Zanzibar Multipurpose Cadastre - GIS Pilot in Africa

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Presentation Abstract

As part of Government of Finland / Government of Zanzibar technical cooperation a detailed aerial photography was conducted in 2004-2005. The whole area of Zanzibar was covered and the base map production started. More than 230,000 buildings have been digitized together with other layers for the digital topographic map. A Multipurpose Cadastre is now built using ArcGIS 9.2 to enable several central and local government agencies to use this common GIS base. Zanzibar is taking first steps towards a modern land management system, property registration and provision of municipal services to the inhabitants.

The MPC pilot will test the technical solutions first in the Stone Town (UNESCO World Heritage Site). If successful, the developed methodology will be replicated to all Zanzibar geographical area. The key users of the GIS application are: Zanzibar Municipal Council (ZMC), Zanzibar Revenue Board (ZRB), Land Registrar, Stone Town Conservation and Development Authority (STCDA), and the Department of Surveys and Urban Planning(DoSUP).

1. Introduction to Zanzibar

Zanzibar is an archipelago consisting of two main Islands, Unguja (commonly referred to as Zanzibar Island), and Pemba, as well as about 52 smaller islands.

The two sister main islands are located in the Indian Ocean about 35km off the coast of Mainland Tanzania at longitude 39 degrees East and latitude 6 degrees South of the Equator. The total area of Zanzibar is about 2644 square kilometres Pemba has an area of about 984 square kilometres and Unguja 1660 square kilometres. Zanzibar is part of the United Republic of Tanzania.

Figure 1-1 Tanzania and Zanzibar

In 2002 the population of Zanzibar was of 981,754[1] with an annual growth rate of 3.1% (compared to 2.9% for the whole of Tanzania). The current population of Zanzibar is about 1,000,000 with the annual growth of 3.1%. The average population density is 400 people per square kilometre. More than 30% of the population live in towns. This situation has made Zanzibar one of the densest populated countries in Africa, South of Sahara.

According to 2002 census there is 2,500 m^2 available for each person, but by 2015, this drops to 1,760 m^2. A significant area has been taken for urban development, hence reducing the productive agricultural production in both Islands (Pemba and Unguja).

The growth of the economy, especially tourism, has resulted in increased demand for land for hotel and residential development, particularly along the coast. Most of this new demand comes from foreigners, including mainland Tanzanians; who do not have the right to own interests in land, only leases.

2. Justification for Multipurpose Cadastre

During the development of the land policy (2006-2007) it became apparent that many of the problems relating to land could be solved by having land and buildings registered with the Land Registry. To bring land into registration it is first necessary to go through adjudication, a process in which land and properties are identified, rights claimed and determined (adjudicated).

Work with Stone Town Conservation and Development Authority (STCDA), Zanzibar Municipal Council (ZMC), and Zanzibar Revenue Board (ZRB) also identified that much of the revenue for

[1] Tanzania National Census 2002

these and other organisation is linked to the correct identification of property. It therefore follows that development of better land administration systems would allow the Land Registry to function efficiently, enhance the revenue earning capacity of organisations like ZRB, ZMC and STCDA, as well as provide information to improve other land based systems, such as conservation of the properties of the historically valuable Stone Town (UNSECO World Heritage Site), urban planning, and public utilities management.

The information needed by the Land Registry and other users is often very similar. Each user needs to know where the property is and the types of rights held and the holder of those rights. Naturally there are differences: Land Registry information is generally about property boundaries and the ownership of rights, while the other users are often more concerned about the occupant and the use to which property is put. But both sets of data are very closely related and there were compelling arguments for collecting them together.

The Sustainable Management of Land and Environment (SMOLE) Project's Steering Committee decided in September 2007 to implement a Multipurpose Cadastre (MPC) Pilot to test the technical and administrative possibilities to bring the key operators together and start using a GIS base for their various activities.

The MPC Pilot intends to determine information on the costs, time required, and most appropriate methods of collecting land information for both Adjudication (first registration), and other property related activities, such as use, occupancy and availability of utilities. The pilot would be sufficiently large to provide statistically valid information, which could then be used to develop proposals which may be submitted to other donors to expand the Multipurpose Cadastre application to cover all urban areas in the future.

The aim of the pilot is to contribute to poverty reduction in Zanzibar through transparent public administration, better provision of urban services, and improved development control, by:

- Collecting information on the buildings (condition, units, photograph) in Stone Town,
- Developing databases for revenue collection (rents, waste water/ garbage collection fees, VAT, stamp duty etc.)
- Developing databases for effective development control,
- Developing databases for conservation (historically valuable buildings), and maintenance of the buildings, and
- Developing further the already operational ZMC database for monitoring of utility management (sewerage, water, garbage collection, electricity etc.)

The ultimate beneficiaries are the inhabitants of Stone Town whose quality of life will improve through better living environment, better working public utilities and improved STCDA and ZMC services.

At the time of initial planning of MPC it was estimated that six to eight months would be needed to complete the fieldwork for the MPC Pilot project (3 data collection teams with 2 persons in each).

3. Multipurpose Cadastre – description

The Multipurpose Cadastre (MPC) is an integrated system for managing cadastral data. It combines geographic and non-geographic data and provides graphical presentations in the form of maps.

The term "multipurpose" refers to the idea of using the cadastral data in MPC, cadastral map layers and MPC system's functionality for both cadastral and non-cadastral domain specific purposes. The latter category includes for example supporting revenue collection activities of municipal and governmental organizations. This can be achieved by expanding the database with non-cadastral data or by integrating the MPC with existing non-cadastral applications.

The MPC system is technically based on client-server and so called representational state transfer (REST) web services architecture. At present the clients are Access project front-ends, browsers or standalone ArcGIS 9.2. SQLServer 2005 is used as DBMS. Two application servers, GeoServer and MPCServer, run on Apache Tomcat.

MPC core system is divided into four main parts:
1) managing real estates and property rights,
2) managing property right holders and occupiers,
3) viewing map layers and thematic maps and
4) administering the application.

Data is gathered through surveys and entered from different adjudication documents. Under each subsection users can enter, update or delete data, and create ready-made reports.

It has to be kept clearly in mind that Zanzibar Multipurpose Cadastre (MPC) in its present state is a prototype and does not contain all the features of a full blown application, and that it has to be developed further. Moreover, the database contents covers at present only Stone Town area.

4. Starting platform – steps taken

SMOLE Preparatory Phase started in September 2003. A detailed aerial photography over the historical Stone Town area was flown (March 2004) in aerial photography scale 1:3,000. Aerial photography covering a larger area (Stone Town and ZMC area) was flown into scale 1:8,000 at the same time. Still another aerial photography assignment was completed in March 2004 and March 2005 to cover all the land area of the islands in aerial photography scale 1:25,000.
As a result Zanzibar has excellent base material that can be used for digital mapping, urban and regional planning, environmental management, public utilities management, and promotion of tourism activities.

These aerial photos were ortho-rectified and photo-mosaics were produced. The Zanzibari staff of Department of Surveys and Urban Planning (DoSUP) was trained to the stereo work. Digitizing the map elements for the production of digital maps for the entire Zanzibar islands was started in 2005. The base map production served as a good platform for the GIS based Multipurpose Cadastre.

The SMOLE Steering Committee approved the Multipurpose Cadastre Pilot in September 2007.

A Memorandum of Understanding between the stakeholders was signed in October 2007 between Stone Town Conservation and Development Authority (STCDA), Zanzibar Municipal Council (ZMC), Land Registry, Zanzibar Revenue Board (ZRB), Department of Surveys and Urban Planning (DoSUP) and SMOLE. The partners agreed:

a. To cooperate together on the design of a Multipurpose Cadastral System to collect and to maintain land information necessary for the efficient development of land information systems within their organisations.
b. To cooperate together on a single data collection pilot, with the resultant individual data sets to be held by the organisation responsible for the maintenance of that data.
c. To agree to lodge those core data sets necessary for the maintenance of a multipurpose cadastre on a central server, to be maintained initially by SMOLE, and to keep these data up-to-date.
d. To cooperate with the other parties on the maintenance of the data
e. As far as possible to make other data held by individual organisations available by the other organisations

Two Finnish short term consultants were invited in Zanzibar in November-December 2007 to start the GIS and Database development. They prepared the use cases in cooperation with the stakeholders, designed the system, and prepared necessary documentation. There was special on-the-job training for data collection and data entry personnel.

Three data collection groups, each consisting of two people (a male and a female) were formed. Students from Zanzibar University and students who have recently finished their secondary school were trained for the house to house inventory.

The local administrative areas (Shehias) were involved to guarantee access to each house. Public media (TV, radio, newspapers) were used to announce the start of the inventory. The shehia representatives were invited to participate in the data collection activity and to give feedback on any problems arising during the work.

Figure 4-1 Shangani area inventory Survey Team C

The actual field work in form of data collection started on 23 February 2008. The field work continues and is expected to be competed late August or early September 2008.

Figure 4-2 Adjudication Claim Form distributed to a shop keeper in Stone Town

Adjudication has started in May 2008 and will continue till the end of 2008. The Adjudication Claim Forms have been distributed at the time of unit data collection.

Revenue collection application development will start with ZRB in August 2008 and the integration of ZMC solid waste revenue collection system to MPC GIS will continue till August 2008.

5. GIS Development

The pilot information system was implemented for management of cadastral building data. The system contains the following main functions:

a. Storage and maintenance of building related business data in relational database by using SQL Server and dedicated maintenance tools.
b. Storage and maintenance of building footprint geometry in ESRI Personal Geodatabase by using ArcView 9.2 and tailored maintenance tools
c. Integration between building geometry and related business data

5.1. Data Structure

Building footprints are stored into ESRI Personal Geodatabase called MPCADASTRE_GEOM. There is only one polygon map layer (feature class) that will be used:

Layer name	Purpose
building_geom	The finalized building polygons with correct unique building ID that is used as link to core database building table.

Other GIS layers (like Shehia boundaries, street network, coast line etc.) can be called, but they are used on read-only basis.

5.2. Integrity between databases

Because the geometric data and actual data of the buildings are managed in different databases, the integrity between spatial data and MPC database data is loosely linked. So there is no direct mechanism to constraint the link between building polygons and their related data in MPC database. The link is maintained in application level.

The link to building polygon is established when building related data is entered into MPC database. The building geometry objects can be manipulated independently from MPC data and therefore the link between map features and the databases could be easily violated. However, the geometry data (and hence MPC data) will be updated only infrequently and therefore the loose link mechanism satisfies the requirements for the pilot project.

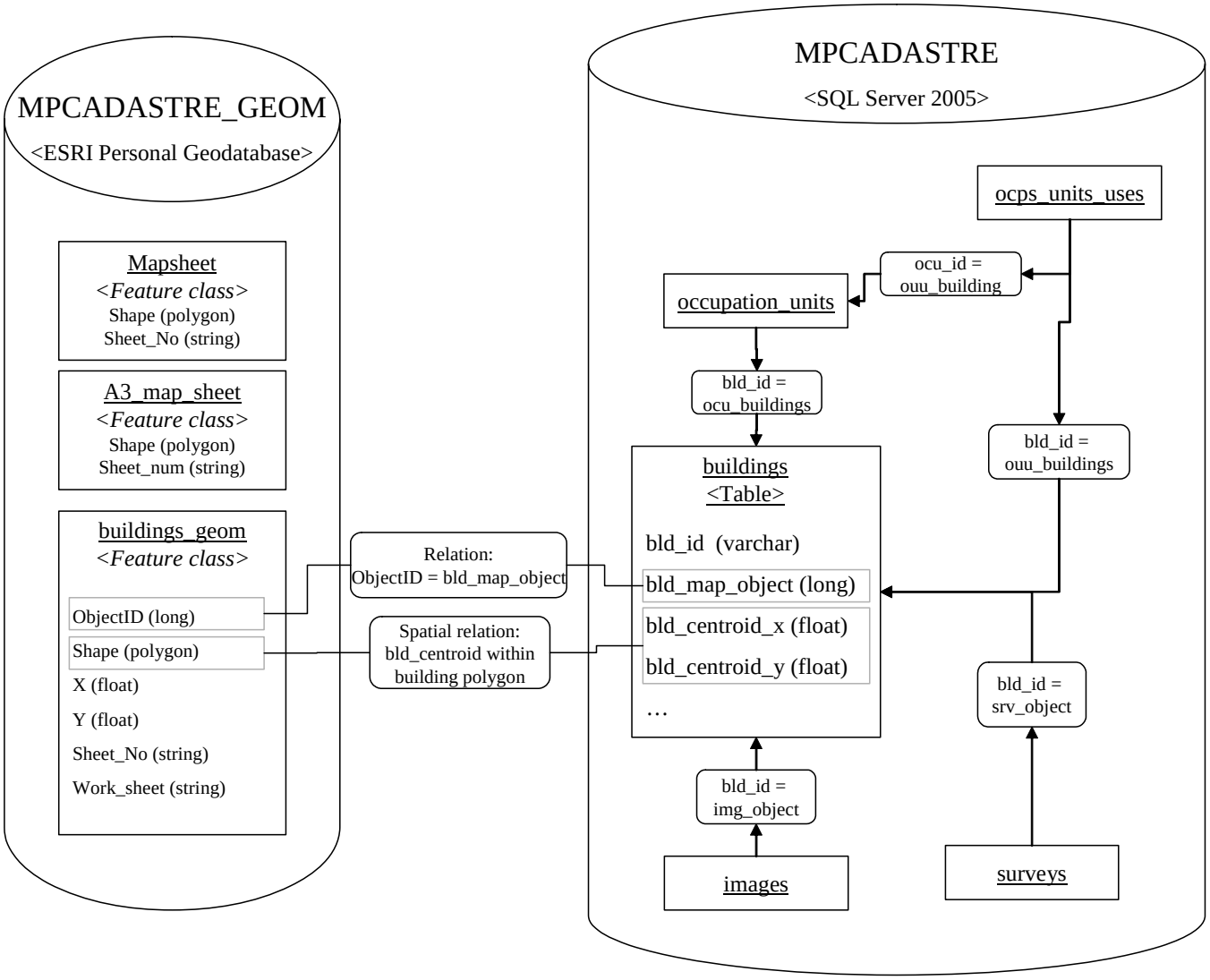


Figure 5-1 Relation between geodatabase and core database

There are two identifiers to keep the relationship between databases:

1. Building ID number: The building polygons in building_geom layer are linked through 1:1 relation to corresponding table "buildings" in MPC database. The primary key ObjectID in the map layer building_geom layer has corresponding foreign key bld_map_object in the MPC database table buildings. The ObjectID is set and maintained by ArcGIS and it remains the same for each building within the layer. If the map layer was processed to another layer the ObjectIDs would be different for corresponding building polygons in the result layers. The buildings_geom layer is copied into MPC database where the link is related from buildings table.
2. Spatial relation: Each building has been described as a label point that falls within building footprint polygon. The point's X and Y coordinates are saved into core database's building table so that they can be used for integrity validation.

These both relations are used as a double check. If the link has been violated (e.g. building id number has been changed by accident in building_geom map or buildings table layer) that can be noticed by a conflict message between spatial relation and building ID based relation. Checking

routines have been created to ArcView to validate the relation based on the consistency between these two relations.

5.3. Creation of building footprint polygons

The building footprint data is originally created and updated in AutoCad environment at the DoSUP survey unit. The building footprint data were collected from aerial images (2004) stereoscopically by using a stereo workstation. Data were collected directly in 3D into AutoCAD files. The building outlines actually follow the eaves of building roofs. The building geometry is updated also during the physical building survey. The building data have been cleaned and checked by using AutoCAD.

The building polygons have been imported from AutoCAD into ArcGIS Geodatabase. The ArcGIS has automatically set unique ObjectIDs for each building in database when data is imported. Also 1:500 mapsheet numbers and A3 map sheet number are attached to each building by using map sheet layer and “select by location” function in ArcGIS.

Figure 5-2 Building # 317 footprint

As can be seen in Figure 5-2, the building # 317 footprint and the actual aerial photo image differ. The roofs are built so that they give maximum shade during daytime when sun is shining from above. Thus extensive fieldwork is necessary before the buildings and streets can be properly surveyed.

The field investigation teams and the Demarcation Officer will also check the real building forms, as it is difficult to define from the aerial photo where one building ends and another starts.

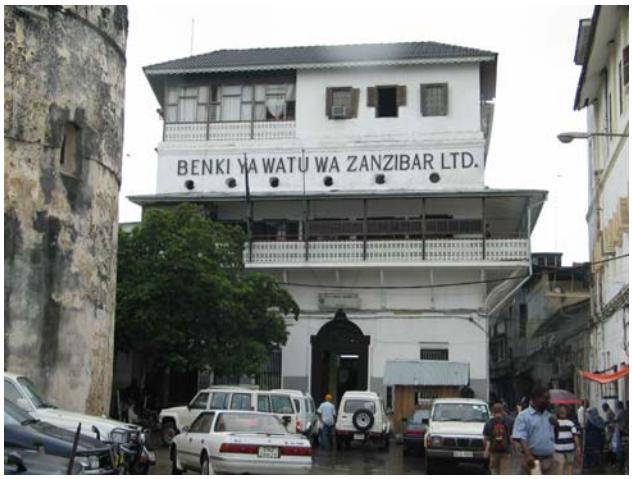


Figure 5-3 Building # 317– Peoples’ Bank of Zanzibar

Figure 5-3 clearly shows how the buildings seen in the ortho photo image do not reveal the street level dimensions. Most of the Stone Town small streets are very narrow and thus allow no access to cars.

5.4. Check settings

The tailored ArcMap tools (macros) for queries assume that the ArcMap document is set up in a certain way to work properly. After the needed map layers and tables are opened into ArcMap document, the user can run a macro “Check Settings” by pressing button 

in toolbar.

If the settings are correct the following dialogs are prompted:

5.5. Validate integration

The integration between building_geom map layer and building table in MPC database can be verified by starting the integration check macro:

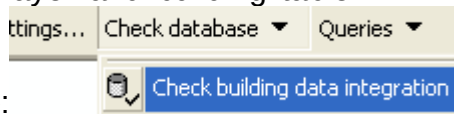


Figure 5-4 The centroid point coordinates in core database are wrong for building no. 448

6. Database Development

6.1. Current Computer Systems

Database development stated with detailed discussions with the participating organizations to verify those elements that are common to all.

Interviews and visits to stakeholder organizations disclosed that at present only Zanzibar Municipal Council and Zanzibar Revenue Board have computer systems related to MPC.

Figure 6-1 depicts the situation.

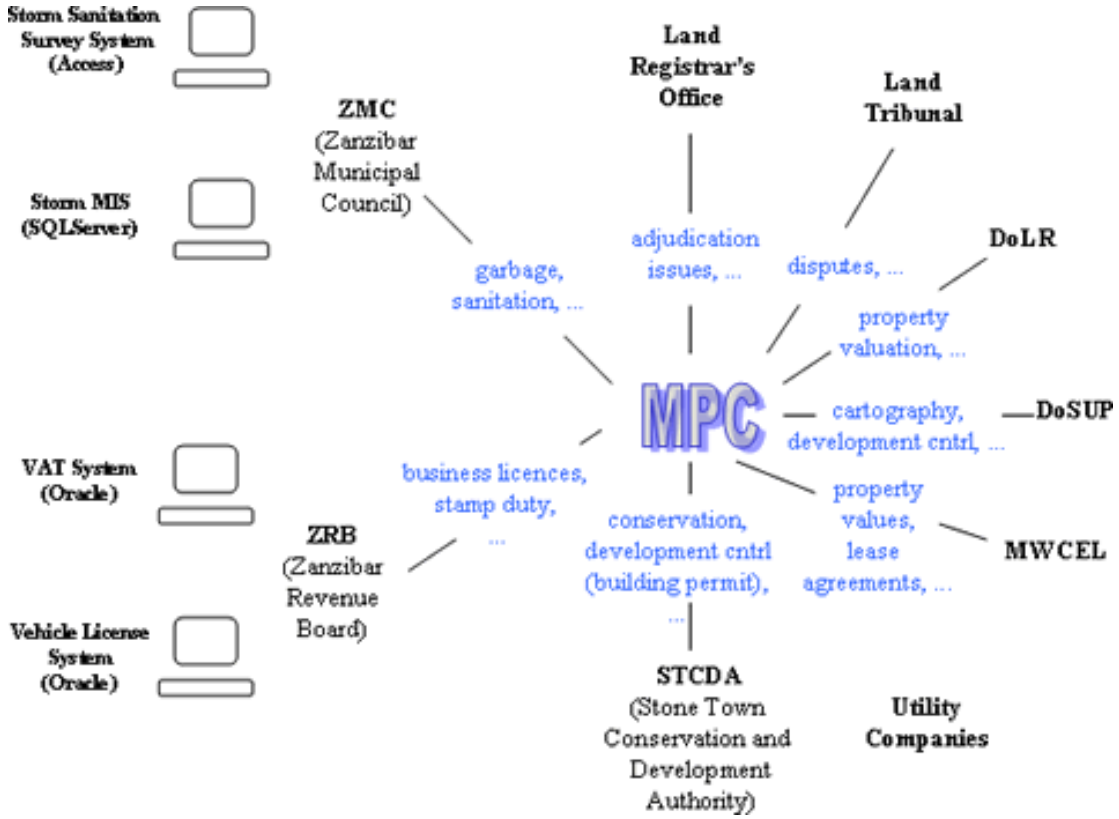


Figure 6-1 MPC Stakeholders and Existing Information Systems

6.2. Problem Statement

The initial and general description of MPC defines that the core GIS comprises of:

- topographic maps,
- orthophotos,
- parcel and building footprint map,
- attribute data: parcel and building identifiers, physical addresses, use of property, condition of property, photograph, land rights held, owner of land rights, name of occupier

The pilot system will cover the Stone Town area with 2074 buildings that would include estimated 7,000 strata lots and an additional 6,000 business units. The final number will be known only after the data collection is completed.

The database application needs user interfaces for entering, updating and deleting data, as well as for browsing and presenting.

MPC is initially located on a central server maintained by SMOLE.

In addition to the core GIS data, other databases need to be created or developed further:

- revenue collection,
- development control,
- conservation,
- land disputes, and
- ZMC database for monitoring of utility management.

6.3. Conceptual Classes

Basic modeling of MPC conceptual classes was carried out by the database advisor in co-operation with the Chief Technical Advisor, Land Management Advisor and GIS Advisor. Figure 6-2 shows the main entities in the domain and their relationships.

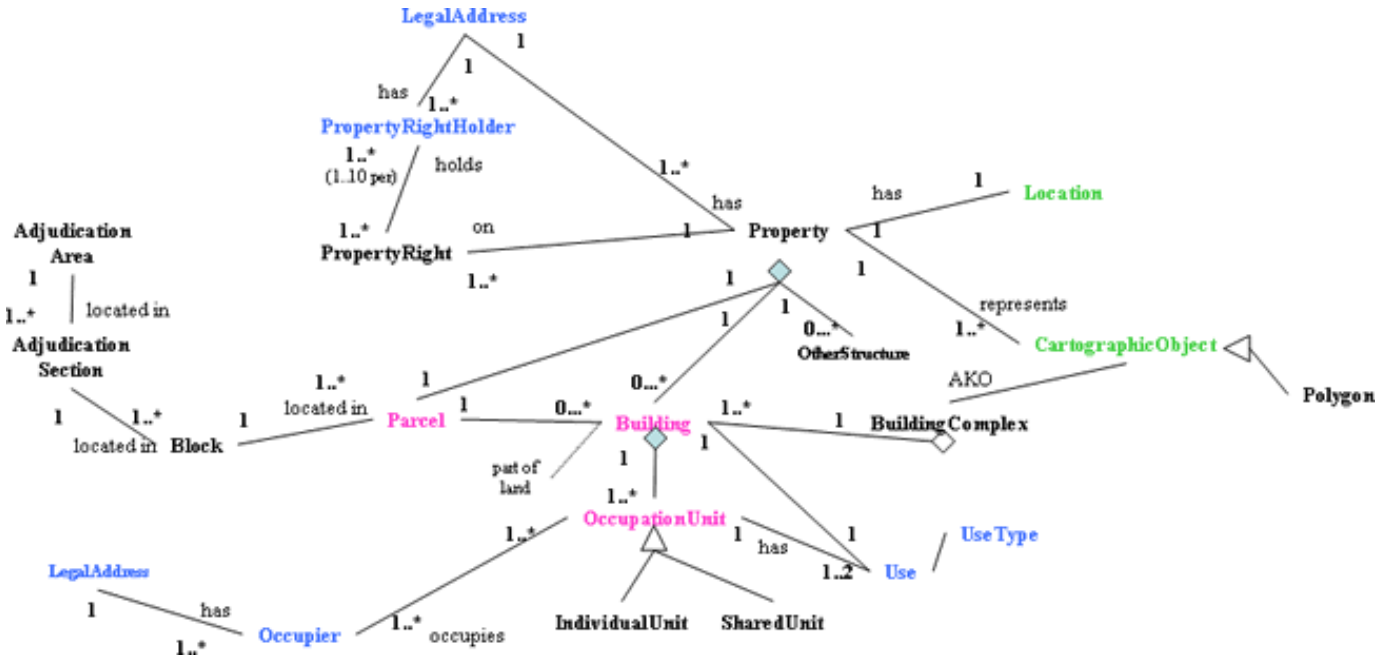


Figure 6-2 MPC Conceptual Classes

6.4. System Context

MPC is intrinsically an application closely connected to its environment. Its content and services should benefit several organizations, like STCDA, ZMC and ZRB. Some of them have already own computer systems in production. Consequently application integration becomes an important issue. Figure 6-1 above gives the first impression of organizations and systems involved. Each connection between MPC and its environment needs a well defined interface.

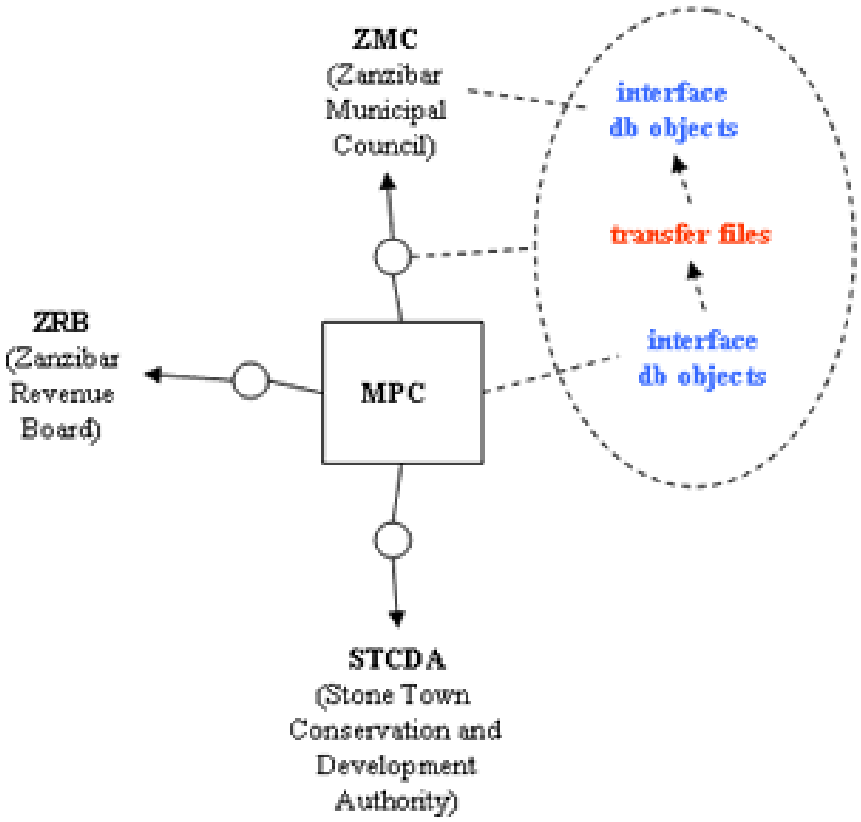


Figure 6-3 depicts some immediate users of MPC data and the main parts of interface. In the first phase the information flows one-directionally from MPC to stakeholder systems. In the future it might happen that even user organizations provide data for to keep MPC database up-to-date.

Figure 6-3 Main Parts of Interface between some of MPC users and MPC

6.5. System Architecture

Figure 6-4 represents the overall MPC system architecture including client components in user organizations. **Core GIS data** is hosted by a Win2003 server with a SQLServer database. This core information is managed through client applications. Whenever significant changes occur in core data, the system creates transfer files that are either downloaded or delivered on CD to user organizations where they are imported into respective systems. The initial architecture does not offer customers any direct access to MPC core database.

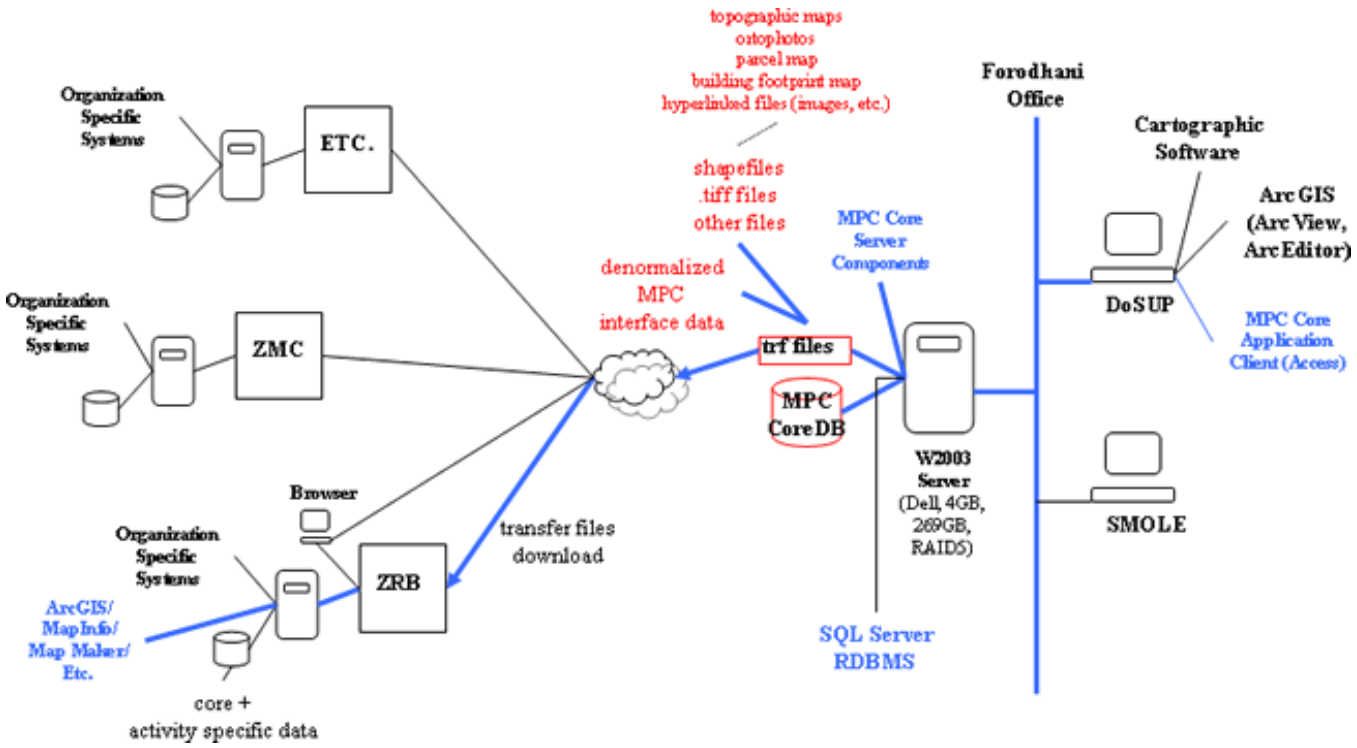


Figure 6-4 Overall MPC System Architecture

Figure 6-5 depicts the core MPC architecture on a lower level. It shows how cartographic processing and presentation is handled by ArcGIS software and cadastral information on Microsoft platforms.

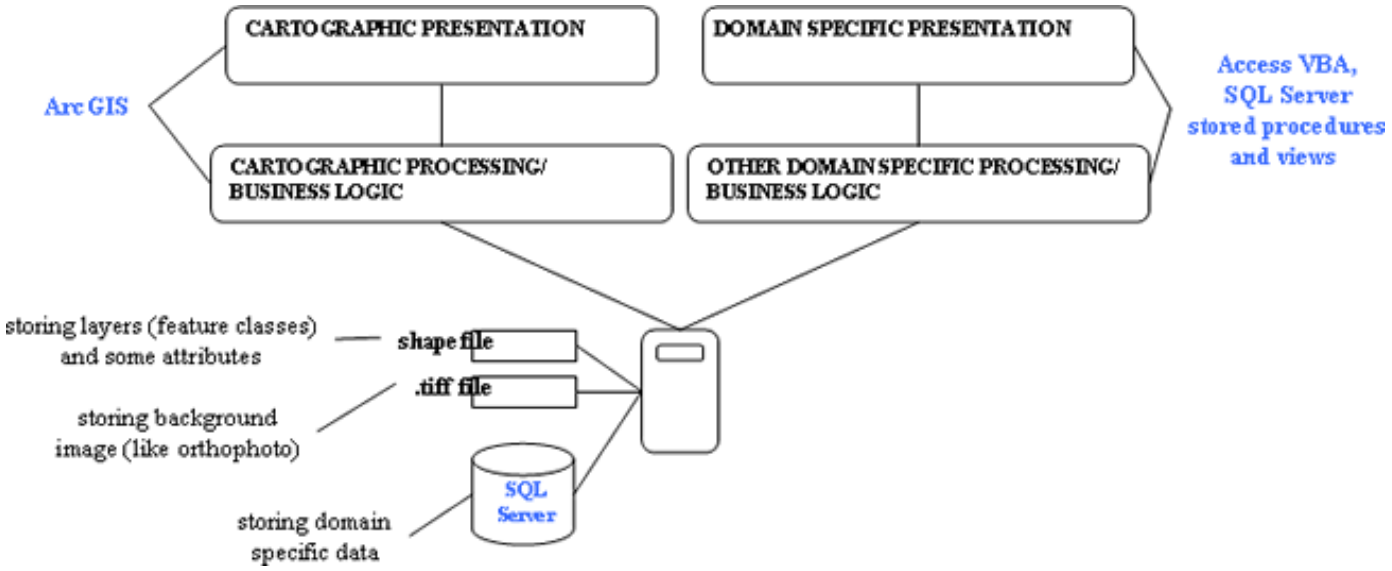


Figure 6-5 Lower Level System Architecture

6.6. Design Platform

Sustainability has been one of the main goals when selecting initial design platform. Therefore, against the background that training on database application development was given in January 2007 to DoSUP's personnel using MS Access and that ZMC's existing systems are based on MS Access and SQLServer, the same technology was chosen as initial MPC design platform. In the fairly short timeframe available for pilot this guarantees at least basic understanding of the new system and capabilities to maintain it.

ArcGIS was chosen as GIS platform because it was known to many employees and it is already in use at DoSUP. The only cost caused by these decisions was the license fee of a new SQLServer RDBMS. The overall design platform can be seen in Figure 6-4.

It is important to regard ArcGIS, Access and SQLServer as an initial platform. Ideas for further development have already arisen in the course of developing the pilot. Cartographic and domain specific information is in the current architecture dispersed into different files and databases. By using a geodatabase, i.e. a database capable of storing spatial data, all information can be put into same store. Next version of SQLServer (2008) will be a geodatabse. At present for example MySQL, PostgreSQL and Oracle already support spatial data. Further, Access client can in the future be replaced with web browser. This entails replacing VBA code for example with Java code and using Java based application server frameworks. A simple test application is already at place on the W2003 server at SMOLE office. The aim is to improve it with installing open source GeoServer beside it. GeoServer offers ready made functionality for presenting geographical data stored in shapefiles or geodatabases.

6.7. Database and Application Design

After deciding on system architecture and platform, the work has been divided into two separate but interrelated processes. GIS advisor has taken care of the cartographic part of MPC and Database Advisor of the domain specific part (cf. figure 6-5).

Cadastral data is managed through an Access front-end application. It represents Microsoft Access Project (.adp) architecture. It means that forms, reports and VBA modules reside in the Access client. Database tables, views and procedures, on the other hand are stored in SQLServer database.

6.8. Summary

The main goals of the first part of database consultancy were:

- To find out what is a relevant architecture and design platform for a multipurpose cadastre information system
- Get off to a good start in creating a prototype for multipurpose cadastre (MPC) database application for managing and presenting information about buildings in Stone Town.

Both of the main goals have been achieved. Special attention needs now to be given to the completion of the prototype to a level, where it can without errors accommodate all core survey data about buildings and offer an easy to use interface for managing this data.

7. Status of MPC System Development on 10 June 2008

The system development has been completed and the MPC Pilot is well in the data collection and data entry. Some minor editing to user interface and database structures have been made. These are quite normal small modifications and do not disturb the data entry.

7.1. GIS Reports and queries

7.1.1. About map queries

The information in MPC database can be linked to the building footprint data in ArcGIS. The information can be converted either to thematic presentations in ArcMap or one can select or search buildings by using certain attributes in MPC database tables. User can also query information about certain buildings in map or get statistics of several buildings selected in the map.

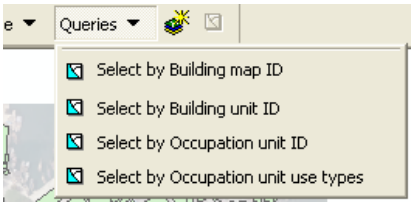
7.1.2. Thematic presentations and queries

The following thematic presentations have been prepared to help the monitoring of the Pilot work completion:

Thematic presentation	Purpose	Implementation	Status
1. Completion of building inventory	Checking survey progress	By using join	Completed
2. Completion of unit inventory	Checking survey progress	By using join	Completed
3. Number of units in each building	Thematic map	By using view and join	Completed
4. Buildings by shehia (admin area)	Checking survey progress / Thematic map	By using join	Completed
5. Unit uses in each building	Thematic map	By using join	Completed
6. Map sheet number	Thematic map	By using view and join	Completed
7. Survey date and Group Check	Checking survey progress / Thematic map	By using view and join	Completed

There are several possibilities to make queries:

- Querying buildings by certain attributes in MPC database
- Query by using Select by Attribute dialog
- Querying by using pre-made queries implemented into MPCADASTER toolbar.



7.1.3. Getting information about buildings by location – Use of identify tools

Identify tool can be used to explore building related data. The relations are established between the building_geom and MPC database tables.

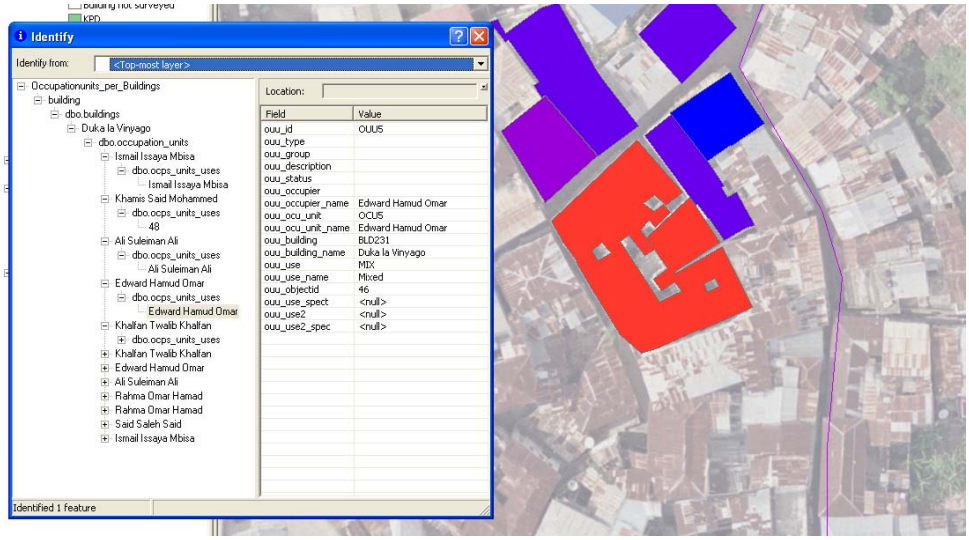


Figure 7-1 Building Identify tool

7.1.4. Use Building Info tool

The specific Building Info tool was created for getting building specific information from MPC database. The tool  can be selected from “MPCADASTRE Building Survey” menu. Then one can point the selected building on the map. Selected attributes of the selected building will be shown. The photos of the selected building can be viewed.

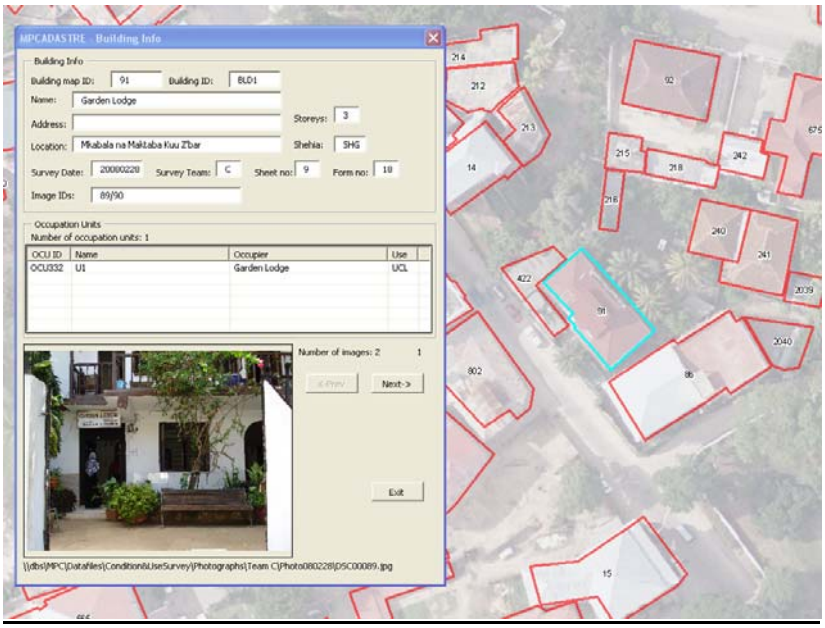


Figure 7-2 Building Info tool

7.2. Database

7.2.1. Front Page and Main Menu

The main menu on the front page shows navigation options. Each main item can be expanded by clicking on the respective button.

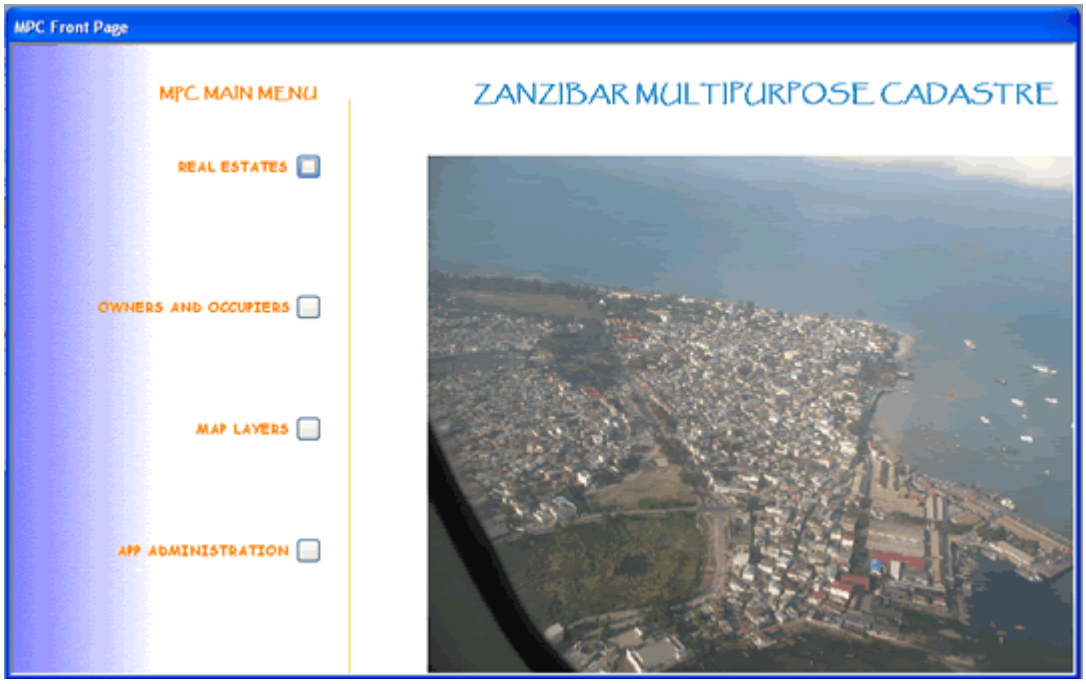


Figure 7-3 MPC Front Page

7.2.2. Real Estates

Under Real Estates section users can manage and view data on land, buildings and their use.

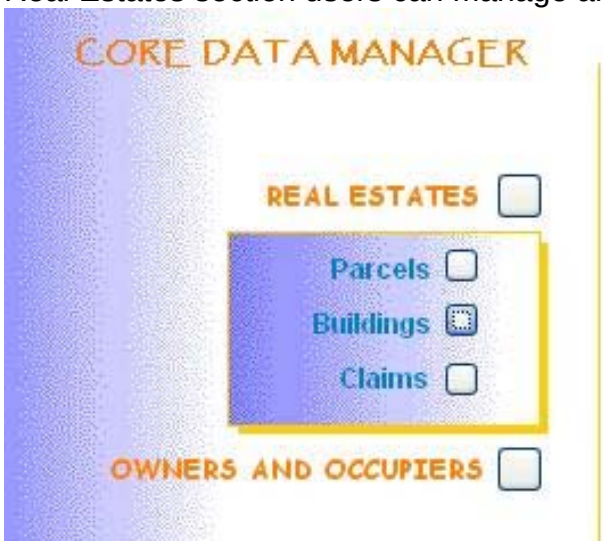


Figure 7-4 Real Estates sub-menu

A detailed user manual has been prepared for data entry and reporting. Each form and their filling instructions have been documented. Below is an example of Building Units and Occupancies form:

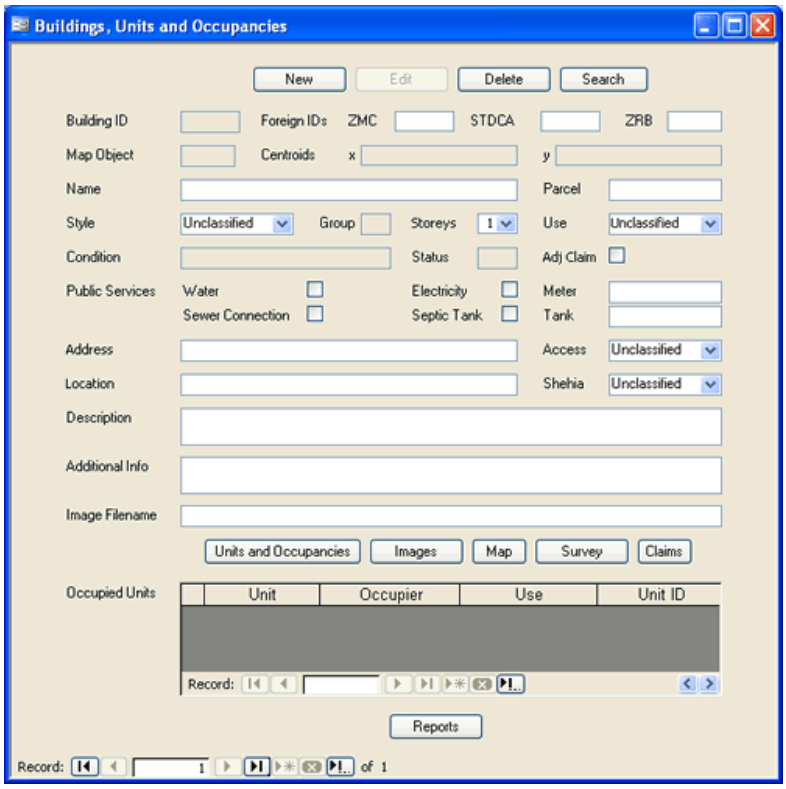


Figure 7-5 Buildings, Units and Occupancies Form

7.2.3. Photos of Building

In MPC application users can attach to every building an unlimited number of photos. As a prerequisite you need pre-processed photos arranged by survey team and date. Pre-processing means, for example, reducing the size of the image file, rotating it to an upright position or adjusting its colour.

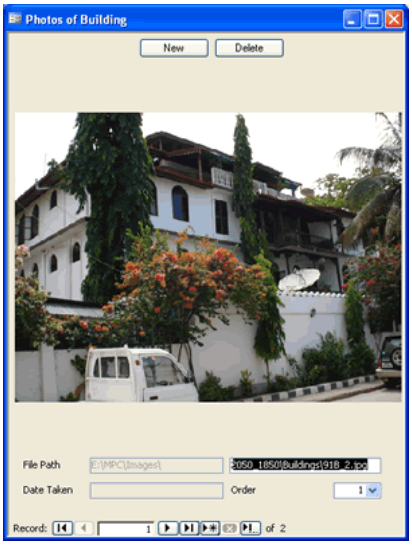


Figure 7-6 Photos of Building Form

7.2.4. Viewing Building Footprint on Map

A very useful feature in MPC is the possibility of viewing a buildings location on the map. After searching and selecting a building the user simply clicks the Map button on the form. The building is seen in the exact center of the map surrounded by building footprint polygon and against the background of an aerial photo. The map is an OpenLayers map that can be zoomed and moved by dragging with the mouse. Using a menu that opens by clicking a plus sign on the map you can make the footprint layer invisible and look at the aerial photo alone.

Figure 7-7 Viewing Building on the Map

7.2.5. Building and Unit Reports

Reports on buildings, units, occupancies and building and unit surveys can be created clicking on Reports button on the Buildings form. The first reports support monitoring surveys. The Reports button opens a small form for entering criteria.

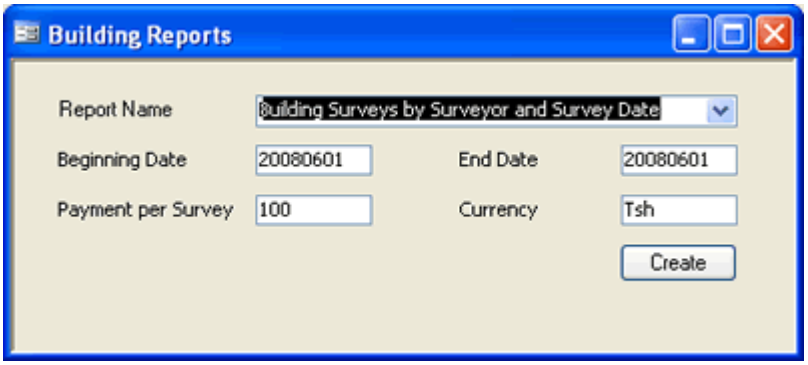


Figure 7-8 Form for Entering Building and Unit Report Criteria

7.2.6. Claims

During adjudication process people (claimants) will submit claims for land and rights to officers. Claimants will be written receipts for the submitted documents. The information in these receipts is also recorded into the MPC database. There are two options:
1) the claim is clearly connected to a building or
2) the claim is on land without buildings.

7.2.7. Map Layers and Thematic Maps

7.2.7.1. Map Layers

Viewing map layers and creating thematic maps constitutes the actual GIS part of MPC system. Map layers can be cadastral (building and parcel polygons) or other (like road lines). Map layers are produced using ArcGIS software, and then used and administered under GeoServer, either as shapefiles or in a database with spatial support (geodatabase). Thematic maps, in turn, can be viewed using ArcGIS or MPCServer. The latter one provides a number of ready made queries and works in combination with GeoServer.

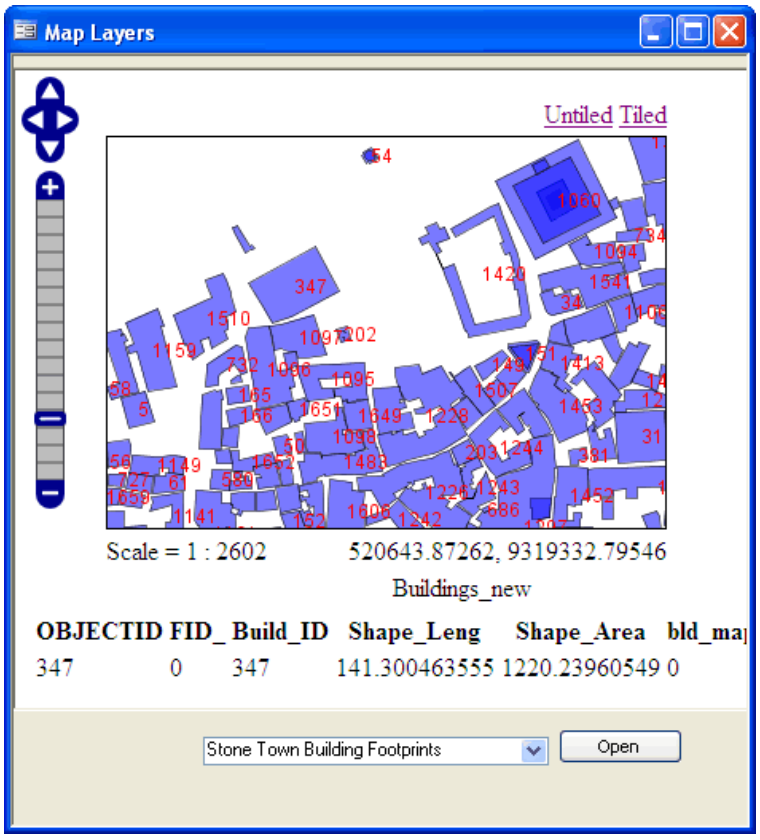


Figure 7-9 Stone Town Building Footprints Map Layer

7.2.7.2. Thematic Maps

Thematic maps display the spatial distribution of attributes that relate to a particular topic or theme. These attributes (and related objects) must in some way be connected to map layer objects (polygons, points, lines).

In a cadastral database we have cadastral objects and their attributes. Because no record can be entered into MPC without defining a corresponding map object, all the data is by default geocoded and can be used to create thematic maps. Figure 7-10 for example shows the distribution of 4-storey buildings in Stone Town.

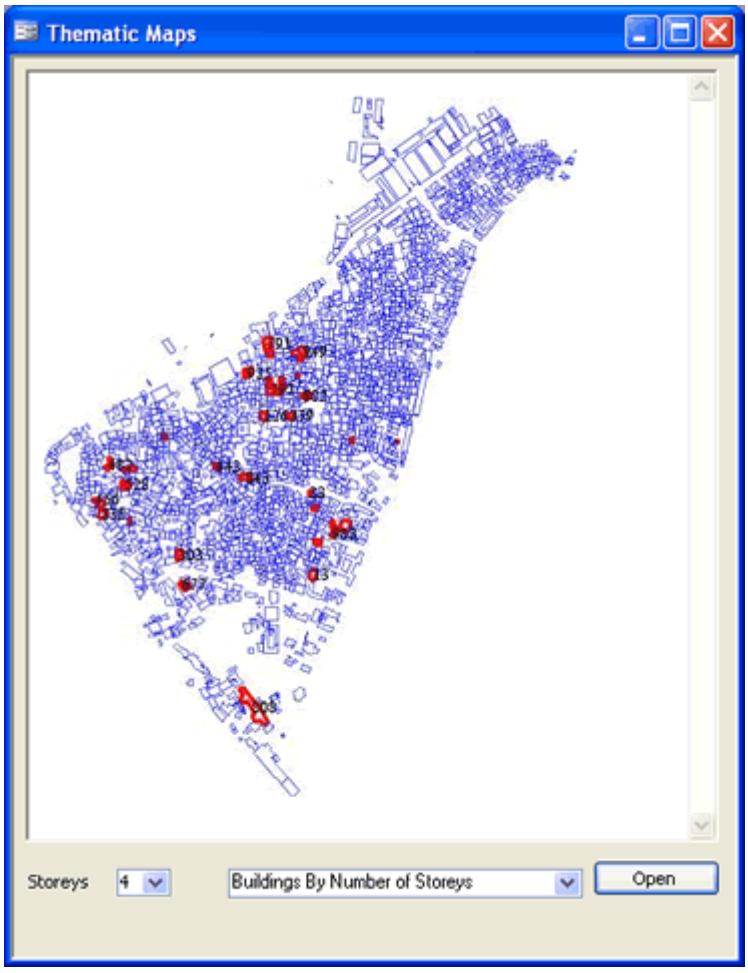


Figure 7-10 Thematic Map Depicting the Distribution of 4-storey Buildings

7.3. Status of Surveys and Data Entry on 10 June 2008

The surveys have continued with three teams visiting each building and collecting data on the predefined data entry forms for buildings, data entry forms for units, and distributing the Adjudication Claim forms. Shangani and Mkunazini shehias are completed and the activity has moved to Kiponda shehia. Malindi shehia will be started late June or early July 2008.

On 10 June 2008 the following results can be reported:

- Building footprints of 2074 buildings in the survey area have been checked and the demarcation of buildings has been done
- Altogether 1234 building inventory forms have been filled, verified and entered in the MPC databases. This is 59.5 % of the total number of buildings.
- In addition 2169 unit inventory forms have been filled, verified and entered in the MPC databases. These cover 1083 of the 2074 buildings in the survey area.
- 30 Adjudication Claim Forms have been received so far
- Parcel demarcation has started and will continue parallel to the unit inventory activity.

8. Steps forward

8.1. Finalization of pilot

The original time table was based on the expectation that the survey activities would have started already in November 2007. The actual data collection only started on 23 February 2008. Thus there will be definite delay in finalizing the MPC pilot. However, the data collection is now in full swing and some of the delay can be compensated if other conditions are favourable. If the surveys can be completed in August 2008, it is envisaged that the final report would be ready in September 2008.

8.2. Replication of the methodology to cover ZMC area

Cities in the developing countries face constant problems with urban management. International financing and development agencies, like World Bank, African Development Bank, and UN-Habitat, have devised several programmes and initiatives to solve this problem. So far only limited success has been recorded. The need to raise sufficient financing for Local Government Unit (LGU) administrations to function effectively is perhaps the main objective of city governance. Plans, objectives, decisions, statements etc. are all irrelevant if there is not the capability to carry them through. This capability requires a sustainable form of income.

The first priority is to enable the Zanzibar Municipal Council to generate its own permanent revenue base. Only with steady and predictable annual revenue is it possible to plan actions for sustainable development. Zanzibar Municipal Council (ZMC) has not yet started any fully covering property taxation. The other revenue sources are user fees, public utility charges, stamp duty and different business licenses.

ZMC needs a system that allows it to identify all taxable/fee paying units and determine the tax/fee payable. This GIS based information needs to be linked to an accounting system that will produce bills, monitor receipts and notify the need for action on arrears. MPC Pilot tests how the identification of individual tax/fee paying units could be done effectively to enable the completion of the Municipal Revenue Management System (MRMS).

The MRMS concept has a fairly good chance to become successful in Zanzibar. The main challenges lie in the political willingness to launch a new revenue collection scheme and to agree in advance on who will eventually benefit from the increased revenues.

A two year sub-component of a much bigger World Bank Urban Sector Infrastructure Improvement Project is proposed where the present Multi-Purpose Cadastre (MPC) Pilot would be replicated to cover the whole Zanzibar Municipal Council area totalling some 80,000 property units.

BIOGRAPHICAL NOTES

Jukka Nieminen is a GIS specialist and urban & regional planner with 30 years experience in urban and regional development in Europe, Africa, Asia and the Middle East.

He initially worked with urban and regional planning in Finland (1973-82) where he took interest in the use of microcomputers in physical planning activities. He then moved to Saudi Arabia (1982-85) to do regional planning and to develop microcomputer based applications for the Al Baha Principal Emirate and the Ministry of Municipal and Rural Affairs (Riyadh).

In 1988 Mr. Nieminen joined the UNCHS (Habitat) as Special Adviser in Data Management. In this capacity he was responsible for data advisory activities and development of microcomputer based applications for the human settlements till the end of 1995.

In 1996 Mr Nieminen joined a private Finnish consulting company where he was in charge of international GIS activities, disaster management, and R&D on GIS applications in the developing countries. The development of SLIM and FAST MAP approaches have been an integral part of his responsibilities.

October 2002 to September 2003 Mr. Nieminen worked for UN-HABITAT in Libya as Senior Planner – GIS Coordinator during the initial phases of the development of GIS framework for the Urban Planning Agency of the Libyan Government.

As of October 2003 Mr. Nieminen has prepared and negotiated for a SLIM project to six cities in the Philippines as a Finnish parallel financed part of ADB “Development of Poor Urban Communities Sector Project” (DPUCSP). This project was to be financed through a Finnish Government Concessional Credit. Both of these concessional credit has been approved by the Finnish authorities and the OECD in June-July 2004.

He has also negotiated and prepared a Finnish Concessional Credit project for the GIS Development of Guiyang City, Peoples Republic of China. The GYGIS Project was implemented 2004-2007.

As of May 2005 Mr. Nieminen has worked as the Chief Technical Adviser in Zanzibar with the Sustainable Management of Land and Environment (SMOLE) project. This four year project is jointly financed by the Revolutionary Government of Zanzibar and the Government of Finland.

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