Cook Islands Ministry of Infrastructure and Planning Executive Summary

Student Consultant, Haya Thowfeek
Community Partner, Timoti Tangiruaine

I. About the Organization

The Ministry of Infrastructure and Planning serves four main outputs: Building Control (Regulatory Services); Civil Works (Road and Water Works); Funding & Planning and Policy & Programmes (Infrastructure Service Delivery) that administers across all of the Cook Islands and currently operates with a 2.1 million dollar budget for the fiscal year of 2012/2013 appropriated by Parliament.

The Ministry of Infrastructure and Planning's vision statement is as follows:

> *Our investment in infrastructure will maximise economic return, improve livelihoods and build resilience.*

A primary function of the ministry is to maintain records of all the information pertaining to the different functions: civil works, survey information, etc; therefore efficient data management is a crucial necessity within the organization. However they operate a number of paper based systems that have led to misfiled documents, lost documents and physically damaged documents.

II. Enhancing the efficiency of the Survey department

There was a disjoint the staff experienced between the geographic information systems, and survey data which was stored under a filing system. Finding specific information was hard as the exact location of the files were difficult to identify and cross reference.

Therefore a database was created to record the survey information for all of the inhabitable islands and to allow for specific information to be found or browsed for through the use of forms. The development of the database went through a number of prototypes and tests before it was deployed onto the Ministry's network.

Consulting Partner

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About the Consultant

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Ministry of Infrastructure and Planning
Final Consulting Report

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Community Partner, Timoti Tangiruaine

I. About the Organization

Organization

The Ministry of Infrastructure and Planning was set up in 2008 following the merger of the Ministry of Works and Office of the Minister of Outer Island Administration. The Ministry serves four main outputs: Building Control (Regulatory Services); Civil Works (Road and Water Works); Funding & Planning and Policy & Programmes (Infrastructure Service Delivery) that administers across all of the Cook Islands and currently operates with a 2.1 million dollar budget for the fiscal year of 2012/2013 appropriated by Parliament.

The Ministry of Infrastructure and Planning's vision statement is as follows:

> *Our investment in infrastructure will maximise economic return, improve livelihoods and build resilience.*

Minister for infrastructure is the Hon. Teariki Heather. The current Acting Secretary is Donye Numa who is responsible for carrying out the functions and duties of the department, including the implementation of Government policies. At present there are 9 external consultants and 57 full-time employees working within the organization under different departments that can be broadly categorized into:

- Funding & Planning
- Policy &Policy & Programmes
- Civil Works
- Regulatory Services (including Survey)

Facilities

The main core of the Ministry is currently situated at the Ministry of Infrastructure and Planning building in Arorangi with an Avarua Post box address. The building is a one story structure on the west side of the southern island of Rarotonga and is surrounded by a number of local establishments. Several divisions of the Ministry operate at different locations of the island (Civil Works and WATSAN) and are set to move to a centralized location at the beginning of July 2012.

The different divisions of the ministry within are separated based on function: Finance, Projects, Administration, IT and so on; there is also a space for meetings that is equipped with a projector and an air conditioning unit. Each section is equipped with either a computer or laptop for the employee to perform their tasks and is set up on a Windows operating system with access to the local intranet and mail server, the internet, and a Microsoft Office suite. Based on the needs of the department, certain sections may have access to additional software such as AutoCAD or Geographic Information Systems and hardware components such as printers and/or plotters

Programs

As stated earlier, the Ministry performs a myriad of functions with relation to the different forms of infrastructure service delivery for the entire Cook Islands. The Ministry's activities are carried out in the form of programmes and/or projects, with each initiative having to go through the respective heads of department and the Secretary for approval before commencement. In some cases, these initiatives require Cabinet approval.

Policy and Programmes oversees all the land based projects that come through the Ministry; they oversee all aspects of the infrastructure development in programme/project form and are documented thoroughly.

Building Control operates under the Act 1992 and Building Regulations 1991 and through a Building Permit Application process with the Ministry of Health (Public Health) and the National Environment Service (NES) ensures that that the planning, construction quality and maintenance of all the buildings on the Island is maintained Plans for new buildings have to go through an extensive approval process that is currently operated on a paper based system. Approved plans are then entered into the Building Control Permit Application database by a member of the building control department.

The present Survey Office collects and administers the survey of all land surveys for the purpose of land security in the Cook Islands. As designated custodians of the Land Survey records in the Cook Islands, they collect, draw and keep both electronic and paper based records of the surveyed land and their corresponding notes of the Islands as part of the information records. The staff use AutoCAD to electronically draw out survey data from plans on paper. It should be noted that this unit will be relocated to the Ministry of Justice in July 2012.

The Water and Sanitation (WATSAN) has personnel operating in a 'site office' outside the Ministry due to the programme being piloted in Muri, however the administration and finances are handled within the building situated in Arorangi. Contracts, finances and project tenders are created and distributed by the program assistant who extensively uses her laptop to communicate across the different stakeholders via email and/or Skype

Staff

All of the divisions mentioned above use technology extensively to record, retrieve and edit data pertaining to their respective tasks. Most of the staff are self-taught or have received training with regards to using the software and any forms of technology required. All new incoming staff members are put through an orientation process that gives them the necessary training required to operate their computer systems and any additional software.

A majority of the staff area able to handle and maneuver through a basic operating system (all Windows based) equipped with a Microsoft Office suite. The Ministry also operates its own email server that has personal accounts for each member of the staff. Not all of the employees are office based as there are a number of personnel working out on the field and on project sites.

The staff working in the building control department and the survey office have access to the ministry's Geographic Information System that contains geographic information regarding several "layers" (Soils, Geology, Demographics, Land Tenure, Water Pipeline network, Basic Infrastructure (Roads, Bridges, Waterways), etc) of the Islands. They also have access to the Microsoft Access databases that currently exist within the Ministry's network. Although an attempt has been made to

obtain licensed copies of GIS software MapINFO (which is a standard package in the South Pacidic Region), the GIS's software is offered by SOPAC (Secretariat Of the Pacific Community, Applied Geoscience and Technology Division) who also offered training sessions as a means of GIS capacity building when required. The members of staff who map the terrain are using an older version of AutoCAD and while they are aware that a newer version of the software exists, it is not compatible with the existing version of the GIS system and therefore is not employed.

The administration staff (human resources and finances) use spreadsheet software extensively to track and report the financial activity of the Ministry including invoice payments, staff payments and operational expenses. The financestaff either setup their spreadsheets according to personal preferences or use existing layouts.

Technical Environment

The Ministry broadcasts two secure Wi-Fi networks throughout the premises with limitations of 17 GB combined per month on the bandwidth usage. Routers are placed in the different subsections to provide access to the internet and given the use of a desktop or a laptop there are network cables available to access the internet.

One of the servers used by the Ministry is housed in a separate server rach/enclosure which is constantly ventilated by a window and air conditioning unit. The other servers (Primary Domain Controller (PDC), NAS Server, Geoserver, Mail Server) are located around the office. All of the offices have ventilation in the same manner but given the climate of Rarotonga, they are only used when necessary.

The Local Area Network connects all of the computers used within the organization and provides shared disk space that has different access levels based on an employee's needs and requirements. All of the computers operate on Windows operating systems that range from Windows XP to Windows 7 throughout the organization. The LAN also connects the printers and plotter to different client computers as the staff needs.

Software usage depends on the staff's requirements but the software ranges from Microsoft Office, MyOB, Quick Books and Quick Books Payroll for finance processes and MapInfo for the GIS users. The 3 databases for the Survey, Water WorksW and Building Control operate on Microsoft Access and are set up on the local network for client computers to access. Updates are installed when necessary for specific software.

Given the previous lack of financial commitment to technology in terms of hardware and software - upgrades are infrequent and several computers within the office space are reused to cater to staff needs. The new fiscal year contains a budget to upgrade the Ministry's servers and general technology within the new office location. Development Partners have also funded a number of computers and in recent months significant investments have been made to procure laptops.

Technical Management

The Ministry does not have a designated ICT department. The service is managed on an ad hoc manner by Mr. Timoti Tangiruaine who oversees all technology aspects of the Ministry including server management and updates, software definitions and hardware management.

All issues regarding any form of technology used are brought to Mr. Tangiruaine's attention when they arise (often verbally) and he aims to settle them as soon as possible within working hours. Within the informal ICT department Mr. Tangiruaine works with Mr. George Nicholls who helps in overseeing and managing all forms of technology within the Ministry. In the new financial year the Ministry will advertise for a full time ICT technician, and with the restructuring of the Ministry places a greater emphasis on becoming a "hub and spoke" for GIS across government.

Software updates and virus definitions often occur on the server side for simpler distribution, client users are informed of the changes and if necessary, training to manage the new change is often delivered - Mr. Tangiruaine sees to all of the updates and installations.

Despite the lack of policies for 'back ups' and data storage, with the exception of WATSAN in particular, backups are made by individual users when necessary onto personal flash drives or external hard disks. Staff members often take backups after significant changes to their systems or data has been made.

Technology Planning

All ICT related expenses are appropriated from the Ministry's operating budget which consists of approximately $30,000. Each division within the Ministry has their own operating budget and fit their needs according to their budget. Mr. Tangiruaine is informed of any new technology requirements and offers potential hardware and software configurations to suit the division's needs.

Internal and External Communication

File servers allow a client-server relationship to exist whereby files and software can be shared throughout the organization. Information within the organization exists on both electronic form and paper. A significant number of processes exist on paper form that is filed and in some cases, entered into an information system.

As mentioned earlier, there is a mail server that employees use for office related communication; phones are also extensively used as a communication tool both internally and externally within the Ministry for quicker communication.

The Ministry of Infrastructure and Planning currently has a website online at http://www.moip.gov.ck/ that clearly states its purpose and their activities. However during the production of this report the Ministry is undergoing a change whereby an external organization has been hired to improve its online presence and potentially offer a number of services online.

Information Management

Information and its management is a core functionality of the Ministry. Clients, suppliers and employee information are managed both electronically and on paper. Spreadsheets and databases hosted on the network allow for information to flow throughout the organization but paper flow seems to hold a higher precedence over electronic means. Email communication between some divisional staff members tends to occur infrequently as most staff members tend to prefer to have face-to-face communication within the Arorangi building which is conducive to this interaction. The Acting Secretary however interfaces with all staff on skype and email given the different locations, but is highly visible throughout the office. The office operates on a paper basis where all of the information is manually written down on paper and stored in numerous box files.

The information and its storage mechanism vary depending upon the different departments: the survey office holds all of their survey plans on paper and has the files stored in a storage unit attached to the survey office. The Human resources office has the staff information stored on a spreadsheet and this information is stored with EMFEM (the Ministry of Finance), who also maintains the salaries and wages information for all the MOIP staff. Access levels to information have been implemented to ensure greater information security and the organization has so far never been subject to security breaches.

However, the Ministry operates mostly on a paper based system whereby all of the information gets transferred around manually. In the past, this has led to information being misfiled, lost and more importantly, easily damaged (as experienced by the fire of 1995).

The paper exchanges that support the functions of the Ministry prove to be inefficient in terms of time – the department's staff has to manually search for information that they need to work on or transfer to another member of staff. The same tedious process is involved when it comes to transferring weekly wages and finding information for interdepartmental processes. When interviewed, the staff often complained about the fact that the search for information contributed to a long and tedious process.

Business Systems

Accounting within the organization is handled by four people within the finance department who handle all forms of capital funding and operational expenditure. Invoices for activities or materials are handed over to finance staff who, dependent on the type of expenditure appropriation, will clear the cheque or process the invoice for payment to the Ministry of Finance & Economic Management who administer CAPEX and POBOC funds.

Spreadsheets are maintained to keep track of the finance flows of the organization and the staff are quite capable of performing complex queries on the information and are able to produce reports when required.

II. Enhancing the efficiency of the Survey department

Motivation

Upon the study of the entire organization, it became evident that efficient data management is crucial to its success and therefore was an issue that needed to be addressed. In the past few years, Mr. Tangiruaine has been developing databases that aim to serve three core functions of the Ministry: Survey information, Water Works and Building Permits. As their name states, theses databases pertain to the specific departments within the ministry but have not be deployed into the network for the staff to utilize as they are still under development.

Mr. Tangiruaine and I reviewed each of the databases during the beginning of the project and at an initial meeting identified that the Survey department's database was the most crucial system to be developed. The Survey office was experiencing a slight disorientation as the survey plans as the members of the survey office would draw the survey plans using AutoCad and then stored the survey plans on files stored in a file room. Visitors to the Ministry often come in and request for a particular survey plan and the survey staff have to stop all of their current work to locate a file in the archives.

There was a disjoint the staff experienced between the systems, and survey staff member Linley Andrews states "It's easier for me to find files on the computer but when someone comes in looking for a survey plan, it takes a long time to find the right one." The process involves a visitor coming in and asking for a survey pertaining to a particular area for a number of reasons and a number of books and ledgers being consulted to find the exact survey being looked for.

Of the different forms of technology available to address the information storage issue, a database proved to be the most reliable option. The result will aim to offer a user friendly system that efficiently caters to the recording and retrieval process of the different processes carried out by the different divisions of the ministry.

The implementation of the database systems aim to enhance the information recording and retrieval processes allowing stakeholders' to experience greater efficiency of information flow. With the new system in place, I hope to reduce the need to have a parallel paper based system so as to reduce information redundancy and increase the efficiency of searching for surveys.

Outcomes

The systems development process was documented using the template created in Appendix A. The entire process of development is documented under Appendix B.

Recommendations

By automating the retrieval and recording process, we have managed to significantly ease the amount of time it takes for a member of the survey office takes to find and record information.

Information regarding a particular surveyor or plan creator need only be recorded once and then can be referenced to multiple times throughout the databases. In the final week of the internship, Mr. Tangiruaine and I deployed the system onto the Ministry's network and begun work filling the system with information. Entering new information into the system will be significantly easier than entering all the older information but in order to make the system thoroughly feasible, all of the older data will have to be manually input into the system as well.

Ensuring all the recorded information is available on digital formatting ensures that specific information can be found easily, the data can be output into a readable format and more importantly is stored with backups to ensure that data is never lost.

About the Consultant

Haya Thowfeek is a rising junior in Information Systems with a minor in Global Systems Management at Carnegie Mellon University in Qatar. She will be taking part in the Technology Consulting in the Global Community internship over the summer and return to Doha in the fall.

Appendix A: Project Documentation Template

Project Name:
Start Date:
End Date:

Section 1: Problem analysis and specification.
- Context described.
- Problem identified.
- Problem put into context.
- Current methods discussed.
- Disadvantages of current methods discussed.
- Desired outcomes identified.
- Success criteria identified.
- Success criteria or desired outcomes discussed in detail.
- Criteria or outcomes are testable / provable.
- Problem specified from user's viewpoint.
- Problem broken into sub tasks from user's viewpoint.
- Problem specified from solver's viewpoint.
- Problem broken into sub tasks from solver's viewpoint.
- Sub tasks discussed in detail.
- Clear indication of how solver will tackle the sub tasks.

Section 2: Design and planning of solution.
- Statement of the range of software available. / No choice available.
- List of software to be used in the solution.
- Choice from the range of software is appropriate.
- Choice of software has been justified.
- Software linked to the problem.
- Statement of the range of hardware available. / No choice available.
- List of hardware to be used in the solution.
- Choice from the range of hardware is appropriate.
- Choice of hardware has been justified.
- Hardware linked to the problem.
- Outline design for solution.
- Method of solution described.
- `Clear` description in terms of an overall system. .. Sufficiently detailed to see how it works.
- Validation considered: Clear description of validation.
- Validation methods justified.
- Testing considered.
- Clear description of testing.

- Test data stated or described.
- Test data justified.
- Expected results stated.
- Systems, tools and techniques clear and justified.
- Clear and appropriate presentation of the solution.

Section 3: Testing of the solution.

- Tests described
- Tests are systematic and match the test plan
- All of the tests in the test plan are covered
- Errors and modifications are mentioned
- Modifications implemented
- Compare test plans with results.

Section 4: Implementation of design.

- Text shows programming attempt / software package use.
- Text description has only minor omissions.
- Text description is easy to follow.
- Screen shots or program listings.
- Screen shots or listings have titles and / or annotations.
- Titles and annotations are appropriate and informative.

Additions to the system implementation
  - Amendments to design mentioned.
  - Amendments to design discussed.
  - Some attempt to justify design amendments.
  - Problems with implementation mentioned.
  - Amendments identified.
  - Evidence of amendments having been carried out.
  - Problems from testing mentioned.
  - Solutions identified.
  - Evidence of solution having been applied. e.g. re-tests
  - References made from screen shots to text / program listing.
  - References made from text / program listing to screen shots.

Section 5: Evaluation of the solution.
-
- Effectiveness of the solution stated and discussed
- Reference to some of the success criteria
- Evidence for meeting **all** success criteria or specified outcomes.
- Evidence **clearly linked** to success criteria or specified outcomes.

- Capabilities of software discussed.
- Effectiveness of software discussed.
- Man-machine interface mentioned and discussed
- Man-machine interface fully evaluated **with clear links to evidence**.
- Weaknesses discussed.
- Weaknesses discussed are specific to the developer's work.
- Weaknesses discussed are appropriate to the developer's work.
- Further development discussed.
- Further development ideas are appropriate.
- Further development ideas are feasible.

Survey Database Project
Ministry of Infrastructure and Planning

Start Date: 18th June 2012

End Date: 3rd August 2012

Section 1: Problem analysis and specification.

The Survey Department since 2002 has been developing a Survey Plan Index Register (SPIR) database using, initially Access 2000 but in 2004 moved the development work to Access 2002.

The purpose of this database is to record Land Information and Ownership details pertaining to the surveyed lands on the Cook Islands.

The data from this database is also linked by ODBC to MapINFO, a Geographical Information System (GIS) software. This link provides a live data link between both systems (under MS ACCESS and MapINFO) with the capability for the database to be used for spatial analysis (Thematic Mapping).

Current status:

The currently existent database system has the structural functionality as to how the system should operate but needs to be reorganized for more efficient usage. The current system does not have any immediate users as it is still in development. The members of the Survey Office are targeted as the primary users of the system and will be involved in the recording and retrieval process.

Success criterion:

During planning sessions, the following success criterion was established by Mr Tangiruaine:

- The system should be able to record and allow retrieval of information as required by the users.
- Recording and reporting functionality
- The system should be portable (i.e. the system should be able to be moved onto different computers.)

Current methods:

The database is built with two different sections: a front end and a back end. The back end of the system handles all of the storage and processing functions and the front end is merely the user interface that an end user is able to access. The information on the front end allows the user to access all aspects of the system.

Section 2: Design and planning of solution.

The current system is built on Microsoft Access 2002 but has the potential to be upgraded to the latest version of Ms Access to allow for wider functionality. Research was carried out in order to investigate whether existing software was available for purchase but it seems more prudent to build a customized database to cater to the needs of the Ministry. Furthermore it would allow for the system to be built using the existing hardware capabilities.

Current layout:

Given below are the entity dictionaries of the existing system:

BACK END:

Table Name: Ownership

Field Name	Description	Data Type	Sample Data
OWNERSHIP_ID		AutoNumber	
PLANINDEX_ID	Auto created by the relationship between Ownership and PLANINDEX	Number	
FNAME	First name of Owner	Text	Turia

SURNAME	Last name of Owner	Text	Teariki Taneao
LOT	LOT number (if any) of subdivision	Text	
PURPOSE	Lease, Occupation Right, Vesting Order (Value List generated)	Text	Occupation Right
LANDUSE	Residential, Commercial, Reserve (Value List generated)	Text	Residential
AREA(ha)	Area in Hectares	Number	0.1195
AREA(arp)	Area in Acres, Roods and Perches (only entered if the plan is from the imperial age).	Text	0:1:4
MBRIEF	Minute Book Reference	Text	RB6/256
COMMENTS	General Comments	Memo	Converted to a Lease on the 18/6/2001
MAPPED	Whether plan is mapped into GIS	Yes/No (Boolean)	

Table Name: PLANREGISTER

Field Name	Description	Data Type	Sample Data
PLANREGISTER_ID		AutoNumber	
PLANTYPE	The survey type under which the survey was conducted - SO (Survey Office - typically for plan sizes from A2 and above), RO (Right of Occupation), DIAGRAM (Survey Diagram), LEASE (Lease Surveys), VO (Vesting Orders). Value List generated	Text	DIAGRAM
PLANNUMBER	Sequential Plan Number prefixed by the Plan Type i.e, SO1245 or RO2541.	Text	D3389
SURVEYED	The Full name of the	Text	Reboama Samuel

	Surveyor		
SDATE	Date Survey was conducted	Date/Time	16/9/2000
FBOOKREF	Field Book Number and page numbers in the form of FB246p45-67	Text	303p19-20
S-COMPSBK	Survey Computation Book and page reference.	Text	205p6
TRAVERSEBOOK	Traverse Book reference and page number	Text	116p2
DRAWN	Full name of Draughtsman who drew the plan	Text	Timoti Tangiruaine
DDATE	Date drawn	Date/Time	17/9/2000
EXAMINED	Full name of Plan Examiner	Text	Rauti Takitaki
EDATE	Date plan was examined	Date/Time	18/9/2000
E-COMPSBK	Examination Book and page reference	Text	
APPROVED	Full name of plan approver (usually the sitting Chief Surveyor)	Text	Tereapii Charlie
ADATE	Date plan was approved	Date/Time	19/9/200
SCALE	Scale at which the plan was drawn in imperial (older plans) or metric (the current system).	Text	1:750
REF	Other references	Text	
RECORDED	Full name of draughtsman/surveyor who recorded the plan information on the Survey Plan Index Register	Text	
REMARKS	General Remarks	Memo	
SPATIALRef	System generated reference code for MapINFO ODBC link	Text	
MapLoc_X	Easting coordinate of	Number	

	centre of plan. Default value of 419500 and updated automatically when the record is moved to it's corresponding polygon in the GIS.		
MapLoc_Y	Northing coordinate of centre of plan. Default value of 7655540 and updated automatically when the record is moved to it's corresponding polygon in the GIS.	Number	
MAPPED	Whether plan is mapped into GIS.	Boolean (Yes/No)	
INTEGRITY	Whether all available data has been filled in the database.	Boolean (Yes/No)	

Table Name: PLANINDEX

Field Name	Description	Data Type	Sample Data
PLANINDEX_ID		AutoNumber	
SECTION NUMBER	Section Number	Text	107
PLANNUMBER	Survey Plan Number	Text	SO312
CHECKED	Checked by Full Name	Yes/No	Timoti Tangiruaine

Table Name: Sections

Field Name	Description	Data Type	Sample Data
SECTION_ID		AutoNumber	
PARTITIONED	Whether the Section has been partitioned	Boolean (Yes/No)	Yes
PARENT_SECTION	If it has been partitioned, what is the parent section number	Text	16H2
SECTION NUMBER	Section Number	Text	16H2C
SECTION NAME	Section Name	Text	Te Makatea

| TAPERE	Tapere Name	Text	Tupapa
DISTRICT	District Name	Text	Matavera
ISLAND	Island	Text	Rarotonga

Outline design for solution.

Software selection:

In order to develop the system for the Ministry, I looked into a number of different systems: off-the-shelf packages, open source software and code based programs. Most, if not all, of the commercial and open source packages possessed a wide range of functionality - which would be excessive and incur an unnecessary cost for the organization that needs a functioning recording and retrieval system – therefore I decided to create a customized database system.

Building a customized system presented two options: I could either use Microsoft Access or MySQL to build the system. Microsoft Access is already available on the Ministry's computers as part of the Microsoft Office 2003 suite installed on machines throughout the office. Access offers the advantages of being a user friendly GUI based development tool with back end programming capabilities using VBA.

Microsoft Access 2003 was chosen as the software package for development. The Ministry's contact and future systems administrator Timoti is most comfortable using a GUI based program to manage the new system and maintain it as required.

Given that the main requirement of the system is to record and retrieve information. The systems users will be given access according to their clearance levels indicated by their position in the organization.

Users will be presented with a switchboard upon entry into the system and will be directed through a series of menus that will allow them to navigate effectively through the system. The overarching structure of the system is illustrated below:
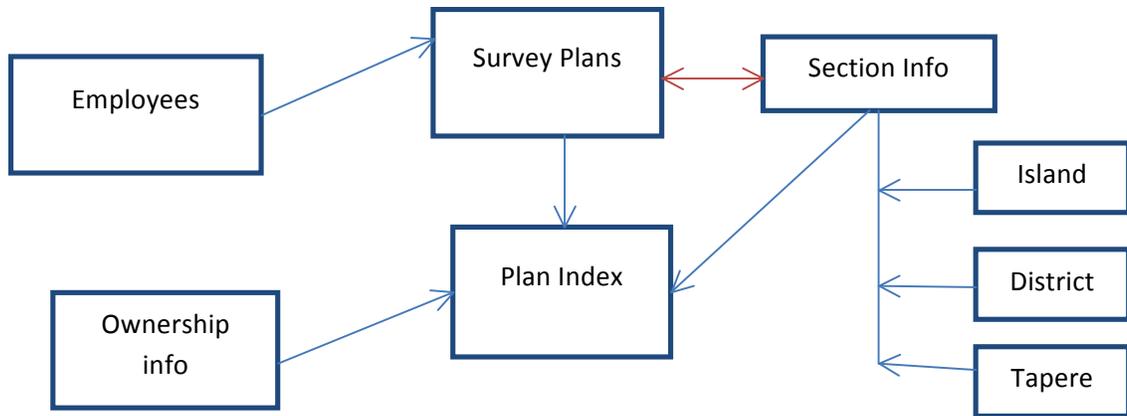
Based on the relational structure of the information, the different entities will record information in the following manner:

Table Name: **EMPLOYEES**				
Field Name	Description	Field Size.	Data Type	Validation
Employee_ID	Employee ID auto generated	6	AutoNumber	NA
First_Name	Employee's first name	15	Text	>L<?????????????
Last_Name	Employee's last name	15	Text	>L<??????????????
Title	Job title	30	Text	>L<?????????????????? ???????????
Section	Division name	15	Text	>L<??????????????
Email	Email address	30	Text	N/A
Contact_#	Preferably a direct number such as a mobile.	10	Number	0000099999

Table Name: **PLANS**				
Field Name	Description	Field Size.	Data Type	Validation
Plan_#	Unique Plan number prefixed with the plan type abbreviations	8	Text (AlphaNumeric)	&&&&&&&&
Plan_Type	Value list: SO (Survey Office -	8	Text	Limit to value list.

Plan_Type	Value list: SO (Survey Office - typically for plan sizes from A2 and above), RO (Right of Occupation), DIAGRAM (Survey Diagram), LEASE (Lease Surveys), VO (Vesting Orders).	8	Text	Limit to value list.
Surveyed_By	Value List: Employee ID and name	6	Number	Limit to value list.
Survey_Date	Date the survey was conducted, format DD-MM-YYYY	8	Date/Time	00/00/0000
Plan_Scale	Scale ratio	5	Text	&&&&&
Field_Book_#	The number of the field book	5	Number	00099
Field_Book_Pages	Page range	9	AlphaNumeric	
Drawn_By	Value List: Employee ID and name	6	Number	Limit to value list.
Drawn_Date	Date the survey was drawn, format DD-MM-YYYY	8	Date/Time	00/00/0000
Approved_By	Value List: Employee ID and name	6	Number	Limit to value list.
Approved_Date	Date the survey was approved, format DD-MM-YYYY	8	Date/Time	00/00/0000

Table Name: OWNERS				
Field Name	Description	Field Size.	Data Type	Validation
Owner_ID	Owner ID auto generated	6	AutoNumber	999990

First_Name	Owner's first name	15	Text	>L<?????????????
Last_Name	Owner's last name	15	Text	>L<?????????????
Address	Owner's address	40	Text	NA
Contact_#	Preferably a direct number such as a mobile.	10	10	0000099999

Table Name: **PLAN_INDEX**				
Field Name	Description	Field Size.	Data Type	Validation
Plan_#	Unique Plan number prefixed with the plan type abbreviations	8	Text (AlphaNumeric)	&&&&&&&&
Section_ID	Section Identifier	6	Number	999990
Owner_ID	Owner Identifier	6	AutoNumber	999990
Area	Measurement of area in square meters	3	Number	990
Land_use	Value list: Lease, Occupation Right, Vesting Order	13	Text	Limit to value list
Mapped?	Boolean whether the land has been mapped?	1	Boolean	NA
Comments	General remarks	50	Text	NA

Table Name: **SECTIONS**				
Field Name	Description	Field Size.	Data Type	Validation
Section_#	Section Identifier	6	AutoNumber	999990
Partitioned?	Indicator of whether section belongs to a partition	NA	Boolean	NA
Parent_#	If the section is part of a partition, the number of the parent section	6	Number	999990

Name	Section Name	15	Text	>L<?????????????
Island	Value List of 15 Islands	10	Text	Limit to value list
District	Value List based on the selection of the previous field	10	Text	Limit to value list
Tapere	Value List based on the selection of the previous field	10	Text	Limit to value list

Table Name: ISLANDS				
Field Name	Description	Field Size.	Data Type	Validation
Island_ID	Island Identifier	6	AutoNumber	99990
Name	Name of the Island	15	Text	>L<??????????????

Table Name: DISTRICTS				
Field Name	Description	Field Size.	Data Type	Validation
District_ID	District Identifier	6	AutoNumber	99990
Name	Name of the District	15	Text	>L<??????????????
Island_ID	Value list: Island ID and Name	15	Text	Limit to value list

Table Name: TAPERE				
Field Name	Description	Field Size.	Data Type	Validation
Tapere_ID	Tapere Identifier	6	AutoNumber	99990
Name	Name of the Tapere	15	Text	>L<??????????????
District_ID	Value list: District ID and Name	15	Text	Limit to value list

Section 3: Testing of the solution.

Tests were carried out to ensure the accuracy of the system whereby every field in the system had dummy data entered into it. Both accurate and invalid data was entered and the results documented. Tests marked

with a check/ tick "√" indicate a test that performed as expected and an exclamation mark "!" indicates an error in testing.

Where errors were experienced, modifications to the system were made immediately and retested for accuracy. The results of the test phase are indicated below.

Table Name: EMPLOYEES					
Field Name	Validation	Test Data		Result	
		Invalid	Accepted	Invalid	Accepted
Employee_ID	999990	AutoNumber		√	√
First_Name	>L<??????????? ???	pe3ter	Peter	√	√
Last_Name	>L<??????????? ???	J0hn	John	√	√
Title	>L<??????????? ???	Adm1n	Admin	√	√
Section	>L<??????????? ???	C0porate	Corporate	√	√
Email	N/A	(No entry)	John.Smith @moip.gov. ck	! Not rejected	√
Contact_#	000009999	Five one two three	51432	√	√

Modification:
- Email field - Field validation changed to "Not null entry"

Table Name: PLANS					
Field Name	Validation	Test Data		Result	
		Invalid	Accepted	Invalid	Accepted
Plan_#	&&&&&&&&	(No entry)	RO1234	√	√
Plan_Type	Limit to value list.	Hand drawing	Diagram	√	√
Surveyed_By	Limit to value list.	Entry not on list	Selection of employee name from list.	√	√
Survey_Date	00/00/0000	Thirtieth June	30/06/201 2	√	√

Field Name	Validation	Invalid	Accepted	Invalid	Accepted
Plan_Scale	&&&&&	Four to one	1: 234	√	√
Field_Book_#	00099	Three	354	√	√
Field_Book_Pages	0099-0099	1**-3**	100-103	√	√
Drawn_By	Limit to value list.	Entry not on list	Selection of employee name from list.	√	√
Drawn_Date	00/00/0000	Thirtieth June	30/06/2012	√	√
Approved_By	Limit to value list.	Entry not on list	Selection of employee name from list.	√	√
Approved_Date	00/00/0000	Thirtieth June	30/06/2012	√	√
Image_ID	NA	Null entry	Link to image	√	√

Table Name: SECTIONS					
Field Name	Validation	Test Data		Result	
		Invalid	Accepted	Invalid	Accepted
Section_#	999990	12***9w3	123456	√	√
Partitioned?	NA				
Parent_#	999990	12***9w3	123456	√	√
Name	>L<???????????? ???	Ja1me 1and	Aretoa	√	√
Island	Limit to value list	Entry not on list	Selection from list.	√	√
District	Limit to value list	Entry not on list	Selection from list.	√	√
Tapere	Limit to value list	Entry not on list	Selection from list.	√	√

Table Name: OWNERS					
Field Name	Validation	Test Data		Result	
		Invalid	Accepted	Invalid	Accepted
Owner_ID	999990	AutoNumber			

Field Name	Validation	Invalid	Accepted	Invalid	Accepted
First_Name	>L<??????????? ???	pe3ter	Peter	√	√
Last_Name	>L<??????????? ???	J0hn	John	√	√
Address	NA				
Contact_#	0000099999	Five ## two three	51432	√	√

Table Name: PLAN_INDEX					
Field Name	Validation	Test Data		Result	
		Invalid	Accepted	Invalid	Accepted
Plan_#	&&&&&&&&	RO &@#(	RO1234	√	√
Section_ID	999990	Entry not on list	Selection from list.	√	√
Owner_ID	999990	Entry not on list	Selection from list.	√	√
Area	990			√	√
Land_use	Limit to value list	Entry not on list	Selection from list.	√	√
Mapped?	NA				
Comments	NA				

Table Name: ISLANDS					
Field Name	Validation	Test Data		Result	
		Invalid	Accepted	Invalid	Accepted
Island_ID	AutoNumber	NA			
Name	>L<??????????? ???	Ja1me 1and	Rarotonga	√	√

Table Name: DISTRICTS					
Field Name	Validation	Test Data		Result	
		Invalid	Accepted	Invalid	Accepted
District_ID	AutoNumber	NA			
Name	>L<??????????? ???	Ja1me 1and	Arorangi	√	√
Island_ID	Limit to value	Entry not	Selection	√	√

	list	on list	from list.		

Table Name: **TAPERES**					
Field Name	Validation	Test Data		Result	
		Invalid	Accepted	Invalid	Accepted
Tapere_ID	AutoNumber	NA			
Name	>L<?????????? ???	Ja1me 1and	Amuri	√	√
District_ID	Limit to value list	Entry not on list	Selection from list.	√	√

Section 4: Implementation of design

Given that the system is to be used by users who have no experience handling a data management system – I designed the system so that the way information was searched for and retrieved would be logical and therefore not require that the user to have extensive background knowledge prior to using the system.

On startup the system loads a main switchboard that allows the users to navigate to one of the 3 main functionalities of the system: data management, new data entry and search information. The menus lead to sub menus that offer the user the different options available under the categories.

Figure 4.1: Main Switchboard:
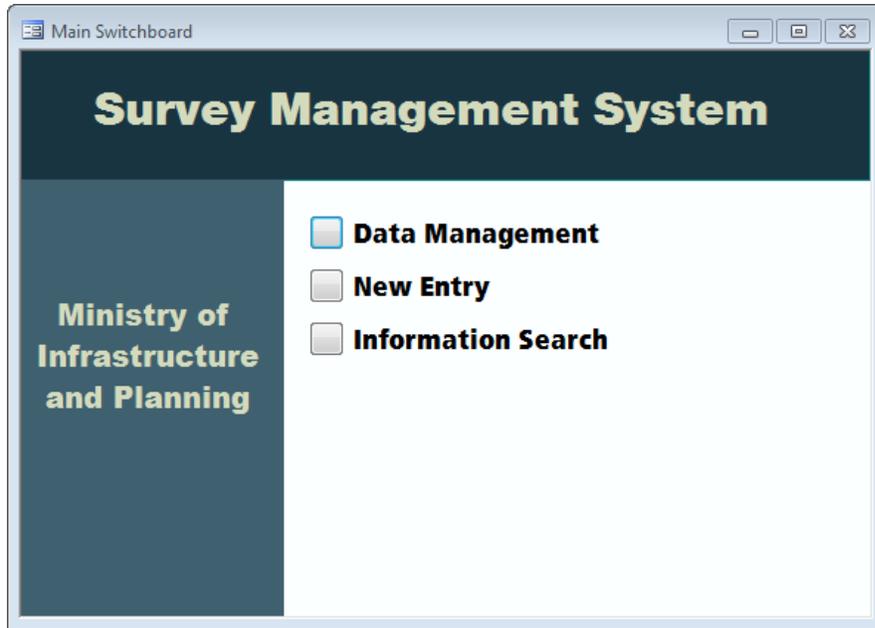
Figure 4.1.1: Data Management Switchboard:

The data management switchboard allows a user to find and edit information within the database based on their needs. Each button, save for the last, directs the user to the different forms in the database; based on a particular users access level they can either read the information only or edit it if necessary.
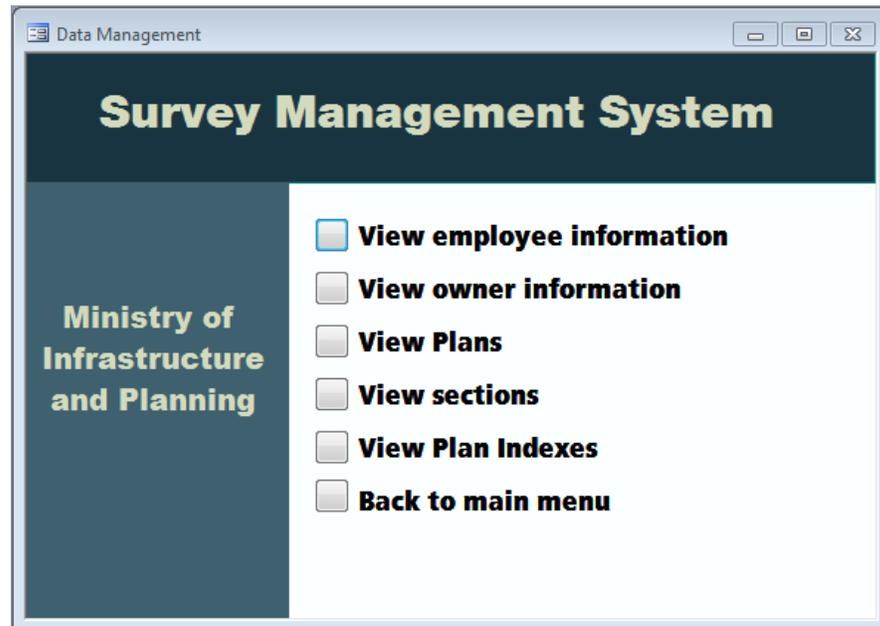
Figure 4.1.2: New Entry Switchboard:

Similar to the Data Management switchboard, the new entry switchboard directs the user to a blank form where they can enter in information based on their selection.
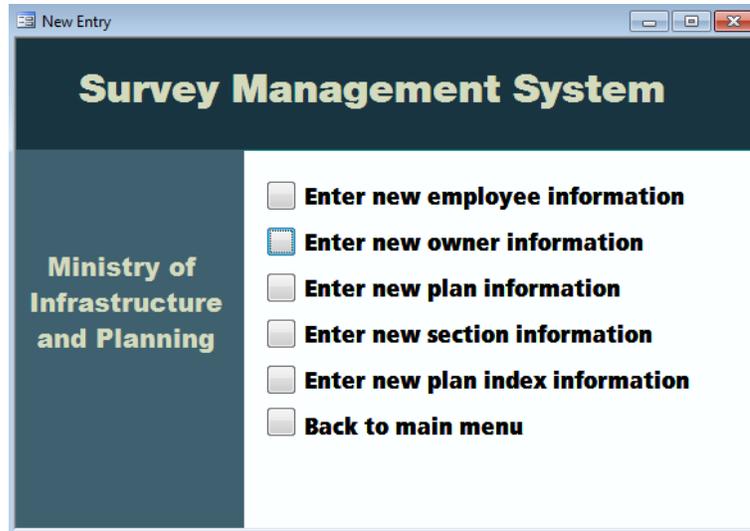
Figure 4.1.2: Information Search Switchboard:

The Information Search switchboard allows a user to find plan information by browsing and specifying geographic parameters (Islands > Districts > Taperes) or specifying a plan's ID. At each selection the user is offered the option of producing a list of existing information in a report or continuing to specify further parameters.

The Plan Search option requires that the users enter a specific plan identifier and produces a report based on the entered parameters.
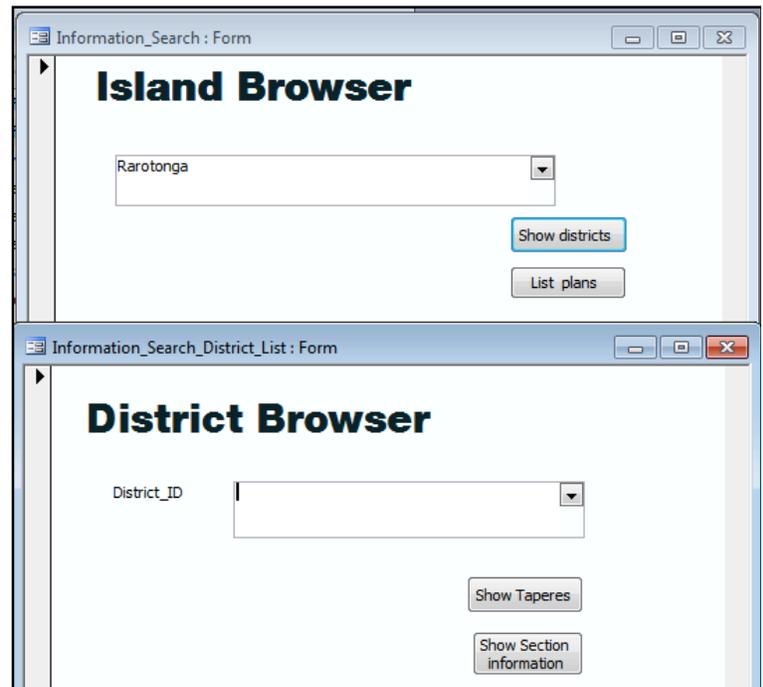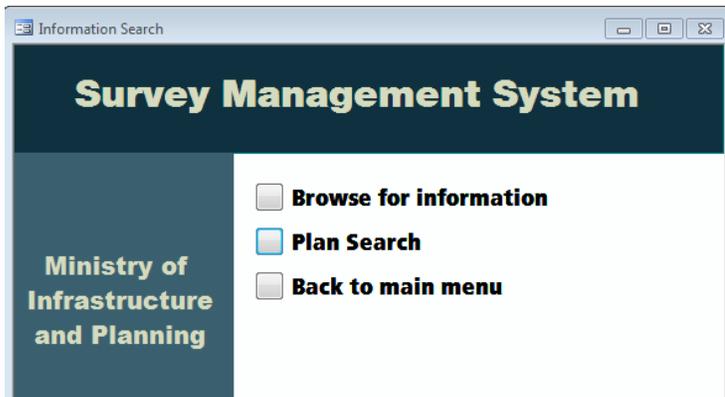
System description:

Entering a new plan's information:
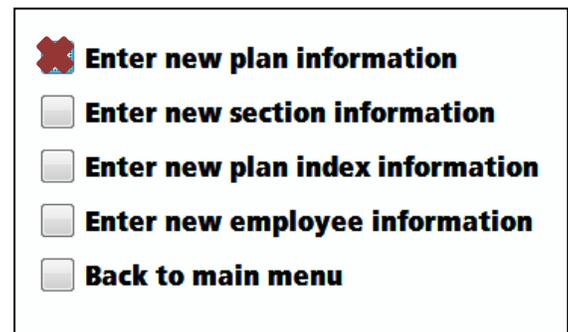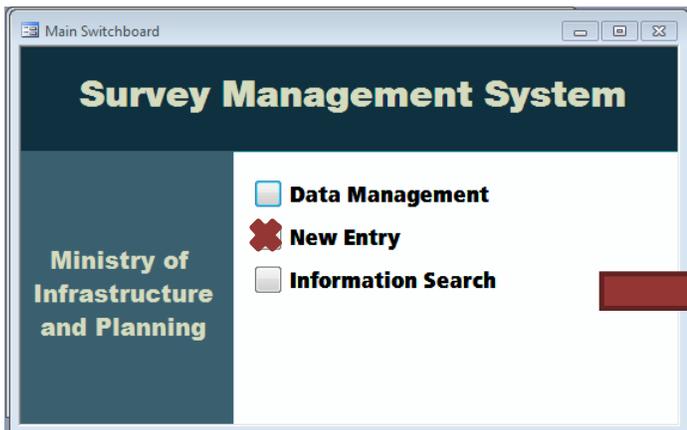
- Open up the database
- From the Main Switchboard, click on "New Entry"
- Under the New Entry switchboard, click on "Enter new plan information"
- Enter information into the form shown below – The requirements of each field are mentioned in the footer at the bottom of the program.

Plans

Plan:

Plan Type

Surveyed By — View employee info

Survey Date

Plan Scale

Field Book

Field Book Pages

Drawn By — View employee info

Drawn Date

Approved By — View employee info

Approved Date

Image_ID

Enter Section Information

Enter plan identifier here

Select information from drop down menu

Output scale

Enter dates in format DD/MM/YEAR

Linking image file to form

Plan Type

Surveyed By

Survey Date

Plan Scale

Field Book

Field Book Pages

Drawn By

Drawn Date

Approved By

Approved Date

Image ID

	Filter By Selection
	Filter Excluding Selection
	Filter For:
	Remove Filter/Sort
	Cut
	Copy
	Paste
	Sort Ascending
	Sort Descending
	Insert Object...
	Hyperlink ▶
	Properties

Enter Section Info
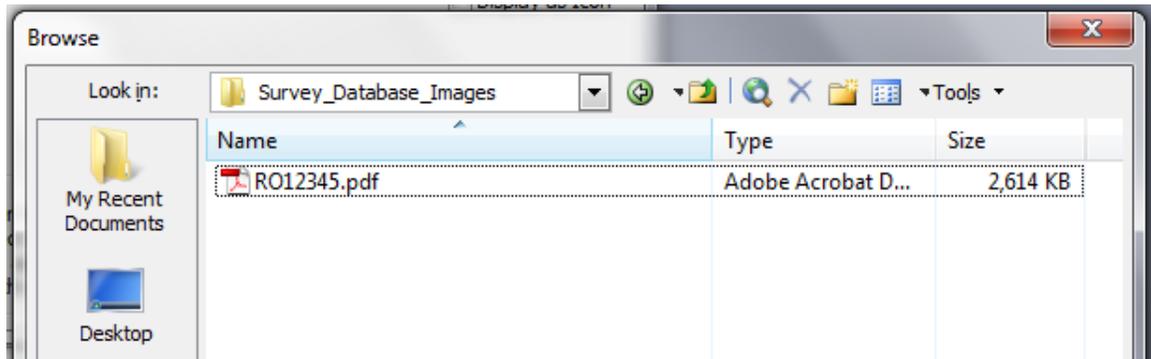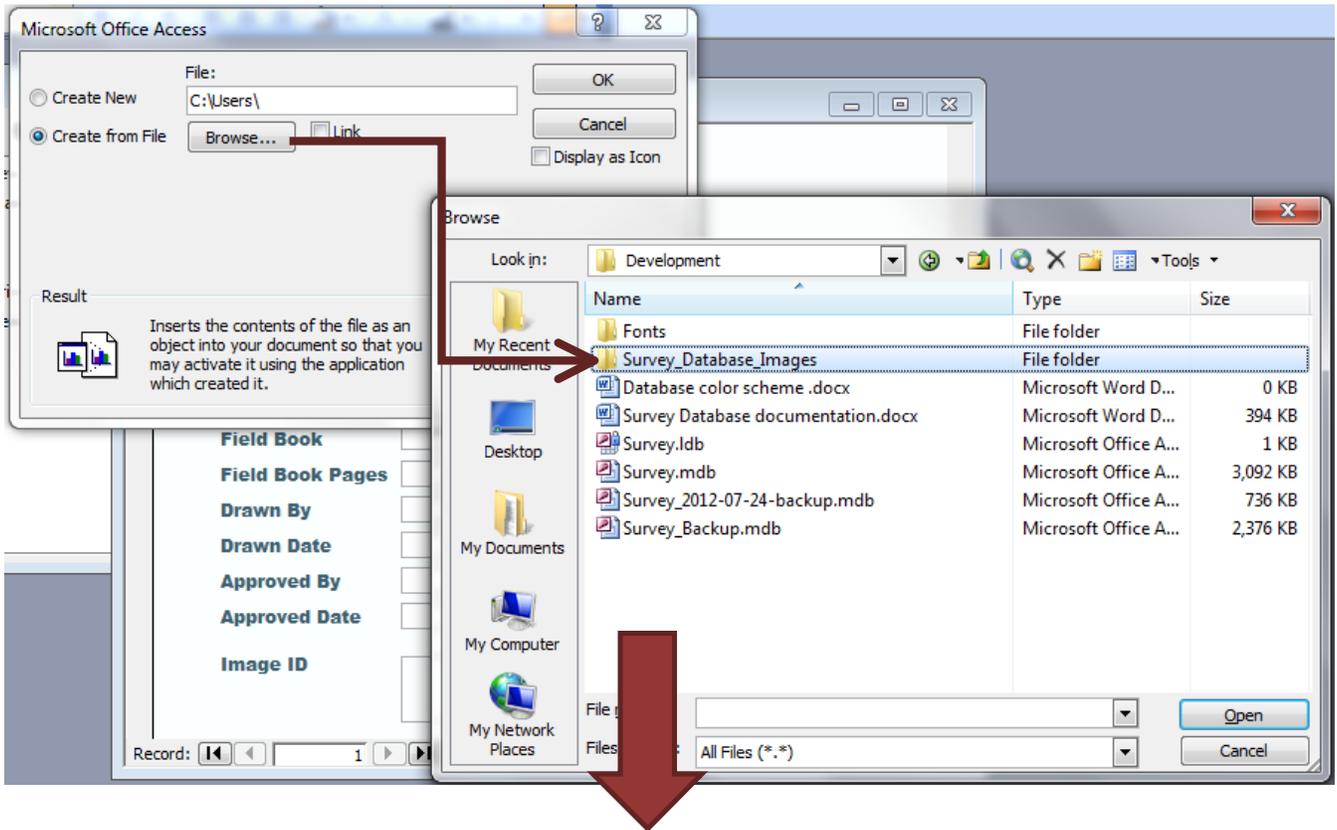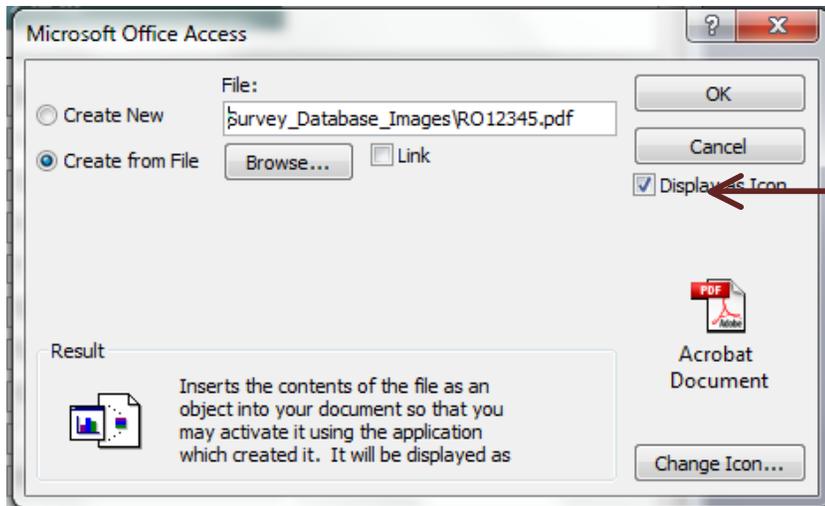
Make sure this option is selected so that an icon is displayed on the form
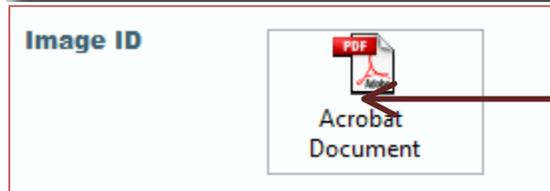
Double click on icon to open file

- Make sure the image is stored in the Database Image folder using the Plan Id as the name of the file.
- On the Plan form right click on the box next to "Image ID"
- Select the "Insert Object" option from the menu to open the menu shown under image xx
- Click on the "Create from file option" and navigate to the image file.
- Select the file and make sure the "Display as icon" box is checked.
- Click on "OK" and an a link to the file will be displayed on the form.
- To open the file, double click on the icon.

Entering a new section's information

Sections

Section ID:

(AutoNumber)

> The section number is automatically filled

Partitioned? ☐

> If the section is partitioned, click on the checkbox and enter the Parent section's ID

Parent ID

Section Name

> Enter the name of the section

Island ▾

District ▾   Delete

Tapere ▾

Enter Plan Index information

> Select the name of the Island and the other fields will populate accordingly.

Record: ◀◀ ◀

> Once the form is filled out, press this button to link the plan and section information.

Enter a new plan_index

The plan index connects the survey plan information with the geographic information under the sections table.

Plan ID form (Plan_Index) with callouts:
- Enter the plan ID here.
- Select the Section ID and Owner ID from lists
- Enter the area in square meters
- Select the area use from the list

Entering a new employee's details

Employees form (John Smith) with callouts:
- Enter the employee's job title
- The employee ID is automatically generated
- All of these fields are to be manually filled by the user.

Entering a new owner's details.

Owners

Owner Information

Owner ID	AutoNumber
First Name	
Last Name	
Address	
Contact #	0

Record: ◄◄ ◄ 1 ► ►◄ ►* of 1

This section will automatically fill up when the user enters an owner's first name and last name.
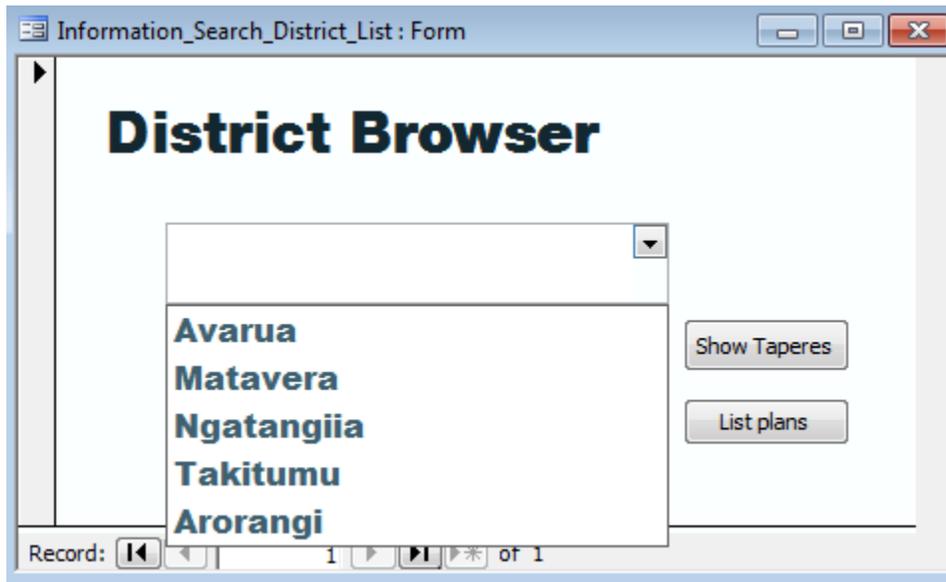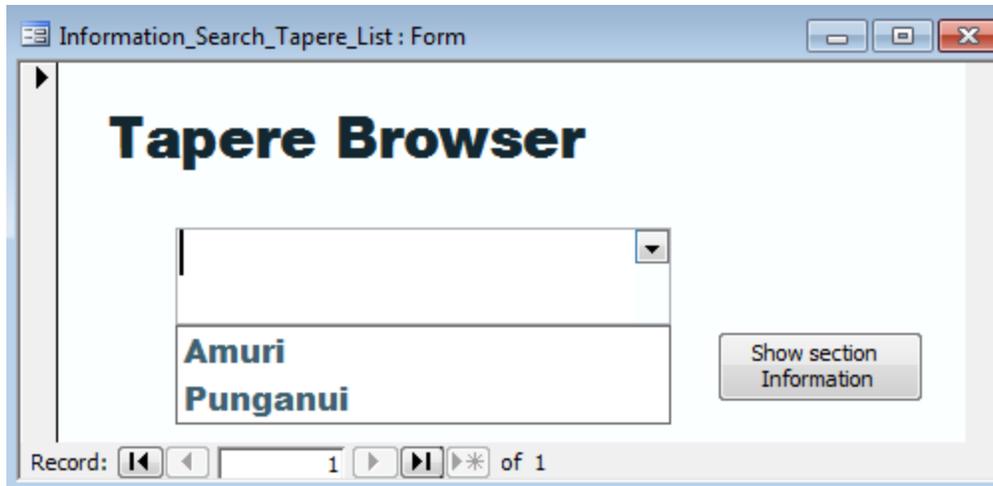
The owner ID is automatically generated

All of these fields are to be manually entered by the user.

Information Search

The Information Search option aims to provide the user with the option of being able to specify what information they want to search for.

- From the Main Switchboard, select the "Information Search" option
- Selecting the button will open the Island Browser
- After selecting the Island Name from the list, select either the "List plans" button to produce a list of all the plans on the selected island or the "Show districts" button to further specify information.
- Selecting the "Show districts" button will opens up the District Browser form. Based on the user's selection on the Island Browser, the drop down menu will list all of the districts on the selected island. Again, from here the user can choose to either choose whether to produce a list of the plans based on the districts or chose the "Show Taperes" button for further information.
- Selecting the "Show Tapere" button will produce another form that allows the user to further specify what Tapere's information they want to search for and then select "Show section information"

Island Browser

Aitutaki
Atiu
Mangaia
Manihiki
Manuae
Mauke

Show districts

List plans

District Browser

Avarua
Matavera
Ngatangiia
Takitumu
Arorangi

Show Taperes

List plans

Searching for information based on plan details

In order to search for a specific plan, where the Plan ID is known:

- The user selects the "Plan Search" option under the Information Search switchboard.
- The User is then prompted to enter the Plan ID into the search box
- On clicking the "Ok" button, a report with the requested information is produced.

The Plan ID is entered here to generate a report with the plan information
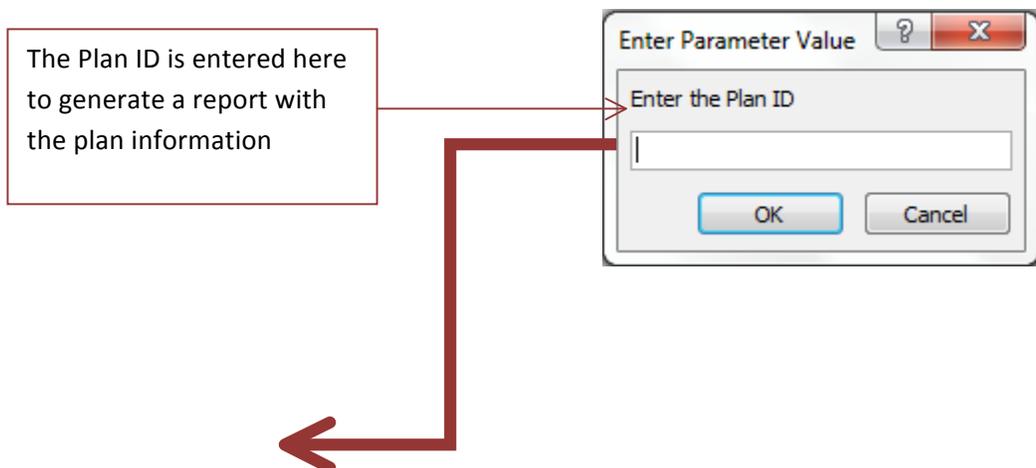
Plan Search

Plan ID:	D123	
Plan Type	VO	
Surveyed By	Donye	Numa
Survey Date	12/3/1201	
Plan Scale	1:300	
Field Book	012-21	
Field Book Pages	12- 13	
Drawn By	Shirley	Napa
Drawn Date	12/12/1201	
Approved By	Donye	Numa
Approved Date	12/23/1201	

Section 5: Evaluation of the solution.

With the completion of the system and successful user testing carried out – the system was deployed on the 3rd of August 2012. The members of the Survey office and a select few higher ranking officials were given different access levels to the system based on their rank within the department.

The completed system successfully offers its users an interface which ensures that the user enters valid information that follows a specific format. The use of switchboard allows the users to be aware of the different options available to be used within the system and flows in a logical manner.

The recording and retrieval process of system is quite straight forward and the user is immediately aware of how to operate the system with minimal training. The system was also developed with the ability to be migrated to a different database management software if need be.

Further development would involve linking the GIS system to the database to eliminate the need to embed file links into the system but rather have links to a digital image in the GIS system that can be printed if necessary.

Appendix 1: System description provided by developer

DIVISION: Survey

APPLICATION: Survey Plan Index Register

The Survey Department since 2002 has been developing a Survey Plan Index Register (SPIR) database using, initially Access 2000 but in 2004 moved the development work to Access 2002.

The purpose of this database is to;

Record Land Information and Ownership details pertaining to

The data from this database is also linked by ODBC to MapINFO, a Geographical Information System (GIS) software. This link provides a live data link between both systems (under MS ACCESS and MapINFO) with the capability for the database to be used for spatial analysis (Thematic Mapping).

DATABASE RELATIONSHIP MODEL

In order to define meaningful relationships and the uniqueness of those relationships between the database records, understanding how the land titling system of land in the Cook Islands is needed.

In the context of the Land Tenure System in the Cook Islands;

- An Island is divided in Districts, in the case of Rarotonga, there are 5 (five) Districts - Avarua, Matavera, Ngatangiia, Takitumu and Arorangi.
- Each District is subdivided into several Tapere's, so for the District of Matavera for example, there are a total of five (5) Tapere's - Titama, Tupapa, Matavera, Vaenga and Pouara.
- In each Tapere, land is further subdivided into land blocks and identified by Section Numbers and Section Names.
- Section Numbers are sequential in a District and starts at number 1 to whatever the number of sections in a particular district. This numbering also spans across the Tapere's in a District. There are cases however (for some unknown logical explanation), where there are more than one Section 1 in a district but in two separate Tapere's i.e, Section 1 in the Tapere's of Arerenga and Akaoa both of the district of Arorangi.
- District's have unique names on each Island but a similiar district name also exist on another Island i.e, The district name Ngatiarua exist on the Island's of Mauke and Atiu.
- Tapere names are unique in each District but may have the same name in another District i.e, Tupapa Tapere in both the Districts of Avarua and Matavera.
- Section names would generally cover several Section Numbers i.e, Pokoinu is a land name for the Sections 107, 107A, 107B, etc. in the Tapere of Pokoinu in the district of Avarua on Rarotonga. This would usually indicate that Section 107 (as a parent) has been further partitioned into several sections because of the landowners' intentions to allocate land to the various families or owners who have interest in those lands. According to traditional land identification or description, the name of a land is usually used. The numbering system, which only came into practice, is only used to distinguish between the landowning interests in providing a system of uniquely identifying a piece of land.

So in identifying a piece of Land, one would describing it as;

- The Name of the Land: **Te Makatea**
- The Section Number of the Land: **16H**
- The Tapere of the Land: **Titama**
- The District in which the Land belongs: **Matavera**
- The Island where the Land is situated: **Rarotonga**

"Te Makatea, Section 16H, Tupapa Tapere, Matavera District, Island of Rarotonga"

Te Makatea PT SEC 16H, Tupapa Tapere, Matavera District, Rarotonga