line	
	03-04		*Over Bridge*	Line	
	03-05		*Under Pass*	Line	
	03-06		*Road Bridge across Rail*	Line	
	03-07		*Subway*	Line	
	03-08		*Foot over Bridge*	Line	
	03-09		*Rope Bridge*	Line	
4	**04-01**	**Flyovers**	*Flyover*	Line	

Table 13: Bridges and Flyovers GIS Data Structure

Geospatial Layer Name: Bridge_Flyover_Line

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Bridge and Flyover ID	**Br_Fly_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 10
Sub-Class	**Sub_Class**	Text	20	Sub Class as given in Table 10
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_Cline
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_Cline
Rail Id	**Rail_ID**	Alphanumeric	15	Rail ID same as in Rail_Line
Railway Line Name	**Rly_Name**	Text	30	Railway Line Name same as in Rail_Line
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Locality Name	**Locality**	Text	50	Locality Name
Bridge/Flyover Width (in mt.)	**Width**	Double	10 Upto 2 decimals	Width in metres
Bridge/Flyover Length (in mt.)	**Length**	Double	10 Upto 2 decimals	Length in metres
Spans Number	**Span_No**	Long		Number of Span in the Bridge
Flyover Type	**Flyovr_Type**	Text	50	Type of Flyover (Single/Double line)
Construction Material	**Cons_Mat**	Text	15	Iron/Masonry/Concrete/Any Other
Construction Year	**Cons_Yr**	Text	4	Year of Construction

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Survey Date	**SVY_Date**	Date		Date of Surveying
Restrictions	**Restrictn**	Text	50	Any restrictions
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 14: Water bodies Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
5	**05-01**	**Water Bodies**	*River*	Polygon	
	05-02		*Stream*	Polygon / Line	
	05-03		*Canal*	Polygon / Line	
	05-04		*Drain*	Polygon / Line	
	05-05		*Ponds*	Polygon	
	05-06		*Lake*	Polygon	
	05-07		*Tank*	Polygon	
	05-08		*Island (River/Lake)*	Polygon	
	05-09		*Reservoir*	Polygon	
	05-10		*Back Water*	Polygon	
	05-11		*Sea*	Polygon	
	05-12		*Estuary*	Polygon	

Table 15: Water bodies Line (Stream, Canal, Drain) GIS Data Structure

Geospatial Layer Name: Waterbodies_Line

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 11
Sub-Class	**Sub_Class**	Text	20	Sub Class as given in Table 11
Name of the Waterbody	**Name**	Text	50	Specific Name of the Stream, Canal, Drain, if any
Waterbody Type	**Type**	Text	50	Water body type whether perennial/seasonal
Survey Date	**SVY_Date**	Date		Date of Surveying
Distributory Name	**Disty_Name**	Text	50	Canal Feeding Distributaries Name
Canal Type	**Canal_Type**	Text	50	Type of Canal (Main/Branch/Diversion/Link/ Distributary/others)

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 16: Water bodies Polygon GIS Data Structure

Geospatial Layer Name: Waterbodies_Poly

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 11
Sub-Class	**Sub_Class**	Text	20	Sub Class as given in Table 11
Name of the Water body	**Name**	Text	50	Specific Name of the water body, if any
Survey Date	**SVY_Date**	Date		Date of Surveying

II. URBAN LAND USE/ LAND COVER:

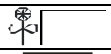
All the urban land uses are extracted as polygons with a corresponding centroid point, except a few, such as Meteorological Station, ATM, Cell Tower WiFi Hotspot, Bus Stop, E-Vehicle charging point, Dairy Booth, Lighthouse, Drinking Water Kiosk, Tree which are extracted as points. Out of these urban land use point features, some of them have feature specific attributes which are provided in the following respective attribute and GIS structure tables.

Table 17: Urban Land use/ Land cover Geospatial Data Content

S. No	Code	Class	Sub-Class	Geometry	Symbol
1	**06-01**	**Residential**	*Residential Area/ Colony*	Polygon	
	06-02		*Township*	Polygon	
	06-03		*Housing scheme*	Polygon	
2	**07-01**	**Commercial**	*Retail*	Polygon	
	07-02		*Wholesale*	Polygon	
	07-03		*General Business*	Polygon	
	07-04		*Hotel/ Lodge/ Restaurant*	Polygon	
	07-05		*Shopping Centre/ Mall*	Polygon	
	07-06		*Multiplex/ Cinema*	Polygon	
	07-07		*Function Hall/ Marriage Garden*	Polygon	
	07-08		*Warehouse*	Polygon	

S. No	Code	Class	Sub-Class	Geometry	Symbol
	07-09		*Storage Godown*	Polygon	
	07-10		*Resort*	Polygon	
	07-11		*Petrol Pump/ LPG Filling Station*	Polygon	
	07-12		*Informal Shop*	Polygon	
	07-13		*Hostel*	Polygon	
	07-14		*Market (Daily and Weekly)/ Mandi*	Polygon	
	07-15		*Garage*	Polygon	
3	**08-01**	**Industrial**	*Manufacturing*	Polygon	
	08-02		*Service*	Polygon	
	08-03		*Chemical*	Polygon	
	08-04		*Pharmaceutical*	Polygon	
	08-05		*Textile*	Polygon	
	08-06		*IT Parks*	Polygon	
	08-07		*Industrial Estate/ SEZ*	Polygon	
	08-08		*Agro based and Food Processing*	Polygon	
	08-09		*Obnoxious*	Polygon	
	08-10		*Cottage and Household*	Polygon	
	08-11		*Other Industries*	Polygon	
	08-12		*Dairy Unit*	Polygon	
	08-13		*LPG bottling Plants*	Polygon	
4	**09-01**	**Mixed**	*Residential and Commercial*	Polygon	
	09-02		*Residential and Household Industry*	Polygon	
	09-03		*Residential and Educational*	Polygon	
	09-04		*Residential and Health Services*	Polygon	
	09-05		*Commercial and Industrial*	Polygon	
	09-06		*Commercial and Health Services*	Polygon	
	09-07		*Commercial and Educational*	Polygon	
	09-08		*Commercial and Recreational*	Polygon	
	09-09		*Residential and Commercial and Public Semi-Public*	Polygon	
	09-10		*Commercial and*	Polygon	

S. No	Code	Class	Sub-Class	Geometry	Symbol
			Public Semi-Public		
	09-11		*Residential and Public Semi-Public*	Polygon	
	09-12		*Residential and Commercial and Health Services*	Polygon	
5	**10-01**	**Educational**	*School*	Polygon	
	10-02		*College*	Polygon	
	10-03		*University*	Polygon	
	10-04		*Vocational Institute*	Polygon	
	10-05		*Anganwadi*	Polygon	
	10-06		*Training Institute*	Polygon	
	10-07		*Kindergarten*	Polygon	
	10-08		*Professional Colleges*	Polygon	
6	**11-01**	**Health Services**	*Govt. Hospital*	Polygon	
	11-02		*Private Hospital*	Polygon	
	11-03		*Diagnostic Centre*	Polygon	
	11-04		*Clinic/Dispensary*	Polygon	
	11-05		*Nursing Home*	Polygon	
	11-06		*Primary/ Community Health Centre*	Polygon	
	11-07		*Medical Colleges*	Polygon	
	11-08		*Blood Bank*	Polygon	
7	**12-01**	**Central Govt. Property**	*Office*	Polygon	
	12-02		*Quarter*	Polygon	
8	**13-01**	**State Govt. Property**	*Office*	Polygon	
	13-02		*Quarter*	Polygon	
9	**14-01**	**Railway**	*Railway Property*[@]	Polygon	
10	**15-01**	**Public and Semi-public**	*Private Office*	Polygon	
	15-02		*Banks*	Polygon	
	15-03		*Credit Society*	Polygon	
	15-04		*Foreign Establishment*	Polygon	
	15-05		*Police Station*	Polygon	
	15-06		*Cantonment/ Battalion*	Polygon	
	15-07		*Jail*	Polygon	
	15-08		*Crematorium Burial Ground / Grave Yard*	Polygon	
	15-09		*Guesthouse*	Polygon	
	15-10		*Community hall*	Polygon	
	15-11		*Dharmashala*	Polygon	
	15-12		*Tourist Facility Centre*	Polygon	

S. No	Code	Class	Sub-Class	Geometry	Symbol
	15-13		*Auditorium*	Polygon	
	15-14		*Convention Centre*	Polygon	
	15-15		*Museum*	Polygon	
	15-16		*Public Library*	Polygon	
	15-17		*Art Gallery and Cultural Centre*	Polygon	
	15-18		*LPG/ CNG Gas Booking Office*	Polygon	
	15-19		*Ticket Booking and Reservation Office*	Polygon	
	15-20		*Stock Exchange*	Polygon	
	15-21		*Disaster Management Centre*	Polygon	
	15-22		*Metrological Station*	Point/Polygon	
	15-23		*Dhobi Ghat*	Polygon	
	15-24		*Crech/ Day Care*	Polygon	
	15-25		*Public/ Community Toilet*	Polygon	
	15-26		*Social Welfare Centre*	Polygon	
	15-27		*Orphanage*	Polygon	
	15-28		*Old Age Home*	Polygon	
	15-29		*Night Shelter*	Polygon	
	15-30		*Fire Station*	Polygon	
	15-31		*ATM*	Point/Polygon	
11	**16-01**	**Religious**	*Temple*	Polygon	
	16-02		*Mosque*	Polygon	
	16-03		*Idgah*	Polygon	
	16-04		*Church*	Polygon	
	16-05		*Gurudwara*	Polygon	
	16-06		*Monastery*	Polygon	
	16-07		*Synagogue*	Polygon	
	16-08		*Chhatri*	Polygon	
	16-09		*Dargah*	Polygon	
	16-10		*Fire Temple*	Polygon	
	16-11		*Stupa*	Polygon	
	16-12		*Tebetian Inscription*	Polygon	
	16-13		*Aashram/ Math/ Bhojan Shala*	Polygon	
12	**17-01**	**Recreational**	*Garden*	Polygon	
	17-02		*Park*	Polygon	
	17-03		*Play Ground*	Polygon	

S. No	Code	Class	Sub-Class	Geometry	Symbol
	17-04		*Club*	Polygon	
	17-05		*Sports Centre*	Polygon	
	17-06		*Gymnasium*	Polygon	
	17-07		*Swimming Pool*	Polygon	
	17-08		*Stadium*	Polygon	
	17-09		*Planetarium*	Polygon	
	17-10		*Aquarium*	Polygon	
	17-11		*Open Air Theatre*	Polygon	
	17-12		*Golf Course*	Polygon	
	17-13		*Race Course*	Polygon	
	17-14		*Exhibition Ground*	Polygon	
	17-15		*Amusement/ Theme Park*	Polygon	
13	**18-01-01**	**Public Utilities**	*Water Treatment Plant*	Polygon	
	18-01-02		*Water Pumping Station*	Polygon	
	18-01-03		*Ground Level Reservoir*	Polygon	
	18-03-01		*Sewage Treatment Plant*	Polygon	
	18-03-02		*Sewage Pumping Station*	Polygon	
	18-04-01		*Electric Power Plant*	Polygon	
	18-04-02		*Electric Sub-Station*	Polygon	
	18-05-01		*City Gate Metering Stations*	Polygon	
	18-05-02		*Area Regulator Stations*	Polygon	
	18-06		*Rain Water Harvesting System*	Polygon	
	18-07		*Effluent Treatment Plant*	Polygon	
	18-08		*Septage treatment Plant*	Polygon	
14	**19-01**	**Solid Waste Management**	*Land Fill Site*	Polygon	
	19-02		*Dumping Yard*	Polygon	
	19-03		*Recycling Plant*	Polygon	
	19-04		*Garbage Collection Point/ Dumper*	Point	
	19-05		*Solid Waste Treatment Plant*	Polygon	

S. No	Code	Class	Sub-Class	Geometry	Symbol
15	**20-01**	**Communication**	*Telephone Exchange*	Polygon	
	20-02		*Post/ Telegraph Office*	Polygon	
	20-03		*Radio/ TV Station*	Polygon	
	20-04		*Satellite and Telecommunication Centre*	Polygon	
	20-05		*Public Telephone Booth*	Point	
	20-06		*Cell Tower*	Point	
	20-07		*WiFi Hotspot*	Point	
16	**21-01**	**Heritage**	*Monument*	Polygon	
	21-02		*Fort*	Polygon	
	21-03		*Archaeological Site*	Polygon	
17	**22-01**	**Slum**	*Notified Slum*	Polygon	
	22-02		*Non-notified Slum*	Polygon	
	22-03		*Squatter/ Kachibasti*	Polygon	
18	**23-01**	**Vacant Land**	*Private Vacant*	Polygon	
	23-02		*Municipal Asset*	Polygon	
	23-03		*Government Asset*	Polygon	
	23-04		*Reclaimed Land*	Polygon	
	23-05		*Layout/ Plotted*	Polygon	
	23-06		*Accreted Land*	Polygon	
19	**24-01**	**Transportation**	*Bus stand/ Terminus*	Polygon	
	24-02		*Railway Station*	Polygon	
	24-03		*Railway Yard/ Siding*	Polygon	
	24-04		*Railway Track Area*	Polygon	
	24-05		*Airport/ Airstrip*	Polygon	
	24-06		*Helipad*	Polygon	
	24-07		*Port*	Polygon	
	24-08		*Harbour*	Polygon	
	24-09		*Jetty*	Polygon	
	24-10		*Truck Terminus*	Polygon	
	24-11		*Freight Complex*	Polygon	
	24-12		*Taxi Stand*	Polygon	
	24-13		*Auto Stand*	Polygon	
	24-14		*Cycle Rickshaw/ Cycle/ Cart stand*	Polygon	
	24-15		*Bus Bay*	Polygon	
	24-16		*Bus Stop*	Polygon/Point	
	24-17		*Transport Nagar*	Polygon	
	24-18		*Intermodal Exchange Facilities*	Polygon	

S. No	Code	Class	Sub-Class	Geometry	Symbol
	24-19		*Fishing Harbour*	Polygon	
	24-20		*Mobility Hub*	Polygon	
	24-21		*Inland Water Transport Terminal*	Polygon	
	24-22		*Boat Yard*	Polygon	
	24-23		*E-Vehicle Charging Point*	Point	
	24-24		*2 Wheeler Taxi Stand*	Polygon	
20	**25-01**	**Traffic related**	*Traffic Island*	Polygon	
	25-02		*Median/ Divider*	Polygon	
	25-03		*Parking Space/ Area*	Polygon	
21	**26-01**	**Rural**	*Village/ Abadi Area*	Polygon	
22	**27-01**	**Green Areas**	*Reserved Forest*	Polygon	
	27-02		*Protected Forest/ Notified Forest*	Polygon	
	27-03		*Social*	Polygon	
			Green belt	Polygon	
	27-04		*Tree Clad Area*	Polygon	
	27-05		*Tree*	Point	
	27-06		*Vested Forest*	Polygon	
23	**28-01**	**Agricultural Land**	*Cropland*	Polygon	
	28-02		*Fallow land*	Polygon	
	28-03		*Plantations*	Polygon	
	28-04		*Orchard*	Polygon	
	28-05		*Horticulture*	Polygon	
	28-06		*Plant Nursery*	Polygon	
24	**29-01**	**Wetlands**	*Waterlogged*	Polygon	
	29-02		*Low lying Area*	Polygon	
	29-03		*Marshy*	Polygon	
	29-04		*Swampy*	Polygon	
	29-05		*Mudflat*	Polygon	
	29-06		*Creek*	Polygon	
25	**30-01**	**Wastelands**	*Scrubland*	Polygon	
	30-02		*Barren*	Polygon	
	30-03		*Rocky*	Polygon	
	30-04		*Sandy area*	Polygon	
	30-05		*Salt affected*	Polygon	
	30-06		*Gullied*	Polygon	
26	**31-01**	**Specific Land Use**	*Hill/ Mountain*	Polygon	
	31-02		*Snow covered area*	Polygon	
	31-03		*Mining Area*	Polygon	

S. No	Code	Class	Sub-Class	Geometry	Symbol
	31-04		*Grazing land*	Polygon	
	31-05		*Pastures*	Polygon	
	31-06		*Meadows*	Polygon	
	31-07		*Tea/ Coffee Garden*	Polygon	
	31-08		*Ghats*	Polygon	
	31-09		*Coral Reef*	Polygon	
	31-10		*Sand Dunes*	Polygon	
27	**32-01**	**Eco-Sensitive Areas**	*Bird Sanctuary*	Polygon	
	32-02		*Bio-diversity Park*	Polygon	
	32-03		*Botanical Garden*	Polygon	
	32-04		*Zoo*	Polygon	
	32-05		*National Park*	Polygon	
	32-06		*Mangrove*	Polygon	
	32-07		*Ox-bow Lakes*	Polygon	
	32-08		*Paleo channels*	Polygon	
28	**33-01**	**Others**	*Salt Pan*	Polygon	
	33-02		*Aquaculture*	Polygon	
	33-03		*Brick Kiln*	Polygon	
	33-04		*Quarry*	Polygon	
	33-05		*Dam*	Polygon	
	33-06		*Barrage*	Polygon	
	33-07		*Aqueduct*	Polygon	
	33-08		*Weir*	Polygon	
	33-09		*Farm House*	Polygon	
	33-10		*Dairy Farm/ Guashala*	Polygon	
	33-11		*Poultry farm*	Polygon	
	33-12		*Nursery*	Polygon	
	33-13		*Slaughter House*	Polygon	
	33-14		*Dairy Booth*	Polygon/Point	
	33-15		*Lighthouse*	Polygon / Point	
	33-16		*Beach*	Polygon	
	33-17		*Mining Control Room*	Polygon	
	33-18		*Animal Rearing*	Polygon	
	33-19		*Building under Construction*	Polygon	
	33-20		*Drinking Water Kiosk*	Polygon/ Point	

@*includes Office, Quarters, Recreational Space, Institutions etc. under Railways*

Table 18: Urban Land Use/ Land Cover Polygon GIS Data Structure

Geospatial Layer Name: ULU_Poly

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 12
Class	**Class**	Text	25	Class as given in Table 12
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 12
Area in sq. mt.	**Area**	Double	10 Up to 4 decimals	Area of corresponding feature in sq. mt.
Name	**Name**	Text	50	Name of the Landmark
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 19: Educational Facilities GIS Data Structure

Geospatial Layer Name: Educational Facilities_pt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Educational Facility Point ID	**Edu_Fac_Pnt_ID**	Alphanumeric	15	Unique Id
Name	**Name**	Text	50	Name of the Educational Facilities
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Institution Type	**Ins_Ty**	Text	20	Institution type whether govt./ pvt.
Construction Type	**Type**	Text	15	Type of Construction (Pucca/ Semi Pucca/ Kutcha)
Status	**Status**	Text	15	Functional/ Non-Functional

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Education Level	**Edu_L**	Text	50	Educational level in case of Schools (Primary/ Middle/ Secondary/ Senior Secondary School for Special Needs/ Others) and In case of Colleges (General/ Medical/ Engineering/ Law/ Vocational Training/ Adult Education Program/ Others)
Playground	**Play_G**	Text	15	Playground availability (Yes/No)
Girls Toilet	**G_Toilet**	Text	15	Separate toilets for girl students available (Yes/No)
Computer lab	**C_Lab**	Text	15	Availability of Computer Laboratory (Yes/No)
Internet	**Int**	Text	15	Availability of internet facility in Computer Labs (Yes/No)
Water Availability	**Water_avail**	Text	15	Availability of water in school (Yes/No)
Water Source	**Water_S**	Text	15	Source of Water (Corp/ Muni/ Tap/ Hand Pump/ Others)
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 20: Health Services GIS Data Structure

Geospatial Layer Name: Health Services

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Health Service Point ID	**Hlt_Ser_Pnt_ID**	Alphanumeric	15	Unique Id
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Status	**Status**	Text	15	Functional/ Non-Functional
Construction Type	**Type**	Text	15	Type of Construction (Pucca/ Semi Pucca/ Kutcha)
Epidemiological details	**Ed_De**	Text	20	Epidemiological details
Facility Type	**Fac_Ty**	Text	20	Medical facility type (Allopathic/ Ayurvedic/ Homeopathic/ Unani/ Family Welfare and Maternity Centres/ Dispensary/ Others)
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 21: Community Toilet GIS Data Structure

Geospatial Layer Name: Community_toilet

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Toilet ID	**CT_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 10
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Toilet Status	**Status**	Text	15	Working/ Not working
Toilet Type	**Type**	Text	15	Eco-friendly/ General
Mode of Construction	**Mode**	Text	5	Public/PPP
Maintained By	**Main_by**	Text	50	Maintained By department/authority
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 22: Fire Station GIS Data Structure

Geospatial Layer Name: Fire_Station

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Fire Station ID	**FS_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 10
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Fire Station Status	**Status**	Text	15	Working/Not working
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 23: Garbage Collection Points/ Dumper GIS Data Structure

Geospatial Layer Name: Garb_Coll_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Garbage collection point ID	**GC_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 10
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_Cline
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_Cline

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Locality Name	**Locality**	Text	50	Locality Name
Type of garbage	**Garb_Type**	Text	30	Domestic/Biomedical/Kitchen/Construction/Mixed
Status of Garbage collection point	**Status**	Text	30	Temporary/Permanent and Collection point/Transfer point
Coverage area of a collection point	**Cov_area**	Double	10 Up to 4 decimals	Coverage area (No of houses or colonies covered by a point)
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 24: Landfill Sites and Dumping Yard GIS Data Structure

Geospatial Layer Name: Landfill_Dumpyard_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Landfill site/Dumping Yard point ID	**LD_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 10
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 10
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Name of the Landfill site/Dumping Yard	**Name**	Text	30	Specific Name of the landfill site or dumping yard, if any
Survey Date	**SVY_Date**	Date		Date of Surveying

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 25: Cell Towers, Wi-Fi Hotspots and Public Telephone Booth GIS Data Structure

Geospatial Layer Name: Communication_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Communication Point ID	**Com_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 10
Sub-Class	**Sub_Class**	Text	20	Sub Class as given in Table 10
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Description	**Descr**	Text	15	On Building/On ground
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 26: Slums GIS Data Structure

Geospatial Layer Name: Slum_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Slum ID	**Slum_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 10
Sub-Class	**Sub_Class**	Text	20	Sub Class as given in Table 10
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Slum Number	**Slum_Num**	Text	10	Slum Number (from ULBs)

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Name of the Slum	**Slum_ Name**	Text	30	Name of the Slum
Locality Name	**Locality**	Text	50	Locality Name
Notified Area	**Notfd_Area**	Double	10 upto 4 Decimals	Notified Area if any, from ULBs
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 27: Bus Stop GIS Data Structure

Geospatial Layer Name: Bus_Stop_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Bus stop ID	**BS_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 10
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 28: Tree GIS Data Structure

Geospatial Layer Name: Tree

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 10
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 29: Other Urban Land use Points: ATM, Meteorological Station, Dairy Booth, Light House and Other if any GIS Data Structure

Geospatial Layer Name: ULU_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Point ID	**Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 10
Class	**Class**	Text	25	Class as given in Table 10
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 10
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_Cline
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_Cline
Locality Name	**Locality**	Text	50	Locality Name
GM Rotation	**G_M_R**	Double	20	Rotation of Feature
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

III. BUILDING FOOTPRINT:

Buildings falling within each of the Class/Sub-class of urban land use/land cover shall be represented in the same Sub-class of Building Footprint Layer. For example, buildings falling within 'Commercial Retail' urban land use/land cover area will be represented as 'Commercial Retail' buildings. The building footprints shall overlap with urban land use/land cover.

A single symbol ☐ *shall be used for representation of all buildings. The Sub-Class details for each building will be provided as an attribute.*

Table 30: Building Footprint Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry
1	**06-04**	**Residential**	*House*	Polygon
	06-05		*Group of Houses*	Polygon
	06-06		*Apartment*	Polygon
2	**07-01**	**Commercial**	*Retail*	Polygon
	07-02		*Wholesale*	Polygon
	07-03		*General Business*	Polygon
	07-04		*Hotel/ Lodge/ Restaurant*	Polygon
	07-05		*Shopping Centre/ Mall*	Polygon
	07-06		*Multiplex/ Cinema*	Polygon
	07-07		*Function Hall/ Marriage Garden*	Polygon
	07-08		*Warehouse*	Polygon
	07-09		*Storage Godown*	Polygon
	07-10		*Resort*	Polygon
	07-11		*Petrol Pump/ LPG filling station*	Polygon
	07-12		*Informal Shop*	Polygon
	07-13		*Hostel*	Polygon
	07-14		*Market (Daily and Weekly)/ Mandi*	Polygon
	07-15		*Garage*	Polygon
3	**08-01**	**Industrial**	*Manufacturing*	Polygon
	08-02		*Service*	Polygon
	08-03		*Chemical*	Polygon
	08-04		*Pharmaceutical*	Polygon
	08-05		*Textile*	Polygon
	08-06		*IT Parks*	Polygon
	08-07		*Industrial Estate/ SEZ*	Polygon
	08-08		*Agro based and Food Processing*	Polygon
	08-09		*Obnoxious*	Polygon

S.No	Code	Class	Sub-Class	Geometry
	08-10		*Cottage and Household*	Polygon
	08-11		*Other Industries*	Polygon
	08-12		*Dairy Unit*	Polygon
	08-13		*LPG bottling Plants*	Polygon
4	**09-01**	**Mixed**	*Residential and Commercial*	Polygon
	09-02		*Residential and Household Industry*	Polygon
	09-03		*Residential and Educational*	Polygon
	09-04		*Residential and Health Services*	Polygon
	09-05		*Commercial and Industrial*	Polygon
	09-06		*Commercial and Health Services*	Polygon
	09-07		*Commercial and Educational*	Polygon
	09-08		*Commercial and Recreational*	Polygon
	09-09		*Residential and Commercial and Institutional*	Polygon
	09-10		*Commercial and Public Semi-Public*	Polygon
	09-11		*Residential and Public Semi-Public*	Polygon
	09-12		*Residential and Commercial and Health Services*	Polygon
5	**10-01**	**Educational**	*School*	Polygon
	10-02		*College*	Polygon
	10-03		*University*	Polygon
	10-04		*Vocational Institute*	Polygon
	10-05		*Anganwadi*	Polygon
	10-06		*Training Institute*	Polygon
	10-07		*Kindergarten*	Polygon
	10-08		*Professional Colleges*	Polygon
6	**11-01**	**Health Services**	*Govt. Hospital*	Polygon
	11-02		*Private Hospital*	Polygon
	11-03		*Diagnostic Centre*	Polygon
	11-04		*Clinic/ Dispensary*	Polygon
	11-05		*Nursing Home*	Polygon
	11-06		*Primary/ Community Health Centre*	Polygon
	11-07		*Medical Colleges*	Polygon
	11-08		*Blood Bank*	Polygon
7	**12-01**	**Central Govt. Property**	*Office*	Polygon
	12-02		*Quarter*	Polygon

S.No	Code	Class	Sub-Class	Geometry
8	**13-01**	**State Govt. Property**	*Office*	Polygon
	13-02		*Quarter*	Polygon
9	**14-01**	**Railway**	*Railway Property*[@]	Polygon
10	**15-01**	**Public and Semi-public**	*Private Office*	Polygon
	15-02		*Banks*	Polygon
	15-03		*Credit Society*	Polygon
	15-04		*Foreign Establishment*	Polygon
	15-05		*Police Station*	Polygon
	15-06		*Cantonment /Battalion*	Polygon
	15-07		*Jail*	Polygon
	15-08		*Crematorium/ Burial Ground/ Grave Yard*	Polygon
	15-09		*Guesthouse*	Polygon
	15-10		*Community hall*	Polygon
	15-11		*Dharmashala*	Polygon
	15-12		*Tourist Facility Centre*	Polygon
	15-13		*Auditorium*	Polygon
	15-14		*Convention Centre*	Polygon
	15-15		*Museum*	Polygon
	15-16		*Public Library*	Polygon
	15-17		*Art Gallery and Cultural Centre*	Polygon
	15-18		*LPG/ CNG Gas Booking Office*	Polygon
	15-19		*Ticket Booking and Reservation Office*	Polygon
10	**15-20**		*Stock Exchange*	Polygon
	15-21		*Disaster Management Centre*	Polygon
	15-24		*Crech/ Day Care*	Polygon
	15-25		*Public/Community Toilet*	Polygon
	15-26		*Social Welfare Centre*	Polygon
	15-27		*Orphanage*	Polygon
	15-28		*Old Age Home*	Polygon
	15-29		*Night Shelter*	Polygon
	15-30		*Fire Station*	Polygon
11	**16-01**	**Religious**	*Temple*	Polygon
	16-02		*Mosque*	Polygon
	16-03		*Idgah*	Polygon
	16-04		*Church*	Polygon
	16-05		*Gurudwara*	Polygon
	16-06		*Monastery*	Polygon
	16-07		*Synagogue*	Polygon
	16-08		*Chhatri*	Polygon
	16-09		*Dargah*	Polygon

S.No	Code	Class	Sub-Class	Geometry
	16-10		*Fire Temple*	Polygon
	16-11		*Stupa*	Polygon
	16-12		*Tebetian Inscription*	Polygon
	16-13		*Aashram/ Math/ Bhojan Shala*	Polygon
12	**17-01**	**Recreational**	*Garden*	Polygon
	17-02		*Park*	Polygon
	17-04		*Club*	Polygon
	17-05		*Sports Centre*	Polygon
	17-06		*Gymnasium*	Polygon
	17-07		*Swimming Pool*	Polygon
	17-08		*Stadium*	Polygon
	17-09		*Planetarium*	Polygon
	17-10		*Aquarium*	Polygon
	17-11		*Open Air Theatre*	Polygon
	17-12		*Golf Course*	Polygon
	17-13		*Race Course*	Polygon
	17-14		*Exhibition Ground*	Polygon
	17-15		*Amusement/ Theme Park*	Polygon
13	**18-01-01**	**Public Utilities**	*Water Treatment Plant*	Polygon
	18-01-02		*Water Pumping Station*	Polygon
	18-01-03		*Ground Level Reservoir*	Polygon
	18-03-01		*Sewage Treatment Plant*	Polygon
	18-03-02		*Sewage Pumping Station*	Polygon
	18-04-01		*Electric Power Plant*	Polygon
	18-04-02		*Electric Sub Station*	Polygon
	18-07		*Effluent Treatment Plant*	Polygon
	18-08		*Septage treatment Plant*	Polygon
14	**19-03**	**Solid Waste Management**	*Recycling Plant*	Polygon
	19-05		*Solid waste treatment plant*	Polygon
15	**20-01**	**Communication**	*Telephone Exchange*	Polygon
	20-02		*Post/ Telegraph Office*	Polygon
	20-03		*Radio/ TV Station*	Polygon
	20-04		*Satellite and Telecommunication Centre*	Polygon
16	**21-01**	**Heritage**	*Monument*	Polygon
	21-02		*Fort*	Polygon
	21-03		*Archaeological Site*	Polygon
17	**24-01**	**Transportation**	*Bus stand/ Terminus*	Polygon
	24-02		*Railway Station*	Polygon
	24-03		*Railway Yard/ Sliding*	Polygon
	24-05		*Airport/ Airstrip*	Polygon
	24-07		*Port*	Polygon
	24-08		*Harbour*	Polygon

S.No	Code	Class	Sub-Class	Geometry
	24-10		*Truck Terminus*	Polygon
	24-11		*Freight Complex*	Polygon
	24-17		*Transport Nagar*	Polygon
	24-18		*Intermodal Exchange facilities*	Polygon
	24-19		*Fishing Harbour*	Polygon
	24-20		*Mobility Hub*	Polygon
	24-21		*Inland Water Transport Terminal*	Polygon
	24-22		*Boat Yard*	Polygon
18	**25-04**	**Traffic related**	*Multi-level Parking*	Polygon
19	**26-02**	**Rural**	*House*	Polygon
	26-03		*Group of Houses*	Polygon
	26-04		*Apartment*	Polygon
20	**31-07**	**Specific Land use**	*Tea/ Coffee Garden*	Polygon
21	**32-01**	**Eco-Sensitive Areas**	*Bird Sanctuary*	Polygon
	32-02		*Bio-diversity Park*	Polygon
	32-03		*Botanical Garden*	Polygon
	32-04		*Zoo*	Polygon
	32-05		*National Park*	Polygon
22	**33-09**	**Others**	*Farm house*	Polygon
	33-10		*Dairy farm*	Polygon
	33-11		*Poultry farm*	Polygon
	33-13		*Slaughter House*	Polygon
	33-14		*Dairy Booth*	Polygon
	33-17		*Mining Control Room*	Polygon
	33-18		*Animal Rearing*	Polygon
	33-19		*Building under construction*	Polygon
	33-20		*Drinking Water Kiosk*	Polygon

@includes Office, Quarters, Recreational Space, Institutions etc. under Railways

Table 31: Buildings GIS Data Structure

Geospatial Layer Name: Building_footprint

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 11
Class	**Class**	Text	25	Class as given in Table 11
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 11
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Locality Name	**Locality**	Text	50	Locality Name
Colony Name	**Colony**	Text	50	Colony Name
No. of floors	**No_floors**	Numeric	5	Number of floors in a building
Construction Type	**Cons_type**	Text	15	Pucca/Semi Pucca/Kutcha
Area in sq. mt.	**Area**	Double	10 Up to 4 decimals	Area of corresponding building footprint
Description	**Descr**	Text	50	Name of building and Details, if any
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

III. UTILITIES:

Utility Layers:
All utility layers like Water Supply Network, Drainage Network, Sewage Network, Electricity Supply Network, Natural Gas Distribution Network database will be prepared from the data collected by ULBs from the concerned engineering and line departments.
All network lines are represented as lines and the nodes (starting point, intersections, valves, end points etc.) are represented as points.

Table 32: Water Supply Network Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
1	**18-01-01**	**Water Supply Network**	*Water Treatment Plant*	Point	
	18-01-02		*Water Pumping Station*	Point	
	18-01-03		*Ground Level Reservoir*	Point	
	18-01-04		*Raw Water Main Pipeline*	Line	
	18-01-05		*Pumping Line*	Line	
	18-01-06		*Distribution Pipeline*	Line	
	18-01-07		*Service Pipeline*	Line	
	18-01-08		*Supply Valve*	Point	
	18-01-09		*Over Head Tank*	Point	
	18-01-10		*Public Stand Post*	Point	
	18-01-11		*Tube Well*	Point	
	18-01-12		*Hand Pump*	Point	
	18-01-13		*Public Tap*	Point	

Table 33:Water Supply Network Line GIS Data Structure

Geospatial Layer Name: Water_NW_Line

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Water Supply ID	**WS_Line_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 12
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 12
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Distance from road (in mt.)	**Dis_frm_rd**	Double	10 Upto 2 Decimals	Distance from road in meters
Construction Material	**Cons_Mat**	Text	10	PSC/DI/HDPE/MS/RCC/Others/GI/AC/CI/PVC
Pipe Dia in mt.	**Pipe_Dia**	Numeric	5	Pipe Diameter in meters
Pipeline Location	**Pipe_loc**	Text	20	Pipeline underground or overhead
Capacity	**Cap**	Double	20	Capacity of Tank/Reservoir in cu litres
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 34: Water Supply Network Points GIS Data Structure

Geospatial Layer Name: Water_NW_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Water Supply ID	**WS_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 12
Sub_Class	**Sub_Class**	Text	50	Sub Class as given in Table 12

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Capacity	**Capacity**	Text	10	Capacity of Treatment plant, Pumping station, GLR, overhead tank in the respective units
GM Rotation	**G_M_R**	Double	20	Rotation of Feature
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 35: Storm Water Drainage Network Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
2	**18-02-01**	**Storm water Drainage**	*Storm Water Drain*	Line	
	18-02-02		*Storm Water Vent*	Point	

Table 36: Storm water Drainage Network Line GIS Data Structure

Geospatial Layer Name: Str_Drain_NW_Line

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Storm Water Drainage ID	**Dr_Line_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 13
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 13
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Locality Name	**Locality**	Text	50	Locality Name
Distance from road(in mt.)	**Dis_frm_rd**	Double	10 Upto 2 Decimals	Distance from road in meters
Depth in mt.	**Depth**	Double	10 Upto 2 Decimals	Depth of Drainage in meters
Width of Drain	**Width**	Double	10 Upto 2 Decimals	Width/ Diameter of Drainage Channel/ Pipe
Construction Type	**Cons_Type**	Text	10	Box/Open Channel/
Network Line Type	**NW_Type**	Text	15	Mainline/Service/Pumping
Name of the Storm water drain	**Name**	Text	50	Specific Name if any
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 37: Storm water Drainage Network Points GIS Data Structure

Geospatial Layer Name: Str_Drain_NW_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Storm Water Drainage ID	**Dr_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 13
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 13
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Distance from road(in mt.)	**Dis_frm_rd**	Double	10 Upto 2 Decimals	Distance from road in meters
GM Rotation	**G_M_R**	Double	20	Rotation of Feature
Survey Date	**SVY_Date**	Date		Date of Surveying

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 38: Sewerage Network Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
1	**18-03-01**	**Sewerage Network**	*Sewage Treatment Plant*	Point	
	18-03-02		*Sewage Pumping Station*	Point	
	18-03-03		*Pumping Line*	Line	
	18-03-04		*Main Sewer Line*	Line	
	18-03-05		*Branch Sewer Line*	Line	
	18-03-06		*Service Sewer Line*	Line	
	18-03-07		*Manhole*	Point	
	18-03-08		*Vent Valve*	Point	

Table 39: Sewerage Network Line GIS Data Structure

Geospatial Layer Name: Sew_NW_Line

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Sewerage ID	**SW_Line_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 14
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 14
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Distance from road(in mt.)	**Dis_frm_rd**	Double	10 Upto 2 Decimals	Distance from road in meters
Depth in mt.	**Depth**	Double	10 Upto 2 Decimals	Depth of Sewer line in meters
Pipe Dia in mm.	**Pipe_Dia**	Double	10 Upto 2 Decimals	Pipe Diameter in millimeters
Construction Material	**Cons_Mat**	Text	10	RCC/CI/SWG/PVC/GI/AC/Others

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 40: Sewerage Network Points GIS Data Structure

Geospatial Layer Name: Sew_NW_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Sewerage ID	**SW_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 14
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 14
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Distance from road(in mt.)	**Dis_frm_rd**	Double	10 Upto 2 Decimals	Distance from road in meters
GM Rotation	**G_M_R**	Double	20	Rotation of Feature
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 41: Power Supply Network Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
1	**18-04-01**	**Power**	*Electric Power Plant*	Point	
	18-04-02		*Electric Sub-Station*	Point	
	18-04-03		*Transmission Tower*	Point	
	18-04-04		*Transformer*	Point	
	18-04-05		*33 Kv Line*	Line	
	18-04-06		*11 Kv Line*	Line	
	18-04-07		*Pole*	Point	
	18-04-08		*Street Light*	Point	

Table 42: Power Supply Network Line GIS Data Structure

Geospatial Layer Name: Power_NW_Line

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Power Supply ID	**PS_Line_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 15
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 15
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_Cline
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_Cline
Locality Name	**Locality**	Text	50	Locality Name
Name of Power Line	**Pow_Name**	Text	30	Power Line Name if any
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 43: Power Supply Network Points GIS Data Structure

Geospatial Layer Name: Power_NW_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Power Supply ID	**PS_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 15
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 15
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_Cline
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_Cline
Locality Name	**Locality**	Text	50	Locality Name
Capacity	**Capacity**	Text	10	Capacity of Power Plant, Sub-station and Transformer, in the respective units
Street Light-ID	**St_Lt_ID**	Alphanumeric	5	Unique Id for Street Light
Type of Street Light Pole	**Pole_Type**	Text	15	Iron/ Concrete/ Other
Type of Street Light	**St_Lt_Ty**	Text	15	HPMV/ Sodium/ Tube Light/ CFL/ High Mast/ Others
Source of Energy	**Sou_ Energy**	Text	15	Electricity/ Others/ Solar
Tower Height	**Ht**	Double	20	Tower height in meters
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 44: Gas Distribution Network Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
1	**18-05-01**	**Natural Gas**	*City Gate Metering Station*	Point	
	18-05-02		*Area Regulator Station*	Point	
	18-05-03		*Main Distribution Line*	Line	
	18-05-04		*Branch Distribution Line*	Line	
	18-05-05		*Regulator*	Point	
	18-05-06		*Flow Meter*	Point	
	18-05-07		*Gas Milestone*	Point	

Table 45: Gas Distribution Network Line GIS Data Structure

Geospatial Layer Name: Natural_Gas_NW_Line

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Gas Distribution ID	**GD_Line_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 16
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 16
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

Table 46: Gas Distribution Network Points GIS Data Structure

Geospatial Layer Name: Natural_Gas_NW_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Gas Distribution ID	**GD_Pnt_ID**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 16
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 16

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Ward Number	**Ward_No**	Alphanumeric	10	Ward Number
Road ID	**Rd_ID**	Alphanumeric	15	Road ID same as in Road_CLine
Road Name	**Rd_Name**	Text	30	Road Name same as in Road_CLine
Locality Name	**Locality**	Text	50	Locality Name
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

IV. HYPSOGRAPHY:

Towns for which monoscopic data is selected, the DEM shall be generated by Total Station survey and Towns for which stereo data is selected, the DEM shall be generated from stereo data. The DEM is a DTM which represent bare earth surface.

Table 47: DEM Layer

S.No	Class	Accuracy	Pixel Value	Geometry
1	**Digital Terrain Model (DTM)**	*0.5 m*	Height in metres	Raster

Contour

Contour shall be generated from the DTM.

Table 48: Contour Geospatial Data Content

S.No.	Code	Class	Contour Interval	Geometry	Symbol
1	**34-01**	**Contour**	*1 m*	Line	

Table 49: Contour Layer GIS Data Structure

Geospatial Layer Name: Contour_Line

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 18
Contour Value	**Cntr_Val**	Numeric	5	Height in metres
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information

Ground Control Points (GCPs)

DGPS survey is used for generation of GCPs. DGPS survey data shall be processed using closed network traverse and the reference station coordinate shall be computed using ITRF reference frame.

Table 50: Ground Control Points (GCPs) Layer Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
1	**35-01**	**GCP**	*Reference station*	Point (X,Y,Z)	⊥
	35-02		*Rover Station*	Point (X,Y,Z)	⊥

Table 51: Ground Control Points GIS Data Structure

Geospatial Layer Name: GCP_Pnt

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Ground Control point ID	**GCP_Id**	Alphanumeric	15	Unique Id
Code	**Code**	Alphanumeric	10	Code as given in Table 19
Sub-Class	**Sub_Class**	Text	25	Sub Class as given in Table 19
X Coordinate	**X**	Double	Up to 8 decimals	X Coordinate
Y Coordinate	**Y**	Double	Up to 8 decimals	Y Coordinate
Z Coordinate	**Z**	Double	Up to 8 decimals	Z Coordinate
Description of the Ground Control point	**Descr**	Text	250	Description
Monument	**Monument**	Text	5	Yes/No
Sketch Map or Image	**Sketch**	Blob		Sketch Map or Image to be attached

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
GCP Status	**GCP_St**	Text	20	Ok/ Distributed/ Missing
Checked on	**Ckhd_ON**	Date		SoI/GoI's Order No. (with date) for inducted team to chek GCP Status
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Blob		Hyperlink of photograph of Feature

V. CADASTRAL LAYER:

Cadastral Layer will be prepared from the data collected by ULBs from the line departments.

Table 52: Cadastral Layer Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
1	**36-01**	**Cadastre**	-	Polygon	

Table 53: Cadastral Layer GIS Data Structure

Geospatial Layer Name: Cadastre_Poly

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 20
Survey Number	**Survey_Num**	Alphanumeric	15	Khasra Number/ Survey Number
Area	**Area**	Double	Up to 4 decimals	Area of Village Cadastre or Parcel

VI. BOUNDARIES:

Table 54: Administrative Boundaries Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
1	**37-01**	**Administrative Boundaries**	*International Boundary*	Polygon	
	37-02		*State Boundary*	Polygon	
	37-03		*District Boundary*	Polygon	
	37-04		*Tehsil/ Mandal/ Block Boundary*	Polygon	
	37-05		*Village Boundary*	Polygon	
	37-06		*Forest Boundary*	Polygon	
	37-07		*Revenue Boundary*	Polygon	

Table 55: Administrative Boundaries GIS Data Structure

Geospatial Layer Name: Admin_Bnd_Poly

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 21
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 21
Area in sq. kms.	**Area**	Double	Up to 4 decimals	Area of corresponding Admin boundary
Name	**Name**	Text	50	Name of the Admin Boundary

Table 56: Planning Boundaries Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
2	**38-01**	**Planning Boundaries**	*Planning Area Boundary*	Polygon	
	38-02		*Highway Corridor Development Zone*	Polygon	
	38-03		*Peripheral Control belt Boundary*	Polygon	
	38-04		*Controlled Area Boundary*	Polygon	
	38-05		*Urbanisable Area Boundary*	Polygon	
	38-06		*Industrial Zone/ Area*	Polygon	
	38-07		*Special Economic Zone*	Polygon	
	38-08		*National Park/ Sanctuary/ Conservation Area*	Polygon	

Table 57: Planning Boundaries GIS Data Structure

Geospatial Layer Name: Planning_Bnd_Poly

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 22
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 22
Area in sq. kms.	**Area**	Double	Up to 4 decimals	Area of corresponding Planning boundary
Name	**Name**	Text	50	Name of the Planning Boundary

Table 58: Municipal Boundaries Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
3	**39-01**	**Municipal Boundaries**	*Municipal Boundary*	Polygon	
	39-02		*Zone Boundary*	Polygon	
	39-03		*Ward Boundary*	Polygon	
	39-04		*Taxzone Boundary*	Polygon	

Table 59: Municipal Boundaries GIS Data Structure

Geospatial Layer Name: Municipal_Bnd_Poly

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 23
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 23
Area in sq. kms.	**Area**	Double	Up to 4 decimals	Area of corresponding Municipal boundary
Name	**Name**	Text	50	Name of the Municipal Boundary
Ward Number	**Ward_No**	Numeric	5	Ward Number in case of Ward boundary
Taxzone Number	**Taxzone_No**	Numeric	5	Tax zone Number in case of Tax zone boundary

Table 60: Other Boundaries (EB, UFS, Mining area, CRZ) Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
4	**40-01**	**Other Boundaries**	*Urban Frame Survey Boundary*	Polygon	
	40-02		*Enumeration Block Boundary*	Polygon	
	40-03		*Mining Area Boundary*	Polygon	
	40-04		*CRZ Boundary*	Polygon	

Table 61: Boundaries (EB, UFS, Mining area) GIS Data Structure

Geospatial Layer Name: Other_Bnd_Poly

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 24
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 24
Area in sq. kms.	**Area**	Double	Up to 4 decimals	Area of corresponding Admin boundary
Enumeration Block Number	**EB_No**	Numeric	5	Enumeration Block Number
Urban Frame Survey Number	**UFS_No**	Numeric	5	Urban Frame Survey Number

Hazard Prone Areas

Database available with NRSC/ISRO, GSI, NDMA, Other State & Central Government Departments will be incorporated into the final database.

Table 62: Hazard Prone Areas Geospatial Data Content

S.No	Code	Class	Sub-Class	Geometry	Symbol
1	**41-01**	**Hazard**	Flood	Polygon	
	41-02		Earthquake	Polygon	
	41-03		Landslide	Polygon	
	41-04		Tsunami	Polygon	

Table 63: Hazard prone Areas GIS Data Structure

Geospatial Layer Name: Hazard_poly

Attribute Name	Attribute Field Name	Attribute Field Type	Attribute Field Width	Description/Value
Code	**Code**	Alphanumeric	10	Code as given in Table 25
Sub-Class	**Sub_Class**	Text	50	Sub Class as given in Table 25
Survey Date	**SVY_Date**	Date		Date of Surveying
Metadata ID	**Meta_ID**	Text	50	ID of Metadata
Additional Information	**Add_Info**	Text	200	Any other information
Photograph	**Photo**	Text	254	Hyperlink of photograph of Feature

7. INDICATIVE FORMAT FOR URBAN DATA COLLECTION

Master Plan formulation requires a variety of data at different stages of the planning process as a diagnostic tool for the health of the city, assessment of existing conditions in a settlement, spatial variations within the city, time series information, etc. as well as analysis and projections for future requirements in respect of various activities. While primary data collection involves time-consuming surveys, most socio-economic data may be obtained from published or un-published secondary sources. In order to streamline the process and diminish delays in the plan preparation process, a standardized data collection format has been provided as an effort to simplify and speed up the process. Most of data collection can be taken up as a separate research/survey before plan formulation to provide processed data inputs.

This format for urban data collection at town/ ward level consists of 25 tables which cover key areas such as demography, physical and locational aspects, physical and social infrastructure, environment, housing and slums, governance, etc. which are vital for study of existing situation and framing of proposals for master plan formulation.

The format is an indicative format. Town planning is a State subject and a great variety of legislations exist which specify requirements for master/development plan formulation, and different State Town Planning Acts may specify different requirements of data to be collected. Further, since the cities vary in size from megalopolitan to Class VI cities, with a great variety of topographic settings, functional specializations, etc., the data requirement for plan formulation cannot be uniform. Therefore, the format may be modified suitably by the State Nodal Agencies as per their requirement depending on size and other characteristics of the urban settlement.

The indicative format for urban data collection is given at Annexure-5; the same is to be linked with the respective features through code. Guidelines to fill the proforma are at Appendix I.

8. FUTURE SCOPE

i. The current SDMS of SoI caters to 2D data only. It does not cater to the requirements of 3D textured models that are also produced via UAS survey. Due to paucity of time/ resources, the Authoring Committee could not develop the requisite 3D SDMS. It is recommended that development of 3D SDMS and its City GML implementation, for depicting city infrastructure and vertical space (floor/unit) in the city landscape, should be taken up on priority.

ii. As multiple units exist in the same building, the classification can be done at Building Unit level. The classification of various classes (commercial/ industrial etc.) can be further done upto the next detailed level.

iii. The current document focuses on Design and Standards for data acquisition and spatial data base creation for Master Plan formulation. Task force may be constituted to document the training requirements; changes in existing mechanism, development of applications for integration of GIS based master-plan into the business processes of TCPO and urban authorities.

9. REFERENCES:

1. NNRMS Standards: A National Standard for EO Images, Thematic & Cartographic Maps, GIS Databases and Spatial Outputs, July 2005, ISRO: NNRMS: TR: 112: 2005 committee report.

2. Civil Aviation Requirements (CAR) Section 3- Air Transport Series X part I, Office of the Director General of Civil Aviation, Government of India- 2018

3. NUIS Design & Standards, July 2006, TCPO/ MoUD, New Delhi.

4. Design and Standards: Formulation of GIS based Master Plans for AMRUT Cities, Town and Country Planning Organisation/ MoHUA, Government of India – 2016

5. Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines, January 2015, MoUD, New Delhi.

6. Andhra Pradesh Municipal Development Project (APMDP), Terms of Reference, 2013, Govt. of AP.

ANNEXURE-1

K-14031/5/2016-AMRUT(CB)-Part(2)
Government of India
Ministry of Housing and Urban Affairs
(AMRUT-IIA)

Nirman Bhawan, New Delhi
Dated: 26th September, 2018

Memorandum

Subject: Constitution of a Committee for framing Design and Standards for application of Drone/UAV Technology in formulation of GIS based Master Plans- reg.

Ministry of Housing and Urban Affairs has constituted a Committee for framing Design & Standards for application of Drone/UAV Technology in formulation of GIS based Master Plans for small and medium towns. The composition of the Committee is as under:

1	Lt. General Girish Kumar, VSM, Surveyor General of India, Dehradun.	Chairman
2.	Shri Vishnu Chandra, Deputy Director General, National Informatics Centre.	Member
3	Shri S.V. Singh, Director, National Geo-Spatial Data Centre (NGDC), Survey of India, Dehradun.	Member
4	Prof. Mahavir, School of Planning & Architecture, New Delhi.	Member
5	Dr. K. Venugopala Rao, Group Head, Urban Studies & Geo-informatics Division, NRSC, ISRO Deptt. of Space, Hyderabad.	Member
6	Dr. Rajiv Kumar Jaiswal, Deputy Director, Earth Observation System Programme Office, ISRO, Bengaluru, Karnataka.	Member
7	Shri S. Surendra, Addl. Chief Planner, Town and Country Planning Organisation, New Delhi.	Member
8	Chief Town Planner, Town and Country Planning Department, Uttar Pradesh.	Member
9	Director, Department of Town and Country Planning, Government of Andhra Pradesh, Guntur.	Member
10	Chief Town Planner (Planning), Town & Country Planning Deptt., Govt. of Kerala, Thiruvananthapuram, Kerala.	Member
11	Chief Town Planner, Town Planning & Valuation Deptt., Govt. of Gujarat, Gandhinagar , Gujarat.	Member
12	Chief Town Planner, Town Planning Organisation, Govt. of Jammu and Kashmir, Jammu.	Member
13	Chief Town Planner, Town Planning Department, Govt. of Manipur, Imphal	Member
14	Shri Rahul Dev, Asstt. Prof., Geomatics Engg., Civil Engineering Department, IIT Roorkee.	Member
15	Shri Mohd. Monis Khan, Town and Country Planner, Town and Country Planning Organisation, New Delhi.	Member-Convener

The committee may co-opt any other member if required.

……2/-

: 2 :

2. Terms and Conditions of the Committee will be as under:

- Formulate the Design & Standards for application of Drone/UAV Technology for generation of base maps at 1:1000 or higher scale.
- Work out the methodology and cost for application of Drone/UAV Technology.
- Roles and Responsibilities of Survey of India, State Town Planning Departments/ULBs.
- The committee will submit its report within three months from the date of its first meeting.

3. This issues with the approval of competent authority.

26/9/18

(Rajeev Kumar Das)
Under Secretary to Govt. of India
Tel:011-23062075

1. Lt. General Girish Kumar, VSM, Surveyor General of India, Dehradun.
2. All members of the committee.

Copy to:

1. PS to AS (AMRUT)
2. PS to Director (AMRUT II)

ANNEXURE-2

सर्व शिक्षा अभियान
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sgo.technical.soi@gov.in

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Office of the Surveyor General of India
हाथीबड़कला एस्टेट, डाक बक्स सं. 37
Hathibarkala Estate, Post Box No. 37
देहरादून - 248 001 (उत्तराखण्ड), भारत
DEHRADUN - 248 001 (UTTARAKHAND), INDIA

OFFICE ORDER No. T- 501/1147-Project (UAV)/Coll.3 **Dt: 12 November, 2018**

Sub:- Constitution of Authoring Committee for framing design and standards for application of Drone/UAV- Reg.

SoI has constituted an Authoring Committee to prepare the draft document for design and standards for application of Drone/UAV technology in formulation of GIS based master plans for small and medium towns.

The composition of committee is as under :

1. Shri S K Sinha, Director, IBD - Chairman
2. Shri D N Pathak, Director, Survey (Air) & D GDC - Member
3. Shri Pankaj Mishra, DSG (Tech) SGO - Member
4. Lt Col Pawan Kumar Panday, DSG, GISTC (SGO) - Member
5. Shri Sidhanta Sen, DSS - Member convener
6. Dr. R D Garg, Asstt. Professor, IIT Roorkee - Member
7. Shri S Surendra, Addl Chief Planner, TCPO - Member
8. Mohd Monis Khan, Town & Country Planner - Member
9. Shri Nitin Kumar Azad, Asst. Town & Country Planner - Member
10. Smit Maitreyee Banerjee, Research Assistant - Member
11. Shri S Shubhash, Research Assistant - Member

2. Terms & condition of the committee will be as under :

Document writing for framing design and standard for application on Drone/UAV technology in formulation of GIS based master plan for small and medium towns as per the directions given by the main committee constituted by MoUD vide letter no. F. N. 2-11/188/DS-Drone/2018/URIS/TCPO dt. 28-09-2018.

3. This issues with the approval of the competent authority.

(Pankaj Mishra)
Deputy Director,
for Surveyor General of India

Distribution :

All members of the committee for compliance .

Copy to : 1. The Director, HP GDC, Chandigarh for information.
2. Shri Rajiv Kumar Das, Under Secretary (AMRUT II A), Ministry of Housing and Urban Affairs, Nirman Bhawan, New Delhi- 110001.

ANNEXURE-3A

सर्व शिक्षा अभियान
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DEHRADUN - 248 001 (UTTARAKHAND), INDIA

No. T- 164 /1147- Project (UAV) / Coll.8 **Dated: 21st Jan., 2020**

To,

The Town & Country Planner,
Town and Country Planning Organization,
Ministry of Housing and Urban Affairs
E-Block, Vikas Bhawan, Indraprasth Estate
New Delhi – 110002.

Sub: Designs and Standards for Application of UAV/Drone Technology in Formulation of GIS Based Master Plans Draft Report – Reg

Ref: Your office letter- F.No.2-11/188/DS-drone/2018/URIS/TCPO, Dated 09.12,2019

1. Please refer your letter under reference above.

2. Approval of the competent authority is hereby conveyed on "**Draft Design and Standard Document**" for application of Drone/UAV Technology in formulation of GIS based Master Plan for small and medium towns, finalized by your office duly incorporating comments /suggestions of Stakeholders.

This has been issued with the approval of Surveyor General of India.

(Pankaj Mishra)
Deputy Director,
for Surveyor General of India

ANNEXURE-3B

No. K-14031/05/2016-AMRUT(CB)-Part(2)
Government of India
Ministry of Housing and Urban Affairs
(AMRUT Division)
***

Nirman Bhavan, New Delhi
Dated: 21 October, 2020

To,

The Addl. Chief Planner,
Town & Country Planning Organisation,
E Block ,Vikas Bhawan,
I.P. Estate, New Delhi-110 002.

Subject:- Design & Standards document for Application of Drone/UAV Technology for 'Formulation of GIS based Master Plans for Small & Medium Towns'-reg.

Sir,

I am directed to refer to TCPO's note No.2-11/88-Drone/2018/URIS/TCPO dated 10.06.2020 on the subject mentioned above and to convey that Ministry of Housing & Urban Affairs has approved the Design & Standards document for Application of Drone/UAV Technology for 'Formulation of GIS based Master Plans for Small & Medium Towns.

2. This issues with the approval of competent authority.

Yours faithfully
21/10/20
(Rajeev Kumar Das)
Under Secretary to the Govt. of India
Tel: 23062075

ANNEXURE-4

सत्यमेव जयते

GOVERNMENT OF INDIA
OFFICE OF THE DIRECTOR GENERAL OF CIVIL AVIATION
TECHNICAL CENTRE, OPP. SAFDARJUNG AIRPORT, NEW DELHI

CIVIL AVIATION REQUIREMENTS
SECTION 3 – AIR TRANSPORT
SERIES X PART I
ISSUE I, DATED 27 AUGUST, 2018 **EFFECTIVE: 01st DECEMBER, 2018**

F. No. 05-13/2014-AED Vol. IV

Subject: Requirements for Operation of Civil Remotely Piloted Aircraft System (RPAS)

1. INTRODUCTION

1.1 Remotely Piloted Aircraft (RPA), autonomous aircraft and model aircraft are various sub-sets of unmanned aircraft. Unmanned aircraft system (UAS) is an aircraft and its associated elements, which are operated with no pilot on board.

1.2 Remotely piloted aircraft (RPA) is an unmanned aircraft, which is piloted from a remote pilot station. A remotely piloted aircraft, its associated remote pilot station(s), command and control links and any other components forms a Remotely Piloted Aircraft System (RPAS).

1.3 This CAR is issued under the provisions of Rule 15A and Rule 133A of the Aircraft Rules, 1937 and lays down requirements for obtaining Unique Identification Number (UIN), Unmanned Aircraft Operator Permit (UAOP) and other operational requirements for civil Remotely Piloted Aircraft System (RPAS).

2. ACRONYMS &DEFINITIONS

2.1 Acronyms

AAI	Airports Authority of India
ADC	Air Defence Clearance
ADS-B	Automatic Dependent Surveillance - Broadcast
AGL	Above Ground Level
AIP	Aeronautical Information Publication
ATC	Air Traffic Control
ATS	Air Traffic Service

ARC	Aviation Research Centre
ARP	Aerodrome Reference Point (published in AIP)
BCAS	Bureau of Civil Aviation Security
CAR	Civil Aviation Requirements
DGCA	Directorate General of Civil Aviation
DGFT	Directorate General of Foreign Trade
DIPP	Department of Industrial Policy & Promotion
FIR	Flight Information Region
FRTOL	Flight Radio Telephone Operator's License
FTO	Flying Training Organization
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IAF	Indian Air Force
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IPC	Indian Penal Code
MHA	Ministry of Home Affairs
MoCA	Ministry of Civil Aviation
MoD	Ministry of Defence
NOTAM	Notice to Airmen
NPNT	No Permission-No Takeoff
NTRO	National Technical Research Organization
PPL	Private Pilot License
RF-ID	Radio Frequency Identification
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft System(s)
RPS	Remote Pilot Station(s)
SARPs	Standards and Recommended Practices
SIM	Subscriber Identity Module
TSA	Temporary Segregated Areas
TRA	Temporary Reserved Areas
UA	Unmanned Aircraft
UAOP	Unmanned Aircraft Operator Permit
UAS	Unmanned Aircraft System(s)
UIN	Unique Identification Number
VFR	Visual Flight Rules
VLOS	Visual Line-Of-Sight
VMC	Visual Meteorological Conditions
WPC	Wireless Planning and Coordination Wing, DoT

2.2 Definitions

Command and Control (C2) Link	The data link between the UA and the remote pilot station for the purpose of managing the flight.
Controlled Airspace[1]	Airspace of defined dimensions within which air traffic control service is provided in accordance with the airspace classification.

[1] *Controlled airspace is a generic term which covers ATS airspace Classes A, B, C, D and E as described in ICAO Annex 11, Para 2.6.*

Danger Area	Airspace of defined dimensions within which activities dangerous to the flight of aircraft exist at specified times. Such timings are notified through NOTAMs.
Geo-fencing	Feature in a software programme that uses the global positioning system or radio frequency identification to define geographical boundaries.
Operator[2]	A person, organization or enterprise engaged in or offering to engage in an aircraft operation.
Owner	A natural or legal person who owns a remotely piloted aircraft and its remote pilot station.
Payload	All components of equipment on board the unmanned aircraft that are not needed for the flight or its control. Its transport aims exclusively to fulfill a specific mission.
Prohibited Area	Airspace of defined dimensions, above the land areas or territorial waters of India within which the flights are not permitted at any time under any circumstances.
Remote Pilot	A person charged by the operator with duties essential to the operation of a remotely piloted aircraft and who manipulates the flight controls, as appropriate, during flight time.
Remote Pilot Station (RPS)	The component of remotely piloted aircraft system containing the equipment used to pilot the remotely piloted aircraft.
Remotely Piloted Aircraft (RPA)	An unmanned aircraft, which is piloted from a remote pilot station.
Remotely Piloted Aircraft System (RPAS)	A remotely piloted aircraft, its associated remote pilot station(s), the required command and control links and any other components, as specified in the type design.
Restricted Area	Airspace of defined dimensions above the land areas or territorial waters of India within which the flight of aircraft is restricted.
RPA observer	A trained and competent person designated by the operator who, by visual observation of the remotely piloted aircraft, assists the remote pilot in the safe conduct of the flight.

[2] *In the context of remotely piloted aircraft, an aircraft operation includes the remotely piloted aircraft system.*

Segregated Airspace	Airspace of specified dimensions allocated for exclusive use to a specific user(s).
Unmanned Aircraft (UA)	An aircraft, which is intended to operate with no pilot on board.
Unmanned Aircraft System (UAS)	An aircraft and its associated elements, which are operated with no pilot on board.
Visual line-of-sight (VLOS) operation.	Operation in which the remote pilot or RPA observer maintains direct unaided visual contact with the remotely piloted aircraft.

3. CATEGORIES OF RPA

3.1 Civil RPA is categorized in accordance with Maximum All-Up-Weight (including payload) as indicated below:

i)	Nano	:	Less than or equal to 250 grams.
ii)	Micro	:	Greater than 250 grams and less than or equal to 2 kg.
iii)	Small	:	Greater than 2 kg and less than or equal to 25 kg.
iv)	Medium	:	Greater than 25 kg and less than or equal to 150 kg.
v)	Large	:	Greater than 150 kg.

4. APPLICABILITY

4.1 This CAR is applicable to Civil Remotely Piloted Aircraft Systems, which are Remotely Piloted from a Remote Pilot Station.

5. APPLICATION PROCESS

5.1 For RPA imported to India:

a) Any entity intending to import RPAS in India shall obtain Equipment Type Approval (ETA) from WPC Wing, Department of Telecommunication for operating in de-licensed frequency band(s). Such approval shall be valid for a particular make and model.

b) The applicant, other than Nano category, shall apply to DGCA for import clearance as per format given in Annexure-IA. Based upon the import clearance issued by DGCA, DGFT shall issue license for import of RPAS.

c) Upon receipt of import license, the applicant shall apply to DGCA for UIN/ UOAP, as applicable.

5.2 For RPA locally purchased in India:

a) The applicant shall ensure that locally purchased RPAS shall have ETA from WPC Wing, DoT operating in de-licensed frequency band(s). Such approval shall be valid for a particular make and model.

b) The applicant shall submit information as per format given in Annexure-IB along with application for issue of UIN / UAOP, as applicable.

5.3 All applications shall be processed on case-to-case basis through "Digital Sky Platform".

6. REQUIREMENTS FOR ISSUE OF UNIQUE IDENTIFICATION NUMBER (UIN)

6.1 Civil RPA except those indicated in Para 6.4 and 6.5 of this CAR, shall require Unique Identification Number (UIN) from DGCA.UIN will be granted where the RPAS is wholly owned either:

a) By a citizen of India; or

b) By the Central Government or any State Government or any company or corporation owned or controlled by either of the said Governments; or

c) By a company or a body corporate provided that:
   i) it is registered and has its principal place of business within India;
   ii) its chairman and at least two-thirds of its directors are citizens of India; and,
   iii) its substantial ownership and effective control is vested in Indian nationals;

   or

d) By a company or corporation registered elsewhere than in India, provided that such company or corporation has leased the RPAS to any organization mentioned in Para 6.1(b) or (c) above.

6.2 Following documents shall be required for issue of UIN:

6.2.1 General:

a) Contact details of owner/ lessee with valid CIN, GSTIN and/ or PAN card.
b) Purpose & base of operation.

6.2.2 Equipment Related:

a) Specification of RPAS.
b) Weight of compatible payload and maximum load carrying capacity of the RPA.
c) RPA Flight Manual/ Manufacturer's Operating Manual (as applicable).
d) Manufacturer's maintenance guidelines for RPA (as applicable).
e) Manufacturer's Certificate of Compliance for NPNT.

6.2.3 Approvals/Clearances:

a) ETA from WPC Wing, Department of Telecommunication for RPA operating in de-licensed frequency band(s), as applicable.
b) Security Clearance from MHA in case of 6.1 (a), (c) & Indian company or corporate leasing RPAS from a company or corporate registered elsewhere

than in India under 6.1, (d) not earlier than five years from date of application for UIN. However, individuals as indicated in Para 6.1 (a) shall either obtain security clearance from MHA or submit self-attested copies of at least two out of three valid identity proofs viz. Passport, Driving License or Aadhar Card. In case of foreign remote pilots employed by Indian entity as per para 6.1 (b), (c), and (d), DGCA shall forward documents for Security clearance to security agencies in accordance with the procedure being followed for Foreign Aircrew Temporary Authorization (FATA) pilots. The application form for security clearance is given at Annexure II/III of this CAR.

6.3 The applicant shall submit duly filled application (through Digital Sky Platform), as per Annexure IV of this CAR, along with requisite documents indicated in Para 6.2and applicable fee to DGCA. The UIN shall be issued in 02 working days, as per the format given at Annexure-V, provided all the documents are complete.

6.4 RPA in Nano category intended to fly upto 50 feet (15 m) AGL in uncontrolled airspace/ enclosed premises for commercial / recreational / R&D purposes are exempted from obtaining UIN.

6.5 RPAs owned / operated by NTRO, ARC and Central Intelligence Agencies are also exempted from obtaining UIN.

6.6 In case of entity specified under Para 6.1 (d) of this CAR, the Indian organization, who has taken RPAS on lease, shall obtain the UIN.

7. REQUIREMENTS FOR ISSUE OF UNMANNED AIRCRAFT OPERATOR PERMIT (UAOP)

7.1 Civil RPA operators other than those mentioned in Para 7.2 shall require UAOP from DGCA.

7.2 Following entities will not require UAOP:

a) Nano RPA operating below 50 feet (15 m) AGL in uncontrolled airspace / enclosed premises.
b) Micro RPA operating below 200 feet (60 m) AGL in uncontrolled airspace / enclosed premises. However, the user shall intimate to local police office 24 hours prior to conduct of actual operations.
c) RPA owned and operated by the agencies as indicated in Para 6.5 of this CAR. However, the agency shall intimate local police office and concerned ATS Units prior to conduct of actual operations.

7.3 Civil RPA operators except entities specified in Para 7.2 shall submit duly filled application through Digital Sky Platform along with requisite fees for issue of UAOP (Application format given in Annexure-VI) to DGCA at least 7 working days prior to actual commencement of operations along with following documents:

a) SOP as indicated in Para 12 of this CAR;
b) Permission of the land/property owner (only for area used for take-off and landing of RPA);

c) Details of remote pilot(s) along with security clearance from MHA or self-attested copies of at least two out of three valid identity proofs viz. Passport, Driving License or Aadhar Card and copies of training records;
d) Insurance details (as applicable);
e) Security programme as approved by BCAS.

7.4 The UAOP shall be issued by DGCA within 7 working days, as per the format given at Annexure-VII, provided all the documents are complete. A copy of the UAOP shall be provided to MHA, BCAS, IAF, ATS Provider (AAI and MoD), and district administration (Superintendent of Police) for information. In case of UIN issued under Para 6.1 (d) of this CAR, the Indian organization, who has taken RPAS on lease, shall be issued the UAOP.

7.5 Validity of the UAOP shall be for a period of five years from the date of issue.

7.6 The UAOP shall be non-transferrable.

7.7 Renewal of the UAOP shall be subject to fresh security clearance from MHA.

8. SECURITY/ SAFETY REQUIREMENTS

8.1 The operator shall be responsible for the safe custody, security and access control of the RPAS. In case of loss of RPA, the operator shall report immediately to the local police office, BCAS and DGCA.

8.2 The operator of all RPA except Nano RPA shall be responsible for notifying any incident/ accident involving RPA to the Director of Air Safety, DGCA as per Annexure VIII who will further intimate to all concerned agencies.

8.3 In case, the RPA is damaged and cannot be restored to original condition, the same shall be notified to DGCA by the owner/ operator for cancellation of UIN.

8.4 The RPAS operator shall ensure that all security measures as enumerated in the Security Programme (approved by BCAS) are in place before operation of each flight.

8.5 The ground control station (while in use or in store) shall be secured from sabotage or unlawful interference.

8.6 The RPAS (issued with UIN) shall not be sold or disposed-off in any way to any person or firm without permission from DGCA.

8.7 Any changes in the contact details specified in UIN shall be immediately notified to DGCA and all other concerned agencies.

9. REMOTE PILOT TRAINING REQUIREMENTS

9.1 Remote pilot shall have attained 18 years of age, having passed 10th exam in English, and undergone ground/ practical training.

9.2 The ground training shall be obtained at any DGCA approved Flying Training Organization (FTO), and include the following theory subjects:

a) Basic Radio Telephony (RT) techniques including knowledge of radio frequencies.
b) Flight Planning and ATC procedures.
c) Regulations specific to area of operations.
d) Basic knowledge of principles of flight and aerodynamics for fixed wing, rotary wing, and hybrid aircraft.
e) Airspace Structure and Airspace Restrictions with knowledge of No Drone Zones
f) Basic Aviation Meteorology.

9.3 The practical training shall comprise of RPA in flight having live component, and/ or simulated flight training to demonstrate control of RPA throughout its operating conditions, including safe recovery during emergencies and system malfunction. Minimum syllabus and curriculum for training capsule for Remote Pilot is given at Annexure-IX.

9.4 The requirements contained in Para 9.1 through 9.3 of this CAR are not applicable for Nano and Micro category RPA pilots intending to operate in uncontrolled airspace. However, the owner and user shall be fully aware of responsibilities for all aspects of flight safety during such operations.

10. RPAS MAINTENANCE REQUIREMENTS

10.1 Maintenance and repair of RPAS shall be carried out in accordance with the manufacturer's approved procedures, as applicable.

10.2 Maintenance of the ground control equipment shall be carried out in accordance with the manufacturer's recommended inspection and overhaul interval, as applicable.

10.3 The remote pilot/ user shall not fly the RPA unless he/ she is reasonably satisfied that all the control systems of RPA including the radio and Command & Control link are in working condition before the flight.

10.4 The UAOP holder shall maintain records of each RPA flight and make such records available to the DGCA on demand. Such records shall be maintained as per the format given in Annexure-X.

11. EQUIPMENT REQUIREMENTS

11.1 All RPA (except for Nano category intending to operate up to 50 ft (15 m) AGL in uncontrolled airspace/ enclosed premises),shall be equipped with the following serviceable components/ equipment:

a) GNSS for horizontal and vertical position fixing
b) Autonomous Flight Termination System or Return Home (RH) option
c) Flashing anti-collision strobe lights

d) RFID and GSM SIM Card/ NPNT compliant for APP based real time tracking
e) Fire resistant identification plate inscribed with UIN
f) Flight controller with flight data logging capability

11.2 In addition to the equipment required under Para 11.1, all RPA (except Nano and Micro category operating in uncontrolled airspace) intending to operate in controlled airspace up to 400 feet (120 m) AGL shall be equipped with the following additional equipment/capabilities:

a) SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment
a) Barometric equipment with capability for remote sub-scale setting
b) Geo-fencing capability
c) Detect and Avoid capability

11.3 Remote pilot shall be equipped with communication facilities to establish two way communication with the concerned ATS unit.

11.4 The tracking system of the RPA shall be self-powered and tamper/ spoofing proof to ensure data relay even in the event of RPA accident.

11.5 Indian Air Force shall monitor RPA movements in the country in coordination with Airports Authority of India.

12. OPERATING REQUIREMENTS

12.1 The RPA operator shall prepare Standard Operating Procedures (SOP), which shall contain following procedures according to the provisions contained in relevant sections of AIP-India:

a) Take-off/landing
b) Collision avoidance
c) Noise abatement
d) Flight plan filing
e) Local airspace restriction
f) Right-of-way
g) Communications
h) RPA emergency including loss of C2 link
i) Safe recovery of RPA through controlled airspace in case RPA system failure precludes the ability to remain outside controlled airspace, etc.

12.2 Irrespective of weight category, all RPA operations shall be restricted to day only, within Visual Line of Sight (VLOS), subject to conditions given in Para 12.3.

12.3 RPA operations except those in enclosed premises, shall be conducted only when the following meteorological conditions exist:

a) During daylight (between sunrise and sunset).
b) In Visual Meteorological Conditions (VMC) with a minimum ground visibility of 5 km and cloud ceiling not less than 1500 feet (450 m).

c) Surface winds of not more than 10 knots or as specified by the manufacturer.
d) No precipitation (rain, hail or snow) or thunderstorm activities, or exceeding those specified by the manufacturer.

12.4 The operator [except Nano intending to operate up to 50 ft (15 m) AGL in uncontrolled airspace/ enclosed premises] shall obtain permission before undertaking flight through 'Digital Sky Platform'.

12.5 In addition to the requirement under Para 12.4, all RPA operators [except Nano and Micro category intending to operate up to 50 ft (15 m) AGL and 200 ft (60 m) AGL respectively in uncontrolled airspace/ enclosed premises]are required to file flight plan at least 24 hours before actual operations and obtain following:

a) ATC briefing, Meteorological (MET) briefing, and ATC clearance from the nearest ATC Unit
b) Air Defence Clearance (ADC) from the nearest IAF Unit
c) FIC Number from the Flight Information Centre (FIC) concerned

12.6 Nano and Micro category RPA operators intending to operate beyond 50 ft (15 m) AGL and 200 ft (60 m) AGL respectively in uncontrolled airspace/ enclosed premises, shall not be exempted from the provisions of paragraphs 6 through 12 and 15 of this CAR.

12.7 All RPA operators (except Nano RPA operating below 50 ft), shall inform the concerned local police office in writing prior to commencing the operations.

12.8 RPA Operator shall carry out safety risk assessment [(a) hazard identification, (b) determination of severity and likelihood of hazard on the operation, (c) mitigation measures to reduce the risk identified, and (d) verification of mitigation actions] of the RPA operations including that of launch/ recovery sites. The site (including emergency operation zone and any safety zone for the operations of the RPAS) shall be under the full control of the operator.

12.9 Designated safe areas should be established by the RPA operator for emergency RPA holding and flight terminations.

12.10 The take-off and landing areas should be properly segregated from public access.

12.11 Remote pilots shall prefix RPA call-sign with the word UNMANNED during voice communications between ATC and the remote pilot station. RPA operator shall ensure that no Radio Frequency Interference (RFI) is caused to air traffic operations and air navigation equipment.

12.12 For operations in the controlled airspace, the remote pilot shall establish and maintain contact with ATC prior to entering the controlled airspace.

12.13 All communication between remote pilot station and ATS Unit shall be in prescribed ICAO phraseology.

12.14 No person shall act as a remote pilot for more than one RPA operation at a time.

12.15 If two or more persons are available as remote pilots for a flight, at any given moment, there shall be only one person acting as a remote pilot-in-command.

12.16 RPA operator shall be responsible for ensuring that the RPA is operated safely and remains clear of all manned/ unmanned air traffic, terrain and obstacles.

12.17 RPA shall, at all times, give way to manned aircraft.

12.18 RPA shall not discharge or drop substances unless specially cleared and mentioned in UAOP.

12.19 RPA shall not transport any hazardous material such as explosives or animal or human payload.

12.20 RPA shall not be flown in a manner to cause danger to any person or property.

12.21 RPA operator/ remote pilot shall be liable to ensure that privacy norms of any entity are not compromised in any manner.

12.22 In the event of cancellation of operations, the operator shall notify the same to all appropriate authorities immediately.

13. OPERATING RESTRICTIONS

13.1 No RPA shall be flown:

a) Within a distance of 5 km from the perimeter of airports at Mumbai, Delhi, Chennai, Kolkata, Bengaluru and Hyderabad;

b) Within a distance of 3 km from the perimeter of any civil, private or defence airports, other than those mentioned in Para 13.1(a);

c) Above the Obstacle Limitation Surfaces (OLS) or PANS-OPS surfaces, whichever is lower, of an operational aerodrome, specified in Ministry of Civil Aviation (Height Restrictions for Safeguarding of Aircraft Operations) Rules, 2015 notified through Gazette of India notification GSR751(E) as amended from time to time;

d) Within permanent or temporary Prohibited, Restricted and Danger Areas including TRA, and TSA, as notified in AIP;

e) Within 25km from international border which includes Line of Control (LoC), Line of Actual Control (LAC) and Actual Ground Position Line (AGPL);

f) Beyond 500 m (horizontal) into sea from coast line provided the location of ground station is on fixed platform over land;

g) Within 3 km from perimeter of military installations/ facilities/ where military activities/ exercises are being carried out unless clearance is obtained from the local military installation/facility;

h) Within 5 km radius from Vijay Chowk in Delhi. However, this is subject to any additional conditions/ restrictions imposed by local law enforcement agencies/ authorities in view of the security.

i) Within 2 km from perimeter of strategic locations/ vital installations notified by Ministry of Home Affairs unless clearance is obtained from MHA;

j) Within 3 km from radius of State Secretariat Complex in State Capitals;

k) From a mobile platform such as a moving vehicle, ship or aircraft;

l) Over eco-sensitive zones around National Parks and Wildlife Sanctuaries notified by Ministry of Environment, Forests and Climate Change without prior permission.

13.2 No RPA shall carry out aerial photography/remote sensing survey over the areas specified in Para 13.1 of this CAR. However, DGCA may authorize such operations on case-to-case basis subject to approval of MoD. In such a case, application shall be submitted to Director Regulations & Information, DGCA (seven copies) in the prescribed format as indicated at Annexure-XI.

14. GENERAL REQUIREMENTS

14.1 Operation of RPA beyond the conditions specified in Para 12.2 and 12.3 of this CAR may be authorised by DGCA on case-to-case basis subject to adequate justification provided by the applicant for safe conduct of RPAS operations.

14.2 To encourage new technology, Indian Organizations/ Institutions involved in R & D related activity of RPAS shall use the test sites as indicated in Annexure-XII for testing/ demonstration purpose.

14.3 The organizations mentioned at Para 14.2, may alternatively utilize unused airstrips or Government educational institutions campus, provided adequate safety precautions are in place.

14.4 It shall be the responsibility of operators/ R&D Institutions, to ensure that no manned or unmanned aircraft is flying during such operations in the intended test area.

14.5 Roles & responsibilities of Govt. Stakeholders on various aspects of operation of civil remotely piloted aircraft system are given at Annexure-XIII.

15. MINIMUM STANDARDS FOR MANUFACTURING OF RPAS (BOTH INDIAN & FOREIGN)

15.1 The minimum standards for manufacturing of Small and above categories of RPAS are given in Annexure-XIV.

15.2 For Nano and micro categories of RPAS, the minimum standards for manufacturing as envisaged by designer/OEM, shall be considered.

15.3 For all categories of RPAS except Nano, the manufacturer shall provide a Certificate of Compliance along with NPNT compliance to DGCA.

16. LEGAL OBLIGATIONS

16.1 UIN and/ or UAOP issued by DGCA shall not:

a) Confer on RPAS operator any right against the owner or resident of any land or building or over which the operations are conducted, or prejudice in any way the rights and remedies which a person may have in respect of any injury to persons or damage to property caused directly or indirectly by the RPA.

b) Absolve the operator/ remote pilot from compliance with any other regulatory requirement, which may exist under the State or local law.

17. INSURANCE

17.1 All civil RPA operators shall have insurance with the liability that they might incur for any damage to third party resulting from the accident/incident.

18. ENFORCEMENT ACTION

18.1 In case of violation of provisions of this CAR/ approved operating conditions, the UIN/ UAOP issued by DGCA shall be suspended/ cancelled.

18.2 Breach of compliance to any of the requirements and falsification of records/ documents shall attract penal action including imposition of penalties as per applicable IPCs (such as 287, 336, 337, 338 or any relevant section of IPC).

18.3 Necessary actions shall be taken as per relevant sections of the Aircraft Act 1934 / the Aircraft Rules 1937 or any statutory provisions.

(B. S. Bhullar)
Director General of Civil Aviation

CIVIL AVIATION REQUIREMENTS
SERIES X PART I

SECTION 3 – AIR TRANSPORT
27TH AUGUST, 2018

Annexure-IA

APPLICATION FOR IMPORT OF REMOTELY PILOTED AIRCRAFT

1. Name of Applicant/ Owner/ Operator:
(In case of Company/ Corporation,
Provide names of owners/directors and their nationalities)

2. Contact details (Address, E-mail ID, Phone No.):

3. Nationality:

4. Category: Existing UAOP holder/ UAOP applicant/ Without UAOP

5. Fleet strength:

No.	RPA type	UIN	Mode of acquisition (Owner / lease)

6. Details of RPA proposed to be imported/ acquired:

Items	RPA details
Name and address of manufacturer	
Nationality	
Model No.	
Serial Number	
Date and Year of Manufacture	
Fixed Wing/ Rotary Wing	
New/ Used	
Maximum all-up-weight	
Maximum height attainable	
Payload details	

7. Mode of import (Lease/Outright Purchase):

Outright Purchase	Lease		
Name & Address of the owner (name of manufacturer in case of new RPA)	Name & Address of the owner	Name & Address of the Lessor	Name & Address of the Lessee

8. Purpose of Operation of RPA:

9. Proposed base of operation:

10. Copy of security clearance:

UNDERTAKING

1. The RPA shall be used only for the purpose for which it is being imported/ locally purchased and meets the regulations contained in CAR Section 3, Series X, Part I.

2. RPA shall be maintained and operated in accordance with the regulation specified by DGCA from time to time and there is no binding or limitation of any kind in this regard in the lease agreement for the acquisition of the RPAS.

3. Certified that the information given above is correct.

Date:

(Signature of the applicant)
Name :
Designation :

Note: Strikeout whichever is not applicable.

CIVIL AVIATION REQUIREMENTS
SERIES X PART I

SECTION 3 – AIR TRANSPORT
27TH AUGUST, 2018

Annexure-IB

PROFORMA FOR INFORMATION FOR LOCALLY PURCHASED REMOTELY PILOTED AIRCRAFT

1. Name of Applicant/ Owner/ Operator:
(In case of Company/ Corporation,
Provide names of owners/ directors and their nationalities)

2. Contact details (Address, E-mail ID, Phone No.):

3. Nationality:

4. Category: Existing UAOP holder/ UAOP applicant/ Without UAOP

5. Fleet strength:

No.	RPA type	UIN	Mode of acquisition (Owner / lease)

6. Details of RPA proposed to be imported/ acquired:

Items	RPA details
Name and address of manufacturer	
Nationality	
Model No.	
Serial Number	
Date and Year of Manufacture	
Fixed Wing/ Rotary Wing	
New/ Used	
Maximum all-up-weight	
Maximum height attainable	
Payload details	

7. Mode of acquisition (Lease/ Outright Purchase):

Outright Purchase	Lease		
Name & Address of the owner (name of manufacturer in case of new RPA)	Name & Address of the owner	Name & Address of the Lessor	Name & Address of the Lessee

8. Purpose of Operation of RPA:

9. Proposed base of operation:

10. Copy of security clearance:

UNDERTAKING

1. The RPA shall be used only for the purpose for which it is being imported/ locally purchased and meets the regulations contained in CAR Section 3, Series X, Part I.

2. RPA shall be maintained and operated in accordance with the regulation specified by DGCA from time to time and there is no binding or limitation of any kind in this regard in the lease agreement for the acquisition of the RPAS.

3. Certified that the information given above is correct.

Date:

(Signature of the applicant)
Name :
Designation :

Note:
1. Strikeout whichever is not applicable.
2. Filled proforma to be submitted along with duly filled application for UIN.

Annexure-II

APPLICATION PROFORMA FOR SECURITY CLEARANCE

I. Details of Company/ Firm (Indian/ Foreign)

No.	Full Name of the company and its foreign collaborator, if any	Date of registration of company	Address of Head Office, Regional Offices & Registered Office	Previous name of company, if any	Details of earlier approvals, if any (Ref. No. & date)

II. Details of Directors

No.	Full Name of Board of Directors	Present Position held with date (since when)	Date of Birth	Parentage	Present & Permanent Address	Nationality	Passport No. and Date of Issue	Contact Address & Tel. No.

III. Details of Shareholders of Applicant Company (All firms/ companies/ entities/ individuals having shareholding more than 10%)

No.	Full Name	Parentage Father/ Mother	Date of Birth	Permanent Address	Present Address	Present Position held in the company, if any	Nationality (if holding dual nationality, both must be clearly mentioned)	% of shares held in the comp-any

IV. Details of criminal cases, if any, against the Company/ Director(s) as per Annexure IIA

Date:

(Signature of the applicant)
Name :
Designation :

CIVIL AVIATION REQUIREMENTS
SERIES X PART I

SECTION 3 – AIR TRANSPORT
27TH AUGUST, 2018

Annexure-IIA

SELF-DECLARATION FOR COMPANY AND DIRECTOR(S) FOR WHOM SECURITY CLEARANCE IS SOUGHT

a)	Name & address and registration no. of the company	
b)	Name & address of owners, promoters and directors of the company 1. 2. 3. 4.	
c)	Is the company owners, promoters or directors listed above have 4. Preventive detention proceedings (PSA/ NSA etc.) 5. Criminal proceedings	 Yes/No Yes/No
d)	If Yes, please provide following details 1. Detention/ Case/ FIR/ Warrant Number 2. Police Station/ District/ Agency 3. Section of law 4. Name & place of the court	
e)	The above mentioned details are in respect of both in India and in foreign country, if any.	

Note: The above self-declaration is required to be filled and signed by the authorized signatory of the company.

Date:

(Signature of the applicant)
Name :
Designation :

CIVIL AVIATION REQUIREMENTS
SERIES X PART I

SECTION 3 – AIR TRANSPORT
27TH AUGUST, 2018

Annexure-III

APPLICATION PROFORMA FOR SECURITY CLEARENCE (INDIVIDUALS)

1. (a) Name of Applicant in full (in block letters)
Surname Name Aliases, if any

(b) Parentage:
Surname Name Aliases, if any

2. Present address in full, including nearest Police Station:

3. (a) Permanent address in full, including nearest Police Station:

(b) If originally a resident of a country other than India, address in that country and the date of migration to India.

4. Nationality:

5. Date and place of birth, with full address:

6. Profession/ occupation after the age of 18 years:

7. Particulars of places, with full address, where the applicant has resided for more than a year during the preceding five years:

8. Has the applicant ever been arrested, prosecuted, kept under detention, or convicted by a court? Give details:

Certified that the information furnished in this proforma is correct and complete to the best of my knowledge and belief. I am aware that furnishing of wrong information or suppression of factual or material information will dis-entitle me from grant of the license/ permit.

Date:

(Signature of the applicant)
Name :
Designation :

Annexure-IV

APPLICATION FOR UNIQUE IDENTIFICATION NUMBER (UIN) OF REMOTELY PILOTED AIRCRAFT (RPA) - (USE ONE APPLICATION PER RPA)

Section A: Particulars of Applicant/Owner/Operator of RPA

1. Copy of import permission / filled proforma for information of local acquisition
2. Valid CIN, GSTIN and PAN Card
3. Copy of security clearance from MHA or self-attested copies of at least two out of three valid identity proofs viz. Passport, Driving License or Aadhar Card (in case of individual/Indian remote pilot)
4. Copy of Permission/ license from WPC Wing, Department of Telecommunication for usage of licensed frequencies used in RPA. (as applicable)
5. Copy of ETA from WPC Wing, Department of Telecommunication for RPA operating in de-licensed frequency band(s) (as applicable)
6. Details of fees paid *

Section B: Specification of Remotely Piloted Aircraft

7. Name and address of manufacturer
8. Model No.
9. Serial Number
10. Date and Year of Manufacture
11. Fixed Wing/ Rotary Wing
12. New/Used
13. Maximum all-up-weight (including Payload)
14. Category of RPA
15. Details of compatible payload
16. Place &region of operation as per AAI FIR
17. Purpose of operation
18. Engine/Motor : a) Type, b) Power Rating and c) Number of Engines/Motors
19. Total fuel capacity (kg)/ Battery capacity (mAh)
20. Propeller details
21. Overall dimensions (l x b x h)
22. Maximum Endurance
23. Maximum Range
24. Maximum Speed
25. Maximum Height attainable
26. Maximum Height of operations required
27. GNSS (GPS) for horizontal and vertical position fixing
28. Autonomous Flight Termination System or Return Home (RH) option
29. Flashing anti-collision strobe lights
30. RFID and GSM SIM Card/ NPNT compliance for APP based real time tracking
31. Fire resistant identification plate inscribed with UIN
32. Flight Controller with flight data logging capability
33. Particulars of previous or existing UIN, if applicable
34. Copy of Remotely Piloted Aircraft Flight Manual/ Manufacturer's Operating Manual (as applicable)
35. Copy of Manufacturer's Maintenance guidelines (as applicable)

36. History of incidents/accidents (if any) along with nature and extent of damage sustained by the RPA and details of any repairs carried out.

37. **Undertaking:**

I hereby declare that the above particulars are true in every respect and that nothing has been concealed or withheld by me. I have studied the relevant regulations issued by DGCA from time to time and shall abide by them.

Date:

(Signature of the applicant)
Name :
Designation :

*** Note:** The fee for issue of unique identification number for a remotely piloted aircraft shall be ₹1000/- only.

CIVIL AVIATION REQUIREMENTS
SERIES X PART I

SECTION 3 – AIR TRANSPORT
27TH AUGUST, 2018

Annexure-V

FORMAT FOR ISSUE OF UNIQUE IDENTIFICATION NUMBER

<table>
<tr><td colspan="5">DIRECTORATE GENERAL OF CIVIL AVIATION
OPP. SAFDARJUNG AIRPORT,
NEW DELHI-110003, INDIA

UNIQUE IDENTIFICATION NUMBER</td></tr>
<tr><td rowspan="2">Unique Identification Number</td><td rowspan="2">Manufacturer and Manufacturer's designation of Remotely Piloted Aircraft System</td><td>Remotely Piloted Aircraft Model No.</td><td colspan="2"></td></tr>
<tr><td>Max. All-up-weight (kg).</td><td colspan="2"></td></tr>
<tr><td rowspan="2">U-XX-XXXX</td><td rowspan="2"></td><td>Category</td><td colspan="2"></td></tr>
<tr><td>Type of Aircraft</td><td colspan="2">Fixed Wing/ Rotary Wing</td></tr>
<tr><td>Name of owner</td><td colspan="4"></td></tr>
<tr><td>Address of owner</td><td colspan="4"></td></tr>
<tr><td rowspan="2">E-mail ID & Contact No. of Owner</td><td colspan="4"></td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Name of Operator</td><td colspan="4"></td></tr>
<tr><td>Address of Operator</td><td colspan="4"></td></tr>
<tr><td rowspan="2">E-mail ID & Contact No. of Operator</td><td colspan="4"></td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="5">It is hereby certified that the above mentioned Remotely Piloted Aircraft System has been duly entered in the Indian Civil Unmanned Aircraft database.</td></tr>
<tr><td rowspan="2">Date of Issue</td><td rowspan="2"></td><td>Signature</td><td colspan="2"></td></tr>
<tr><td>Name</td><td colspan="2"></td></tr>
<tr><td>Place of Issue</td><td></td><td>Designation with Seal</td><td colspan="2"></td></tr>
</table>

CIVIL AVIATION REQUIREMENTS
SERIES X PART I

SECTION 3 – AIR TRANSPORT
27TH AUGUST, 2018

Annexure-VI

APPLICATION FOR ISSUE/ RENEWAL OF UNMANNED AIRCRAFT OPERATOR PERMIT (UAOP)

1. UIN No./ Existing UAOP Number (If applicable)
2. Details of Remote pilot(s) and training records
3. Security programme approved by BCAS
4. Permission of land/ property owner (area used for take-off and landing of RPA)
5. Insurance details (as applicable)
6. Standard Operating Procedures
7. Details of fees paid*

8. **Undertaking:**

(a) I hereby declare that the above particulars are true in every respect and that nothing has been concealed or withheld by me. I have studied the relevant regulations issued by DGCA from time to time and shall abide by them.

(b) I shall keep RPA Flight Manual / Manufacturer's Operating Manual (as applicable) up to date at all times. I shall specify procedures to be followed by remote pilots and other relevant persons to ensure safety of RPA operations and shall produce the same as and when demanded by DGCA.

(c) I shall maintain RPAS as per maintenance system established by manufacturer and details of the same shall be kept up to date at all times and shall produce relevant records of maintenance as and when demanded by DGCA.

Date:

(Signature of the applicant)
Name :
Designation :

***Note**:
1. Fees for issue of Permit is ₹25,000/-
2. Fees for renewal of Permit is ₹10,000/-

CIVIL AVIATION REQUIREMENTS
SERIES X PART I

SECTION 3 – AIR TRANSPORT
27TH AUGUST, 2018

Annexure-VII

FORMAT FOR ISSUE OF UNMANNED AIRCRAFT OPERATOR PERMIT

DIRECTORATE GENERAL OF CIVIL AVIATION
OPP. SAFDARJUNG AIRPORT,
NEW DELHI-110003, INDIA

UNMANNED AIRCRAFT OPERATOR PERMIT

Unmanned Aircraft Operator Permit	
Name of operator	
Address of operator	
E-mail & Contact No. of operator	

This certificate certifies that <operator name> is authorized to perform RPA operations as defined in the attached operations specifications and in accordance with the regulations prescribed in CAR Section 3, Series X, Part I.

Date of Issue		Signature	
Date of Expiry		Name	
Place of Issue		Designation with Seal	

DIRECTORATE GENERAL OF CIVIL AVIATION
OPP. SAFDARJUNG AIRPORT,
NEW DELHI-110003, INDIA

RPAS OPERATIONS SPECIFICATIONS

UIN Number	
Type of operations	
Area of base of operations	
Approved personnel for RPAS operation	
Operating limitations	
1. Maximum Endurance	
2. Maximum Ceiling	
3. Compatible Payloads (with weight), etc.	
Date of Issue	
Signatures	

CIVIL AVIATION REQUIREMENTS
SERIES X PART I

SECTION 3 – AIR TRANSPORT
27TH AUGUST, 2018

Annexure-VIII

OCCURRENCE REPORT FOR REMOTELY PILOTED AIRCRAFT (RPA)

Date of occurrence	
Time of occurrence	
Place of occurrence	
Latitude/Longitude	
Phase of flight	Take-off/ cruise/ landing/ hover
Type of operation	Commercial/ recreational/ survey/ photography/ R&D/ Other (please specify)
Colour of RPA	
Category of RPA	Nano/ Micro/ Small/ Medium/ Large
Make/Model No.	
UIN No.	
Year of manufacture	
Damage details	RPA/ property
Details of injury to persons	
Name of operator/company	
Details of remote pilot	
UAOP No.	
Brief description of occurrence	
Was RPA flying near aircraft? • If yes, provide approx. distance	
Was RPA flying near airport/ helipad? • If yes, provide approx. distance	
Was RPA last seen near prohibited/ restricted areas?	Please specify
Date:	(Name & Signature)

Annexure-IX

BLOCK SYLLABUS FOR TRAINING CAPSULE - 05 WORKING DAYS

No.	Subjects	No. of Classes
Theory Classes		**11**
1.	Regulations of DGCA	01
2.	Basic Principles of Flight	01
3.	ATC Procedures & Radio Telephony	01
4.	Fixed wing Operations/Aerodynamics	01
5.	Multi rotor Operations/Aerodynamics	01
6.	Weather & Meteorology	01
7.	Drone equipment and maintenance	01
8.	Emergency Identification & handling	01
9.	Payload installation & utilization	01
10.	Image/Video interpretation	01
11.	Final Test Theory	01
Practical Training		**24**
1.	Flight Simulator training	08
2.	Practical lessons in Lab	01
3.	Practical flying lessons	15
Total Training		**35**

DETAILED CURRICULUM FOR TRAINING CAPSULE - 05 WORKING DAYS

Day 01:

- Regulations of DGCA , Civil Aviation Requirements (01 Class)
  - Classification
  - Basic Air Regulations
  - Salient points
  - Do's and Don'ts

- Basic principles of flight (01 Class)
  - Fundamentals of flight
  - Aerodynamics
  - Take-off, flight, and landing
  - Manoeuvres, turns and circuit pattern

- ATC procedures & Radio Telephony (01 Class)
  - Understanding ATC operations
  - Airspace Structure and Airspace Restrictions with knowledge of No Drone Zones
  - Communicating with ATC including Position and Altitude Reporting
  - Flight Planning Procedures
  - Collision avoidance
  - Radio Telephony (RT) techniques
  - Standard radio terminology and RT Phraseology
  - Practice Session in Radio Communication

- Fixed wing operations and aerodynamics (01 Class)
  - Types of fixed wing drones, make, parts and terminology
  - Operation and manoeuvres of fixed wing drones
  - Applications and operations
  - Advantages/disadvantages over multi rotor drones

- Multi rotor introduction (01 Class)
  - Basic drone terminology
  - Types of drones, material used and size of drones
  - Motors and propellers
  - Electronic Speed Controller (ESC), flight controllers
  - Operation and Applications of drones
  - Advantages/disadvantages over multi rotor drones

- Weather and meteorology (01 Class)
  - The standard atmosphere
  - Measuring air pressure
  - Heat and temperature
  - Wind
  - Moisture, cloud formation
  - Met Terminal Aviation Routine Weather Report (METAR)

- Drone equipment maintenance (01 Class)
  - Maintenance of drone, flight control box, ground station
  - Maintenance of ground equipment, batteries and payloads
  - Scheduled servicing
  - Repair of equipment
  - Fault finding and rectification

Day 02:

- Emergency identification and handling (01 Class)
  - In flight emergencies
  - Loss of link
  - Fly-aways(Straying)
  - Loss of power
  - Control surface failures

- Payload, installation and utilization (01 Class)
  - Types of payloads
  - Parts of payloads
  - Installation
  - Features of payloads
  - Utilization

- Image and video interpretation (01 Class)
  - Principles of observation
  - Interpretation of image/video
  - Analysis

- Final test - Theory (40 min)

- Introduction to flight simulator (01 Class)
  - Basic operating features of simulator
  - How to select different aircrafts and aerodromes
  - Demo flight

- Flight simulator training (02 Classes)
  - Pre-flight checks and start-up
  - Preparation cum coordination for flight
  - Take-off and flight stage
  - Approach and landing
  - After flight checks

Day 03:

- Flight simulator training (05 Classes)
  - Pre-flight checks and start-up
  - Preparation cum coordination for flight
  - Take-off and flight stage
  - Approach and landing
  - After flight checks

- Practical lessons in Lab (01 Class)
  - Assembling of drone
  - De-assembling
  - Integration of sub-sections/ modules
  - Integration of engine/propulsion system
  - Fault finding and rectification
  - Repair maintenance and documentation

- Practical flying with instructor (01 Class)

Day 04:

- Practical flying with instructor/solo flying (full day)

Day 05:

- Practical flying with instructor/solo flying (full day)

CIVIL AVIATION REQUIREMENTS
SERIES X PART I

SECTION 3 – AIR TRANSPORT
27TH AUGUST, 2018

Annexure-X

SAMPLE OF RPA LOG BOOK

RPA LOG BOOK

Name of the Owner/Operator:

Address of Owner/Operator:

SAMPLE CONTENTS OF RPALOG BOOK

1.	UIN	
2.	Category of RPA	
3.	Date of flight	
4.	Name of Remote Pilot	
5.	Place &time of commencement of operation	
6.	Place &time of termination of operation	
7.	Hours of flight (00:00 hrs)	
8.	Remote pilot observation (if any)	
9.	Record of maintenance as prescribed by manufacturer	
10.	Compliance record of other instructions issued by manufacturer	

Date: (Signature of Remote Pilot)

Annexure-XI

APPLICATION FOR GRANT OF PERMISSION FOR AERIAL PHOTOGRAPHY/ REMOTE SENSING SURVEY
(To be submitted in seven copies)

1. Name and details of the company/agency seeking permission for aerial photography/Remote Sensing Survey with its registered office address.

2 Detail of person(s)/company intends to undertake photographs/aerial survey on behalf of agency at Para 1 above.

   a) Name (expanding Initials)
   b) Father's name
   c) Date and place of birth
   d) Present address
   e) Permanent address
   f) Nationality (if foreigners, information at Sl. No. (g) & (h) may also be provided)
   g) Passport No., date of issue & issuing authority
   h) Visa particulars including type, No., date, validity & issuing office

3. a) Purpose of aerial photography/aerial survey
   b) Objects to be photographed with exact location i.e. latitude/ longitude
   c) Scale of photography
   d) Focal length of camera
   e) Height of the flight
   f) Format size
   g) Type of camera/sensor being used
   h) Type of data

4. Proposed date when aerial photography/aerial survey is to be undertaken

5. Description of RPA, along with the name and address of the owner and the remote pilot (if owner/pilots are foreigner, information in Sl. No. 2 (g) and (h) be also provided).

6. In case the task is to be carried out for State/ Central Government, copy of authority from the concerned Government be provided.

7. Undertaking to comply with the following conditions and any other conditions as prescribed, if permission is granted:

   a) Photography/ remote sensing survey will be confined to the exact area as applied and cleared by the Ministry of Defence.
   b) No photography/ survey will be undertaken in the area so specified by the Ministry of Defence.

c) The exact date and time of actual photography/ remote sensing survey will be intimated to Air Hqrs. (Directorate of Intelligence) at least two weeks in advance to enable them to detail a Security Officer.

d) The Security Officer of the Ministry of Defence will be positioned at the launching site of aerial photography, if considered necessary.

e) Air Hqrs. (Directorate of Intelligence) will be intimated on completion of photo/survey task and for detailing another Security Officer to check the cover plots/ photo products/digital data as required.

f) In cases where it is not considered necessary to depute security officer by the Ministry of Defence, the exposed film will be processed and plotted but not issued for use till security vetted by a representative of the Air Hqrs. (Directorate of Intelligence).

g) In case so specified by the Ministry of Defence in their clearance letter, the film/digital image after exposure will be processed in the presence of Air Force representative designated who will vet them from security angle before releasing them.

h) Government will not be liable for any loss or damages of films/digital data while in their custody.

i) Where exposed films/ digital data have to be conveyed outside India because facilities to develop/ process them do not exist in the country, Ministry of Defence will be informed of this fact at the initial stage of application.

Date:

(Signature of the applicant)
Name :
Designation :

Note: Strikeout whichever is not applicable

Annexure-XII

LIST OF IDENTIFIED AREA FOR TESTING/ DEMONSTRATION OF RPAS

State	Name of Place	Coordinates
North		
Punjab	Phagwara	31° 17' 00" N 75° 48' 00" E
Uttarakhand	Sakkhanpur Farm	29° 18' 15" N 79° 03' 05" E
Uttar Pradesh	Lucknow, Shivgarh Resorts	26° 36' 27" N 81° 00' 42" E
Uttar Pradesh	Sultanpur	26° 14' 52" N 82° 02' 33" E
South		
Karnataka	Chitradurga	14° 23' 17" N 76° 34' 19" E
Karnataka	Ganimangala Village	12° 13' 02" N 76° 37' 33" E
Kerala	Munnar,Devikulam	10° 03' 23" N 77° 07' 11" E
Kerala	Idukki	09° 55' 08" N 77° 06' 08" E
Tamil Nadu	Vellore	12° 54' 31" N 79° 04' 00" E
Tamil Nadu	Coorg, Choudigudi Estate	12° 07' 25" N 76° 03' 42" E
Tamil Nadu	Salem, Pullagoundanpatti	11° 28' 49" N 77° 43' 19" E
Tamil Nadu	Erode, Nambiyur	11° 21' 28" N 77° 19' 14" E
Tamil Nadu	Coimbatore, Chettipalayam	10° 54' 47" N 77° 02' 12" E
Telangana	Hyderabad, Mulugu Village	17° 43' 41" N 78° 42' 02" E
East & NE		
Assam	Sonapur, Betkuchi	26° 08' 29" N 91° 57' 17" E
Assam	Sivasagar	26° 58' 57" N 94° 38' 32" E
Arunachal Pradesh	Daporijo Airfield	27° 59' 07"N 94° 13' 18" E
West		
Gujarat	Surendranagar	22° 46' 26" N 71° 40' 02" E
Maharashtra	Shirpur Airport	21° 19' 43" N 74° 57' 40" N
Maharashtra	Amravati	20° 53' 48" N 77° 46' 30" E
Maharashtra	Aurangabad	19° 57' 00" N 75° 15' 00" E
Maharashtra	Ahmednagar	19° 05' 42" N 74° 44' 58" E
Maharashtra	Satara	17° 40' 49" N 74° 01' 05" E

Note:
The above list of Identified Area for Operation of RPAS excludes the restricted areas notified by various Government agencies.

CIVIL AVIATION REQUIREMENTS
SERIES X PART I

SECTION 3 – AIR TRANSPORT
27TH AUGUST, 2018

Annexure-XIII

ROLES & RESPONSIBILITIES OF GOVT. STAKEHOLDERS ON VARIOUS ASPECTS OF OPERATION OF CIVIL REMOTELY PILOTED AIRCRAFT SYSTEM

No.	Stakeholder	Responsibility
1.	Directorate General of Civil Aviation	• Import clearance • Issuance of UIN • Issuance & renewal of UAOP • Enforcement (Cancellation/Suspension of UIN/UAOP) in case of violations of regulation
2.	Directorate General of Foreign Trade	• Import license
3.	Ministry of Home Affairs	• Security clearance
4.	Ministry of Defence	• Permission for aerial survey/imageries/ videography/ still photography over the restricted/prohibited areas on case-to-case basis
5.	Indian Air Force	• Air Defence Clearance. • Monitoring of RPA movements in the country. • Monitoring RPA movements in the country
6.	Wireless Planning and Coordination Wing, DoT	• Equipment Type Approval
7.	Bureau of Civil Aviation Security	• Approval of Security Programme
8.	Airport Authority of India	• Publication of guidelines for operation of RPAS in civil airspace in AIP. • Approval of RPAS Flight Plan and issuance of ATC Clearance to RPAS, where applicable. • Issue of Drone NOTAM when required. • Segregation of RPAS operations from manned aircraft movements. • Reporting of incidents / accidents involving known or controlled RPAS to DGCA.
9.	Local Police Office	• Enforcement of violators as per applicable IPCs

Annexure-XIV

MINIMUM STANDARDS FOR MANUFACTURING OF SMALL AND ABOVE CATEGORIES OF RPAS (BOTH INDIAN & FOREIGN)

Design/ Manufacturing Standards:

a. All-up-weight
b. Wing span/rotor diameter (as applicable)
c. Stall speed
d. Cruise speed (minimum and maximum speeds at which the RPA remains stable and operational need to be established)
e. Range (maximum range travelled in still air, to be established)
f. Endurance
g. Operational altitude
h. Ceiling height
i. Propeller speed and pitch for safe operation
j. Powerplant - engine/battery operated (utility of source of supplying power to the RPA, and its adequacy to support the RPA during its entire operational phase, must be demonstrated).
k. Payload (strength requirements to be specified in term of limits loads i.e. maximum loads to be expected in operation. Simplified structural design criteria may be used for RPA. The structure must be able to support limit loads without detrimental, permanent deformation).
l. Shock absorbing mechanism of RPA need to be established to ensure that in the event of rough landing, structure is not damaged.
m. RPA must achieve sufficient energy and controllability at the end of the launch to ensure safe and controllable fly-away under any operating conditions.
n. Type of data-link used for communication (frequency band etc.).
o. Type of material for construction (to meet approved specifications for ensuring strength and other properties assumed in the design data).
p. Fabrication Method (methods of fabrication used for designing RPA must produce consistently sound structure).
q. Structure must be suitably protected against deterioration or loss of strength in operation due to any cause i.e. weathering, corrosion and abrasion.
r. Fire resistant identification plate on RPA for inscribing UIN.
s. Compliance to Digital Sky Platform Specifications for "No Permission – No Takeoff (NPNT)" for small and above RPA. (NPNT Specifications available in DGCA RPAS guidance manual).
t. Instruments/ Equipment and Qualification Testing

i) Instruments/ Equipment
- Global Navigation Satellite System (GNSS) receivers for horizontal and vertical position fixing.
- Geo-fencing capability.
- Autonomous Flight Termination System or Return Home (RH) option.
- Flashing anti-collision strobe lights.
- RFID and GSM SIM Card.
- Flight controller with flight data logging capability.
- SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment.
- Barometric equipment with capability for remote sub-scale setting.
- Detect and Avoid capability.

ii) Qualification testing
- Environmental tests
  - EMI/EMC test.
  - Any other tests carried out by the OEM.

ANNEXURE 5

Formulation of GIS based Master Plans

INDICATIVE FORMAT FOR URBANDATA COLLECTION
(Proforma may be modified as per the requirement of State Governments)

TABLE 1: PHYSICAL ASPECTS AND LOCATIONAL PARTICULARS

1.1. Name of City/Town	
1.2. Civic Status	
1.3 Name of Tehsil/ Mandal/ Block	
1.4 Name of District	
1.5 Name of State/UT	

1.6 Area of City/Town

Ward		Area (sq. kms.)	
	1991	2001	2011
1			
2			
3			
…			
Total			

Source: _____

Extent as per various authorities may be specified as under:
Area as per Census of India _____
Extent of Local Planning Area _____
Municipal Area _____
Extent as per Urban Development Authority/Planning Authority
Urbanisable Area _____
Controlled Area _____

1.7 Distance from Town

S. No.	*Description*	Name	Distance (kms.)
i	State Head Quarters		
ii	District Headquarters		
iii	Tahsil/ Taluk/ Mandal Headquarters		
iv	Nearest city (having 1 lakh and above population)		
v	Nearest Railway Station/s		
vi	Nearest Airport/Air strip		
vii	Nearest Port		
viii	Nearest Bus Stand (govt/ private)		

Source: _____

1.8 Nearness/Distance of Major River/Canal/coastline from Town

S.No.	River name and distance (kms.)	Canal name and distance (kms.)	Distance of Big Drains	Distance of major Dams and Reservoirs	Distance from Coast lines	Indicate High/Low Flood Levels (meters)	Indicate high/Low tide Lines (meters)

Source: _____

1.9 Physiographical details with relevant map

1.10 Hydrological details with relevant map

1.11 Soil and Geological details with relevant map

1.12 Climate : Month-wise maximum, minimum and average Temperature, Precipitation (Rainfall/Snowfall) and Humidity

TABLE 2: DEMOGRAPHIC and BASIC SOCIO-ECONOMIC DATA

Note: Please attach Primary Census Abstract 2011, District Census Handbook (for whichever Census it is available), Housing Tables, Slum Tables and Economic Tables of Census of India. Also any Report by Bureau of Economics and Statistics or any other State Government Report

2.1 Population and Growth Rates

	1961	1971	1981	1991	2001	2011
Total population						
Decadal Growth rate						

Source: _____

2.2 Primary Census Abstract 2011

Ward	Population			Child Pop (0-6)			SC Pop.			ST Pop.			Literates		
	T	M	F	M	F	T	M	F	T	M	F	T	M	F	T
1															
2															
…															
Total															

Source: _____

2.3 Housing Data (For Ward/Town)

Ward	Population 2011	No. of Households	Occupied residential houses	Houseless population
1				
2				
…				
Total				

Source: _____

2.4 Vital Statistics (Town wise) Year: _____

S. No.	Vital Statistics	Male	Female	Total
1	Birth rate (%)			
2	Death Rate (%)			
3	Infant Mortality (%)			
4	Life Expectancy at birth (years)			

Source: _____

2.5 Persons below Poverty Line Year _____

Ward	No. of BPL	
	Families	Population
1		
2		
…		
Total		

Source: _____
Note: Poverty Line defined as: _____

TABLE 3: OCCUPATIONAL CLASSIFICATION

3.1.1 Workforce 2001 – 2011

Ward	Main Workers			Marginal Workers			Other workers			Total Workers			Non-workers			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
1																
2																
…																
Total																

Source: _____
Note: Separate Table can be made for 2001 and 2011

Workforce Participation Rate (WFPR) 2001: _____
Workforce Participation Rate (WFPR) 2011: _____

3.2 Occupational Classification of Main Workers, 2001

	A, B, C									D						E			F			G			H			I			J&K			L to Q		
Ward	Cultivators			Agricultural labourers			Plantation, Livestock, Forestry, Fishing, Hunting & allied activities			HHI			Non HHI			Electricity, Gas and Water Supply			Construction			Wholesale and Retail Trade			Hotels and Restaurants			Transport, Storage and Communications			Financial Intermediation, Real Estate, Renting &					
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
1																																				
2																																				
…																																				
Total																																				

Source: _____

Note: Separate Table can be made for 2001 and 2011

Industrial Categories as per Census 2001

INDUSTRIAL CATEGORIES: A – Agriculture, Hunting and Forestry; B – Fishing; C – Mining and Quarrying; D – Manufacturing ; E – Electricity, Gas and Water Supply; F – Construction; G – Wholesale and Retail Trade; H – Hotels and Restaurants; I – Transport, Storage and Communications; J – Financial Intermediation; K – Real Estate, Renting and Business Activities; L – Public Administration and Defence, Compulsory Social Security; M – Education; N – Health and Social Work; O – Other Community, Social and Personal Service Activities; P – Private Households with Employed Persons; Q – Extra-Territorial Organisations and Bodies.

Industrial Categories as per Census 2011

If data is available in above categories, please provide. If not, then provide in 4 categories for which it is available: cultivators, agricultural workers, household industry and other services.

Table 4: Industrial Aspects (Town Level)

S.No.	Type of Industries	Up to 2005	2006	2007	2008	2009	2010	2011
1	Large							
2	Medium							
3	Small							
4	Household							
5	Hazardous							

Source: _____
Definitions:
(as per ---------- Act)

4.1: Industries details Year: _____

S.No.	Types of Industries	No. of units	No. of workers	Run by Manual/HP	H.P
1	Large				
2	Medium				
3	Small				
4	House hold				
5	Hazardous				

Source: _____

4.2: TRADITIONAL INDUSTRIES (Year _____)

S.No.	Type of Traditional Industries	No. of units associated with each industry	No. of employees associated with each industry	Raw materials used	Commodities manufactured
1	Handicrafts				
2	Pottery				
…					

Source: _____

4.3. Most important commodities imported
4.4 Most important commodities manufactured
4.5 Most important commodities exported
4.6 Most Important agricultural produce

Note: Please attach Lead Bank Report, DIC Report, and any other industrial report

TABLE 5: LAND USE (in Hectares)

S. No.	Typeof Land	1991	2001	2011	Proposed 2021
1	Residential				
2	Commercial				
3	Industrial				
4	Recreational				
5	Public and semipublic				
6	Transportation				
7	Public Utilities				
8	Reclaimed land				
9	Vacant land				
10	Agricultural land				
11	Built Up area (Rural)				
12	Forest				
13	Wastelands				
14	Wetlands				
15	Water bodies				
16	Others				
Present Land use Notified ---------- on date ----------					

Source: _____

TABLE 6: AVAILABILITY OF DRINKING WATER

6.1 Important sources of drinking water Year _____

Ward	No. of Households covered by								
	Tap water		Well	Hand Pump	Tube well	Tanks/ Ponds/Lake	Spring	River/canal	Others
	from treated source	from un-treated source							
1									
2									
…									
Total									

Main source of drinking water _____
Distance from source _____
Treatment Plant (nos. and names) _____

Source: _____

6.2 Water Supply Details Year _____

Ward	Quantity of Water Supplied (MLD)	Times/Hours of supply per day	No. of Connections	Per Capita Consumption (LPCD)	Area Covered (sq. kms.)	Metering Achieved (%)	Efficiency in collection of charges
1							
2							
…							
Total							

Source: _____

6.3 Supply Infrastructure:

Ward	No of Over Head Tanks/Reservoirs and Capacity	Capacity of WTPs	Treated supply as % of total water supplied

Source: _____

6.3.1 Is there any scheme for recycling of waste water in the town? | Yes | No |

6.3.2 Is the ground water table receding in the city? | Yes | No |
If yes, please give present water table
(Please attach any available report of CGWB/ State Govt)

6.3.3 Is there any separate water supply line for non-drinking purposes such as industry, parks etc.
If yes, give area covered under the scheme.

6.3.4 Details of ongoing and committed projects under water supply with agency

TABLE 7: ELECTRICITY (Town wise) Year _____

Source of Power	Distance (kms.)	Total Electricity Demand (MW)	Total electricity Supply (MW)	Total Consumption (MKWH)

Source: _____

Type	Residential	Commercial	Industrial	Agricultural	Others	Total
No. of Electric Connections						
Electric Consumption (KWH)						

Source: _____

Proposed power projects to be taken up in the city:_____

Details of non-conventional energy sources (private or public) which are fed in to the main grid: _____

Details of on-going and committed projects under power sector, with agency: _____

TABLE 8: POST AND TELECOMMUNICATIONS (Town wise) Year_____

No. of telephone Exchanges	
No. of telephone connections (land line)	
No. of Public Telephone booths	
No. of Mobile Connections	
No of Mobile Towers	
No. of Post/telegraph office	
No of Internet Connections	
No. of Wi-fi hotspots	

Source: _____

TABLE 9: EDUCATIONAL FACILITIES Year_____

Type of Institutions	No. of Institutions		No. of Class Rooms		Enrolment		No. of teachers	
Educational Institution	Govt.	Private	Govt.	Private	Govt.	Private	Govt.	Private
Anganwadi								
Primary								
Middle								
Secondary								
Senior Secondary								
School for Special Needs								
Colleges								
General								
Medical								
Engineering								
Law								
Others								

Type of Institutions	No. of Institutions		No. of Class Rooms		Enrolment		No. of teachers	
Vocational Training								
Adult Education program								
Others								

Source: _____

TABLE 10: MEDICAL FACILITIES Year_____

10.1 Number of hospitals, dispensaries, etc., doctors, nurses, paramedical staff and total number of beds available therein

Type of Hospital	No. of Units		No. of Beds		No. of Doctors		No. of Nurses		No. of Paramedical staff		Patients Treated	
Hospital	Govt	Pvt	Govt	Pvt	Govt	Pvt	Govt	Pvt	Govt	Pvt	Govt	Pvt
Allopathic												
Ayurvedic												
Homeopathic												
Unani												
Family welfare and maternity center												
Others												
Dispensary												
Allopathic												
Ayurvedic												
Unani												
Homeopathic												
Others												
Primary Health Centres												
Nursing Home												

Source: _____

Note: Please follow standard classification if specified by Govt/Local Authority and give data in that format, namely Sub-Centre, PHC, CHC, District Hospital, Super Specialty Hospital, Nursing Home, etc.

10.2 Epidemiological Details (Period from _____ to _____)

Name of Predominant Diseases	No. of persons Affected	Percentage of Curing	Prominent Location
Leprosy			
Phylaria			
Tuberculosis			

Cholera			
Dengue			
Chikungunya			
Malaria			
Others (Specify)			

Source: _____

TABLE 11: AVAILABILITY OF SANITARY FACILITIES

What is the major sanitary system in the town: Sewerage/Septic Tank/LCS (please tick)
Does the Town have a sewerage system: _____
If yes, Combined or Separate: _____
Length (kms.) _____
Area Covered: _____sq.kms. _____%
Population covered _____(nos) _____ %

11.1 Household Sanitary Facilities (Town/Ward wise) Year _____

Ward	Households having following sanitary facility (%)						
	Water Closet			Pit Latrine	Other Latrine	No Latrine within the premises	
	Piped sewer system	Septic tank	Other system			Public latrine	Open
1							
2							
…							
Total							

Source: _____(Please attach relevant Census Reports)

11.2 Network Details Year _____

	Open surface drains	Covered drains	Underground sewerage	Others
Length in kms.				
Area served (sq. kms.)				

Source: _____

11.3 Estimated quantity of sewage generated (MLD) _____
11.4 Quantity treated (MLD) _____
11.5 No. of sewage treatment plants (with capacity) _____
11.6 Disposal of treated sewage (river, nala, open land) _____
11.7 Disposal of untreated sewage (river, nala, open land)_____
11.8 Disposal Industrial wastewater (treated/untreated) (river, nala, open land)_____

11.9 Public Toilets

Public toilets (in no.)	
No of Toilets Pay and Use	
Users per toilet daily (in No)	
Average User Charge	
Average yearly expenditure on maintenance (Rs. in Lakh)	

Source: _____

11.10: Major Storm Water Drains

S. No.	Name of the Drain	Wards coverage	Length (kms.)	Capacity	Open/Covered
1					
2					
…					
Total					

Source: _____

TABLE 12: SOLID WASTE MANAGEMENT (Ward/ Town wise data)

Is there door to door collection system: _____
Is there municipal disposal of waste: _____

12.1 Solid waste generation Year _____

Ward	Average generation (Tons/day)	Average collection (Tons/day)	No. of Houses covered for House to House Collection	Total Area Used for Sanitary Land Fill (sq. kms.)	Manpower deployed	No. of Sites used for Land Fill
1						
2						
…						
Total						

Source: _____

12.2 Disposal method of solid waste (Put a tick mark on appropriate column) Year __

Sanitary land fill	Incinerated	Open dump	Recycled	Burned openly	Others

Source: _____

12.3 Vehicles deployed for Collection and Disposal of Solid waste, Year _____

Type of Vehicles deployed	Trucks/Lorry	Tippers	Dumpers/Placers	Tricycle	Others

Source: _____

12.4 Employees details Year _____

No. of Sanitary supervisors	No. of Health Assistant	No. of Health workers	Others

Source: _____

12.5 Is there any system of segregation of solid waste?

Yes	No

If yes, please furnish following details (%age of quantum)

Degradable	Biodegradable	Hospital waste	Others

Source: _____

12.6 Location of collection point:_____
Frequency of collection :_____
No. of houses with own disposal facility:_____
Plastic recycling unit present or not:_____
Whether the town has 'Material recovery facility':_____

12.7 Details of ongoing and committed projects under solid waste disposal management

TABLE 13: AVAILABILITY OF RECREATIONAL, CULTURAL, BANKING AND CREDIT FACILITIES

13.1 Community and other Facilities Year_____

S. No.	Facilities	Numbers
1	Corporation Gardens	
2	Community Hall	
3	Swimming Pool	
4	Corporation Playgrounds	
5	Gymnasia	
6	Corporation Stadium	
7	Cinemas	
8	Open Air Theatres	
9	Zoo	
10	Public libraries	
11	Art Galleries	

S. No.	Facilities	Numbers
12	Museum	
13	Other (specify)	
14	Fire Services	
	No. of Fire stations	
	No. of fire tenders	
	Personnel	
15	Cremation/Burial Ground	
16	Petrol/Gas Station	
17	Hotels and Eating Places	
18	Others	

Source: _____

13.2 Number of banks and credit societies Year_____

No. of Banks	No of ATMs	Agricultural credit societies	Non-agricultural credit societies

Source: _____

13.3 Details of Self Help Groups(SHG) and NGOs Year _____

	No. of Self Help Group	No. of Members	No. of NGOs	No. of Resident Welfare Associations (RWAs)

Source: _____

TABLE 14: LAW AND ORDER – CRIMES REPORTED (No.)
Year wise for Last Five Years

Type	2012	2011	2010	2009	2008
Theft					
Burglary					
Kidnapping					
Robbery					
Riots					
Murder					
Crimes against women					
Fatal Accidents					
Non-fatal Accidents					
Cyber crimes					

Source: _____

No. of CCTVs installed _____

TABLE 15: HOUSING

15.1 Distribution of House Holds (HHs.), No. of persons and Tenure,Year_____

Tenure Status	Number of	
	HHs	Persons
Owned		
Rental		
Sub-letting		
Rent free		
Squatter without Rent		
Squatter with Rent		
Others		
Total		

Source: _____

Distribution of Persons by living rooms	Number of	
	HHs	Persons
One room		
Two rooms		
Three rooms		
Four rooms		
Five and above		
Total		

Source: _____

15.2 Categories of Houses

Type of Houses	No. of Houses	Age of Building
Pucca with RCC Roof and flooring		
Pucca with Tiles Roof and Kaccha floor		
Semi pucca		
Kaccha		
Others		
Total		

Source: _____

Note: For Housing Data, please attach relevant abstract of Housing Tables

TABLE 16: LAND OWNERSHIP AND COST (Ward wise)

16.1 Land Ownership Pattern Year_____

Type of ownership		No. of Dwelling Units(DU)	Area covered (sq. kms.)	Average cost of DU per sq. mt (Rs.)
Public				
Private	Developers and Promoters			
	Authorized Individuals			
	Unauthorized Individuals			
Others (Specify)				
Total				

Source: _____

16.2 Land Prices (Ward wise), Year _____

Ward	Land Price in Planned Area (Rs./sq.mt.)	Land Price in Unplanned Area (Rs./sq.mt.)	Annual Rent of Dwelling Unit (Rs.)
1			
2			
…			
Total			

Source: _____

16.3 Mortgage to credit ratio for housing (Rs. In Lakhs)

Institutions	Total Mortgage/ Loans (Rs. In lakhs)	Total Non Mortgage/ Loans (Rs. In lakhs)	Total Outstanding Loans (Rs. In lakhs)
Commercial Banks			
Financial			
Institutions			
Personal Loans			
Others			

Source: _____

16.4 Housing Finance

Source of financial in flow in the Housing Sector				
Banks	Financial Institutions	Personal Loans	Cooperative Societies	Others

Source: _____

TABLE 17: DISASTERS

Are there any structures which have been damaged by disaster during last ten years? Yes/No
If yes, please give following details

Type of Disaster	Year of disaster	No. of Houses damaged	Wards No. affected	Persons affected	Property Loss (Rs. Lakhs)	Action Taken
Earthquake						
Floods						
Cyclone						
Landslides						
Tsunami						
Fire						
Others (specify)						

Source: _____

TABLE 18: PUBLIC-PRIVATE-PARTNERSHIPPROJECTS IMPLEMENTED IN THE TOWN (PPP)

Agency	No. of Housing units (area in sq. km.)	Water supply (MLD)	Solid Waste (area covered in sq. km.)	Sewerage (km.)	Roads (km.)	Electricity			Community Development		City Beautification & Park maintenance (Area in sq. km.)	Others
						Generation (MW)	Distribution	Maintenance (Rs.)	Improvement of Slum (Area in sq. km.)	Slums and Squatters resettlement (Area in sq. km.)		
Public												
Private												
PPP												

Source: _____

TABLE 19: SLUMS

19.1 Slum Concentration, Year _____

	Notified Slum		Non-notified Slum		Squatters		Total land	
	Public	Private	Public	Private	Public	Private	Public	Private
No. of Slum HH units								
Population								
Area covered (sq. km.)								

Source: _____

19.2 Availability of Basic Amenities in Slums Ward wise

Type of Amenity	No. of HHs covered
Water Supply	
Electricity	
Community toilets	
Other (specify)	

Source: _____

Note: Please attach relevant extract of Slum Tables of Census of India with year.

19.3 Houseless Population

Is there any scheme functioning for promotion of housing for houseless population?

Yes	No

If yes, please give details as under

Name of Scheme	Dwellings constructed during last five years	Size of the dwelling unit in sq.mt.	Price of house	Mode of payment	No. of households benefited

Source: _____

Note: Please attach relevant extract of Houseless Tables of Census of India with year.

TABLE 20: TRAFFIC and TRANSPORTATION- Time Series Yearly Data

20.1 Registered Vehicles

Type of Vehicles		No. of Vehicles
Heavy vehicles:	Trucks Public Private Buses Public Private	
Light Vehicles:	Two wheeler Car Jeep Three wheeler Omni Buses Taxies/ Cabs	
Non-motorized	Cycle Rickshaw Tonga Others	

Source: _____

20.2 Work Trips Undertaken from Residence to Work Place

Type of vehicles	No. of Work Trips per day	Average Time taken for one way trip (in minutes/ per day)
Private motorized • Private cars • Two wheelers • Buses/ cabs/ mini car		
Sub-Total		
Public Transport • Trains • Trams/metro • Bus/mini bus		
Sub-Total		
Non-motorised • Cycle/Rickshaw • Walking • Others		
Sub-Total		
Total		

Source: _____

20.3 Road length and Footpath (in kms.)

Surfaced road (kms.)	Un-surfaced road (kms.)	Total road length (kms.)	Foot paths (kms.)	Cycle Tracks (kms.)

Source: _____

20.4 Railway

Items	No.
No of railway Stations	
Types of rail gauge; viz broad, narrow and meter gauge	
Length of rail network (in kms.)	
No of platforms	
No of yards	

Source: _____

20.5 Inland Water ways

Items	No.
No. of major and minor ports	
Length of the coastline (in kms.)	
No. of navigable rivers and canals	
Total no. of boats	
Ships	
Oil tankers	
Vessels	

Items	No.
Total tonnage of goods carried by ships/tankers etc.	
No. of shipping yards	

Source: _____

20.6 Air

Items	No.
No. of Airports (Domestic and International)	
Traffic volume and passenger data	

Source: _____

TABLE 21: ENVIRONMENT

Does the town have Air Quality Monitoring Station _____

21.1 Air Pollution Concentration (µg/m3) (Date _____)

Type of pollutant	Area			
	Residential	Industrial	Commercial	Others
SO2				
NO				
SPM				
CO				

Source: _____

21.2 Level of Noise Pollution (Db) (Date _____)

Residential	Commercial	Industrial	Silence zone

Source: _____

21.3 Water Pollution (Mg/l) (Date _____)

Name and Type (River, Pond, Back water, Major Streams, Canal & other Water Bodies)	Present use (source of drinking water, Irrigation, Temple pond, no specific use)	Physical characteristics – colour, odour, turbidity etc.	Major sources of pollution (industrial waste, domestic waste, hospital waste, market waste, garages)	BOD level	Coliform level	PH value	Remarks

Source: _____

Please attach any report of Pollution Control Board, etc. if available.

21.4 Forest

Sl No	Name and Type ((Natural/Vested/ Plantation)	Area (Ha)	Species Wise Flora (major)	Species Wise Fauna (major)	Forest Resources for Commercial Production- Timber, Fire wood, Poles etc.	Forest Resources for Industrial Production- Eucalyptus, Acacia, Bamboo, Reeds etc.	Remarks
1							
2							
3							

21.5 Details of Social Forestry

Sl. No:	Location	Area
1		
2		
3		
4		

21.6 Sacred Groves/ Mangroves/Hillocks etc.

Sl No	Name and Type	Area (Ha)	Species Wise Flora (major)	Species Wise Fauna (major)	Remarks

TABLE 22: Animal Husbandry details Year _____

S. No.	Description	Number
1	No. of Veterinary Hospital or dispensary or clinic	
2	No. of Dairy outlets & collection centers (Milk Co- Operative Societies) (MILMA)	
3	No. of Dairy Farm	
4	No. of Poultry Farm	
5	No. of Slaughter Houses	
6	No. of Hatcheries	
7	No. of Broiler Farm	
8	Others (Specify)	

Source: _____

Table 23: TRAVEL AND TOURISM Year _____

S. No.	Description	No. of Units
1	Tourism Destination Centers	
2	Tourism Information Centers	
3	Tourism Season	
4	Average No. of Foreign Tourist	
5	Average No. of Domestic Tourist	
6	No. of Star hotels	
7	No. of House boats	
8	No. of Homestay facilities	
8	No. of Travel Agencies	
9	No. of Tourism Promotion Councils	
10	Other institutions promoting Tourism	

Source: _____

.

Type of Tourism - (Natural, Adventure Tourism, Religious/ Pilgrimage, Heritage/ Architecture, Cultural, Health, Wild Life, Backwater)

TABLE 24: GOVERNANCE

24.1 Civic Status of the Town:

24.2 Size and Class of the Town:

24.3 Status of Master Plan/Development Plan

Whether town has a statutory Master/Development Plan? Details

1st D.P. and Date	Date of latest revision D.P	D.P implementation percentage

Source: _____

24.4 Name and Address (with Phone, Fax and e-mail) of Commissioner/Executive Officer of ULB:

S. No.	Name (with Designation)	Address (with Phone, Fax and e-mail)

Source: _____

24.5 Name and Address (with Phone, Fax and e-mail) of Mayor/Chairperson of ULB:

S. No.	Name (with Designation)	Address (with Phone, Fax and e-mail)

Source: _____

24.6 Total Staff Strength of ULB (in Nos.) :

24.7 Division-wise breakup of Staff Strength:

S. No.	Name of Division	Sanctioned Post	No. of Posts filled	Posts Vacant
1.	Administration			
2.	Education			
3.	Finance			
4.	Engineering			
5.	Agriculture/Horticulture			
6.	Environment/Conservation			
7.	Housing			
8.	Public Health and Utilities			
9.	Social Services			
10.	Transportation			
11.	Security including Fire Services			
12	Other, if any			

Source: _____

24.8 Is the local body elected? If yes, state the year of last election.

Yes	No

24.9 Functions entrusted to local bodies as per 12th Schedule appended to 74th Constitutional Amendment Act, 1992.

24.10 List of Government Offices

TABLE 25: Revenue and Receipt of Local Body: Year_____

(Rs. in Lakh)

Revenue Receipt	
Revenue Expenditure	
Revenue less expenditure	
Resource Mobilization	
Debt service charges	
Revenue and Receipt of Local Body or Department of state Government	
Detailed Revenue Receipt heads	

Source: _____

25.1 Proposed Large Projects

Proposed Capital Projects	Source of Finance	Investment	Project period
Upgradation			
New Infrastructure			
Expansion/Diversification			

Source: _____

Appendix I

Guidelines for Filling the Format

Introduction

The format for collection of town level data consists of 25 tables which cover key areas such as demography, physical and locational aspects, physical and social infrastructure, environment, housing and slums, governance etc. This data is to be collected by the Nodal Agency at city/town level, in most cases the Urban Local Bodies.

Census Town

As per the Census definition, Towns comprise the following:

(a) All statutory towns, i.e., all places with a municipality, corporation, cantonment board, or a notified town area committee, etc.
(b) All other places which satisfy the following criteria:
- a minimum population of 5,000 ;
- at least 75 per cent of the male working population engaged in non-agricultural activities; and
- a density of population of at least 400 persons per sq. kms.

The city/town which do not have an urban local body as per (a) above, but satisfy conditions given in (b), are called by Census of India as Census Towns.

Urban Agglomerations

Urban Agglomerations represent a continuous urban spread constituting a town and its adjoining urban outgrowths or two or more physically contiguous towns having a common boundary together with continuous well-recognised urban outgrowths, if any, of such towns. Very often, around a core city or statutory town, there are come up fairly large well recognized railway colonies, university campuses, etc. Even though these places lie outside the precincts of a statutory city or town or within the revenue limits of the village(s) which (are) contiguous to the town, such areas may not be themselves qualify to be treated as towns. But if they form a continuous spread with the town, they are outgrowths of the town and deserve to be treated as urban. Such towns, together with their outgrowths, have been treated as one urban unit called `Urban Agglomeration'. Thus, an urban agglomeration may constitute:

(a) A city or a town with continuous outgrowth, the outgrowth being outside the statutory limits but falling within the boundaries of the adjoining village or villages; or
(b) Two or more adjoining towns with their outgrowths, if any, or
(c) A city and one or more adjoining towns with or without outgrowths all of which form a continuous spread

Definitions, explanations of the parameters (including abbreviations) used in different Tables of the Proforma are as follows:

TABLE 1: PHYSICAL ASPECTS AND LOCATIONAL PARTICULARS

1.1 Name of City/Town

Names of the city/town selected under the Scheme

1.2 Civic Status

The civic administration status is a determinant for categorization of a place as urban which is to be indicated using the following abbreviations:

Civic Status	Abbreviation
Municipal Corporation/Corporation	M.Corp.
Municipal Committee/Municipal Town Committee	MC
Municipality	M
Municipal Board	MB
Municipal Council/Town Municipal Council/ City Municipal Council	M Cl
Cantonment Board/Cantonment	CB
Notified Area/Notified Area Committee/ Notified Committee/Notified Town Area Committee	NAC
Industrial Notified Area	INA
Town Committee/Town Area Committee	TC
Town Area	TA
Municipal Township	MTS
Township	TS
Town Board	TB
Panchayat Township	PTS
Gram Panchayat/Village Panchayat	GP
MandalPanchayat	MP
Nagar Panchayat/Town Panchayat	NP
Panchayat	P
Sanitary Board	SB
Special Area	SA
Special Area Development Authority	SADA
Estate Office	EO
Census Town/Non-Municipal Census Town	CT
Non-Municipal/Non-Municipal Area	NM

1.3 Name of the Tehsil/Mandal/Block
1.4 Name of the District

Name of the district where the city/town is located

1.5 Name of the State

State name

1.6 Area of the City/town

The area figures of statutorily notified towns are given by the civic bodies/municipal committees based on available records.

Area figures are also given in the Census Town Directory/District Census Handbook is the municipal/UA area. However, the Planning Area of the city/town may be much larger. Further, for purposes of planning, urbanisable and controlled areas may have been defined by the development authorities. These are vital, because master plan is to be prepared for the urbanisable area.

1.7 Distance from Town in kms.

State HQs., District HQs., Tahsil/Taluk/Mandal HQs., nearest city (having 1 lakh and above population) and nearest Railway Station along with distances

These columns provide details on locational particulars of the town with reference to names of the State Hqs., District Hqs., Tahsil/Taluk/MandalHqs., nearest city (having 1 lakh and above population) and nearest Railway Station, indicating their distances in kms., from the town. In case the nearest city or the railway station is situated in a state other than the state to which the town belongs, name of the nearest city or nearest railway station alongwith the name of the state may be indicated.

In some north-eastern states, namely, Arunachal Pradesh, Assam and Nagaland where `Circle' is equivalent to Tahsil, etc., names of Circle Hqs., have to be reported whereas in Manipur and Sikkim, Sub-Division is the equivalent to Tahsil, names of Sub-Division Hqs., have to be indicated. Apart from these in some states, Community Block/Rural Development Block is the equivalent of Tahsil, in both cases Block of Police Station may be indicated as Tahsil.

1.8 Nearness/Distance of Major River/Canal

This column provides details of navigable river/canal passing nearby (within a distance of 10 kms.), or through the town.

1.9 Physiographical details with relevant map

Physigraphic (Relief) classification, its characteristics with relevant map

1.10 Hydrological details with relevant map

Hydrological details such as natural drainage pattern, drainage basin, ground water table map etc. can be collected

1.11 Soil and Geological details with relevant map

Soil classification, characteristics etc. with map and the geological details such as lineaments, faultline, etc. with relevant maps can be collected

1.12 Climate : Month-wise maximum, minimum and average Temperature, Precipitation (Rainfall/Snowfall) and Humidity

Climatic details such as month wise maximum , minimum and average temperature, month wise rainfall/precipitation, humidity, wind direction and speed etc. can be collected.

TABLE 2: DEMOGRAPHIC DATA and BASIC SOCIO-ECONOMIC DATA

2.1 Population and Growth Rates

Population of the City/town in time series from Census of India. This is available in Town Directory published by Census of India. Growth rates may be given or calculated.

1.2 Primary Census Abstract 2011

This information may be derived from PCA and extract from PCA could also be provided for the city/town and if the plan formulation is to be done for planning/ urbanisable area, then other administrative units covered. For example, the planning area for a particular city may cover one or more revenue villages, census towns, outgrowths, etc.

1.3 Housing Data

This table covers basic housing data from Housing (H-series) Tables from Census of India.

Number of households: In Census, a household is defined as a group of persons who commonly live together and take their meals from a common kitchen.

Number of occupied residential houses: This Table gives the number of occupied residential houses in respect of each town. A Census house is a building or a part of building having a separate main entrance from the road or common courtyard or staircase etc., used or recognized as a separate unit.

2.4 Vital Statistics

- ***Crude Birth Rate****:* The Crude Birth Rate (CBR) is defined as the number of live births in a year per 1,000 of the midyear population.
- ***Infant Mortality Rate*** : Infant Mortality Rate (or IMR) is defined as the number of infant deaths in a year per 1,000 live births during the year
- ***Life expectancy at birth*** *= Total child births - death of Children at the time of birth.*

2.6 Persons below Poverty line

Households whose total income is below the poverty line as defined by the national/state/local standards. Poverty line is defined by the State Governments and records will be available with State Departments of Economics and Statistics or other sources.

TABLE 3: OCCUPATIONAL CLASSIFICATION

3.1 Workforce 2001-2011 – Definitions as per Census of India

Workers and Non-workers

A 'worker' is a person who mainly participates in any economically productive activity either physically or mentally. Work not only involves actual work but effective supervision and direction of work as well.

Total workers

Total workers = Main workers + Marginal workers

Main workers

Main workers were those who had worked for the major part of the year preceding the date of enumeration i.e., those who were engaged in any economically productive activity for 183 days or six months or more during the year.

Marginal workers

Those who worked any time in the year preceding the date of enumeration but did not work for a major part of the year i.e., those who worked for less than 183 days or six months were classified as Marginal workers.

Non-workers

Those who had not worked any time at all during the year preceding the date of enumeration are non-workers. Non-workers include (i) those engaged in household duties at home, (ii) students, (iii) dependents, (iv) retired persons (v) beggars, (vi) inmates of institutions and (vii) other non-workers.

3.2 Occupational Classification of Main Workers

Main workers classified into 9 major categories are given in Census of India B-series tables. This is called the Functional Classification and helps in understanding the functional classification of the city/town. This data may be provided for the Census year for which it is available.

TABLE 4: INDUSTRIAL ASPECTS

Number of units of different type of industrial units (Large, Medium, Small House Hold, Hazardous etc.) of the town/ward for the last five years to be furnished.

4.1 Industries

Provide latest details for the year available.

4.2 Traditional Industries

Details may be provided for the types of traditional industries found in the city/town. Some towns specialize in certain traditional industry, often at household level, for which special provisions are to be made in Master Plan.

4.3 Most important commodities imported

The names of the most important commodities decided in terms of estimated volume of commodities imported are to be indicated.

4.4 Most important commodities manufactured

The names of the most important commodities manufactured are to be indicated. This is decided in terms of the volume of total output of the commodities concerned.

4.5 Most important commodities exported

The names of the most important commodities decided in terms of estimated volume of commodities exported are to be indicated.

4.6 Most important agricultural produce

The region surrounding the city/town may be rich in a particular type of produce, for which markets/ mandis, processing industry etc. may be located in the city.

TABLE 5: LAND USE (in Hectares)

The area under different land uses in 1991, 2001, 2011 to be furnished. Details regarding land use classes, etc. is given elsewhere in the Design Standards document. The table may be modified as per requirements.

TABLE 6: AVAILABILITY OF DRINKING WATER

6.1 Important sources of drinking water

Indicate the important sources of drinking water and also indicate the distance in kms. from the main source, and number of households covered from different sources. Refer HH-series tables (Tables on Houses, Household Amenities and Assets) from Census of India.

6.2 Water Supply details

Ward wise details of the quantity of water supplied (MLD), No. of Connections, Per Capita Consumption (LPCD), Area Covered (sq. kms.), Capacity of WTPs, percentage of treated water recycling, etc.to be furnished.

TABLE 7: ELECTRICITY

The information on electric supply to the town is presented in the form of number of connections under different consumption groups viz., domestic, industrial, commercial, and others which includes electricity for agricultural purpose, proposed projects requiring land in the city/town.

TABLE 8: POST and TELECOMMUNICATIONS

Details of number of telephone connections (land line), mobile connections, Post Office etc. to be furnished here.

TABLE 9: EDUCATIONAL FACILITIES

Pre-primary schools have been treated as Anganwadi, Schools upto Class IV have been treated as Primary, schools upto Class VIII as Junior secondary or middle schools, schools upto Class X as Secondary schools and schools or colleges upto XII as Senior secondary schools or at places Intermediate and Junior college.

If there are composite schools like middle schools with primary classes, or secondary schools with middle classes, these have been included in the number of primary and middle schools respectively. For example, if in a town, there are two primary schools and one middle school with primary classes, the number of primary schools in the town will be given as three and that of middle schools as one even though there are only three educational institutions. Same is the case with secondary or senior secondary schools.

Number of Vocational Training Institutions

This includes vocational institutions like Applied Art/Painting College, Pharmacy College, B.Ed. College, Teachers Training Institutions, Govt./recognized polytechnics, Shorthand, Typewriting, Music/ Dance Schools, etc.

Number of colleges

The number of different types of colleges offering various courses in the town is to be indicated under following sub-heads:

(1) General
(2) Medical
(3) Engineering
(4) Law

A general college means Arts, Science and Commerce colleges.

Number of Adult Education Centers

This aspect was first introduced in the Town Directory of 1981 Census keeping in view the Minimum Needs Programme of the Planning Commission. In this column the number of adult education centres conducting regular classes is to be indicated.

TABLE 10: MEDICAL FACILITIES

10.1 Number of hospitals, dispensaries, etc., doctors, nurses, paramedical staff and total number of beds available therein

The particulars of various type of medical institutions in various system of medicines like Allopathic, Ayurvedic, Unani, Homeopaththic etc. and their numbers viz., Hospitals, Dispensaries, Health Centres, Family Planning Centres, Nursing Homes and other medical institutions and the capacity with reference to total beds, doctors, nurses, paramedical staff available is to be given. The data is to be provided for both Govt./Private institutions.

10.2 Epidemiological Details

No. of persons affected by diseases like Leprosy, Phylaria, Tuberculosis, Cholera etc.

TABLE 11.0 AVAILABILITY OF SANITARY FACILITIES

The sanitation facilities in a city/town could be based on septic tanks or sewerage system or low cost sanitation. Studies have shown that proper sewerage systems cover less than 20 per cent of Indian Cities. Therefore, the correct data has to be filled in here so that planning could be undertaken accordingly.

Sewerage System

Sewerage system implies the network of mains and branches of underground conduits for the conveyance of sewage to the point of disposal. Sewers that carry only household and industrial wastage are called separate sewers; those that carry storm water from roofs, streets and other surfaces are known as storm water drains, while those carrying both sewage and storm water are called combined sewers. However, towns which are not provided with such underground sewerage system normally have open surface drain, covered drains, etc.

11.2 Network Details

The details about the sewerage/drainage network to be provided.

11.3 to 11.8 Details of sewage generation, treatment and disposal

11.9 Public Toilets

11.10 Major Storm Water Drains

TABLE 12: SOLID WASTE MANAGEMENT

There are three major steps involved in the management of solid waste viz. collection, transportation and disposal. Disposal of solid waste is generally done through land filling.

Municipal solid waste includes commercial and residential waste generated by a community
Collection means collection and removal of solid waste from different collection points

Disposal means final disposal of solid waste;

Recycling means the process by which waste is transformed into new products in such a manner that the original products lose their identity;

Land fill: Means disposal of solid waste by spreading it in layers over a lined surface or land, compacting it to the smallest volume and covering it by impervious soil layer at the end of the day or more frequently. A landfill is operated to prevent leachate for contaminating ground water and maintaining ambient air quality;

Incineration: Incineration is a process of controlled combustion for burning of waste and residue, containing material, Carbon dioxide, water vapour, ash and non-combustible end products.

Biodegradable substance means a substance that can be degraded by micro-organisms.

Hospital Waste: Waste generating from the hospitals is called hospital waste

TABLE 13: AVAILABILITY OF RECREATIONAL, CULTURAL, BANKING AND CREDIT FACILITIES

13.1 Community Facilities

The particulars of recreational facilities such as stadia, museum, cinema halls and auditoria/drama/community halls and their number in the town are to be recorded. The availability of cultural facilities in the form of the number of public libraries and reading rooms, if any, available in the town is to be indicated. If firefighting facility is not available in the town, the name of the nearest place where this facility is available is to be indicated and the distance of the same is given in column.

13.2 Number of banks and credit societies

Banks

Number of banks, commercial as well as co-operative functioning in the town has to be indicated. It gives the number of banks both the head as well as branch offices of banks in each town, which actually transact banking business. The head or branch offices not actually transacting any banking business are not to be taken into account.

Credit Societies

The information on Agricultural Credit Societies and Non-Agricultural Credit Societies are to be furnished.

The agricultural credit societies include service, multipurpose, agricultural produce, marketing cooperative societies, etc. The non-agricultural credit societies include consumer cooperative societies and also credit co-operative societies of certain categories of persons like teachers, postal-workers, etc.

TABLE 14: LAW AND ORDER/CRIMES

TABLE 15: HOUSING

TABLE 16: LAND OWNERSHIP AND COST

16.3 Mortgage to credit ratio for housing (Rs. in Lakh)

Mortgage/loans

Percentage of dwellings purchased during the past year that are covered by mortgage and percentage of dwellings that are covered by non-mortgage.

TABLE 17: DISASTERS

TABLE 18: PUBLIC PRIVATE PARTNERSHIP PROJECTS IMPLEMENTED IN THE TOWN (PPP)

TABLE 19: SLUMS

All the inhabitants of the areas, which have been notified as slums by the state governments under any legal provisions or even recognized by them, are to be accordingly considered as slum population. Besides areas in cities/towns, which satisfy the usual criteria for declaring an area as slum have also been included.
As per Census of India, the slum areas broadly consist of:-

1. All specified areas notified as 'Slum' by State/Local Government and UT Administration under any Act;
2. All areas recognized as 'Slum' by State/Local Government and UT Administration which may not have been formally notified as slum under any Act;
3. A compact area of at least 300 population or about 60-70 households of poorly built congested tenements, in unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities.

Houseless Population: As per Census of India 2011, households which do not live in buildings or Census houses but live in the open or roadside, pavements, in hume-pipes, under fly-overs and staircases, or in the open in places of worship, mandaps, railway platforms, etc., are to be treated as Houseless households

TABLE 20: TRAFFIC and TRANSPORTATION

20.3 Road length and Footpath (in kms.)

The road length to be shown in these columns pertains to Surfaced i.e., Pucca and Un-surfaced i.e., Kutcha roads and its total road length.

TABLE 21: ENVIRONMENT

Environmental pollutant means any solid, liquid or gaseous substance present in such concentration as may be or tend to be, injurious to environment and environmental pollution means the presence in the environment of any environmental pollutant.

21.1Air pollution

Air pollution is the excessive concentration of foreign matter in the air, which adversely affects the well-being of the individual or cause damage to property. The important air contaminants are SO2, NO, Suspended Particulate Matter (SPM), CO. Air pollutants are measures in µg/m3.

Sulfur dioxide (SO_2):SO_2 is an irritant colourless gas, which affects the mucous membranes when inhaled. Exposure at low level can cause increased upper respiratory symptoms such as cough, sore throat and affects lung function.

Oxides of Nitrogen (NO): Of the seven oxides of nitrogen known to exist in the ambient air, Nitrogen dioxide is the main oxides affecting human health. Oxides of nitrogen are released in all the types of combustion as they are formed by the oxidation of atmospheric nitrogen at high temperature. Exposure to excessive NO_2 affects the defense mechanism of human body.

Suspended Particulate Matters (SPM): Particulate is a term given to the minute particle of solid or semi solid material dispersed in the atmosphere. SPM presence in the air cause respiratory diseases.

Carbon Monoxide (CO): Carbon monoxide is a colourless, odourless gas with relatively poor solubility in water. CO emission is due to incomplete combustion of fuel of vehicles. CO affects the central nervous system and also responsible for heart attacks and a high mortality rate.

21.2 Noise Pollution

Noise is an unwanted sound without agreeable musical quality. Noise levels are measured in decibels. One decibel is the threshold of hearing.

21.3 Water pollution

Water pollution is any physical or chemical change in water that can adversely affect organisms

Biochemical oxygen demand, or BOD

The amount of organic material that can decompose in the sewage is measured by the biochemical oxygen demand. BOD is the amount of oxygen required by micro-organisms to decompose the organic substances in sewage. Therefore, the more organic material there is in the sewage, the higher the BOD. Dissolved oxygen is an important factor that determines the quality of water in lakes and rivers. The higher the concentration of dissolved oxygen, the better the water quality. BOD level measured in mg/l.

Coliform level: Coliform level is an important index to measure pollution by human waste. Water pollution due to human excreta is caused mainly by the lack of proper municipal sewerage.

pH Value: A number used to express degrees of acidity or alkalinity in solution.

21.4 Forest

Name of the forest, forest type, whether it is natural or manmade/vested and the species of animals and plants.

21.5 Social Forestry

Social forestry is the management and protection of forest and afforestation of barren and deforested lands with the purpose of helping environmental, social and rural development. The details of such forests should be mentioned here.

21.6 Sacred Grooves

Sacred groves of India are forest fragments of varying sizes, which are communally protected, and which usually have a significant religious connotation for the protecting community. Hunting and logging are usually strictly prohibited within these patches. The particulars of such sacred grooves have to be given in this table.

TABLE 22: ANIMAL HUSBANDARY DETAILS

Animal husbandry continues to be an important activity in most Indian cities/towns, most often found in urban villages and peri-urban areas. Details are essential for master plan formulation.

TABLE 23: TRAVEL AND TOURISM

Aspects related to travel and tourism closely affect demand for facilities, demand for land and economic activity generated such as hotels, parking, eateries, water demand, electricity demand, etc.

TABLE 24: GOVERNANCE

Civic Status of town: see para 1.2.

Status of Master/Development Plan: Many cities/towns will have at least some kind of pre-existing plan document. The details such as date of sanction of the Ist Plan, plan revision are to be furnished.

Revenue and Receipt of Local Body (Rs. in Lakh)

The actual revenue receipt and revenue expenditure figures of the administrative body governing the town are to be filled. Data is to be presented not only in respect of statutory

bodies but also in respect of non-statutory bodies managing the civic administration of the towns if they have separate budgets and accounts of their own pertaining to the town.

City Product

Total product of the city as defined in national accounts procedures. It may either be taken as the total income or value-added (wages plus business surplus plus taxes plus imports), or the total final demand (consumption plus investment plus exports).

City Product = (GNP) x (number of households in the city) x (average household income in the city) (Total national household income, from national accounts)

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