Smart Data for Smart People

Creation of Geo-Spatial Database for Colombo Metropolitan City Corporation (CMCC) Areas & Emerging Urban Areas (EUA) in the Colombo District.

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1.0 Introduction

Sustainable urban development has become a critical issue in Sri Lanka with the population growth and associated high levels of urbanization. It is estimated that more than two third of the world's population would live in cities in year 2020 (UNHABITAT). This is likely to be the position in Sri Lanka as well. The main responsibility of city planners should be to grasp this change and take right decisions at the right time. All cities in the world are now entering IT enabling smart cities and Sri Lanka also cannot avoid that situation.

The Urban Development Authority (UDA) as the main planning organization in Sri Lanka was entrusted to prepare development plans for its declared urban development areas. The foremost objective of this task is to create a sustainable living environment for the people who live within these areas. The City of Colombo is the commercial capital of Sri Lanka located in the Western Province. It is as a coastal city. The Government decision to shift all administrative function from City of Colombo to an adjoining area with offices located 7 km away from Colombo has caused the spread of urbanization into the hinterland. As a result of this, the city area has become larger and larger regardless of its administrative boundaries. The newly constructed express ways has also added considerable weight in transforming some areas into the emerging urban areas category. The rapid pace of urbanization in the city of Colombo and suburban areas have outpaced the ability and resources of city planners to visualize the scale of services to be provided in their development plans. Therefore they should have a sound spatial database system to measure or to calculate changing future scenarios.

Land is a fundamental and finite resource for most human activities. Humans have been changing land cover since pre-historical times through their multiple activities, including agriculture, livestock, industry, living space and recreation. Although the land cover and land use changes are substantial, these are difficult to grasp when they occur incrementally. According to the available historical data, the main land use changes observed in the Colombo city areas is the rapid increase in built-up land, which is over 84% at present. This built-up area replaced domestic gardens, water bodies and marshes while a significant decline in the extent of domestic gardens occurred mainly due to change to commercial activities.

The land use data pertaining to the Colombo Metropolitan City Corporation (CMCC) Area & Emerging Urban Areas (EUA) for the preparation of development plan was collected in the year 2000 and since then the database has not been updated.

During the last 15 years the building density has increased both vertically & horizontally due to new developments, growth of population and expansion of settlements within the CMCC &

EU areas. Land Use changes have also occurred due to the other physical developments such as roads, mega commercial developments, industries, government & private sector buildings, recreational activities, etc. there were no records regarding these development at one place to examine the development trends and the development expansion.

2.0 Existing Situation

The existing land use data for the Metro Colombo City Corporation Area is based on different years from 1998 to 2005. Since then the changes that have taken place during the past two decades are unknown. Planning clearance, new developments, changing regulations and making important planning decisions have been taken in isolation on one to one basis without considering the overall picture of the future city. This may course ad hoc development throughout the CMCC & EU Area. Therefore, the need of updating of land use database is vital at this point. Updating the land use database is alone not sufficient but also details of other physical structures are also very important to collect. Accordingly, the UDA has commenced a spatial data survey within the CMCC & EU Area and is hoping to finish it within two years from March 2015 to April 2017.

Updated land use and buildings information will,

1. Indicate the growth of the city
2. Facilitate investors to take decisions on investments
3. Provide information on infrastructure facilities
4. Foresee future development trends and take prior action to avoid or minimize problems
5. Identify the Urbanization Pattern and Trend.
6. Make alternative solutions for urban problems.
7. Help the decision making process.

3.0 Objectives

The main objective of creating and updating the Geo-Spatial Database is to facilitate urban planners, decision makers, and other professionals who are entrusted and interested to design and implement urban development projects and services for the benefit of city dwellers.

By doing so, it is hoped to achieve following goals.

- To see the Changing land use pattern in the past decades
- Forecast the land use trends \ pattern
- To identify underutilized areas
- To identify Land availability for developments
- To identify constraint for development
- To facilitate the infrastructure agencies
- To develop a comprehensive monitoring system on land use, buildings & physical infrastructure based on web application

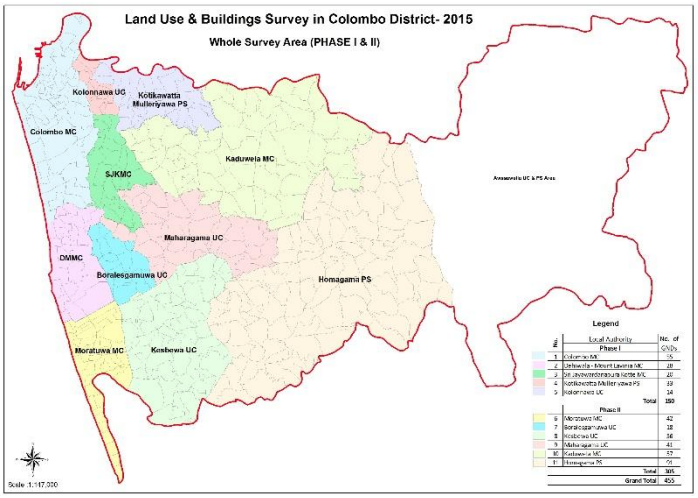
4.0 Spatial Extent

The spatial extent of this task is spread within 11 major Local Authorities out of 13, located within the Colombo District, i.e. Colombo MC, Dehiwala - Mount Lavinia MC,

Sri Jayewardenepura Kotte MC, Moratuwa MC, Kaduwela MC, Kolonnawa UC, Boralasgamuwa UC, Kesbewa UC, Maharagama UC, Homagama and Kotikawatte PS. The total spatial extent is 415 sq. km and it covers 450 GN Divisions and the Total Population in the year 2001 was 2,094,020 and the year 2011 was 2,159,839.

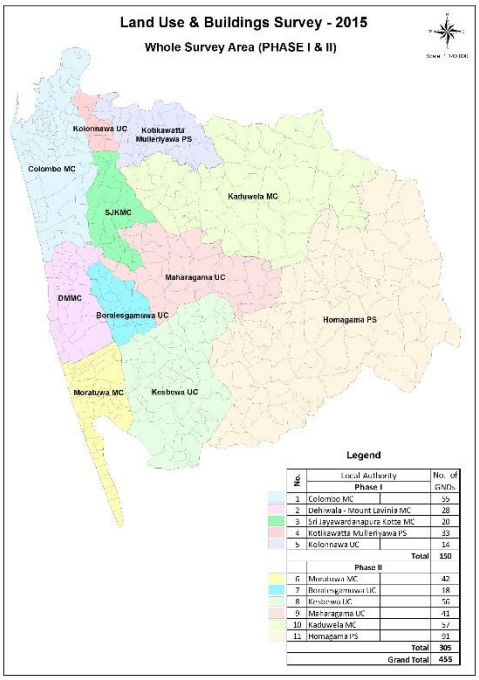
Map No. 1

Study Area within the Colombo District



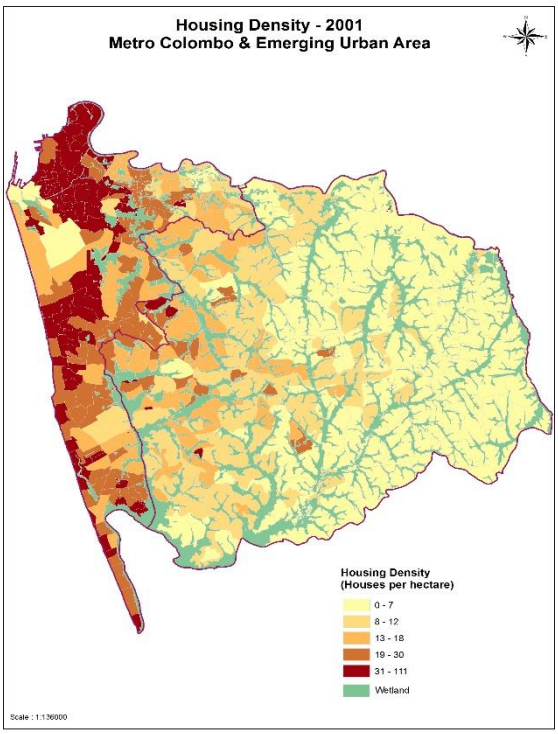
Map No. 2

Location of Local Authorities within the Study Area

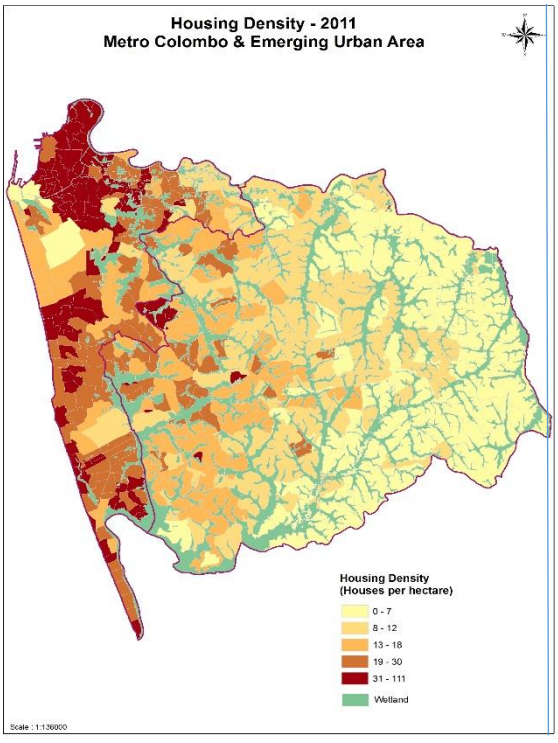


The distribution pattern of housing density within the Metro Colombo Area is illustrated below Map No.3 & Map No.4 for the year 2001 and 2011. Total hosing stock in 2001 was 469,885 and in 2011 it was 520,828 according to the Census & Statistic Department.

Map No. 3

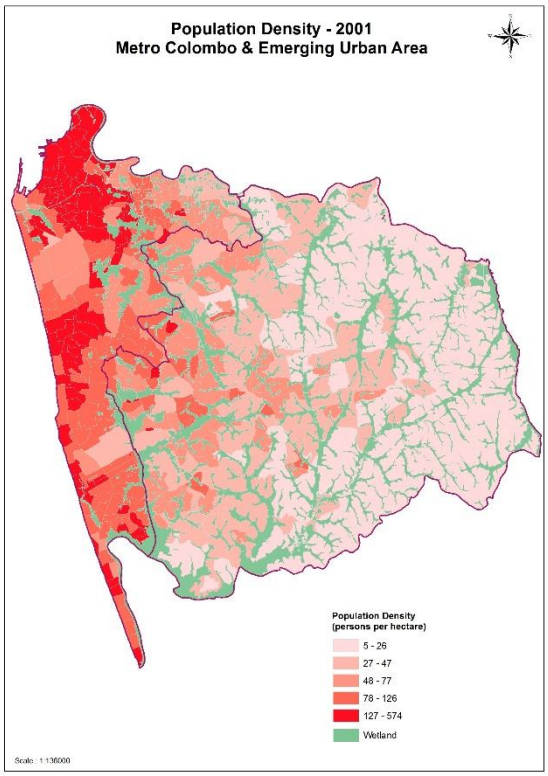


Map No. 4

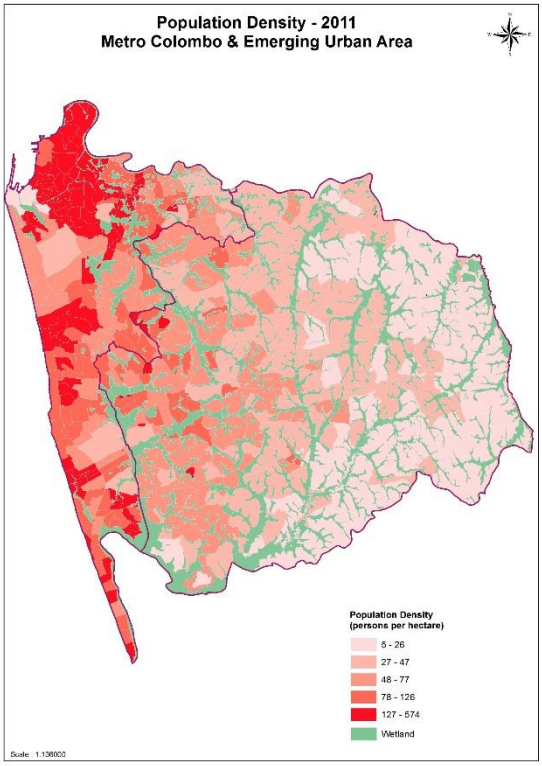


Map No.5 and Map No.6 indicate population density of Metro Colombo and Emerging Urban areas in the year 2001and 2011 respectively.

Map No.5



Map No. 6



5.0 Methodology

The methodology used for creation of geo-spatial database, has included following activities and ArcGis 10.2 and SQL database management system were used.

- Base Data Preparation
- Awareness Programme
- Recruiting Field Survey Assistants
- Training Field Survey Assistants
- Database Designing
- Data Collection, Data Entering & Analyzing
- Develop Web based GIS application for real time data collection & for Monitoring
- Preparation of Final Report & Submission

6.0 The way of conducting the field survey

The land use and Building data collection was carried out based on the Grama Niladhari Division Boundaries and data has been compiled accordingly. The data was collected at the field, on each plot of land and obtain right time data on,

- Land Use Categorization
- Building Information
- Roads & Street Furniture
- Street Lamps
- Surface Drains and

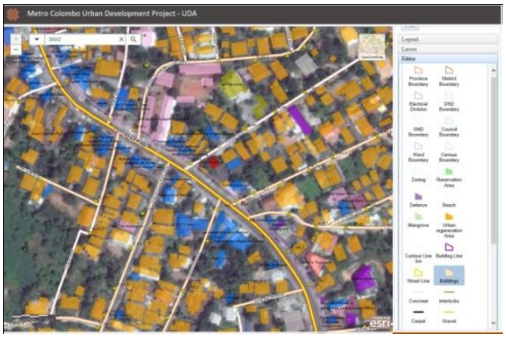
- All other physical structures such as electricity lines, water tanks, garbage collection points and culverts etc.
  Activity survey was based on the Survey Department Categorization and collected under the land use code and segment category. Building survey was based on the type of building, building height, no. of floors, building conditions and usage of building etc.

7.0 Base maps and Scales:

a. Base maps were prepared based on 1: 2000 scale digital data from the Survey Department
b. Acquired Geo-view Satellite Images for the year 2014 covering CMCC and EUA area
c. Digitizing the Footprints of buildings

At the beginning of the survey three forms were used to collect three categories of data, i.e land use, buildings and some street furniture as polygons, roads, electricity, storm and surface drains as lines and other physical infrastructures such as street lamp posts, garbage collection points and some road assets as points. After that, data was to be stored in the database using relational database system based on SQL platform. This process was very cumbersome, time consuming and an error producing process and the data quality & reliability was very poor. After six months, it was realized that the survey results has not come up to the expected standard. It has taken considerable time to rectify and correct data to obtain expected quality. As a remedy for this situation, the field survey method was changed into an online real time data acquiring process, and the whole data collection and database monitoring process was converted into a web based system. By doing so we could reduce 90% errors in data collection process and monitoring is much easier than before.

8.0 Interfaces of Web Application



9.0 Benefits and Achievement of the Database

Updated land use and building database would;

a. Indicate the growth of the city
b. Facilitate investors to take decisions on investments
c. Provide information on infrastructure facilities
d. Foresee future development trends and take prior action to avoid or minimize problems
e. Identify Urbanization Pattern and Trend.
f. Make alternative solutions for urban problems.
g. Help decision making process.

a. It also helps professionals to carryout following analysis:

1. Land use planning proposals
2. Land suitability analysis
3. Citizen Service request
4. Community planning
5. Infrastructure planning
6. Flood mitigation planning
7. Able to model the city
8. Disaster risk reduction plan
9. Tax parcel viewer
10. Election results viewer
11. Damage Assessment
12. Valuation Purposes
13. Special Event Planning

b. To find out urban expansion trends

c. To calculate future population and housing scenarios

d. To take rational decision on potential lands for development

10.0 Conclusion

It is hoped to apply this system to the other urban development areas in the Western Province and digital enabling data usage would be introduced. By using the spatial database future city modeling would be carried out easily. If someone is smart he could use this smart database effortlessly and seamlessly.

References

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5. ESRI Training Manuals on Spatial and Image Analysis