

# Methodology for the Preparation of GIS Based Master Plans in India

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## Abstract

*Master Plans prescribe the spatial pattern on how the city should get developed for a period of twenty years in India. The time period for the preparation of Master Plan in India varied from 1 to 4 years and in some cases it is beyond that also. As the time period for the preparation is too long, Ministry of Urban Development, Government of India, looked forward, on how the technology can be harnessed to prepare the master plans for the towns and Cities. In this context, the Government have thought to use High Resolution Satellite Imageries and GIS as a tool to speed up the preparation of Master Plan. In this context, Ministry of Human Development have formulated GIS Based Master Plans for Cities and Towns. It involves preparation of Existing Land use Plan using High Resolution Satellite Imagery using GIS, preparation of Concept Plan, Preparation of Infrastructure Plan and Preparation of Proposed Land use Plan. This paper attempts to lay down the procedure on how GIS Based Master Plan can be prepared for Indian Cities.*

**Keywords:** *GIS Based Master Plan, Existing Land Use Plan, Infrastructure Plan and Land Use.*

## 1. Introduction

Local land use planning and decision-making can be seen as a big-stakes game of serious multiparty competition over an area's future land use pattern [1]. Master plan is a tool to guide and manage the growth of cities in a planned manner [2]. Third Five Year Plan of Government of India defined the term 'Master Plan' as a statutory instrument for controlling, directing and promoting sound and rational development and redevelopment of an urban area with a view to achieving maximum economic, social and aesthetic benefits [3]. In fact, the master plan is a vision document giving perspective of 20 to 25 years keeping in view the future growth of population, economic development potential and ecological improvements likely to come up during the plan period. [4] Many cities use

master plans, zoning, subdivision regulations, building codes and other public policies to shape development [5]. Traditional Master Plans have had the physical planning approach translated into spatial plans i.e. envisaging spatial distribution of land uses for the cities in future. Master Plan will allocate land use for the future activities and the spatial allocation will be shown in Proposed Land use Plan. Master Plan took considerable time in its preparation [6]. In this, Context, Town and Country Planning Organization, Ministry of Urban Development, Government of India, brought in the concept of GIS Based Master Plans to prepare Master using the latest technology like using high resolution Satellite Imagery, Geographical Information System (GIS) to speed up the preparation of Master Plan. GIS Master Plan preparation involves preparation of Existing Land Use using high resolution satellite Imagery and GIS, preparation of Concept Plan, Preparation of Infrastructure Plan, and Preparation of Proposed land use map using GIS. This paper tries to outlines the methodology that can be adopted for the preparation of GIS Based Master Plan.

## 2. Inception Report

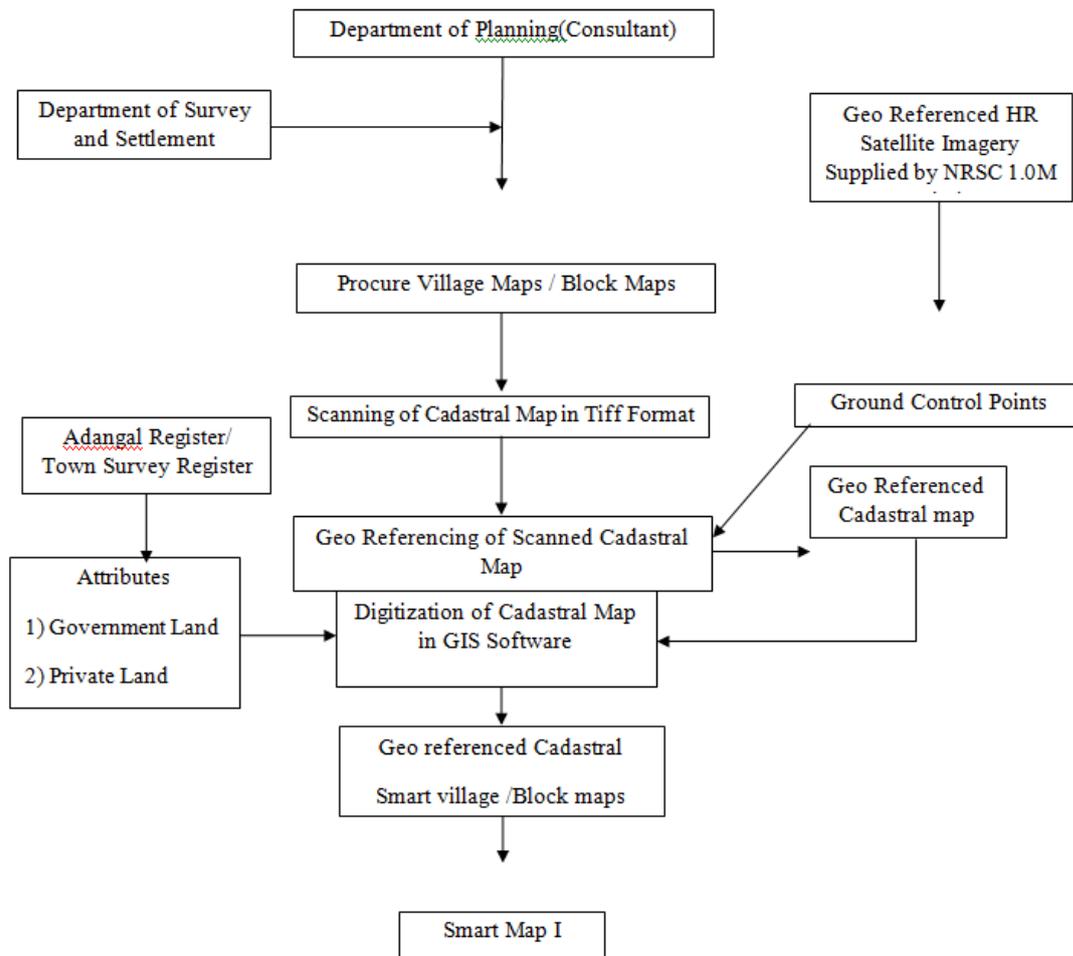
On commencement of the assignment for preparation of Master Plan, the Consultant's Team Leader and other key staff will conduct a meeting with the Client and Officials. This is to primarily discuss the project objectives in detail, appropriate approach and methodology, identified constrains in the planning area and concept to be developed. During the discussions with the Client, the Consultant will review the work plan, manning schedule and deployment plan of the key and support staff for the project. After submission of Inception report, preparation of Existing Land use Survey process will get initiated by the Consultant.

### 2.1 Existing Land use Survey

“Survey before Plan” a famous quote by Sir Patrick Geddes, Urban Planner is valid today in the context of the preparation of Master Plan. Thus Survey becomes foremost essential component to elicit information about the area,. There are many surveys usually carried out in the preparation of Master Plan, like Reconnaissance Survey, Existing Land Use Survey, Socio-Economic Survey and Transportation Survey etc. The survey that is usually carried out after Reconnaissance Survey is Existing Land use Survey in the preparation of Master Plan. Preparation of Existing Land use starts with the preparation of Cadastral base for the preparation of Existing Land use Plan.

#### 2.1.1 Georeferencing and Digitization of Cadastral Map

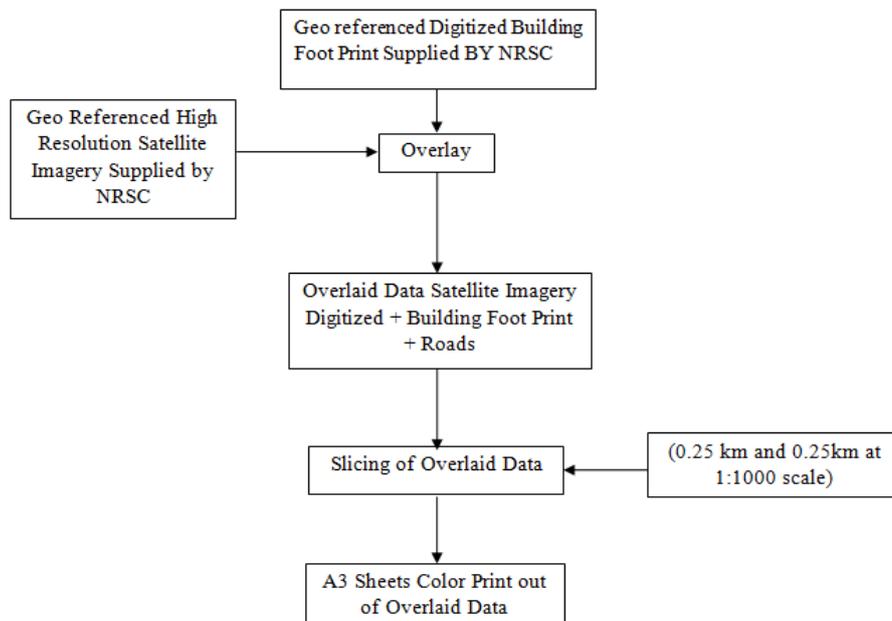
The process starts with the consultant procuring the Village maps and Block maps from Department of Survey and Settlement, Government of Tamil Nadu. The procured maps are then scanned and stored in the computer in TIFF format. The scanned maps are then Geo referenced. The Geo referenced Block map and Village map is then digitized and then attribute such as Government Land, Private Land and Water bodies are attached with it. The digital Geo referenced Cadastral Smart Village and Block map can be called as Smart Map 1. (**Figure 2.Geo Referencing and Digitization of Cadastral Map** ).



**Figure 1. Geo Referencing and Digitization of Cadastral Map**

### 2.1.2 Preparation of Overlaid data using NRSC Building Foot Print

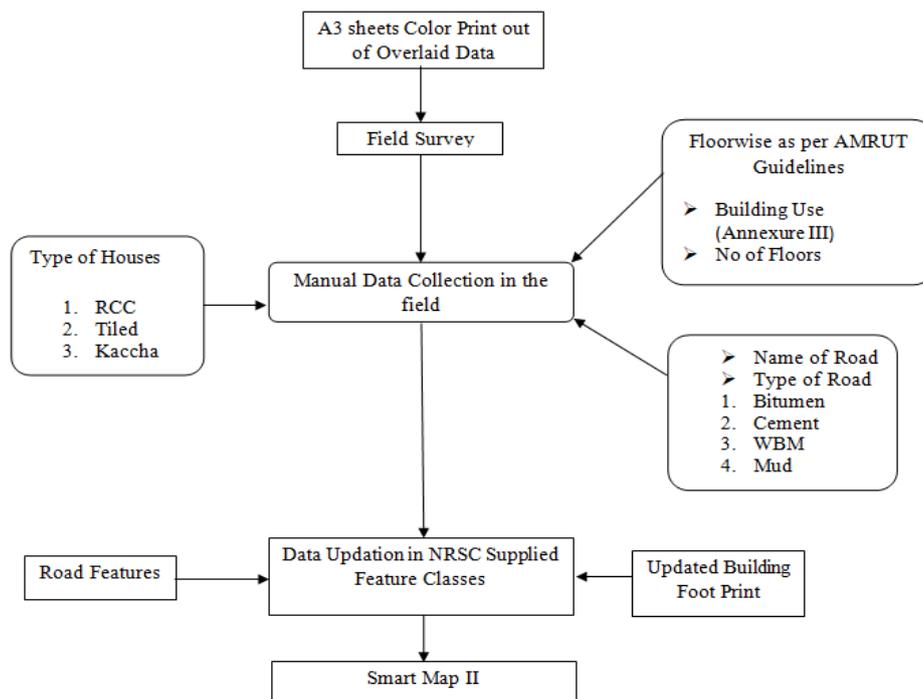
Geo referenced digitized building foot print data supplied by National Remote Sensing Centre (NRSC) is overlaid with Geo referenced high resolution satellite imagery supplied by NRSC in GIS software. The entire planning area is sliced by 0.25 km x 0.25 km in 1:1000 scale in GIS software. A key map is prepared for the planning area showing the slice name and the location of each slice. All the sliced overlaid data is then printed in Color in the sheet size of 297x420mm. (**Figure 2.Presentation of Overlaid data using NRSC Building Foot Print**).



**Figure 2. Geo Referencing and Digitization of Cadastral Map**

### 2.1.3 Data Collection and Updating of Building use data supplied by NRSC

The field surveyor takes the prepared A3 sheet color print out of overlaid data and does Manual data collection in the field. The data collected in the field are building use, No of floors, type of house and details regarding road such as name of road and type of road. The surveyor updates the GIS data using the Tablet on the spot and thereby preparing the Smart Map II in the field itself. (**Figure 3. Data Collection and Updation of Building Use by NRSC**).



**Figure 3. Data Collection and Updation of Building Use by NRSC**

### 2.1.4 Preparation of Existing Land use Plan

Urban Planners overlays the cadastral data and updated building foot print and road data in GIS software. There will be small mismatches in aligning cadastral data and updated building foot print data. Urban Planner is to use his experience in such case and update the cadastral map with the land use taken from the building foot print data. The updated land use data in cadastral map becomes the Existing land use map for the town. Using the Existing land use plan prepared, Existing land use register can be prepared using the report option in GIS software. The Existing Land use register will contain Cadastral Revenue survey/Town Survey Number with the land use. (Figure 4.Preparation of Existing Land Use Plan)

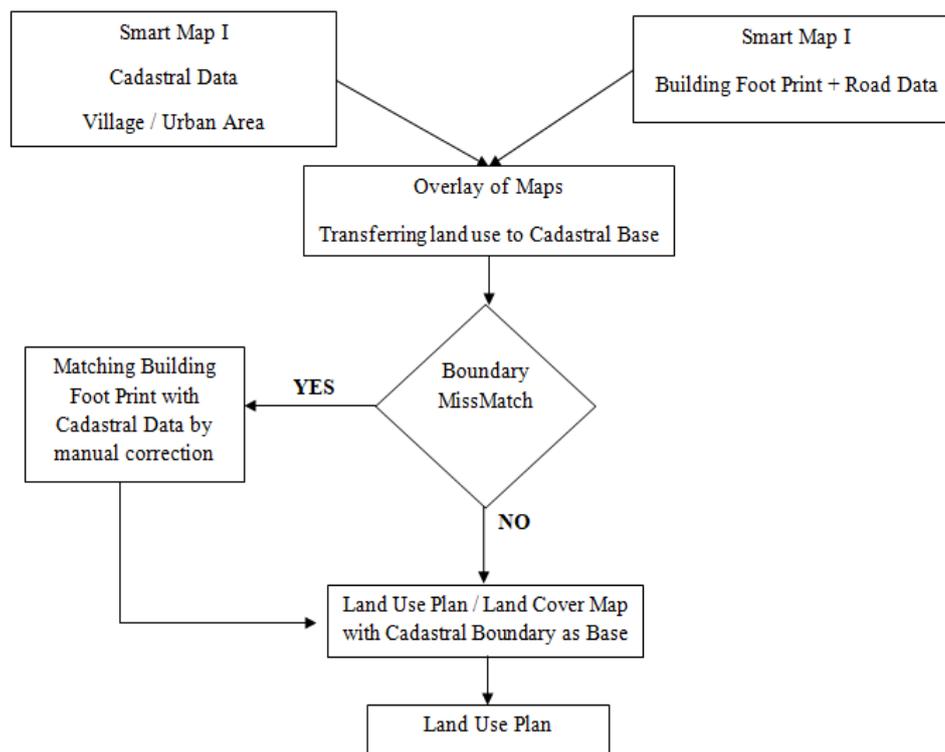


Figure 4. Preparation of Existing Land Use Plan

### 3. Economy

The prosperity of the place or town is understood by looking into the parameters that define the economy. One of the most important parameter that defines the economy is Work Force Participation Rate. Work force Participation Rate is defined as the percentage of workers to the total population as per Census of India. Percentage of workers is computed by adding the number of Main workers with the number of Marginal workers. Work Force Participation Rate is influenced by the composition of Primary sector, secondary sector and tertiary sector. Therefore the pulse of the economy can be understood by looking into the employment that is generated in that place and the unemployment scenario prevailing in that place. Looking into Economy from Master Plan perspective is to identify and finalize the employment that is required for a town and that can be generated in a Town. Employment in a town can be generated under six major headings in a town namely, Agriculture, Mining, Industries, Tourism, Fishing and Service sector. Agriculture employment that can be generated in an area can be found out by looking into existing area

under agriculture land use and areas that can be converted for Agricultural use based on the potential and suitability of the place. Mining employment depends upon the mineral deposits available and current level of exploitation of mineral resources. Industries employment is based on the raw materials from the mining sector, raw products from the agricultural sector and Infrastructure availability for import and export of goods such as good Roads, Rail Network, Inland Waterways, Harbor and Airport. Tourism employment in a town depends on the tourism places available in the town and from nearby places. Fishing employment depends upon the fishing catch potential and the number of fishermen available in the locality. Service sector depends upon the number of people working in the Government doing services to all the citizens in the town and the services to be provided to the people who are employed in Agriculture, Mining, Industries, Tourism and Fishing and general public. Based on the potential under various sectors in the town, employment that can be generated from the town can be worked out. Area requirement for various land use such as Industries, Commercial, Agriculture, Tourism can be worked out as an output from the employment generated in the Town. (Figure 5. And Table 1.Process and Data Collection).

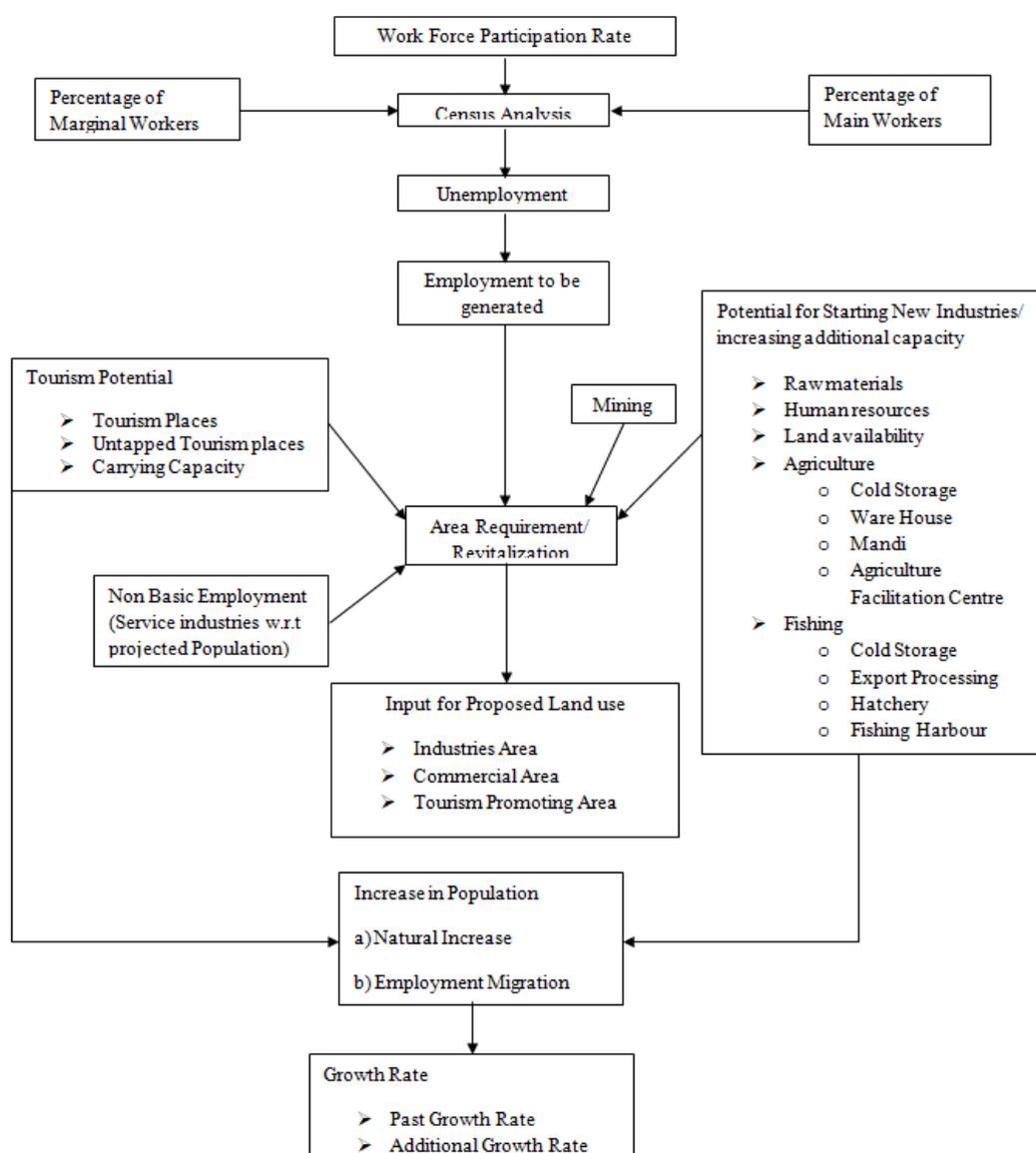


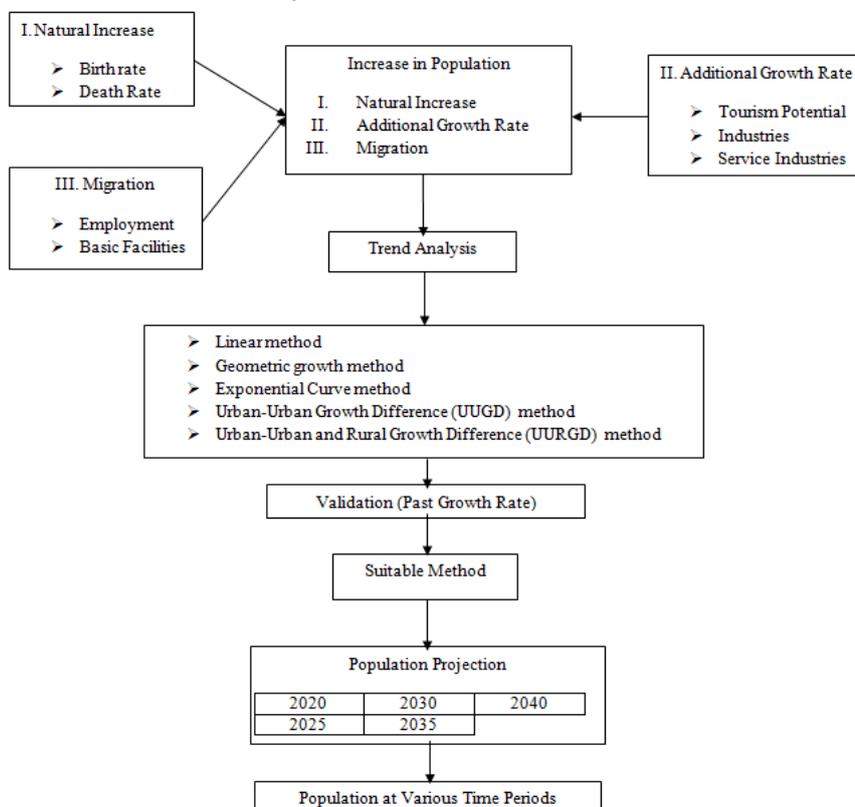
Figure 5. Preparation of Existing Land Use Plan

**Table 1. Data Collection for Economy**

Data element	Analyses	Relevance
Economic base	Resources – primary, secondary, tertiary, No. of units, Investment, Employment, Income,	Potentiality of different sectors to generate employments
Socio-economic status of families	Income, expenditure & employment pattern of families	Direction for the future economic projection
Economic status of Local Bodies (LBs)	Economic viability & financial wherewithal of LBs	Evolve economic financial strategies

#### 4. Population Projection

By understanding the Natural Increase of population and the potential of the area, trend analysis of the future can be predicted. Natural Increase of population can be ascertained by the Birth rate and Death rate registers available with the municipalities, town Panchayat and the villages. Potential of the area can be found out by looking into the basic employment that can be created by Tourism, raw material availability to support Industries, Agriculture and Non basic employment created by the basic employment. Based on the trend and the opportunities, growth rate is fixed and employment is projected using Arithmetic Projection method, Geometric Projection method, Graph Method, Incremental Increase method, Master Plan Method, Linear method, Exponential curve method, Urban-Urban Growth difference method, Urban-Urban and Rural Growth Difference method etc. The projected population by various methods is validated with the past trend and the growth potential of the town. Master Plan Period is prepared for 20 years. Therefore, the Projected Population that suits the trend is used to project the population at various time periods 2020, 2025, 2030 and 2040. (Figure 6. Population Projection and Table 2. Data Collection for Economy).



**Figure 6. Population Projection**

**Table 2. Data Collection for Economy**

Data element	Analyses	Relevance
Population size: temporal data	Trend analyses, Growth rate, Density	Future population estimation Distribution of population in different zones
No. Households	Family size	Demand for basic amenities and infrastructure
Male & female	Sex Ratio	An index for employment potential
Literacy Level	Comparative analyses	Primary & adult education
Birth Rate & death rate	Natural growth rate	Estimation of migration & future population
Age group	Age -sex pyramid	Assessment of demand for employment & other facilities
Occupational pattern	Trend analyses	Potentiality & future projection

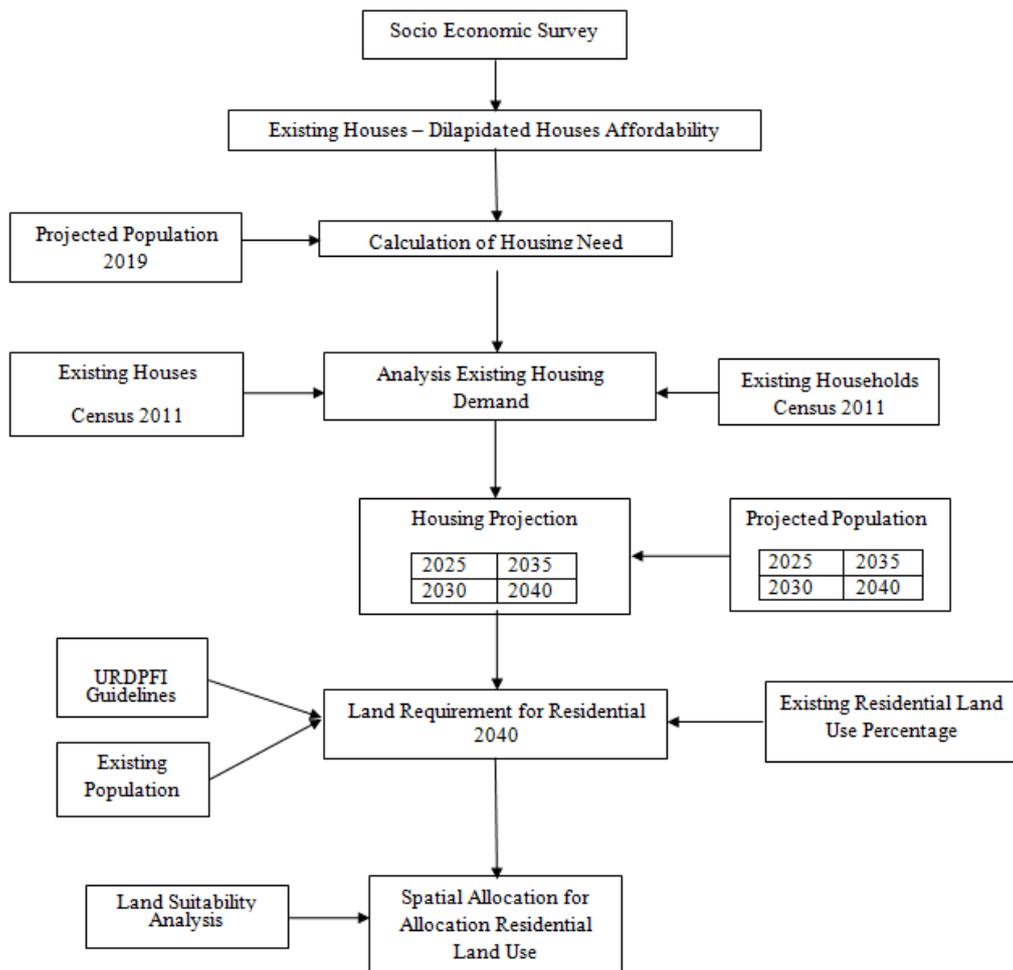
## 5. Housing

Food, Clothing and Shelter are the three components, which are very important for the survival of a human kind. Thus shelter assumes greater significant importance in the life style of people. In the context of preparation of Master Plan, Housing assumes greater significance because nearly fifty five percent of the land is allocated for Residential Land use. To understand the shelter requirement of the people living in the area, one has to understand the socio-economic profile of the people living in the Town. Socio-Economic Profiling can be done by conducting a Socio-Economic Survey. Socio- Economy survey is to be conducted to understand the ability to pay i.e. affordability of people living in the Town for shelter. Socio-Economic profile also gives the number of dilapidated houses in the town.

To understand the housing scenario of the town, housing need and demand needs to be worked out. Calculation of Housing Need is easily calculated with the help of the particulars available in the Census data such as the projected population and family size. Calculation of Need is achieved by dividing the projected population with the family size. Housing Need gives us the idea of the requirement for the town under ideal conditions. In realistic approach, Housing Demand gives us the requirement on ground. Housing Demand is calculated by taking note of the existing housing stock, number of dilapidated houses, number of houses and number of households. As the population is projected for the years 2020, 2025, 2030 and 2035, housing demand can be worked out and accordingly the requirement for residential land use can be computed. After doing land suitability analysis for the Local Planning area, spatial allocation of computed residential requirement can be allotted. (**Figure 7.Process of Residential Spatial Allocation and Table 3.Data Collection for Housing**).

**Table 3. Data Collection for Housing**

Data element	Analyses	Relevance
Housing stock: materials & basic amenities	Housing shortage	Assess the future demand
Age, number of stories, materials, basic amenities	Qualitative shortage Housing distribution based on income pattern	Identify area for Urban renewal
Ownership & rental, rental value	Existing demand for rental housing	Estimate the future demand for rental housing



**Figure 7. Process of Residential Spatial Allocation**

## 6. Stakeholder Consultation - 1

An Open house meeting is to be conducted after the completion of land use survey, data collection and preliminary analysis, in order to ensure the public about the Master Plan preparation. This is also to gain cooperation and create awareness among the public about the projects. Such meetings will also help the consultant team to understand the requirement of the beneficiaries. And thus the consultant team will also incorporate their comments and suggestions. With the collected detail and the incorporation of suggestions from the meetings, a 'Vision Plan' for the development of the Planning area could be framed, based on which 'development goals' can be identified.

The Consultant with the help of the Stakeholders would frame the vision goals and objectives and prepare a concept plan.

## 7. Physical Infrastructure

Physical Infrastructure is the backbone of development in an urban area. Quality of life of the people living in a town improves based on the availability of the Physical Infrastructure. Physical Infrastructure in a Town is dealt in majorly four categories i.e. Water Supply, Sewerage, Storm Water and Solid waste for the preparation of GIS based Master Plan.

### 7.1.1 Physical Infrastructure – Water Supply

Water is an essential component for the survival of human being as water constitutes 70-80% of our body. From time immemorial, civilization started to happen in nearby areas where there is abundance of water. Water supply also promotes Industrial development. Thus water availability and supply defines the growth of the town. Therefore while preparing a Master Plan for a town, a plan for water supply for the future assumes greater significance.

Water supply analysis in the context of preparation of Master Plan starts with analyzing the availability of Existing Water supply in Litres per Capital per day (LPCD) for the Town. The outcome of the analysis is to identify (i) Demand and Gap in the provision of water of the supply for the town. (ii) To have a better understanding of existing requirement, a map showing the covered areas and uncovered areas of water supply is also prepared. After looking into the existing gap that is to be filled, the future requirement is computed from the projected population for the years 2025, 2030, 2035 and 2040. After projecting the future demand, the sources for tapping the requirement are given as proposal consulting the Tamil Nadu Water Supply and Drainage Board (TWAD) and the officials in charge of water supply in Municipality, Town Panchayat and Villages.

Residential development in an area depends upon the availability of water. Therefore probable areas for residential development will be charted out based on the existing network and the possibility of extending into newer areas by consulting Engineers from TWAD Board, Municipality, Town Panchayat, Block Development Office, and Villages. The identified areas for residential development based upon water will give us the input for the proposed spatial allotment. (Figure 8. And Table 4. Data Collection and Water Process).

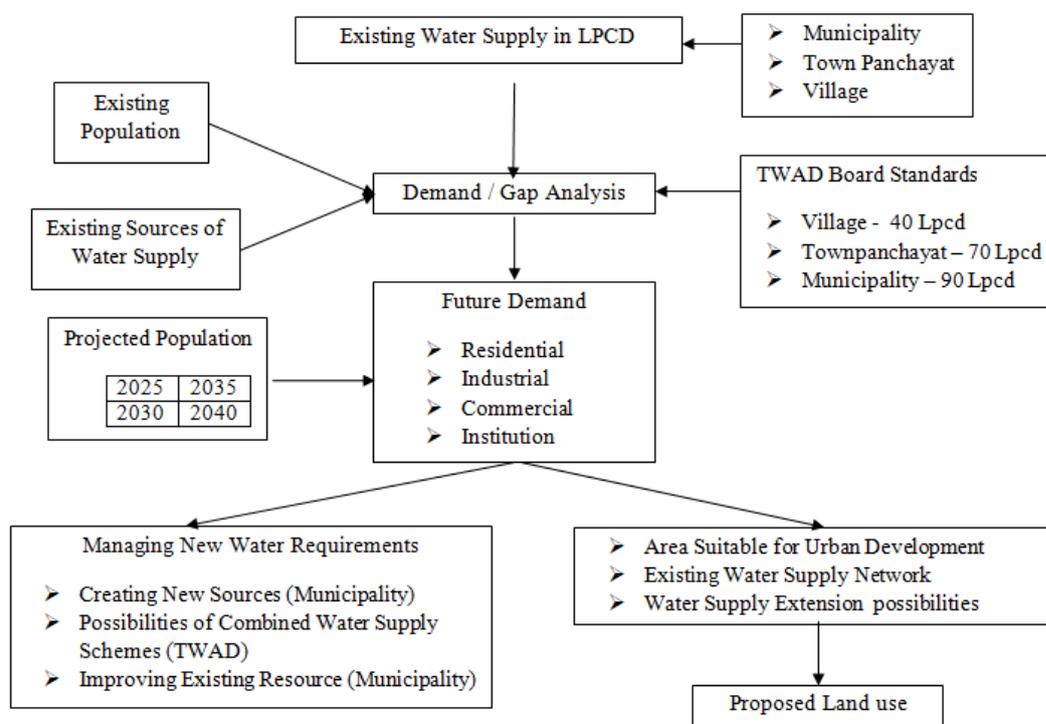


Figure 8. Physical Infrastructure (Water Supply)

**Table 4. Data Collection for Water Supply**

Data element	Analyses	Relevance
Project Report Evaluation  Quantity, quality & duration of supply, tariff, source of supply	Technical, financial, social, cultural, environmental, legal & institutional aspects Review a. basic design considerations b. Standards – quality, quantity for different sizes of cities & various uses & purposes c. Conservation d. increasing water availability e. demand & supply management Assess existing status	Assess the future demand
Components of the system: head works, siting of pumping stations, treatment works, reservoirs, reliability for all seasons, distribution system, & over-head tanks	Examine with reference to the CPHEEO Manual	Ensures efficiency & effectiveness
Area supplied, hours, metering, supply for domestic, commercial & industrial area	Analyse uncovered area in terms of economic & social status, trend of development	Evolve strategies to ensure equity & inclusiveness
Public perception	Analyse feedback	Incorporate the feedback in proposals

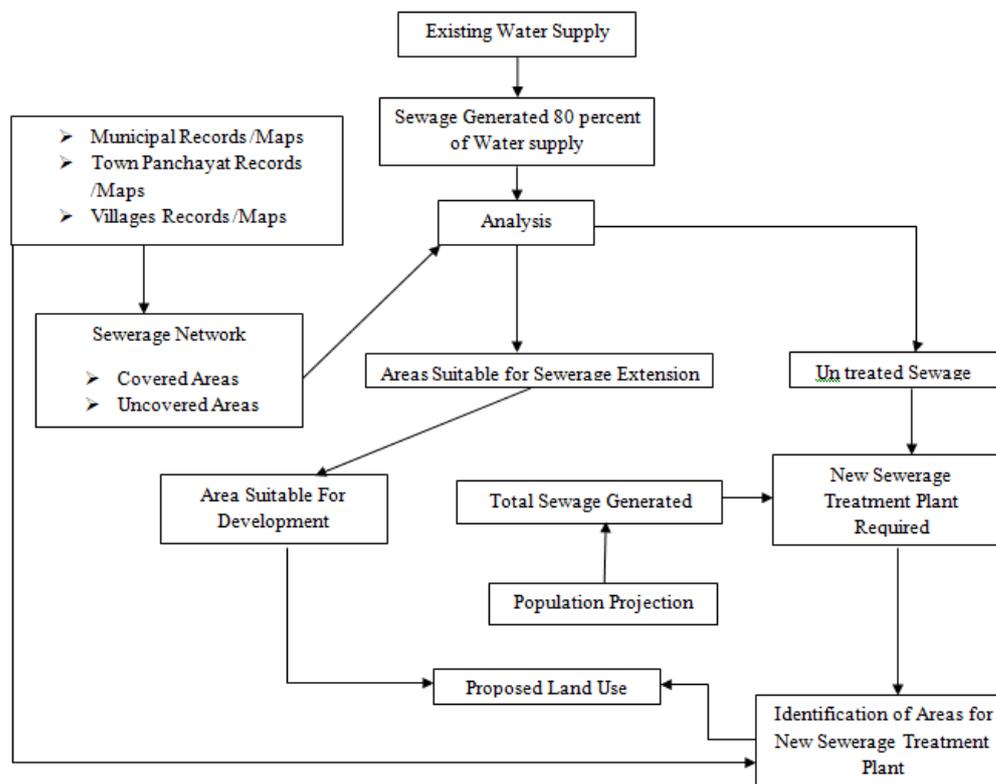
### 7.1.2 Physical Infrastructure – Sewerage

75 – 80 % of water supplied to Residences, Industries, Shops, and Institutions returns as Sewage. Sewage generated in an area, to be moved immediately within four hours to stop its septic formation en route. The sewage that is generated in the town to be treated immediately in a Sewage Treatment Plant, before the Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) rises to its alarming levels. The Projected Sewage for the town for the next twenty years is projected with the data, projected water supply. For the projected sewage, adequacy analysis of existing Sewage Treatment Plant is examined, and if required New Treatment Plants are suggested as proposals in the Master Plan in consultation to Municipal engineers and Town Panchayat. In the case of villages, as against conventional treatment plants, Decentralized Waste Water Treatment Plant can be suggested for improvement of sanitation in villages if required. Area suitable for development in the context of provision of Sewerage facilities in the projected future will be studied and analyzed, in consultation with the Municipality and Town Panchayat. The suitable area identified, as result of the analysis and discussion will provide input for the preparation of Proposed Land Use. (**Figure 9. And Table 5. Data Collection and Sewerage Process**)

**Table 5. Data Collection for Sewerage**

Data element	Analyses	Relevance
Review of Project Planning: Engineering - Topography, depth of ground water table, soil, disposal, reuse, water supply system, Institutional aspects Environmental consideration Ground water quality Odor & mosquito nuisance Public health	Data collected for all aspects referred in column 1 and evaluated against CPHEEO standards	The Project formulation must be in conformity with the CPHEE Manual on sewerage & sewage treatment

Landscaping Treatment proves Financial aspects Legal issues Community participation Inter & intra Departmental co-ordination Geographical Information System Master Plan & Sanitation Plan		
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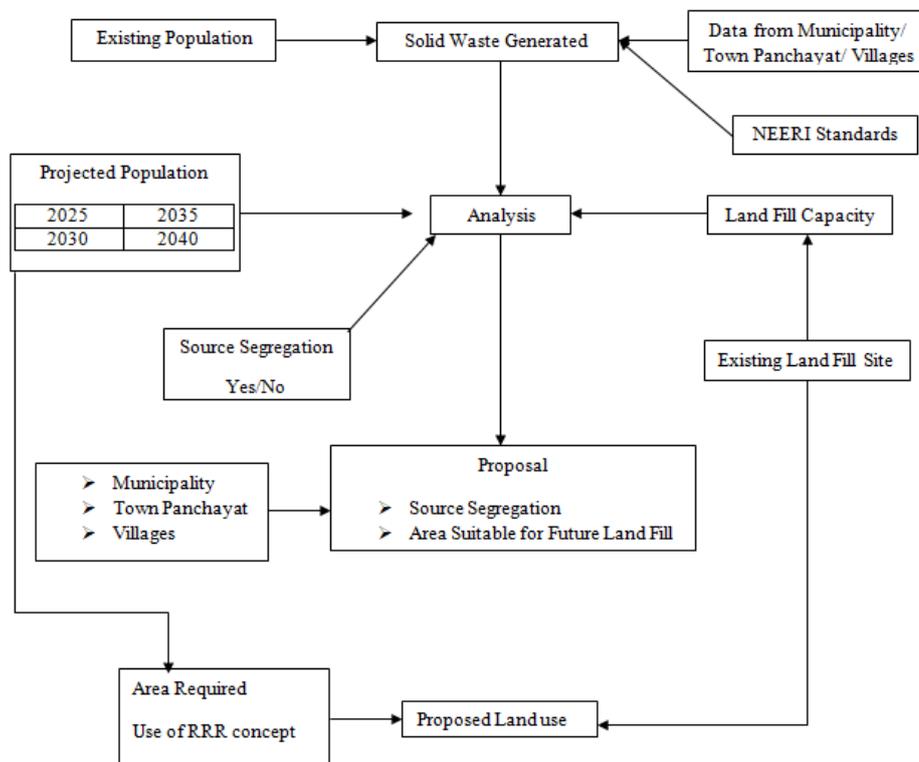


**Figure 9. Physical Infrastructure (Water Supply)**

### 7.1.3 Physical Infrastructure – Solid Waste

To prevent unhygienic conditions, Solid waste generated in a Town or City is to be removed and disposed of in a scientific method as early as possible. Solid waste as a topic in Master Plan preparation is discussed under four Main headings i.e. (i) Calculation of Solid Waste generated in the city, (ii) Identifying suitable locations for the disposal of Solid Waste and (iii) Marking the identified area in the proposed land as Public and Semi-Public land use. Calculation of Solid Waste generated in the City or Town starts with multiplying the projected population with the solid waste generated in that area. The Solid Waste generated in the city is thus analyzed to look for the possibilities of storing the Solid waste in the existing Solid Waste Management site or to look for other location alternatives for disposing of the Solid Waste in discussion with the Municipalities and Town Panchayat using Reduce, Recycle and Reuse method approach. In the case of Villages, the Solid Waste generated is to be disposed off through pit method employing reduce, recycle and regenerate method as proposed by the Tamil Nadu Government in discussion with the Panchayat president. The sites identified by the Government/Municipality/Town Panchayat/Villages for Municipalities, Town Panchayat, and villages for the projected population are marked as Public and Semi-Public in the proposed land use. 100 meters around the

proposed solid waste management facility will be marked for recreation or non urbanisable zone as the case requires it. (Figure 10. And Table 6. Data Collection and Solid Waste).



**Figure 10. Physical Infrastructure (Solid Waste)**

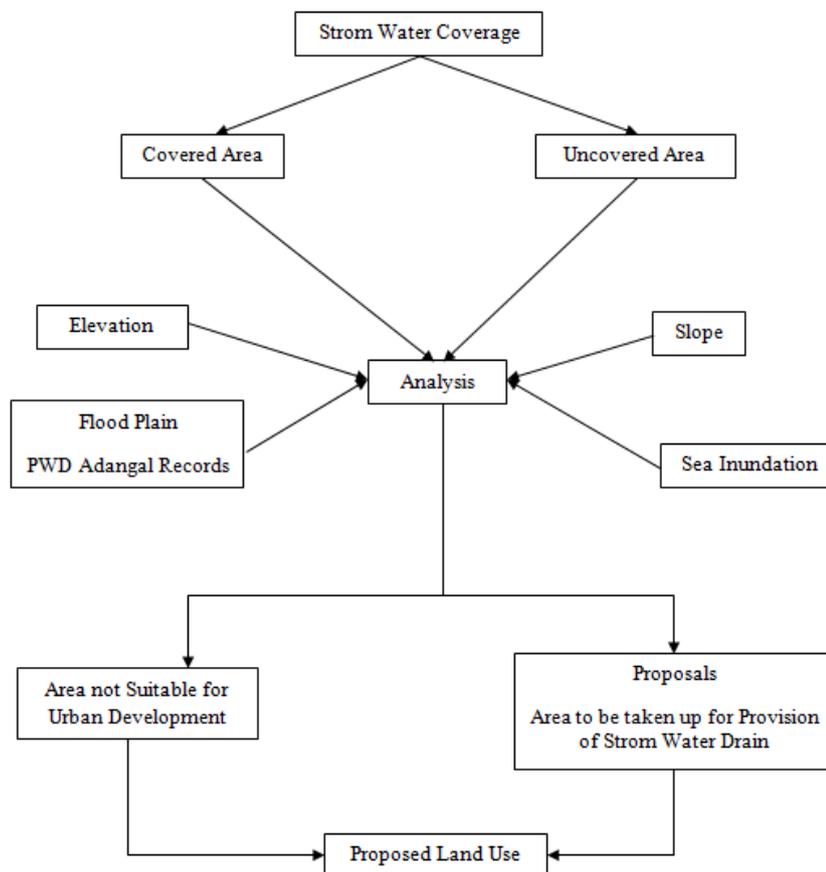
**Table 6. Data Collection for Solid Waste**

Data element	Analyses	Relevance
Waste quantity generated b. waste generated rate c. primary collection d. secondary collections & transportation e. storage points f. street sweeping g. processing h. disposal i. private & community participation.	Analyse the compliance with the Solid Waste Management Rules, 2016	Understand the current status & propose future strategies

#### 7.1.4 Physical Infrastructure – Storm Water Drains

Storm Water Drain is essential for the Town/City to drain out the excess storm water, which cannot be collected and stored. Natural Drains, usually drains out the excess Storm Water collected in the Towns, Town Panchayat and Villages. Natural Drain Details are available in the village maps. In Urban areas, these Natural Drains are encroached, thereby not making way to flush out the Storm water into the river or sea. Therefore in Urban areas, an analysis is to be carried out with the help of the data such as sea inundation areas, slope, elevation, flood plain data maintained by Public Works Department (PWD),

Adangal records and storm water coverage to identify the reason for flooding. The analysis will reveal the reasons for flood prone areas and sea inundation areas. Based upon the problems, solutions are identified to overcome the problem. The probable solutions are (i) Providing Storm Water in areas of flooding, to drain out excess flood water, (ii) removing encroachments in natural drainage channels to pave way for the water to naturally get drained off into the sea or river as the case may be, (iii) low lying areas to be ear marked under Non-Urbanizable zone or recreational use in Proposed land use. (**Figure 10. Flow hart for process**).



**Figure 11. Physical Infrastructure (Storm Water Drains)**

## 8. Social Infrastructure

By concentrating on Physical Infrastructure in the Local Planning Area (LPA) alone, we may not be able to achieve economic development. Social Infrastructure is also needed to support Physical Infrastructure to improve the economy of the Town and to have a good quality of life to the people living in that area. Usually in Master Plan, the following Social Infrastructure is studied in detail (i) Hospital (ii) Schools (iii) Police Station and (iv) Fire Station. The Social Infrastructure listed above is analyzed with respect to standards in term of its adequacy and spatial location. Adequacy in terms of number of Hospital, School, Police Station and Fire Station are analyzed with respect to Standards prescribed by the Government and the number of facilities required is worked out. The Spatial allocations of space for those facilities are finalized looking into standards prescribed and areas suitable for development of those facilities arrived from land suitability analysis. (**Figure 12. Flow chart for the process and Table 7. For Data Collection**).

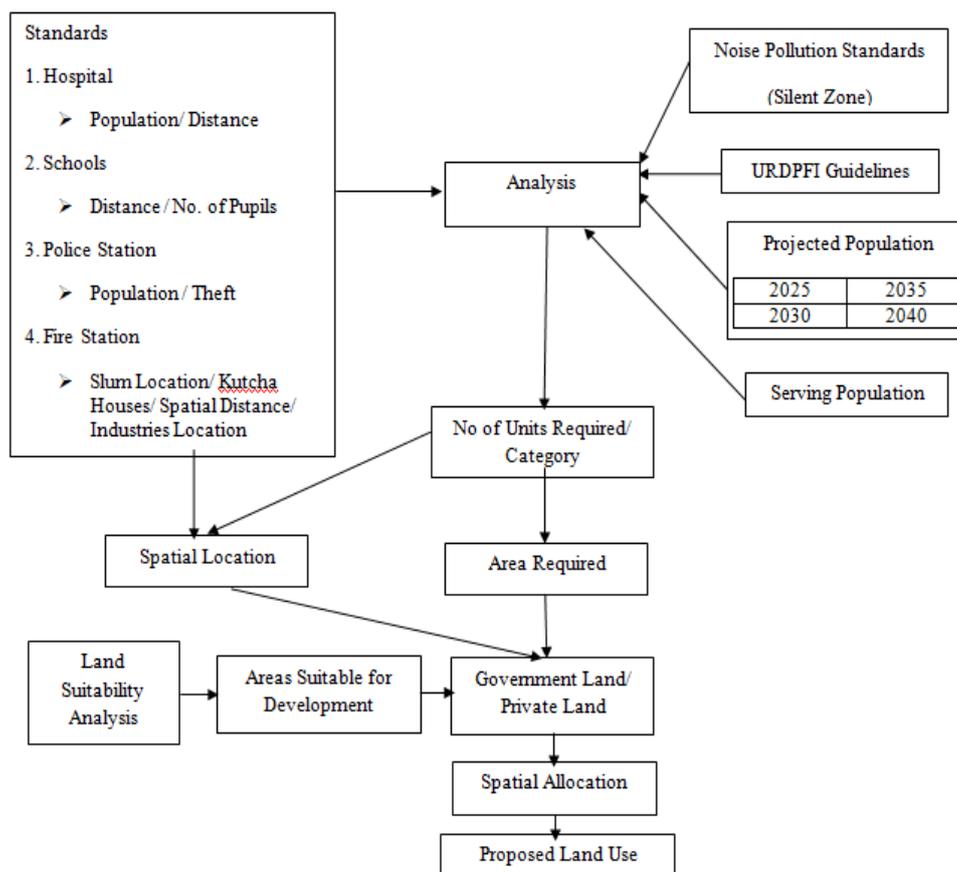


Figure 12. Social Infrastructure

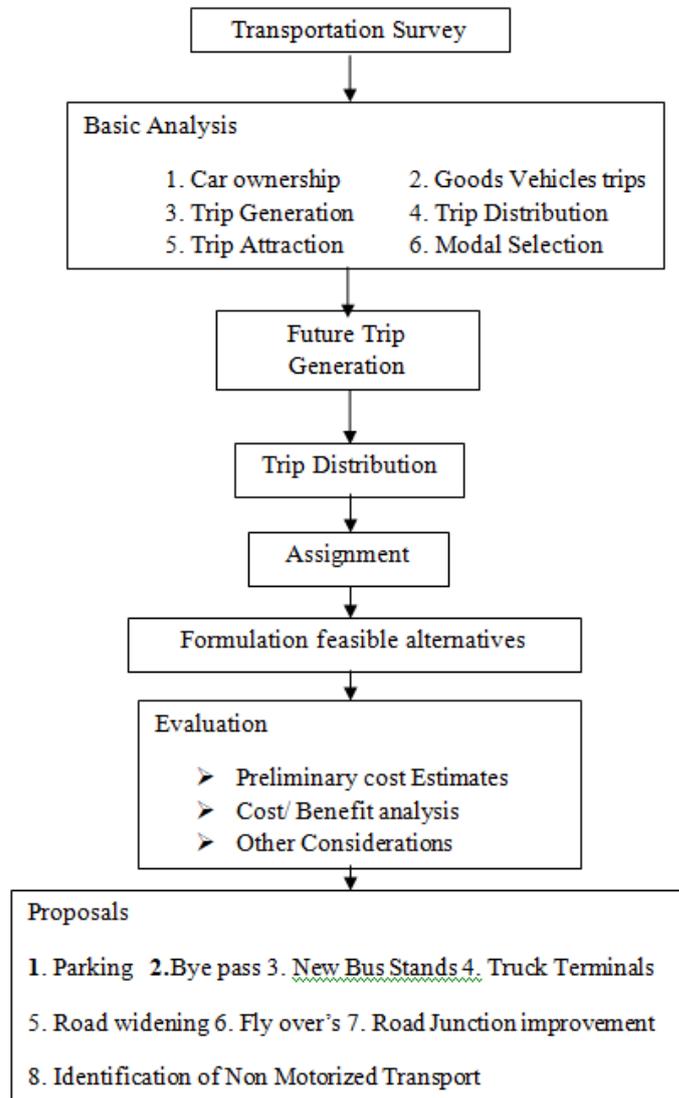
Table 7. Data Collection for Social Infrastructure

Data element	Analyses	Relevance
Institutions: Hierarchy wise number of institutions, location & area - Educational Health Recreational Religious	Analyse data with reference to Threshold population Range of distance Area & Assess the area unserved for each type of institution	Ensures rational distribution of social facilities

## 9. Traffic and Transportation

One of the most important physical infrastructures for the development of the town is development of roads to improve the mobility in the towns. To improve the mobility, Transportation Surveys are to be carried out. Usually Transportation Surveys are carried out in three major headings namely Inventory of existing travel pattern, Inventory of existing transport facilities and study of Land use and economic activities. The Surveys, Interviews and studies carried out in Inventory of existing travel pattern are (i) Origin and Destination Surveys, (ii) Household interviews, (iii) Rail and bus Surveys, (iv) Goods vehicle interviews, (v) Coach surveys (vi) Cordon and Screen line Studies. The Inventory of

existing transport facilities is carried out by doing Street Inventory, Travel time studies, Bus Inventory, Rail Inventory and Parking Inventory. Land use and economic activities is studied and analyzed by looking into the Zoning, Land use, Population structure, Household Structure, Employment pattern and Income. After conducting the above surveys, analysis is done to find out the Trip Generation, Trip Distribution, Modal Selection and Trip Generation in the study area for the proposed plan period. Based upon the trips to take place in the future, proposals such as Parking, Bye pass, New Bus Stands, Truck Terminals, Road Widening, Fly over's, Road Junction Improvement, Identification of Non Motorized Transport and Suggestion to improve the circulation pattern are proposed. The proposed proposals are then suitably incorporated in the Proposed Land use map. **(Figure 13. Flow chart for the process and Table 8. For Data Collection)**



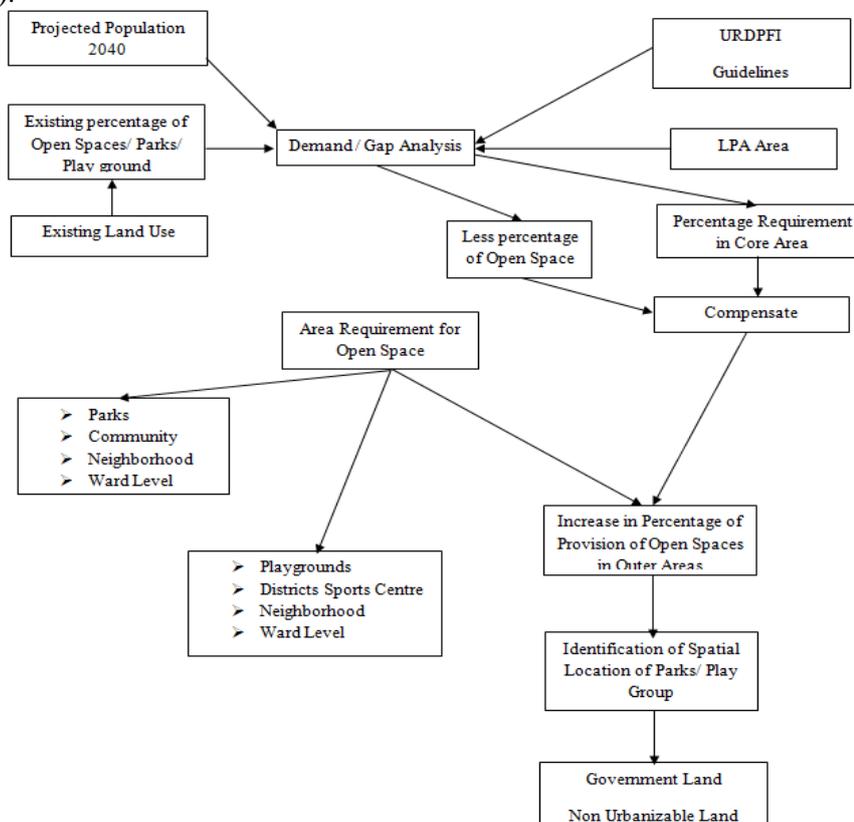
**Figure 13. Social Infrastructure**

**Table 8. Data Collection for Traffic and Transportation**

Data element	Analyses	Relevance
Road characteristics: Classification, length, right of way, carriage way, footpath, cycle track, median, surface characteristics, intersections, bridges/flyovers/subways	Assess the existing status, problems & potentials	Draw future proposals
Traffic characteristics: Volume, composition, speed, pedestrians volume & facilities, parking, accidents, modal split, signals, signs, markings		
Bus transport facilities: inter & intra – city, terminals		
Railways: number of lines, volume of passengers, status and amenities at stations, – inter modal & parking		

## 10. Parks and Open Spaces

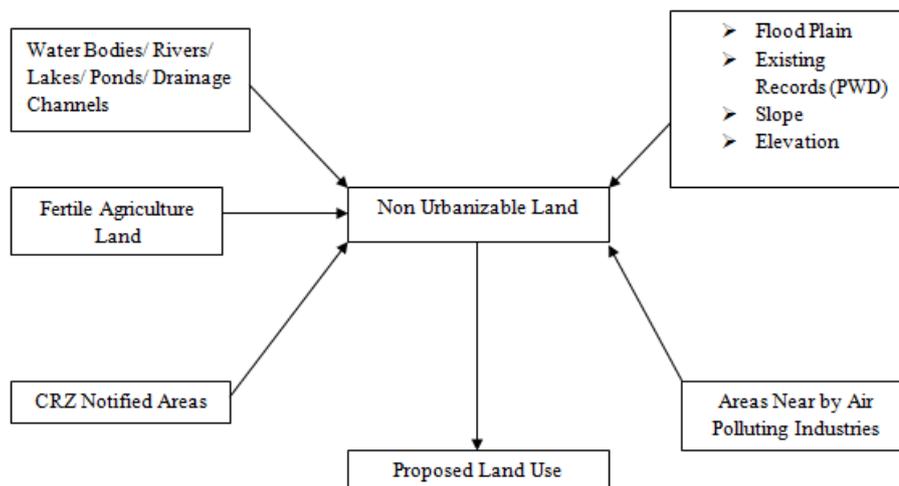
Parks and Open Spaces acts as lung spaces for the urban areas. Ten percent of the area is usually reserved as Open spaces in Master Plan. As against the standard prescribed in Tamil Nadu, Demand Gap analysis is done by taking note of current population, projected population, existing percentage of opens spaces, parks and playgrounds. The analysis will give us an idea of the existing percentage in open space and the proposed percentage to be adopted in core area and the outskirts. As the core area is already developed in the urban areas, the percentage of open space will be less. Whereas in the periphery, it is less dense and chances of reserving more open space is possible. Therefore, area requirement for open space will be worked out and hierarchically open space is to be allotted spatially as per the requirement and need. Wherever possible, the identified space will be located in a Government land, rather than the private land to minimize acquisition and reduce litigation. (Figure 14. Flow chart for the Process of Parks and Open Spaces).



**Figure 14. Parks and Open Spaces**

## 11. Environment

Environment is to be conserved and protected for the well being of the people and to have a very good quality of life in urban areas. Environment in the context of Master Plan preparation will be to identify Non Urbanizable land in the Local Planning areas. The Non-urbanizable areas are identified by analyzing the data such as, location of water bodies, rivers, lakes, ponds, drainage channels, fertile agricultural land; Coastal Regulation Zone (CRZ) notified areas, flood plain (PWD records), slope, elevation and areas nearby air polluting industries. The identified areas are marked as non urbanizable areas in the proposed land use plan. (**Figure 15. Flow chart for the Environment**).



**Figure 15. Environment**

## 12. Land Suitability Map

Suitability analysis is the process that involves use of criteria maps in combination with the standardized criteria weights and subjecting them to various processing module in GIS software to obtain ranked land use suitability maps (Khaemba et al 2012)<sup>1</sup>. Site suitability analysis greatly reduces the time as well as effort that have to put in otherwise in manually searching the records, processing data and undertaking field surveys (Manish Kumar and Vasim 2012)<sup>2</sup>. In identifying suitable an area for urban development, the first step is to identify the suitability factors for urban development such as slope, elevations, existing land use etc. The identified factors are discussed with the stakeholders and the weight ages for the factors are arrived by consensus. The identified factors are standardized to a common scale to apply the weight ages. The standardized identified factors are then overlaid with their weight ages to obtain the suitable urbanizable areas in graded format such as more suitable, less suitable and non suitable etc. The urbanizable land identified for urban area expansion from overlay analysis will be used for various uses such as Residential, Commercial, Industrial, Public and Semi Public and other uses etc. (**Figure 16. Flow chart for the Process of Land Suitability Map**).

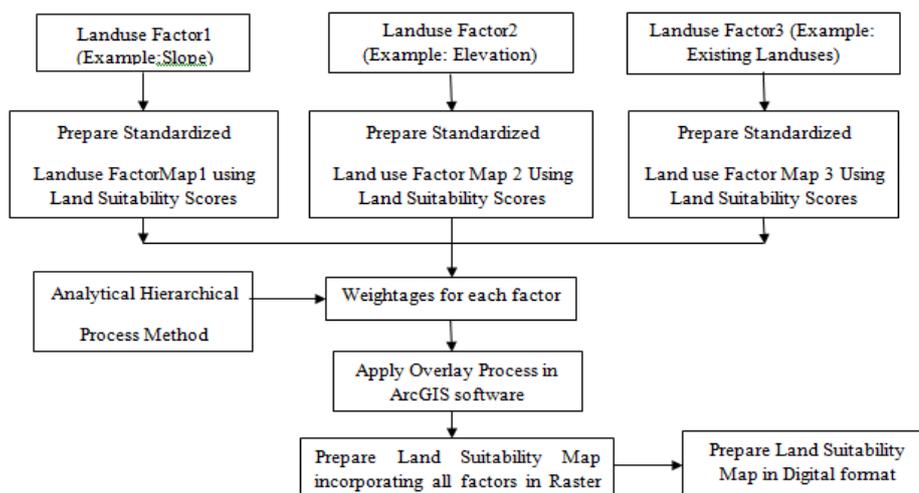


Figure 16. Land Suitability Map

### 13. Proposed Land Use

Proposed Land use defines the land lay of the future plan spatially in the Master Plan. The process starts with the identification of requirement for the land uses such as Residential, Commercial, Industrial, Public and Semi-Public, Parks and Open space, Traffic and Transportation by studying the economy, housing, social infrastructure. The area required is then allotted spatially in the Local Planning Area for various land uses as per land use planning principles and the suitability of the land for which it is intended to. The allotted space for various uses is transferred to the cadastral map. The cadastral map with the proposed land use becomes the proposed land use map. The prepared proposed land use with Cadastre information is presented in land use register also for reference. (Figure 17. Flow chart for the Process of Proposed Land Use and Table 9. For Data Collection).

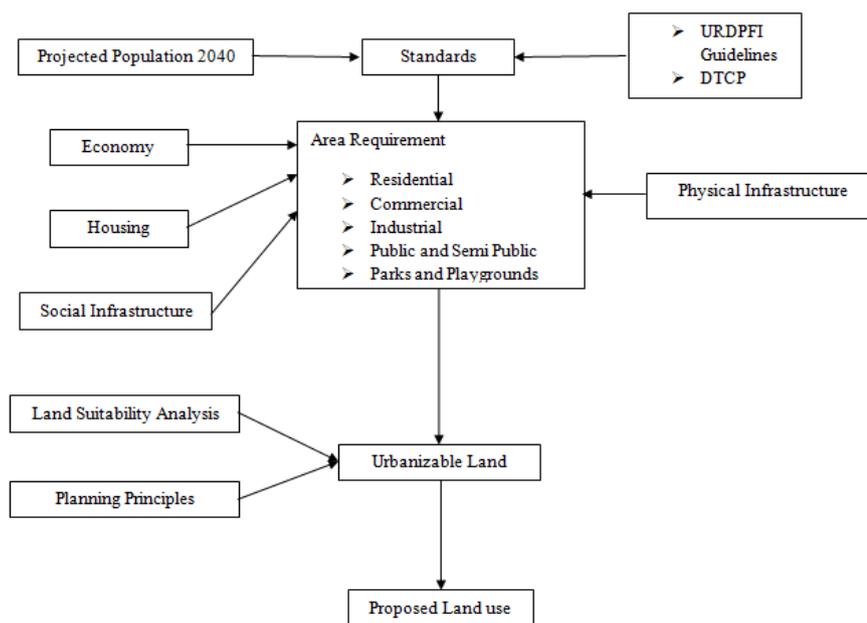


Figure 17. Proposed Land Use

**Table 9. Data Collection for Land Use**

<b>Data element</b>	<b>Analyses</b>	<b>Relevance</b>
Classification b. area c. percentage d. per capita e. density f. spatial distribution g. strategy adopted	Evaluation with reference to land use planning principles Compatible & conflicting land uses Change detection analyses using GIS to understand the dynamics of land use changes - a. extent/percentage change b. rate of change c. Land use change matrix d. spatial distribution of changes e. change trajectories Land suitability analyses in GIS for spatial assignment of future land use pattern	To assess land requirement for future dispensation

#### **14. Stakeholder Consultation - 2**

After submission of proposal and before submission of Draft Master Plan, an open house meeting is to be conducted in the presence of District Collector to the stakeholders. The Consultant will present a power point presentation about the need for Master Plans, the steps in Master Plan preparation, Concept Plan and Proposals of Master Plan. After the presentation, views and suggestions from the stakeholders will be elicited in the form of questions and write-ups. The views and suggestions by the stakeholders will be scrutinized and worthwhile views and suggestions will be incorporated in the Draft Master Plan.

#### **15. Submission of the Draft Master Plan**

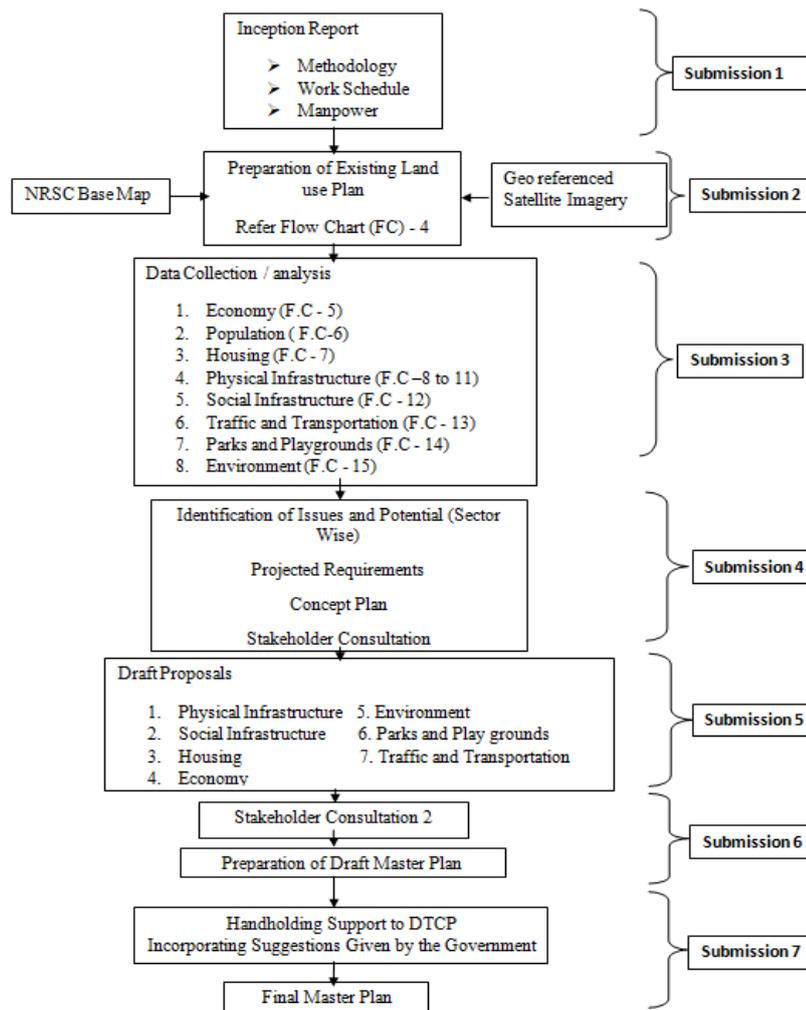
The Draft Master plan would be submitted with incorporation of above said details within 12 weeks from submission of inception report. The draft Master Plan would be presented to all stakeholders including the officials for suggestions and comments.

#### **16. Submission of the Final Master Plan**

The suggestions and objections will be reviewed with the consultation of the planning authorities and necessary modifications to the required extent will be incorporated in the final Master Plan. The Final Master Plan prepared will be submitted to the Government for approval with necessary plans and reports. In the mean time, during the approval process by the Government, the consultant will conduct a course on GIS, to familiarize the officials in Directorate of Town and Country Planning (DTCP) to utilize the GIS dataset supplied by the Consultant.

#### **17. General Process of Preparation of Master Plan**

The General process of preparation of Master Plan along with the submissions and deliverables as suggested in the terms of reference is given in the flow chart 18 for ready reference. The Methodology and details of the Master Plan preparation is detailed in paragraphs in 1 to 14 (**Figure 18. General Process of Preparation of Master Plan**).



**Figure 18. General Process of Preparation of Master Plan**

## 18. Conclusion

Master Plan involves preparation of Existing Land use Plan, Review of Existing Plans, Data collection and Analysis, preparation of Concept plan, conduct of Stakeholders meeting, Preparation of Proposed Land use Plan. The Methodology discussed above, will give a glimpse of the processes involved in the Master Plan. As the Problems in each city will vary from place to place, the processes outlined above, may be modified to suit the local conditions.

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