

Distr.
RESTRICTED

LC/R.1789
27 January 1998

ORIGINAL: ENGLISH

E C L A C

Economic Commission for Latin America and the Caribbean

**A MUNICIPAL INFORMATION SYSTEM
FOR PORT OF SPAIN, TRINIDAD AND TOBAGO**

This document was prepared by the consultant Mr. Desmond Dougall, under the project "Urban management in selected medium-sized cities of Latin America and the Caribbean" (ITA/95/S71), which is being carried out by the Environment and Development Division of ECLAC, with the support from the Government of Italy. This document has been reproduced without formal editing. The views expressed herein are those of the author and do not necessarily reflect the views of the Organization.

CONTENTS

	<u>Page</u>
Summary	vii
 SECTION 1 - INFORMATION REQUIREMENTS AND CONCEPTUAL FRAMEWORK FOR DEVISING A MUNICIPAL INFORMATION SYSTEM	
I. INTRODUCTION	1
A. SPECIFIC OBJECTIVES OF PROJECT	2
B. MUNICIPAL INFORMATION SYSTEM IN RELATION TO STRATEGIC PLAN 1996-97	2
II. INFORMATION COLLECTION ACTIVITIES	5
A. WORKSHOPS WITH DEPARTMENT HEADS	5
1. Workshop of 17 June	5
2. Workshop of 23 June	5
B. INDIVIDUAL MEETINGS WITH DEPARTMENTS HEADS	6
C. GENERAL ANALYSIS OF RESULTS	6
1. Historical/Philosophical Rationale for the Municipal Information System	8
III. INFORMATION MANAGEMENT WITHIN THE POSC	9
A. PRESENT ACTIVITIES, INFORMATION USAGE AND STAFFING OF DEPARTMENTS	9
B. ENTERPRISE-WIDE MANAGEMENT INFORMATION SYSTEM	9
C. THE PROPOSED MUNICIPAL INFORMATION SYSTEM	10
1. Information Technology Aspects	10
IV. CONCEPTUAL FRAMEWORK FOR ESTABLISHING THE MUNICIPAL INFORMATION SYSTEM	13
A. SUBSYSTEMS WITHIN THE MUNICIPAL INFORMATION SYSTEM	13
1. Draft system design concepts for the Municipal Information System	13
B. REAL PROPERTY SUBSYSTEM	14
1. Aspects of a System supporting Real Property Information	14
2. Relevant POSC Functions within a Real Property Subsystem	16
C. INFRASTRUCTURE SUBSYSTEM	20
1. Maintenance of City Institutions and Properties	21
2. Maintenance of Roads and Infrastructure	21
3. Relevant POSC Functions within an Infrastructure Subsystem	24
D. PLANNING SUBSYSTEM	27
1. Present input into Planning of Port Of Spain	27
2. Expected impact of new legislation on Planning and Development and its relevance to the Information System	28
3. Relevant POSC Functions supported by a Planning Subsystem	30

V.	INFORMATION REQUIREMENTS OF THE MUNICIPAL INFORMATION SYSTEM	34
A.	INFORMATION REQUIREMENTS OF SUBSYSTEMS	34
1.	Information Requirements for Real Property Subsystem	34
2.	Information Requirements for Infrastructure Subsystem	36
3.	Information Requirements for Planning Subsystem	38
4.	Standardisation of city's administrative zoning	38

SECTION 2 - DESIGN OF THE MUNICIPAL INFORMATION SYSTEM

VI.	DESIGN ISSUES CONSIDERED FOR THE MUNICIPAL INFORMATION SYSTEM	41
A.	ORGANIZATIONAL AND ADMINISTRATIVE CONSIDERATIONS	41
1.	Evolutionary Process	41
2.	Departmental control over data and functions	42
3.	Compatibility with existing system at City Treasurer's Department	42
B.	TECHNICAL CONSIDERATIONS	43
1.	Computerisation	43
2.	Appropriate skills and training	44
VII.	TECHNICAL DOCUMENTATION ON DESIGN OF THE SYSTEM	46
A.	ORGANIZATIONAL DESIGN ISSUES	46
1.	Subsystems of the Municipal Information System	46
2.	Distributed architecture	48
B.	HARDWARE AND OPERATING SYSTEMS	49
1.	Server	49
2.	Client	50
C.	EVALUATION OF SOFTWARE OPTIONS	51
1.	GIS	52
2.	Relational Database Management Systems (RDBMS)	54
3.	Other Software	55
D.	DATABASE MANAGEMENT - TECHNICAL AND OPERATIONAL STRUCTURE	56
1.	Municipal Information System Network Design Diagram	56
2.	User Capabilities within the Municipal Information System	58
3.	Standard Operating Methodologies within the Municipal Information System	59
4.	Linkage between City Assessor's Department and City Treasurer's Department	61
5.	Examples of Improved Procedures	63
E.	DATA DESIGN AND MANAGEMENT ISSUES	66
1.	Subdivision of the city into functional districts by the various departments	66
2.	Numbering systems for city properties	67
3.	Data Modeling within MGE	68

F.	DATABASE DEVELOPMENT	71
1.	Creation of Base map	71
2.	Creation of attribute database	76
G.	COSTING	76
1.	Hardware	77
2.	Software	77
3.	Database development	77
4.	Personnel	78
5.	Training	78
6.	Required Startup Funding	78
VIII.	MUNICIPAL ORGANISATION STRUCTURE	80
A.	ORGANISATION CHART REFLECTIVE OF MUNICIPAL INFORMATION SYSTEM	80
B.	INTER-DEPARTMENTAL COORDINATION	81
1.	Setup of Database Administration Office	81
IX.	IMPLEMENTATION PLAN	83
A.	COMPONENTS OF THE IMPLEMENTATION ACTIVITY	83
1.	Acquisition of hardware and software	83
2.	Training	84
3.	Personnel	84
4.	Data Collection	84
B.	KEY CONSIDERATIONS FOR SUCCESSFUL IMPLEMENTATION	84
C.	MOST URGENT AND SIMPLEST ACTIVITIES FOR IMMEDIATE IMPLEMENTATION	86
X.	FUNDING THE IMPLEMENTATION OF THE MUNICIPAL INFORMATION SYSTEM	89
A.	INCREASED PROPERTY TAXATION	89
B.	EXISTING POSC BUDGET ESTIMATES FOR AUTOMATION	90
1.	Departmental automation plans and budgetary allocations	90
2.	Use of 1998 Budgetary Estimates to significantly finance Municipal Information System	91
C.	LINKING WITH DIGITAL MAP PRODUCTION FACILITY	91
D.	OTHER SOURCES OF FUNDING	92
	Notes	93
	References	94
	Appendices	96

Summary

The purpose of this report is to outline the design of the Municipal Information System for the Port of Spain Corporation Trinidad and Tobago. This Municipal Information System contains two subsystems, the Real Property Subsystem and the Infrastructure Subsystem. The existing activities within the Corporation in the areas related to Real Property and Infrastructure were investigated. Questionnaires and interviews were used to focus the situation on those areas requiring urgent attention for the Municipal Information System.

This report is subdivided into two sections - the first dealing with Research and Evaluation, the second finalises the Design of the Municipal Information System.

The Conceptual Framework and the Information Requirements of each subsystem were identified and this provided an understanding of how the relevant numerous functions of each of the respective departments would interact and be represented within the Municipal Information System.

Section two of the report describes the design and its attendant considerations in some detail, identifying that a distributed system within the Corporation, relating to each of the relevant departmental users as well as to the City Treasurer's Department, can suit the requirements. A complete description of the Database and the Network Layout Design is included which allows some preliminary costing to be considered.

The Organisational chart for the Corporation, as affected by the Municipal Information System is included, as is a discussion of various funding options available to the Corporation to implement the Municipal Information System.

SECTION 1

INFORMATION REQUIREMENTS AND CONCEPTUAL FRAMEWORK FOR DEVISING A MUNICIPAL INFORMATION SYSTEM

I. INTRODUCTION

This report forms part of a larger project being undertaken by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) as a Technical Cooperation Programme in Systems of Municipal Urban Management for the City of Port of Spain, Trinidad and Tobago (Project ITA/95/S71).

This component of the project centres on the design of a Municipal Information System for the City of Port of Spain. The overall objective of the Information System is to improve the existing urban management process, by supporting the process of modernizing the Port of Spain Corporation.

This report is divided into two sections - the first dealing with the Research and Evaluation of the present situation, the second with the actual Design of the Municipal Information System from technical, procedural and organizational points of view.

The First Section outlines the information requirements and conceptual framework for devising a municipal information system. In particular it encompasses items 1.1, 1.2 and 2.1 of the Terms of Reference, as follows:

- 1.1 Determine information requirements for processing real property information and data on provision of infrastructure and services;
- 1.2 Prepare the conceptual framework for establishing subsystems;
- 2.1 Determine staff availability and requirements and specifying each stage of the reorganization process.

The Second Section presents the proposed Design of the Municipal Information System and encompasses the activity components of the remainder of the Terms of Reference, as follows:

- 1.3 Designing information system (components, inputs, outputs, users, processing methods, budgets, hardware, software, etc.). This system should enable the Corporation to evaluate and use it readily and should provide all the technical elements necessary for its use (from theoretical concepts to design of the configuration, and data-processing systems; in particular, the report should evaluate

different possible configurations, based on computer systems available on the market).

- 1.4 Developing a program for actual implementation of this system with respect to the capacities, resources and policies of the Corporation.
- 1.7 Assistance to the Corporation in identifying possible sources of funding for the system (international organisations, private sources, etc.); assistance in completing applications for funding.
- 2.2 Preparing a programme for implementation and staff training.

A. SPECIFIC OBJECTIVES OF PROJECT

The specific objectives of the project as per the Terms of Reference are as follows:

- 1. To design an information system in gradual and incremental steps which would, primarily, compile real property information and secondary support the planning and urban management processes.
- 2. To re-organise the operational structure of the municipal offices on the bases of the new information system.

B. MUNICIPAL INFORMATION SYSTEM IN RELATION TO STRATEGIC PLAN 1996-97

The project is timely in that it coincides with a concerted exercise in strategic planning and reorganisation that is being undertaken within the organisation. Serious attempts are being made to define a corporate vision statement and specify the Corporation's role in the future. A recent draft of the Vision Statement for the POSC illustrates these intentions as follows:

The Port of Spain Corporation is an international leader in municipal governance with a solution driven, technologically advanced team of Councilors, Aldermen and Employees.

The document "Outline of the Strategic Plan, 1996-97" describes the POSC in terms of its proposed objectives. It is evident that the introduction of a Municipal Information System will positively impact both the 'Success Indicators' and the 'Values' of the POSC, as identified in the document.

The document also identifies nine major functional areas and their respective subfunctions. It is expected that the Municipal Information System will impact directly in six of these major functional areas in the subfunctional areas as follows:

Major Functions	Subfunctions
Administration	<ul style="list-style-type: none"> ■ Records & Information Management ■ Management & Information Systems ■ Advisory & Support Services ■ Socio-Economic Planning
Finance and Investment	<ul style="list-style-type: none"> ■ Revenue Collection & Control
Security	<ul style="list-style-type: none"> ■ Protection of People and Property ■ Traffic Management
Engineering	<ul style="list-style-type: none"> ■ Planning and Design ■ Development & Maintenance of Infrastructure ■ Control & Regulate Buildings and Other Development
Health	<ul style="list-style-type: none"> ■ Environmental Health Control
Property and Estate Management	<ul style="list-style-type: none"> ■ Assessment ■ Valuation ■ Estate Inventory Management ■ Purchasing/Sales/Leasing ■ Institutional Management

II. INFORMATION COLLECTION ACTIVITIES

A. WORKSHOPS WITH DEPARTMENT HEADS

1. Workshop of 17 June

A workshop was held at the Corporation's main meeting room on June 17th, 1997 with the heads of departments and heads of sections or their representatives, the Consultant and the Corporation's counterparts on the project. All departments were represented except for the City Assessor.

This being the first forum for interaction between the consultant and the department heads, the majority of the discussion was exploratory in nature. The department heads had previously been provided with a questionnaire which explained the type of information required by the consultant and was an attempt to guide the discussion for the workshop. Unfortunately, insufficient time had been given for most departments to complete the questionnaire while others did not fully understand the requirements. The workshop then became a useful forum to outline the information requirements of the consultant and set the foundation for the subsequent individual meetings with department heads.

The questionnaire is included as Appendix A.

2. Workshop of 23 June

A subsequent workshop was held at the Corporation's main meeting room on June 23rd, 1997 following the individual department head meetings. This was used to further discuss and consolidate the information collected over the course of the previous week.

All departments were well represented at this workshop and the level of interaction was high. The minutes of this workshop are included as Appendix B.

B. INDIVIDUAL MEETINGS WITH DEPARTMENTS HEADS

In the week between the two workshops a series of individual meetings with department and unit heads were carried out by the consultant. The purpose of these meetings was to primarily complete the questionnaires in as much detail as possible and compile as much department-specific or unit-specific information as possible.

The schedule of meetings was as follows:

Wednesday 18th, June 1997

8 a.m. - 10 a.m.	City Engineer Dept.	Mr. Edwin Yuk Low (Head of Department) Mr. Revenales (Head of Works Section)
10 a.m. - 12 a.m.	Inspectorate Section, Public Health Dept.	Mr. Ali (Head of Inspectorate Section)
1 p.m. - 3 p.m.	Public Health Dept.	Dr. Chang (Chief Medical Officer of Health)

Friday 20th, June 1997

8 a.m. - 9 a.m.	City Treasurer Dept.	Mr. Jeffrey Washington Mrs. Suzette Ablack (Dept. representatives)
2 p.m. - 4 p.m.	City Assessor Dept.	Mr. Seales (Deputy Dept. head)
4 p.m. - 5:30 p.m.	City Clerk Dept.	Mr. Christopher Samuel (CEO/City Clerk)

These meetings proved very productive for ascertaining more in-depth activities and information usage and requirements of the respective departments. Several of the department and section heads promised to provide additional information particularly regarding organizational/staffing charts and maps used to subdivide the city for administrative/functional purposes. Each of the departments was also to provide a copy of all forms used for any form of data collection, management and/or storage. The majority of the consultant's requests for these follow-up information were fulfilled by the relevant department and section heads.

The meeting with the City Clerk/CEO as the last meeting of the entire round proved particularly useful as a sounding board to solicit the wider ranging views of the higher administration as compared to the departmental perspectives gained earlier.

C. GENERAL ANALYSIS OF RESULTS

The questionnaire proved only partially effective in soliciting the responses desired by the Consultant. In most cases these responses were effected in the later individual conversations with department/section heads. Nonetheless, it became clearly evident from the workshop and

discussion responses and particularly from the reactions to sections (2) and (3.b) of the questionnaire, that the operations of the majority of the departments/sections are conditioned into a sequence of standard routines based on long established convention whose relevancy to the desired outcome has not been established but for which (in most cases) no alternatives have been identified and/or proposed. The effects of this being:

- (1) little attention (in most cases) to substantial reorganisation for improved effectiveness which would impact upon:
 - operations and functions,
 - staff capabilities, and
 - work techniques;
- (2) lack of knowledge and understanding as to sources, value and availability of data used in operations.

Additionally, when changes were suggested, in most cases, they would appear to have little more than cosmetic value. Rearrangement of the same functions, undertaken in a similar manner by the same staff, but merely given a different title and a different chain of command may improve the efficiency somewhat but will hardly impact the overall effectiveness of the POSC within its sphere of influence.

It is expected that this response is largely due to two factors:

- (1) the effect of having to deal with sometimes overwhelming duties in a resource-limited environment, and
- (2) the effect of changing political realities which, in the past, have blurred the mandate of the executive of the POSC sufficiently to limit innovation.

The negative effect that these factors have had on defining and holding to a vision for the POSC and on following a Corporate mission was expressed on numerous occasions.

Under the circumstances, one may assume one of two competing scenarios to describe the Corporation's present functions, either:

- (1) extremely effective and efficient system that requires little adjustment, or
- (2) outdated system that has lost its effectiveness to fulfill its primary functions.

As the latter was identified in the First Phase report and the results of this analysis tend to provide confirmation, this assumption holds.

Fortunately the POSC have identified this problem of the Corporation's lack of effectiveness themselves and have initiated a strategic planning and Corporate vision exercise to

re-channel the Corporation's efforts at becoming a more relevant force in the City of Port of Spain. The basis for an effective Municipal Information System is, therefore, already in place.

1. Historical/Philosophical Rationale for the Municipal Information System

An inexplicable respect for the status quo without question, is a common situation throughout the Corporation, as it is throughout the local Civic Service. From a philosophical standpoint, resistance to change is a fact of the human condition as it forces us into the uncomfortable position of facing the unknown. Individuals generally accept and embrace change only when it becomes detrimental to life, liberty or financial sustenance. Thus, it is generally accepted that individuals operating in the Private Sector must embrace flexibility as a means of personal financial survival - either through maintaining their job or the profits of their business. While their peers in the local Civil Service have much less of a threat of losing their jobs because of tradition and Civil Service conditions of employment.

As a result, the Civil Service in Trinidad and Tobago, and indeed, the majority of the Caribbean which have undergone a similar history, still largely operate as they did under British Colonial Rule, over three decades ago. The POSC is no exception.

The major change that has occurred has been those in charge and their motives. The purposes of development and societal control and the collection of revenues, which generally described the Colonial *raison d'être*, have been largely replaced by a system of political control and patronage, not much more interested in development, but rather in gaining the control and support of society at large (i.e. voters).

While the last fifteen years have seen a trend locally in the maturing of these systems towards more business and development oriented approaches, the process is long and arduous. Political patronage is still fully entrenched in the POSC, as the Executive are forever relating instances of forced alteration of some professionally designed plan due to political expedience. However, this will always be so to a degree as an acceptable means of public participation.

This should not necessarily be a cause for despair by the executive - their natural reaction - but rather an impetus to provide well thought out and professional advice and service to the Corporation based upon sound information with a high degree of authenticity and reliability. Only by providing a consistent and concerted approach based on fact rather than subjective opinion, will the executive of the POSC be able to thwart frivolous political interference. By such a consistent and solid approach, the true effect of public participation through political representation will eventually be encouraged. Herein lies a major benefit of a Municipal Information System.

The Consultant believes this approach to be universally true and particularly applicable to the Caribbean and Latin America, where unbridled political patronage often exists.

III. INFORMATION MANAGEMENT WITHIN THE POSC

A. PRESENT ACTIVITIES, INFORMATION USAGE AND STAFFING OF DEPARTMENTS

As a consequence of the above described attempts to ascertain the extent of the activities and the information usage and requirements of the various departments and sections, an evaluation of the multitude of information was undertaken. The results of this exercise are contained in Appendix C and form the information base for the analysis to follow. It represents the consultant's best understanding of the present activities undertaken, information usage and staffing of the POSC.

The primary purpose of the proposed Municipal Information System is to manage the Real Property information of the Corporation. The secondary purpose being to support the planning and Urban Management functions of the Corporation. Therefore, the general focus of the description and analysis contained in Appendix C is on those functional areas of the POSC that are relevant to those sectors. Subsequently, this is not intended to be an exhaustive analysis of the entire functionalities and information management of the Corporation.

Neither were all of the staff of the Departments and Sections considered - only those that may have an impact on (as a user of or contributor to) the Municipal Information System. This should likely exclude daily paid or casual staff - due to their lower skills level - and the majority of the lower-rated clerical staff.

Upon this extensive description of the activities, information usage and staffing of the POSC, the basis of a Municipal Information System was conceptualised.

B. ENTERPRISE-WIDE MANAGEMENT INFORMATION SYSTEM

It became clearly obvious through the workshops and discussions that the multitude of functions of the various departments of the POSC represented the total scope of what may be included in an enterprise-wide Management Information System. This would of course include the physical property and infrastructure management functions of the proposed Municipal Information System as well as additional administrative and general information management functions to

facilitate the Corporation's total operations. The design of the Municipal Information System will consider the wider Information System context of the enterprise.

C. THE PROPOSED MUNICIPAL INFORMATION SYSTEM

The proposed Municipal Information System is expected to fulfill the primary and secondary objectives as specified earlier. It is expected that the Municipal Information System will become an integral part of all activities of the POSC dealing with Real Property, Infrastructure and Planning.

For these reasons the Municipal Information System will largely centre around operations of the City Assessor and City Engineer Departments. It will impact on the Public Health functions to some degree, largely providing a service to the department for the more efficient storage, analysis and retrieval of data.

Nevertheless, it is not expected that the Municipal Information System will be taken up into the regular working repertoire of the Corporation's senior personnel without some resistance and confusion. Department heads do have ideas regarding the restructuring of the departments and sections to suit existing circumstances but in many cases the impact of Information Technologies (IT) have not been considered, except in a superficial sense, largely because its effect on departmental operations is unknown and is difficult for most department heads to conceptualise.

It was also evident from responses to the questionnaire that not much consideration is given to future expansion of activities, training needs and appropriate staffing. This largely holds true for consideration of IT activities within the departments.

Because of these concerns, an important aspect of the design and introduction of a Municipal Information System into the POSC would necessarily require:

1. Its incremental introduction ;
2. Procedures based initially on, or very close to, existing functions;
3. No requirement for the user to understand the technical aspects of the system - unless they so desire.

1. Information Technology Aspects

The challenge is, therefore, to provide the conceptual framework within which a robust yet fairly straightforward Information System (IS) can be applied. The opportunity also arises to consider the use of a multitude of IS options in the Municipal Information System design, such as:

- Relational Database Management Systems (RDBMS),
- Spreadsheets,
- Digital Mapping,
- Computer Aided Design (CAD),
- Geographic Information Systems (GIS),
- Document Management/Archiving, and
- a host of Multimedia options - graphics, video, sound, etc.

Considering the objectives of the Municipal Information System, the major operations that would be expected of the system are as follows:

1. Storage of parcel/property based data.
2. Storage of road, other infrastructure and utility data.
3. Storage of other data with a locational value - i.e. a reference to either a point, line or area feature within the city.
4. Maintenance of historic or archive data.
5. Retrieval of data.
6. Amalgamation of data on conditions.
7. Comparison of data on conditions.
8. Viewing of data.
9. Presentation of results of analysis for decision making.

While it is conceivable that these operations could be managed, in its base form, within a database system, the incorporation of a Geographic Information System (GIS) into the Municipal Information System would further expand the potentials of the system by allowing firstly, a graphical map interface for the information and secondly, further area -wide analyses based on topological or neighborhood relationships. The issue of utilising a GIS was first recommended in the Phase I report of this project but was specifically targeted towards the management of the properties owned by the Corporation for the effective management of their land and building portfolio.^{1/} While this is a useful instrument for these purposes, its utility is being proposed for expansion to include the real property information for all property within the City limits (and some outside, as necessary).

The value of the extended GIS system would be in its ability:

1. Firstly, to support all assessment activities by providing the necessary real property information;
2. Secondly, to support the management of Corporation infrastructure as well as allowing the continuous enhancement of infrastructure management procedures by providing the technological capability to tap into existing and future utility, land and other GIS' that also impact the City in some fashion, and;
3. Thirdly, to support the planning activities of the Corporation by providing the map and information management base to store and analyse all relevant physical and socio-economic data.

The GIS can therefore be the backbone of the Municipal Information System, providing information to assist and support these three subsystems.

a) Base Information Requirements

For a GIS to be operational within the Municipal Information System, digital basemapping for the city would need to be prepared. This is not available through the Lands and Surveys Division (L&SD) of the Ministry of Agriculture, Land and Marine Resources (MALMR), the source of the country's mapping and map data. However, it may be commercially available through private sources. This will be identified and its utility evaluated.

If it is necessary to build all or a large part of this digital map database for the City, the majority of this work may need to be contracted out of the POSC. However, an excellent introduction can be had to the data collection, editing and management aspects of digital map data by completing some of these works within the POSC. This would be a simple enough case of equipping the POSC with some necessary specialist digitising hardware, standard computers, a basic CAD programme and a short training and guidance period for a semi-technical staff member. This will be explored further and outlined further in the implementation scheduling phase.

IV. CONCEPTUAL FRAMEWORK FOR ESTABLISHING THE MUNICIPAL INFORMATION SYSTEM

A. SUBSYSTEMS WITHIN THE MUNICIPAL INFORMATION SYSTEM

The objectives of the project as outlined in the Terms of Reference refer to the creation of an information system primarily which would compile real property information and secondly which would support the planning and urban management process.

The outputs identified in the Terms of Reference indicate that the information system should contain a real property information subsystem as well as a subsystem for the management of infrastructure and services.

It is proposed that the Municipal Information System to be developed contain three subsystems for reasons that will be elaborated further. These subsystems are as follows:

1. Real Property Subsystem
2. Infrastructure Subsystem
3. Planning Subsystem

1. Draft system design concepts for the Municipal Information System

Subsystems are not expected to be physically separated entities but rather can be seen as similar groupings of data relevant to the subsystems as well as the major functions which access the data for their operations.

The Planning subsystem, particularly, is not expected to maintain any data of its own but rather be solely a grouping of major functions that will depend on the data within both of the other subsystems to complete its operations.

It is worth noting that databases - and specifically data tables - within each subsystem of the Municipal Information System will include only data that is relevant to it, but departmental

functions may access only one or cross two or all subsystems to retrieve data necessary to fulfill a functional goal, based upon a set of database design rules that apply.

In fact, because of the nature of the division of the datasets between such subsystem groupings, and the desire not to duplicate data within the total Municipal Information System, certain Boolean rules are expected to apply to the exclusive natures of the datasets and their distribution amongst the subsystems. The conceptual framework behind the Municipal Information System design and the separation of subsystems can be stated by system database design rules, as such:

1. Datasets may only appear within the database of one subsystem within the Municipal Information System.
2. Functions may access datasets from one or more subsystem's databases dependent on their data requirements.

These rules will be expanded in the course of the database design.

For example, at the level of the Real Property and Infrastructure subsystems is stored those datasets that may relate directly to individual parcels or roads, respectively, whereas the Planning subsystem would operate upon the datasets of the Real Property and Infrastructure subsystems to create data of a wider-nature, including data of a socio-economic nature or data that has been amalgamated so that the identity of the original components is not identifiable. This ensures the mutual exclusivity of datasets within each subsystem while providing a two-level hierarchical ranking of subsystems based upon the functionalities of the Municipal Information System.

The Planning subsystem, although it is designed herein to complement Real Property and Infrastructure functions, will be designed so that it can be expanded, as required, to include greater socio-economic and other operational analyses not directly related to these two subsystems.

B. REAL PROPERTY SUBSYSTEM

1. Aspects of a System supporting Real Property Information

The POSC currently has approximately twelve thousand (12 000) properties within its jurisdiction upon which it levies property taxes annually. The collection of these taxes amounts to the largest revenue earner of the Corporation.

A large amount of information is used to effect the valuation - some objective information such as the sizes of properties and the type of structures thereon, some subjective information such as the estimated rental values of the properties and the judgments on real estate market trends. The assessments are based largely upon the timely supply of this information, a major

problem at present which has largely caused the Corporation to miss several re-assessment deadline dates.

The information stored in a real property subsystem can be tailored to fit the requirements of the users with the flexibility to expand to service other user applications as the utility of the system is extended. It is expected that all information presently used to undertake the duties of the City Assessor will be supported. This will include the relatively 'fixed' information on the physical characteristics of the property, the 'semi-fixed' information on issues such as ownership and usage and the 'transient' information such as rental and market values. The first two categories are clearly characteristics of each property that are either physically, legally or technically a component or description of the property itself. While the latter requires the input of professional knowledge to transform information on area-wide property rentals and sales into trends that may affect the value of the property.

Therefore, while the Municipal Information System will support the functions of the City Assessor's Department, the requirement of professional judgment is not easily replicable in an information system.

a) Digital Fiscal Cadastre

A fiscal cadastre may be defined as an inventory of land parcels that provides the information necessary to determine the value of each parcel and the tax due on it.^{2/} A digital fiscal cadastre would be an automated system used to maintain the same information for the same purposes.

Dale and McLaughlin also state that the steps to creating a fiscal cadastre are as follows:

1. Identify and map all properties
2. Classify each property
3. Analyse market data
4. Value each property
5. Identify owners and taxpayers
6. Prepare valuation rolls
7. Send out bills and collect taxes
8. Establish appeals procedures.^{3/}

Arguably, all of these steps have already been established to varying degrees by the POSC. However, the frustrations still exist at the POSC that the use of the available property taxation instruments is not being maximised by the POSC, corresponding to a less than desirable revenue generation from this activity.

Notwithstanding the implied problems of political interference in the property assessment and taxation activities and the definite lack of professional competence in the assessment field within the POSC, the major technical problem that exists in the assessment and property taxation

field within the POSC has undoubtedly been the lack of timely maintenance of the necessary information to undertake steps 1 - 5. Additional problems exist in the unwieldy manual management of steps 6 and 7.

It is expected that a digital Municipal Information System based on proper collection and management of real property information would effectively provide the necessary information to enhance the assessment activity and, by extension the property taxation activity and revenue generation of the Corporation.

2. Relevant POSC Functions within a Real Property Subsystem

Given the previous analysis of the Corporation's activities by Department, those activities of each Department/Section whose information could conceptually be managed by the Real Property Subsystem within the Municipal Information System are identified below.

a) City Engineer Dept. and the Real Property Subsystem

Type of Activity performed by <i>Transport and Cleansing Section</i>	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Garbage Collection	Daily, regular	Collection regions fixed.
Removal of derelict vehicles	Council, City Police	Locations of vehicles.
<i>Works Section</i>		
Construction of retaining walls	Internal work demand. Public requests. Council requests.	Location of works required. Nature of works required.
Preparation of project estimates	Based on internal requests.	Project location and nature.
Project feasibility assessment	Based on requests from council	Project location and nature. Knowledge of internal design, construction and financial capability.
Design		Location of works required. Nature of works required.
Pruning & cutting of trees	Internal work demand. Public requests.	Location of works required. Nature of works required.
<i>Buildings Section</i>		
Receive & acknowledge building/development applications	Town and Country Planning Division (T&CPD).	Approved building/devt. plans. Name and address of applicant.

Type of Activity performed by <i>Buildings Section (Cont'd)</i>	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Compare building plans to building regulations	T&CPD. POSC building regulations.	Approved building/devt. plans. Knowledge of POSC building regulations.
Site inspection	T&CPD. Internally collected.	Approved building/devt. Plans. Site location.
Structural verification of building	T&CPD. POSC building regulations.	Approved building/devt. Plans. Knowledge of POSC building regulations.
Solicit public health verification	POSC Public Health (P.H.)Dept.	Recommendation of P.H. Dept.
Approve/refuse building permits	T&CPD. Internally collected.	Approved building/devt. plans. Results of above activities.
Monitor approved construction	T&CPD. POSC building regulations.	Approved building/devt. Plans. Knowledge of POSC building regulations Conditions of Building permit.
Investigating and reporting unauthorised construction	T&CPD. POSC building regulations.	Approved building/devt. Plans. Knowledge of POSC building regulations Conditions of Building permit.
Certification (completion certificates)		Given upon request of constructing party

b) City Assessor Dept. and the Real Property Subsystem

Type of Activity performed by City Assessor Department	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Assessment of 12 000 properties within the POSC limits every 3 years	Internally collected Title Registry	Valuation Information: <ul style="list-style-type: none"> • Property size • Usage of property • Address of property • Rental Values approximated Title deeds (optional).
Mailing out these assessments by March 31 st annually	Internally collected	Owner name. Owner address.
Reassessment of structures that are improved	Internally collected Building Section, City Engineer Department (C.E. Dept.)	Valuation Information. Information on all building construction, renovation and other development.
Assessment of new structures as built	Internally collected Building Section (C.E. Dept.)	Valuation Information Information on all building construction, renovation and other development.
Valuation of the Corporation's land leases		Info. on POSC landholdings.
Recording mergers and subdivisions of properties and renumber properties	Building Section (C.E. Dept.)	TCPD subdivision Plan. C.E.Dept. Final approval.
Do insurance valuation for Corporation properties		Listing of POSC properties. Valuation Information.

c) Public Health Dept. and the Real Property Subsystem

Type of Activity performed by <i>Inspectorate Section</i>	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Monitoring and surveillance of health environment in POS	Min. of Health (MOH) Min. of Local Government Water and Sewerage Authority (WASA) Solid Waste Management Company (SWMC)	Government policy on health and food handling. Sectoral inputs regarding health aspects of city.
Monitoring the sale of food of all food handling outlets	Trinidad Public Health Laboratory, Govt. Chemist (MOH), Caribbean Industrial and Research Institute (CARIRI)	Results of laboratory testing.
Investigation of complaints by public	Various Govt. depts., WASA, City Engineer Dept. (C.E.Dept.)	Location of complaint. Nature of complaint.
Maintenance of public conveniences, sewage disposal and chemical toilets.	Night Soil Unit (P.H.Inspectorate). WASA. SWMC. Administrative Section (P.H.Dept.) Complaints of public.	Location of cesspits, pits and chemical toilets. Location of WASA collection infrastructure. Historical information on activities of Night Soil Unit.
Control of mosquitoes, vermins, bats and stray dogs	Vector Control Unit (P.H. Inspectorate). POS Dog Pound (C.E.Dept.). Centeno Experimental Station, Min. of Agriculture, Lands and Marine Resources (MALMR). Administrative Section (P.H.Dept.) Complaints of public.	Location of problem. Nature of problem. Rabies testing and results. Reports of field inspectors. Regular vector control exercises. Location of all vacant lots in city and owner's name and address. Historical information on vector control activities and positive occurrences.

Type of Activity performed by <i>Inspectorate Section</i> (Cont'd.)	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Consider building applications for approval	Town and Country Planning Division (T&CPD). Building Section (C.E. Dept.) Administrative Section (P.H.Dept.)	Public Health guidelines on construction and structures. Approved building plans from T&CPD. Historical information on building applications
Consider lease applications for approval	Administrative Section (P.H.Dept.)	Public Health guidelines on structures and environment. Historical information on leases and lease applications.
Water connection applications	WASA. Administrative Section (P.H.Dept.)	Historical information on water applications.

C. INFRASTRUCTURE SUBSYSTEM

A major mandate of particularly the City Engineer's Dept. of the POSC lies in the area of management and maintenance of the city's physical infrastructure. This includes:

1. Parks and squares
2. Roads
3. Main waterways
4. Drains (surface and underground)
5. City-owned institutions (eg. markets, cinerary, etc.)
6. Cemeteries

A secondary objective of the function of a Municipal Information System is the support for infrastructure management. This will be provided by the ability of the system, to maintain data necessary for the efficient completion of infrastructure management activities.

These maintenance and management functions are undertaken in a resource-limited environment. While the City Engineer's Department has a large daily-paid staff of skilled, semi-skilled and unskilled employees to effect these works, constraints of money, materials and long entrenched labour arrangements that do not favour medium to longer term development, all

combine to limit the effectiveness of these operations. The effect is that proactive development and regular maintenance works are often foregone, by necessity, in favour of emergency works and work planning is often done on a week to week basis.

The major effect of a Municipal Information System in this area will be its ability to provide information of a locational, temporal and administrative nature to assist in more effective, information-rich work and maintenance planning.

1. Maintenance of City Institutions and Properties

The City of Port of Spain owns and operates several institutions for the benefit of the public and for its own internal operations. The City Engineer's Dept. is responsible for the operation and maintenance of institutions as listed:

1. St. James Market
2. Central Market
3. Port of Spain Abattoir
4. Lapeyrouse Cemetery
5. Mucurapo (Woodbrook) Cemetery
6. Western Cemetery
7. The Cinerary
8. Transport & Cleansing Dept. Headquarters
9. Public Tennis Courts
10. City Hall
11. All Parks and Squares
12. Other Recreational Facilities
13. Public Conveniences.^{4/}

Access to historical information on the instances of maintenance, construction materials, etc. would allow a better projection of maintenance requirements for these institutions and properties. This leads to better planning of workflows, personnel needs, equipment purchases and finance budgeting. These data management functions can all be developed by the City Engineer's Dept. to their requirements.

Additional information of a spatial nature can also be maintained with the GIS functionalities of the Municipal Information System.

2. Maintenance of Roads and Infrastructure

The physical infrastructure of the City is also managed by the POSC. This would include all road, drainage and, as an informed user and unofficial landlord, the utilities.

Much the same constraints identified above for the maintenance of institutions and properties applies for these maintenance functions. However, similar use of databases and a GIS

to assist in the management functions can be made use of. For example, conditions of roads or the occurrence of potholes on roads, could be recorded in the GIS and coded with a graded rating indicating its level of significance and/or need for repair. These codes can be used to dispatch work gangs to fix roads. The same can be done for all city infrastructure. Emergency works can also then be better handled because, even if delays exist for the planned infrastructure repair/construction works, the quantum of the works are known and the time, personnel and equipment budgeting can be better managed.

From a GIS design aspect, infrastructure such as roads, rivers and drainage are represented by line features and these lines form a series of networks along which information can be associated. The use of network datatypes within the GIS allows additional functionalities that can also assist Planning functions.

a) Management of Utility Information

At present, the POSC does not manage or maintain any of the utilities which service city properties and crisscross the city. Responsibility for utilities resides in several quasi-governmental and private agencies, as listed:

Utility Infrastructure	Function Performed	Agency Responsible
Water distribution lines	Distribution of potable water	Water and Sewerage Authority (WASA)
Sewerage lines and manholes	Sewage collection	WASA
Natural Gas Pipelines	Distribution of natural gas to power generating facilities	National Gas Company
Electricity poles and lines - above and under ground	Distribution of electricity	Trinidad & Tobago Electricity Commission (TTEC)
Fire hydrants	Firefighting	Fire Services
Salt water distribution lines	Distribution of salt water for fire hydrants	WASA/Fire Services
Street lights and lightpoles	Lighting of streets	TTEC
Telephone poles and lines - above and under ground	Provision of telephone services	Telecommunication Services of Trinidad and Tobago (TSTT)
Television Cable lines and poles	Connection to cable TV	Various private cable companies
Telephone switch boxes	Management of lines and individual customer services in area	TSTT
Electrical transformer compounds	Step up/down of electricity supply	TTEC
Water booster stations	Regulate water pressure	WASA
Various Generating, Treatment and Collection plants/Administration/Storage areas, etc.	Non-distribution functions of utility companies	All Utilities

While the POSC has no jurisdiction over the operations or management of utilities within the City, the utility companies do have a responsibility to inform the POSC of their space needs or of their needs to undertake excavation works ahead of time. In practice this is loosely followed. There is an existing coordinating committee between the POSC and the utility companies but they hardly meet because of the perceived lack of a well-defined mandate and terms for their cooperation.

In Trinidad and Tobago, the utility companies, led by WASA, are arguably the most advanced and definitely the most prominent users of GIS. WASA, in particular, has done extensive mapping of the country, including Port of Spain, and is also attempting to store information on all of its distribution and collection facilities within the GIS.

With the introduction of similar technology and working procedures in the POSC as part of the Municipal Information System, maximum advantage can be taken of the opportunity to access data held by the utility companies for their facilities within the City. Also, the POSC can get involved in the maintenance and management of utilities in a meaningful way by being able to provide the utility companies with improved assistance in spatial distribution and planning as well as data collection. Consequently, in an indirect way, the POSC may be better able to become a significant influence on the city-wide operations and management of the various utility companies, with a more sound footing from which to exert its will on the development of utilities within the City.

3. Relevant POSC Functions within an Infrastructure Subsystem

Given the previous analysis of the Corporation's activities by Department, those activities of each Department/Section whose information could conceptually be managed by the Infrastructure Subsystem within the Municipal Information System are identified below.

a) City Engineer Dept. and the Infrastructure Subsystem

Type of Activity performed by <i>Transport & Cleansing Section</i>	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Maintenance of equipment with the following service sections: <ul style="list-style-type: none"> • Tyre repair shop • Tractor shed (heavy equipment) • Garage works • Welding shop • General servicing • Battery works • Paint shop • Facilities maintenance • Internal security 	As required or regular servicing.	As required or regular servicing.

Type of Activity performed by <i>Transport & Cleansing Section</i>(Cont'd)	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Major cleaning of rivers	Internally collected. Works Section (C.E.Dept)	Location of necessary works.
<i>Works Section</i>		
Roadway repairs	Internal work demand. Public requests.	Locations of potholes.
Repairs to slipper drains and other masonry repairs	Internal work demand. Public requests.	Locations of repairs required. Nature of repairs required.
Welding works, metal fabrication	Internal work demand.	Location of work required. Type of works required.
Maintenance of park greenery	Internal work demand. Public requests.	Daily work schedules. Special attention to complaints.
Sweeping road surfaces	Fixed daily activity (gangs of six people involved)	Daily work schedules. Special attention to complaints.
Washing of road surfaces (Central Business District)	Fixed daily activity (gangs of six people involved)	Daily work schedules. Special attention to complaints.
Removal of silt from underground drains	Fixed daily activity (gangs of six people involved)	Daily work schedules. Special attention to complaints.
Sweeping of main water courses	Fixed daily activity (gangs of six people involved)	Daily work schedules. Special attention to complaints.
Resheeting of roads with asphalt	Development programme that is usually contracted out - Periodic	Locations of roads. Scope of Works.
Construction of retaining walls	Internal work demand. Public requests. Council requests.	Location of works required. Nature of works required.
Preparation of project estimates	Based on internal requests.	Project location and nature.
Project feasibility assessment	Based on requests from council	Project location and nature. Knowledge of internal design, construction and financial capability.

Type of Activity performed by <i>Works Section (Cont'd)</i>	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Design		Location of works required. Nature of works required.
Bridge repair (primarily masonry works)	Big jobs done by private contractors	Locations of bridges. Scope of Works.
General bldg maintenance	Internal work demand.	Regular maintenance schedule.
Pruning & cutting of trees	Internal work demand. Public requests.	Location of works required. Nature of works required.

b) City Assessor Dept. and the Infrastructure Subsystem

Type of Activity performed by <i>City Assessor Department</i>	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Naming of streets	Building Section (C.E. Dept.)	TCPD subdivision Plan. C.E.Dept. Final approval.
Recording mergers and subdivisions of properties and renumber properties	Building Section (C.E. Dept.)	TCPD subdivision Plan. C.E.Dept. Final approval.

c) Public Health Dept. and the Infrastructure Subsystem

Type of Activity performed by <i>Inspectorate Section</i>	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Maintenance of public conveniences, sewage disposal and chemical toilets.	Night Soil Unit (P.H.Inspectorate). WASA. SWMC. Administrative Section (P.H.Dept.) Complaints of public.	Location of cesspits, pits and chemical toilets. Location of WASA collection infrastructure. Historical information on activities of Night Soil Unit.
Water connection applications	WASA. Administrative Section (P.H.Dept.)	Historical information on water applications.

Type of Activity performed by <i>Inspectorate Section</i> (Cont'd)	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Control of mosquitoes, vermins, bats and stray dogs	Vector Control Unit (P.H. Inspectorate). POS Dog Pound (C.E.Dept.). Centeno Experimental Station, Min. of Agriculture, Lands and Marine Resources (MALMR). Administrative Section (P.H.Dept.) Complaints of public.	Location of problem. Nature of problem. Rabies testing and results. Reports of field inspectors. Regular vector control exercises. Location of all vacant lots in city and owner's name and address. Historical information on vector control activities and positive occurrences.

D. PLANNING SUBSYSTEM

1. Present input into Planning of Port Of Spain

Physical planning of the city is essentially undertaken by the Town and Country Planning Division (T&CPD), the central planning authority for the country within the ambit of the Ministry of Planning and Development. There is little input from or control by the Corporation. The effect of this is obvious as it is clearly stated by the CEO and other administrative heads of the POSC, that the majority of them have never actually read the Port of Spain Plan of 1987 prepared by the Town and Country Planning Division. The CEO is even unsure as to whether the Corporation has a copy of the plan, and it is not referred to in the regular management of the city.

The major input into planning of the city in which the POSC is involved is in the checking of building plans by the City Engineer's Department and the Public Health Department to ensure that they comply with building codes and public health guidelines, respectively. Two copies of the final plans are submitted to the POSC by the T&CPD after the latter has already given its final planning approval. The T&CPD also has an outline planning approval stage in which plans are submitted by the applicants for change of use and during which discussions may ensue on the viability of the proposal, leading to a decision by the T&CPD. The POSC is not involved nor generally consulted for this initial approval for change of use.

The obvious choice by the POSC, voiced many times during discussions with the department heads, is that the POSC would like to be much more involved in the planning of the

city. The realities of the situation, requiring trained staff and altered organizational arrangements are also evident for such a function to be incorporated into the POSC.

2. Expected impact of new legislation on Planning and Development and its relevance to the Information System

The draft Bill of the expected 'Planning and Development of Land Act' has very recently become available for comment. It contains many drastic differences to the existing planning legislation, many which may affect Local Authorities in substantial ways.

There are provisions in the draft Bill that would provide the local authorities with much greater control over major aspects of planning.

a) Devolution of Development control and building construction approval functions to local authorities

It is proposed in the draft Bill that full powers of Development Control and Approval over Building Construction be devolved to local authorities, including the POSC. The draft Bill states the following:

7A.(1) Within one year of the coming into operation of this Act, the Commission shall consult with local authorities and prepare for the approval of the Minister a report setting out a programme for devolving to local authorities the functions of determining appropriate categories of-

(a) development control matters as provided for in Part IV; and

(b) matters relating to-

- (i) the issue of building and demolition permits;*
- (ii) the safety of buildings;*
- (iii) the inspection and approval of work performed on buildings undergoing construction and the issue of certificates of completion therefor; and*
- (iv) the inspection and approval of the installation of infrastructure and services in land subdivision layouts*

in accordance with any provisions made therefor under Part V.

(2) The Minister may approve such report with or without amendments and, in accordance with the provisions of section 26, shall make an order appointing the several local authorities to be planning authorities to discharge such functions and exercise such powers as are specified in the order.^{5/}

b) Appointments to prepare development plans

Local authorities, including the POSC, may be given the powers to determine and design their own Development Plans. This will give the POSC substantial power to guide the development of the city along a path it so chooses. The draft Bill states:

12.(1) Of his own motion or upon the advice of the Commission, the Minister may, by instrument in writing and subject to such conditions, directions, reservations and restrictions as the Minister considers appropriate, appoint for the purpose of preparing a development plan, other than a development plan for the whole of Trinidad and Tobago-

(a) a local authority; or

(b) an authority appointed by the Minister for the purpose of preparing a development plan,

such local authority or authority appointed by the Minister being referred to herein as a "planning authority."^{6/}

c) Appointment of Local Authorities as Planning Authorities

The draft Bill will also seek to provide local authorities, including the POSC, with full powers over Development Control - the ability to effectively approve or reject proposed developments as they relate to the development plan of the city - by appointing them as 'Planning Authorities'. The proposed legislation states:

26.(1) Subject to subsection (6), the Minister shall after consultation with the Commission, by order and subject to such conditions, directions, reservations and restrictions as the Minister deems appropriate, appoint a local authority or any other body or authority, herein referred to as a "Planning Authority," the authority to-

(a) receive applications for permission to develop land, either generally or in respect of different developments or different classes of development;

(b) grant, with or without conditions, permission to develop land pursuant to applications therefor;

(c) refuse applications for permission to develop land; and

(d) return incomplete and undetermined applications to applicants.^{7/}

d) Possible consideration for a Planning Department within the POSC

With the introduction of the expected new legislation as outlined above, it is more than likely that the POSC will require an entire new department dedicated to Planning. A Planning Department that is required to effectively undertake the functions as indicated above cannot be operated simply as a sub-department within the existing organizational structure.

This assumption is the rationale behind the consideration of a separate Planning Subsystem for the Municipal Information System. The impact of the legislation and the subsequent organisational restructuring are not likely to be long in coming and, as such, it would be wise to incorporate the necessary information system architecture at the time of introduction of the system.

These organizational restructuring aspects need serious further consideration at all levels of the POSC.

3. Relevant POSC Functions supported by a Planning Subsystem

Given the previous analysis of the Corporation' activities by Department, those activities whose information could conceptually be managed by the Planning Subsystem within the Municipal Information System are identified below.

a) City Engineer Dept. and the Planning Subsystem

Type of Activity performed by <i>Buildings Section</i>	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Receive & acknowledge building/development applications	Town and Country Planning Division (T&CPD).	Approved building/devt. plans. Name and address of applicant.
Approve/refuse building permits	T&CPD. Internally collected.	Approved building/devt. plans. Results of above activities.

b) City Assessor Dept. and the Planning Subsystem

Type of Activity performed by <i>City Assessor Department</i>	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Assessment of 12 000 properties within the POSC limits every 3 years	Internally collected Title Registry	Valuation Information: <ul style="list-style-type: none"> • Property size • Usage of property • Address of property • Rental Values approximated Title deeds (optional).
Valuation of the Corporation's land leases		Info. on POSC landholdings.
Naming of streets	Building Section (C.E. Dept.)	TCPD subdivision Plan. C.E.Dept. Final approval.
Do insurance valuation for Corporation properties		Listing of POSC properties. Valuation Information.

c) Public Health Dept. and the Planning Subsystem

Type of Activity performed by <i>Health Education Section</i>	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Community surveys on health behaviour	Institute for Social and Economic Research (ISER)	Trends in society
Mobilising the community to effect a health-related action		Perceptions of the community of the Dept. and the programmes
<i>Inspectorate Section</i>		
Monitoring and surveillance of health environment in POS	Min. of Health (MOH) Min. of Local Government Water and Sewerage Authority (WASA) Solid Waste Management Company (SWMC)	Government policy on health and food handling. Sectoral inputs regarding health aspects of city.

Type of Activity performed by <i>Inspectorate Section</i> (Cont'd)	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Control of mosquitoes, vermins, bats and stray dogs	Vector Control Unit (P.H. Inspectorate). POS Dog Pound (C.E.Dept.). Centeno Experimental Station, Min. of Agriculture, Lands and Marine Resources (MALMR). Administrative Section (P.H.Dept.) Complaints of public.	Location of problem. Nature of problem. Rabies testing and results. Reports of field inspectors. Regular vector control exercises. Location of all vacant lots in city and owner's name and address. Historical information on vector control activities and positive occurrences.
Maintenance of public conveniences, sewage disposal and chemical toilets.	Night Soil Unit (P.H.Inspectorate). WASA. SWMC. Administrative Section (P.H.Dept.) Complaints of public.	Location of cesspits, pits and chemical toilets. Location of WASA collection infrastructure. Historical information on activities of Night Soil Unit.
Consider building applications for approval	Town and Country Planning Division (T&CPD). Building Section (C.E. Dept.) Administrative Section (P.H.Dept.)	Public Health guidelines on construction and structures. Approved building plans from T&CPD. Historical information on building applications
Consider lease applications for approval	Administrative Section (P.H.Dept.)	Public Health guidelines on structures and environment. Historical information on leases & lease applications

Administration Section

Use of all P.H. Dept. records to incorporate in a Planning related function for neighborhood, zone or city-wide analysis. Information, such as follows, would be made available in original form or aggregated to the study level and/or in a statistical form:

- Births and deaths
- Food handlers
- Liquor licenses
- Certificates of registration
- Immunization
- Ambulance services
- Revenue of liquor licenses
- Complaints on health matters and nuisances in the city
- Building plans
- Leases
- Water applications
- Cleaning and emptying of cesspits and septic tanks

V. INFORMATION REQUIREMENTS OF THE MUNICIPAL INFORMATION SYSTEM

A. INFORMATION REQUIREMENTS OF SUBSYSTEMS

Having established the Conceptual Framework of the various subsystems of the Municipal Information System with an appreciation of their various functions, and also having related the activities of the appropriate POSC departments to these subsystems, the necessary information that will support the functions of the various subsystems was determined.

The identification of information requirements was predicated upon several assumptions, as listed:

1. Information requirements were based upon existing information needs and presently perceived additional needs to support expanding requirements.
2. Listing and classification of information is not intended to be exhaustive but mainly the guide for the information management of each subsystem.
3. As the primary objective of the design of the Municipal Information System confirms the approach of developing it “in gradual and incremental steps”, and as it is fairly easy to add information management responsibilities to the IS once expandability is catered for in the design stage, it is not expected that all future information requirements will be, or indeed need to be, identified.
4. Regardless of the detailed attention to design, a large part of the actual design of any IS actually takes place at the implementation stage in an iterative process. The success factor for the Municipal Information System is in ensuring that the IS design concept is sound.

1. Information Requirements for Real Property Subsystem

It is expected that the Municipal Information System will be designed to manage a multitude of different datatypes and datasets. At the Real Property level all data that can be allocated to the

one physical feature - the property - can be included. This will include both physical descriptors of the property itself (such as Size) as well as administrative and related descriptors (such as Owner Name).

1. Physical characteristics of properties within the Corporation
 - Size
 - Boundaries
 - Buildings/structures
2. Locational information of all properties
 - Addresses
3. Planning Information
 - Actual usage
 - Approved usage
 - Date of approval from T&CPD
4. Ownership Information
 - Owner Name
5. Occupation information
 - Occupant name
 - No. of occupants
6. Public Health Information
 - Vector control information
 - Information on clearance of cesspits/septic tanks
7. Other information
 - Unique identifier

Within the Municipal Information System there will also be a lot of other inherent relationships that will be stored that can add to the description of the property itself. Through the use of the Overlay function and Topological capabilities of the GIS, many other relationships can be determined. For example, the nearest schools, police station , fire hydrant, etc. can be determined using these relationships as required. These data do not need to be stored as attributes of each property because they can be generated by the system.

2. Information Requirements for Infrastructure Subsystem

The following information can be supported by the Municipal Information System:

1. Parks, Squares and Recreational Facilities
 - Name of Park/Square
 - Location
 - Area
 - Perimeter
 - Usage (passive/active)
 - Description of any structures
 - Name of caretaker/manager
 - Last date grass cut/maintained
 - Next date to cut grass/maintain
2. Markets
 - Name of market
 - Address
 - Name of caretaker/manager
 - Employee information
 - Number of stalls of different types
 - Names of vendors
 - Stall rental information (renter/amount/date due/outstanding amt./etc.)
 - Last date maintained/cleaned
 - Next maintenance date
 - Description of works to be done
3. Port of Spain Abattoir
 - Address
 - Name of caretaker/manager
 - Employee information
 - Information on type and number of cattle/animals slaughtered
 - Fees information
 - Last date maintained/cleaned
 - Description of works to be done
4. Cemeteries
 - Name of cemetery
 - Address
 - Name of caretaker/manager
 - Employee information
 - Burial information
 - Map of cemetery layout showing plot ownership/burial/assignment/etc. information
 - Fees information
 - Last date maintained/cleaned
 - Next maintenance date
 - Description of works to be done

5. The Cinerary
 - Address
 - Name of caretaker/manager
 - Employee information
 - Service fees information
 - Information on equipment
 - Last date maintained/cleaned
 - Next maintenance date
 - Description of works to be done
6. Transport & Cleansing Dept. Headquarters
 - Address
 - Area
 - Perimeter
 - Name of caretaker/manager
 - Employee information
 - Information on services performed by type for the year
 - Information on cost of services performed by type for the year
 - Information on equipment
 - Last date maintained/cleaned
 - Next maintenance date
 - Description of works to be done
7. Public Tennis Courts
 - Address
 - Area
 - Perimeter
 - Name of caretaker/manager
 - Employee information
 - Information on facilities (courts/fences/stands/lights/posts/nets/etc.)
 - Last date maintained/cleaned
 - Next maintenance date
 - Description of works to be done
8. City Hall
 - Address
 - Area
 - Perimeter
 - Building information
 - Information on completed maintenance
 - Maintenance-due information
 - Description of works to be done

9. Public Conveniences

- Name of public convenience
- Address
- Name of caretaker/manager
- Information on building and facilities
- Last date maintained/cleaned
- Next maintenance date
- Description of works to be done

Much of this data already exists in manual ledgers within the POSC as well as inherently within the minds of the senior and supervisory staff.

3. Information Requirements for Planning Subsystem

Information requirements to support the present Planning functions of the POSC are sufficiently cumbersome to encourage consideration of an information system to assist in the management of these functions. Most of the present planning-related information - for example on building plans - can be stored at the Real Property level as an attribute of that subsystem.

With the introduction of new Planning legislation, the scope for the collection and management of planning-related information magnifies many times over. This will include a multitude of socio-economic data derived from different sources that will assist in preparation of development plans for the City.

4. Standardisation of city's administrative zoning

Each of the Departments in the POSC use a different zoning of the City to effect its responsibilities. Even within departments, among sections, this disparity occurs.

This creates immediate logistical problems in the case of multi-sectional or multi-departmental projects being undertaken. The effect being that common zoning references are useless and coordination can become difficult.

For comparison and analysis of historical data - these are generally amalgamated and represented by zones - cross-referencing or matching of information between departments and/or sections becomes difficult or worthless.

This may not be a problem now but with the introduction of a Municipal Information System and especially with the digital mapping and locational data stored in a GIS, problems will occur where data overlays (the ability to compare different data types over the same area to determine some trends, conditions or occurrences) may be problematic or impossible.

Agreement needs to be made between the POSC department/section heads as to the standardisation of City area administrative zoning. A committee comprised of department/section heads needs to deal with this as the rationale behind many administrative zoning choices are highly subjective and/or technical.

It is proposed that the eventual intention is to determine a series of zones that can be subdivided into subzones that can be further subdivided into sub-subzones, etc. The effect being that data is always collected and maintained at the lowest level and can be amalgamated to the level of generalisation required for the particular project or purpose at hand. Data can then always be shared and compared between departments as the same area can be constructed from a combination of zones.

SECTION 2

DESIGN OF THE MUNICIPAL INFORMATION SYSTEM

VI. DESIGN ISSUES CONSIDERED FOR THE MUNICIPAL INFORMATION SYSTEM

A. ORGANIZATIONAL AND ADMINISTRATIVE CONSIDERATIONS

1. Evolutionary Process

a) Implementation focused

The major raison d'être for the design of a Municipal Information System from the outset is that it be implementable. The strength of the design is expected to be that it can be implemented with the minimum of disruption to Corporation operations or resistance from Corporation staff.

In order to achieve this it is proposed to not attempt to do "too much, too soon" but rather in an evolutionary process that is embraced and understood along each step of the way before the next step is significantly implemented. In the environment which typifies the POSC, and even though it is sorely needed, it will be difficult to propose and effectively implement both significant departmental reorganisation as well as new operating procedures based on automation.

Therefore, within the context of the larger goal towards increased effectiveness and efficiency of the POSC, it is probably better to have the system design fit the functionalities of the user rather than adjust the functionalities of the user substantially to fit the design of the system. This will be explored within the design.

b) Acceptance Within POSC

The above situation could largely affect the acceptance of the system and its intentions within the Corporation. Regardless of the technical value of the design, if the system does not meet with the approval of the individuals who are expected to implement it on a daily basis, it has failed in its primary function - effective implementation.

In addition to the above, careful consideration must be taken in recognising the general limited level of technical and professional qualification and competence at the POSC as well as the limited exposure to/experience with similar concepts and operating procedures and environments.

This is particularly evident at the City Assessor's Department, as expressed in Section 1 of this report.

c) Fostering Communication Within POSC

An evolutionary approach will also encourage small steps at internal communication in an effective way, based on fixed procedures on a technical basis. Means will be built into the system that force increasing levels of interaction and interdependency between Corporation departments, leading to a more cohesive whole over time. A small yet effective example would be the in-built system feature whereby the assessment data at the City Treasurer's Department will be automatically updated nightly to reflect any alterations made in the course of the day by the City Assessor's Department.

2. Departmental control over data and functions

Of major concern to all departmental heads is that control over and management of the department's data not be relegated to a central authority. From the point of view of maintenance of accurate and relevant data within the respective departmental databases, this may also prove the most useful approach. Each department will obviously have a vested interest in maintaining the accuracy and relevancy of its data.

3. Compatibility with existing system at City Treasurer's Department

There needs to be an interactive linkage between the City Treasurer's Department and the City Assessor's Department to allow the assessment data to be passed real-time to the Treasurer for collections and accounting. This cannot only occur once in a while as the Assessment Rolls are created or largely updated, but must be on a very regular basis to reflect the daily operations of the City Assessor's Department in upgrading and updating the valuations of city properties.

As the City Treasurer's Department already utilises a computerised system for its payroll operations and as it expects to expand into information on revenue collection for the property taxes, it is imperative that the Municipal Information System designed have full operational connectivity to the City Treasurer's Department database, for the necessary transfer of valuation and payment information.

B. TECHNICAL CONSIDERATIONS

1. Computerisation

a) Existing Computerisation

The existing hardware available within the POSC, except for the City Treasurer's and City Clerk's Departments, is extremely obsolete and carries out very little useful function. From minutes of the Computer Networking Committee of the POSC, the total computer capacity in the POSC outside of these two departments is:

- 1no. 386 Computer
- 2no. 486 Computers

These are used in no effective means other than for simple office administration functions.

The City Treasurer's Department has undergone an evolution in its automation to arrive at the point where it is now. It operates its payroll management functions utilising a UNIX network with a server and four (4) client PC's. Plans exist to expand to upgrade the capability of the system to, firstly, handle the payroll more efficiently and also to manage assessment data and rates and taxes payment records.

The City Clerk's Department is presently proposing an expansion of the automation of its operations. An extensive networking report exists for this department and also incorporates hardware improvements for the City Police Department as well as the City Treasurer's Department.

b) Context for Automation Initiatives within the POSC

It is expected that the two main initiatives towards automation of operations within the POSC, at the City Clerk's Department and the City Treasurer's Department, are suitable to the internal requirements of the respective departments as the management of these departments were directly involved in the selection and determination of the hardware requirements. However, outside of these initiatives there exists no serious consideration of automation. Also, from the overall position of the total Corporation, there exists no comprehensive computerisation plan within which these initiatives actually fit.

It is within this context that the Municipal Information System is proposed. It is ironic that the two departments that seem least interested in serious automation of their activities, the City Assessor's Department and the City Engineer's Department, form the greatest portion of the focus of the Municipal Information System.

Although the operations of the Municipal Information System are primarily directed to these two departments, an attempt will be made to provide a Corporation-wide focus by the direct and/or indirect incorporation of functional aspects of diverse sectors of the Corporation.

Simplicity in the design and the component hardware and software will also allow a wider acceptance and eventual usability of the system. Attempts were made to utilise common operating systems and hardware at the interface with the user, although "behind the scenes", transparent to the regular user, is designed a robust Information System utilising the most recent in GIS technology - a leading edge spatial management technology itself - and incorporates multiple operating systems utilising Open Database Connectivity (ODBC) and Open Systems methodologies.

2. Appropriate skills and training

Existing training in the use of computers is being undertaken in-house through an initiative started by Alderman Lewis. From a slow start this training has become very popular and is now over-subscribed by Corporation employees. This is an excellent start at introducing the Corporation employees to automation.

In general, the skills level of the Corporation employees is fairly low, with an inordinate proportion of clerical and daily-paid workers with little or no technical skill at all.

For a Corporation-wide system of automation of operations to take place, an extensive modernisation of the work force will be necessitated. This will entail training programmes in computer usage and training on specific software programmes. It may also involve some substitution of unskilled and clerical workers with new workers with the necessary computer skills as well as the needed initiative to operate within a modern corporate environment.

The Municipal Information System does not, at present, require such large workforce adjustments as it will attempt to evolve these within the POSC. It is expected that a significant impact from the introduction of the Municipal Information System will be the gradual but timely transformation of a larger portion of Corporation workforce to a higher skill level. At a point in the future when more comprehensive Corporation-wide automation is desired and the stated Corporation goal of becoming technology driven and a model of modern municipal operations is sought, decisions on a minimum technological skill level for employees must be made.

The Municipal Information System will require the introduction of one to two highly skilled individuals in the field of Database and Systems Management as well as GIS operations management. As the latter especially are extremely scarce in the local workforce, it is expected that the implementation phase must entail a degree of "handholding" by vendors and external consultants, while both formal and on-the-job training is gained by a suitably qualified individual.

The existing proposal by the City Clerk's Department for training of a Database Administrator and a System Manager is encouraged and should be expanded to further move the Corporation along the path of automation of operations.

VII. TECHNICAL DOCUMENTATION ON DESIGN OF THE SYSTEM

A. ORGANIZATIONAL DESIGN ISSUES

Taking the lead from the database design concepts identified in Chapter V and particularly the assumptions guiding the Information Requirements, the design of the Municipal Information System was concretised.

1. Subsystems of the Municipal Information System

As identified in the discussion on the conceptual design issues in Chapter IV, the subsystems are not designed as physically separated entities but rather as similar groupings of data relevant to each subsystem accompanied by the major functions which access the data for their operations. The datasets of each subsystem - data tables, digital map data, etc. - will, therefore, not reside in different places within the POSC, but rather within different places in the Municipal Information System database itself.

Therefore, the subsystems are identified more as a means of understanding the functional and organisational grouping of data and operations rather than actual defined sections of the Municipal Information System itself. In other words, one will not be able to enter the database of the Municipal Information System and look in a section of the database entitled "Real Property Subsystem". For this reason, it is proposed that once the initial design and setup of the Municipal Information System is complete, the subsystems become transparent to the user. These will be functionally represented by Graphical User Interfaces (GUI's) at the departmental level.

The discussion on the subsystems will be used until the actual design specific to the software identifies the transfer of these data and functions to actual database tables and digital maps and illustrates the interrelationships.

a) Real Property Subsystem

This subsystem will substantially include all of the datasets maintaining data best represented at the level of the parcel.

The majority of the data presently collected and maintained by the City Assessor's Department will be included as will the data related to individual parcels stored at the City Engineer's Department, such as information related to applications and approvals for Building Permits, etc.

All of the maps presently used by the City Assessor's Department for the referencing of parcel-level data will be entered into the Municipal Information System also to provide the base upon which the GIS will operate and to which all of the attribute data at the parcel level can be connected.

The City Assessor's Department maintains an extensive collection of files and maps to represent all of the 12 000 properties within the Corporation's limits. Each property is allocated a file - a physical manila folder - in which all information, documentation and correspondence relating to the property is kept. Each property is identified by an address consisting of a street name and the appropriate number of the property on the street, eg. 33 Gallus Street. No totally unique property referencing system is used.

Cadastral reference maps are maintained for the entire City through the 1968 cadastral/topographic maps at 1:1 250 scale. These are the Master maps to which all reference is first made in attempting to place a property. These are supplemented by additional general survey plans in most areas where further subdivision or merger of parcels has occurred since the 1970's. Notations are made on the Master map to reference the additional survey plans so as to assist in the search for a particular property's map.

Each of the property folders is referenced to the map(s) by means of a street number written in on the parcel on the map(s) which represents the property.

b) Infrastructure Subsystem

This subsystem will include all data that refers to the infrastructure of the City, such as roads, rivers, drainage courses, utilities, etc. Although it is not expected that utility information will be initially designed into the system because its management is not under the purview of the Corporation, the system will be designed to incorporate it as it becomes necessary or useful.

The functions of this subsystem are largely undertaken by the City Engineer's Department in terms of management and maintenance of the infrastructure of the City. Digital map data of the City's infrastructure will also form part of this subsystem.

c) Planning Subsystem

As expressed previously, the Planning subsystem is not expected to maintain any data of its own but rather be solely a grouping of major functions that will depend on the data within both of the other subsystems to complete its operations.

Planning functions, in this context will include both the present legislated planning functions of the POSC, that relate to permits and approvals but will be more geared towards the expanded role of the Corporation in the effective planning of its own spatial layout and management that will come with the passage of the 'Planning and Development of Land Act', as expressed previously in Chapter IV, subsection D-2. This is expected within the second quarter of 1998.

2. Distributed architecture

A distributed architecture system for the network is proposed as the most efficient and acceptable means of both utilising the system effectively and satisfying the valid requirements of the individual departments that their functionalities not be usurped by a centralised system. This system is also preferred to a system of total separation of systems at each department from the point of view of its providing greater organisation-wide data sharing and consistency as well as by avoiding duplication of the Corporation's resource allocation in hardware, software and personnel.

In this design, a central Administration Office will be responsible for the storage, editing and maintenance of data to ensure a standard level of consistency and accuracy. Each department that impacts the Municipal Information System will access this central office as a client over a network system. Thus a Client - Server design will be utilised.

A different grouping of functionalities will be allowed the clients as opposed to the server for reasons of maintaining data security and some degree of centralised control over the integrity of the data. The different functional groupings at each can be described as follows:

SERVER - Administrator

Can undertake the following operations within the system:

- Input data
- Reporting/Output data
- Query data
- Analyse data
- Edit data
- Maintain/Alter Database structure
- Provide permission to users to access database through user accounts

CLIENTS - Users

Can undertake the following operations within the system:

- Input data (limited)
- Reporting/Output data
- Query data
- Analyse data

B. HARDWARE AND OPERATING SYSTEMS

As identified at the “Technical Considerations” level, simplicity in the design is essential for its effective system management and particularly in its interface to the end user. This is particularly true in the POSC where the level of computer skills and familiarity is deficient and the system is expected to evolve over time.

Therefore, two aspects were considered in determining the eventual hardware and operating system configurations of the Municipal Information System:

- the best configuration to satisfy the capabilities of the server and
- the simplest yet most effective interface for the user.

1. Server

Several valid options were considered, each having merit on its own.

a) Operating Systems

The selection of software that complied to Open Systems architecture and ODBC standards allowed the flexibility in the choice of the operating systems within the server itself and indeed across the client-server platform and also in respect of the interfaces the client may maintain with the Corporation’s other networks. The operating system required by the software thus became the overriding consideration.

Windows NT Server was determined as the operating system for the server system as it is required for the chosen software.

b) Hardware

The determination of the hardware requirements of the server was based on the required data processing, data management, data storage and peripheral capabilities of the system as well

as the requirements of the software. The most effective system that could provide these required capabilities in the simplest configuration was determined. Cost issues were also considered.

As it is expected that the data management for the GIS will be undertaken here also, additional consideration had to be given to the provision of expanded data input and output capabilities. For this reason a digitiser and plotter were also included.

Below are the **minimum** requirements for the proposed server hardware and peripherals:

SERVER

266Mhz Intel Pentium II processor

- 64 MB RAM
- 3.6 GB Hard drive
- 4mm DAT Tape Backup
- CD ROM drive
- 17" Monitor
- Windows NT Server
- 10 base T Network card

DIGITISER

- 24" x 36"
- Including stand

COLOUR PLOTTER

- A1/E Size
- Including Roll Feed Kit
- Inkjet

COLOUR PRINTER

- Inkjet
- 8.5" x 14"

ADDITIONAL PERIPHERALS

- UPS

2. Client

a) Operating Systems

The chosen operating system at the client workstations, the interface with the users, was determined to be necessarily simple to operate and providing a common, well-accepted interface to the user. Windows 95 was determined to suit these conditions best while it could also provide the necessary functionality with the server software and operating system. There is easy

compatibility between Windows NT and Windows 95 - as server and client operating systems, respectively.

b) Hardware

At each of the departments that interfaces with the Municipal Information System a system must be put in place to provide the interface between the user and the server. While the majority of the GIS processing functions will be done by the server, the client system must still be sufficiently robust to manage several database and other operations. The client systems and their users must also be given the capability to output report presentation material without the necessity to interact directly with the server system. A tabloid size colour printer is proposed for this requirement. Only one should be required per department, regardless of the number of workstations in the department.

As the capabilities of the users at the various departments interacting with the Municipal Information System matures, additional workstations with the same configuration should be acquired.

Below are the **minimum** requirements for the proposed server hardware and peripherals:

CLIENT WORKSTATIONS

133Mhz. Intel Pentium processor

- 32 MB RAM
- 1.2 GB Hard drive
- Windows 95 / Windows NT Workstation
- 10 Base T Network Card

COLOUR PRINTER

- Inkjet
- 11" x 17"

ADDITIONAL PERIPHERALS

- UPS

C. EVALUATION OF SOFTWARE OPTIONS

As identified previously, a GIS along with an RDBMS are required to provide the functionalities required of the Municipal Information System. Other Software are proposed to be included in the grouping, which will improve the utility of the system to the user. Within each of these software groupings an evaluation was made.

1. GIS

The determination of the GIS to be used in the Municipal Information System was guided by the following factors:

- Internationally proven capability
- GIS functionalities
- Local technical support
- Cost

Only two GIS packages met the necessary qualifications to be considered as possible options for the Municipal Information System. Others fell short in one or more of the above evaluation areas. The main area in which all other systems fell short was in the crucial area of being able to provide effective local technical support. Although several other GIS packages besides the two mentioned do have local agencies, they are as yet unproved and potentially technically lacking.

The two GIS packages that were considered for the Municipal Information System were the Arc/Info package from Environmental Systems Research Institute (ESRI) and Intergraph MGE (Modular GIS Environment) from Intergraph Corporation.

a) Intergraph VS Arc/Info

i) Internationally Proven Capabilities. It is very difficult to determine any significant gain by one of these packages over the other in this area. Both are considered the industry leaders and if one would believe the propaganda that emanates from both, one would have to believe that each is always ahead of the other.

The significant point here is that each are by far represented in more GIS sites than the nearest competitors. The applications they both satisfy range the full gamut from environmental and resource management to traffic routing and utility information systems.

On the international scale, it would be difficult to place one ahead of the other but they both outrank their nearest competitors in proven experience - though maybe not necessarily in pure GIS functionalities.

ii) GIS Functionalities. Although the two packages present and undertake GIS functions such as overlays, buffering, etc. differently, from the point of view of pure GIS technology they essentially are capable of the same analyses, albeit in different ways.

The main functional advantage that Intergraph MGE holds over Arc/Info, however, is in its greater ease of use and understanding to the new user and the consequently shorter learning curve and easier skills upgrade throughout a project.

Several examples will be used to explain this as follows:

The CAD base of Intergraph MGE, using Microstation (Computer Assisted Design) CAD software as the base of its design makes the interface and the functional setup of the system easier to understand to new users and especially to users familiar with common CAD packages. Arc/Info users, however, must from the outset learn an unfamiliar user interface and commit to memory many unfamiliar software-specific terms or the meanings thereof.

Intergraph MGE design languages throughout the software are Visual Basic and Visual C whereas Arc/Info utilises several proprietary design languages. Granted that although these would not be immediately used within the Municipal Information System by POSC users of the system, they will be, as users gain skill and confidence in the system. They must be used from the outset in the design stage, however, by the technical system developers to effect maximum use of the software and develop the necessary interfaces and other flexibility for the POSC users. The Arc/Info design languages are as follows:

- for viewing, Arc/View (a simplified user interface package for client stations) uses a design language called Avenue
- to create batch commands in Arc/Info, a design language called Arc Macro Language (AML) is used
- to manipulate the graphic data effectively, a design language called Spatial Data Engine (SDE)

Each is essentially different and has its own learning curve.

In comparison, it is far easier to obtain programming services, various documentation and training as well as it is easier to become independent of the software vendor for much costly support, when using the industry-common design languages used by Intergraph MGE - Visual Basic and Visual C.

Data modeling and representation of real-world objects and their attributes is more readily understandable to the user and better reflects the organisational structure of the Municipal Information System and the POSC, under Intergraph MGE than it does with Arc/Info. Intergraph MGE represents attributes by a system of category and feature classes which attempt to mimic real-world interrelationships. Arc/Info does not encourage inherent relationships to be effectively designed into the database setup of the system.

iii) Local Technical Support. In this area Intergraph MGE has significant advantage over Arc/Info. This is a result partly of international corporate marketing methodologies obviously in use by the parent companies of the respective software packages and partly because of visible local marketing and product sales strategies. Of course, the subjectivity of this particular evaluation is unavoidable as the majority of the reasoning is based on experiences of the Consultant, third party experiences and personal observation and evaluation of the local and international marketing strategies.

Nevertheless, the predominantly greater commitment to the effective completion of the GIS project, to the satisfaction of the user and project owner, resides in the local agent for Intergraph MGE, Complete Computer Systems (CCS). It is this Consultant's opinion that the lack thereof by the local agent for Arc/Info, Fujitsu-ICL, is not so much the strategy of the local agent but more in keeping with the marketing strategy of Arc/Info's parent company, ESRI, towards a policy of market saturation of the software product at lower cost, dealing with the project development and management issues at a later date, as the users attempt to effect the system for his project.

Additionally, CCS is part of the local Neal and Massy Corporate Group which may have a longer range local development philosophy which is reflected in the patient and gratuitous attitude of the management of CCS to the unforeseen problems which have arisen in GIS project development.

Although insufficient local GIS projects have attained the maturity necessary to effectively evaluate the outcomes to determine any quantifiable trends, these qualitative trends and professional interpretations will lean the issue of local technical support in favour of Intergraph MGE.

iv) Cost. Software package costs are an obscure evaluation determinant as the modular nature of these GIS's and their various useful software appendages, leaves a fair degree of flexibility in the costing of software. Both packages are, however, in a similar price range.

The more important cost factor for evaluation is in the area of costing for project setup in terms of time, in-house personnel time and external consultant cost and time. This cost factor often outweighs the initial software cost by a multiple of five to ten, making the initial software purchase a negligible cost factor in the whole project.

Because of its generally longer learning curves and project startup period, it is expected that the implementation of an Arc/Info-based project will be more costly.

Intergraph MGE is proposed as the GIS software to be used. Microstation is also necessary to form the base upon which Intergraph MGE operated and provide all CAD functionalities.

2. Relational Database Management Systems (RDBMS)

a) Oracle RDBMS

In making an evaluation of which RDBMS to consider one is led naturally to favour the industry leader for issues of compatibility and support. This is also the case in this evaluation. In the Consultant's knowledge of existing relevant technical applications locally, Oracle RDBMS

appears to be the leader. And definitely in existing GIS or related applications, the same holds true.

However, even so, this is no reason on its own to select this software over others. Other reasons identified to support this evaluation include:

- Oracle is already in use at the City Treasurer's Department
- It is well proven internationally alongside GIS software
- There is extensive local support and a regional users forum in the Eastern Caribbean Oracle Users Group (ECOUG)

The combination of these reasons favour the selection of Oracle as the RDBMS to be used in the Municipal Information System. Particularly, the existing payroll system operating in the City Treasurer's Department gives an in-house expertise based on project development and systems management that would be hard to gain simply from training courses.

3. Other Software

In addition to the software above, additional software are proposed.

a) Microstation

As explained, will form the base upon which Intergraph MGE resides. Microstation provides the CAD functionality to Intergraph MGE.

b) Parcel Manager

Is proposed to be included as a specific add-on to the GIS. It is a module of the Intergraph MGE suite of software that provides specific functionalities in the area of management of parcel-based data. The value of this add-on module is that the majority of functionalities that one would like to see represented within a software that is to assist in the management of parcel-based data, would already be represented in this module. This means, less time, effort and money would be required to develop these suboperations - actually macros or batch operations of the primary GIS software operations. This will reside at the server only.

It is proposed that, at the time of implementation, the Parcel Manager software be evaluated in operation to determine its exact fit within the system and the further degree of customisation that may be required. At that time, an understanding of the extent of the fit of the software to the Real Property information management solutions required will be fully evaluated.

c) Geomedia

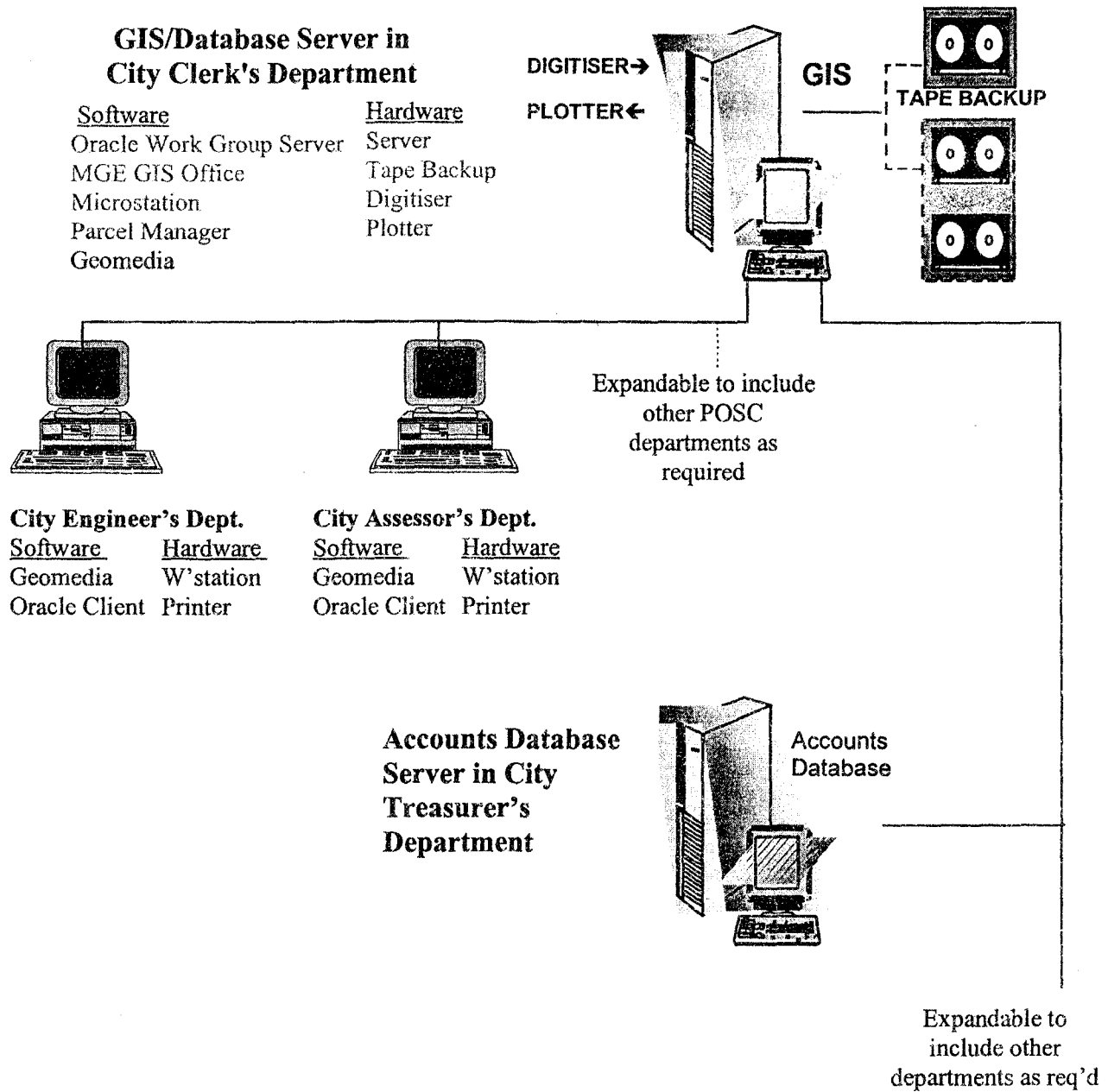
Geomedia is proposed to be used at all workstations (server and clients) to provide ease of use of the system for the regular users at the departmental level. It provides a simplified interface that can be easily customised using standard programming language to reflect the exact functional requirements of the users at each department, respectively. This will allow a faster acceptance of the system and the easier amalgamation of the system into regular departmental operations.

Further technical and other descriptions of the Intergraph software - Intergraph MGE, Parcel Manager and Geomedia are available on the Intergraph webpage at WWW.INGR.COM. Users groups which are linked to this page also provide some excellent evaluation tips and implementation ideas gained through experience.

D. DATABASE MANAGEMENT - TECHNICAL AND OPERATIONAL STRUCTURE

1. Municipal Information System Network Design Diagram

The proposed layout of the network Municipal Information System is identified by the diagram on the following page. Key components of this design are elaborated further in this subsection.



MUNICIPAL INFORMATION SYSTEM NETWORK DESIGN DIAGRAM

2. User Capabilities within the Municipal Information System

a) Centralised capabilities of GIS Manager

Preceding discussion identified the possibility of sharing the functions of the Database Manager/Systems Manager required by the City Clerk's Department with the functions of the GIS Manager required for the Municipal Information System. It is likely, however, that one individual will not be found with the necessary qualifications to fulfill these multiple roles and that the roles of Database Manager/Systems Manager for the City Clerk's Department will need to be separated from the role of Municipal Information System GIS Manager.

The significance of this is that the duties of the GIS Manager cannot be delegated to a non-qualified Database Manager/Systems Manager for the effective management of the Municipal Information System.

The GIS Manager has the following capabilities within the system:

Data Management Capabilities

- Input data (map and/or attribute)
- Output data (map and/or attribute)
- Query data (map and/or attribute)
- Perform analyses on data (map and/or attribute)
- Edit data (map and/or attribute)

Database Management Capabilities

- Alter Database Structure (map and/or attribute)
- Provide/manage/remove user accounts
- Determine access privileges for each user (or department) independently - this would include one or a combination of the capabilities listed above and could be for the entire database or part of it.

b) Distributed capabilities of departments

For the purposes of the Municipal Information System for the POSC, it is advised that departmental users not be given any of the Database Management Capabilities and that these be reserved for the GIS Manager. Additionally, it is advised that the departmental users not be allowed Editing capabilities of any kind or Map Data Input capabilities. The capabilities thus proposed at the departmental level are:

- Input attribute data only
- Output data (map and/or attribute)
- Query data (map and/or attribute)
- Perform analyses on data (map and/or attribute)

3. Standard Operating Methodologies within the Municipal Information System

Arising from the above identification of the capabilities of each component user, a description of the effect on operations methodologies is provided below.

a) Input Map Data

The GIS Manager will be solely responsible for the input, updating, management and maintenance of the digital map base of the Municipal Information System.

It is not desirable for the departmental users at the client workstations to be allowed to manipulate this base data as it may interfere significantly with the topological connections of the GIS database. If the departmental user identifies an instance where editing of the digital map base is required, the necessary information with an explanation attached on a prescribed paper form, should be forwarded to the GIS Manager. Alternatively, an electronic bulletin can be sent to the GIS Manager by the departmental user indicating the alteration necessary. The GIS Manager will act on the information with due attention to maintain the integrity of the information in the GIS.

The map data input will be done through digitising in Microstation.

b) Input Attribute Data

Attribute data input will be undertaken at both the level of the GIS Manager and the Department user (client) using Oracle RDBMS. Customised input by the use of standardised input forms or tables is proposed. This simplifies the operations for the user and gives the system a certain transparency that does not require the user to learn Oracle. The value in this is that it will allow the use of temporary data input staff in the initial stages of building the database as well as in subsequent stages where data-input-intensive operations are necessary - for example, during a re-valuation exercise for a large part of the City properties.

c) Output Map data

Output of map data will be performed at both sites. At the server four output options are available, dependent on the need. Microstation, Intergraph MGE, Parcel Manager and/or Geomedia can provide the server with output capabilities. Map output capabilities at this site will include output to both colour printer and colour plotter for a range of map sizes from letter size to maps E-size in width by practically unlimited length.

At the clients, the output will be managed through Geomedia, using full access to the graphic GIS database and customisation of the output to full GIS specifications. Output at the

client sites will be to colour plotters with 11" by 17" capability. Larger maps can be printed, through the network, at the server site.

d) Output Attribute Data

Attribute data can be output at both server and client using Oracle, with its attendant linkages to the GIS database. Queries will be inbuilt at the client sites to facilitate output of commonly or regularly required information. These will be developed using the capabilities of Oracle Forms.

e) Query Map Data

Queries on the map data will be performed at both clients and server using Intergraph GIS functionalities. At the server, the GIS Manager has the option of using either Intergraph MGE, Geomedia or Parcel Manager for querying the map database. The clients will use Geomedia for this purpose. Within Geomedia will be built customised functions that will allow standard or regular queries to be inbuilt as a menu item, requiring only one command to initiate a batch operation that performs the query on the map database. Full GIS query functionalities will be available through Geomedia.

The GIS Manager will have the added flexibility of using Intergraph MGE and Parcel Manager.

f) Query Attribute Data

Queries on the attribute data will be performed at both server and clients using Oracle. Standard attribute queries can be pre-built using Structured Query Language (SQL) macros and set in a menu format for the users at both sites. Full SQL capabilities through Oracle will be available to all users.

g) Analysis of Map Data

The clients will use the Geomedia interface to access the functionalities of the Intergraph MGE and the parcel Manager. Departmental-specific GUI's should be developed to reflect the requirements of each respective department. These GUI's should include within their menus most of the common analysis functions undertaken at the specific department, built using macros that are invisible to the user. As the departmental users mature in their use and application of the system, they can learn additional functionalities of the various software and apply them, as desired.

The server will utilise the above but also have access to the full capabilities of Intergraph MGE and Parcel Manager.

h) Analysis of Attribute Data

Analyses can be performed on the attribute data at both server and clients using Oracle. Analyses of the attribute data will usually be in conjunction with an analysis that is performed on the map data, the connectivity between the two allowing access to the relevant records of the attribute database. Full SQL capabilities through Oracle will also be available to all users.

i) Edit Map Data

The client users will not be allowed to edit map data as this may affect the structure of the relationships between the map data and their respective attribute data. If the client user identifies that some map data requires editing, the use of paper and/or electronic message forms is proposed for the transfer of the necessary information on the require editing to the GIS Manager at the server.

The GIS Manager can use the full functionalities of Intergraph MGE and Parcel Manager to effect the necessary editing, as identified by the client users. The GIS Manager will in this way also take care to ensure the proper connectivity is maintained between the map data and its respective attribute data to ensure the integrity of the data is maintained.

j) Edit Attribute Data

The client user can edit attribute data using Oracle. Common editing functions can be inbuilt to the GUI's at the respective departments to facilitate this. Additionally, Oracle Forms can be used to design appropriate input formats that may be easier for the client users to understand and will allow them to operate the system and input valuable attribute data without an extensive knowledge of Oracle itself.

The GIS Manager at the server will have the responsibility to regulate the editing of the clients and perform accuracy and data integrity checks over incoming edits. The GIS Manager at the server will also be able to undertake any necessary editing using Oracle.

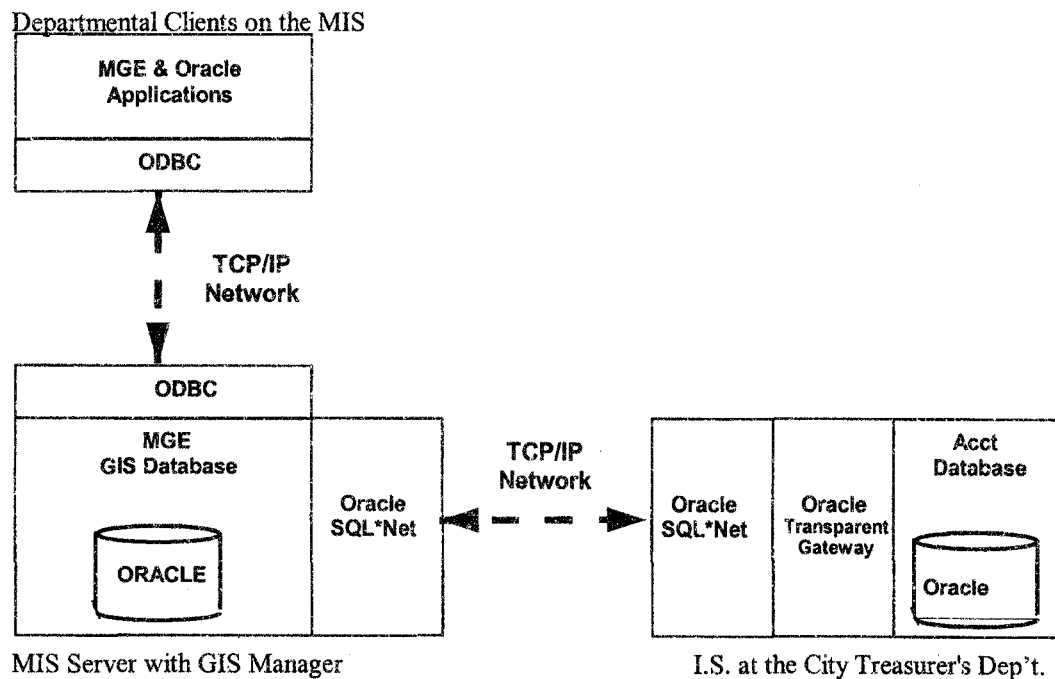
4. Linkage between City Assessor's Department and City Treasurer's Department

As a separate database is proposed for the Municipal Information System as opposed to the present accounting and payroll Administrative I.S., a link must be created between the two using Oracle. With the City Assessor's Department being expanded to include the digital assessment data, the link can be maintained between the two databases using a unique identifier. The data

can then be transferred on a nightly basis from the City Assessor's Department files to the City Treasurer's Department files to upgrade the digital assessment roll with any newly collected valuation and assessment data.

With the population of the attribute tables of the GIS database by the City Assessor's Department, the unique identifier used for each parcel will also have to populate in the corresponding record for the parcel in the City Treasurer's Department database. Using Oracle's SQL Net and the unique identifier as the link, the information for the parcel from both databases can be viewed simultaneously in Oracle and a report generated.

The diagram below illustrates the interface between the Municipal Information System and the existing I.S at the City Treasurer's Department.



Components of the linkage are as follows:

- Open Database Connectivity (ODBC) used to maintain connection between departmental users and Municipal Information System server
- Oracle networking software, SQL*Net used to transfer Oracle data between different Oracle databases maintained at the Municipal Information System server and the City Treasurer's Department database. This will effect the transfer across the different operating systems also - the former using Windows NT and the latter using UNIX.
- SQL macros are used to effect the daily (at night) transfer of updated assessment data from the City Assessor's Department to the City Treasurer's Department via the Municipal Information System server.

- TCP/IP network used to maintain correct addressing of the terminals on the total organisational network.
- Within the City Treasurer's Department I.S. the Oracle Transparent Gateway is used to present data in a UNIX-recognised format from the original NT format. This function translates NT database tables into a format for Oracle or UNIX to understand.
- Maintaining a separation of the City Treasurer's Department accounts and payrolls database from the rest of the departmental users ensures a higher degree of security. Only the GIS Manager at the Municipal Information System server will have authorisation to send data to the City Treasurer's Department I.S.

5. Examples of Improved Procedures

Substantially less effort would be required to update and maintain both assessment and other property-based data as well as data on the City's infrastructure. Operating procedures, capabilities and duties would be clearer as identified in subsection 3 above. The main benefit from the system is, therefore, expected to be in the overall improvement of efficiency, particularly in the assessment functions and infrastructure management functions of the City Assessor's Department and City Engineer's Department, respectively. Additionally, increased efficiency at the City Treasurer's Department would be borne by the reduction in the exorbitant paperwork and updating of a multitude of ledgers with numerous cross-references.

Efficiencies

- Easier retrieval of map data
- Easier retrieval of parcel attribute data
- Easier cross-referencing of parcel data
- Easier storage and retrieval and effective evaluation of trends (for budgeting, work planning, etc.) of all data related to each parcel in the same database (the Municipal Information System) or in a linked database (eg. at the City Treasurer's Department) rather than papers distributed amongst the various departments (valuations data, ARV, building permit info, vector control info, payments and arrears).
- Easier storage and retrieval and effective evaluation of trends (for budgeting, work planning, etc.) of information related to infrastructure (descriptive information as well as information on activities performed, eg. last date cleaned)

Added to that, new capabilities that were impossible previously will become standard functions of the departments, increasing efficiencies further. Some of these will include the items listed below.

a) Automatic Mail Merging and printing of Assessment notices

Using Oracle's SQL Net the data in the Municipal Information System database can be setup so as to facilitate the merging of the data in the fields to other commonly used documents stored in other Windows programs, eg. Microsoft Word. The ODBC driver can be set up as the "source" of the data and in the document the data fields can be appropriately positioned and the data merged so as to facilitate the automatic generation of multiple different copies of the same document using the data from the database. For example, if the document had to be posted and the data was stored in the database the address fields could be positioned in the document and the data merged so that the address information could be automatically generated on the documents for immediate mailing.

The end document being mailed out from the City Assessor's Department with the notice of tax payable for the year in question, will look exactly like the existing form sent to taxpayers. Of course, the design of the form can be altered, if so desired.

b) Automated Identification (Flagging) of Properties due for Maintenance

In the database, the last date that each section of road, park, institution, building, river, etc. was maintained, will be stored as a field. And using the GIS viewers on the client systems at the City Engineer's Department, queries can be done on this field so as to establish whether the time period between maintenance checks for the parcels has elapsed. For example, in other words, the City Engineer can sit at his office with his computer and query the database to find all City infrastructure that had not been maintained in any way in the last three months. In the implementation stage of the GIS, structured queries can be designed such that if the maintenance period has elapsed, the affected parcels will become highlighted or flagged and using the mail merge feature or otherwise, regular conditioned outputs can be generated leading to the easy planning and dispatching of maintenance crews.

c) Posting of arrears notices with annual assessment notices - improved revenue collection

Presently, data on payments of taxes are stored in ledgers at the City Treasurer's Department alongside the information on the property tax values for each parcel provided by the City Assessor's Department. However, the information on arrears on payments to date is not returned to the City Assessor's Department for posting to the taxpayers along with the notices of taxation for the current year. This may be a cause for large arrears outstanding because of an ineffective means of notification and the fact that payments for current property taxes will be accepted by the City Treasurer's Department before arrears are liquidated. The system gets unnecessarily confused leading to difficulties in revenue collection and frustrated taxpayers who may not be cognizant of their arrears.

It is provided for in the design that the link between the City Assessor's Department and the City Treasurer's Department will also allow the data on arrears to be available to the former.

It is proposed, therefore, that the annual notice of property taxation that is sent to taxpayers, include an automated notice of arrears, using the same technical means as described above.

d) Updating of data on parcel splits and mergers

Presently, parcel data is updated as collected by the City Assessor's Department. This information on changes that have occurred is gained either through notification of a subdivision or merger from the Town and Country Planning Division or through the result of in-house investigation.

When a parcel is either subdivided or merged at present, a process is put in place at the City Assessor's Department to reflect the reality of the new situation. If a subdivision occurs, all the contents of the file representing the parcel are photocopied and placed in another folder(s) and a notification of the date of the split and the origin of the original 'parent' parcel are made in the folio placed in each file. The 'new' parcels are renumbered and these new numbers are identified on the respective file folders. For example 33 Gallus Street could be subdivided to 33A and 33B Gallus Street, each with its own folder. The subdivision is also indicated on the Master map by a hand drawn boundary line(s) or a general survey plan for the subdivision is filed with the appropriate notation made on the Master map indicating the existence of this sub-map.

For a merger much the same occurs, except in the opposite direction. The contents of the two or more files is combined into one file which represents the 'new' parcel. The original numbers are discarded and a new number is allocated to the merged parcel. Alternatively, one or more of the original numbers is chosen to represent the address of the 'new' parcel. For example, 33, 35 and 37 Gallus Street are merged with the result being either 33, 35, 37 or 33-37 Gallus Street as the new address. The folio in the new file indicates the original parcels and the date of the merger. The merger is also identified on the Master plan by a hand-drawn notation or a reference to a general survey plan for the merger held in-house.

The Municipal Information System will, of course, do away with these systems in favour of a system where the split or mergers are recorded directly onto the map database. The Municipal Information System will reduce the need for large amounts of paper-based files. Those paper documents that may be useful on a regular basis can be scanned into the system as an attribute of the parcel, while the remainder of the paper documents can be archived. Additionally, historical information can be maintained as an attribute of the parcel itself so as to retain information on the mergers or subdivisions of the parcel. Automatically generated numbering will provide the identifier between the new parcel and its attributes in the data tables.

- e) Eliminate need for manual duplication of assessment role from City Assessor's Department to City Treasurer's Department and WASA

The database linkage, as identified in the diagram above, between the City Assessor's Department and the City Treasurer's Department via the Municipal Information System server, will allow the automated transfer of all assessment data from the former department to the latter. This will eliminate the need for the tedious procedure that now holds where the assessment data for all 12 000 properties is manually transcribed to an exact copy of the assessment data at the City Treasurer's Department. The further transcribing of this data within the City Treasurer's Department, into several other assessment books separated by streets or city areas can also be eliminated.

This data can also be provided to WASA in a digital file by a diskette or magnetic tape or via electronic communication means using a modem.

- f) Eliminate need for manual updates and cross-referencing of assessment role

The database linkage can also take advantage of the use of regular automated updates of the assessment information across the entire POSC. Rather than using the present system whereby paper notices are sent out weekly or monthly to the City Treasurer's Department and WASA by the City Assessor's Department indicating the new assessment values of re-assessed properties, this information can be electronically transferred almost automatically - or daily as is proposed.

E. DATA DESIGN AND MANAGEMENT ISSUES

Several key factors affect the way in which the real-world is modeled and stored as representative data in the system. Both physical and administrative situations must be accurately and effectively modeled in the system for it to reflect reality and therefore provide a degree of management of these situations that as closely mimics the real-world as possible. The major of these are discussed below.

1. Subdivision of the city into functional districts by the various departments

It is proposed that the many different subdivisions that are used for the functions of the various departments within the POSC remain for the present. As the Municipal Information System is evolutionary in nature, it is proposed that the introduction of automated procedures and information management and analysis capabilities will be a significant enough adjustment at this time. It is not desired that the process of acceptance of these automated procedures and usage be in any way hindered by additional fundamental alteration of the working arrangements of the departments. By altering the functional subdivisions of the city by each department to reflect a

standardised format, many new conceptions of the city structure and the functional operations of each department will also have to alter to change it. This itself may be more of a shock and a burden of adjustment than the automation step itself.

Actually, the implementation of a GIS allows these functional subdivisions to remain without major implications for the hindering of the effective operations of the POSC. What should be standard is that all data be stored at the lowest level - i.e. the property level - and so be amalgamated as desired by each of the departments for their own purposes.

The value of using some type of standardised city district subdivisions should be seen as a goal and should be defined by a committee of the POSC executive in an evolutionary process.

2. Numbering systems for city properties.

The debate here was whether the numbering system to be used should be location-relevant or simply applicable to proper database functionality without any locational value.

The proposal is to use a consecutive numbering system with no particular locational value for the Municipal Information System in this initial phase. The expectation is that the system of Unique Parcel Reference Numbering (UPRN) that is presently being proposed and determined for the entire country under the National GIS initiative being headed by the Director of the L&SD, will fulfill the purpose of a nationally-relevant and locationally acceptable referencing system when the time comes. If a locationally-referenced parcel numbering system for POS only were to be implemented, consideration would obviously have to be given to the expansion of this system to fulfill similar needs for the entire country or at least the compatibility of this system with the UPRN system at a later date.

The GIS to be implemented at the POSC will allow the locational nature of the parcels to be recorded appropriately within the mapping. Non-redundant attributes can also be used within the attribute database to define some spatial or locational attributes of the parcel, e.g. neighbourhood (Woodbrook, Newtown), street address, etc.

Parcel addresses are presently the means used to locationally reference the properties at this stage and for all intents this will remain, as it is the only useful addressing means familiar to the technical people of the POSC. The map data of the GIS and other attribute information for the parcels can provide some greater spatial referencing potentials and these will be built in.

Unique parcel numbering will more than likely only be used by the database administrator at this time until numbering systems rather than addresses assume functional dominance in daily operations. Again this can be defined as the goal towards which the Municipal Information System will evolve - to utilise the national UPRN system when it becomes available.

3. Data Modeling within MGE

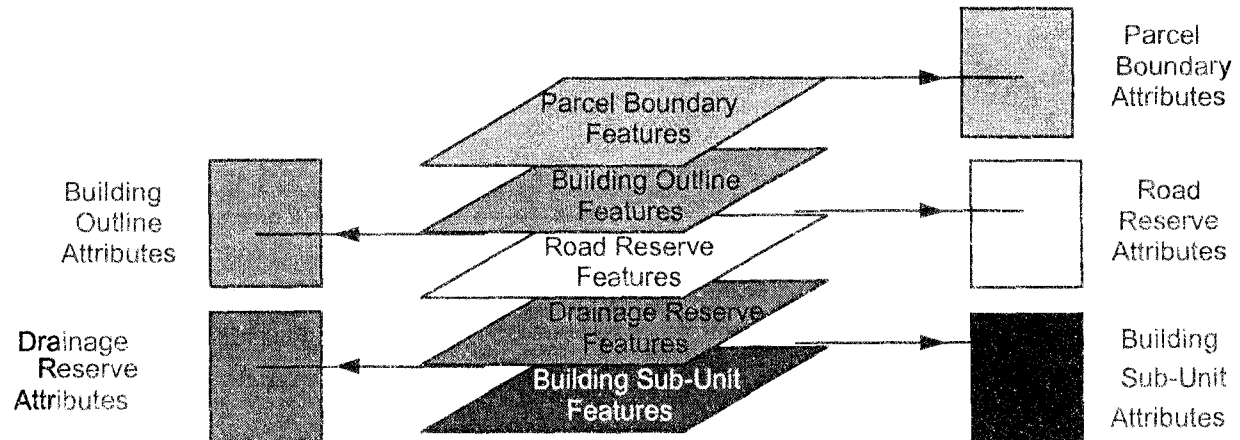
The following table illustrates the recommended spatial data structure for the Municipal Information System following the data structure methodology used by Intergraph MGE. A description of the MGE Data Model and how it operates within Intergraph MGE is included as Appendix D.

Category	Feature Types	Features
POSC	Infrastructure	Parcel Boundary
		Building Outline
		Road Reserve
		Road Center Line
		Drainage Reserve
	Property	Parcel Boundary
		Parcel
		Building Outline
		Building
		Building Sub-Unit

The structure of the spatial data can be conceived such that the data - both graphic and attribute - are attached to the individual feature occurrences represented in the respective feature tables. In other words, for example, each building is represented by an occurrence in the Building table, to which all the attributes of that building are recorded by means of a series of columns within which each of the values of the attributes are recorded. That occurrence in the Building table is attached by means of a unique identifier to a graphic/map feature occurrence in the graphic/map database.

This relationship as well as the relationship between each of the features can be illustrated by the diagram below. It is the ability to separate and combine these data layers as desired that provides the data management and analysis capabilities of the Municipal Information System.

Example of Data Layers in the Municipal Information System



If reference is made to the sample listing of the information that is to be stored in the Real property Subsystem of the Municipal Information System - Chapter V, Section A-1 of this report - the way in which the listed datatypes can be modeled within the Municipal Information System in Intergraph MGE is identified by the table below.

ACTUAL ATTRIBUTES	REPRESENTED IN DATA TABLES BY:
1. Physical Characteristics of properties within the Corporation	
SIZE	PARCEL
BOUNDARIES	PARCEL BOUNDARY
BUILDINGS/STRUCTURES	BUILDING/BUILDING OUTLINE
2. Location Information of all Properties	
ADDRESSES	PARCEL/BUILDING/BUILDING SUB-UNIT
3. Planning Information	
ACTUAL USAGE	PARCEL
APPROVED USAGE	PARCEL
DATE OF APPROVAL FROM T&CPD	PARCEL
4. Ownership Information	
OWNER NAME	PARCEL/BUILDING/BUILDING SUB-UNIT
5. Occupation Information	
OCCUPANT NAME	BUILDING/BUILDING SUB-UNIT
NUMBER OF OCCUPANTS	BUILDING/BUILDING SUB-UNIT
6. Public Health Information	
VECTOR CONTROL INFORMATION	PARCEL/BUILDING/BUILDING SUB-UNIT
INFORMATION ON CLEARING OF CESSPITS/SEPTIC TANKS	PARCEL/BUILDING
7. Other Information	
UNIQUE IDENTIFIER	ALL FEATURES

In a similar manner, all road and drainage information will be stored in the Road Reserve and Drainage Reserve tables, respectively. And each occurrence in each of these tables will represent one graphic/map feature in the graphic/map feature database.

F. DATABASE DEVELOPMENT

1. Creation of Base map

a) Base Map Data Sources

Several methods exist for the creation of the base mapping for the City upon which the Municipal Information System will depend. These range from the original creation of mapping for the Municipal Information System to the purchase and upgrading of existing mapping.

As the system is essentially being created to support the maintenance of Real Property information as well as to support the management functions related to Planning and Infrastructure maintenance, it would be best that both Topographic and Cadastral map data be utilised in the system. The former relates to the physical features visible on the surface of the earth and would include houses, roads, drainage features and relief. The latter would entail the property boundaries throughout the City which, although indicated at times by a physical feature (a fence or wall), are generally not visible features.

The most useful sources of Topographic data for the City available at present include:

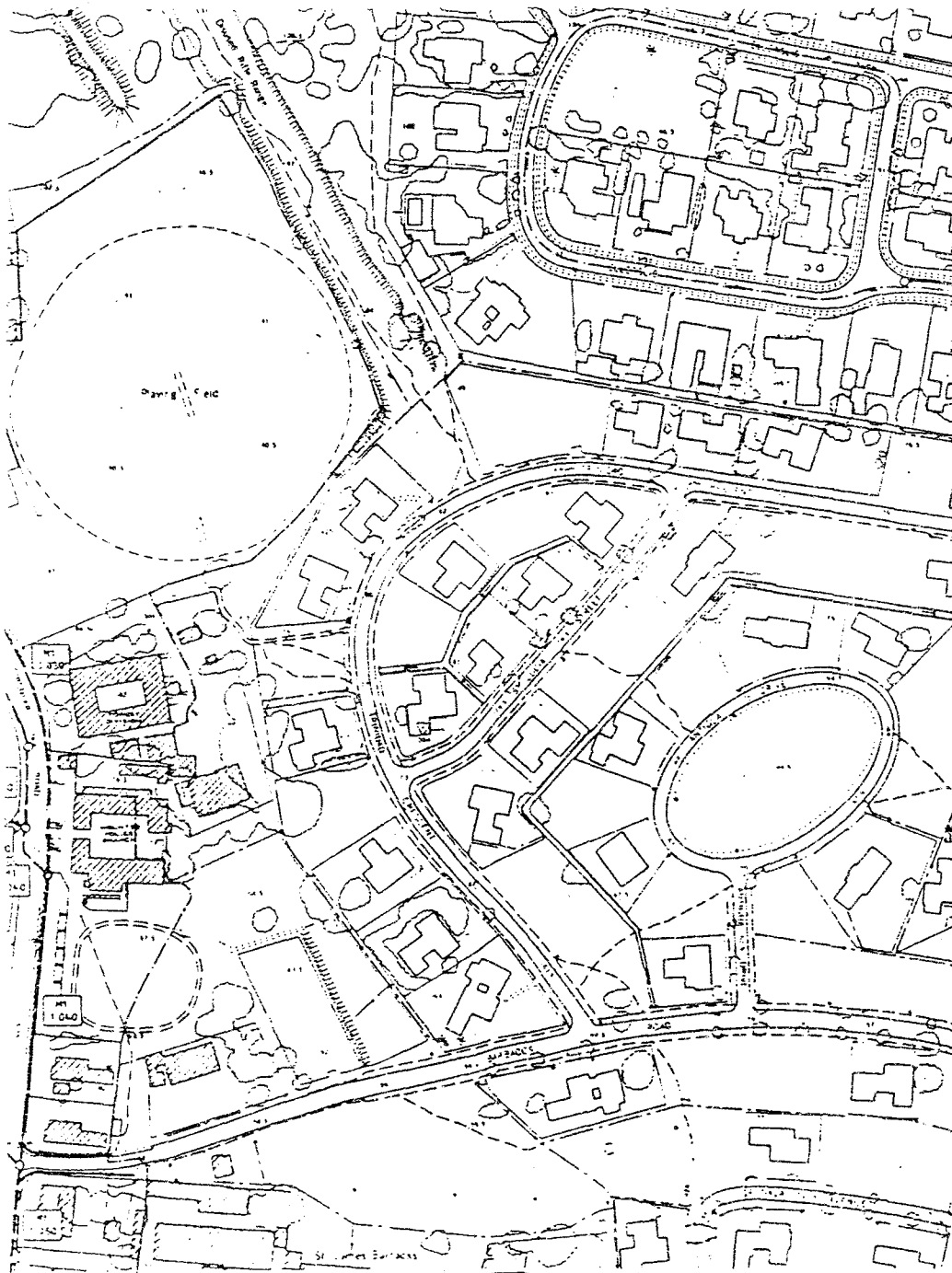
1. 1994 aerial photography covering the City (at 1:12 500 scale)
2. 1968 topographic/cadastral mapping of the City - partially updated in the 1970's (at 1:1 250 and 1:2 500 scales)
3. WASA digital topographic mapping.

Additionally, the 1983 Port of Spain Drainage Study contain extensive information on the locations of the City's drainage system. This drainage data should form an important map/graphic data layer in the digital database. The attached Map 1 is an excerpt from this Study and shows the drainage network as well as the backdrop of the 1968 topographic/cadastral mapping.

The most useful sources of Cadastral data for the City available at present include:

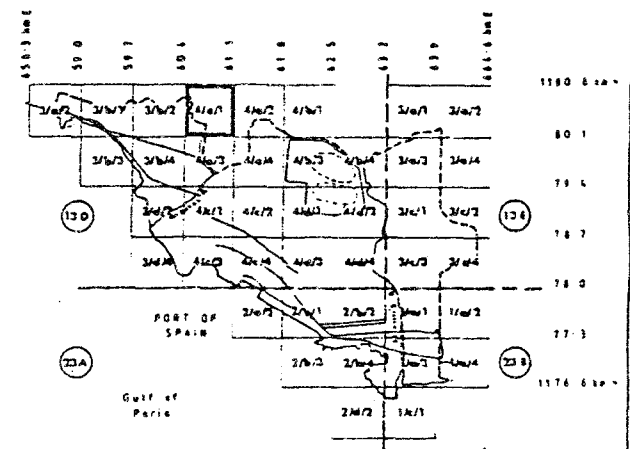
1. 1968 topographic/cadastral mapping of the City - partially updated in the 1970's (at 1:1 250 and 1:2 500 scales)
2. Individual Survey plans attached to Title documents (various large scales from 1:100 - 1:1 000))
3. Approved subdivision general survey plans (various large scales from 1:500 - 1:5 000)

The only one item within the above two lists that is already digital is the WASA topographic data.




13.030	24.28	21.58	0	600	-
9.040	22.25	21.49	70	750	480
1.040	21.54	19.89	70	950	1440
14.000	23.84	22.10	70	900	1180
14.310	19.59	17.85	70	900	1240
14.020	17.40	16.21	70	900	1300
1.350	17.31	15.75	70	1230	1200

MAP 1



KEY PLAN

Produced from maps provided by
LOCAL AND SURVEY DEPARTMENT, TRINIDAD AND TOBAGO

No.	DATE	REVISION	BY	APP'D	CLIENT
REPUBLIC OF TRINIDAD AND TOBAGO MINISTRY OF LOCAL GOVERNMENT PORT OF SPAIN CITY COUNCIL					
PORT OF SPAIN DRAINAGE					
EXISTING DRAINAGE SYSTEM SHEET 130 4/a/1			BY DESIGNED DRAWN TRACED CONTRACT	CHECKED DATE Jan. 1983	DRAWING NO. 130 4/a/1 (E)
SCALE 1:1250					
 MILLETTE ENGINEERING (INTERNATIONAL) LTD. 1, HERBERT ST., PORT OF SPAIN, TRINIDAD PHONE 62-28451					

b) Evaluation of Cadastral Map Data

i) Accuracy of Cadastral map data. It is proposed that a combination of the above data sources be used to complete the base mapping for the City. Because of the nature of the Municipal Information System that is to be built and also because of the nature of the available input data, it is proposed to construct a base map that is indicative of the topography and cadastral boundaries of the City, yet without the level of accuracy that would be attributed to a cadastral survey title plan. In other words, as the purpose of the system is for the management of property data and infrastructure maintenance functions, it is not proposed to design a system which has a level of accuracy that would be unnecessary. This is not to say that the system cannot eventually evolve to the level of accuracy that would be maintained in a cadastral survey system. However, besides the fact that this level of accuracy is not necessary or useful at present, certain cost and technical factors also mitigate against this.

For a cadastral survey level accuracy to be maintained in the system, the input data would necessarily be the individual cadastral survey plans or the cadastral survey general subdivision plans at a large scale. These are not available for a large portion of the City as they have either never been completed, are outdated or are simply not filed with the Land Registry (filing of survey plans is not obligatory for properties under the Old Law/Deeds system). The cost of completing cadastral surveys for the remainder of the parcels for which no survey plans exist would be prohibitive over the short term and within the budgets of the POSC.

It is proposed that a system be designed that can incorporate the more accurate cadastral survey plan information on a gradual basis, as they become available and as can be afforded. During the course of implementation and operation of the system, tests will have to be run to determine whether the cadastral survey maps can be directly incorporated into the base map or whether they are sufficiently different to warrant the creation of a parallel map data layer that can eventually replace the original parcel boundary data layer, first in sections and eventually over the entire City.

For the purpose at hand, the design of a cadastral map base for the Municipal Information System, it is proposed that the cadastral parcel boundaries indicated on the 1968 topographic/cadastral mapping be used. Where these prove to be severely outdated they should be updated by additional information from available general survey plans.

ii) Proposed Procedures for Inputting Cadastral Data. The base source of the cadastral data for the City is proposed to be the 1968 cadastral/topographic mapping. It is proposed that the digitising of these cadastral boundaries be contracted out primarily because of the time it will take to undertake the digitising and editing in-house while learning the process. A small test may be conducted in-house to determine the time such a project may take.

This data may already be available in a digital form from the Town and Country Planning Division or WASA, and these potential sources should be checked for availability, cost and the source of their data to determine whether it can provide the necessary cadastral base.

If the digitising is to be contracted out, it must be ensured that the Scope of Works for the data digitisation specifies that the data is to be collected in a GIS-compatible format rather than a CAD-compatible format.

c) Evaluation of Topographic Map Data

ii) Topographic mapping alternatives. Two options exist for completing the topographic mapping of the City. The relative value of these options will be evaluated at the pre-implementation and implementation stage through a series of tests on the data. One test would be to evaluate the positional accuracy, currency and extent of coverage of the City of the data itself. The positional accuracy relates to the geographic and locational accuracies of the data. Currency refers to whether the data is recent or outdated while the extent of coverage refers to whether the area of the City itself is covered by the data set or whether sections of the City are not included.

Another important evaluation would be to determine its utility relative to the cadastral data. This latter test is of vital importance as the accurate georeferencing of the topographic and cadastral data relative to each other would make the data both visually correct and correctly maintained in the database. However, if the two datatypes are not properly georeferenced or one or the other is inaccurate, inconsistencies in the data will occur. Evidence of this will be found by parcel boundary lines intersecting buildings or extending into roads.

As the only relatively complete and readily available source of cadastral map data for the City exists in the 1968 cadastral/topographic maps, this cadastral map data must provide the guide upon which to evaluate the topographic data. Obviously, the topographic map data that best complements the cadastral data from this source would be the topographic map data on the same map sheets. The simplest solution would, therefore, be to utilise this source for both cadastral and topographic data. However, as the chart below indicates, while the positional accuracy is presumed correct, the currency of the data is definitely lacking.

Data Source	Positional Accuracy	Currency	Extent of Coverage of the City
1994 aerial photography	Excellent	1994	Complete
1968 topographic/cadastral mapping	Assumed Good (official L&SD mapping)	1970's	Complete
WASA digital topographic mapping	Assumed Good (based on official L&SD mapping)	1989 - some parts of City up to 1992	Complete

While it would seem best to utilise the 1994 aerial photography because it exceeds in all three areas, the extra cost and time necessary to generate new mapping entirely from aerial photography through photogrammetric means would be unnecessary in light of the other existing available data sources. This photogrammetric mapping process would be many multiples more costly than other available means.

The option that makes the most practical sense to implement from the point of ease of activity and time saved is that the existing digital WASA data be utilised. However, as previously mentioned, tests would need to be performed at the pre-implementation and implementation stage to determine the relative accuracy of this data to the cadastral data from the 1968 mapping. The WASA data would be preferable from the point of view of its currency.

It is worth noting that a Digital Map Production Facility is presently being implemented at the Lands and Surveys Division of the Ministry of Agriculture, Land and Marine Affairs. This is expected to provide accurate and current topographic and cadastral mapping for the entire country with the first map products being made available sometime in mid-1999. This impending availability of proper mapping for the City within the next two years militates against the Corporation actually spending excessively for production of the same level of mapping. A lesser accuracy and currency of map data should probably be tolerated until the digital mapping can be purchased from the Lands and Surveys Division within two years.

ii) Proposed Procedures for Inputting Topographic Data. The process that is in fact proposed for providing a topographic map base of the City is this:

1. Purchase a sample of the WASA data for a small test area
2. Test its positional accuracy through georeferencing relative to the cadastral map data from the 1968 sheets (which have been previously digitised). It would be advisable to undertake this test in multiple locations across the area of the City to ensure no localised distortions occur.
3. If the WASA data proves positionally accurate, cost and data input factors would then be used to determine the chosen option - input of digital WASA data or digitising of 1968 maps (or some combination of both).
4. Whichever option is chosen, some degree of topographic map update will be necessary. The 1994 aerial photographs can be used to provide a Map Update. Through analytical photogrammetry, the digital topographic maps created at (3) can be checked against the 1994 photographs, and the appropriate additions/alterations made directly to the digital topographic maps based upon the differences between the two data sources, the 1994 photographs providing the lead because of its currency.

2. Creation of attribute database

a) Sources of Attribute Data

i) Real Property. The primary source of attribute data for the 12 000 properties within the City is the individual property files of the City Assessor's Department. Each property is represented by a manila file in which all data ever collected for valuation purposes as well as all correspondence affecting the parcel is maintained.

Another key source of Real Property data is in the approval documents maintained by the City Engineer's Department on all Building and other approvals that have passed through that office. The Public Health data on vector control activities may also be attached to the parcels and can be so represented in the database.

ii) Infrastructure. The City Engineer's Department maintains much data on the City's roads and drainage system in particular. Additional information is available on the City parks and squares. These are all available within reports and other documentation at the City Engineer's Department. The relevant information must be determined by the City Engineer as to what is vital to be included within the digital database of the Municipal Information System. This information would then be sourced from the existing files and added to the database as collected in the field.

A key source of drainage data is the 1983 Port of Spain Drainage Study which identifies the entire drainage network throughout the City and contains recommendations on its upgrading. Road. This study has an extensive description of the entire drainage network including information on drainage heights at inflow and outfall points, material of construction of the drainage infrastructure, sizing of the drainage infrastructure, etc. This could be valuable information on the City's drainage network that would be maintained within the attribute database.

The majority of the attribute data is expected to be periodically updated through regular and comprehensive reporting of works completed on City infrastructure.

G. COSTING

An indication of the cost of the initially proposed equipment, software, services and personnel is included below to give some direction to the cost of implementation of the system. These are approximations and are subject to change due to the fluid nature of the computer hardware, software and services environment.

Value Added Tax (VAT) at 15% as well as customs duties (none on hardware, 15% on software) are not included in the estimates.

1. Hardware

The approximate costs of the hardware recommended above is as follows:

1 no.	Workstation Server + 17" Monitor	US\$7 000
1 no.	Tape Backup	US\$1 600
1 no.	Digitiser with base	US\$3 500
1 no.	Colour Inkjet Plotter	US\$4 500
2 no.	Pentium PC Computers	US\$4 000
3 no.	Colour Printers (11"x17")	US\$9 000
	Networking equipment (Hub, cabling, trunking, etc.)	US\$4 000
	Miscellaneous peripherals	US\$1 000

2. Software

The approximate costs of the software recommended above is as follows:

1 no.	Intergraph MGE GIS Office	US\$10 200
1 no.	Microstation CAD	US\$ 5 500
1 no.	Parcel Manager	US\$ 4 000
3 no.	Geomedia	US\$ 4 500
2 no.	Oracle Client	US\$ 1 000
1 no.	Oracle Workgroup Server	US\$ 3 000
1 no.	Windows NT Server + 10 user License	US\$ 1 500
	Miscellaneous Software	US\$ 2 000

Additionally, software service agreements that should be entered into, at least in the first year of the project startup, may total in the region of US\$5 000 per year.

3. Database development

The cost of the development of the database and data collection activities is usually the largest component of any GIS project - ranging from 60% to 90% of the total cost of the project. As identified previously, the exact nature of the data collection activities - particularly the map/graphic data collection - is left to be decided at the pre-implementation stage, dependent on several tests to determine the easiest means and the best cost options.

The majority of the attribute data collection is expected to be done in house.

No costs are included below for consultancy costs for database development, customisation of the systems or other services that would be required from external consultants.

These may best be negotiated at the implementation stage, as the quantum of the work required becomes more readily identifiable.

4. Personnel

Several new full-time employees would be required to operate the Municipal Information System at both the database manager level and the departmental user level. In order to attract people with the appropriate mix of qualifications and experience that could impact positively on the project, the salaries to be considered should be more in line with present local market rates. As these may not be in line with existing ranges of Public Service salaries, some means of contracting these people outside of the regular Public Service employment system may need to be adopted.

The salaries that may be necessary to attract individuals with the proper qualifications and experience may be in the following ranges:

- 1 no. GIS Manager @ between US\$1 200 to US\$2 000 per month
- 3 no. GIS Technicians @ between US\$700 to US\$1 200 per month each

5. Training

Various training courses supplied by the software vendors for the various software as identified above would be necessary. These should include both training in the operational aspects of the systems as well as in-house guidance in the actual implementation and project startup activities.

For the various software identified above, it is estimated that the total cost for this service would approximate US\$25 000. This does not include any expense for non-vendor provided training.

6. Required Startup Funding

Based on the above approximations the funding required to offset the costs of the Hardware, Software, Training and Personnel components for the first year may total in the region of US\$155 000.

Assuming that data collection activities in this project approximate at 75% of the total project cost and that the cost of developing the Municipal Information System to its entirety will require two years, the following approximations are expected:

First year cost(except Data Collection)	US\$ 155 000
Second Year (essentially salaries and software service agreements)	US\$ 65 000
SUB-TOTAL	US\$ 220 000
Therefore, Data Collection costs approximate	US\$ 660 000
TOTAL	US\$ 880 000
Contingency @ 20%	US\$ 176 000
GRAND TOTAL	US\$1 056 000

It is to be stressed that this is an approximation that will be highly tempered and made more accurate by the completion of a few tests particularly with regard to data collection requirements and methodologies. These tests should be carried out as a key part of the pre-implementation stage to guide the implementation.

Additionally, a large part of the cost may be able to be either deferred, avoided or shared through data sharing agreements, hardware leasing or the timely availability of appropriate digital data at a fraction of the cost of project-specific data collection.

VIII. MUNICIPAL ORGANISATION STRUCTURE

It is not proposed that substantial reorganisation of the structure of the POSC be enacted to implement the Municipal Information System. The effect of this, as identified previously, would be only to compound the confusion that will already be experienced by the introduction of automated systems and procedures.

However, of equal virtue is the fact that the Municipal Information System and its operations are expected to provide more of a service function to each of the relevant sections within the relevant Departments rather than form an organisational entity of their own within each of the departments.

The distributed system proposed will allow the centralised maintenance of data while the departments will have the ability to selectively manipulate and analyse the data based on fixed procedures utilising GUI's defined for each department.

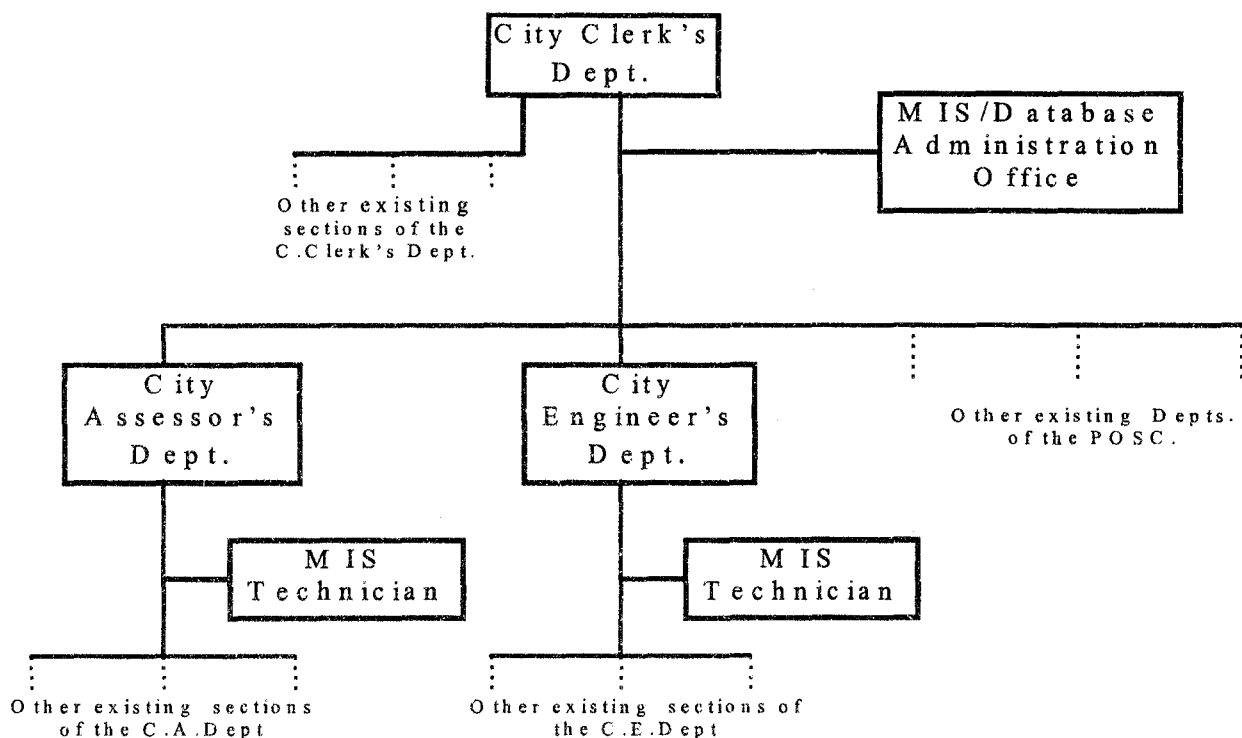
In the evolutionary nature of the Municipal Information System, there is initially propose to be only one station at each of the applicable departments, manned by an appropriately trained and qualified technician. In the initial stages of data collection and setup of the systems, this individual will largely be responsible for the operations of the Municipal Information System at the departmental level. However, the in-house training that will take place soon after at each department by these technicians, specific to the operations of the system, and more specifically to the operation of the GUI at the respective department, will allow a transfer of the knowledge of system operations to the technical and even clerical individuals at each of the respective departments. This will be accompanied by an increased number of computers in these offices, allowing the trained individuals to manipulate the system from their desks.

A. ORGANISATION CHART REFLECTIVE OF MUNICIPAL INFORMATION SYSTEM

The organisation chart below reflects the service function of the Municipal Information System and its component parts throughout the relevant departments of the POSC. For ease of reading, only those departments that are directly affected by the Municipal Information System are represented in the organisation chart.

The service function of the Municipal Information System/Database Administration Office is evidenced by its placement under the control of the City Clerk's Department yet with enough flexibility to interact freely with the other departments.

The functional linkages between the departmental components and the central administrative office and also between the City Assessor's Department and the City Treasurer's Department are identified in the Technical Documentation.



B. INTER-DEPARTMENTAL COORDINATION

1. Setup of Database Administration Office

The Chapter VII, Section D-1 illustrates the network that will support the Municipal Information System. As a central database administration office is proposed, it is intended that this office be located within the City Clerk's Department. This will complement the existing plans for the setup of a similar office in this department to deal with operational functions specific to the department. Logistically, the same office space can be shared and, dependent on the extent of operations and quantities of data expected under the City Clerk's proposed system, it may be possible to even share hardware and software - servers, peripherals, operating systems, etc.

It is proposed that an independent technical investigation be undertaken to determine this possibility at a stage when the volumes of work expected for the Database Administration Office arising out of its use by the City Clerk's Department is better known.

Dependent on the capabilities of the individual, the same person may be able to manage the City Clerk's Department proposed system as well as the Municipal Information System and its GIS and database functionalities. In all likelihood, however, separate persons will need to be employed to obtain the correct mix of technical skills and experience.

a) Data Collection and Maintenance Capability

It is proposed to setup full data collection capabilities at the MIS/Database Administration Office. The necessary equipment as identified previously must be acquired.

This office can assist in the initial data collection activity, although it is proposed that the majority of this initial work be contracted out. Recurrent data collection and maintenance activities for the Municipal Information System will be undertaken at this office. This will entail both map and attribute data. Additionally, editing and monitoring of the quality of the data input from the City Engineer's Department and City Assessor's Department will be undertaken on a regular basis - daily or weekly dependent on quantity.

One trained technician should be capable of fulfilling these functions in the initial stages. Further trained technicians can be hired or transferred from POSC departments as needed. On-the-job training of a conscientious individual, supplemented by some formal training courses in database management and manipulation, may suffice for the latter.

IX. IMPLEMENTATION PLAN

All attempts were made in the system design to provide an easy yet effective start to the implementation of the Municipal Information System through simplicity of design and the restriction of the application of the system to only a portion of the POSC. It is expected that as the utility of the Municipal Information System within the Corporation grows, it should expand to incorporate some of the functionalities of other departments.

The scenario proposed above for the setup of the Municipal Information System is in fact the minimum requirement for its effective implementation. It is designed such that all of the components described need be acquired approximately around the same time and implemented largely simultaneously. Because of this, although the development and maturing of the Municipal Information System within the Corporation itself will be an evolutionary process, at least the startup of the system - as described above - must take place as one activity with interrelated parts.

Because of this, it is not expected that the formation of the Municipal Information System within the POSC can be wholly financed through regular operational budgets over the course of several years. This would be counterproductive to the nature of the system.

Each of the component parts are herein identified and an indication of their content and implementation timing will be proposed. As each of these components have been dealt with in detail within the body of the report, they will be itemised in point form here for ease of understanding.

A. COMPONENTS OF THE IMPLEMENTATION ACTIVITY

1. Acquisition of hardware and software

- Hardware and software as identified above must be acquired at the start of the project.

2. Training

- Immediate training in the use of computers in general must continue.
- Training of a Database Manager/Systems Manager as proposed by the City Clerk's Department should continue.
- Specialised vendor-based training in the use of the software proposed for use at the department level by the Municipal Information System must take place at the start of the project, if not earlier.
- Formal (vendor/agent-led) courses in the use of Oracle and Geomedia for Department personnel
- On-the-job training on the application of these systems

3. Personnel

- Employment of a GIS Manager must take place at the start of the project.
- Employment of GIS Technicians for the City Assessor's Department and the City Engineer's Department must take place at the start of the project.

4. Data Collection

- Preparation of the necessary base mapping for POS can start immediately but must be completed early on in the project.
- Input of attribute parcel information can commence as soon as the purchase and setup of the database is completed.

B. KEY CONSIDERATIONS FOR SUCCESSFUL IMPLEMENTATION

Several issues which must be dealt with at an executive or policy level at the POSC have also been identified. These would require the attention of the POSC Executive and/or Council within the earlier stages of implementation. These issues must definitely be considered and effectively resolved to ensure the proper continuous functioning of the Municipal Information System as an integral component of the total Information System capability of the Corporation.

1. The role of a Planning Department in the POSC needs to be studied in greater detail. Greater attention need be given to the role of the POSC in planning at all levels - Development Planning, Development Control and Building Construction Approval. In the absence of a Planning Department presently and without the services of a professional planner on staff, it would be most relevant to the development of the Municipal Information System that the Planning subsystem be set up to deal with the existing planning responsibilities of the POSC (i.e. provision of building permits), but be systematically enhanced to a comprehensive Planning

Information System within the following twelve months. This timing should coincide with the earliest time by which the POSC would be designated a Planning Authority with responsibility for Development Control (under the new Act).

It is very likely, however, that the POSC could undertake to prepare a city-wide Development Plan much earlier. In which case, all planning data - landuse, socio-economic, construction trends and plans, utilities' information, etc. - would be necessary. The reality of this development plan preparation exercise is that the POSC may have to rely on private planning firms and professionals to collect the necessary data and do a large part of the analysis and development plan preparation, either in totality or in conjunction with an in-house planning team, seconded planners from the T&CPD or the T&CPD itself.

2. The design of the Municipal Information System is provided herein with supporting guidelines on logistics, capabilities, what must be included, levels of user interaction, accessibility issues, etc. However, the effective completion of the design will require the involvement of the Department/Section heads in the definition and actual testing of procedural methodologies in the form of one or a series of Pilot Projects. This is especially true for the design of the GIS. This Testing stage will serve to fine-tune the design to suit the desired application and is best incorporated as the immediate precursor to the full implementation of the Municipal Information System within the organisation. Departmental involvement in the Testing and fine-tuning activities is crucial to ensure a well designed and appropriate Municipal Information System.
3. The heads of all relevant departments should support the initiatives by 1) acknowledging the need for alteration in their present data management systems and the operations they support, and 2) being willing to learn, at least the rudimentary aspects of the systems so as to be able to guide the departmental goals and objectives as well as provide some measure of troubleshooting and operational work programming within the context of the application of the Municipal Information System.
4. The head of the City Assessor Dept., in particular, must clearly appreciate 1) that even if he does not have a thorough understanding of the GIS, he should at least attempt to partially understand it; 2) the utility of the system in streamlining operations, and; 3) the need to reorganise operations and staffing roles to support a digital data management system. It must be stressed that the role of the City Assessor is crucial in allowing the effective implementation of the Municipal Information System and the take up of its capabilities into the regular operations of the Department.
5. A general shortage of professional and technical training throughout may significantly affect the incorporation of the technology into regular usage. Existing senior staff should be encouraged to gain some knowledge of the Municipal

Information System and GIS technology. Further, a decision should be taken by the Council and transferred to the Chief Personnel Officer, not to appoint people to senior positions without the proper qualifications and/or experience to hold that position.

6. Salary scales particularly for the post of City Assessor need to be reviewed to bring it more in line with a competitive market rate. This, in conjunction with public advertisement of the post, should ensure a valuation professional at the head of the Department that would appreciate the Municipal Information System and support its implementation. The advice of the Chief Personnel Officer (CPO) should be sought in this matter.

Alternatively, contracting the services of a private valuation professional on retainer to oversee the relevant valuation areas and coordination of departmental activities may be considered. This person should be able to work in conjunction with the GIS Manager.

C. MOST URGENT AND SIMPLEST ACTIVITIES FOR IMMEDIATE IMPLEMENTATION

There are a number of priorities to which attention can and should immediately be given. Some have already been implemented within the course of the project. These are identified below.

1. Familiarisation with computers in a formal setting and preferably access to computers during working hours for exercises/experimentation is required for all levels of staffing that may impact on the Municipal Information System. The present computer training courses initiated by Council members and held twice weekly should be formalised and expanded to include more participants.
2. The Consultant arranged a basic introduction to GIS and similar Municipal Information System applications for department/section heads, technical managers, the CEO, Mayor and Councillors. Neither the Mayors nor the Councillors were able to attend. Two private local companies who represent the two major GIS software agencies assisted in this exercise. Complete Computer Systems (CCS) demonstrated GIS usage and specifically the Intergraph MGE software capabilities on August 19. While Fujitsu-ICL, who represent the Arc/Info line made a similar presentation on October 3. These sessions provided a focused demonstration of capabilities of GIS and specific applications and included some interactive sessions to allow a hands-on experience for the POSC personnel. The level of interest among the POSC personnel was generally high and the application ideas were well received.

3. Touring of facilities where GIS's are in place has been proposed to the POSC. An open invitation already exists from the Land Bank Unit of the Ministry of Housing and Settlements and the Consultant is awaiting a response.
4. Upon the recommendation of the Consultant, four members of the POSC executive and administration attended the "Caribbean Conference on GIS - Third Annual Technical Conference of the Geographic Information System Society of Trinidad and Tobago (GISSTT)", held at the University of the West Indies (UWI), Sta. Augustine, Trinidad on November 6th and 7th. The City Engineer, Acting Assistant City Assessor as well as the two project counterparts attended. There was a general level of satisfaction expressed regarding the information learned and its applicability to the POSC. This will undoubtedly assist in the implementation phase of the Municipal Information System.
5. Again, on the Recommendation of the Consultant, the two project counterparts from the POSC also attended a short course offered in conjunction with the above Conference. The one day course was offered on November 5th and was entitled "Managing GIS Implementation in Your Organisation". They were joined by thirty professionals from several regions of the Caribbean in this course where they were able to exchange ideas and learn from other's experiences. The course was jointly presented by Dr. Jacob Opadeyi (Head of the GIS programme at UWI) and the Consultant, Desmond Dougall.
6. Options should be evaluated between temporary hiring of data entry personnel by POSC versus external sourcing of this service, specifically with regard to cost and the flexibility of the POSC in using in-house contract employment.
7. The existing Coordinating Committee between the POSC and the utility companies should be immediately revamped. As the utilities are either using GIS presently or are in the process of evaluation leading to implementation, a particular mandate of this Committee should be the agreement on methods of collection and sharing of digital data. Some agreement should also be sought on the data standards used and communication techniques to effect easy transfer of data across different systems resident at the distributed organisations. The utility companies and the POSC can, therefore, assist each other in developing their GIS's. The Consultant can provide guidance in this regard.
8. A POSC Task Force should be convened to study the effects of the expected Planning legislation and the possibilities of the creation of a Planning Dept. within the POSC. A particular aspect of the Terms of Reference for this Task Force would be the requirements the Planning Dept. would have from a Municipal Information System.
9. Immediately, all staff of the City Assessor Dept. and technical staff of the City Engineer Dept. need to start formalised courses to familiarise themselves with

computers. The early familiarisation with automated systems of word processing, spreadsheets and other basic applications will foster a quicker adoption of automated property management systems, digital mapping systems and GIS, when the time comes.

10. As familiarisation with computers and automated procedures becomes accepted, those staff identified at (8) above should undertake introductory training courses on data collection methodologies and RDBMS usage and application.
11. An appropriate amount should be included in budget estimates as early as possible for a Digitiser and CAD software to allow the start of data collection activities in-house.
12. A technical committee should be formed to consider the eventual standardisation of the administrative zones presently used by the various departments of the POSC. The assistance of the Consultant can be sought here to brief the committee on the benefits and the options available.

X. FUNDING THE IMPLEMENTATION OF THE MUNICIPAL INFORMATION SYSTEM

A. INCREASED PROPERTY TAXATION

The property taxation for the POSC is based on the Annual Ratable Value of the properties within the city. This ARV represents the amount that a property will fetch annually in rentals on the open market. The property taxation is calculated at 10% of the ARV.

According to the City Assessor's Dept. the total ARV for 1997 is TT\$131 262 949.00. This represents a property taxation of TT\$13 126 294.90. (TT\$6.30 = US\$1 @ November 1997).

In the opinion of several knowledgeable persons in the fields of Real Estate and Valuations, the ARV for the City should be at least \$TT1 billion. From the conservative estimates of this Consultant, it is likely that the ARV would be at least \$TT750 million.

Assuming the lower estimate, this would entail a property taxation of approximately TT\$75 million annually or almost six times the present value.

Obviously, the issue of increasing taxation is highly political and cannot be dealt with in as sterile a manner as expressed above. However, the fact is that there already exists, within the capability of the POSC, the means of increasing its own revenue. Although the POSC does not have direct control over this revenue, it will at least endear itself more substantially to the Central Government through its increased contribution to the Consolidated Fund. This should result in the Corporation having an easier time in justifying its demands from the Consolidated Fund of the Central Government to satisfy its own budgetary requirements.

When one considers that the total annual operating budgets for the Corporation were over TT\$86 million in 1996 (actual) and are proposed at over TT\$97 million for 1997, the effect of increasing the revenue from property taxation would contribute substantially to a positive balance for the Corporation. Self-sufficiency in its financial affairs is of course a key component in attaining total financial self-management, one of the key stated goals of the POSC, and the lack of which is a major cause of consternation for most POSC executives.

While the issue of increases in the taxation and revenue collections of the Corporation is not the direct purpose of this study, it is an obvious by-product of the effects of implementing the proposed Municipal Information System. Additionally, for an effective argument to be made for increasing the ARV's of the City properties, proper information must be available upon which to base the valuations data and the means for maintaining this data effectively should be put in place.

It is evident that the cost of the implementation of the Municipal Information System should easily be offset by a fraction of the increased revenue gained through an improved property taxation system. This is in fact the main rationale used internationally for the implementation of Fiscal Cadastres.

B. EXISTING POSC BUDGET ESTIMATES FOR AUTOMATION

1. Departmental automation plans and budgetary allocations

It may be possible to incorporate the automation costs of the Municipal Information System into the 1998 budgetary allocations for automation of various departments of the POSC. The figure proposed for 1998 is TT\$1 797 688 (item 03-001-002 of the 1998 estimates). This represents upgrades in the automation capabilities of primarily the City Clerk and City Treasurer's Department. This figure (which is at least a 1 000% increase over the budgetary allocations for this item in the previous two years) and the detailed listing of expenditures included in this budgetary item is evident of the attention being paid to automation by these two departments. They have already undergone an extensive evaluation of their automation requirements (primarily for the purposes of financial and personnel administration) and have identified the necessary hardware, software and training components.

Conversely, the lack of serious attention being paid to automation by the City Assessor's Department and the City Engineer's Department is reflected in the details of expenditure. The former has no allocation identified for any aspect of automation whatsoever, which tends to reflect the attitude of the City Assessor that existing operating procedures and the results therefrom are satisfactory. The City Assessor, however, as evidenced from the workshops and meetings, is the only senior administrator within the POSC that considers the City Assessor's Department to be operating effectively.

Allocation of expenditures for automation within the City Engineer's Department is reflected by a budget item for three pentium computers totaling TT\$60 000 (item 03-006-02). This is apparently not accompanied by budgetary allocations for peripheral hardware, software or training in the application of particular software. While the City Engineer's Department recognises the value of automation to its operations, it has likely not undertaken any evaluation exercise to arrive at the budgetary allocation proposed, but rather acted on 'gut feeling'.

It is the intent of the Municipal Information System that specific application areas related to Infrastructure maintenance duties of the City Engineer's Department be designed into the system. The necessary changes in operating procedures and the training and personnel necessary to effect these within the Department are identified above.

2. Use of 1998 Budgetary Estimates to significantly finance Municipal Information System

The budget estimates identified above may be reorganised and redistributed in an agreed upon manner to also partially finance the setup of the Municipal Information System.

This, of course, may not prove favourable with the City Clerk's Department or the City Treasurer's Department as these departments have undergone a degree of self-evaluation and determination of their automation needs to formulate departmental automation plans. However, it is not seen to be desirable for the POSC as a whole to encourage lopsided development of automation capabilities within different departments of the Corporation. Notwithstanding the present lack of enthusiasm regarding automation that exists at the City Assessor's Department, the decision to automate cannot also be left solely with a department head, but must be seen in the context of the Corporation.

The implementation of the Municipal Information System, as identified within this report, will create an interaction between departments at the level of automated procedures and the sharing of digital data that none of the existing departmental automation plans have considered in their design. Additionally, allowances are made in the design of the Municipal Information System for the interdepartmental sharing of logistical, equipment and personnel costs.

Therefore, a combination is proposed whereby the 1998 budget allocations towards the automation items identified in the budget be distributed in an organised and effective manner while at the same time an approach is made to the Ministry of Finance to allow an increased expense for the automation activities to be borne by increased property tax revenue. An agreement should be sought with the Ministry for this increased revenue to be staggered over three years at which point it should reach a new equilibrium with steady upward growth (dependent on the national economy primarily). The time lag is to allow the effective re-assessment of properties within the City and the increased pressure on the collection of taxes therefrom.

C. LINKING WITH DIGITAL MAP PRODUCTION FACILITY

The issue of using the cadastral information base of POS City as the case study for the cadastral mapping component of the setup of the Digital Map Production Facility (DMPF) at the Lands and Surveys Division, had been raised by the Consultant within the course of this project.

Preliminary discussions and approaches have been made but some degree of formal interaction on the part of the Client and POSC will be required presently to provide the impetus to move it further along.

D. OTHER SOURCES OF FUNDING

Strictly from a business proposal point of view, the payback figures from the increased taxation revenue due from the relatively small investment necessary to implement the Municipal Information System, are impressive. With the proper marketing and some commitments to effect an early reassessment of properties as well as an improved collections procedure, the financing for this project should be readily sourced from lending agencies.

A package needs firstly to be prepared detailing these factors after which approaches can then be made to both local and foreign private banks as well as the international development and funding agencies for investment capital. The Consultant can assist in this regard.

Notes

1/ ECLAC (Economic Commission for Latin America and the Caribbean), Urban Management in Medium Sized Cities - Final Report of the Case Study, Port of Spain, Trinidad and Tobago (LC/R.1651), Santiago, Chile. Pg. 55.

2/ Dale: Peter F. and McLaughlin: John D. (1988), "Land Information Management - An Introduction with Special Reference to Cadastral Problems in Third World Countries". Oxford, Great Britain, Clarendon Press. Pg. 46.

3/ Ibid. Pg.53.

4/ City Engineer Department, Port of Spain Corporation (1997), "City Engineer's Department - 1996 Administrative Report". Port of Spain, Trinidad and Tobago. Pg. 20.

5/ Government of Trinidad and Tobago (1997), "Draft Bill - Planning and Development of Land Act, 1997". Port of Spain, Trinidad and Tobago. Sections 7.A(1) and (2).

6/ Ibid. Section 12(1).

7/ Ibid. Section 26(1).

References

de Bruijn: ir C.A. and den Haan: ir R.N. (1990), "Survey of Information Needs and Design of Municipal Information Systems - Examples of Some Approaches". Department of Urban Survey and Human Settlement Analysis, International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede, The Netherlands.

CEPAL (Comision Economica para America Latina y el Caribe) (1994), "Sistema de Informacion para la Gestion Urbana en la Ciudad de Cordoba, Argentina" (LC/R.1422), Santiago, Chile.

City Engineer Department, Port of Spain Corporation (1994), "Proposed System for Scavenging Works in the City of Port of Spain". Port of Spain, Trinidad and Tobago.

City Engineer Department, Port of Spain Corporation (1997), "City Engineer's Department - 1996 Administrative Report". Port of Spain, Trinidad and Tobago.

Complete Computer Systems (1996), "Automation Plan for the City Clerk's Office of the Port of Spain Corporation". Port of Spain, Trinidad and Tobago.

Dale: Peter F. and McLaughlin: John D. (1988), "Land Information Management - An Introduction with Special Reference to Cadastral Problems in Third World Countries". Oxford, Great Britain, Clarendon Press.

ECLAC (Economic Commission for Latin America and the Caribbean) (1996), "Urban Management in Medium Sized Cities - Final Report of the Case Study, Port of Spain, Trinidad and Tobago" (LC/R.1651), Santiago, Chile.

Government of Trinidad and Tobago (1997), "Draft Bill - Planning and Development of Land Act, 1997". Port of Spain, Trinidad and Tobago.

den Haan: ir R.N.(1990), "Utility Information Systems - Lecture Notes". Department of Urban Survey and Human Settlement Analysis, International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede, The Netherlands.

Henssen: Prof. J.L.G. (1990), "Land Management". Keynote Address to the XIXth. International Congress of Surveyors, Helsinki, Finland.

Larsson: Gerhard (1991), "Land Registration and Cadastral Systems". Great Britain, Longman Scientific and Technical.

de Man, Erik W. H.(1988), "Establishing a Geographical Information System in Relation to its Use: A Process of Strategic Choices", International Journal of Geographical Information Systems, vol.2, No.3.

Port of Spain Corporation (1987), "Welcome to the Port of Spain Corporation". Port of Spain, Trinidad and Tobago.

Port of Spain Corporation (1996), "Outline of Strategic Plan, 1996-1997". Port of Spain, Trinidad and Tobago.

Port of Spain Corporation (1997), "Port of Spain Corporation - Estimates 1998". Port of Spain, Trinidad and Tobago.

Republic of Trinidad and Tobago (1990), "The Municipal Corporation's Act, 1990". Port of Spain, Trinidad and Tobago. Government Printery.

Transport and Cleansing Department, City Engineer Department, Port of Spain Corporation (1995), "Transport and Cleansing Department of the Port of Spain Corporation - Another Perspective, 1995 - 2005". Port of Spain, Trinidad and Tobago.

UNESCO (United Nations Educational, Scientific and Cultural Organisation) (1984), Edited by: W.H. Erik de Man, "Conceptual Framework and Guidelines for Establishing Geographic Information Systems" (PGI-84/WS/20), Paris, France.

APPENDICES

APPENDIX A

Questionnaire Guide for Workshop on Activities, Data usage and Staffing of Units of the Port of Spain Corporation to be held on June 17th, 1997

The following is the context of the information to be sought out of the workshop to be conducted on Tuesday 17th, 1997 from 1:30 pm. It would be appreciated if the information below could be collected and organised prior to the workshop so that we may be able to more quickly focus on the solutions.

1. Listing of Activities and Information inputs

List all activities that are available or desired to perform the functions of your Unit in a table similar to the one below.

Type of Activity performed by your Unit	Other units, other agencies or public that provide information to help in the completion of this activity	Type of information provided by each unit
Approve new building plans	Town and Country Planning Division	Copies of building plans (sometimes with extra planning information)
“	Public Health Inspectorate	Approval that plans satisfy public health requirements

The example above can be described as follows:

The Building Inspection Division of the City Engineer's Department approves new building plans that are forwarded to it from the Town and Country Planning Division. It must get input from the Public Health Inspectorate of the Public Health Department on whether the plans satisfy public health requirements.

2. Data Availability and Sources

List all data that are available or desired to perform the functions of your Unit in a table similar to the one below. Use the descriptions below of the **Nature** and the **Value** of the data to classify the data.

Data Type	Nature	Value
addresses	4	4
Actual Land use	1 (must be collected house-to-house)	3

Nature

Data are not available, to your knowledge

Data are available but not accessible to you (where is data?)

Data are being used and supplied by others (by whom?)

Data are being used and are collected by this Unit.

Value

For reference only

Sometimes needed

Wanted

Indispensable

The example below can be described as follows:

The City Assessor's Department uses data on the addresses of properties that it collects itself. This data is indispensable to the functions of the Department.. The Department would also like to have data on the actual land usage of all properties within the City but it is not readily available and would have to be collected in a house-to-house survey.

3. Staffing

- a) List all staffing that exists within your unit at present and indicate the post, level of training and whether the post is filled or vacant as in the table below.

Name	Post	Level of Training	Filled/Vacant
J.Doe	Clerk1	Secondary School	Filled

- b) Additionally, indicate extra posts that you would like to see created and filled and indicate their expected duties, as below.

Post	Expected Duties

APPENDIX B

Outcome of Workshop with the Department Heads of the POSC June 23rd, 1997

City Assessor (Mr. Singh - Head, Mr Seales - Assistant Head)

- hereditaments (*unsure of exact connotation ?*)
- administrative districts - own potential for dev't. and own neighbourhood characteristics, patterns - therefore, basis for subdivision
- different formulae used for determining Annual Ratable Values (ARV's) - site value is used as opposed to capital value
- value of bldg. is not determined by the aesthetics or material construction of the bldg. but rather by the location of the bldg. - location will impact on the rental value of the bldg.
- Look at similar structures in the area and compare to see what rental they are fetching
- Influence of community and the area will determine the reasonable rental value of each property
- Assessors cannot raise revenue outright because they are restricted by market forces and legislation
- A reference card (*what exactly is this?*) is used for each property - this goes to Council.
- The council has an important role in the smoothing of the rates to suit the prevailing interests of the council members.
- The decision of the council is minuted and the Treasurer, auditor general and (*one other that I missed ?*) are given a copy of this decision
- 31st March - house rate notices manually written up - 12,000 in all
- Some come back because of postal service and some ratepayers come in person to collect their notices
- General valuation of the corporation's land leases - Example: Woodbrook estate
- Mergers and subdivisions, naming of streets
- WASA depends on the dept. for assessment information - Assessor is the authority for land values in the city
- Water rates are based on house rates - only the POSC can rate properties in the city by law - WASA has tried to rate properties themselves but had to discard this because of the confusion that followed with double rates existing.
- *All political decisions have to be based upon knowledge of the technical basis even though the politicians have full reign to alter the information for political reasons as they determine. The role of the technical person is, however, to provide the politicians with correct technical information.(MB)*
- *Are you happy with the present way that operations are maintained in the Assessors Dept.? (example is direct problem of the manual transcription process)(MB)*
- *How are the illegal (squatter) plots of land dealt with?(MB)*

- Once there is a structure the law allows the assessor to assess it. Whatever is seen is assessed as such; example - if a property has approval for residential but is actually a business place, it is assessed as a business place.
- Sometimes the taxation revenue from the assessment of some of the illegal or low-income properties is not worth the effort because of the low rates.
- The assessor feels that there is no such issue as squatting as far as assessment is concerned.
- *While the areas of squatting may not be important for assessment they do have issues re: public health, etc.(DD)*
- While the law requires a general reassessment triennially there is a constant assessment going on for new buildings or improved buildings.
- There is not always a sticking to the triennial assessment if it is felt that the total reassessment will come up with the same assessments as previously.
- The next reassessment will be in 2000.
- Assessor turns a blind eye to small residences because they are trying to encourage residential use of the city.
- Assessor seems to feel there is no problem with the information flow or processes of his department.

City Engineer (Mr. Revenales, Lorraine Alexander)

- Four divisions - central, eastern, western and St. James Division
- Discussion of northern division which would include Federation Park, etc., i.e. the recent expansion areas of the city boundaries.
- This city division used by the City engineers only.
- *Are the subdivisions common across all departments?(MB)*
- No, each department of the POSC uses its own subdivision.
- Political/administrative dichotomy exists because the new role of the city of POS is not clearly elucidated by the political arm. As such the administrative arm is not given clear guidance. Delays exist between the political decision-making and the diffusion of the decisions to the administrative arm.
- Manual process of entering information into vote books (*how exactly do these operate?*) by each department to respond to one document/request by central government and the council, is counter productive because there is no cohesion between the various administrative departments involved.
- Problem of lack of automation is prevalent because of the inability to pass information in real-time.
- *Decentralisation process is defining changing roles for the administrative arm of the local governments. Previously, the role of the professionals in the local govt. was to carry out the decisions of the politicians. The change that is occurring in local govt. is that the politicians are asking the administrative professionals for guidance - not to make the decisions themselves but to provide professional advice. Generally a new role for the professional is seen.(MB)*
- *The issue of computerisation is useful but it is not the automatic solution to all problems. Has there been any computerisation efforts to date or on-going?(MB)*

- *When there is a need for information to be collected from several sectors of the POSC for the central government is there any one person taking up this role of collection or is it distributed to each of the relevant departments for their piece to be supplied?(MB)*
- On-going. Ad hoc purchasing of computers over a time period. Recently some introduction of the software that can help in procedures.
- No central person taking control of collection. Left in the hands of each of the departments to deal with their own information.
- Delay of information from each of the four divisional supervisors to the City Engineers and then a further delay to the Council. Delay fraught throughout the system because of the existing steps of administration and control.
- *What is the state of the information that is available on the city's infrastructural information? And what is the relationship with these agencies?(MB)*
- Each of the utilities is individually responsible for the maintenance of the information on their own infrastructure. However, the accuracy and up-to-dateness of this data is not known.
- WASA cannot determine exactly what the \$5.5 m. payment was for certain works undertaken that \$ was owed to the POSC. Problem obvious that there is a lack of information at WASA itself.
- POSC has information on the drainage system of POS as well as the road lengths and widths. Also information known on the parks and squares of the city. Information known on the quantity of public street lighting (not mapped but known quantities per street)
- The utility companies are changing the infrastructure constantly and these changes are often not passed to the POSC.
- *The utility companies do not have proper information of their own and they do not effectively transfer information to the POSC as new works are completed.(DD)*
- Because of the loss of information due to the City Hall fire of 1948 and the lack of procedures for collecting information properly and the amalgamation of the responsibilities of the utility companies into central operations, utility management within the city is still problematic.
- *What the POSC calls Town and Country Planning Division (T&CPD) outline approval is actually T&CPD final approval. POSC calls it outline approval because they consider their role to be paramount in city planning.(DD)*
- Very little involvement between gov't. agencies as per the planning requirements of the city.

Public Health (Dr. Chang - Chief Medical Officer of Health, Mr. Ali - Head, PH Inspectorate, Mr. Williams, Head, PH Education Unit)

- Field officers need to be connecting to the base on a more regular basis for storage , retrieval and sharing of information.
- Coordination occurs with the City Engineer's Dep't.
- Liaison also occurs with T&CPD
- Information exists on the sanitation (sewage) in pit latrines, cesspits, etc.

- Lots of information but not setup in a coordinated fashion
- *Why is this so, what needs to be done to use the information?(MB)*
- The use of this information right now is a very tedious project but if this could be done by computerisation it would be desirable.
- Inadequate filing system that knowledge is stored with individuals rather than in a knowledge system. When someone leaves their knowledge leaves.
- The reorganisation of offices and the filing system have caused confusion in sourcing the information.
- *The common idea of having information at the "touch of a button" is faulty. This requires even more coordination between organisation players. Requires more understanding of what is really required at a detailed understanding so that exactly what is wanted is what is designed for. When there is too much information and all of it is seen to be of some importance, usually little comes out of the automation of these processes because of the lack of clear understanding of what is desired.(MB)*
- *Need to determine the hierarchy of information within the departments so as to identify the more important areas of focus.(MB)*
- Disaster management, formation of food surveillance unit and *(one other that I missed ?)* would be desirable in the PH units
- Lots of data is collected by the regular activities of the daily paid staff.
- Linkages with the City engineers Dept., Ministry of Health, PAHO, Caribbean Epidemiology Centre (CAREC), WHO
- PH involved in the approval of bldg. Plans
- 36 primary schools and many pre-schools are immunised. If there were a better way to track students or those immunised it could help
- *What has been the approach towards automation of the Dept.?*
- The input of computers into the Dept. Brings with it issues of training also. One computer exists in the PH Dept. with some very recent training and orientation occurring.
- Environmental data is very lacking even though the POSC is responsible for the environmental management of the city. The POSC seems to be more involved in the Health Management of the city with the wider environmental management being left to the Environmental management Authority (EMA).

City Police (*Insp. Searles, one other*)

- Manual recording in register is the methodology used at present.
- Interaction with the central Police Services' Criminal Records Division (CRD) is done manually even though the CRD is automated.
- 45,000 residents in POS but 250,000 people in the city during the day.
- Interaction with all of the other departments of the POSC once there is need to maintain order in the function of any of the other departments
- One computer exists for which training will be needed to use.

City Treasurer (*Suzette Ablack, Jeffrey Washington, lady with glasses*)

- *The deficiency of the non-payment of taxes by the squatter population may actually be quite significant. They are still using the city and should therefore be liable for taxation. Should we therefore then attempt, through the setting up of a GIS, to differentiate the amount of illegal housing and population and whether we should input this information into the IS?(MB)*
- *Networking of the computers?(MB)*
- *Only exists presently within the treasury dept. for payroll organisation and some other functions. Some other Departments centred around the City Clerks department are expected to be networked by June 1998.*

Conclusions

General conclusion of MB

- *Some lack of information, therefore, a need to focus on collection of information*
- *Lack of coordination and sharing of information*

Specific Conclusions

- *An information system without the necessary legislation to enable it may be deficient. (comments of the auditor)*
- *Improvement of communication between the departments regardless of automation (engineer)*
- *Quite a large interaction not only within the POSC but between the POSC and external agencies*
- *The IS can be used to identify the disparities that may exist within the city using the information that is already available to the POSC. However, when this is used to recommend changes in the way that operations are conducted or that services are targeted, these recommendations may or may not be accepted by the political arm of the POSC. That is none of our concern.*
- *We need to use the opportunity that exists within this project to determine what type of system we design. What exactly will be the priority within the setup of an IS for the POSC? This should determine the focus of the IS design.*
- *Within each department we need to determine what is the most achievable objective based upon a series of priorities. This will likely be done on a departmental basis that will then have to be negotiated to a common system design for the POSC on the whole.*
- *An incremental approach would also be absolutely required.*
- *If some feedback can be provided by myself (DD) as a starting point upon which they can comment to focus the design of the IS, that would be definitely helpful. At the same time try to get the dept. heads to undertake their own prioritisation exercise so that they are involved in the process all the way through.(DD)*
- *A genuine desire by the executive for an operational IS is absolutely necessary.(engineer)*

- *Each department should set 3 areas of concern/interest that could provide the focus of the IS.(MB)*

APPENDIX C

Port of Spain Corporation Activity, Information and Staffing Survey

Combined Analysis of Information from workshop and meetings held on 17, 18 & 20 June 1997 and subsequent discussions with Department and Unit Heads of the Port of Spain Corporation

This report serves to describe the existing situation regarding activities, information usage and management and staffing of the Port of Spain Corporation (POSC). It is intended to provide the base for which a Municipal Information System is to be designed to manage many of the functions of the POSC.

The primary purpose of the proposed Municipal Information System is to manage the Real property information of the Corporation. The secondary purpose being to support the planning and urban management functions of the Corporation. Therefore, the general focus of the description and analysis contained herein is on those functional areas of the POSC that are relevant to those sectors. Subsequently, this is not intended to be an exhaustive analysis of the entire functionalities and information management of the Corporation.

Neither are all of the staff of the Departments and Sections considered - only those that may have an impact (as a user of or contributor to) on the Municipal Information System. This will likely exclude all daily paid or casual staff - due to their lower skills level - and the majority of the lower-rated clerical staff.

CITY ENGINEER DEPARTMENT

City Engineer - Mr. Edwin Yuk Low

Asst. City Engineer - Vacant

Transport & Cleansing (Damian Street)

Type of Activity performed by Department/Section	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Garbage Collection	Daily, regular	Collection regions fixed.
Removal of derelict vehicles	Council, City Police	Locations of vehicles.
Major cleaning of rivers	Internally collected. Works Section (C.E.Dept)	Location of necessary works.

Maintenance of equipment with the following service sections: <ul style="list-style-type: none"> • Tyre repair shop • Tractor shed (heavy equipment) • Garage works • Welding shop • General servicing • Battery works • Paint shop • Facilities maintenance • Internal security 	As required or regular servicing	As required or regular servicing
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------	----------------------------------

PRESENT STAFFING

Name	Post	Level of Training	Filled/Vacant
Jude Albert	Supt. Of Transport & cleansing	Secondary School & many course	Filled
Robert grant	Clerk 4		Filled
George Houlder	Transport Foreman	Sec. School	Filled
Kerwin Alexander	Workshop Foreman	Certificates	Seconded temporarily/ Vacant
Silas Khan	Garage Super.	Tech. & Mech. Courses	Filled

ADDITIONAL NOTES

Views of the City Engineer regarding the organisation of the Section:

- CE would like to see Garage separated. Priority right now is given to scavenging vehicles but should be for all. Move post from Garage Supervisor to Mech. Engineer - beef up post of garage supervisor.
- Garage should be placed directly under the asst. city engineer
- Want to group all scavenging function together - include some duties from Works on scavenging back into Transport & Cleansing. May require restructuring of monthly paid staff.
- Transport foreman doubles as Sanitation foreman presently. Suggestion to remove the Transport Foreman role and leave only Sanitation foreman role.
- Sanitation is seen to be a Public Health function - it is expected that this will be strongly opposed. City Engineer can provide a service function to Public Health. Will require shifting people.
- Transport Foreman is seen to be a redundant posts. No central dispatching actually takes place which was the original role of the Transport foreman. Seen better that vehicles are under each dept. as it is done now an that central dispatching is not req'd.

Works Section

Type of Activity performed by Department/Section	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Roadway repairs	Internal work demand. Public requests.	Locations of potholes.
Repairs to slipper drains and other masonry repairs	Internal work demand. Public requests.	Locations of repairs required. Nature of repairs required.
Welding works, metal fabrication	Internal work demand.	Location of work required. Type of works required.
Maintenance of park greenery	Internal work demand. Public requests.	Daily work schedules. Special attention to complaints.
Sweeping road surfaces	Fixed daily activity (gangs of six people involved)	Daily work schedules. Special attention to complaints.
Washing of road surfaces (Central Business District)	Fixed daily activity (gangs of six people involved)	Daily work schedules. Special attention to complaints.
Removal of silt from underground drains	Fixed daily activity (gangs of six people involved)	Daily work schedules. Special attention to complaints.
Sweeping of main water courses	Fixed daily activity (gangs of six people involved)	Daily work schedules. Special attention to complaints.
Resheeting of roads with asphalt	Development programme that is usually contracted out - Periodic	Locations of roads. Scope of Works.
Construction of retaining walls	Internal work demand. Public requests. Council requests.	Location of works required. Nature of works required.
Preparation of project estimates	Based on internal requests.	Project location and nature.
Project feasibility assessment	Based on requests from council	Project location and nature. Knowledge of internal design, construction and financial capability.
Design		Location of works required. Nature of works required.

Bridge repair (primarily masonry works)	Big jobs done by private contractors	Locations of bridges. Scope of Works.
General bldg maintenance	Internal work demand.	Regular maintenance schedule.
Pruning & cutting of trees	Internal work demand. Public requests.	Location of works required. Nature of works required.

PRESENT STAFFING

Name	Post	Level of Training	Filled/Vacant
Ricardo Revanales	Works Supervisor III	Technical/Diploma	Filled
G. Thomas	Works Supervisor III	Technical/Diploma	Filled (temporarily on Study Leave)
C. Sampson	Works Supervisor II	Technical/Diploma	Filled
N. Ramdhanie	Engineering Asst. II	Technical	Filled
D. Roberts	Works Supervisor I	Semi-Technical	Filled
D. Beddoe	Works Supervisor I	Semi-Technical	Filled
Mc. V. Hall	Works Supervisor I	Semi-Technical	Filled
M. Fingal	Works Supervisor I	Semi-Technical	Filled
	Works Supervisor I		Vacant
6 no.	Asst. Work Supervisors	Skilled Foremen	Filled

ADDITIONAL NOTES

- City split into four zones for C.E. Dept. purposes (with a fifth being considered).
- Separate crews are responsible for each of the four areas of the city.
- Some zone supervisors have to deal with different numbers of councilors.
- Works offices are split up for each of the zones even though they may be on the same compound.
- recommends:
- Split up based upon functions rather than zones.
- No desire to increase personnel but redeploy personnel.
- Building maintenance, roadway works, masonry, construction (new) remain as main functions of Works.
- Park/squares/recreation facilities should operate separately.
- All cleansing works should go under Cleansing Section.
- Maintain one facility for all Works activities and entire civil engineering functions.

Buildings Section

Type of Activity performed by Department/Section	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Receive & acknowledge building/development applications	Town and Country Planning Division (T&CPD).	Approved building/devt. plans. Name and address of applicant.
Compare building plans to building regulations	T&CPD. POSC building regulations.	Approved building/devt. plans. Knowledge of POSC building regulations.
Site inspection	T&CPD. Internally collected.	Approved building/devt. Plans. Site location.
Structural verification of building	T&CPD. POSC building regulations.	Approved building/devt. Plans. Knowledge of POSC building regulations.
Solicit public health verification	POSC Public Health (P.H.)Dept.	Recommendation of P.H. Dept.
Approve/refuse building permits	T&CPD. Internally collected.	Approved building/devt. plans. Results of above activities.
Monitor approved construction	T&CPD. POSC building regulations.	Approved building/devt. Plans. Knowledge of POSC building regulations Conditions of Building permit.
Investigating and reporting unauthorised construction	T&CPD. POSC building regulations.	Approved building/devt. Plans. Knowledge of POSC building regulations Conditions of Building permit.
Stopping unauthorised construction		
Certification (completion certificates)		Given upon request of constructing party

PRESENT STAFFING

Name	Post	Level of Training	Filled/Vacant
D. Cadet	Building Inspector II	Technical/Diploma	Filled
I. Mungal	Building Inspector I	Technical	Filled
D. Ramtahal	Building Inspector I	Technical	Filled

CITY ASSESSOR DEPARTMENT

Type of Activity performed by Department/Section	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Assessment of 12,000 properties within the POSC limits every 3 years	Internally collected Title Registry	Valuation Information: <ul style="list-style-type: none"> • Property size • Usage of property • Address of property • Rental Values approximated Title deeds (optional).
Mailing out these assessments by March 31 st annually	Internally collected	Owner name. Owner address.
Reassessment of structures that are improved	Internally collected Building Section, City Engineer Department (C.E. Dept.)	Valuation Information. Information on all building construction, renovation and other development.
Assessment of new structures as built	Internally collected Building Section (C.E. Dept.)	Valuation Information Information on all building construction, renovation and other development.
Valuation of the Corporation's land leases		Info. on POSC landholdings.
Naming of streets	Building Section (C.E. Dept.)	TCPD subdivision Plan. C.E.Dept. Final approval.
Recording mergers and subdivisions of properties and renumber properties	Building Section (C.E. Dept.)	TCPD subdivision Plan. C.E.Dept. Final approval.
Do insurance valuation for Corporation properties		Listing of POSC properties. Valuation Information.

Other Information Interactions

- The Water and Sewerage Authority (WASA) bases their rates for properties within POS upon the valuations of the City Assessor.
- Any changes to the valuations of properties would be entered into the Assessment roles, individual property file and minutes of Assessment Committee meeting (Standing Committee of the Council). The City Treasurers Dept's assessment role is also manually updated to allow collection of appropriate taxes. WASA is also informed of the changes. The Public Health and City Engineer Departments are informed of the changes of property ownership and/or value by the use of a monthly bulletin.
- The Valuations Division of the Ministry of Finance sometimes uses valuation information from the POSC files for some POS properties. However, there is little effective interaction between the two agencies. No sharing of procedures or information to any great degree.
- The Assessment Committee of the council has the eventual responsibility of approving or altering the valuations and assessments of properties. They perform an important role in the smoothing of the rates to suit the prevailing interests of the Council.

PRESENT STAFFING

Name	Post	Level of Training	Filled/Vacant
Mr. Singh	Deputy City Assessor	Technical	Filled
Mr. Seales	Valuation Assistant I	Technical	Filled
	Valuation Assistant I	Technical	Filled
8 no.	Site investigators	Daily Paid - Unskilled/On-the-job-trained	Filled

- Post of City Assessor not filled for several years
- No Professionally qualified personnel employed in this Department

ADDITIONAL NOTES

- Addresses are the only means of geographical reference.
- Maps and sketches are kept of the properties but the files on the property's are the best track of the Department's information.
- Many of the daily paid (supposedly unskilled) employees have many years of experience and are asked to perform highly technical procedures.
- Approx. \$4.5 m has been collected by the Assessors to date this year
- To review property values on new and renovated properties a site investigation is undertaken. Measurement are made of the bldg., take a sketch, check for rental rates of the area based on area trends.

- ARV is based on the monthly rental X 12. The taxable value is based on 10% of the ARV.
- Discussion is made on the ARV's of the properties and the rates to be charged prior to the new rates being fixed.
- Checks are made also based on sighting of new construction in an area and a new ARV would be fixed based on that.
- Depend on the deeds from the Registry . Procedure is being put in place to keep a copy of all deeds for city properties.
- New rates on a renovated property would be due from the first day of the following month.
- Assessors Dept. provides information on land ownership to the rest of the POSC on request.
- POSC Assessors Dept. follows procedure set out in legislation.

PUBLIC HEALTH DEPARTMENT

Chief Medical Officer of Health (CMOH) - Dr. Chang

District Medical Officer (DMO) - Vacant

Health Education Section

Type of Activity performed by Department/Section	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Health promotion and prevention	Health Education Division (Min. of Health)	Policy of central government
Meeting with neighbourhood leaders	Ministry of Community Development	Profiles of the community
Counseling families on health matters	Health Visitors Unit (P.H.Dept.)	Health/social problems
Community surveys on health behaviour	Institute for Social and Economic Research (ISER)	Trends in society
Planning joint programmes with other agencies	Local Health Authorities	
Speaking with teachers on health issues	Ministry of Education	Provision of information to aid planning
Explaining content of health programmes to community leaders	National Housing Authority, City Council	Solutions advanced by communities
Preparing materials for newsmedia when special health events occur	Public library reference section	Historical trends

Mobilising the community to effect a health-related action		Perceptions of the community of the Dept. and the programmes
In-service training - i.e. public service reform, vector control, litter wardens, etc.	Training Unit (City Clerk's Dept. and P.H. Inspectorate)	
Radio and TV broadcasts	Government Broadcasting Unit (GBU), advertising agencies	
School health education	Ministry of Education	Concerns that arise in school
Food handlers lectures	P.H. Inspectorate Section (P.H. Dept.)	Profile of food handlers and food institutions
Photography and video taping		
Production of audio-visual material		
Counseling		
Seminars/workshops/training	Central Training Unit, City Clerk	
Preparation of educational materials	Health Education Division, Min. of Health	Policy of Min. of Education
Communication - mass media	Advertising agencies	Surveys/target groups

PRESENT STAFFING

Name	Post	Level of Training	Filled/Vacant
David Williams	Health Educator II	Tertiary	Filled
Steve Khan	Health Educator I	Tertiary	Seconded temporarily/Vacant
Glen Glod	Audio visual officer	Secondary	Filled
Carlton David	Motor Vehicle driver/Operator	Primary	Filled

Inspectorate Section

Type of Activity performed by Department/Section	Internally collected or external sources of information to assist this activity	Type of information used or collected internally or provided by others
Monitoring and surveillance of health environment in POS	Min. of Health (MOH) Min. of Local Government Water and Sewerage Authority (WASA) Solid Waste Management Company (SWMC)	Government policy on health and food handling. Sectoral inputs regarding health aspects of city.
Monitoring the sale of food of all food handling outlets	Trinidad Public Health Laboratory, Govt. Chemist (MOH), Caribbean Industrial and Research Institute (CARIRI)	Results of laboratory testing.
Monitoring food handling personnel	Administrative Section (P.H.Dept.)	Historical records Names and addresses of food handlers
Investigation of complaints by public	Various Govt. depts., WASA, City Engineer Dept. (C.E.Dept.)	Location of complaint. Nature of complaint.
Control of mosquitoes, vermins, bats and stray dogs	Vector Control Unit (P.H. Inspectorate). POS Dog Pound (C.E.Dept.). Centeno Experimental Station, Min. of Agriculture, Lands and Marine Resources (MALMR). Administrative Section (P.H.Dept.) Complaints of public.	Location of problem. Nature of problem. Rabies testing and results. Reports of field inspectors. Regular vector control exercises. Location of all vacant lots in city and owner's name and address. Historical information on vector control activities and positive occurrences.
Maintenance of public conveniences, sewage disposal and chemical toilets.	Night Soil Unit (P.H.Inspectorate). WASA. SWMC. Administrative Section (P.H.Dept.) Complaints of public.	Location of cesspits, pits and chemical toilets. Location of WASA collection infrastructure. Historical information on activities of Night Soil Unit.

Educating and promoting health activities to schools and general public	Health Education Section (P.H.Dept). MOH. Service organisations, eg. Lions, Rotary, etc. Schools. NGO's/CBO's	Nature of health education topics to be dealt with. Educational material. Audio-visual material.
Consider building applications for approval	Town and Country Planning Division (T&CPD). Building Section (C.E. Dept.) Administrative Section (P.H.Dept.)	Public Health guidelines on construction and structures. Approved building plans from T&CPD. Historical information on building applications
Consider lease applications for approval	Administrative Section (P.H.Dept.)	Public Health guidelines on structures and environment. Historical information on leases and lease applications.

PRESENT STAFFING

Name	Post	Level of Training	Filled/Vacant
Anthony Thompson	Public Health Inspector (PHI) 1	Secondary School plus 2 yr. Basic Programme in Environmental Health	Filled
Ivan Beharrysingh	- ditto -	- ditto -	- ditto -
Julien Elie	- ditto -	- ditto -	- ditto -
Lochan Manoo	- ditto -	- ditto -	- ditto -
Nazrudeen Learin	- ditto -	- ditto -	- ditto -
Florence Fraser	- ditto -	- ditto -	- ditto -
Debralee Persad	- ditto -	- ditto -	- ditto -
Miton Sawhlal	- ditto -	- ditto -	- ditto -
Raphael Sookran	- ditto -	- ditto -	- ditto -
Prain Sammy	- ditto -	- ditto -	- ditto -
Ramiza Ramkissoon	- ditto -	- ditto -	- ditto -
Mark Laurence	Temporary PHI 1	- ditto -	- ditto -

Anthony Watts	PHI 2	Above training plus Post Basic Course in Meat and other Foods	- ditto -
Mohan Lutchman	- ditto -	- ditto -	- ditto -
Hollister Thompson	- ditto -	- ditto -	- ditto -
Edgar Garraway	- ditto -	- ditto -	- ditto -
Ragbir Ali	Acting PHI 2	- ditto -	- ditto -
Ken Ramsarran	Acting PHI 2	- ditto -	- ditto -
Samuel Pascall	PHI 3	Same as above plus Post Basic Course in another area of Environmental Health	- ditto -
Seuraj Lalchan	- ditto -	- ditto -	- ditto -
Chandra Ramlakhan	- ditto -	- ditto -	- ditto -
Anthony Cassie	Acting PHI 3	- ditto -	- ditto -
Sayad Ali	Acting PHI 4	Degree in Environmental Health	- ditto - (He has since returned to his post at the Arima Borough Corporation)

ADDITIONAL NOTES

- Vacancies exist at present for six PHI 1's, one PHI 2 and one PHI 3.
- Head of the Inspectorate Section would like to see entire Food Unit established for POSC. Specialised officers dealing exclusively with the sale of food from restaurants, shops, parlours, etc.
- Dealing with preventative medicine rather than curative medicine.
- Sometimes overlaps between city and suburbs
- Look after health affairs of both resident and transient population
- Monitor vigorously the itinerant vendors for compliance with pub.health regulations and give a wholesome product
- Investigate complaints from the public - takes up a large amount of time to receive and act on complaints. Need to find solutions to health problems.
- Manage vector control - stationed at Terre Brulee (behind the Western Cemetery at George Cabral St.) - responsible for vector control for the entire city.
- Manage a "night soil" unit - responsible for the emptying of septic tanks and pits. In the course of the normal duties of the Inspectors, they may notice overflow of pits etc. that will then suggest to the owner that he report it to the POSC for cleaning. Owner charged for service whether required or forced upon owner - added to the assessment bill.

- Involved in health education and promotion - important role to sensitise the school children and all burgesses on health activity. If education is successful than legislation should be able to be less used. Provide this education function as a service to the Education unit.
- New approval - PH will look at all public health - Engineers look at the plans first and then send it to PH, which is not the way it is supposed to be.
- Application for completion certificate is made by owner to Engineers. PH will then investigate the completed structure to give their approval. PH must be involved in the providing of completion certificate once initially involved.
- Occupation safety and health is an area that they want more attention being focused on. Would like to see workers wearing sanitary gear, health gear, ergonomics, etc. Education would be the major procedure.
- Occupational Hygienist at the Min of health called in on extreme cases for Noise pollution, air pollution by emission control.
- Testing of factory water pollution into public watercourses can be checked through the govt. chemist
- Public Health Engineering Unit of the Min of Health gives guidance or assistance for heavy particulate matter and soot emission into the environment.
- Control of the vacant lots of the city - role of District PHI to look at all vacant lots on a monthly basis. Check is made to locate the owner first and give verbal instructions or serve a notice to clean the lot. Information passed on to the City Engineers Dept. for cleaning up at the owners expense.
- Vector control - mosquito, rodent, rabies, canine units at St. James. Entire city monitored on a cyclical basis to ensure well within acceptable mosquito index. When above acceptable index, take action. Each of the units will be headed by a Public Health Inspector 2, with subordinate staff - this provides focused attention to each of the vector problems. Rodent and Rabies are combined under one PHI2. MALMR is largely involved in the bat control only. Stray dog unit and mosquito unit are under same PHI2.
- For general Public Health issues city is divided into three (3) zones; Northern, Southern and Eastern.
- City is divided into twelve (12) zones for mosquito vector control.
- City is divided into six (6) zones for anti-rabies vector control. These are subsets of the three zones used by the P.H. Dept.
- It is obvious that each of the departments uses their own interpretation of the city structure in a different way for their own management activities. That is that they subdivide the city into blocks of their own making which they use to manage their activities. There should be some value to coordinating these functional areas.
- Very little input of Min of Health into corporation's activities
- POS abattoir - services of a veterinary officer at this unit. Regulations are that all meat sold at the POS market must pass through the abattoir. Inspectors monitor the abattoir and the market to see (1) certified handler and (2) general conditions meet PH requirements.

- Potable water sampling done weekly at the Trinidad PH lab (run by Min of Health and CAREC) at no cost. Good relationship and interaction with PH lab.
- Food sampling done by Trinidad PH lab.
- Periodic checking of water from watercourses from rivers taken to test at the govt. Chemist (Min of Health)
- CARIRI can provide paid service as necessary for an independent analysis.
- PHI1's are presently not traveling officers due primarily to the perceived small size of the city.
- On-going training must be a reality for PHI's

Health Visitor Section

- Deals with the following:
- Running of immunization programmes.
- Screen schools for health concerns.
- Investigation of medical complaints.
- Staff nurse, trained as midwife, trained with sociology background and must have managerial experience.
- Many of the schools and the curative treatment facilities are run by the St. George West Corp. Therefore, the SGWC are responsible for the maternal and childcare and home visiting.
- School health - physical health of the child - social, medical (incl. medical) - determine general aptitude of the child. If a problem is seen to exist they are referred to a medical officer for a procedure. Parents can also get counseling. Manpower shortage means that worst cases are dealt with first.
- Data from hospital on children with infectious diseases.
- Set up of a national cancer registry
- POSC has agreed to get involved in putting together all the national information from the various sources.
- Data on communicable diseases is collected - eg. children data on communicable diseases.
- groups are dealt with: (1) communicable infectious diseases (2) chronic non-communicable diseases (diabetes, hbp) and (3) terminal diseases (cancer).
- Staff is irregular with only three staff with 2 being temporary on 6 month rollover contract - 1 has been temporary in this matter for 6 years.
- Care of the vaccines during transport.
- Only deal with the primary schools and the pre-schools in a cyclical basis at the beginning of each year - the health check take the entire year - all new admissions will be checked at the beginning of the year.
- Each Visitor has at least 12 primary schools under their control.
- Much data collected but not all used because of the difficulty of using it.

Administration Section

Type of Activity performed by Department/Section - all internally collected

Registry of all Public Health data - records and statistical data on:

- Births and deaths
- Food handlers
- Liquor licenses
- Certificates of registration
- Immunization
- Ambulance services
- Revenue of liquor licenses
- Complaints on health matters and nuisances in the city
- Building plans
- Leases
- Water applications
- Cleaning and emptying of cesspits and septic tanks

Administrative functions:

- Counter services - For dealing with applications and complaints from public.
- Financial - Maintenance of P.H. Dept. finances and preparations of requisitions and estimates.
- Secretarial - Typing of reports of technical officers for Council committees.
- Personal administration - Preparation of timecards and paysheets.

Additionally, this Section would like to have the capability to:

- Extract trends of statistics for food handlers
- Evaluate information on change of use for restaurant use
- Use computers for evaluating trends and monitoring
- Link across sub-offices to transfer information across departments

Start of a computerising programme has been enacted with the introduction of one computer and limited access to it by staff to do independent self-learning.

PRESENT STAFFING

Post	Number of staff	Level of Training	Filled/Vacant
Clerk IV	1	Secretarial/ Office Administrative	Filled
Clerk III	1	- ditto -	- ditto -
Clerk II	2	- ditto -	- ditto -
Clerk I	4	- ditto -	- ditto -
Clerk/Stenographer II	1	- ditto -	- ditto -
Clerk Typist I	2	- ditto -	- ditto -
Messenger I	3	Unskilled	- ditto -

CITY POLICE

Prevention

- Patrol (mobile and foot)
- Education (outreach/counseling)
- Escorts

Detection*Error! Bookmark not defined.*

- Investigation/Inquiries

Process (execution of actions)

- Maintenance of criminal records
- Court action
- Detention of criminals
- Dealing with Criminal Records Office of Police Service (input/access to criminal information)

TREASURER DEPARTMENT

Cashier

- Collection of revenues

Ledgers

- Maintenance of property accounting

Payables

Payment to contractors/suppliers for goods and services

Abstracts

- Maintenance of all revenue and expense information (daily transactions)
- Preparation of bank reconciliations
- Journal entries
- Automation of the ratable values of the properties so that changes and alterations are immediate and info. is on—line.

CITY CLERK (CEO)

Servicing 11 committees of Council

- Preparation of agendas
- Preparation of reports
- Archiving minutes
- Dispatching decisions, follow-up and reporting results back to committees
- Compilation of all minutes annually (including reports/reports/complaints)

Printing

- Majority of printing for the corporation
- Liase with external printers

Personnel

- Liase with Service Commission Department (re: leave, employment, etc.)
- Manage movement of staff/general staffing activities
- Processing leave application

Social

- City Day activities
- Other festivities

Records keeping

Complaints desk

Processing all stationery and equipment applications

Handling assignments for cemetery allotments and transfer of assignments

ADDITIONAL INFORMATION

- Legal input in terms of preparation of the leases
- Dealing with the complaints of the public
- Dealing with the external agencies
- In 1965, the activities of the utilities agencies was under the POSC. After it was transferred to the utility authorities.
- All utilities have to provide the POSC with information of their intentions to dig roads, plant poles, etc.
- A coordinating committee has been formed to interact with the agencies and utilities
- The Capital Site Value consultancy is being done at a national level
- Each of the Departments are expected to prepare their own automation plan
- Some departments do not have.

- Automation done in a piecemeal manner because of the disbursements of funds from the Central Government

Internal Auditor

- General overseeing role for all departments

APPENDIX D

INTERGRAPH MGE DATA MODEL

This data is provided via the Intergraph Internet webpage at www.ingr.com. Permission has been granted from Intergraph Corporation to reprint the documentation below with alterations as desired.

MGE is a layer-based system in terms of the geographic data storage structures, allowing users to access the data by selecting and querying on features of interest. The layered implementation allows efficient storage structures for the geometry and linkages to the relational database records, while remaining virtually transparent to the users. The layered implementation is accommodating to users that are just beginning the transition to GIS due to the simplicity of its workflow.

In an MGE database, maps are grouped into related categories. A geographic element is represented on a map as a feature. Features are grouped into the same categories as the maps on which they appear. Therefore, a map of a particular category can only contain features that are associated with that same category, and the feature hierarchy within MGE (please refer to Figure 1-1) can model geographic reality by representing geographic themes as MGE categories, geographic feature types as MGE features, and unique occurrences as unique feature occurrences within the MGE database (graphics and attributes).

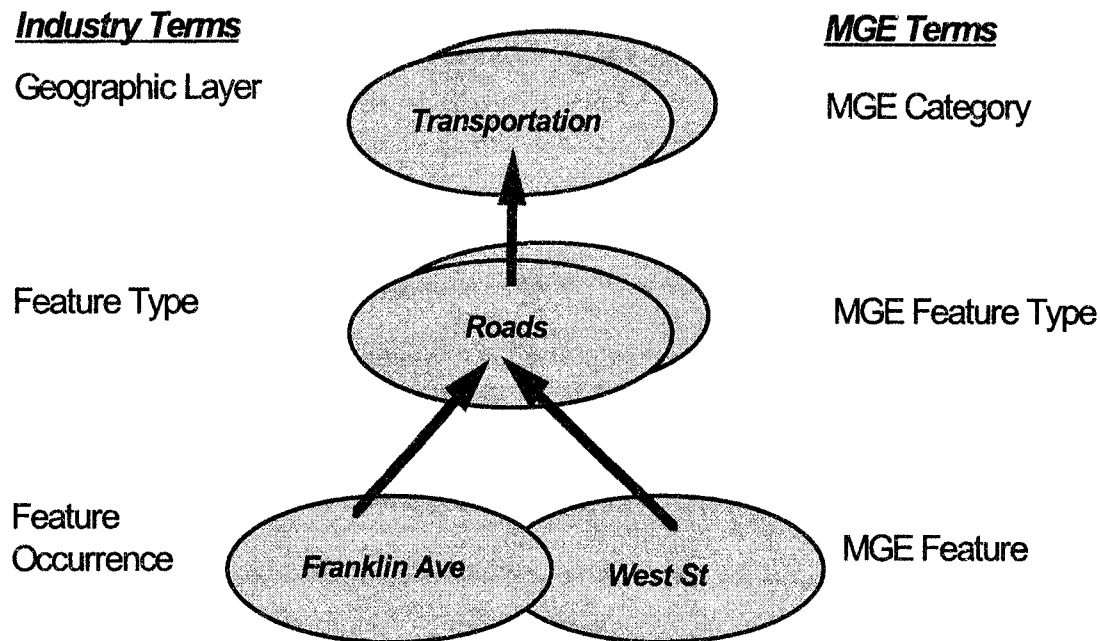


Figure 1-1. Geographic Feature Hierarchy

Layering by graphic level allows users to display any combination of features that have been placed on any map. In a manual GIS, a similar result is achieved with transparent overlays.

Each feature on a map can have a unique look because users specify its graphic attributes, which are collectively known as its symbology. However, non-graphic attributes of features do not appear graphically on a map and are stored in attribute tables.

Information in the attribute tables reflects instances of features. For example, the name of the owner of a building and the date a fire hydrant was last tested are examples of non-graphic attributes of a feature.

How MGE Represents Graphic Information

MGE's data model is composed of graphic elements linked to descriptive attribute information in a relational database (please refer to Figure 1-2). Graphic elements can consist of points, lines, and area features. Point elements, such as fire hydrants, utility poles, and manhole covers, are represented as single points in the graphics file. Linear features, such as roads, rivers, and utility lines, are defined by connected points that represent linear elements.

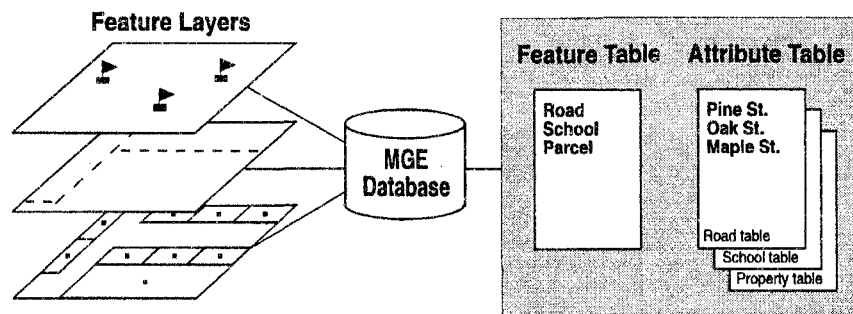


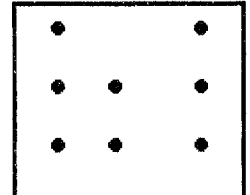
Figure 1-2. The MGE Data Model

Areas are depicted as polygonal features and corresponding area centroids. The area centroids are points placed within the area feature on which the area's attribution is attached.

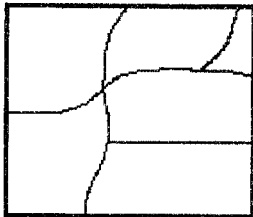
All of these graphic elements are linked to relational database (RDB) information that further describes and defines each individual feature. For example, a linear graphic element may be defined as "Solomon Hochoy Highway". This geographic feature can be further attributed as an asphalt, 4-lane, limited-access highway that was last resurfaced in 1984. The MGE data model allows a virtually limitless amount of descriptive information to be attached to a graphic element.

The MGE user has two options for relating lines with multiple shape points to attributes. The first is to collect all linear features by end points, with one attribute record for each 2-vertex line. For data storage optimization, the preferred mechanism is to attach only one attribute record for each topological line (for example, from node-to-node), regardless of the number of intermediate shape points.

Graphic information in MGE is stored in a CAD database (MicroStation design files) and represented as maps. A geographic element is represented on a map as a feature. Regardless of what users call it or what it represents, a type of graphical feature in MGE can be a point, a line, an area boundary, an area centroid, or undefined. A point represents the location of a geographic element, such as a utility pole or a fire hydrant, that is too small to be displayed as a line or area. A point can be displayed on a map as a graphics point (zero-length line), text node, text, or cell element.



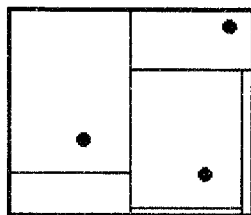
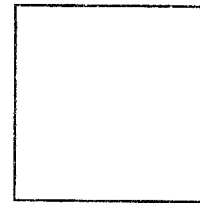
Points



Lines

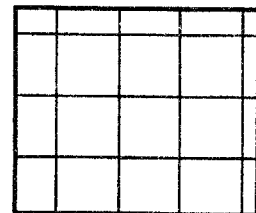
A line is a set of connected points. If straight line segments are short enough, a line appears to be curved. Streets and property lines are typical linear features.

An area boundary is a set of lines enclosing a geographic region, such as the shoreline of a lake or a city limit. Boundaries can be shared by adjacent areas. The graphic element need not be duplicated.



Centroids

An area centroid contains attribute information about an area and must be placed somewhere within the area boundary. In MGE, a user creates attribute tables to contain this information and links them to features. A centroid can be displayed on a map as a graphics point, text node, text, or cell element.



**Undefined
feature type**

An undefined feature can be whatever the user desires. A grid is an example of an undefined feature.

Each feature, regardless of its type, can have a unique look because MGE allows users to define the symbology for each feature. The symbology consists of the level, style, weight, and color. For example:

	Style 0	Style 3	Style 1	Style 4
Weight 1	_____	-----	-----	-----
Weight 8	██████████	██████████	██████████	██████████
Weight 31	██████████	██████████	██████████	██████████

Some attributes of a feature cannot be displayed graphically, and this non-graphic information must be represented in another manner. MGE not only stores non-graphic information, it allows users to link non-graphic information to existing features or to features as they are generated (through digitizing).

How MGE Represents Non-Graphic Information

An attribute table contains one or more columns for which a value can be entered. For example, the value assigned to the attribute street address for one building centroid is "61-63 Edward St." Another way to look at it is that "61-63 Edward St." is the entry in the street address column of the buildings table, and all of the values for this particular building centroid constitute a record (or row) in the buildings table.

Assigning values to one or more attributes linked to a feature is called defining attribution. Because MGE lets users define attribution automatically for features as they are digitized, it is said to provide intelligent digitizing.

Intergraph's MGE solutions are built solidly upon a distributed architecture so that the applications may be remote from the data. For the attribute data, MGE incorporates the use of the Relational Interface System (RIS), which facilitates client-server network communication to the RDBMS. The use of RIS enables multiple workstations to communicate with the database server simultaneously. This cuts costs by reducing the number of database licenses required, as well as reducing data redundancy by allowing multiple users to share a single database on the local area network (LAN).

MGE's Data Layers

The use of this simple yet accommodating data structure (reference Figure 1-3) allows users to add the differing graphic layers to their personalized MGE view transparently and at random. Assuming users have access to a layer of data, they will be able to select the graphic features of interest from any available graphic layer for display, query, and update as appropriate.

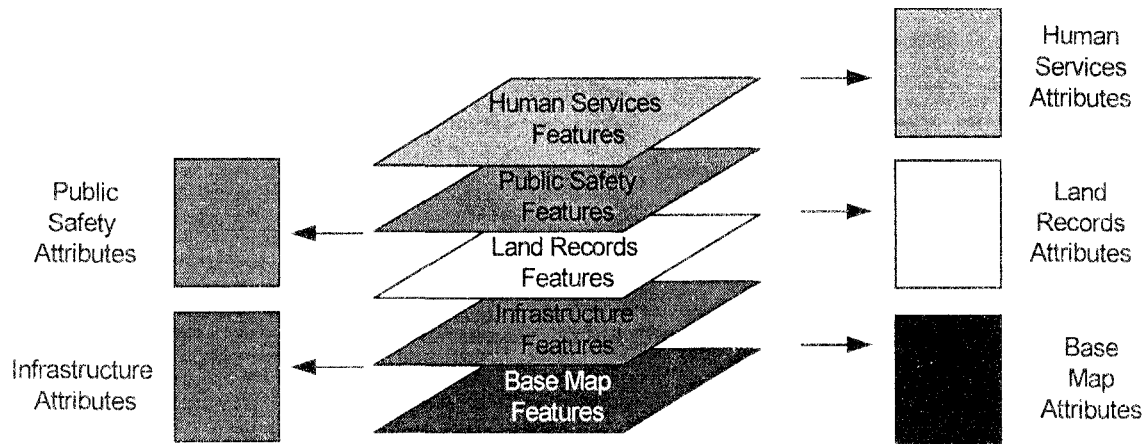


Figure 1-3. Example GIS Data Layers

MGE - a single, seamless, basemap of the entire geographic extent

The MGE database is composed of horizontal tiles (or mapsheets) that will be segmented (partitioned) into optimal file sizes for system performance (please refer to Figure 1-4). These tiles may represent, for example, one square mile of geographic coverage, depending upon the density of data covered.

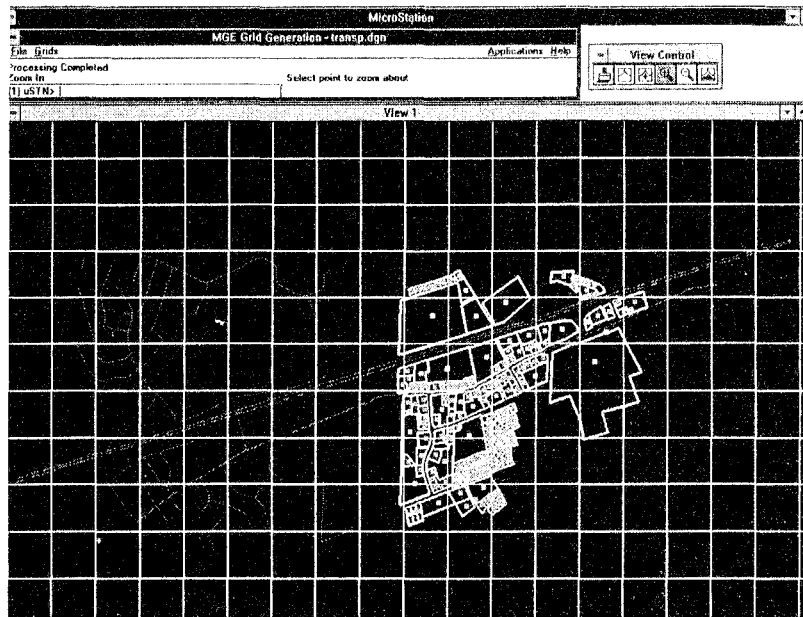


Figure 1-4. Sample Partitioning of GIS Data

Although this physical segmentation exists within the GIS database, it is completely transparent to the user in virtually all GIS-related activities. For example, when a user initiates a geographic query based on a database attribute value, the result will be the immediate location and display of the graphic entity to the user with no outward appearance that a specific graphics file has been accessed and displayed (please refer to Figure 1-5).

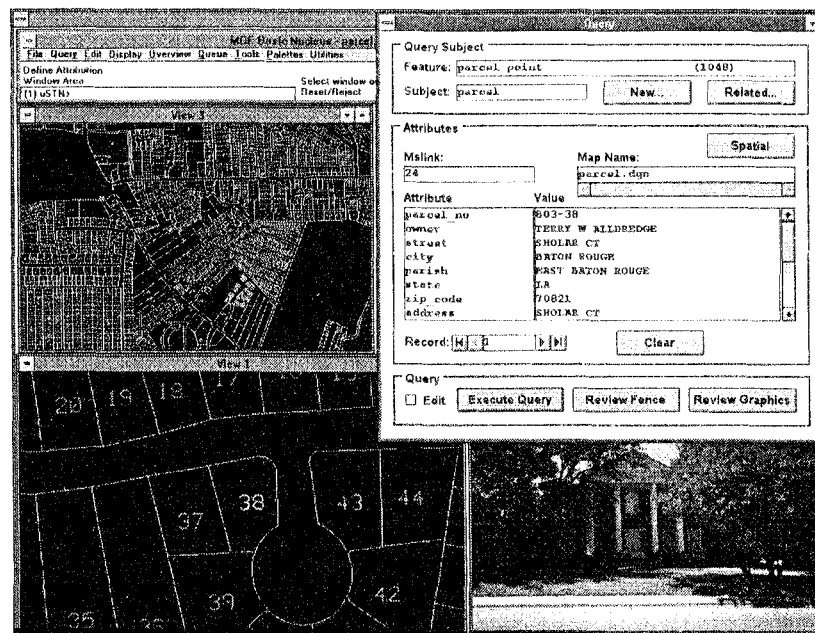


Figure 1-5. Sample Attribute Query resulting in Graphic Identification

Accessing geographic data from a graphics perspective, when the user knows the approximate geographic location of the feature desired, is accommodated within MGE with the GeoIndex Locate function. This allows the user to begin searching the GIS database with a top-level view of the entire GIS database, narrowing the physical geographic search by “zooming” into specific areas, and then “poking” on the geographic features to review database-specific information to identify the desired feature.

All three user systems support the same type of seamless graphics and attribute access. Once the graphic entities of interest have been located, all subsequent tasks can be performed immediately, such as complex topological analysis, feature edits, map production, or continued queries.

MGE supports one to many relationships with spatial data.

The MGE system delivers many system administrator tools built on GUIs. These tools assist the administrator with special purpose tasks, such as defining system-wide data standards (the Feature-Schema Builder), defining relationships between local and system-wide relational database tables (the Join Manager application), and creating views of the data based on join relationships.

The Join Manager GUI allows the administrator to define the relationships between tables by selecting the master table, join table, and identifying the columns in each that have related values. Multiple column combinations can be defined for any join condition. One-to-one, one-to-many, many-to-one, and many-to-many relationships are all supported by this GUI.

The View Manager GUI allows the administrator to create RDB views on the GIS database. The administrator selects a primary table for a view. A list of available columns is presented. The administrator may select all or a subset of columns. The administrator may also give columns an alias name. For example, the administrator may want to alias the standard Census Bureau column name “p0001001” as “total_population” so that users can use the data without being experts on government naming standards. The View Manager GUI also allows the user to select one or more joins created by the Join Manager. Upon selecting a join, a list of available columns in the join table is presented so that the administrator can select additional columns of data to be presented to the user. These columns can also be aliases if the administrator so chooses.

The standard Desktop and High End database query tools enable the user to select attributes based on the original table definition or on a view. Selected interfaces allow the user to traverse from one table to the next based on a join condition. Two examples, one-to-many and many-to-one, are as follows:

- A one-to-many example

A user clicks the mouse on a parcel to retrieve the related database information. The parcel record has a unique parcel identification, area, and other information. This parcel, however, is flagged in the database as a condominium. Upon seeing this flag, the user selects the “related information” button and is presented with a selection of views and related database tables. The user selects the “parcel_owner” table and is immediately presented with the records for each owner of this particular condominium parcel (a 1:n relationship—one physical parcel, many owners). If the owner’s Social Security Number, for example, were in the “parcel_owner” table, the user could use that information to traverse the database to other related information for which that user has the privilege to see.

- A many-to-one example

Where split by ROWs, for example, parcels may also be discontinuous (for example, many physical lots of land joined to a single owner record). The user queries for a parcel owner, John Q. Smith, and is returned one parcel identification. Using the “related information” button, the user learns that two physical lots of land are associated to this parcel identification. Using the “locate query” button, the user may identify both lots of land (an n:1 relationship—many parcels, one owner).
