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Corporate-LIS for Effective Land Administration of Sri Lanka

Nelson Wijenayake
Senior Superintendent of Surveys, Survey Department of Sri Lanka
nelsonwijenayake@gmail.com

Abstract

A drastic improvement on the technical and the administrational sector follows some global trends. E-government with location based applications have been initiated and launched in most developed countries and conducted in different stages of implementation. These projects greatly influence the Land administration sector witnessing the general truth; about eighty percent of all information is spatially referenced. E-application at privilege of client interaction has opened new ways of co-operation between the public and the private sector in the area of electronic Land Administration too. Spatial data are produced on various levels with different contents and different standards. Especially land administration projects will only be successful when all the players in the game follow the same rules. Hence, Land Information System (LIS) in corporation with relevant stakeholders can play a dramatic role in e-land administration of the country. Creation of seamless set of parcel data, based on country's administrative hierarchy; Divisional Secretary Divisions (DSD) was the greatest achievement for successive LIS, in which all the parcel related information could be easily mapped for user interaction. Land parcel, being the key object in LIS should be graphically created through a suitable survey method. As the responsible organization for land surveying in the country, the Survey Department is conducting the task with well accurate field surveys. Field surveying for parcel based cadastre has been conducted in years back with resulting many progressive areas while a complete survey has been done in Moratuwa and Ratmalana Divisional Secretariats. Hence, in this paper, while discussing the LIS for whole the country, Moratuwa Divisional Secretariat will be taken as the project area. Moratuwa is situated next to the capital city; Colombo, and it is one of the populated and built-up areas in the country. The area is almost flat and 3-10m average Mean Sea Level (MSL) height depicted in the vicinity. The state land administration is governed by the Divisional Secretary and infrastructure development is mainly handled by the Local Authority; Moratuwa Municipality Council (MMC). A design or creation will not be a product, until it is published for customer use. Hence, the proceedings need to be attended are numerous for making the LIS to be an effective and efficient product for its customers. The paper will further discuss on the follow up actions for developing the system architecture, middle ware interface, web Application etc. This article may be very useful for those who wish to develop location based applications related in effective land administration towards the sustainability of the country.

Keywords: Land Information System, Land Administration, Cadastre, Land Parcel

Introduction

Survey Department of Sri Lanka (SDSL) had initiated in 2007 to establish the Land Information System (LIS) with the idea of elaborating a friendly system to facilitate the spatial data community with up-to-date land information. Since its inception, the cadastral survey data collected in field surveys under the Land Title Registration Project (LTRP) had been taken as the LIS input source. The field survey data collected with electronic total station equipment and the tenement information as collected at field survey stage have been processed to develop the LIS.

Land Title Registration of the Country has been mandated by the Survey Act, No.17 of 2002, from which the Surveyor General has been empowered as the principal authority responsible for receiving, storing and exchanging in any form land related data for maintaining the Land Information System.

Hence, the responsibility of the SDSL in maintaining the LIS is expanding continuously with improvement of the enabling technology in the spatial data environment.

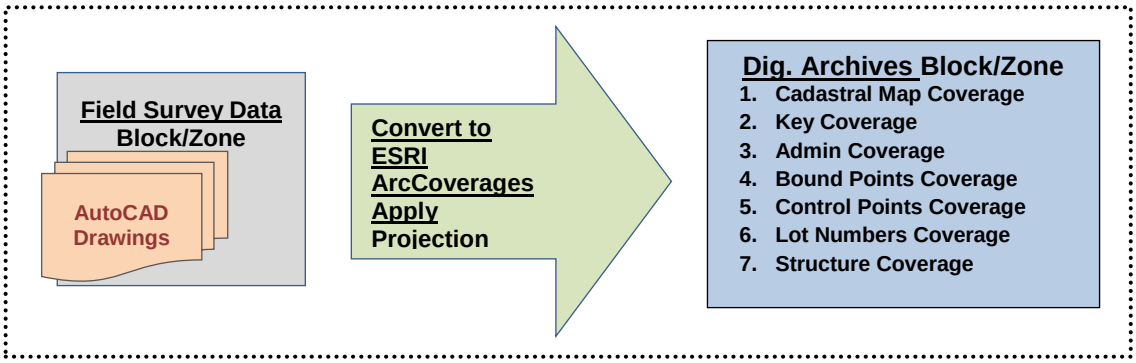
However it's very important to mention that the SDSL has commenced to collect spatial data in digital format-AutoCAD drawings, since 1990 onward, aiming the final product of conventional printed survey plans.

By 2008, Land Titling Registration act was fully implemented under the "Bimsaviya[1]" project with initiating at 18 administrative divisions; Divisional Secretary Divisions (DSD[2]). Further, field survey data collection has been expedited with increasing the land surveyors in each DSD. With expediting the field data collection and related field activities through "Bimsaviya" project, receiving of field survey digital data to the LIS has been increased at a great deal.

Inventory based Electronic Archives and Stakeholders' needs

The field surveyors stationed in respective project areas, firstly investigates and demarcates the survey block/zone, which consists about 100-land parcels, mostly bounded by natural features, in order to conduct the survey and preparation of Cadastral maps. Then the surveyors conduct collection of data with electronic total station equipments and follow up necessary editing, through AutoCAD software tools to prepare the layout plans. They should structure raw digital data in accordance with the guidelines provided by the Departmental Survey Regulations (DSR) to satisfy the LIS requirements. The LIS spatial data preparation is done through the ESRI-ArcGIS software tools following the Coverage topology principles. The processed datasets are then archived in seven different layers as detailed in the Figure-1, abbreviated as CM; Cadastral Map, K; Key, AD; Admin, BP; Boundary Points, CP; Control Points, LN; Lot Numbers and ST; Structures.

Figure - 1 Electronic Archive of ESRI ArcInfo Coverages



LIS data preparation is conducted in order to clean and build the topology of spatial datasets so that parcel polygons, boundaries and nodes are created as identical object entities. Each land parcel is then numbered with 12-digits national unique number as the specific key attribute for all the references. The parcel inherited attributes; such as extent and the boundaries. are maintained as the feature class attributes at this stage. These sets of block based spatial data have been archived in the LIS centre as the Electronic Spatial Archives.

Associated land tenure information for each land parcel, which have been collected in field survey stage are maintained in MS-Access Db-files named as TLDb. These two sets of spatial and non-

[1]" Bimsaviya" is an expedited project to issue Title Certificates to land owners under Land Titling Registration Act.
[2] DSD is the 3rd order hierarchy of Country's administration; i.e.: Province, District & DSD

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spatial attributes data are separately archived at the LIS centre of the SDSL. Since, the TLDb has been maintained in MS-Access, it cannot be used in multiple editing environment through network. The data collected over the country has to be populated in to single database at the LIS centre. Even though each set of attributes have been specified with the corresponding parcel number, it could be learnt that an ambiguous situation in consistency at the effort of linking the data sources. Therefore, the TLDb data can only be maintained as an Electronic Inventory of the land parcel information.

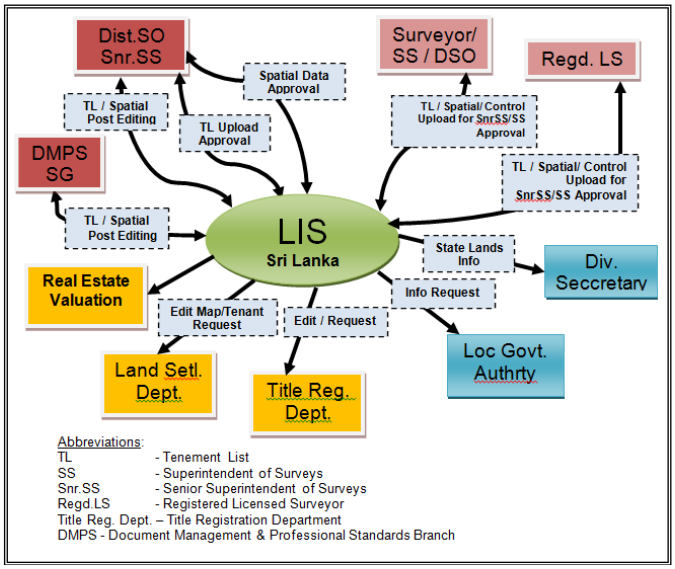
Working with an Inventory based spatial data sets is rather complicated and it arouses controversial situation at the presence of GI based sophisticated software tools, which immensely supports towards user friendly geo-spatial information systems. Availability of parcel based spatial data in SDSL archives and being unable to corporate interactively with the stakeholders with relevant information would result towards darkness of the LIS community.

Land Information System as a total solution for the country's land administration has to be thorough for stakeholders' requirements. While the SDSL being a key organization for the LIS, who provides the system with spatial component of the LIS with parcel inherited attributes, collaboration with external organizations is crucial for a sustainable system performance. A brief configuration of the LIS and its internal and external stakeholders are shown in the figure-2.

ICT as an essential component of the LIS has to be magically performed in all the activities of the LIS. However, while the SDSL faced a critical drawback in ICT applications since last two decades, the improvement of the LIS can be stated as a greater achievement for land administration of the country.

LIS as an information producer should possess as many as its entity related non-spatial attributes on stakeholders' interest. It has been resulted towards an ambiguous situation of data analyzing and manipulation of the LIS. Therefore developing an electronic protocol for sharing the basic information related with land parcel at stakeholder forum would elaborate the prospective clients to initiate value added services on their own interested scope.

Figure 2 - LIS-Sri Lanka and Its Stakeholders



Spatial Data Consistency and Seamless Approach

Manipulation of spatial data in a parcel based LIS is rather complicated in both aspects of accuracy and maintenance for subsequent surveys. Land parcel as the main object entity of the system should be dynamically managed for its changes in individual properties. Therefore a proper study of the each dataset is essential for defining the method of data processing to LIS.

The digital spatial data archives in SDSL can be learnt in three different categories in respect of accuracy, lineage and their processing levels as follows;

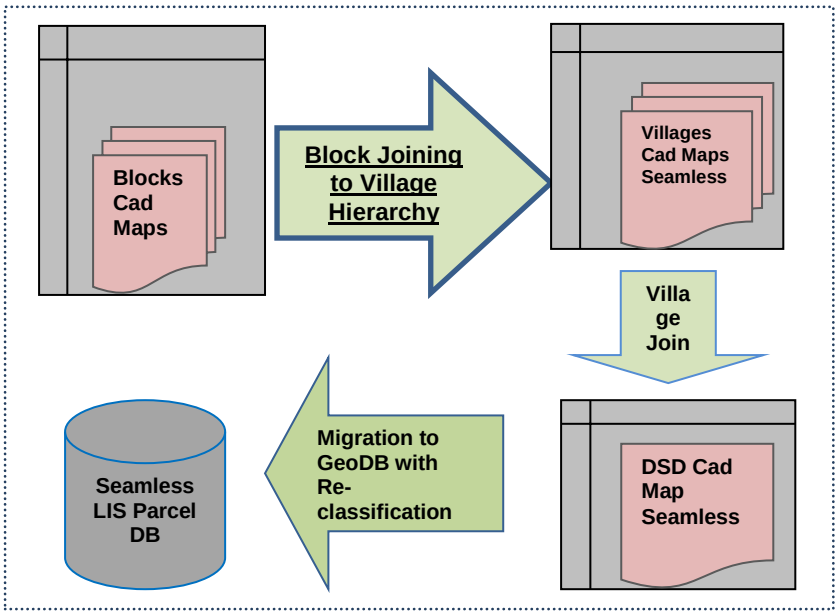
1. Field Surveyed, parcel based Data with identical national grid coordinates.
   These data can be learnt at the highest level of accuracy and should be easily managed in seamless approach. In practice, considerable amount of boundary mismatches are found due to the surveyors' failure to follow up adjoining boundaries in field survey stages.

2. Field Surveyed, parcel based Data, scanned/digitized from hard copy plans, which can be considered as graphic land parcels.
   Field surveys, which had been carried out in years back and no digital data available are considered in this category. Since the data have been extracted from old survey sheets, merging the adjoining sheets would form gaps and overlaps, which could really be learnt as digitizing errors and no seamless approach be possible for these data.

3. Field Surveyed, block or area based Data, scanned/digitized outer boundaries from existing land administrative survey plans.
   There are a large amount of conventional survey plans, which are essential to be dealt with new surveys. Even the outer boundaries of these survey plans with relevant Meta information are crucial to depict in a LIS. Hence, the digital traces under this category can be incorporated in the LIS as graphical displays for maintaining the system consistency.

A combination of the above three data categories with corresponding information would formulate an effective LIS for Sri Lanka at preliminary level. Defining of specific attributes to manage each dataset identically has to be followed at Data Modeling stage.

Figure 3 - Digital Archives to GeoDB Seamless Approach



Further, in addition to the above datasets, which are in full or partial digital format, there is thousands of land administrative survey plans in the SDSL archives, both in centrally and district offices as hard copies. Within the context of land administration and legal framework of the country, these survey plans are crucial to refer for new surveys in order to maintain the legal consistency of individual land parcel enabling to depict in the LIS.

Therefore, digital approach of all the existing land administrative survey plans could be a boon towards an effective decision making tool for property ownership handling through the LIS.

The steps followed in approaching the seamless datasets for afore mentioned category-1 (high accuracy) dataset is illustrated in the Figure-3.

Conceptual Models of Admin-LIS and Corporate LIS

Field survey data collected by the SDSL has an utmost legal authority in which the Surveyor General is responsible for their respective adjudication matters. Hence, the conventional survey records; field books and originals of hard copy plans are archived in respective district offices in secure manner. In digital environment, similar responsibility should be maintained in the SDSL offices while a greater attention should be paid on data duplication and unauthorized alterations.

While maintaining a secure digital archive, dissemination of Geo-information would become a major responsibility of the SDSL as the national organization for Cadastre. In order to face this challenge the SDSL needs to follow its own strategies on prevailing ICT arena. Hence, conceptualizing the needs in administration and stakeholders' corporation of the LIS, the terminologies; Admin-LIS and Corporate-LIS will be discussed in the following paragraphs.

Admin-LIS

In the process of modeling the land parcel data, there are many specific regulations carried out to maintain the spatial data accuracy and consistency in which, general customers and the external organizations are not merely interested. Such a dataset should be properly maintained and dynamically updated by the SDSL within the organization and it could be denoted as "Admin-LIS".
The Admin-LIS should mainly be consisted with following spatial entities and consistencies with relevant attribute information to explicitly describe, manipulate and update the dataset in any location.

- Should be a well-structured set of parcel data in a specific domain area of DSD.
- History records should be maintained as dead parcels with status date.
- Specific spatial entities, which may explicitly describe a land parcel; Polygon, Boundary and Nodes with inherited attribute information should be maintained.
- Associated and supportive feature classes for analyzing and visualizing should be incorporated.
- All the tenement information as available in the collection should be associated.

In addition to the above main feature classes, the associated feature classes; Admin, Transport and Building feature classes or any other raster images can also be maintained as the supportive data layers. A spatial dataset view of Admin-LIS of Moratuwa DS division is illustrated in the Figure-6.

Corporate LIS

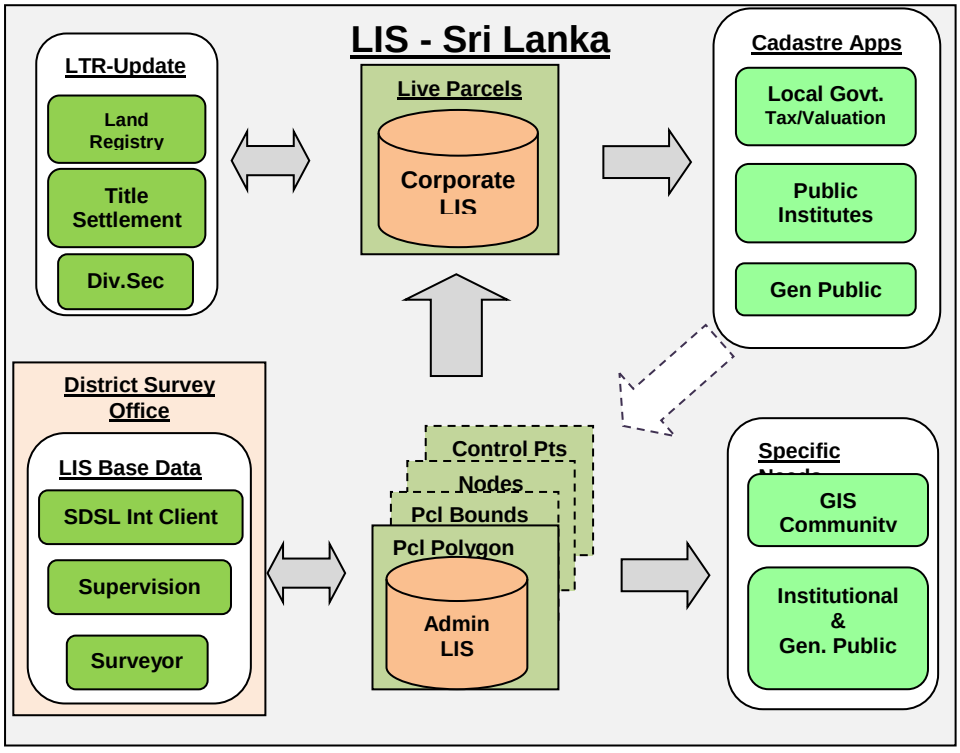
As detailed under Admin-LIS, since the general customers and external organizations are interested in corporation with the LIS for their individual or organizational needs and interaction with their own

data for elaborating towards value added products, there should be a simple and consistent dataset for external client's interaction.

An up-to-date dataset which provides land parcels as closed polygon entities with related parcel information and privilege to interact with external users is considered as Corporate-LIS, which is explicitly a subset of Admin-LIS.

Gaining the reality of sustainable Corporate-LIS would not merely be SDSL's individual effort. However, the land parcel as the key object with its inherited attributes becomes the initiative and crucial beginning for the concept of Corporate-LIS.
The Admin-LIS, which contains every aspect of basic survey data, interactively collaborates with the SDSL administration as internal clients; it externally collaborates with the GIS community or any other legal needs of interested parties, such as court commissions and adjudication institutes.

Figure 4 - LIS-Sri Lanka: System Architecture



The Corporate-LIS, which contains a refined set of parcel data, fulfills the national needs of a Land Information System towards an effective land administration. This dataset should frequently or on-line be updated as privileged by the software tools. Information through Corporate-LIS may be accessed to any interested parties, explicitly towards multi-purpose cadastre applications.

The figure-4; shows the LIS top-level conceptual architecture for Admin-LIS and the Corporate-LIS.

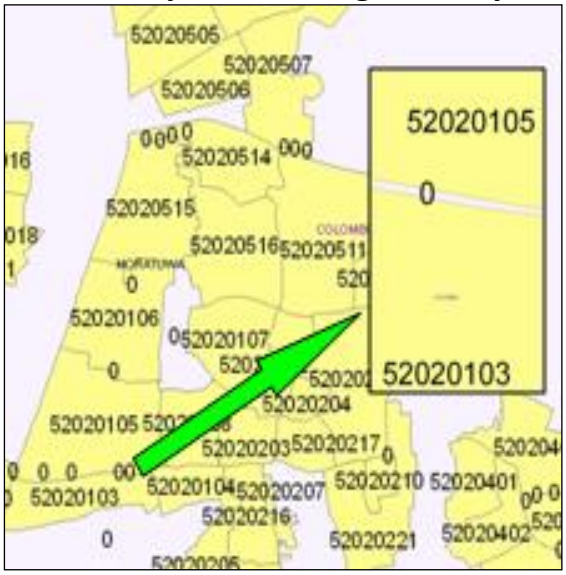
Client feedback can be expected through the cadastre applications for the improvement of Admin-LIS with value added information. Specially, the Admin-LIS may be incorporated with up-to-date building and land use data from the municipalities.

Methodology Adapted in Approaching the Conceptual Models

Developing the conceptual models of Admin-LIS and Corporate-LIS is not merely a matter of terminology. It aroused the effects of continuous efforts in processing and understanding the complexity of bulk dataset in view of customer driven application. As described in the chapter-2, while processing the three different datasets towards a DSD based structured dataset a sequence of processing steps had to be followed.

Firstly, let me convince the complexity of the joined feature class of the category-1 dataset, which had been resulted with a large number of 0-polygons (gaps & overlaps) as seen in the figure-5. Boundary mismatches due to the gaps and overlaps between the block boundaries has been caused for these null valued polygons. The land parcels affected with these null valued polygons had to be recorded as erroneous objects and corrections were applied only for minimal differences while bigger conflicts were referred to field verification.

Figure 5 - Boundary Mismatching of Surveyed Blocks



It could be worthwhile to mention that the GIS applications with dynamic software tools are most similarly applied in LIS too while more legal and accuracy concern should have to pay in LIS. The ESRI software tools and provisions in Geo-Database have been adapted at further processing and feature classification aspects.

Object Relational Data Model for LIS

Land parcel being the key object of the LIS, an object relational data model has been initially designed in ESRI Geo-Database file system with planning privilege to migrate towards an enterprise solution.

Following feature classes and the attribute tables have been introduced as the basic/Supportive/Associate aspect of object entities of the LIS;

Table1 - List of Feature Entities of the LIS

Code	Feature/Table	Aspect	Geometry	Description
1.1	Parcel Polygon	Basic	Polygon	Land parcel bounded by the survey
1.2	Parcel Info	Basic	-	Table; describes the Parcel related
1.3	CM Sheet	Basic	Polygon	Outer boundary of Printed Admin
1.4	Sheet Info	Basic	-	Meta info of the Printed Admin Plan
1.5	Parcel Boundary	Basic	Line	Boundary of a Land parcel
1.6	Parcel Node	Basic	Node	Surveyed nodes of Land parcel
1.7	DSR Index	Basic	-	List of coded Abbreviations published in Department Survey Regulation
2	Administration			
2.1	Admin Village Bound	Supportive		Boundary line of Village[3]
2.2	Admin GN Bound	Supportive		Boundary line of GND[4]
2.3	Admin DSD Bound	Supportive		Boundary line of DSD
2.4	Admin Village Polygon	Supportive	Polygon	Polygon Topology of Village
2.5	Admin GN Polygon	Supportive	Polygon	Polygon Topology of GND
2.6	Admin DSD Polygon	Supportive	Polygon	Polygon Topology of DSD
2.7	Admin District Polygon	Supportive	Polygon	Polygon Topology of District[5]
2.8	*Admin Ward Index*	Supportive	Polygon	Polygon Topology of Ward[6]

[3] Village is the lowest hierarchy administration unit comes from ancient times showing the identical geographical locations.
[4] GND is the middle administrative division; Grama Niladari Diviaion which falls between DSD & Village hierarchy.
[5] District is the 2nd level Administration hierarchy. There are 25 Districts in Sri Lanka.
[6] Ward is a smaller division mostly within municipality areas introduced for taxing and management needs.

2.9	*Admin GN Index*	Supportive	-	Key Index for GND administration
2.10	*Admin DS Index*	Supportive	-	Key Index for DSD administration
2.11	*Admin DT Index*	Supportive	-	Key Index for District administration
2.12	*Admin PR Index*	Supportive	-	Key Index for Province[7] administration
3	Transport Line	Associate	Line	Line Topology of Transport feature
4	Control Points	Associate	Point	Control Points feature class
5	Building Polygon	Associate	Polygon	Polygon Topology for building feature
6	Utility			
6.1	Utility Line	Associate	Line	Line Topology of Utility feature
6.2	Utility Point	Associate	Point	Point Topology of Utility feature
7	Annotation & Toponomy	Associate	-	Annotation and Place Names feature class

Each of the listed feature classes and the attribute tables have been well defined with standard notation and recommended entity values so that the interactive system users would easily refer with required data fields effectively. Hence, the most important feature attributes of the land parcel, at the highest level of inheritance have been formulated as listed in the table-2.

Table 2 - Parcel Polygon – Feature Class Definition

Definition	The Land Parcel is the basic feature in LIS defined with an identical number, which consists an Extent and a definite boundary.	**Attributes**	**Short Name**
		Parcel ID	**PCL_PG_ID**
		Sheet Number	**SHT_PG_ID**
		Parcel Type	PCL_PG_TP
		Parcel Status	PCL_PG_ST
		Status Date	PCL_PG_DT
Table Name	PCL_PG	Lineage	PCL_PG_LG
Geometry	Polygon	Entity Reliability	PCL_PG_ER
Capture	Coordinates of the Nodes & Parcel Inheritance	Action Suspend	PCL_PG_AS
		Extent Shape	PCL_PG_ES
		Old Plan Reference	PCL_PG_OR

Data Processing to Admin-LIS

[7] Province is the 1st level Administrative division. There are nine Provinces in Sri Lanka

The electronic archives of seven ESRI-Arc-Coverage datasets described in chapter; 1.2 with the illustration in figure-1, have been separately work out at this stage. As detailed early in this chapter with the illustration of figure-5, the conflict situation of boundary mismatching between the blocks were taken in to account with analyzing the each case for error compilation.

Error Compilation and Accuracy Definition

Considering the higher positional accuracy governed by the SDSL survey regulations, handling the object errors for future reference is an essential component of the system. Hence, the identified errors would be addressed even at the sub-sequent survey stage, so that they would not be cumulated for a long run. Following steps were carried out in order to define the erroneous land parcels and to attribute the specific feature class.

i. Assigned all the parcel polygons of the dataset with the "Accuracy Status=1", which means that the parcels represent the top level accuracy.
ii. Cleaned the dataset with assigning 10cm tolerance and the affected parcels were selected and re-attributed with "Accuracy Status=2"
iii. The 0-polygons represent furthermore, which shows the higher level errors than 10cm have been referred for field investigation and the affected land parcels were assigned with the "Accuracy Status=3
iv. The area, which shows larger overlaps, could be learnt as repeatedly surveyed and hence, they were assigned with specific parcel numbers. Similarly, the area, which shows considerably larger gaps, could be learned as un-surveyed areas and they were also assigned with specific parcel numbers. Both of these specific land parcels were referred to field for consistency verification.

DSD Hierarchy of Admin-LIS

A refined set of individual Arc-Coverage-datasets with the error compilation at lower level village hierarchy were then joined to the next administration hierarchy; DSD with following the 4-step accuracy definitions. All the seven coverage-datasets were then adapted in to DSD hierarchy as separate feature datasets in order to accomplish the land parcels as Polygon, parcel boundaries as Lines and survey nodes as Points. Accomplishment of all these digital spatial DSD representation then considered for connecting with tenement information; the records inventory, TLDb. Since there were no proper validation rules adapted in TLDb attribute fields, it could be learnt the need of reclassification of attribute data therein. The attributes used in the TLDb were in local language; Sinhala font "IDAMA", which is not belonged to Unicode font. Therefore, a font converter has to be programmed with external resources to run the system properly. All these spatial and none spatial data were then migrated in to ESRI-GeoDatadase schema designed for the detailed Data Model. A dataset of Admin-LIS for Moratuwa[8] DSD area is shown in the figure-6.

[8] Moratuwa is a DSD unit bounded by the western sea in Colombo district which spreads over 16.5 sqkm.

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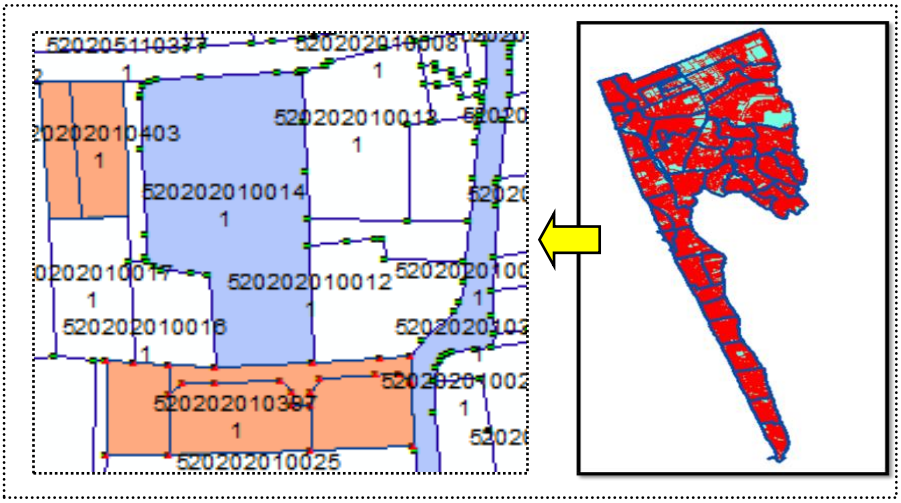
Figure 6. Spatial Dataset view of Admin-LIS of Moratuwa DSD



Source Data for Corporate-LIS

As the concept, detailed in the chapter-3.2, a sub-set of the Admin-LIS; up-to-date land parcel polygons with the relevant parcel information are loaded in to a separate ESRI-Geodatabase, predefined schema named as the Corporate-LIS. This database is currently being updated manually in monthly frequent. Software tools are being developed for a mechanism to update the Corporate-LIS automatically. A spatial data view of Corporate-LIS is shown in the figure-7.

LIS web Publishing

Designing of LIS would not merely be a product until it proven a publication for its customers. This long run effort could be slightly boomed with dawn of the year; 2014 with publication of LIS website; www.lis.survey.gov.lk as an initial step for a long journey of the corporate LIS in Sri Lanka. The website provides the limited privileges, for browsing and searching facility of the land parcels with the information; Land Name, Parcel ID, Land area, Land use and old survey reference. It provides the facility to overlay the land parcels on Google images and interface with few more general tools. Figure-8 shows the website home page view and zoomed parcel level view.

Figure 7 - Spatial Dataset view of Corporate-LIS of Sri Lanka

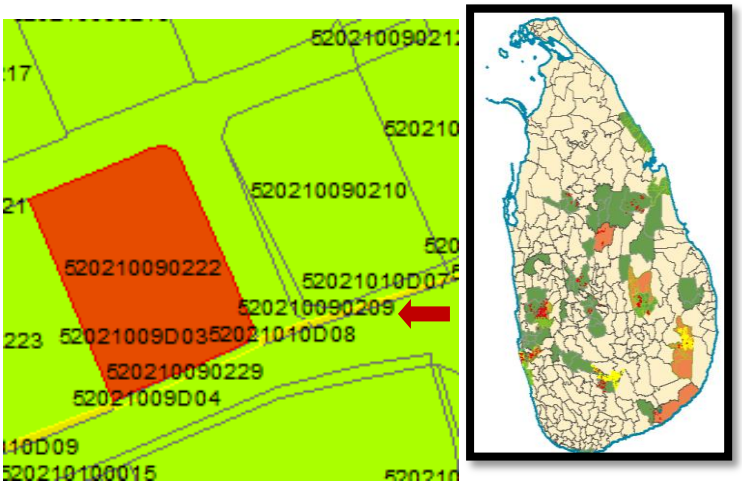


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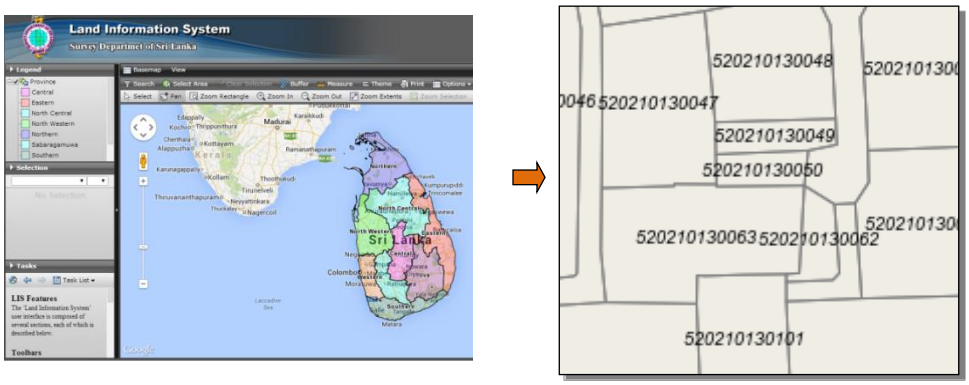
Figure 8 - Website & Parcel Level Zooming



Source: www.lis.survey.gov.lk

It is expected to improve the LIS website towards an interactive web application of the Corporate-LIS as illustrated in the figure-4.

LIS Effectiveness in Land Administration of the Country

The key words; Land Administration, Cadaster and Land Information System are the main characters in this article. While a numerous definitions can be learnt for these key words, a simple definition for the word; Cadastre is given in Wikipédia as follows;

> *"A cadastre commonly includes details of the ownership, the tenure, the precise location, the dimensions (and area), the cultivations if rural, and the value of individual parcels of land. A **cadastre** (also spelled **cadaster**), using a **cadastral survey** or **cadastral map**, is a comprehensive register of the real estate or real property's metes-and-bounds of a country."*[9]

LIS is a Geographic Information System (GIS) for cadastral and land-use mapping, in which the Land-parcel is the basic unit for access and control of land, land use decisions. LIS provides a base for land markets, development, and other economic activity assuring the Current, reliable land information necessary for many public programs: land planning, infrastructure development and maintenance, environmental protection and resource management, emergency services, social service programs and so forth.

Relationship of LIS with cadaster and land administration can be illustrated graphically as shown in the figure-9. LIS may also be learnt as a platform for practicing Cadaster in sustainable Land Administration.

[9] "Cadaster" definition in Wikipedia; on-line encyclopedia

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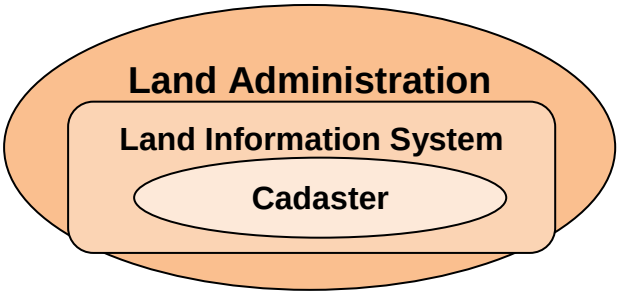
Figure 9 - Cadastrer & LIS in Land Administration



LIS applications in the specific project area; Moratuwa Divisional Secretariat would be a massive project for effective land administration, which can subsequently be customized in whole the country. The total area of Moratuwa Divisional Secretariat is 1650 Hectares and around 40,000 household units are inhabited. The cadastral surveyed land parcels are counted to be almost 50,000 in number.

Identical household or Land-parcel related information in different aspect are maintained in both the organizations; Survey Department of Sri Lanka (SDSL) and Moratuwa Municipal Council (MMC) based on Parcel ID and assessment number respectively. Recognizing of each parcel identity at assessment number, a graphical representation can be easily introduced for connecting of the valuable attributes in both the datasets. The resulted parcel based LIS would facilitate access for state-of-art technology for successive privileges discussed above.

In addition to the SDSL maintained, high accurate parcel related data, action can be taken to incorporate the system with crucial but less accurate data, such as Building features traced from aerial photography and satellite images. Then the LIS can be very effective as a decision making tool for issuing building permits and valuation reports as an efficient customer service at municipality. Numerous efficient and effective customer driven services can be introduced in collaboration with the datasets, maintained by the various organizations.

Concluding Remarks

Parcel based LIS is the key element for sustainable land administration, which is merely neglected by most of the developing countries due to the complications and the fear of failure. Some organizations in the country have allocated a great amount of money for making GIS as solution for their land administrative issues, commencing from the scratch of collecting spatial data from various sources at low accuracy. These projects become failure in short run due to inconsistencies present at updating and maintenance stages.

Considering the issues in various datasets found in Cadastral Survey Authorities, it can be easily initiated to design a data model suits for their own organization. A simple and dynamic data model would facilitate the system maintenance and updating easier with lesser complications.

Through the Corporate-LIS, the authorities responsible for land valuation will be highly benefitted in fiscal and taxation means for providing immense improvement in public financial services while the land use planners can play a dramatic role in resource management and planning control for environmental sustainability.

Defining of standard notation criteria for each entity would be an effective beginning to design a data model for a sustainable LIS. A Clear demarcation of the contents of Admin-LIS and Corporate-LIS cannot be defined. However, it can be learned by the respective authorities by considering the stakeholders' corporate needs, LIS data volume and feature classification for the LIS.

Interaction between the Admin-LIS and the Corporate-LIS is presently handled with a manual updating procedure so that completed dataset of the Admin-LIS is transferred to Corporate-LIS. Therefore automation is being developed for on-line updating the Corporate-LIS.

National Spatial Data Infrastructure (NSDI) established a few years back, has to formulate guidelines for national geo-spatial data producers and GIS application developers so that the stakeholders of the LIS would follow the NSDI standards in mutual interactions which may help to lessen the conflicts of system interoperability.

Land parcel as the main object of the system should be interactively related to its descriptive information so that a mechanism should be developed to update the system simultaneously for both graphics and descriptive information at the field survey stage.

In Moratuwa Divisional Secretariat, the LIS will be very effective and sustainable to initiate early, as the complete set of land-parcels have been already traced at high accurate field surveys and the information available in both SDSL and MMC would be most recent and up-to-date. Hence, it may be triggered to draw the researcher's attention for making of dynamic LIS model towards effective land administration of the country.

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