"A COMPARATIVE STUDY OF EVALUATION SYSTEMS TO IMPLEMENT SAMOAC IN PRETORIA"

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ENGLISH SUMMARY

This dissertation, entitled "A COMPARATIVE STUDY OF EVALUATION SYSTEMS TO IMPLEMENT SAMOAC IN PRETORIA" was completed by RYAN SCOTT GANDY, supervised by GWEN BREEDLOVE in the DEPARTMENT OF LANDSCAPE ARCHITECTURE, ARCHITECTURE AND INTERIOR DESIGN, for the degree MASTER OF LANDSCAPE ARCHITECTURE.

The study sets out to analyse and compare the effectiveness of traditional application methods with technologically enabled methods that make use of GIS, to implement the South African Manual for Outdoor Advertising Control (SAMOAC).

Literature studies reviewing the past and current status of outdoor advertising control both locally and internationally were followed by a review of literature on GIS. Present and future aspects of both physical functionality and philosophically speculative trends in GIS were studied.

In order to establish a control for the evaluation of the GIS based system's success, the function of the previously paper based system was analysed. Problems relating to the paper based system (as experienced by the Department of Outdoor Advertising Control at the City Council of Pretoria (DOACCP) and the Outdoor Advertising Association of South Africa (OAASA)) were used as test criteria to establish whether or not the GIS based system was an improvement on the paper based system.

The findings of the dissertation were as follows. Problems experienced by the DOACCP and the OAASA were caused by: omissions in the SAMOAC document, a lack of information prior to application and poor implementation of the SAMOAC guidelines.

The GIS based system was found to adequately correct or neutralise all of the problems that the DOACCP and the OAASA experienced with the paper based application of SAMOAC. As hypothesised, major improvements in running efficiency, transparency and as a spin off from these, cost effectiveness were experienced. The conclusion drawn from this is that the GIS based implementation of SAMOAC at the DOACCP continues to be a resounding success.

PREFACE AND ACKNOWLEDGEMENTS

The compilation of this dissertation has relied on a variety of data sources and much of the data presented has been work shopped and tested by members of the Outdoor Advertising Control Scheme for the Pretoria Metropolitan Area (OACSPMA) project team. Reviews and suggestions from controlling authorities and outdoor advertisers alike have resulted in many necessary backtracks and revisions. It is hoped that the dissertation document presented here will be of value to the Pretoria Community. I would like to thank the following people and organisations for their guidance and support (in alphabetical order):

- Gwen Breedlove (U.P.)
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- Salome Minnie (GIS at CCP)
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- Braam Visser (GIS at CCP)

List of Definitions

Definitions of terminology relating specifically to the subjects covered in this dissertation are many and for this reason have been included as an Annexure. All other words have their standard Oxford dictionary meaning.

An alphabetical list of definitions can be found in ANNEXURE A – GLOSSARY of TERMS on page 111.

List of Abbreviations and Acronyms

API	Application program interface
ASCII	American Standard Code for Information Interchange
CAD	Computer Aided drafting
CADD	Computer Aided drafting and Design
CASE	Computer-Aided Software Engineering
CCP	City Council of Pretoria
DBMS	Database Management System
DEAT	The Department of Environmental Affairs and Tourism

DOACCP	The Department of Outdoor Advertising Control at the City Council of Pretoria.
DXF	Data Exchange Format
GIS	Geographical Information Systems
GUI	Graphic User Interface
ISDN	Integrated Services Digital Network
ISO	The International Organization for Standardization
LAN	Local Area Network
NCPFOA	The National Code of Practice for Outdoor Advertising
OA	Outdoor Advertising
OACSPMA	The Outdoor Advertising Control Scheme for the Pretoria Metropolitan Area
OAASA	The Outdoor Advertising Association of South Africa
OAGIS	Outdoor Advertising Geographic Information System
ODBC	Open Database Communication
OLE	Object Linking and Embedding
OS	Operating System
PAT	Point Attribute Table or Polygon Attribute Table
RDBMS	Relational Database Management System
SAMOAC	The South African Manual for Outdoor Advertising Control
SQL	(sequal) Standard Query Language
TCP/IP	Transmission Control Protocol/Internet Protocol
TIN	Triangulated Network Model
TIFF	Tagged Interchange (Image) File Format
VB6	Visual Basic Version Six
VBS	Visual Basic Script
WAN	Wide Area Network
WWW	World Wide Web

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1 INTRODUCTION

Outdoor Advertising (OA) as a means of communication is not a new concept. In fact, OA has been a part of civilisation since around the time of Christ. In fact, according to Tony Davidson (chairman of the Outdoor advertising association of South Africa (OAASA)), the earliest known outdoor advertising was discovered by Archaeologists working in Pompeii who uncovered an in tact mural advertising a gladiator contest to be held in one of the Pompeii arenas.

Recently in terms of the history of outdoor advertising, (1920-2000), the explosion of new materials, construction and printing techniques and the move towards mass printed media, has led to an explosion in the number and variety of outdoor advertising media. Billboards, banners, blimps, trailers, flyers and an ever-increasing host of advertising media "carriers" provide or bombard us with information, depending on the point of view taken.

In the last 20 years, pressure on national government from the private sector and environmental groups mounted due to the perceived lack of control of visual degradation of our living environment caused by OA. This pressure was aggravated by the frustrations and problems being experienced by the outdoor advertising industry as a result of indefinite or non-uniform guidelines. The fragmentation and out datedness of provincial and local legislation together with the ineffective guidelines and bylaws adopted by the local councils were glaring to say the least. In the early 90's, National government started looking for better methods to regulate outdoor advertising, and assigned the task of investigating this situation to the then Department of Environmental Affairs and Tourism (DEAT).

DEAT compiled a task team comprising the University of Pretoria and Van Riet and Louw Landscape Architects to complete a study on possible methods of controlling South African OA. Initiating this process was a bold step by government as the concept of developing control measures for OA had been met with much scepticism the world over. Many European and American sub continental countries had tried and failed to successfully regulate OA. (Velcich 2000)

The task team forged ahead, and through a series of incremental breakthroughs produced the National Code of Practice for OA. This document was however never put into print. Instead, the National Code of Practice document was transformed into "The South African Manual for Outdoor Advertising Control" or SAMOAC. SAMOAC was reviewed and adopted by National Government, and became a non-statutory guideline for councils and advertising contractors.

In an interview in 1999, Peter Velcich, who was part of the team that compiled the National Code of Practice for OA, stated that problems with the implementation of the SAMOAC document have hampered its widespread application in South Africa. On investigating this statement further,

several metro councils in Gauteng expressed similar views. Pretoria City Council, the City council of Kyalami, the Eastern Gauteng Services Council, the Greater Johannesburg Metro Council, the City Council of Cape-town and the City Council of Durban all stated (during either telephonic or personal interviews) that they had adopted SAMOAC but, as a result of its national scale, were struggling to implement it effectively on an erf by erf basis. Were these problems due to gaps in the SAMOAC guidelines or due to ineffective implementation of the guidelines presented? CHAPTER 4 explores the SAMOAC guidelines and compiles a list of problems with SAMOAC based on interviews with the DOACCP and the OAASA. The initial findings of CHAPTER 4 led to the discovery that problems with implementing SAMOAC stemmed from two distinct sources. Firstly, the quantum leaps that the SAMOAC document had made meant that gaps existed in the guidelines and secondly, many problems seemed to be caused by ineffective implementation of the presented guidelines, resulting in conflict between authorities and advertisers. SAMOAC had never been validated as a literature source, and this study is the first academic appraisal and review of SAMOAC since its publication in April 1998 (Jordaan 2000). Gathering and assimilation of feedback from controlling authorities and advertisers was therefore seen as the first step in the validation process. This feedback was later used by IGIS (PTY) LTD when compiling a set of guidelines that the DOACCP used to develop a modified version of SAMOAC, the "The Outdoor Advertising Control Scheme for the Pretoria Metropolitan Area" (OACSPMA). The latter part of the initial review of SAMOAC, which suggested that implementation procedures were causing problems led to the second part of this study. How could the SAMOAC guidelines be implemented better? Could a rethink on the process of implementation by perhaps incorporated computer technology and in particular spatial databases and GIS benefit the controlling authorities and the OAASA members in the regulation of OA. To test this question, two different ways of implementing SAMOAC, the traditional manual scenario, and a technology-based implementation with GIS are compared.

It may be argued that it is a generally accepted fact that GIS is more effective than paper based systems in almost all spatial applications. However, as the literature search will show, no GIS application or implementation systems for outdoor-advertising are currently documented, so precedents for such a system do not exist. As a result, the validation of a GIS to implement OA control was seen as necessary.

The fact that both controlling authorities and the OAASA members support SAMOAC bears testimony to its (all be it short) success. A vast percentage of the support and motivation for this dissertation stems from a pilot study initiated by the DOACCP together with IGIS (PTY) LTD in which the development of a GIS based system to implement the SAMOAC guidelines as well as those covered in CHAPTER 4 of this document was completed. The GIS based system was also designed to meet the DOACCP requirements of improving efficiency, productivity and transparency. City councils throughout South Africa wait with anticipation to ascertain whether

Pretoria has succeeded in its efforts to alleviate some or all of the teething problems being experienced with implementing SAMOAC on local scale.

The findings of this dissertation are important in that they validate the SAMOAC document as well as ascertain whether the use of a GIS is a positive step towards successfully implementing the SAMOAC guidelines. Once the findings of this dissertation are released, councils will be in a better position to understand whether (and how) a technology-based approach can help to streamline management techniques allowing Outdoor Advertising to generate large amounts of previously untapped revenue whilst still protecting the visual environment. From a commercial point of view, the removal of uncertainties as to what the outdoor advertising GIS will deliver will allow councils to better motivate the spending of funds on the development of their own GIS to implement SAMOAC.

The following chapter compiles the issues stated here into a formal academic problem statement. This problem statement is then analysed and compartmentalised into sub problems that flow into hypotheses used to define the structure of the data and procedures presented in the study.

2 THE PROBLEM AND ITS SETTING

This dissertation follows on recommendations made by Peter Velcich in his M.L. dissertation entitled "Towards a national code of practice for outdoor advertising" submitted in July 2000, and accepted in August 2000.

South African OA control has advanced significantly up to the turn of the millennium. The most remarkable milestone was the publishing of SAMOAC, which established a nationally accepted set of guidelines for the control of OA. SAMOAC has been widely accepted, but due to the quantum leaps the SAMOAC document made, several omissions and perceived gaps were found to exist that still require filling in. The introduction mentioned how these gaps have become a set of issues that the controlling authorities and the Outdoor Advertising Association of South Africa (OAASA) are currently struggling to bridge. The introduction also introduced the fact that many of these perceived gaps are caused by ineffective implementation of existing guidelines and not just by omissions or an incomplete set of guidelines. As a result, the process of implementation as well as the existing document guidelines may need rethinking or "speeding up".

Validating and reviewing the SAMOAC document as well as evaluating the existing procedure of implementation of the guidelines, i.e. trying to find new technologically advanced methods of implementing SAMOAC so as to alleviate known teething problems are the source of this documents main problem statement.

2.1 STATEMENT OF THE PROBLEM

The fact that SAMOAC is facing problems can be seen in the many court cases and public hearings surrounding its implementation. But how should the document be tested, validated and possibly updated? The question posed as the focus of this study is set up in such a way that the ideal test criteria to answer the problem statement can be build from the SAMOAC document combined with feedback from the DOACCP and the OAASA on the SAMOAC documents success up to this point in time. The problem statement is thus:

What is the comparative effectiveness of traditional (paper based) and technology driven (GIS based) systems in the implementation of SAMOAC on local scale?

In testing the two systems, the effectiveness of SAMOAC will be reviewed and steps to improve the application of the SAMOAC guidelines will be documented.

In order to deal with the problem statement effectively, it is broken down into a series of sub-problems. The sub problems deal with the establishment of test criteria, and the specific natures

of each of the systems being tested against these criteria. The main problem statement consists of three logical subsections. The first is the exploration and documentation of the original paper based system. The second is a similar exploration of the new GIS or technology based system, and the third is a synthesis of the differences between the two.

The following flow chart presents a structural representation of the relevant sub problems (Vide Leedy 1997:58).

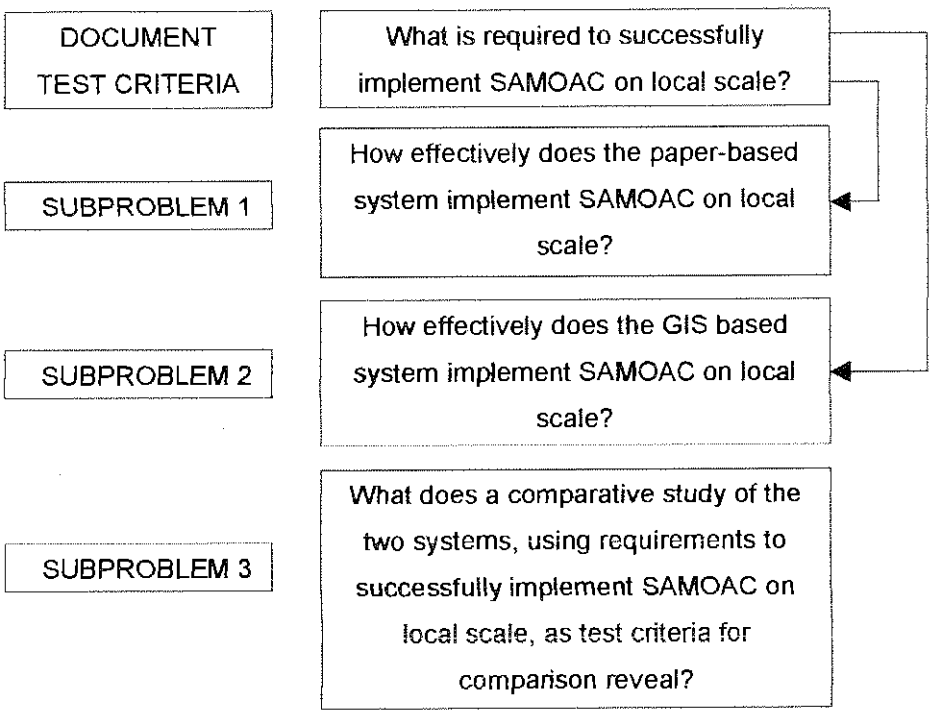

FIGURE 1: SUB PROBLEMS IN THIS STUDY

Based on the theory that the implementation of the SAMOAC guidelines as well as the guidelines themselves were causing regulation problems in the OA industry, the main research question sets out to compare two systems, the traditional paper based system and a technology driven GIS based system. In order to maintain its scientific value, the entire issue of evaluation needs to be based on some rational set of testable criteria. Measuring one complete system against another is difficult unless a common set of test criteria can be established. Since the end goal of SAMOAC is to regulate OA, the most logical set of criteria to test any implementation process is a list of requirements needed to successfully implement SAMOAC. Unfortunately on compiling a pilot list of criteria (mentioned earlier) it became painfully clear that the SAMOAC document was not as comprehensive as originally anticipated. Gaps caused by unique situations not previously encountered during the drafting of SAMOAC were causing problems. A revised list of criteria was thus compiled that included requirements which had come to light through the use of SAMOAC by industry. The process and complete list of test criteria can be found in CHAPTER 4. With this working set of test criteria, the sub problem statements were developed.

2.1.1 STATEMENT OF SUB PROBLEM 1:

How effectively does the paper-based evaluation system implement the SAMOAC guidelines?

Once the test criteria required to evaluate the success of a process at implementing SAMOAC had been compiled, the next step was to concisely define the scope of the test. This sub-problem strives to evaluate the success of the paper-based implementation of the SAMOAC guidelines. A critical analysis of the paper-based process will be conducted, by testing how effectively it meets the criteria specified in CHAPTER 4. Critical factors such as accuracy of information as well as time to process an OA application will be measured. The success with which the paper based system implements SAMOAC will then be used in the comparison process documented as sub problem three.

2.1.2 STATEMENT OF SUB PROBLEM 2:

How effectively does the GIS based evaluation system implement the SAMOAC guidelines?

With the test criteria established (see CHAPTER 4), and the evaluation of the paper-based system completed, (Sub-problem 1) the previously mentioned test criteria are now used to evaluate the GIS based system. This sub-problem thus strives to evaluate the success of the GIS based implementation of the SAMOAC guidelines. A critical analysis of the GIS based process will be conducted in the same way as sub-problem 1, by testing how effectively the implementation process meets the criteria specified in CHAPTER 4. Once again, critical factors such as accuracy of information and time to process an OA application will be measured. The information captured in this evaluation will then be used in the comparison process documented as sub problem three.

2.1.3 STATEMENT OF SUB PROBLEM 3:

By employing qualitative comparison procedures, evaluation of two complete systems designed to perform identical tasks is possible. The key link between the two systems being evaluated is the use of a common set of test criteria. This comparison is vital, as it will provide relative feedback on the success of one system of application over another. Sub problem 3 is thus:

What does a comparative study of the analyses conducted in 2.1.1 and 2.1.2 reveal when tested against the requirements needed to implement SAMOAC at municipal level?

This sub problem assimilates the information from sub-problems 1 and 2, and compares the results of evaluation of the two systems. This sub-problem is designed to highlight the positive and negative points of one system over the other.

With the problem statements defined, the next step is to generate a hypothesis for each of the sub problems. The system of problem statement, sub-problem statement, hypothesis is presented in a simplified linear fashion to aid legibility. This entire process was by no means linear, and entailed constant definition and redefinition of both problem and expected result as the proposal for the study was developed.

2.2 HYPOTHESES

In essence, this step is a synergy of knowledge, existing literature and current paradigm that is used to formulate a theory on the expected outcome of the proposed research. Hypothesis generation is basically an educated guess at what to expect. Based on the idea that nobody has a true and complete knowledge of the world, proving a hypothesis true is seen by science as impossible. The scientific method therefore uses, mutually exclusive hypothesis pairs, with the idea that disproving a mutually exclusive null hypothesis indicates that the alternative hypothesis is supported. As this study is primarily qualitative in nature, developing a pair of mutually exclusive hypotheses that "cover all the options " is almost impossible. For this reason, only the alternative hypothesis is stated, and the study is satisfied with being able to show that the hypothesis is either supported or not supported.

2.2.1 HYPOTHESIS 1:

Sub problem 1 set out to evaluate the success with which the paper-based system implemented SAMOAC. The SAMOAC document provides a model for implementation that strongly suggests the use of a manual or paper-based system. But is this system really highly effective? Interviews with the DOACCP and the OAASA, two groups working with SAMOAC from opposite ends revealed that the suggested paper-based system was fraught with problems. Members of these bodies were asked to describe their experiences with the paper-based system. Initial responses stated that the guidelines in SAMOAC were the cause of the problem. On closer investigation however a deeper pattern emerged. This pattern of associated shortcomings was distilled and a theory was formulated that implementation procedures and support documentation rather than the actual SAMOAC guidelines were the main issues hampering the successful implementation of SAMOAC. A hypothesis was formulated to test this theory and was written as:

The effectiveness of the paper-based implementation of SAMOAC on municipal level is limited as a result of a lack of information and ineffective processing techniques.

2.2.2 HYPOTHESIS 2:

The paper based implementation system has been in use since the publishing of SAMOAC in 1998. Both the DOACCP and the OAASA are very familiar with the process and eliciting feedback was relatively simple. Due to the fact that the GIS based system (requiring testing as part of sub problem 2) had only been in place for a few months, eliciting in depth feedback from

either the DOACCP or the OAASA proved more challenging. Even though the GIS based system was specifically designed to implement the SAMOAC guidelines, assuming success would negate the requirement for a scientific test, one of the objectives of this dissertation. Thus, the limited feedback from the DOACCP and the OAASA members was combined with theoretical projections of the systems known capabilities to implement the SAMOAC guidelines. A technical review of the system is provided in ANNEXURE D - Data from the IGIS (PTY) LTD. Consultants The combination of these two sources indicated an extremely positive outcome and the following hypothesis was thus proposed.

A GIS based implementation system is a highly effective method of implementing SAMOAC on local scale.

2.2.3 HYPOTHESIS 3:

Based on the "educated guesses" or hypotheses for sub problems 1 and 2, it stands to reason to predict that the GIS based system will be more effective than the paper-based system. As the test criteria will receive qualitative responses (criteria in CHAPTER 4), defining the absolute values for the differences between the two systems is almost impossible. For this reason, qualitative evaluation of the responses will be used as best possible to ascertain whether the GIS based system really is better than the paper-based system. The hypothesis for sub-problem 3 is thus:

The GIS system is more effective than a paper based system when measured against requirements needed to implement SAMOAC at municipal level.

As mentioned above, the measurement criteria, the anticipated responses and the interpretation of these responses are all qualitative in nature. In order to remove as many uncertain or grey areas as possible, a tight set of delimitations needs to be put in place. These delimitations are aimed at removing unnecessary "noise" thereby highlighting the results and findings more clearly.

2.3 DELIMITATIONS

As with statistically oriented dissertations (of which this one is not a part) the researcher aims to use a methodology that eliminates as many outside influences as possible (noise) whilst leveraging every available mechanism to enlarge the effects of treatments applied. In this dissertation, the two "treatments" being tested are the paper-based and GIS based applications of the SAMOAC guidelines. The following delimitations try to define the study as best possible so that the results received could be predicted with certainty should the study be repeated.

Since the study is to be performed in Pretoria, with its unique set of circumstances and OA applications, the discussion is limited to sign types requiring specific consent in terms of the

Pretoria specific version of SAMOAC, the "Outdoor Advertising Control Scheme for the Pretoria Metropolitan Area" (OACSPMA).

The entire outdoor advertising application procedure involves many stages and spans several departments and official bodies. Since the treatments being tested are both housed entirely within the DOACCP, it stands to reason that stages of an application procedure outside of the DOACCP can be viewed as constant and therefore do not require evaluation for each of the two treatments. Hypothesis testing will therefore be restricted to those activities performed by the DOACCP from the time an application is received in full until the time that that application leaves the office of the DOACCP.

As the treatments being tested pertain solely to the DOACCP, the study will be limited to the geographic areas covered by the eleven planning zones of the Pretoria Metropolitan Area as defined at the time of this study. Due to incomplete and incompatible data, the municipalities of Acacia and Centurion are not covered.

Due to cost and time, the GIS based system cannot be tested on more than one GIS platform. Since validating the implementation of the SAMOAC guidelines as opposed to validating different GIS platforms is the key objective of this study, the GIS system used will be limited to REGIS, the system currently in use at the City Council of Pretoria. Understandably, the use of a legacy GIS such as REGIS limits certain functionality, especially 3D capabilities. This limitation is not seen as being problematic as both the SAMOAC and the OACSPMA can be accommodated on a two-dimensional GIS system.

Since this dissertation is concerned with OA, a self evident delimitation is that this study is only concerned with outdoor advertising signage, and does not include information transfer signage such as road traffic and other statutory information signs.

2.4 ASSUMPTIONS

In order to determine a base upon which this dissertation is build, certain assumptions about aspects of the study need to be qualified before hand. With out qualification, the evaluation of whether the findings in this dissertation are applicable and valuable or not would be almost impossible.

The crux of the evaluation of the two treatments is based on the assumption that both the DOACCP and OAASA members have experienced problems with the implementation of SAMOAC at local scale.

In order to test one implementation process (treatment) against the other the variance in procedure between the two treatments needs to be small. As their step-by-step objectives are

identical, the paper-based and GIS systems are assumed to perform an almost identical set of tasks.

As many of the results and conclusions from the testing of the two treatments requires continuously accurate data in order to make projections, it is assumes that the data in use at the DOACCP is current, and that this will continue to be the case in the medium and long term, with land parcel information changes being updated on a regular basis. Linked to this is the assumption that data captured by the DOACCP, the GIS department of the CCP and its relevant sub consultants is true and correct.

Extensive literature reviews were performed to ascertain whether SAMOAC is in fact the most applicable set of guidelines to implement. No literature surfaced to contradict the assumption that SAMOAC is currently the most comprehensive set of guidelines available to control outdoor advertising in South Africa. Linked to this, is the assumption that SAMOAC will continue to be used as the guideline document to control outdoor advertising in South Africa.

As mentioned earlier, the Pretoria Metropolitan Area has a unique set of OA conditions that require regulation. SAMOAC was found not to cover all sign types found in the Pretoria Metro Area. It is assumed that the Pretoria specific version of SAMOAC, the OACSPMA, which was compiled to address the Pretoria specific shortcomings of SAMOAC, contains guidelines for all the sign types found in Pretoria.

As part of the process of implementing SAMOAC, Gateways and Prominent Ridges need to be defined. It is assumed that the methodologies used to define these areas are scientifically sound and that the areas shown to comprise these categories are true and correct.

The zoning information of the DOACCP has been used in both the paper-based and GIS based treatments, and the assumption is therefore made that the effect of detail of this information plays no role in the evaluation of the two treatments. If is here assumed that the DOACCP zoning information is sufficiently detailed to implement the SAMOAC guidelines effectively.

It is assumed that the guidelines described in SAMOAC are of such a nature that they can be feasibly implemented, and that the people tasked with this implementation are working effectively and efficiently towards applying SAMOAC guidelines throughout the OA application process.

The treatment testing done in Pretoria is based on a set of principles, the SAMOAC guidelines. It is assumed that the methodology used is robust enough to allow projections of similar advantages and disadvantages of the two treatments in areas where SAMOAC is being applied outside of Pretoria.

2.5 METHODOLOGY

The preceding sections defined the scope of this study and looked at the process that will be used to test each of the stated hypotheses. This section becomes slightly more technical, and serves as an inventory of the data, standards and processes needed to test each of the hypotheses. In essence this section is a list of requirements that need to be met in order to place the researcher in a position to draw reliable conclusions about the hypotheses stated. A research method is then provided for each sub problem / hypothesis pair to illustrate how the process, conclusions, and findings will be dealt with and documented.

2.5.1 THE CRITERIA GOVERNING THE ADMISSIBILITY OF THE DATA

The manual for research and postgraduate studies at the University of Pretoria promotes the use of quantitative research procedures in the compilation of a master's dissertation (Burger 1987 ed. Holm 2000). The nature of this dissertation and many others relating to the field of landscape architecture is however more qualitative than quantitative. As far as possible, data is captured and manipulated using the "scientific method" (Vide Leedy. 1995).

It goes without saying that every attempt to document the whole truth has been made. As mentioned earlier however, the basis of this dissertation is qualitative in nature. Based on the concept of holism, it must be understood that conversion of qualitative narration information such as data from interviews into quantitative data such as graphs and tables will cause elements of the process to be lost. The process used to ensure that this conversion was uniform for both systems, (required to draw conclusions) is now presented.

2.5.2 THE RESEARCH METHOD

Although Hillway (1956) pointed out that vague description of the approach is indicative of poor understanding of what is to be done and such research potentially will be ineffectual, the evaluation and comparison of paper based and GIS based systems is essentially an non quantifiable qualitative process.

In order to prevent ambiguity, a description of the schema is thus in order. As mentioned in the discussion on developing the sub problems, a set of test criteria against which the two treatments could be measured needed to be compiled. An initial set of interviews with the DOACCP and the OAASA was planned, in order to determine the test criteria found in CHAPTER 4. Once the test criteria were determined, a second series of interviews with the DOACCP and OAASA were planned. The objective of this second set of interviews was to gather information on the functioning of the two systems. The objective was to distil the feedback from the interviews into a flow diagram of the steps in both the paper-based and GIS based systems. The effectiveness of each of the steps in the flow diagrams would then be tested against the previously determined test criteria to ascertain whether the given system could

adequately implement a SAMOAC procedure or requirement. Differences in effectiveness would then be documented and used as a basis to draw conclusions.

Each of the sub problems requires unique information and the following sections document these requirements.

2.5.3 COMPILING THE TEST CRITERIA

As mentioned earlier, the compilation of the test criteria is a combination of SAMOAC guidelines and interpretations of problems experienced by the DOACCP and the OAASA. The guidelines in SAMOAC rely heavily on the land use zonings of cadastres. In order to evaluate the SAMAOC guidelines, i.e. when building a set of test criteria, the compatibility of the SAMOAC land zoning classes and the DOACCP land zoning classes needs to be compared. A list of land zonings and land use interpretations for the Pretoria town-planning scheme is thus required. Since Pretoria uses a combination of "zoning code" and "zoning information" to determine the land zoning of a given cadastre, a complete list of "zoning codes" and "zoning information" categories as well as the corresponding SAMOAC area of control evaluations are required.

As mentioned in the section on problem and sub problem development, gaps were found in SAMOAC. These gaps comprise the second part of the test criteria. Interviews with the DOACCP and the OAASA were conducted to establish the severity of these gaps. A list of all the problems experienced by the DOACCP and OAASA derived from these interviews was thus required. Pilot interviews were conducted to determine the impact of the problems experienced. Several of the problems highlighted required additional information to be captured. This information included a list of all the sign types and classes that SAMOAC covers as well as a list of the sign classes in Pretoria that SAMOAC does not adequately regulate. Control ratings for each of these signs was required as these control ratings will be used in the evaluation processes of both the paper-based and GIS based systems. The process used to compile the list of criteria will be discussed further in CHAPTER 4.

2.5.3.1 WHERE THE DATA IS LOCATED

The first portion of data detailed above will be collected from the SAMOAC and OACSPMA documents. All cadastral and zoning information is available from the cartographic department of the CCP. The second section of data comprising a list of the gaps in SAMOAC will be collected through interviews with members of the DOACCP and the OAASA.

2.5.4 SUB PROBLEM 1: HOW EFFECTIVELY DOES THE PAPER-BASED IMPLEMENTATION SYSTEM PREVIOUSLY USED AT THE DOACCP IMPLEMENT SAMOAC?

The tasks outlined as sub-problem 1 were the definition of the paper-based application process as a flow diagram and the evaluation of the effectiveness of each of the elements in this

diagram. It is obvious that central to the research of sub-problem 1 is an understanding of the paper-based implementation procedure. The methodology presented above proposed a series of interviews to derive the raw data from which a flow diagram of the paper-based implementation procedure could be distilled. The outline of the raw data required is simply a very detailed explanation of the procedure used in the paper-based implementation of the SAMOAC guidelines from both the DOACCP and the OAASA. These explanations will be cross-referenced to define the flow diagram. Once the flow diagram has been constructed, evaluation of the effectiveness of the components is required. As discussed in sub-problem 1, one of the most comprehensive ways of evaluating the effectiveness of this implementation process is to measure the time that is required to perform the various steps in the process. A time line of the paper-based application procedure is thus required. The evaluation and the time line will then be used as part of the basis for comparisons done in sub problem 3.

2.5.4.1 WHERE THE DATA IS LOCATED

All the qualitative data will be obtained from either the DOACCP or the OAASA via interview. The remaining data required for the flow diagrams will be sourced from the SAMOAC and OACSPMA documents. Evaluation of effectiveness of each of the steps in the process will be done by interviewing the DOACCP and the OAASA on their perception of the steps' effectiveness at implementing SAMOAC. Once assimilated, this data will be sufficient to construct an objective view of the efficiency of the process.

2.5.5 SUB PROBLEM 2: HOW EFFECTIVELY DOES THE GIS BASED IMPLEMENTATION SYSTEM IMPLEMENT SAMOAC?

The tasks outlined as sub-problem 2 were the definition of the GIS based application process as a flow diagram and the evaluation of the effectiveness of each of the elements in this diagram. It is obvious that central to the research of sub-problem 1 is an understanding of the paper-based implementation procedure. The methodology presented above proposed a series of interviews to derive the raw data from which a flow diagram of the GIS based implementation procedure could be distilled. The outline of the raw data required is simply a very detailed explanation of the procedure used in the GIS based implementation of the SAMOAC guidelines from both the DOACCP and the OAASA. These explanations will be cross-referenced to define the flow diagram. Once the flow diagram has been constructed, evaluation of the effectiveness of the components is required. As discussed in sub-problem 1, one of the most comprehensive ways of evaluating the effectiveness of this implementation process is to measure the time that is required to perform the various steps in the process. A time line of the GIS based application procedure is thus required. The evaluation and the time line will then be used as the basis for comparison in sub problem 3.

2.5.5.1 WHERE THE DATA IS LOCATED

All the qualitative data (interviews) can be obtained from either the DOACCP or the OAASA. The remaining data required for the flow diagrams will be sourced from IGIS (PTY) LTD, the company that developed the system. Evaluation of effectiveness of each of the steps in the process will be done by interviewing the DOACCP and the OAASA on their perception of the steps' effectiveness at implementing SAMOAC. Once assimilated, this data will be sufficient to construct an objective view of the efficiency of the process.

2.5.6 SUB PROBLEM 3: WHAT DOES A COMPARATIVE STUDY OF THE ANALYSES CONDUCTED IN 2.1.1 AND 2.1.2 REVEAL, WHEN TESTED AGAINST THE REQUIREMENTS TO IMPLEMENT SAMOAC AT MUNICIPAL LEVEL?

Almost all the data required to complete sub-problem 3 is derived in either sub-problem 1 or sub-problem 2. In order to be in a position to evaluate the successes and failures of the two systems, a base level of knowledge on current trends in information management is also necessary. The literature study conducted in the following chapter provides a solid base of information on all the required aspects of both paper-based and GIS based systems, with specific emphasis on the use of these in OA. Where necessary, subjects such as urban and environmental planning are introduced as these subjects play an integral role in defining and monitoring guideline application.

2.5.6.1 WHERE THE DATA IS LOCATED

The data for sub-problem 3 is found in the results of sub problem 1 and 2. The knowledge base required for the comparison of the two systems is covered in the next chapter, the literature review.

3 THE REVIEW OF THE RELATED LITERATURE

The focus of a research document is traditionally seen as being rooted in a predetermined academic discipline, revealed through the research literature and theoretical or methodological concerns (Robson 1993). This fact places a considerable amount of work on researchers, as prior to undertaking any investigation, they should have a thorough and up-to-date understanding of literature, detailed knowledge of the relevant discipline, technical proficiency. In many "real world studies" such as this one, it can be argued that the research literature and the discipline, provides a background resource rather than the essential starting point for research designs (Walker, 1985). A good understanding about what is already known, or established, does not then have the absolutely central role in applied real world enquiry that it does in fundamental, discipline-developing research (Robson 1993). A thorough understanding of research methodology is one of the objectives of a Masters dissertation (Holm 2000). For this reason, the starting point for the study was to investigate and understand the process of research methodology, with specific reference to the requirements for a Masters at the University of Pretoria. Burger (1978) as edited by Holm (2000) provided the starting point. This material provided the link to Leedy (1974), the literature source initially used to compile the UP *"Manual for Research and Post Graduate Studies: Master's and PHD."* Leedy (1997) comprehensively covers various methods of qualitative and quantitative research, from the scientific method as detailed by Bouma (1994) to the phenomenological narration approach. The UP Faculty of Engineering and the Build Environment promote the use of a strictly objective, scientific approach. This appears to stem from the use of Leedy 1974, which only covers the scientific method. Leedy (1997) covers research techniques that the social sciences, which many aspects of Landscape Architecture fall under, can better utilise to document qualitative research.

With the above in mind, a research method was established that would achieve the end goal of the study, to answer or shed light on the research questions posed. A literature search relating to each sub problem statement was then conducted, the objective being to get an idea of how much literature was available on the subjects of Outdoor Advertising Control, GIS and the link between the two. Interestingly, no documentation was sourced on the link giving even more relevance to the study at hand. It appears that the link between GIS and the control of OA has never been established. The second objective of this broad scale search was to experiment with as many literature search methods as possible. A clear understanding of how journals, periodicals, book loans CDROM catalogues, World Wide Web and search engines could be used to retrieve information was formed.

As the basis of the entire study is centred on OA control, this was the natural starting point for the detailed literature study. As part of the development of the National Code of Practice for Outdoor Advertising, the task team mentioned previously conducted an exhaustive literature

search on OA. This search unfortunately turned up very little. The fact that little or no literature on OA exists was sadly confirmed when I conducted a personal international library search, turning up almost nothing new. The search was then broadened, and instead of searching for specific topics, each sub-problem was analysed and separated into key words and phrases. These key words and phrases were then listed as an agenda for sourcing and "reading into the literature" (Leedy 1997:75). The bibliography can be reviewed on page 95.

The two main areas that were explored were Outdoor Advertising and Geographic Information Systems. As mentioned, literature on OA was very scarce. A real world research approach (Robson 1993) was thus adopted, and interviews and questionnaires were used to substitute the lack of available literature.

3.1 OUTDOOR ADVERTISING

The topic of OA and its regulation is central to this dissertation, with an understanding of the South African system of OA regulation being perhaps the most important aspect of the topic. In order to provide a reference point for the understanding of the source of current South African OA guidelines, a brief history of OA control was reviewed. The current South African guidelines for control were then studied, and the methodology for application was analysed. This included aspects of environmental planning and urban design, which helped to determine the OA guidelines.

A major component of the literature review is a detailed analysis of SAMOAC's success with regard to controlling authorities such as the DOACCP and the OAASA. The interviews with these authorities provides the basis for a major portion of the dissertation, and for the sake of clarity, are presented separately in CHAPTER 4.

The Flow diagram in Figure 2 illustrates the topics that were investigated in order to complete the first part of the literature review, the study of outdoor advertising.

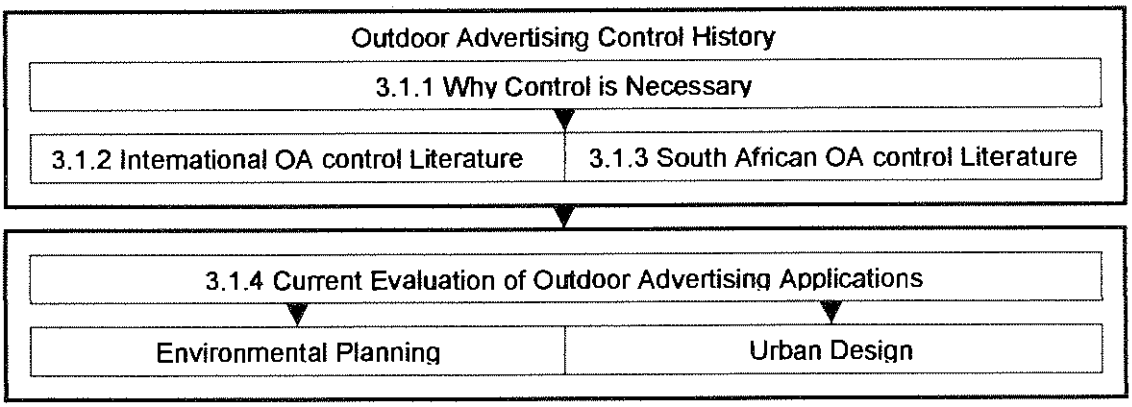

FIGURE 2: LITERATURE REVIEW ON OUTDOOR ADVERTISING

3.1.1 WHY CONTROL IS NECESSARY

Before launching into a detailed discussion on various controls methodologies, an overview of why control is necessary is perhaps in order. The question of whether OA really should be separately regulated has been a topic of debate for many years (Velcich 1999). One would expect two strongly opposed camps to exist, the first being advertisers who feel that advertising should be left to its own devices and the second, controlling authorities and the public who feel that the visual degradation of human living environments caused by advertising is reason enough to ban all OA (City Council of Pretoria, 2000). In reality, these two theoretical camps are not nearly as far apart as one would guess. Findings, backed by both South African controlling authorities and the OAASA, show that regulation increases advertising revenues as guaranteed exclusivity is worth large sums of money (Davidson 2000 and Rofail 2000). From a public perspective, not everyone is opposed to advertising either. Many township residents are thoroughly pro billboards as they feel the bright colours enhance their living environments, and the billboards have been dubbed as "the flowers of the township" (Velcich 1999). These findings suggest that regulation can be a positive thing for all concerned and that if the right advertising is put in the right place it can have a positive or at worst neutral effect. Legislated regulation of OA is therefore designed to put the right advertising in the right place; preventing incompatibility between advertising and landscape (IGIS 2000). The question of course is, what is the right place and the right type of sign. The USA and the UK have conducted post mortem case studies and pilot tested different models of control. The two main variables tested in the pilot studies were 1) the level of control and 2) the method of control. The main findings relevant to this dissertation are that lower control results in increased conflict with the public. This is completely logical, as the general public more often than not perceive OA as intrusive (Velcich 1999). An interesting finding was that the amount of OA is not proportional to the revenue generated (Rofail 1999). An inflection point exists where increasing the number of billboards in a city does not increase the revenue generated (Rofail 1999). The reason cited for this is that advertisers are willing to pay far higher premiums for exclusivity, as "volume reduces impact" (Davidson 2000). The USA found out the hard way that letting OA proliferate unchecked is far more costly than implementing proper regulation (Velcich 1999) as the cost of lawsuits to bring a sign down far outweighs the revenue that the sign produced in the first place (Velcich 1999).

3.1.2 INTERNATIONAL OA CONTROL

Outdoor Advertising dates back as far as the Roman Empire. Archaeologists unearthed murals in the buried city of Pompeii that advertise a contest of gladiators to be held in the city arena. (Davidson 2000, presentation on the history of OA.) Agnew (1985) illustrates that outdoor advertising is an integral part of civilisation. OA has had both positive and negative effects on cities across the USA (Velcich 2000) however, the general consensus appears to be that when left unchecked, OA has the potential to severely degrade human living environments.

Various countries have attempted to control OA in a variety of ways. Establishing an all encompassing standardised set of controls applicable on a national basis has never been achieved anywhere in the world (Velcich 2000). Regulation systems ranging from completely prohibiting OA through to actively encouraging it have been attempted. Methods of control included allocation of number of billboards per area unit, using road hierarchy or land use based systems to implement controls. The most effective methods seamed to be systems that combined safety and aesthetics by linking a detailed value system to a cadastral layout (Velcich 2000). Such a system was capable of highlighting areas suitable or unsuitable for a specified advertising medium, ensuring that aesthetic resources were managed effectively. This is the system that the South African Department of Environmental Affairs and Tourism adopted when developing South Africa's OA control guidelines. During an international study conducted by the Department of Environmental Affairs and Tourism to understand how European and American states and countries were controlling OA, it was stated by many International participants that attempting to develop a National Code of Practice for Outdoor Advertising bordered on impossible (Velcich 1999 personal communication). DEAT proved that national guidelines are possible and, with the publishing of SAMOAC, South Africa became a world leader in the control of OA.

3.1.3 South African OA Control

In the last 25 years, an advertising explosion had occurred in the USA and South Africa was starting to follow suite. In response to growing concerns, the South African government initiated a project to investigate Outdoor Advertising and in April of 1994, the Department of Environmental Affairs and Tourism (DEAT) together with the Department of Transport were tasked with the investigation of OA on all major routes in South Africa.

Once the pilot was completed DEAT were requested to conduct an extensive study aimed at producing a set of guidelines for the control of Outdoor Advertising. DEAT conducted an exhaustive search on international OA and, based on the findings of this research set about compiling a set of guidelines, which became known as the National Code of Practice for Outdoor Advertising.

3.1.3.1 The National Code of Practice for Outdoor Advertising

Flowing from its initial study, DEAT were commissioned to compile a report on the status of Outdoor Advertising in South Africa. Due to the size of the study, DEAT appointed the University of Pretoria to conduct the study. The University of Pretoria in turn appointed Van Riet and Louw Landscape Architects as sub-consultants. This project got underway in 1999 and became known as the National Code of Practice for Outdoor Advertising with Peter Velcich of Van Riet and Louw and Frans Jordaan of DEAT completed the majority of the information gathering and processing.

The aims of the study were to:

- UNDERSTAND THE CURRENT SITUATION
- ANALYSE THE ISSUES FOUND
- MAKE RECOMMENDATIONS TO MITIGATE THESE ISSUES

Based on the findings of the international pilot studies highlighted in section 3.1.1 and 3.1.2 the most appropriate method appeared to be one that established patterns in both landscape and sign type, to eventually arrive at a classification system for both. Sign classification was concerned primarily with potential aesthetic impact and looked at size, construction, location-dependence and public function. Landscape classification entailed land use, existing aesthetic impact and the overall value of the aesthetic resource. An inventory of different landscape types and aesthetic classes was compiled, and once classified, control measures for the various landscape types were generated. These control measures assigned an evaluation to a landscape type, directly linked to the various sign classes. The aim being to generate lists of sign types that could be displayed on each of the various landscape types.

Guidelines sheets for each of the sign classes were then developed so that each sign would have its own set of applicable control measures and areas where it could be displayed.

Although the National Code of Practice for Outdoor Advertising was never put into print, as originally intended, Peter Velcich completed the document as a Masters dissertation, which provides an excellent insight into the development of this dissertation. The reason that the National Code of Practice was never published was that a decision was made to compile the document into a manual called SAMOAC.

3.1.3.2 PUBLISHING OF SAMOAC APRIL 1998

Prior to the completion of the National Code of Practice, a decision was made by DEAT to publish the findings of the National Code of Practice study as a manual rather than an academic report (Jordaan 2000). Reasons cited were that the subject in contention was extremely new, and there were bound to be alterations and additions. Additional sign classes and landscape types, together with their control methodologies and guidelines sheets were bound to be required. The manual that DEAT published was called SAMOAC, and was derived from the National Code of Practice. SAMOAC is a reference style version of the National Code of Practice, and was structured to be a working document easily understood by the general public and any novice interested in Outdoor Advertising regulations. SAMOAC incorporates the principles and findings of the National Code of Practice, but eliminates the lengthy support information that led to the regulation formulations. As a set of guidelines, it must be noted that SAMOAC does not have statutory status (Rofail 1999). The updating of SAMOAC never occurred, and local authorities such as the City Council of Pretoria undertook to revise and customise the document individually (IGIS 2000). This process was aimed at dealing with unique

situations present only in the Pretoria area. Other local authorities such as Knysna and Cape Town have made similar updates. When the guidelines received full government support in 1998, SAMOAC became the de facto basis for OA regulation in South Africa. The document leaves room for adaptation by local authorities, since need and character of each local area differs.

SAMOAC adopted a nation wide all-encompassing approach to the subject of OA and defines OA as follows.

"Advertising is defined as a the act or process of notifying, warning or generally making known. In other words, the term refers to information transfer in a visible manner. (DEAT 1998 Pg 5)

The DEAT interpretation of OA will be used throughout the rest of this dissertation. The definition is further clarified by DEAT, illustrating the very broad and far reaching nature of OA.

"Outdoor advertising is traditionally associated with large billboards and posters advertising products and services. However, in its broadest interpretation, outdoor advertising includes all signs erected and displayed out of doors for the purpose of providing information from small 'beware of the dog' signs on garden gates to the more familiar giant billboards that advertise commercial products.

Outdoor advertising is furthermore not restricted to the advertisement of products and services. Place names, notice of events and directional information can also be construed to be outdoor advertising. The information can be communicated via painted, printed, projected or incised surfaces and can be internally or externally illuminated. Signs can be animated, including flashing signs, tri-visions, fascias, windows, walls, or roofs or in structures such as towers, pylons or bridges. Free-standing signs may be on frames or poles." (DEAT 1998 Pg 5)

Using such a broad definition has both positive and negative aspects. By choosing such a broad definition, the chance of omitting or failing to control an aspect of the field of OA was greatly reduced. The downside was that developing controls for such a broad classification was a mammoth task (Jordaan 2000). The compilation of SAMOAC formulated information on each aspect of OA and its related impacts on landscape and aesthetics in such a way that the relative impact of a given sign type on a specific landscape type could be estimated. I.e. the impact of a sign is directly correlated to combination of the type of sign and type of landscape. Once the correlation was established, control could be implemented by ensuring that the impact of a given sign in a given a landscape was below a theoretical threshold value of impact. If sufficiently low impacts were found, a sign would be permissible in the specified landscape.

A brief overview of the SAMOAC model is now presented, and aspects of its success in terms of an integrated approach to control are then discussed. Once the SAMOAC process has been presented, the current state of the application of SAMOAC is summarised, providing a platform upon which to evaluate the pros and cons of the guidelines. For clarity, this evaluation is carried out in chapter 4.

3.1.3.3 THE SAMOAC MODEL FOR CONTROL OF OA IN SOUTH AFRICA

SAMOAC set out to define a set of OA control guidelines that would incorporate conservation, safety, and sustainable development (for a full list of objectives see section 10.1). An in depth review of international case studies were incorporated into the initial structure of the control procedure. Throughout its development, SAMOAC was rigorously reviewed in public participation workshops so that all interested and affected parties could have input. This fact had the single largest influence on the future success of the SAMOAC document (Velcich 2000). Although a tough procedure to follow, successful public participation ensured that all parties could air their views, table their suggestions and claim a stake in the final product (Jordaan 2000). SAMOAC's advantages for the various stakeholders as highlighted by the workshops can be viewed in section 10.2.

The SAMOAC model satisfies all the goals that the interested and affected parties brought to the table by finding a middle way between Advertising Contractors, controlling authorities and the public Figure 3, documents the SAMOAC model. This model forms the core of the entire set of SAMOAC guidelines.

3.1.3.4 A MODEL FOR SAMOAC

SAMOAC is based on a theoretical model of process based on certain assumptions, which are synthesised by means of the following steps.

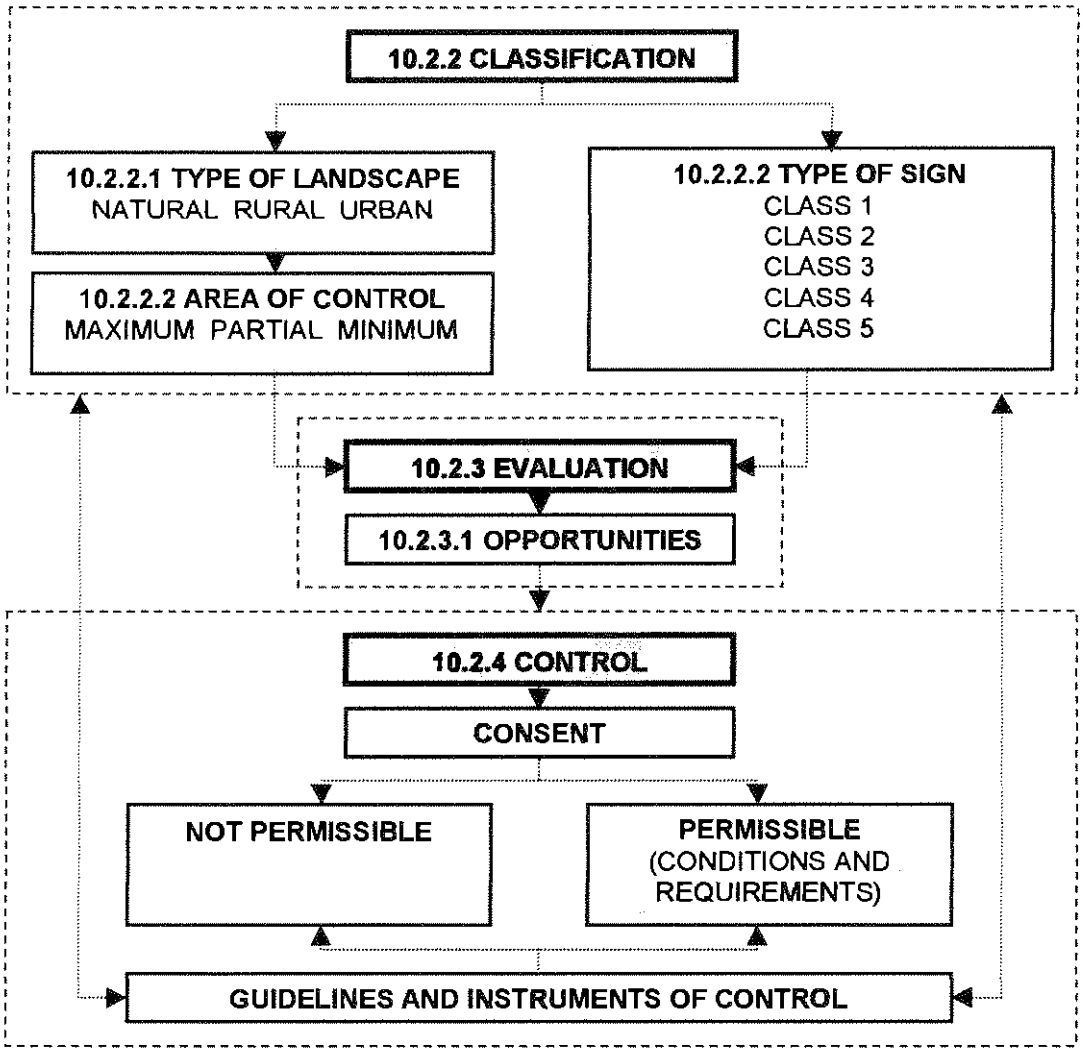

FIGURE 3: A MODEL FOR SAMOAC (DEAT 1998)

As the thread of the argument being presented is not centred on describing the SAMOAC model, the various steps of the process will not be discussed in detail here. For more information on each of the steps as presented in SAMOAC see section 10.2.2 for CLASSIFICATION, 10.2.2.1 for TYPE OF LANDSCAPE, 10.2.2.2 for TYPE OF SIGN, 10.2.2.2 for AREA OF CONTROL, 10.2.3 for EVALUATION, 10.2.3.1 for OPPORTUNITIES and 10.2.4 for more on CONTROL.

3.1.3.5 WHAT MAKES THE MODEL SUCCESSFUL

In section 3.1.1 the reasons why control are required was discussed. An overview of the SAMAOC model was then presented. But is this model a good one, and how can we evaluate its potential to successfully control OA in South Africa?

To start with, based on the National Code of Practice review, the SAMOAC model incorporates the world's most comprehensive set of criteria to determine suitable sign/landscape combinations (IGIS 2000). SAMOAC incorporates sound environmental planning, urban design and town planning principles, and is a truly multidisciplinary model (IGIS 2000).

Advertising can theoretically be erected anywhere. A model should therefore be able to accommodate all landscape types, with rural, urban and wilderness landscape areas being the three main components (DEAT 1998). Outdoor advertising comprises a multitude of media and applications. A successful model should therefore be able to accommodate all the various sign types. Outdoor advertising impact is primarily visual/aesthetic. A model should therefore be able to define evaluate and accommodate landscape aesthetics as defined by public perception. This last requirement is anything but straightforward. Landscape aesthetics are determined by both physically calculable factors such as sight lines, ridge and crest lines as well as less easily definable areas such as places of historic value and places with high scenic beauty. In order to define the latter set, a combination of various disciplines needs to be employed. Environmental planning, urban design and town and regional planning principles all contribute to defining and measuring places of scenic beauty. Furthermore, once identified, a model needs to be in a position to be legislated such that digressions from its process and guidelines can be measured and responsibility for such digressions or offences can be pinned to a specific party.

From a legislation point of view, the town-planning scheme is the ideal engine to divide and regulate landscape areas linked to specific owners. From a design point of view, urban designers and environmental planners should theoretically have informed town and regional planning schemes, highlighting areas of aesthetic, environmental and urban importance.

The SAMOAC model is successful in that it combines the strengths of town and regional planning, environmental and urban design, ensuring that principles from each guide the regulation of signage (Velcich 1999).

3.1.3.6 ENVIRONMENTAL PLANNING

SAMOAC takes great care to ensure that environmental (and this includes social and aesthetic) principles are upheld when determining opportunities to display given sign classes. Conservation areas, recreation areas and areas with high scenic value such as ridges and crests, water bodies, open space and forests are all zoned MAXIMUM control. All rural and wilderness areas (large tracts of South Africa) are also zoned MAXIMUM control

3.1.3.7 URBAN DESIGN

Urban areas and streetscapes are the traditional prime targets for advertising (Rofail 1999). SAMOAC enforces areas of MAXIMUM control on all passive recreation and residential areas.

Furthermore, these strict controls apply to important urban design features such as scenic vistas across build up areas or down streets and avenues, national monuments, heritage sites, special tourist areas and gateways to the city.

3.1.3.8 TOWN AND REGIONAL PLANNING

From a town and regional planning perspective, SAMOAC incorporates and regulates all the above controls by placing limitations on specific land zonings. Additional controls designed for safety are also incorporated on various transportation routes.

SAMOAC, as a set of guidelines is truly a broad-spectrum approach, meeting all the requirements to be a successful model. With the guidelines on paper, half the war was won (IGIS 2000). The next half entailed the application of SAMOAC in the various city councils throughout South Africa (Velcich 1999).

3.1.4 CURRENT EVALUATION OF OUTDOOR ADVERTISING INCLUDING THE YEAR 2000

With the publishing of the SAMOAC document in April 1998, South Africa became a word leader in Outdoor Advertising control. Both locally and internationally, the field of OA control is still quite new and much research and testing is still required, hence the need for documents such as this one.

The biggest hurdle at present is that SAMOAC is not legislated (Velcich and Rofail 1999). Without the status of law, a true reflection of SAMOAC's ability to regulate fairly will be impossible (IGIS 2000). Some local authorities have had bylaws promulgated, the leading council being that of Pretoria. Pretoria is currently the most advanced in terms of legislating, testing and applying SAMOAC (Distilled from interviews with authorities in metro councils throughout Gauteng).

Due to its national scope and somewhat open-ended nature, different councils are implementing SAMOAC in a variety of ways. Since SAMOAC is not legislated, each council has the right to interpret SAMOAC as they see fit (Conference on OA in Gauteng, August 2000). The CCP is the most advanced in this process, having passed bylaws to implement SAMOAC as well as develop a GIS system that allows the CCP to electronically evaluate applications in terms of SAMOAC. The success of the Pretoria area stems from two things (Rofail 2000) and they are the pre-emptive and precautionary approach that Pretoria took when implementing SAMOAC. Controls were put in place early so that the minimum number of possibly non-compliant applications was passed. The precautionary approach in the passing of applications as well as the development of the GIS system have resulted in the minimum number of problematic signs being erected in the Pretoria area. Further discussion of the details of both SAMOAC and this topic, are however continued in CHAPTER 4 where SAMOAC is analysed and reviewed. The

literature review now switches across to its second part, a discussion on GIS and spatial information, necessary for the understanding of the Pretoria GIS implementation of SAMOAC.

3.2 GEOGRAPHIC INFORMATION SYSTEMS

The Flow diagram in Figure 4 illustrates the relationship of the topics that required investigation in order to study Geographic Information Systems and with more specific detail, their link to outdoor advertising control.

This section of the literature was completed to create a solid understanding of where GIS originated. This process was necessary to ground ideas and thoughts attempting to establish and understand where GIS is headed.

The literature studied aimed to understand the many facets comprising a GIS. The development of GIS is explored, as are the components of a complete GIS system. Problems with GIS are highlighted, and these are then researched in more depth, illustrating the various areas that have presented development challenges in the past.

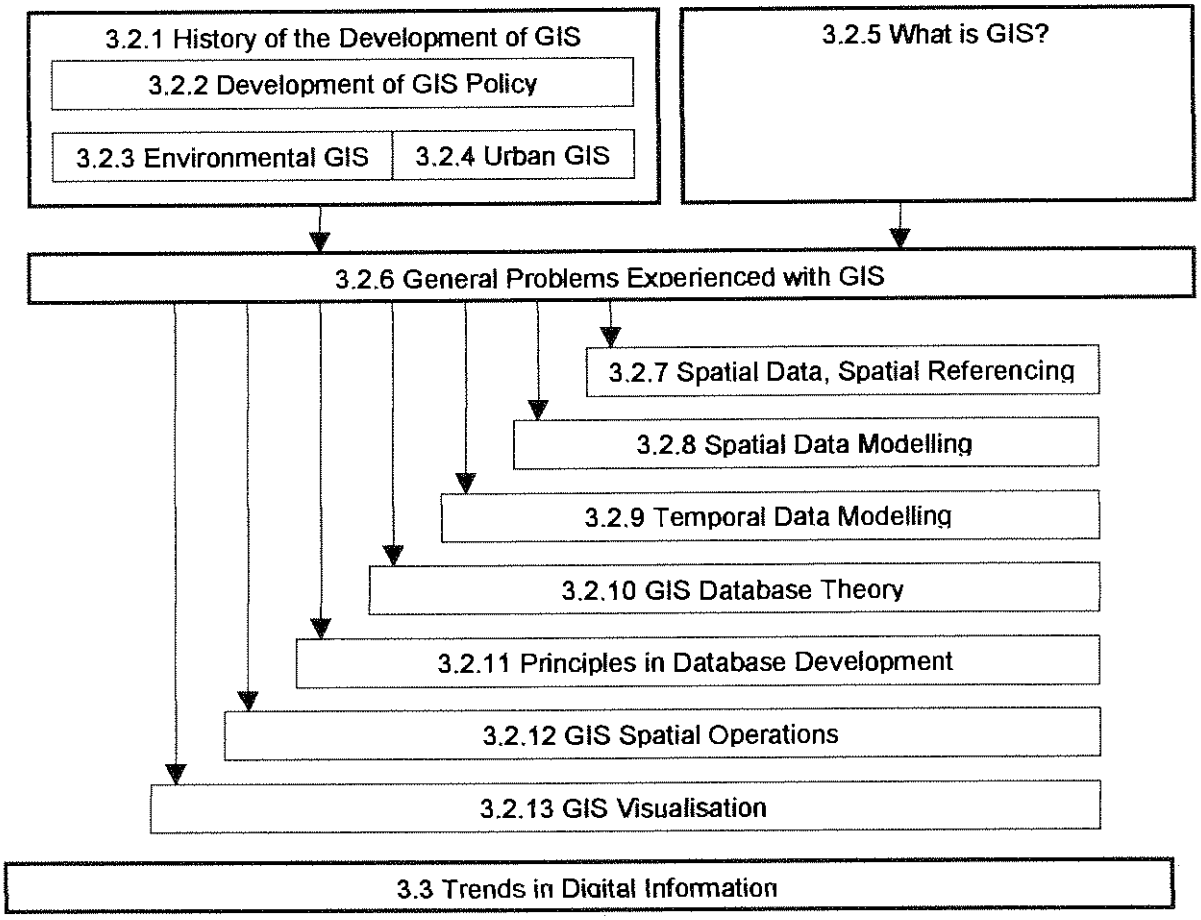

FIGURE 4: LITERATURE REVIEWED TO SUPPORT SUB PROBLEM TWO

3.2.1 History and Development of GIS

GIS dates back as far as the 1960's where punch card systems were used to perform spatial calculations. GIS developed as a link between databases and CAD based computer systems, with software vendors usually favouring one or the other. With the rapid expansion of PC based technology, GIS became more accessible to a larger world sector. Traditionally, only large organisations such as the military and government research agencies could afford GIS. This exclusivity is slowly eroding, with desktop GIS systems now available in a price range that small organisations or municipal agencies can afford.

3.2.2 Development of GIS Policy

GIS policy relates to the rules and norms established by governments and the GIS industry. The British government were the leaders in policy generation for GIS. The report written by Lord Chorley (Chorley R 1988) on the handling of GIS information, and ways to improve the growth of the spatial information industry provided a solid base for GIS specialists such as Ian Heywood to work from. Heywood (1998), entitled "Beyond Chorley – Current Issues in GIS" builds on and confirms projections that the Chorley commission documented.

GIS policy is of particular interest to this dissertation in that the evaluation of the success of the DOACCP GIS system should ideally be based on an established and accepted set of norms. The fact that the GIS being evaluated is public domain knowledge, indicates that the structure of the system and data should conform to industry norms.

3.2.3 Environmental GIS

Environmental GIS is a term that has been "created" by environmentalists using GIS as an evaluation tool. Strictly speaking, environmental GIS is not a logical category to split aspects of spatial data modelling into. It is included here as a section because much of the DOACCP spatial data manipulation is performed to protect environmentally sensitive areas. Government policies such as the ridges and rivers policy are converted from text descriptions to spatial entities using a GIS.

Selection sets such as the ridges and crests override are discussed in the section on Ridges and Crests on page 183. Woodhouse et.al. (2000) discuss various methods of using a GIS to select priority areas for conservation. These guidelines, together with procedures suggested by IGIS (PTY) LTD. were used to isolate environmentally (with specific reference to visually sensitive areas) sensitive regions in the Pretoria area. The GIS system then implemented these controls on the various data sets as shown in Figure 13: Data Flow Diagram of the GIS.

3.2.4 URBAN GIS

As with Environmental GIS, Urban GIS is a rather woolly category to split GIS into. For the purpose of this study, Urban GIS refers to spatial modelling procedures used to implement land planning and urban design principles on spatial data sets.

From a cadastral point of view, GIS is ideal to manage urban areas. Large sets of data can be easily manipulated and displayed. A limitation with GIS regulation of urban areas is that, as with most digital data, areas are treated as completely uniform, and perfectly defined by a polygon created from a set of vectors.

This study was able to make use of the positive aspects of Urban GIS in that detailed control ratings could be generated for large areas, and each area is clearly defined by a cadastral boundary.

Urban design principles such as protection of gateways and other prominent entrances to the city were implemented using a GIS. Visual basins were evaluated manually, and these areas were then digitised and included in the Geobase.

Although placed on order, literature relating to Urban GIS was very sparse. This study used the procedures in Woodhouse et al (2000) to evaluate the implementation of Urban design principles stipulated by prominent urban designers at the CCP.

3.2.5 WHAT IS GIS

This subject was briefly investigated to ensure completeness of the study. Literature on the subject was gathered from web sites linked to Module one of the UNIGIS program at UP, entitled "An Introduction to GIS". Mather (1976) sketches a background of how computers could be used in Geography, Antenucci et. al. (1991) provides a comprehensive guide to the technology of GIS.

As discussed earlier, GIS is essentially a set of tools that allows its users to link non-spatial data (database tables and queries) to spatial entities (CAD). The power of GIS lies in its ability to manipulate both spatial and non-spatial data. Hardware aside, the components of a GIS vary depending on whether the CAD, DATABASE or INTEGRATED approach is taken. The background data storage of both spatial and non-spatial information varies form package to package. The front end toolbox comprises a set of commands that allow the user to input, label, edit and manipulate the four main components of a spatial data set, viz. points, lines, polygons and meshes.

3.2.6 General Problems Experienced with GIS

Many of the problems experienced with GIS relate to the medium that GIS operates on. PC hardware and software has been a severe limiting factor in the past. The cost of technology is dropping daily, and PC's are getting faster and faster. These two facts are improving the cost effectiveness and efficiency with which a GIS can be used. Desktop GIS can perform spatial manipulations that were unheard of ten years ago. Similar advancements have taken place in the fields of workstations and large server systems. Initially, sparked by the PC industry, a strong move towards decentralised workstation GIS occurred. The drawbacks of this decentralised (non mainframe/minicomputer) system was the obvious cost of upgrading and maintaining multiple computers, operating systems and software. The issue of data concurrency is another key factor that comes into play when distributed systems are implented. Recently, a move towards a modified mainframe approach has emerged. Thin client computing allows for workstation style processing capacity but all software is housed centrally. This approach reduces the amount of maintenance and distributed down time, and ensures data concurrency issues are handled on a single "mainframe" system.

Problems with data stem from the single fact that the real world does not fit into a set of columns and rows. As a result, most GIS databases use the object oriented database model. The back end of this database is a relational model, comprising sets of linked tables that maintain the relationships between data. Problems are experienced in that many of the aspects of the real world, such as the temporal nature of information, are not easily accommodated into tabular structures. The object oriented approach discussed in section 3.2.11.1 on page 30 provides insight into the future of data storage. The object-oriented approach allows attributes of objects in the real world to be captured more freely. Relationships between these objects can then be programmed as rules. This approach together with the superior computational power of future computing technology will allow the real world to be modelled more accurately. Transformation and interdependence of such data becomes an obvious problem. For this reason, eXtensible Markup Language (XML) was developed, to allow object oriented data types to be easily created and ported between legacy and advanced systems.

Depth of capture is a problem that relates somewhat to the hardware issue already discussed. Although a current philosophical debate the real world appears to have an almost infinite level of detail (Punt personal communication 2000). GIS systems attempt to simplify the real world into spatial models accurate to a required scale. This simplification known as the data's granularity can cause major problems if accurate metadata is not captured and the user does not have a thorough knowledge of the area being dealt with. For this reason, a sub-study was undertaken to establish the most appropriate data scale for the DOACCP GIS. This study can be reviewed in section 11.1 on page 139.

As Chorley (1988) and Heywood (1998) explain, one of the most difficult hurdles to overcome is the exclusive nature of GIS technology. Software is expensive, and a high level of training is required to make effective use of a GIS system. Methods to overcome this problem are presented by Heywood, and a discussion of these and other prominent GIS issues are presented in section 3.3.1.1 entitled "Findings of the Symposium on The Future for Geographic Information" on page 37.

3.2.7 SPATIAL DATA, SPATIAL REFERENCING

The very nature of a GIS means that most data represented on the system has a set of spatial attributes. Unlike statistics in tabular format, GIS data usually has a link to geographic space. For this reason, methods of capturing, referencing and representing spatial information were reviewed. The manuals for Arcview and Regis developed by ESRI and REGIS respectively document many of the different map projections that can be used to accurately represent real world features on a Cartesian plain.

For the purpose of this dissertation, only one projection needed to be reviewed in depth. The GIS department at the CCP have referenced their GIS data using the LO 29 local grid. This grid aims at providing accurate distance measurements on printed maps. As with all projections, only distance, area or shape (bearing) can be accurate. The LO 29 grid uses a Transverse Mercator map projection. The curvature of the earth is modelled according to the Clark 1880 Datum (the more accurate WGS84 datum was only adopted in January 2000), and the central meridian (line of highest accuracy) is taken as the longitude of 29 degrees east of the Greenwich (or zero) Meridian.

3.2.8 SPATIAL DATA MODELLING

Spatial Data modelling refers to the various ways that a GIS can capture and store information. In essence, two major categories or spatial data models exist namely raster and vector. As a result of the cadastral nature of the CCP GIS, the vector (originally CAD based) data model was chosen. REGIS is primarily vector based, with points, lines and polygons being used to make up all the feature entities in the Geobase. Raster based systems allow for a far higher level of spatial analysis, with each grid cell being able to respond to the values of its neighbours. Vector based systems are a lot more compact, and allow for a far higher level of spatial boundary definition. Vector based systems however do not handle detailed map areas with constant, often gradual, changes in value effectively.

3.2.9 TEMPORAL DATA MODELLING

Temporal data modelling refers to methods that are employed to simulate the passage of time in a GIS. For the purpose of this study, temporal data modelling is hardly necessary. As determined by the DOACCP, the system will only need updating every three months. The temporal nature of the changes is represented as absolutes. For example, the land use of an erf

is either residential or business. The change is effected immediately, and no grade of land use between residential and business needs to be modelled. A backup procedure will allow the temporal progression of the system to be accurately documented.

3.2.10 GEOGRAPHIC DATABASE THEORY

Geographic Database Theory deals with ways in which spatial and non-spatial data are linked and stored in the GIS. Since the GIS chosen by the CCP was REGIS, the Geographic Database model was predetermined. REGIS uses a one to one tabular link to spatial entities. A simple or compound key in a database field(s) corresponds to a feature TAG in the Regeo module. Various additional fields can then be added to the table. In essence the model used is a very restricted relational model.

By linking the REGIS tables to Microsoft Access, the full functionality of the relational model was incorporated into the system. The development of the database model is dealt with in Figure 13 on page 159.

3.2.11 PRINCIPLES IN DATABASE DEVELOPMENT

Prior to evaluating whether the database structure developed to implement SAMOAC is as efficient as technology will allow, an understanding of the following is required.

1. The different types of database structures available.
2. Database structures compatible with the GIS and Database Management System (DBMS) software in use at the city council both at present and in the near future.
3. Requirements of the database in order to implement SAMOAC.

A suitable Relational Database Management System (RDBMS) structure for the application of SAMOAC in terms of this dissertation is selected, and a discussion of its strong and weak points is documented. A full-length investigation on the merits of the various database structures is not covered as this would result in a dissertation on its own.

3.2.11.1 TYPES OF DATA BASES

A variety of database structures have developed oven the past fifty years. Originally database structures were geared towards specific application driven procedures. The output and functions of the application would determine the database structure. More recently, the move is towards a unified database with a malleable DBMS that manipulates data into the required format. Further developments of databases include the move from a relational to an object-oriented approach, which creates data units that simulate the real world characteristics of an object rather than attempting to mould the object into a set of linked tables.

The first option is a hierarchical data model, which, in essence has a tree structure based on the parent and children approach. Each parent can have many children, but each child object can have only one parent. An example is a storeowner that owns two shops. Each shop has a different array of items. Each item is only found in one shop and each shop only has one owner. Problems arise where the shops have two owners or an item is of such a nature that it is found in both shops. Redundant data occurs, and the efficiency of the system deteriorates.

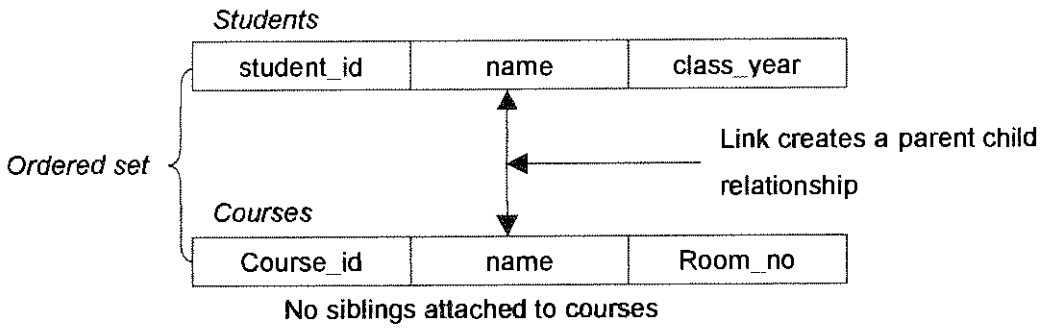

FIGURE 5 HIERARCHICAL DATABASE STRUCTURE

Diagram Taken From: (http://www.infomasters.com/services/hierarchical.html)

The Hierarchical database model was the original database model developed in the 1960's. It is very limited and allows very little flexibility but was very popular at the time of its inception. As the diagram denotes, it was implemented in the IBM IMS Database Management. The diagram also shows the limits of such a system. It follows a tree-like structure and can have a lot of redundant data thereby increasing the chance of error.

The second option is a network data model. This model is similar to the Hierarchical model. The key difference is that child objects can link to more than one parent object. This single feature alleviated the problems of multiple-ownership experienced in the hierarchical data model. Network database flow diagrams look somewhat like a spider web, composed of nodes and links. The fact that the model is complex is its biggest limitation. In order to retrieve information from the data, the user/programmer has to know exactly what the data structure of his database is. This model is approaching true data independence, and has been widely and very successfully used.

Figure 6 is an example of a Network Database model, taken from:
http://www.csuohio.edu/accounts/ACT688/Data4/sld009.htm

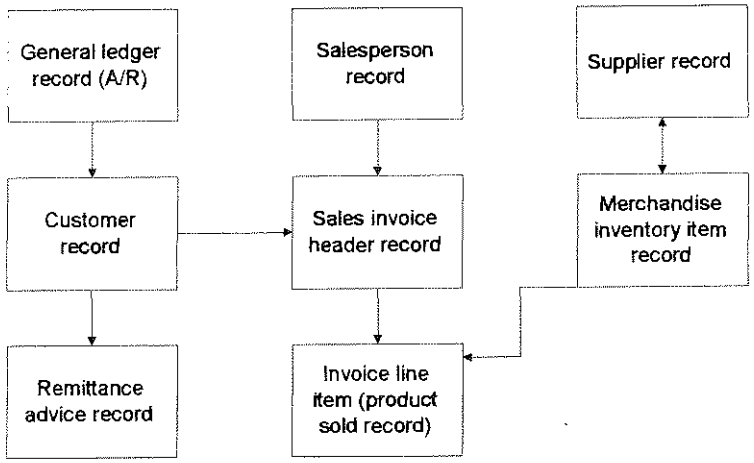

FIGURE 6: NETWORK DATABASE MODEL

The third option is the relational data model, which, unlike the previous two models, did not develop in an ad hoc organic fashion. The relational data model was developed from an abstract theoretical idea, long before a DBMS existed to access data in such a model. The relational model is based on a set of two-dimensional (row and field) tables. Links between the tables is established by means of common columns (fields). Due to the simplistic yet versatile nature of the relational model, it is currently the dominant database structure used in industry. Most GIS software packages make explicit use of the relational model. Both spatial to temporal and temporal to temporal data connections are handled using the relational model. Limitations of the relational model are its lack of flexibility when simulating real world situations. As can be seen in Figure 13: Data Flow Diagram of the GIS, complex table structures are required in order to simulate real world scenarios. In the Pretoria City Council database, a GISKEY is used as common fields to link spatial and non-spatial information.

The fourth model is the Object oriented approach to database model design. Companies such as Intergraph have used a combination of the relational model and neural networks to create a database structure that has the ability to simulate real world situations, including those based on chance and other non-binary situations. The Environmental Systems Research Institute (ESRI) has developed a geo-database that uses an object-oriented structure to store real world rules about objects in the database

3.2.11.2 DATA BASE SYSTEM CHOICE

Both REGIS, the current GIS in use by the City Council of Pretoria, and ArcInfo, the GIS being phased in to replace REGIS, make extensive use of relational databases. Industry standards presently favour relational databases and most future developments in databases appear to be related to the relational model in some way.

For these reasons, the relational database model was selected by IGIS as the database system of choice for the implementation of SAMOAC.

With the explosion of database systems in the early seventies, many software development companies were loosely using the term relational to describe their DBMS. A set of guidelines relating to relational database systems is provided in 3.2.11.3.

3.2.11.3 RELATIONAL DATABASE MANAGEMENT SYSTEM REQUIREMENTS

In order to provide a level of compliance as to what is and what is not a relational database, Dr. Edgar Codd set about defining a set of rules in 1972. Date, C.J. (2000) states that in 1980, Codd's research and development defined a DBMS as fully relational if the following twelve rules were observed.

The twelve rules stem from a single foundation rule, "Rule Zero," which can be stated as:

For a system to qualify as a relational database management system, that system must use its relational facilities to manage the database.

Following is an explanation of Codd's twelve subsidiary rules.

1. The information rule

The information rule simply requires all information in the database to be represented in one and only one way, namely by values in column positions within rows of tables. This requirement is referred to as "the basic principle of the relational model."

2. The guaranteed access rule

This rule is a restatement of the fundamental requirement for primary keys. It says that every individual value in the database must be logically addressable by specifying the name of the containing table, the name of the containing column, and the primary key value of the containing row.

3. Systematic treatment of null values

The DBMS is required to support a pre-presentation of "missing information and inapplicable information" that is systematic, distinct from all regular values (distinct from zero or another number).

4. Active online catalogue based on the relational model

The system is required to support an online, relational catalogue that is accessible to authorized users by means of their regular query language.

5. The comprehensive data sub-language rule

The system must support at least one relational language that (a) has linear syntax, (b) can be used both interactively and within application programs, and (c) supports data definition

operations, data manipulation operations, security integrity constraints, and transaction management operations (begin, commit, etc).

6. The view-updating rule

All views that are theoretically updateable must be updateable by the system.

7. High-level insert, update, and delete

The system must support set-at-a-time INSERT, UPDATE, and DELETE operators.

8. Physical data independence

Stand Alone. Self-explanatory.

9. Logical data independence

Data is not hidden somewhere, the data can be found and extracted easily.

10. Integrity independence

Integrity constraints must be specified separately from application programs and stored in the catalogue. It must be possible to change such constraints without unnecessarily affecting existing applications.

11. Distribution independence

Existing applications should continue to operate successfully (a) when a distributed version of the DBMS is first introduced; (b) when existing distributed data is redistributed around the system.

12. The non-subversion rule

If the system provides a low-level (record-at-a-time or "by the back door") interface, then that interface cannot be used to subvert the system by (e.g.) bypassing a relational security or integrity constraint.

Due to the costs involved in acquiring various Relational Database Management Systems (RDBMS) software packages to run compatibility tests, to ascertain which RDBMS is most suitable to implement SAMOAC, a decision to use the well-established software package, Microsoft Access 2000, which complies with the rules of Codd as listed, was made. Access 2000 is one of the most widely used RDBMS at present.

3.2.12 GIS Spatial Operations

GIS spatial operations refer to the set of tools that a GIS can employ to manipulate spatial information. This toolbox is limited by the software package selected. REGIS has a powerful set of selection and query tools, but is not as efficient when multi, cross-feature editing is required. In order to fully understand the features available in REGIS, the manuals were studied in depth. IGIS confirmed that a GIS could be engineered in such a way that the REGIS toolbox would be capable of implementing the SAMOAC spatial guidelines.

3.2.13 GIS Visualisation

GIS visualisation refers to the methods and techniques that a user can employ to represent GIS data in hardcopy format. Procedures to group data for clarity and legibility are dealt with. The

literature consulted also deals in depth with 3D representation, a rapidly expanding field of GIS. As mentioned in the delimitations, this research is based on a GIS system known commercially as REGIS, implemented by the CCP. REGIS is a two dimensional GIS, and for this reason, the power of 3D GIS is not entered into in this dissertation. It must be noted however that the ease of understanding and modelling capabilities of 3D GIS are extremely valuable, and development of 3D interfaces continues to expand at a rapid rate.

The GIS system reviewed in CHAPTER 6 was designed to make GIS data accessible to the layman. For this reason, the use of sound interface design and usability testing were paramount, both for the representation and retrieval of information. An interesting aspect of the system was the fact that live representation of data would be far more important than hardcopy (printed) plans. This move towards presentation of live digital data is indicative of the digital data age of today. Data and interface design are becoming more and more important as the base of viewers and people interacting with data broadens every day.

Development of technology is evident everywhere one cares to look today. Technology can be very fickle, with killer apps of today, the has-been technology of tomorrow. The "Tamaguchi" phenomenon is a part of any technologies development (Margel 2000), making prediction and evaluation of success difficult to gauge. What is a trend and what is fad? The distinction between the two is critical when evaluating or planning a technology strategy. Projections on regression of existing trends are unfortunately the best sources of future prediction available. This method is mathematically flawed (ZAR 1999) but at present the most effective method available. The next section explores some of the trends and standards that industry specialists predict will form the basis of future GIS technology development.

3.3 TRENDS IN DIGITAL INFORMATION

Do current trends and existing literature determine tomorrow's trends and discoveries? According to Charles H Duell, who in 1899 said "Everything that can be invented has been invented" history does not inform future discoveries and trends. However, 100 years later, we are so used to high-speed technological advancement that quotes such as "The best way to predict the future is to invent it" by Alan Kay do not seem out of place.

Since documenting the past often fails to accurately predict the future, technical specialist opinions as well as existing literature were consulted in order to understanding current and future trends in GIS, the objective of which was to be in a position to project whether the DOACCP's move from paper to GIS (and the method of the GIS system development) is in keeping with the movement of technology and industry. We are firmly entrenched in an age where the operators of mechanical tasks are being replaced with pre programmed digital routines that can respond to inputs and provide logical and often hugely complex outputs. Cheap computer technology is being used to interpret data that was previously interpreted by low and medium skilled work

forces. An example is the new Deutch Diesel plant in the Rohrgebiet in Germany (Gandy R Snr. personal communication 1999). Computers control the entire engine assembly line. The factory runs eighty automated forklifts that respond to required tasks as needed. The plant runs 24hours a day, requires a mere 80 staff to manage the computer system, puts out twice as many engines as its predecessor that required 3000 staff to run the operation.

The Internet revolution is another major component of the digital swing. The move is to link as much and as many as possible to as much and as many as possible. The trend being to network everything in such a way that distance becomes irrelevant. This trend holds true for communications as well. Being able to control your microwave from your cellular phone or Personal Digital Assistant (PDA) is just around the corner. With the release of the new 64-bit TCP/IP system, there will be sufficient TCP/IP addresses to uniquely identify every electronic device and person on the planet. Each device, having a unique id will be able to be contacted by Internet, LAN, WAN, TCP/IP IPX, satellite, and a myriad of other ways.

Essentially, artificial intelligence technology is being used to replace mundane, often repetitive decision-making. From neural nets that interpret aerial photography to object oriented database design that simulates how the real world would respond to a given situation, technology continues to replace unreliable and often problematic workforces.

The technology is still in its infancy, and problems exist with logical decision-making. Current computer technology is ideally suited to replace repetitive tasks. Training a system and ironing out problems that occur from unplanned deviations remains a long and time-consuming process. However, once trained, a computer is immensely fast and accurate. The current challenge is to develop robust systems that can intelligently handle unplanned deviations, artificial intelligence, to list the buzzword.

The current success of computers to handle repetitive tasks is the basis of the technology reference in this dissertation. Technology in the form of rule based (binary) software has been developed to blanket-implement a spatial model that regulates outdoor advertising. The motivation being that repetitive rule based blanket applications are ideal for a computer to handle. The repetitive implementation of a rule-based model onto a large data set such as the entire cadastral layout of Pretoria is ideal for such a system.

The application presented in this dissertation is extremely specific in nature. The next section drills down a little deeper, into the specific field of GIS, the software system used to implement the SAMOAC application.

3.3.1 CURRENT TRENDS IN GEOGRAPHIC INFORMATION MANAGEMENT

As we break into the new millennium, particularly in the technology hungry environment of SA, (CSIR VR development department, lecture on digital trends at the South African computer fair, 1999) the move towards computers can no longer be seen as a whimsical fascination with new technology. Roger Tomlinson, as quoted by Heywood (1998) said, "Nobody will return to a manual system..." once he has tasted the advantage of technology and will continue to use it. In general, the advantages of any forms of automation and digital development to replace previously manual methods are seen to supersede the negative aspects such as loss of security. With this in mind, the direction of development, rather than the yes/no debate about development, is of relevance here. This section identifies directional trends that are seen as advantageous. These directional trends will be used to evaluate whether or not the GIS system developed for the DOACCP is moving in the right direction.

"In April 1987 the report of the Chorley Committee of enquiry into the *Handling of Geographic Information* was published. The Chorley report was the culmination of two years of painstaking work examining the treatment of geographic information (GI) in the UK. The report was a critical appraisal of current geographic provision in the UK and set out the barriers to its wider use. The report made 65 recommendations suggesting how these barriers could be overcome. These recommendations have played a central role in establishing a framework for geographic information in the UK (and beyond), which has served the geographic information community well for a decade. " Ian Heywood (Heywood 1997)

Beyond Chorley (Heywood 1997) reflects on the trends that have developed since the publishing of the Chorley report in 1987. This review is based on a symposium entitled *The Future for Geographic Information.* The aims of the symposium were to

1 Reflect on the last decade and identify what progress has been made
2 To identify current impediments to progress
3 To look to the future to examine how current and foreseeable technologies might revolutionise the use of GI and its impact on the economy and society.

The Chorley report compiled a list of thirteen findings that were seen as key points required to further the development and impact of Geographic Information (GI).

3.3.1.1 FINDINGS OF THE SYMPOSIUM ON THE FUTURE FOR GEOGRAPHIC INFORMATION

The following is a list of 13 points that government organisations should strive for in order to expand the development and sustained use of GI. The relevance and success of the DOACCP GIS is discussed, with the aim of illustrating how effectively the system complies to future trends and requirements. In essence, each point listed is seen by Chorley as positive progress for the development of GI.

1. Make GI more available to a broader spectrum of users. GI should be available to the general public via media such as the Internet. Pricing, licensing and copyright need to be further adjusted to allow easier access to GI.

The DOACCP system was designed for the WWW based layman from day one. The interface and front end were specifically designed to remove as much of the complexity of spatial data as possible from the system. Data is public domain; with revenue being generated by OA applications processed and handled by the system. Easy access to the GI was planned from day one, both in the selection of protocols and the model of revenue generation.

2. Establishment of a national data infrastructure to facilitate widespread distribution of GI.

The DOACCP system is fully integrated with the CCP GIS system, and maintains a live feed from several of the CCP data sources. The DOACCP system is fully compliant with the CCP strategy to deliver information on the WWW, maintaining a strong link to national organisations such as the surveyor general.

3. Improve methods of informing users where GI can be located and how it can be used.

The DOACCP system has been designed to fully integrate with the current online GIS delivered by the CCP. Access to the system is widely advertised and links directly from the CCP home page.

4. Encourage partnerships between public and private companies. GI needs to be available in hypermarket format, so users can shop for required information.

The DOACCP system was developed in partnership with IGIS (PTY) LTD. The system was designed to facilitate the widespread distribution and sales of information on CD and via web format to the general public.

5. Encourage the govemment to speed up its programme to make GI available.

The DOACCP as part of the larger CCP organisation are currently the leading local authority when it comes to distribution and strategy on GI. The CCP continue to make an aggressive push to remain an example to the rest of South Africa as to how a local authority can position itself to actively incorporate GI as part of its daily procedures.

6. Promote the wider value of GI at all levels, from schools to senior govemment.

The DOACCP aided by IGIS (PTY) LTD. have initiated a series of public participation workshops, aimed at National and local government organisations to illustrate how effective the DOACCP system has been implemented.

7. Promote the link between commerce and academia.

This thesis is the first formal link between the DOACCP system and academia. The entire SAMOAC development was however closely linked to the University of Pretoria as was the development of the OACSPMA documentation.

8. Set up an independent GI committee

This point has not been covered by the DOACCP as they fall under a planning division of the CCP. The CCP as an organisation has however developed a fully fledged GIS and mapping division responsible for the development and maintenance of committee driven protocol.

9. Promote an understanding that data is not information. The value of GI lies in the interpretation and use of the data.

The DAOCCP system is a pioneer for the CCP in this regard. The DOACCP system interprets data from several sources and converts this data into information used to inform and automate decision-making. The entire DOACCP system is build around leveraging the value of existing information.

10. Develop national coverage of the Surveyor General large-scale maps.

The DOACCP system is the first pilot step in developing a system that will eventually be adopted on a Nation wide basis. Several local councils are investigating the use of the system, and plan to roll out similar developments in the near future.

11. Increase awareness of what technology and data are available and what is possible with a combination of these.

The DOACCP system was designed for public use, aimed specifically at engaging the interested layman with existing information. By serving the data and system over the WWW, both data and cutting edge technology are delivered into the homes and offices of the entire South Africa.

12. Access to data held by government, public and private institutions.

The DOACCP system is a landmark case in this regard. Government and private information has been exposed in a controlled fashion, allowing the public to interact and gain valuable usage of a set of resources that now generate revenue for both government and private concerns.

13. Develop a more advanced/comprehensive cost benefit methodology. This will allow business to establish a case for the use of GIS technology.

The DOACCP system once again comprehensively illustrates how correct business planning and symbiotic data and technology relationships can be used to benefit multiple parties. Exposing and manipulating real time GIS information in a controlled manner has benefited the DOACCP and the public a great deal.

The overall success of the DOACCP system is summed up very well in the following quote:

"The reams of spatial data that we expect to see in the future do not necessarily translate into an explosion of growth for GIS. Growth in this industry depends not only on having data, but on having a compelling application for using the data at one's finger tips." –Gartzen (1997)

The use of GIS as an engine to drive the development of a system to regulate and inform has been shown to be a tremendously compelling application by the DOACCP. All the benefits of "going digital" could not be contained in one volume. The major benefits of the DOACCP system relate to the ease of access of accurate and up to date information, the speed with which all the required information to process an Outdoor Advertising application can be accessed and the transparency and objectivity with which decisions can be made.

The transition from paper-based to digital is however not a process that should be seen as easy and hassle free. Aronoff (1989) notes that with any form of shift in paradigm, there are both positive and negative aspects, negative aspects in this case being the initial cost of developing a digitally based system. Cassettari (1993) shows that digital systems requires a high level of expertise to maintain sound data and also require a relatively high level of computer literacy to operate efficiently. Constant updating of data is required. With a paper-based system, this data is updated on a need to know basis. Since the GIS based system provides accurate data for the entire Pretoria area, land use data across the board needs to be kept accurate. For these reasons the DOACCP GIS was designed to integrate as much existing data as possible, making the updating of the system almost completely automatic.

3.4 CONCLUSIONS

Controlling OA requires the assimilation of a complex web of information from a variety of sources. If correctly implemented, OA can be formulated as a set of binary rules that need to be implemented. Due to the complex nature of information, and the anologue nature of the real

world decision making on these rules is sometimes difficult, allowing extensive levels of subjectivity and error to creep in.

By assimilating the input from many disciplines and parties, the DEAT developed a comprehensive set of guidelines known as SAMOAC. These guidelines are a binary set of rules that can be applied to a land based system. Problems have however occurred where OA contractors have disputed interpretation of SAMOAC's "rules" by controlling authorise. The sources of these disputes are primarily the perceived non-uniform or subjective evaluation of the SAMOAC controls. The document was designed to be a set of guidelines that should be followed to evaluate advertising applications. The anticipated solution to these disputes appeared to be a spatial representation of the SAMOAC guidelines, allowing both OA contractors and DOACCP officials to reach consensus prior to the expense of energy and money to compile and submit advertising applications. But how should this spatial representation be achieved. The second part of the literature study investigated GIS, a spatial database system that can store, retrieve and intelligently interpret rule-based criteria.

GIS as a science has developed a long way since the 1960's and has reached a point where its capacity to model the real world is more than sufficient to represent the SAMOAC guidelines as a spatial model. GIS has been used successfully in environmental applications for many years, and the use of GIS to regulate land based "rule sets" such as SAMOAC is a logical step. The DOACCP implemented such a GIS in 1999-2000, and appear to have ironed out many of the problems previously experienced with the SAMOAC guidelines.

Literature studied indicates that GIS is ideally suited to represent, store, interpret and manipulate large-scale, highly detailed land based data systems. The evaluation of its success to implement SAMOAC begins with a study of the SAMOAC guidelines that need to be spatially modelled and represented. The following chapter reviews and evaluates SAMOAC, establishing a set of rules that would require implementation in order to successfully apply the SAMOAC guidelines. These rules are then used as test criteria to establish the relative successes and failures that paper-based and GIS based systems experience attempting to implement SAMOAC on an erf by erf basis.

4 EVALUATING AND REVIEWING SAMOAC

SAMOAC, published in 1998, was reviewed and adopted by National government as a guideline document shortly afterward. SAMOAC has been tested in the field by many South African city councils, from Cape Town through to Pretoria. Due to the varying nature of the South African landscape, the guidelines have had an extremely wide range of situations test their effectiveness at controlling OA. As expected, many situations have occurred where the guidelines were not comprehensive enough to handle the situation at hand. This chapter provides a review of the successes of SAMOAC by synergising and distilling the feedback from both controlling authorities and adverting bodies such as the OAASA. This process is the first time that feedback on the SAMAOC guidelines has been documented and reported (Jordaan 2000).

The review of SAMOAC is an interesting point of discussion in itself but, its relevance to this dissertation needs to be explained. In the discussion of the problem statement, the argument on how to test different methods of applying SAMOAC was presented. The key information needed to test the two implementation systems discussed was a list of criteria that a system should be capable of performing if it wished to successfully implement the SAMAOC guidelines for control. The original SAMOAC document provides an initial list but, in order to be complete, this list needs to be supplemented with the information received in the feedback from the controlling authorities and advertising organisations. (For a more detailed explanation refer to section 2.1).

To reiterate the main points, this checklist is important in that it will be used as a set of test criteria to establish the relative effectiveness with which the traditional (paper based) and computer oriented (GIS based) systems implement the SAMOAC guidelines.

The following discussion assumes that the reader is familiar with the contents of the SAMOAC document. Those who wish to read more on the document and the model it uses as a basis for control can consult **ANNEXURE B – SAMOAC Guidelines for Control of OA** on page 130.

4.1 INTENDED SAMOAC IMPLEMENTATION PROCEDURE

As the SAMOAC document has been accepted nationally, any person (an applicant) wishing to erect any forms of OA whatsoever should consult the SAMOAC document. The document is structured in such a way that the applicant can classify the desired sign into one of five classes and fifty sub classes. Based on this sign classification, the applicant will be able to ascertain whether the sign has deemed consent or whether the sign requires specific consent. These two mutually exclusive classes are used as different sign classes have varying levels of potential impact that they can exert on an environment. Sign classes with low impact potential are given deemed consent and formal application to controlling authorities is not required. All other sign

classes are said to require specific consent, and written permission from authorities is a requirement. Based on this principle, all signs have either deemed consent or specific consent.

Should the applicant have a sign that requires specific consent, a formal application will need to be submitted to the local authorities. According to SAMOAC, authorities should process written applications in the following manner. The sign should be classified in terms of SAMOAC (the same process as above). The area that the sign will be displayed on should be classified as either MAXIMUM, PARTIAL or MINIMUM control. Once classified, the "area of control" and "sign type" are used to read off the display opportunities from the display opportunities matrix in the SAMOAC document. If the display opportunity is "Not Permissible", then the application is rejected. If the display opportunity is "Permissible", then the application is passed subject to compliance with general principles and conditions, which deal with public safety and related issues. The above example is designed to explain how the SAMOAC model should be implemented. The narrative style is converted into a fully fledged checklist of requirements needed to implement SAMOAC in section 4.3.

The intended procedure to implement SAMOAC is in essence simple. Problems occur when borderline case submissions are filed. Borderline cases can be sign types that SAMOAC does not cover, landscape areas that are not classified in SAMOAC, or conflict zones such as legal signs in close proximity to MAXIMUM control areas. The list of possible shortcomings is many. The following section is the first formal feedback and compilation of these shortcomings since the document was published. Interestingly, many of the same issues crop up time and time again. It is these issues that need to be addressed most urgently. In fact about nine out of every ten problem applications would be solved by implementing only five additions or updates to the SAMOAC document (IGIS 2000).

4.2 Problems Experienced with Implementing SAMOAC on Local Scale

SAMOAC was written to provide guidelines on a National scale and was aimed at initiating interaction between authorities and advertising contractors, thereby breaking the stalemate that had occurred in many instances. No attempt was made to try and cover every anomaly that might arise as a result of site-specific conditions. (Velcich 2000, personal communication)

This section documents and analyses information gathered by interview from local councils and advertisers throughout Gauteng. Two groups, the DOACCP and the OAASA were instrumental in bringing about the discussions and feedback presented in this section.

In early 1999, the City Council of Pretoria together with several other Gauteng councils went through a scoping exercise, publicly work shopping SAMOAC to determine what site specific additions were required to successfully implement SAMOAC on municipal scale. (Rofail 1999, personal communication)

According to Kal Rofail of the DOACCP and Tony Davidson of the OAASA, the initiation of this sub study, performed by the DOACCP stems from problems experienced by the controlling authorities and advertising contractors alike who have attempted to implement SAMOAC on a local scale. SAMOAC has been in circulation since April 1998, and as anticipated, there are areas in the SAMOAC document that require refining. Local councils were encountering local issues that SAMOAC did not cover.

This section centres on the issues highlighted by the DOACCP and the OAASA during a series of interviews and telephonic conversations held with members of these two bodies throughout 1999. It must be understood that the list of grievances with the control of OA was varied and vast (Rofail and Davidson 1999, personal communication). Only pertinent issues pertaining to this study are listed below. Successful handling of this list of grievances is an essential part of compiling the set of test criteria presented in section 4.3.

4.2.1 SAMOAC is Not Site Specific

It can be appreciated that with the huge variety of climates and vegetation types, coupled to the large variety of cultural uses of South African landscapes, the site specific nature of any given area may not be fully covered or regulated.

A lack of availability of site-specific information prior to submitting an application existed in many cases. Due to its national scale of application, the availability of site-specific information such as cadastral boundaries and OA zoning information for specific sites is not available. Due to the lack of mapped information OA contractors were required to use a process of trial and error in order to find sites that can legally display advertising signs. Two major problems then arise. Firstly, the submission of applications by OA contractors is costly and time consuming, and much money and time is wasted. Secondly, as a result of the trial and error nature of the application process, the DOACCP receive large numbers of completely unfeasible applications, each of which has to be evaluated on merit. This resulted in masses of paperwork, and the appearance of unreasonable numbers of applications being turned down.

Local implementation of SAMOAC requires large amounts of "support" information for each land parcel in the given control area (in this case the Pretoria Metro area). OA contractors should ideally be able to view spatial zoning plans, sign display opportunities and control ratings for every land parcel in Pretoria prior to handling an application. This would reduce the number of applications submitted, lightening the paper work load that the DOACCP need to process. With the trial and error aspect being removed, the number of successful applications would increase, and the processing time for applications would decrease substantially.

Support information such as online versions of the SAMOAC document, 360degree photography of prominent intersections and a user-friendly point and click computer interface would improve the amount of information available to OA contractors and the DOACCP.

Secondly, no accurate information demarcating sensitive ridges is available. SAMOAC suggests that crests (prominent skylines) should be zoned MAXIMUM control. In reality however, as no data existed to accurately define where crests were located, this was never enforced properly. SAMOAC does not provide a methodology to define crests, which by their very nature are difficult to accurately demarcate. This needs to be corrected by developing a methodology to define crests accurately. Two criteria, change in elevation and change in gradient, are often used to do this.

Thirdly, no information accurately demarcating gateways to the city is available. SAMOAC suggest that gateways (prominent entrances to the city) should be zoned MAXIMUM control. In most City Councils however, no data exists on the position of Gateways, and SAMOAC does not provide a methodology to define a gateway, resulting in the control being bypassed. The position and extent of the visual basins that comprise the Gateways in a city need to be defined.

4.2.2 SAMOAC DOES NOT COVER ALL THE SIGN TYPES FOUND IN THE METROS COMPRISING GAUTENG, AND MORE SPECIFICALLY THE CCP.

When SAMOAC was published, the Department of Environmental Affairs and Tourism decided that a file rather than bound format would be applicable, as the creative nature of the OA industry would undoubtedly develop new methods and mediums of OA as time passed. This has definitely occurred, unfortunately new guideline sheets for the additional sign classes were never published for SAMOAC.

The City Council of Pretoria found that as outdoor advertising spread and advertising contractors became more and more ingenious in thinking up methods of displaying advertisements outdoors, the original list of sign types in SAMOAC no longer covered all sign types being applied for.

In addition to this, SAMOAC did not put enough emphasis on the difference between locality and non-locality bound advertising. (Rofail, personal communication, 1999) The City Council of Pretoria put forward a list of signs that they were struggling to control, and together with independent consultants, drew up a set of Guidelines sheets. These classes are extensions to existing SAMOAC advertising opportunities.

The signs in question are the following:

TABLE 1: SIGN TYPES IN PRETORIA NOT COVERED BY SAMOAC

CLASS	SIGN TYPE
1E	Gantry Billboards
2D(6)	Direction signs to show houses
2D(7)	Handbills, leaflets and pamphlets
3C(1)	Flat Signs: locality bound
3C(2)	Flat Signs: non-locality bound
3C(1)	Projecting signs: locality bound
3D(2)	Projecting signs: non-locality bound
3E(1)	Veranda, Balcony, Canopy and under-awning signs: locality bound
3E(2)	Veranda, Balcony, Canopy and under-awning signs: non-locality bound
3G(1)	Window Signs: locality bound
3G(2)	Window Signs: Non-locality bound
3H(1)	Signs incorporated into the fabric of a building: locality bound
3H(2)	Signs incorporated into the fabric of a building: non-locality bound
3N	Freestanding signs at educational institutions
3O	Boundary wall signs

4.2.3 SAMOAC CONTROLS ARE TWO DIMENSIONAL AND ARE INEFFECTIVE IN THREE DIMENSIONAL SPACE SUCH AS THE PRETORIA CBD

The town-planning scheme of Pretoria promotes mixed-use development in the CBD (J Barbir Chief Urban Designer, Personal Communication 1999). SAMOAC was written to control land parcels with one land use only. The Urban Planning Department of Pretoria aim at developing the CBD in three distinct zones. Zone one is street level, Zone two entails all floors between street level and rooftop and Zone three is the building rooftops. (See Figure 7 on page 47.)

One of the major problems experienced by the DOACCP is that SAMOAC controls are mainly geared towards controlling a two dimensional cadastral layout. SAMOAC only incorporates three-dimensional aspects by controlling height of sign structure and by limiting the attachment height of signs on buildings. In practice, the impact that advertising has on the visual environment is directly linked to the elevation of the sign above ground level. An example is the Ponte sign in Johannesburg Central. This sign is visible from Pretoria on a clear day. The same sign on ground level would not have nearly the same visual impact. In essence, OA controls that incorporated the third dimension were required.

The following is a set of proposed adaptations and additions to SAMOAC, work shopped with the DOACCP, IGIS (PTY) LTD and Van Riet and Louw Landscape Architects to determine a set of criteria that could be used to implement 3D zoning controls. The streetscape was evaluated in several areas in Pretoria. Criteria such as visual character and activity zones in mixed-use areas were evaluated. The zones illustrated in Figure 7 and Table 2, Table 3, Table 4, Table 5 and

Table 6 were established. The following 3D zonings need to be incorporated in the display opportunities evaluation system.

Level one extends from ground floor to approximately 2nd floor level (measured as 4.5m high). Level two extends from 4.5m above street level to the start of the building roof. Level three denotes the roof structure of the building. Areas that do not contain a tick or cross are deemed not applicable. For Example, a Class 1A super billboard on level 3 is not applicable as its controls are covered under a different sign type, namely Class 3A Sky Signs.

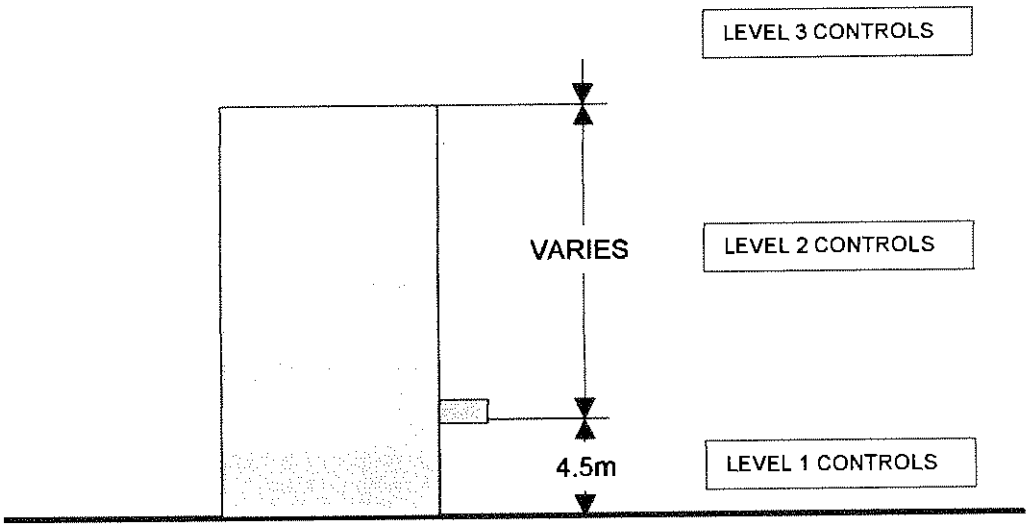

FIGURE 7: 3D CONTROLS AND ADVERTISING OPPORTUNITIES GENERATION CRITERIA

TABLE 2: CLASS 1: BILLBOARDS AND OTHER HIGH IMPACT FREE STANDING SIGNS

TYPE OF SIGN		AREA OF CONTROL								
		MAX			PAR			MIN		
	LEVEL	1	2	3	1	2	3	1	2	3
1A	Super Billboards	X	-	-	X	-	-	✓	-	-
1B	Custom Made Billboards	X	-	-	X	-	-	✓	-	-
1C	Large Billboards	X	-	-	X	-	-	✓	-	-
1D	Small Billboards and Tower Structures	✓	-	-	✓	-	-	✓	-	-
1E	Gantry Billboards	X	-	-	X	-	-	✓	-	-

TABLE 3: CLASS 2: POSTERS AND GENERAL SIGNS

TYPE OF SIGN		AREA OF CONTROL								
		MAX			PAR			MIN		
	LEVEL	1	2	3	1	2	3	1	2	3
2A	Large posters and advertisements on street furniture	✓	-	-	✓	-	-	✓	-	-
2B	Banners and flags	✓	✓	X	✓	✓	X	✓	✓	✓
2C	Suburban ads	✓	-	-	✓	-	-	✓	-	-
2D(1)	Temporary Advertisements: - Estate agents boards	✓	X	X	✓	X	X	✓	✓	X
2D(2)	Sale of goods and livestock (non-commercial premises)	✓	X	X	✓	X	X	✓	X	X
2D(3)	Pavement posters and notices	X	X	X	✓	X	X	✓	X	X
2D(4)	Project boards	✓	X	X	✓	X	X	✓	✓	X
2D(5)	Temporary window signs	✓	X	-	✓	✓	-	✓	✓	-
2D(6)	Direction signs to show houses									
2D(7)	Handbills, leaflets and pamphlets									
2E	Street name advertisements	X	-	-	✓	-	-	✓	-	-
2F	Neighbourhood watch and similar schemes	✓	X	X	✓	X	X	✓	✓	X
2G	Product replicas and three-dimensional signs	X	X	X	✓	X	X	✓	✓	✓

TABLE 4: CLASS 3: SIGNS ON BUILDINGS, STRUCTURES AND PREMISES

TYPE OF SIGN		AREA OF CONTROL								
		MAX			PAR			MIN		
	LEVEL	1	2	3	1	2	3	1	2	3
3A	Sky signs	-	-	X	-	-	✓	-	-	✓
3B	Roof signs	-	-	X	-	-	✓	-	-	✓
3C(1)	Flat signs: locality bound	✓	✓	-	✓	✓	-	✓	✓	-
3C(2)	Flat signs: non locality bound	✓	X	-	✓	✓	-	✓	✓	-
3D(1)	Projecting signs: locality bound	✓	✓	X	✓	✓	X	✓	✓	X
3D(2)	Projecting signs: non locality bound	✓	X	X	✓	✓	X	✓	✓	X
3E(1)	Veranda, balcony, canopy and under-awning signs: locality bound	✓	✓	-	✓	✓	-	✓	✓	-
3E(2)	Veranda, balcony, canopy and under-awning signs: non locality bound	✓	X	-	✓	✓	-	✓	✓	-
3F	Signs painted on roofs and walls	X	X	X	✓	✓	✓	✓	✓	✓
3G(1)	Window signs: locality bound	✓	✓	-	✓	✓	-	✓	✓	-
3G(2)	Window signs: non locality bound	✓	X	-	✓	✓	-	✓	✓	-
3H(1)	Signs incorporated in the fabric of a building: locality	✓	✓	X	✓	✓	X	✓	✓	X

	bound									
3H(2)	Signs incorporated in the fabric of a building: non locality bound	✓	X	X	✓	✓	X	✓	✓	X
3I	Advertisements on forecourts of business premises	✓	-	-	✓	-	-	✓	-	-
3J	Miscellaneous signs for residential oriented land use and community services	✓	✓	X	✓	✓	X	✓	✓	X
3K	On-premises business signs	✓	✓	X	✓	✓	X	✓	✓	X
3L	Advertising on towers, bridges and pylons	X	X	X	X	X	X	✓	✓	✓
3M	Advertisements on construction site boundary walls and fences	X	X	X	✓	X	X	✓	✓	X
3N	Free standing signs at educational facilities									
3O	Boundary wall signs									

TABLE 5: CLASS 4: SIGNS FOR THE TOURIST AND TRAVELLER

TYPE OF SIGN		AREA OF CONTROL								
		MAX			PAR			MIN		
	LEVEL	1	2	3	1	2	3	1	2	3
4A	Sponsored road traffic projects	✓	X	X	✓	X	X	✓	X	X
4B	Service facility signs	✓	✓	X	✓	✓	X	✓	✓	X
4C	Tourism signs	✓	✓	X	✓	✓	X	✓	✓	X
4D	Functional advertisements by public bodies	✓	✓	X	✓	✓	X	✓	✓	X

TABLE 6: CLASS 5: MOBILE SIGNS

TYPE OF SIGN		AREA OF CONTROL								
		MAX			PAR			MIN		
	LEVEL	1	2	3	1	2	3	1	2	3
5A	Aerial signs	✓	✓	X	✓	✓	X	✓	✓	X
5B	Vehicular advertising	X	X	X	X	X	X	✓	✓	✓
5C	Trailer advertising	X	X	X	✓	X	X	✓	✓	X

The tables shown above, were accepted by the CCP in 1999, and present the most advanced set of Outdoor Advertising control criteria in South Africa at the present moment (2000). Traditionally, the ground floor is retail/commercial, and the upper floors are office/residential, with the roofs reserved for services. The new set of controls separates high-rise areas into these three distinct user zones. The advertising opportunities and constraints are adapted to suit these zones.

4.2.4 SAMOAC Does Not Seek to Prevent Conflict on the Boundaries Between Maximum and Minimum Control Areas.

On analysing the geographic location of areas of conflict, the DOACCP found that the majority of conflicts occurred on the boundaries between MAXIMUM and MINIMUM control areas. The majority of complaints received by the DOACCP stemmed from the fact that residential areas were being impacted upon by MINIMUM control commercial or industrial areas that contained large billboards. SAMOAC does not provide a methodology to alleviate these conflicts. A methodology that separates areas of MAXIMUM control from areas of MINIMUM control by inserting a buffer of PARTIAL control would alleviate much of the conflict. Tests were run on the CCP information, and a 30m buffer, including all cadastres that fall within or touch the buffer line, was found to be sufficient to alleviate the majority of spatial conflicts experienced.

4.2.5 SAMOAC Does Not Provide Detailed Zoning Plans

SAMOAC does not provide detailed zoning plans for individual land parcels in the city. The original idea was that individual authorities should provide paper copy zoning plans that can be added to SAMOAC. Failure to provide these maps must not be seen as a gap in SAMOAC, but a gap in local administration (Jordaan, personal comment 2000-12-19).

During discussions held between the DOACCP and the OAASA in 1998 and 1999, it was agreed that a zoning plan that detailed the SAMOAC control zoning for each and every land parcel was needed. This would allow advertising contractors to determine whether their application would be passed or not prior to spending large sums of money on fruitless applications.

4.3 Checklist for Requirements to Implement SAMOAC on Local Level

This chapter set out to do two things, document the gaps in SAMOAC that have come to light since it was published in April 1998 and compile a comprehensive checklist that incorporates these findings. The majority of these gaps are as a result of applying a national scale document to a local scale problem. The City Council of Pretoria, together with several other councils in Gauteng developed a set of additional requirements that needed to be fulfilled in order to successfully apply SAMOAC at local scale. These requirements, and methodologies to achieve these requirements were discussed.

By combining these requirements with an existing list generated from SAMOAC, a comprehensive set of criteria required to implement the SAMOAC guidelines is achieved. As discussed in the problem statement, this checklist forms the criteria against which the previously used paper based and currently used GIS based application processing systems of the CCP will be tested in order to establish a comparison in terms of overall efficiency and transparency.

The complete list of criteria is as follows:

CONTROL

5.3.1 To establish AREA OF CONTROL a system applying SAMOAC at local scale, should firstly, be able to identify cadastral units with the following land zonings

- Natural open space
- Urban conservation areas
- Parks
- Non commercial squares
- Residential areas
- National monuments
- High rise residential areas
- Commercial shopping centres in residential areas
- Educational institutions
- Recreational facilities
- Improved government owned land
- Urban small holdings
- Commercial districts
- Shopping centres
- Central office precincts
- Commercial enclaves
- Industrial areas
- Entertainment districts
- Bus stations
- Railway stations
- Taxi-ranks

5.3.2 To establish AREA OF CONTROL, a system applying SAMOAC at local scale, should secondly, be able to identify the following landscape characteristics.

- Scenic areas
- Vistas
- Views down streets or avenues
- Gateways to the city
- Architecture with historic significance
- Specific tourist areas
- Viewing points
- Visual zones (250m buffer) along urban freeways

5.3.3 To establish AREA OF CONTROL, a system applying SAMOAC at local scale, should thirdly, be able to identify the following items in a landscape inventory.

- Water bodies
- Rivers
- Ridges
- Forests

SIGN

5.3.4 To establish the TYPE OF SIGN, a system applying SAMOAC at local scale should be able to supply information on standards for the following principles and conditions.

- Amenity and decency
- Safety
- Design and construction
- Maintenance
- Position
- Illumination

5.3.5 To establish the TYPE OF SIGN, a system applying SAMOAC at local scale should be able to determine a sign's class and sub class based on the following criteria.

- Role and function
- Shape
- Size
- Height
- Position
- Colour and texture
- Illumination and animation
- Specific safety requirements
- Specific design and construction requirements
- Specific maintenance requirements

OPPORTUNITIES

5.3.6 To establish SIGN DISPLAY OPPORTUNITIES, a system applying SAMOAC at local scale should be able to link the following information

- Landscape type to area of control
- Area of control to sign display opportunity

5.3.7 To determine the GUIDELINES for a specific sign class, a system applying SAMOAC at local scale should be able to accurately retrieve the relevant guideline sheet for a specific sign type.

5.3.8 A system applying SAMOAC at local scale should be able to supply the following information for any land parcel in the systems jurisdiction in graphic map format, prior to the application being submitted:

- Accurately mapped cadastral boundaries
- Accurately demarcated land zoning plans
- Accurately demarcated OA zoning information, demarcating areas of MAXIMUM, PARTIAL and MINIMUM control.
- Accurately demarcated maps displaying OA sign display opportunities for each sign type.
- Accurate demarcation of sensitive ridges
- Accurate demarcation of gateways to the city
- Display opportunities for any sign type covered in SAMOAC
- Display opportunities for any new sign type not covered by SAMOAC
- Display opportunities for sign display opportunities in the third dimension

5.3.9 To PREVENT CONFLICT, a system applying SAMOAC at local scale should be able to complete the following:

- Establish where areas of conflict between MAXIMUM and MINIMUM control zones occur
- Be able to alleviate these conflicts according to a set methodology such as a partial control buffer system.

With the above list of test criteria completed, the requirements listed in the problem statement discussion (section 2.1) have been fulfilled. Testing of the efficiency with which the paper based and GIS based implementation systems implements the SAMOAC guidelines will thus commence in the following two chapters.

5 THE PAPER BASED IMPLEMENTATION SYSTEM

This chapter has two objectives. Firstly, to document the exact procedure that the Department of Outdoor Advertising at the City Council of Pretoria (DOACCP) follow when using a paper based application system to apply SAMOAC and secondly, this chapter has the objective of testing how successfully this paper based system implements and meets the requirements to implement SAMOAC at local level.

5.1 A DETAILED EXPLANATION OF THE PROCEDURE USED IN THE PAPER BASED OA EVALUATION

This section contains a subjective overview of the paper based application system as presented by the DOACCP officials and OAASA members who worked with this system on a day-to-day basis. The original transcript has been embellished with information gathered during project meetings held by IGIS (PTY) LTD with the DOACCP throughout 1999.

In Figure 8: A Flow Diagram of the Paper Based Application Processing Procedure the relationships between each of the items discussed in this section is established. Consulting Figure 8 may aid with clarification of procedures presented in this section. Prior to submitting any form of application to the DOACCP, a potential advertising contractor has to fulfil the following application requirements.

5.1.1 APPLICATION REQUIREMENTS

The following checklist needs to be complete prior to submission of an application

- Have a scale drawn site plan indicating position of sign in relation to street boundary and buildings on erf drawn up by a land surveyor.
- Have an Elevation sketch of sign drawn to scale with wording, sizes, height and colours etc by an architect.
- Building Inspects application form to perform a site inspection
- Source a stamped and approved Surveyor General diagram from Land Surveyor Department
- A letter of consent from Property legal Services
- A letter of consent from the Culture and Recreation Department
- If the applicant is not the property owner, a letter of consent from the owner
- Source a Zoning Certificate
- Application form completed in full
- Area of sign(s) indicated
- Erf number, street name and address, suburb etc indicated

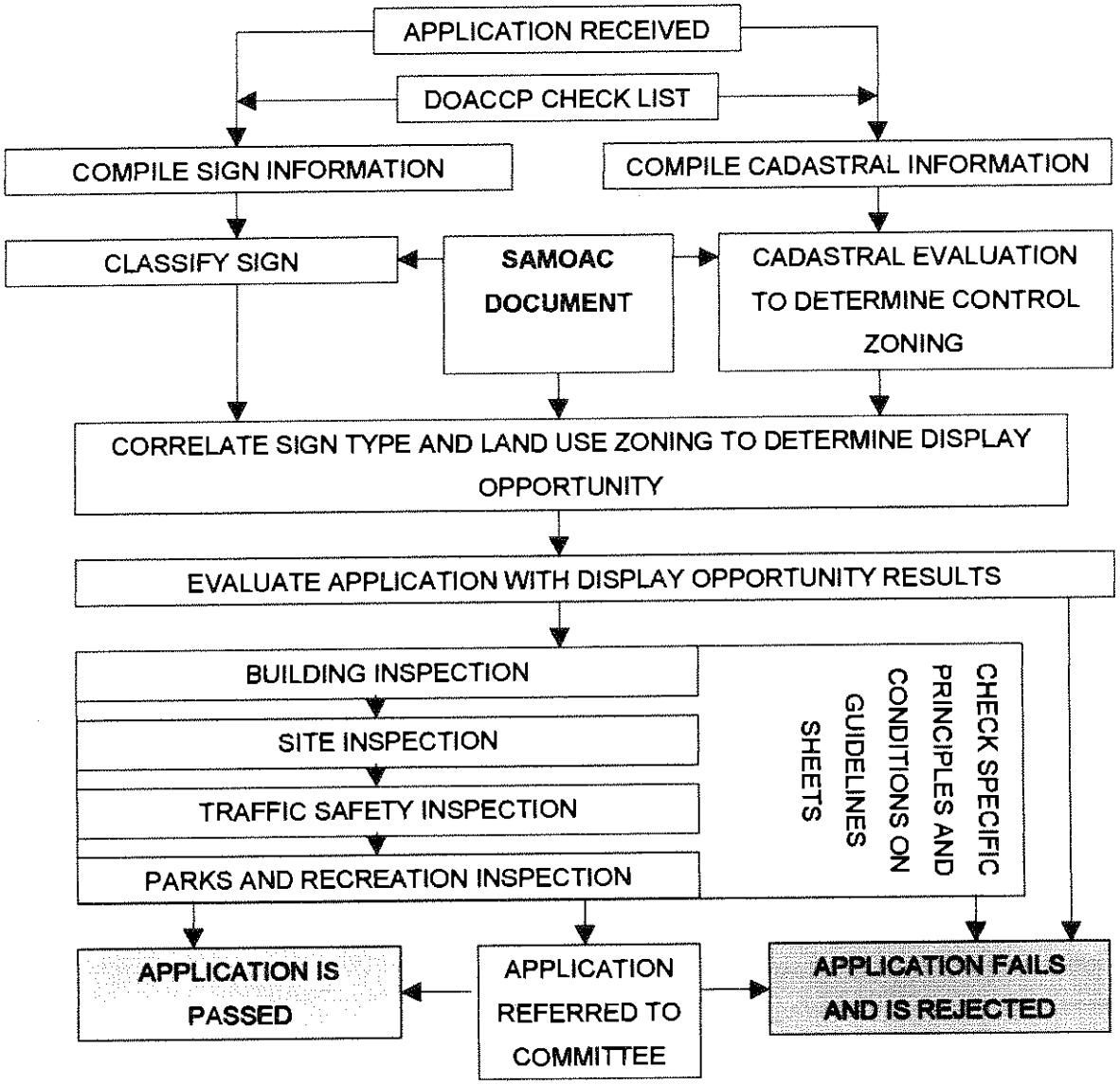

FIGURE 8: A FLOW DIAGRAM OF THE PAPER BASED APPLICATION PROCESSING PROCEDURE

5.1.2 FEES CALCULATION

Once the application form is submitted, the total surface area of the sign is calculated. The application fee structure of R200 per application plus R25.00per m^2 for all signs up to and including $6m^2$ and R40.00per m^2 for all signs larger than $6m^2$ is applied. This application fee needs to be submitted with the application.

5.1.3 LAND USE AND "ANNEXURE B"

A reference map is used to pull the cadastral layout of the erf that corresponds to the given street address. The erf number is noted, and this is used to pull planning information from the archives that provide zoning information on the relevant erf. "Annexure B" information, which

contains rulings and stipulations in terms of any re-zoning applications that may have been passed for the site, is also collated. Sufficient data is now present to determine whether the land-use specified for the advertising sign application is legal or not.

5.1.4 BUILDING INSPECTION

The landuse information is passed on to the building inspector who performs a site inspection in terms of the site inspection application form. The building inspector will check for illegal land use activities as well as contraventions of building regulations such as building lines. This is an additional set of checks not specified by SAMOAC, but the DOACCP have joined forces with the building inspector to perform illegal land use checks simultaneously. The reason for this is that many advertising applications received are destined to advertise businesses being performed on illegal land use rights.

The results of the building inspectors site inspection are returned to the DOACCP. The application either passes or fails the site inspection. In the event that the site inspection is passed, the legality of the advertising structure to be displayed is evaluated.

5.1.5 OA ZONING CONTROL RATING AND DISPLAY OPPORTUNITY EVALUATION

The land use data is evaluated in terms of SAMOAC. The site is determined as being an area of MAXIMUM, PARTIAL or MINIMUM control. This procedure is performed on a site-by-site basis. Once the area of control is determined, the sign being applied for is categorised in terms of SAMOAC. Height, Width, Thickness, Weight, Distance from a building, colour, illumination, movement, revolving or flashing elements, construction, and information being displayed are used to classify the sign. The sign class determined is correlated with the area of control determined and the relevant display opportunities are ascertained. Should the display opportunity be permissible, a site inspection is undertaken.

5.1.6 ON SITE EVALUATION

The DOACCP site inspection is undertaken to ascertain whether any other extenuating circumstances need to be taken into account. For signs larger than $6m^2$, (SAMAOC requires 36 m^2) the requirement for an EIA is also evaluated. In the event that extenuating circumstances exist, the applicant is notified, and any further requirements are requested. The application is circulated to the relevant departments (Urban Design, Parks and Recreation and Traffic Safety) for comment.

5.1.7 VERDICT BY A DOACCP OFFICIAL OR EVALUATION COMMITTEE

With most applications, the evaluation decision is an open-shut case, and a verdict is given by one of the OA officials. In the event that the sign is a "borderline' case, or if the sign exceeds $6m^2$ in surface area, the final evaluation is forwarded to the Outdoor Advertising Evaluation

Committee. This body is a sub-committee of the Town Planning Committee. The application is discussed and a verdict given.

5.1.8 NOTIFICATION OF APPLICANT

Once a verdict has been reached, the applicant is notified, and standard building regulations and procedures apply to the erecting of the structure.

5.2 A TIME LINE (IN WORKING DAYS) OF THE PAPER-BASED APPLICATION PROCEDURE

The application evaluation procedure is linear in nature, with each step in the process requiring a non-parallel time period for completion. The length of time to complete each step in the process varies slightly from application to application, but on average the time frames for each step are fixed, shown in Figure 9.

Interestingly, the two longest "delays" take place outside of the immediate bounds of the DOACCP's jurisdiction. The building inspection, which takes an average of 7 days and the verdict or decision by the OA evaluation committee of the CCP which takes roughly 14 days (bi-weekly meetings) comprise 21 out of the total 25 day process. From a procedural perspective, these are the two areas that require attention most in order to reduce the time taken to process an application. The building inspection takes time, as the inspector is required to visually evaluate the site, and on most occasions has to drive out to the site to conduct the evaluation. The evaluation committee verdict is required on borderline cases where interpretation of the SAMAOC document is required.

Thus, a system that could reduce the number of building inspection trips and the number of borderline cases requiring evaluation committee verdicts would greatly speed up the process of evaluation.

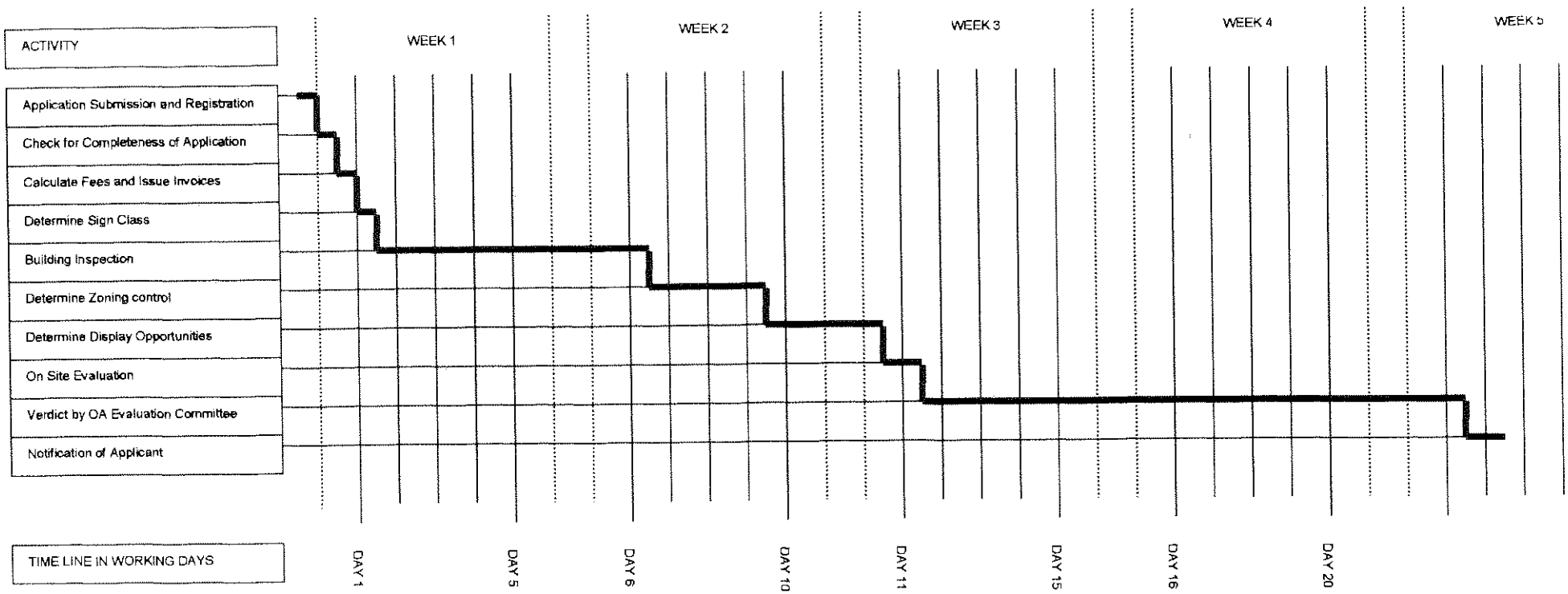

FIGURE 9: TIME LINE OF THE PAPER BASED EVALUATION SYSTEM

5.3 QUALITATIVE CORRELATIONS BETWEEN THE PAPER BASED PROCEDURE AND THE SAMOAC TEST CRITERIA

This section deals with the second objective of CHAPTER 5.

CONTROL

5.3.1 In order to successfully apply SAMOAC at local scale, a system must demonstrate that it is able to identify cadastral units with a variety of land zonings. The paper-based system is able to identify the land zoning of any specific land parcel in Pretoria. This is done by manually pulling the relevant files on the specified cadastre. With a paper based system, cross-referencing cadastres to search for land parcels with a specific land zoning is however not possible.

This means that any specific application for a site can be assigned an area of MAXIMUM, PARTIAL or MINIMUM control, allowing the application to be evaluated. A limitation of this system is that advertising contractors would not be able to search for all land parcels with a given land use and therefore control zoning. Although paper-based copies of areas of control can be made available to the contractors, producing these maps is cumbersome and not feasible.

5.3.2 The second requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to identify areas with specific landscape characteristics. The paper-based system is not able to identify areas of scenic value, as this information has never been captured. The paper-based system relies on the knowledge and judgement of the DOACCP official evaluating the application. All cadastral maps are two dimensional, and the user is required to interpret the contour plan in order to establish whether or not a site falls in a vista.

Establishing whether the site will obstruct views down streets or avenues has to be determined by means of an on site inspection.

The paper based system is not able to establish where gateways are found as this is not a land use that can be assigned to a cadastre. Separate maps illustrating gateways would need to be created specifically for that purpose.

The paper-based system is able to establish whether a site contains historic significance. The DOACCP official needs to pull and consult the relevant South African Heritage Resource Agency (SAHRA) map. The problem with this is that these maps are often outdated as it is very costly to reproduce them on a regular basis.

As with the evaluation of areas of scenic value, the paper-based system relies on the inherent knowledge of the DOACCP official to establish whether a site falls within a specific tourist area or not. Information on tourist routes is assumed from information on architecture and sites of historic value.

Information relating to the whereabouts of viewing points is not available with the paper-based system. The DOACCP official has to have a solid background knowledge of the city and then needs to link this to two dimensional contour drawings to establish whether a site falls on a viewing point or not. The paper-based system made an attempt to establish the visual zone along urban freeways. The shortcoming of the system stems however from the lack of available information on where national and provincial roads start and stop. This becomes especially vague when national routes such as Proes street pass through the CBD.

5.3.3 The third "CONTROL" related requirement that a system must demonstrate its proficiency to identify certain items in a landscape inventory. The paper-based system is able to identify water bodies and rivers. These two elements are captured on the cadastral maps and are clearly demarcated. Forests and ridges however are not as easily available. Forest areas are not defined by cadastral boundaries. In certain cases, particularly nature reserve areas, tree cover maps are available. Maps demarcating where ridges occur are unavailable. In most areas contour maps can be sources, and these can be used to generate desktop studies of ridge areas. No criteria exist, so defining accurate boundaries is problematic.

SIGN

5.3.4 From a SIGN related perspective, the first requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to supply information on standards for general principles and conditions. In this regard, the paper based system draws directly from SAMOAC. The DOACCP official correlates the information provided in the application with the GENERAL PRINCIPLES and CONDITIONS contained in SAMOAC.

5.3.5 The second requirement is that a system must demonstrate that it is able to determine a signs class and sub-class.

As with the GENERAL PRINCIPLES and CONDITIONS, the DOACCP official draws information directly from the SAMOAC document. By a system of trial and error, information pertaining to Role and Function, Shape, Size, Height, Position, Colour and Texture, Illumination and Animation, specific safety requirements, specific design and

construction requirements and specific maintenance requirements is correlated. The DOACCP official first classifies the sign into a broad class, and then refines the classification to establish the signs sub-class. Once complete, the official refers to the relevant guidelines sheet in SAMOAC and checks the classifications correctness. This process is slow and allows for human error to creep in.

OPPORTUNITIES

5.3.6 A system that is to successfully apply SAMOAC at local scale must demonstrate its ability to accurately link a given landscape type to a specific area of control.

In the paper-based system, linking landscape type to area of control is performed manually. The DOACCP official establishes the CCP land use zoning from the cadastral maps and then determines which one of the SAMOAC land use categories this land zoning best fits into. Once established, the official correlates the SAMOAC land use to the SAMOAC area of control and receives an answer of MAXIMUM, PARTIAL or MINIMUM control.

Once the DOACCP official has established which area of control the site falls into, SAMOAC is again consulted. TABLE 6 in SAMOAC, on page 55 in the 1998 edition of the SAMOAC document is used to link the area of control to the sign type class and sub class that was established earlier. This procedure is time consuming and the manual nature of the entire process leaves significant room for human error.

5.3.7 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to accurately retrieve relevant guideline information for a specific sign type. The paper-based system relies on the DOACCP official to source the relevant guidelines sheet in the SAMOAC document. The official correlates the sign type class and sub-class to source the relevant guidelines sheet.

5.3.8 Furthermore, a system that is to successfully apply SAMOAC at local scale must demonstrate that it is able to provide various pieces of information for any land parcel in its jurisdiction in graphic map format prior to the application being submitted.

The paper-based system can supply accurately mapped cadastral boundaries for all land parcels in Pretoria. The limitations of the mapped data are as follows. The maps are difficult to source. The data is only available on a single scale. If accurate drawings are required, they need to be constructed from co-ordinate pairs. The paper-based system can supply accurately demarcated land use zoning plans. The limitations are as follows. The plans are often out of date. Rezoning applications, City Council ANNEXURE B information and sub divisions are often not present.

The paper based system has no way of supplying outdoor advertising zoning information demarcating areas of MAXIMUM, PARTIAL and MINIMUM control. The entire paper based system functions on a site-by-site evaluation. The nature of this procedure means that the DOACCP official does not have sufficient information to understand what the control zonings for the adjacent sites are.

Due to the size complexity and dynamic nature of the cadastral layout of cities it is not feasible to generate paper based zoning control maps. It is also not feasible to generate maps demarcating sign display opportunities of permissible or not permissible for a given sign type.

The paper-based system is not able to generate maps showing areas with sensitive ridges or gateways.

The paper-based system is not capable of generating display opportunities for the third dimension. This shortcoming relates back to the lack of OA zoning control plans. Without these plans, display opportunities cannot be generated.

5.3.9 A final requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to establish where conflicts between areas of MAXIMUM and MINIMUM control occur and be able to alleviate these conflicts according to a set methodology.

Due to the dynamic nature of land zonings, it is very time consuming to maintain manually updated maps that show where maximum control areas border on minimum control areas. The manual nature of the paper based process also means that alleviating these conflicts is a time consuming exercise. As a result of the site-by-site evaluation procedure, it is far to time consuming for the paper-based system to establish what is happening on adjacent sites. For this reason, it is difficult to establish whether conflict will occur or how to deal with this conflict.

5.4 CONCLUSIONS

This chapter set out to achieve two objectives. Firstly, to document the exact procedure that the Department of Outdoor Advertising at the City Council of Pretoria (DOACCP) follow when using a paper based application system to apply SAMOAC and secondly, this chapter had as its objective to test how successfully the paper based system implements and meets the requirements set out in the conclusion of the preceding chapter. The second objective is directly linked to HYPOTHESIS 1:

HYPOTHESIS 1: The effectiveness of the paper-based implementation of SAMOAC on local level is limited as a result of lack of information and ineffective processing.

The conclusion is the shortcomings that the paper based systems have when applying SAMOAC on local scale supports HYPOTHESIS 1.

The paper-based system complied with most of the requirements to implement the SAMOAC model as documented in the SAMAOC manual. Large incapacities were however apparent in areas that required any form of site-specific information, zoning plans of areas of MAXIMUM, PARTIAL and MINIMUM control, or that attempted to plan OA applications in advance.

Nowhere does the paper-based system make provision for OA contractors to source legal sites for their signboards. Both the OA contractors and the DOACCP officials are kept in the dark about control ratings until an application evaluation approaches completion.

This fact would explain why the DOACCP and the OAASA have been experiencing an extremely low percentage of positive answers to applications. This would also explain why the DOACCP are swamped with paperwork. Every OA contractor that requires one successful application has to apply several times using a system of trial and error. This problem could be eliminated if it was possible to quickly and effectively produce and update the paper-based system.

With this set of findings, the next step in the process is to conduct the identical set of qualitative tests on the GIS based system; to ascertain how successfully it meets the requirements needed to implement the SAMOAC guidelines.

As stated in the problem statement, the GIS based system was specifically designed to deal with the problems being experienced with the paper-based system. As a result, the hypotheses are quite different, and the expected findings are that the GIS based system will be far more effective than the paper-based system.

6 THE GIS/TECHNOLOGY BASED IMPLEMENTATION SYSTEM

This chapter has two objectives. Firstly, to document the exact procedure that the Department of Outdoor Advertising at the City Council of Pretoria (DOACCP) follow when using the GIS based application system to apply SAMOAC and secondly, this chapter has the objective of testing how successfully this GIS based system implements and meets the requirements to implement SAMOAC at local level.

6.1 A QUALITATIVE ACCOUNT OF THE GIS PROCEDURES USED IN OA EVALUATION

The functioning of the GIS application requires a slightly more in depth study than the paper based application.

For ease of use by members of the DOACCP, advertising contractors and laymen, the GIS was developed as a self-contained "black box" application. The objective was to remove contact with the internal mechanics of the GIS development from the end-user. A user-friendly point and click Internet enabled front end (Microsoft Explorer ® 5) that accessed the GIS was developed for this purpose. Figure 10 illustrates how an application is processed using the GIS. As with the paper based application procedure, Figure 10 was compiled from information collected by interview with DOACCP and OAASA officials.

The internal workings of the GIS "Black Box" can be reviewed in section 12. Figure 13 on page 159, illustrates the data flow diagram of the GIS "black box". The functioning of the GIS will support and in some cases substantiate the procedures and findings documented in this chapter. An in depth understanding of the "GIS" is not a requirement however.

The GIS system needed to accomplish all the steps that the paper based system does. In short, the development of the GIS required the conversion of the SAMOAC model into Boolean "rules" that manipulate the GIS data provided by the CCP's GIS department.

In order to be in a position to document and review the development and implementation of the database tables and procedures developed by IGIS (PTY) LTD. the following background knowledge was assimilated.

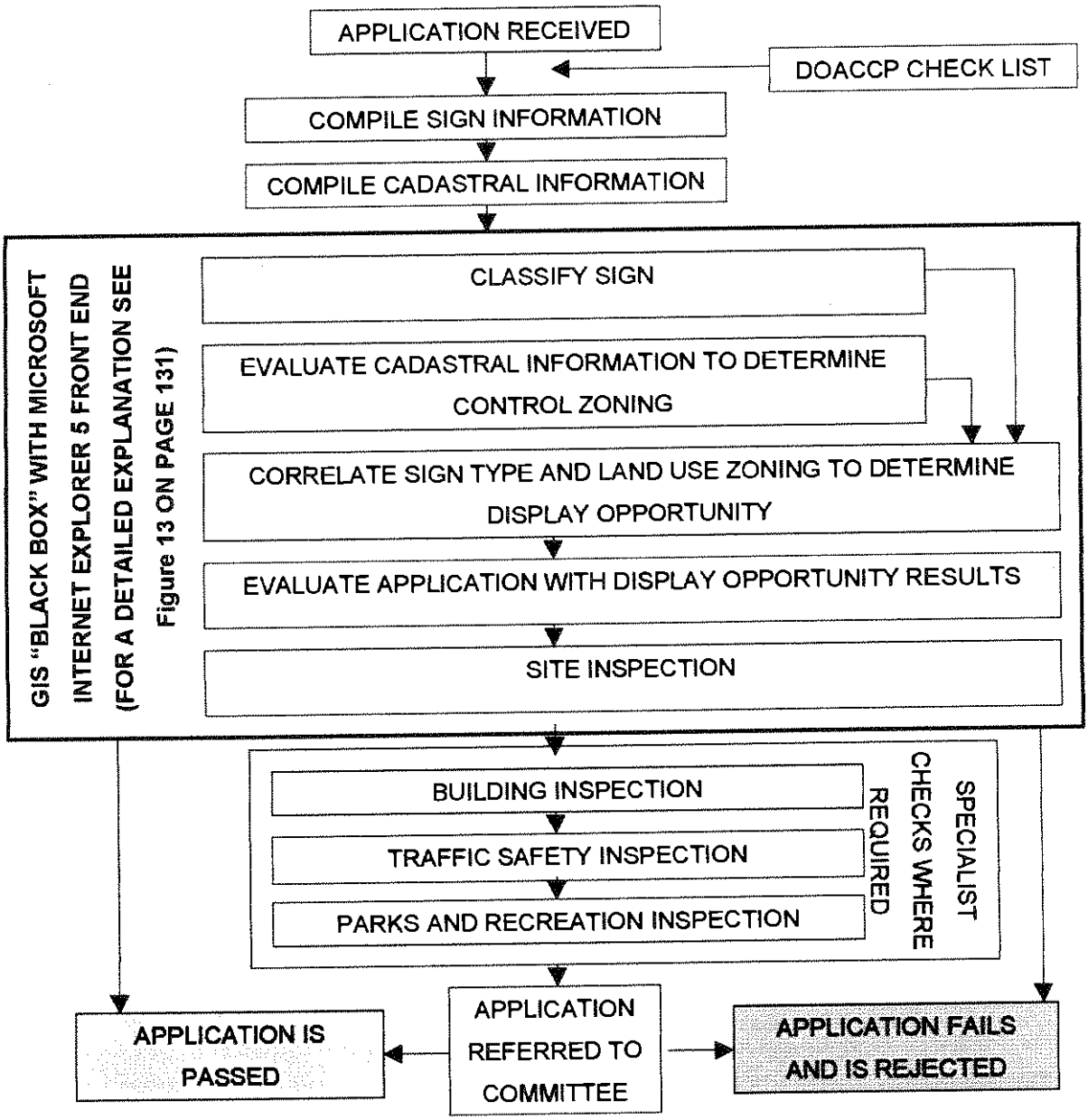

FIGURE 10: A FLOW DIAGRAM OF THE GIS BASED APPLICATION PROCESSING PROCEDURE

Step One (section 3.2.11) was to understand the various types of database structures available. Some DBMS's function better in a GIS than others, and, as recommended by IGIS (PTY) LTD. the limitations and advantages of the various database structures were reviewed. This step culminated in the review and testing of the database system and program (RDBMS) that IGIS (PTY) LTD. used to implement the chosen database system. The RDBMS chosen was Microsoft Access 2000. This program was found to completely comply with the twelve rules of Dr Edgar Codd, discussed in section 3.2.11.3.

Step Two, covered in section 11.2, "A Detailed Explanation of the City Council Zoning Information" was the documentation and evaluation of the Zoning information that the Pretoria

City Council GIS system contains for erf level detail. Since this data forms the basis of the entire GIS, its integrity is imperative for success of the initial zoning plan development.

Step Three entailed the documentation and explanation of the paper-based development of the database system. Step three gave rise to the flow diagram shown in Figure 13, which lays out the various processes and tables that the database is comprised of.

Step Four consisted of the documentation and review of each of the tables and table structures that contain the information detailed in step three. Once designed, the population of these tables using the processes shown in Figure 13 was documented and reviewed.

Step Five consisted of the documentation and review of the SQL statements, that pass and manipulate information in the tables reviewed in step four. (See ANNEXURE D - Data from the IGIS (PTY) LTD. Consultants, for an explanation of the SQL statements)

Step Six entailed the development of Environmental Overrides. (See section 12.10, Implementation of additional "Environmental Overrides" in ANNEXURE D - Data from the IGIS (PTY) LTD. Consultants. Whilst these overrides form part of the entire development in steps three four and five, they are dealt with separately for purposes of clarity. Figure 13 details where the various overrides influence the data in the database system.

Step Seven dealt with the development of support information to make the data developed in steps one to six more accessible to the layman. The support information includes the writing of an on-line version of the revised SAMOAC document, the development of Quick-time VR imagery to remotely assess prominent intersections in Pretoria.

Figure 10: A Flow Diagram of the GIS Based Application Processing Procedure on page 65, provides a synopsis of the relationships between each of the items discussed in this section. Consulting Figure 10 may aid with clarification of procedures presented in this section.

6.1.1 APPLICATION REQUIREMENTS

Any application submitted has certain requirements in terms of data and maps for evaluation.

The following checklist needs to be complete prior to submission of an application

- Access the GIS system to print out a scale drawn site plan. On this plan, the position of sign in relation to street boundary and buildings on erf is then indicated
- Have an elevation sketch of sign drawn to scale with wording, sizes, height and colours etc.
- Building Inspectors check application form to perform a site inspection

- Source a stamped and approved S.G. diagram from Land Surveyor Department
- A letter of consent from property legal services
- A letter of consent from the Culture and Recreation Department
- If the applicant is not the property owner, a letter of consent from the owner
- Print out a Zoning Certificate from the GIS system
- Application form completed in full
- Area of sign(s) indicated
- Access Erf number, street name and address, suburb etc by clicking and querying the site on screen from within the GIS browser.

6.1.2 FEES CALCULATION

The fee structure remains unchanged from the paper based fee scale detailed in section 5.1.2 on page 55.

6.1.3 LAND USE AND "ANNEXURE B"

The GIS is queried, and information regarding the application site is accessed. Any data relating to the site can be viewed immediately. The data available for all cadastral units in Pretoria can be found in Table 20 on page 154. Zoning information and a hotlink to any "Annexure B" information, which contains rulings and stipulations in terms of any re-zoning applications that may have been passed for the site, is immediately available. Sufficient data is now present to determine whether the land-use specified for the advertising sign is legal or not.

The checking of land use to determine advertising control ratings and sign display opportunities is no longer necessary, but is done as a check for illegal land use. It was found by the CCP that many sign applications are submitted as a result of perceived (often illegal) land use rather than actual (legal) land use.

6.1.4 BUILDING INSPECTION

The land use and "Annexure B" data is passed on to the building inspector who performs a site inspection in terms of the site inspection application form submitted in terms of the application requirements.

The building inspector will check for illegal land use activities as well as contraventions of building regulations such as building lines.

The results of the building inspectors site inspection are incorporated in the application folder and returned to the DOACCP. The application either passes or fails the site inspection. In the event that the site inspection is passed, the GIS is consulted to determine the legality of the advertising structure to be displayed.

6.1.5 OA ZONING CONTROL RATING AND DISPLAY OPPORTUNITY EVALUATION

DOACCP officials locate the site in question by accessing the GIS. The correct site can be located using build in search facilities to search by street address, erf number, owner, and a host of other data queries. The point and click Internet Explorer 5 enabled GIS allows the DOACCP official to click on the selected site and within seconds, the GIS calculates the control rating and display opportunities according to the flow diagram shown in Figure 13. The land use evaluation is performed automatically, and a rating of MAXIMUM, PARTIAL or MINIMUM control is returned. The control ratings of the surrounding erven are also displayed as a thematic map.
The next step is to determine the sign class. The sign is categorised in terms of Height, Width, Thickness, Weight, Distance from a building, colour, illumination, movement, revolving or flashing elements, construction, and information being displayed are used to classify the sign. A series of on screen choices, allow the user to accurately and efficiently determine the sign class. Advertising opportunities can now be established.

The GIS then correlates the advertising opportunities shown for Class one signs in Table 2, Class two signs in Table 3, Class three signs in Table 4, Class four signs in Table 5 and class five signs in Table 6, with the MAXIMUM, PARTIAL or MINIMUM control rating already established. An rating of PERMISSIBLE or NOT PERMISSIBLE is returned for the sign type in question, and this information, together with the reasons why the rating and display opportunity for the specific site have been calculated.

Should the display opportunity be permissible, a site inspection is undertaken.

6.1.6 ON SITE EVALUATION

Traditionally, the DOACCP site inspection entailed a trip out to the site. Valuable time and travel costs were expended to ascertain whether any other extenuating circumstances needed to be taken into account. For signs larger than $6m^2$, the requirement for an EIA is also evaluated.

The GIS system currently incorporates a set of one hundred forty 360-degree photographs in Quick Time VR format. These photos have been taken at prominent intersections throughout Pretoria. The DOACCP officials can now check many of the advertising sites from their desktops. Quick Time VR allows them to pan, zoom and revolve in a 360-degree direction, and a comprehensive idea of the site can be generated from these photos. If a sign is not located at one of the prominent intersections for which there is a photograph, an on site evaluation is required.

In the event that extenuating circumstances exist, the applicant is notified, and any further requirements are requested. The application is circulated to the relevant departments (Urban Design, Parks and Recreation and Traffic Safety) for comment.

6.1.7 VERDICT BY A DOACCP OFFICIAL OR EVALUATION COMMITTEE

With most applications, the evaluation decision is an open-shut case, and a verdict is given by one of the OA officials.

In the event that the sign is a "borderline' case, or if the sign exceeds $6m^2$ in surface area, the final evaluation is printed out and forwarded to the Outdoor Advertising Evaluation Committee. This body is a sub-committee of the Town Planning Committee. The application is discussed and a verdict given.

6.1.8 NOTIFICATION OF APPLICANT

Once a verdict has been reached, the applicant is notified, and standard building regulations and procedures apply to the erecting of the structure.

6.2 A TIME LINE OF THE GIS BASED APPLICATION PROCEDURE

As with the paper-based implementation of the SAMOAC guidelines, the GIS based system is linear in nature, with each step in the process requiring a non-parallel time period for completion. Due to the computerised nature of the process, the length of time to complete each step in the process is almost identical from application to application. The required time for each step is illustrated in Figure 11.

The most obvious, and the most important difference between the time lines of the paper-based and GIS based implementations shown in Figure 9 and Figure 11 respectively is that the GIS based approach more than halves the required processing time. This is apparent in both the procedures within and outside the jurisdiction of the DOACCP. As expected, the greatest timesavings were made on the tasks of building inspection, which was reduced from an average of 7 days down to less than 1 day, and the time taken to reach a verdict or decision by the OA evaluation committee of the CCP, which was reduced from 14 days down to 7 days. The total time reduction was from 22 working days down to 8.5 working days.

The time savings were achieved by using digital photography linked to cadastral units to replace the time consuming and costly building inspection site visits and by reducing the number of borderline cases required for review by the OA evaluation committee. The more comprehensive computer based system allowed DOACCP officials to make criterion-based decisions on many more applications, reducing the number that required transferral. Further more, as advertisers were able to use the system to plan their campaigns, the number of applications requiring processing was greatly reduced. In essence, advertisers were able to pre process their own applications, and could test the viability of an application prior to submitting, saving much time and effort previously required by DOACCP officials to perform this task.

Small time savings were registered in the classification of sign class, zoning control and display opportunities as this information is pre computed and instantly available on the GIS system. The GIS application of the SAMOAC guidelines appears to have streamlined the application process, by improving both the accuracy and speed with which applications can be completed.

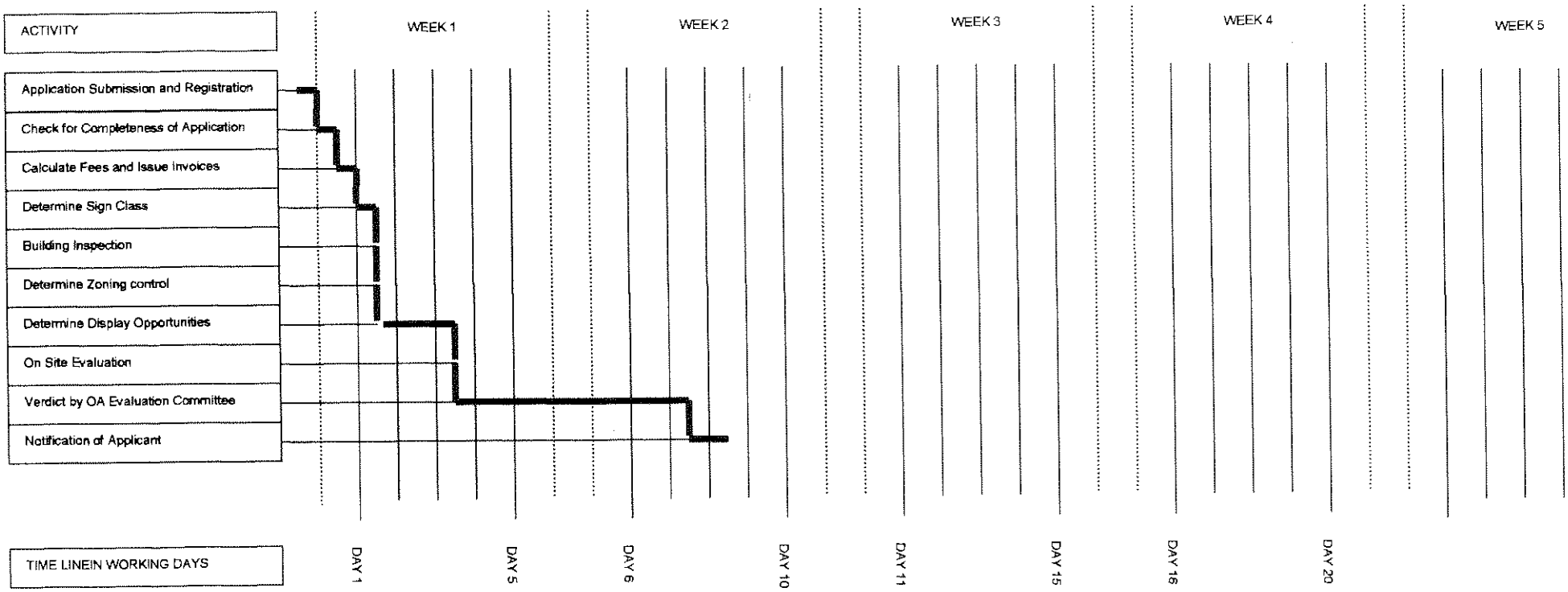

FIGURE 11: TIME LINE OF THE GIS BASED EVALUATION PROCEDURE

6.3 QUALITATIVE CORRELATIONS BETWEEN THE GIS BASED PROCEDURE AND THE SAMOAC TEST CRITERIA

This section deals with the second objective of CHAPTER 6. In this section, the GIS-based system is tested to see how successfully it fulfils the requirements established in CHAPTER 4 to successfully implement SAMOAC on local scale.

CONTROL

6.3.1 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to identify cadastral units with a variety of land zonings.

The GIS based system is able to identify the land zoning of any specific land parcel in Pretoria. This is done automatically. The DOACCP official can locate a specific land parcel in several ways. Firstly, he can visually zoom in on screen and click on the relevant land parcel. Secondly, he can make use of a point and click search engine that finds the land parcel by GISKEY, Suburb and Erf number, owner or street name and number. The land parcel is automatically centred on screen and the zoning information is displayed in the right hand margin of the screen. Cross-references of cadastres to search for land parcels with specific land zoning criteria are very fast and uncomplicated. The GIS can generate a THEMATIC map shading all cadastres of a specified land zoning with only a single button click.

The GIS has automatically pre-determined the OA zoning control of either an area of MAXIMUM, PARTIAL or MINIMUM control, and the application is pre-evaluated. Advertising contractors are able to search for any land parcels with a given land use or specific control zoning.

6.3.2 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to identify areas with specific landscape characteristics.

The GIS based system has been pre-programmed to search for combinations of criteria such as open spaces bigger than a set size or areas within 50m of a river. These search criteria immediately red flag areas with potentially high scenic value. The GIS based system relies on the rules that the GIS specialist programmes in. The knowledge and judgement of the DOACCP official evaluating the application is required to confirm or reject the scenic value data that the GIS returns. The same holds true for vistas. The GIS contains a 3D image of the Pretoria city, and has been pre-programmed to identify areas that have large and sudden changes in grade and elevation, the two topological requirements for a good vista.

View shed analysis to establish whether a site will obstruct views can be performed with the GIS. In addition to this, the GIS based application system contains about one hundred forty 360deg photos of prominent sites throughout Pretoria. These can be called up immediately from an on screen map and are invaluable when performing desktop studies.

The GIS based system contains a dataset that demarcates the prominent gateways in Pretoria. These gateways were generated by means of a desktop and ground truthed study. The data was then fed into the system from where it is activated as soon as a query in one of these areas is performed.

The GIS based system is able to establish in an instant whether a site contains historic significance. The GIS cadastres are linked directly to an up to date list of heritage and national monument sites in the city. The system is such that as soon as a new site is added, it is immediately available on the GIS system.

As with the evaluation of areas of scenic value, the GIS based system relies on a set of rules to establish whether a site falls within a specific tourist area or not. Information on tourist routes is based on the proximity of historic architecture, sites of historic value and proximity to public transport.

Information relating to the whereabouts of viewing points has been captured on the GIS. Walking trails, and other activities that have prominent viewing points have been captured. In general, these viewing points are found in areas of environmental or historic importance, and are therefore zoned MAXIMUM control in any case. The GIS supports this information with points selected according to prominent topography.

The GIS based system has defined accurate visual zones along urban freeways. Data from the National Roads Agency was converted and manipulated to establish the exact areas along National roads that fall within the 250m buffer from the road reserve. Problems such as Proes Street (N4) that passes through the CBD were easily overcome as the National Roads agency data pinpointed the transition from freeway to arterial.

6.3.3 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to identify certain items in a landscape inventory.

The GIS based system is easily able to identify water bodies and rivers. In fact, by using a 3D analysis package, the GIS can determine where perennial and non-perennial rivers occur, based on Theissen polygon interpolation of rainfall at known weather stations. Forest data was compiled from the interpretation of 1:50 000 topographic maps, and as discussed earlier, ridges were ascertained by calculating alterations in slope and

elevation. As no criteria exist for defining the extent of ridges, they were established by trial and error. The benefit of using a GIS was that the regulations were applied uniformly across the city.

SIGN

6.3.4 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to supply information on standards for GENERAL PRINCIPLES AND CONDITIONS.

In this regard, the GIS based system is successful. The GIS based system contains a digital copy of SAMOAC written in Hypertext Markup Language (HTML). The user interface contains a button that links directly to the GENERAL PRINCIPLES and CONDITIONS information. This information can then be edited, printed or e-mailed directly from the users computer.

6.3.5 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to determine a signs class and sub-class.

As with the GENERAL PRINCIPLES AND CONDITIONS, the GIS based system successfully implement this requirement. A button on the user interface links directly to a sign classification screen. The user has the option to "select by picture" or to fill in text fields that are then evaluated. Once complete, the system returns the relevant guidelines sheet in HTML format and the user can read any pertinent information pertaining to the specified sign.

OPPORTUNITIES

6.3.6 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to accurately link a given landscape type to a specific area of control.

In the GIS based system, this link is performed automatically. The DOACCP official locates the relevant land parcel as discussed earlier, and the full evaluation appears on screen. The GIS internally evaluates the relevant data and establishes the area of control.

As with the AREA of CONTROL, the SIGN DISPLAY OPPORTUNITIES are evaluated automatically. A full list of all sign types on all three levels is generated in a scroll box to the right of the screen. Each row of the scroll box contains a sign type and an evaluation of either PERMISSIBLE or NOT PERMISSIBLE. This procedure is instantaneous and error free.

6.3.7 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to accurately retrieve relevant guideline information for a specific sign type.

Once again, the GIS based system is successful. By clicking on the required sign type in the scroll box mentioned above, the system will perform two tasks. Firstly, it will retrieve the relevant Guidelines sheet, and secondly it will generate a two-tone map illustrating areas where the selected sign is either PERMISSIBLE or NOT PERMISSIBLE.

6.3.8 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to provide various pieces of information for any land parcel in its jurisdiction in graphic map format prior to the application being submitted.

The GIS based system successfully achieves this requirement. On request, it can supply tabular or colour coded (thematic) maps of any data field on the system. These include 27 data fields from the CCP database that contain land-zoning information (See 11.3 on page 151), 7 fields from the control zonings database and 51 fields from the display opportunities database. The advantage of this system is that it is continuously aware of all adjacent land parcels, and will generate maps, which centre the relevant site within the context of its surrounds. Evaluation of isolated or non-contextualised information is thus avoided.

The GIS based system can generate accurately demarcated land use zoning plans with up to the minute land zoning accuracy. Plans are only as old as the data being captured. Plans can also be printed at any scale required. Redrawing sites using co-ordinate pairs is no longer necessary.

The GIS based system can supply outdoor advertising zoning information demarcating areas of MAXIMUM, PARTIAL and MINIMUM control for any area in the entire city. The entire GIS based system functions on a seamlessly integrated spatial database, where information on anything anywhere is just as easy to access as anywhere else. Both the DOACCP and the OAASA can access everything they need to know at all stages of the application process.

The GIS automatically calculates sign display opportunities demarcating areas as PERMISSIBLE and NOT PERMISSIBLE. These results can be displayed in map or text format at the touch of a mouse button. The GIS based system can also generate maps showing areas of sensitive ridges and gateways.

The GIS based system stores display opportunities for the third dimension in a table. This information can be queried or thematically mapped at any time.

6.3.9 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to establish where conflicts between areas of MAXIMUM and MINIMUM control occur and be able to alleviate these conflicts according to a set methodology.

The GIS based system is successful on both counts. Within minutes, the GIS system can identify every instance in the entire city where a MAXIMUM control land parcel lies ADJACENT to a MINIMUM control land parcel. Once these areas of conflict have been identified, they can be corrected using a PARTIAL control buffer procedure.

The GIS is used to select all land parcels with a MINIMUM control rating that lie partially or totally within 30m of a land parcel of MAXIMUM control, and once selected, the OA zoning of these land parcels is converted to PARTIAL control. Once in place, no area exists in the entire city where two land parcels of opposing control rating lie closer than 30m to each other.

6.4 CONCLUSIONS

This chapter set out to achieve two objectives. Firstly, to document the exact procedure that the Department of Outdoor Advertising at the City Council of Pretoria (DOACCP) follow when using a GIS based application system to apply SAMOAC and secondly, this chapter had as its objective to test how successfully the GIS based system implements and meets the requirements to implement SAMOAC at local scale. The second objective ties in closely with HYPOTHESIS 2:

HYPOTHESIS 2: A GIS based implementation system is effective to implement SAMOAC on local scale.

The GIS based system is 100% successful when tested against the criteria required to implement SAMOAC at local level. It's ability to manipulate spatial and non-spatial data, and to link large quantities of varying types of information make GIS the ideal tool to implement the SAMOAC guidelines.

The level of versatility, speed and accuracy that the GIS system displays is very significant. The GIS appears to be easy to use, and provides all the functionality necessary to meet the requirements documented in CHAPTER 4.

The GIS system is able to manage all the requirements of the SAMAOC model as well as the requirements to implement SAMOAC on local scale.

7 RECAPITULATION, CONCLUSIONS AND RECOMMENDATIONS

7.1 RECAPITULATION

From the beginning, this dissertation set out to validate and review the SAMOAC document as well as evaluate the existing and future procedures of implementation of the SAMOAC guidelines, i.e. establishing how new technologically advanced methods of applying SAMOAC could alleviate current problems being experienced with the paper-based implementation.

Two methods of implementing SAMOAC were evaluated. First, a set of test criteria to compare the two treatments was first compiled. This set of criteria was based on the requirements necessary to implement SAMOAC at local scale. The list of requirements that an application system should be able to perform was grouped into logical categories to make the data manageable. Each of the two systems tested was measured against the requirements of each of these categories.

The list of requirements compiled as test criteria were derived from two primary sources. The first set of requirements stemmed wholly from the guidelines in the SAMOAC document. The second set of requirements was based on a list of problems being experienced by both controlling authorities and the OAASA. At the time of acceptance of this document (2001), the second set of test criteria had not been documented, evaluated or tested. Due to their comparatively recent introduction, mitigation measures for these problems were understandably less comprehensive. The result was that the most severe limitations on the implementation of SAMOAC as a national set of OA control guidelines stem from this second set of criteria (IGIS (PTY) LTD. 1999).

Each system was evaluated separately, and the success with which the test criteria were met was documented. The comparison of the two systems, in essence the culmination of this dissertation is presented in section 7.2 of this chapter.

CHAPTER 2 defined the problem statements. A discussion of how the problem statement was generated and an analysis of this problem statement to compile a list of sub-problems dealing with the various aspects of the problem statement were also discussed. From these sub-problems, Hypotheses were generated, and the required delimitations and assumptions for the study were drawn up. The final section in Chapter 2 is a documented methodology to be used in the study, and stems from the original study proposal submitted.

CHAPTER 3 contained the literature review. As discussed, a broad literature search relating to the requirements for a Masters Dissertation was conducted, after which literature searches relating to the various aspects of the sub-problems were conducted. The real world nature of the study required that much of the studies background be conducted via interview and personal communication, as many of the issues covered have not been documented. The information gleaned from the literature study, provided insight into the nature of the problem statement, helping to establish meaningful sub problems and hypotheses.

CHAPTER 4 contained data on the regulation of OA in South Africa. The SAMOAC model was reviewed and a comprehensive list of requirements to implement SAMOAC was documented. Furthermore, a list of issues and gaps in SAMOAC as presented by the DOACCP and the OAASA were discussed, and possible solutions to these issues were presented. The combination of the requirements to implement SAMOAC and the gaps in SAMOAC identified by the local authorities and OAASA formed the basis of a set of requirements (test criteria) needed in order to successfully implement SAMOAC at local scale.

CHAPTER 5 dealt primarily with HYPOTHESIS 1:

> *HYPOTHESIS 1: The effectiveness of the paper-based implementation of SAMOAC on municipal level is limited as a result of lack of information and ineffective processing.*

Chapter 5 contained a qualitative account of the paper-based application of SAMOAC. Conclusions drawn were that the hypothesis was fully supported. Lack of available documentation to pre-test applications as well as to efficiently process applications, compounded by the shear number of submittals caused by this led to the frustrations and apparent ineffective processing of applications by the DOACCP. The evaluation of the paper-based system formed the basis for understanding where shortcomings in the process existed. Lack of site-specific information (erf level detail), zoning control plans and support information were the definite weak points of the paper based system. It should be noted that smaller (primarily rural) municipalities might still find the paper-based system effective as the amount of information that needs to be stored could be handled without a computer. As soon as erf numbers and zoning complexity increase, such as in large municipalities, the need for a computer-based system becomes evident.

CHAPTER 6 dealt primarily with HYPOTHESIS 2,

> *HYPOTHESIS 2: A GIS based implementation system is effective to implement SAMOAC on local scale.*

Chapter 6 contained a qualitative account of the GIS based application of SAMOAC. This information formed the basis for understanding how the GIS based system at the DOACCP functions. The chapter then went on to establish that the GIS based system is completely effective when tested against the criteria required to successfully implement SAMOAC at local scale. The GIS based system excelled in all aspects required to successfully implementing SAMOAC at local scale, fully supporting hypothesis 2. The system was entirely effective as it successfully met all the criteria set out in section 4.3. This comprehensive set of requirements, covers all aspects required by the SAMOAC document as well as all additional requirements outlined by the DOACCP and the OAASA through extensive use of the SAMOAC document.

7.1.1 Review of the Research Procedure

The findings of the research as detailed above are both interesting and significant for those wishing to implement SAMOAC using a technologically advanced system such as GIS. However having said this, weaker aspects of the research procedure need to be evaluated first so that the final comparison between the two systems can be reviewed in a more balanced light.

As mentioned in the literature review very little information exists on the link between outdoor advertising and GIS. As a result a process of interviews and personal communications with prominent members of the outdoor advertising community were used as substitutes. The severe lack of empirical research available reduces the stability of the entire research process. Many of the steps taken throughout the evaluation process of both paper based and GIS based systems relied solely on the opinions and experience of the people who deal with outdoor advertising control on a daily basis. Motivation to support this methodology stems from the fact that the views and opinions documented equally represent both sides of the divide. By allowing both Outdoor advertisers (through OAASA) and regulating bodies (through the relevant city council department spokesperson) the opportunity to become involved in the evaluation of SAMOAC, its paper based implementation and its GIS based implementation, an evenly distributed view was formed on what the real world really thinks feels the strong and weak points of each processes are.

The research process could have been improved by substituting the impressions and opinions of members consulted with empirical based performance studies. For example the speed of application processing was determined by interviews with both DOACCP officials and OAASA members. This could more accurately have been substituted by a context based performance evaluation on the officials in their work place.

The evaluations of successes and shortcomings of SAMOAC were captured via interviews with parties from both sides of the advertising equation. As a result the relative sizes and impacts of the problems highlighted could only be guessed at based on these interviews. Prior to any

serious updating of SAMOAC the changes to the guidelines presented in section 4.2 should be both publicly work shopped and empirically tested on a sample of advertising applications.

The final requirement of this dissertation was to conduct a point-by-point comparison between the two systems, highlighting where they differ, and which system appears to be most effective. This information is intended to synergise the dissertations findings up till this point, providing the required base necessary to support or refute hypothesis three, which states that:

> *HYPOTHESIS 3: The GIS system is more effective than a paper based system when measured against requirements needed to implement SAMOAC at municipal level.*

7.2 COMPARISON BETWEEN THE TWO TREATMENTS AND CONCLUSIONS DRAWN

The paper-based and GIS based systems were measured against a set of nine criteria listed in section 4.3. The following is a synergy of the evaluations of the two systems pro's and con's in implementing these nine criteria. Where possible, interpretation rather than repetition of previous sections is provided. For the system specific evaluations, please consult section 5.3 (for the paper-based system) and section 6.3 (for the GIS based system).

CONTROL

7.2.1 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to identify cadastral units with a variety of land zonings.

The study found that both systems are fully capable of identifying land zonings. The GIS system is however superior in both speed and accuracy. The main reason for this being that the chance of human error is substantially reduced as the GIS data retrieval is completely automated. Accuracy is improved as the GIS is updated on a monthly basis as compared to the paper based system updates which were sporadic with large time spans (up to a year) present between updates. The land zoning information for the entire CCP is updated daily. This information is thus available throughout the CCP organisation as it is entered. Issuing and concurrency hassles caused by paper plans are almost completely non-existent. Furthermore, digital replication allows for multiple users to access the same information simultaneously. This is not possible with paper maps that need to be signed out and returned.

The GIS was also found to be far easier to use. This is because it "hides" the unnecessary aspects of the evaluation process from the operator making it possible for personnel with no previous experience or understanding of the detailed zoning codes and explanation (see section 11.2.2) to perform almost as efficiently as veteran evaluators. Furthermore,

public (layman) access to and understanding of the process is far easier to achieve as server side data is exposed on a need to know basis.

The GIS provides an important function which the paper based system cannot perform and that is "reverse searching" The GIS is capable of searching for all erven that meet specific land zoning requirements, allowing advertisers and officials to source sites that are suitable for advertising display. The paper-based system cannot do this, as land-zoning information is text based and manual searching is to time consuming.

Thus, from both a feature function and speed and efficiency point of view the GIS was found to be superior to the paper based system.

It must be noted that the accuracy of all the GIS procedures performed is subject to the accuracy of both the programming and the data being put into the system. The notion of "rubbish in – rubbish out" is definitely true on all counts. The programming accuracy of the entire system was tested for almost ten months on at least two thousand simulated applications. Ground truthing of more than 150 of these applications was also performed throughout 1999. Blanket checks on A0 sized print outs of three to four suburbs at a time were also performed as desktop studies. All accuracy issues found in the programming were ironed out prior to implementation. All accuracy problems experienced with the input data were reported to the CCP and were systematically resolved.

7.2.2 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to identify areas with specific landscape characteristics.

The paper-based system was found to be lacking in this regard as it is not capable of locating three dimensional multi facetted landscape characteristics such as vistas and viewpoints. The main reasons for this are that composite maps, comprising interpretation of several plans, is often required and interpretation of 2D contour plans is too inaccurate. The paper based system struggles with issues such as variance of scale in maps, and difficulty in performing overlays of information sets presented on map sheets making data synthesis an arduous task for evaluators.

The GIS system is far more successful as it alleviates the problems of differing map scales and projection (co-ordinate) systems. All information is correctly overlaid, and themes can be switched on or off with the click of a button. Even externally referenced information such as heritage data is incorporated into the feature set and displays as an additional theme. Interpretation of several data sources such as location of vistas and viewpoints is performed automatically as a set of rule based commands. These scenic areas are flagged automatically for evaluation, preventing omissions, and reducing the amount of gut

feel evaluation required by the DOACCP. In addition, the GIS allows evaluators to check for vistas down streets and corridors from a desktop PC using 360 degree Quick Time VR photography, preventing the need for expensive and time consuming site visits. The system at the CCP currently contains 140 photographs, which cover about 25 percent of the MINIMUM control areas in Pretoria. The database is being expanded continuously. Naturally the time and cost saving of the desktop studies is only realised where photography is available.

Overlays of non-cadastral information such as Gateways are easily performed as themes in the GIS, a function that, due to map scale differences and paper overlay inaccuracies caused a substantial amount of inaccuracy and wasted time in the paper based system.

7.2.3 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to identify certain items in a landscape inventory.

The paper-based system could successfully identify only two of the four required landscape inventory elements with forested areas and ridges proving to be somewhat of a challenge. Aerial photography could identify forested areas, but due to differences in scale and projection, correlation with cadastral boundaries was difficult. Ridges and crests could be identified in general, but accurate boundaries illustrating where a ridge or crest stopped was impossible to determine. As a result of a non rule-based set of criteria, an area evaluated as a ridge today could be evaluated with a different result tomorrow.

The GIS system was capable of accurately demarcating all four required landscape inventory elements. Aerial photography under lays could be scaled and projected perfectly, and turned on and off as a theme with the click of a button. Rule based scenarios using a combination of slope and elevation change were used to define crest and ridge areas, a far more precise and repeatable method than the paper-based system.

IGIS (PTY) LTD tested the rules or parameters defined in the programme throughout 1999. These rules are not hard and fast and may be revised at a later date when more powerful (or accurate) software is available. The ideal scenario would be an automated view shed analysis. Unfortunately this process is to data and processor intensive to consider at this time. The fact that the parameters may change at a later date rekindles some of the problems currently experienced.

When all is considered, automation and digital accuracy make the GIS system the process of choice.

SIGN

7.2.4 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to supply information on standards for GENERAL PRINCIPLES AND CONDITIONS.

This is one of the few points where both systems performed almost equally well. The paper-based system requires a manual search for the relevant guidelines sheet, and the GIS system performs an automated search based on the selected sign type. The GIS system is faster in retrieving the information, and being digital allows for instant on demand replication, the draw back being the legibility issue of on screen text, which the paper-based system overcomes by presenting the data in hard copy format.

7.2.5 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to determine a signs class and sub-class.

The manual (and in this case trial and error) system of classification requires more interpretation and understanding than the point and click GIS interface. Initially time saving of the GIS is large, but as familiarity with the sign categories improve, this time saving decreases to become almost negligible. As a result, the stage of use where the GIS is most effective is with novice operators who are not familiar with the evaluation process. These novice operators seemed to be able classify a sign or evaluate an application almost immediately using the GIS but required substantial time to read up and understand the process in order to accomplish the same evaluation using only the paper based system. With no initial understanding of the classification system, the simplified request / response interface makes the procedure far more simplistic than the paper-based system.

OPPORTUNITIES

7.2.6 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to accurately link a given landscape type to a specific area of control.

The GIS system is more effective than the paper-based system when performing this set of tasks. Being a multi-staged process, requiring several decisions that build on each other, the chance of human error in a manual system is large. The fact that the errors propagate down the line, results in a small error having a large effect on the end result. The evaluation process performed by the GIS produces a completely accurate result (subject to programming flaws only). Officials who access this information through a web based point and click interface receive accurate evaluations within two to three seconds of submitting an evaluation request. A major additional benefit of the GIS is that information is presented on a need to know basis, cutting out much of the previously required

understanding necessary to reach an accurate evaluation decision. Furthermore, as the entire process is rule based, any disputes can be immediately reviewed and settled as the process of evaluation can be repeated step by step for any application.

The evaluation of the GIS based system was performed relatively soon after its implementation at the DOACCP. The results of the time and related cost savings should be verified once the system has had time to "settle in". As the number of applications processed by the GIS is quite few, the chance of having encountered severe problems is obviously less than the paper-based system, which had been in operation for almost 18 months.

An important consideration is that the perceived accuracy of the GIS is on occasion questionable. There are four key weaknesses in the CCP GIS system that have and continue to cause inaccuracies. The first source of error occurs at the time of capture of the spatial information. The GIS spatial database was captured from paper-based maps printed by the surveyor general. These maps were often hand drafted and contained inaccuracies. The capture procedure (digitising) has its own fuzzy tolerance and as a result introduces an additional error rate. Updating procedures such as subdivisions and sub zonings cause further problems in that the superseded information is often not removed. Thus a farm may be subdivided into erven but the farm portion remains in tact in the database leading to confusions about evaluations. Many areas have been ground truthed and corrected using more up to date methods such as mobile global positioning systems (GPS). The spatial accuracy of the Geobase was tested in a desktop study using scanned 1:10 000 orthophoto maps. The most inaccurate area found was the fountains valley interchange, which registered a spatial inaccuracy of more than 100m. The source of the error appeared to be inaccuracies caused by incorrect TIC marks used in the digitising process.

The second source of error is found in the alphanumeric databases linked to the spatial Geobase. Data input does not appear to have any strict integrity checks and as a result human errors such as incorrect typography has crept in. The error rates are extremely low (less than 0.1%) but the end result is that automated processing of the data cannot be relied upon with 100% certainty. In producing the control ratings and opportunities maps data constantly needed to be validated and corrected. Each monthly data run required manual corrections to the programming code in order to account for data entry errors that had occurred through updates made the previous month.

The third source of error is as a result of out datedness of the GIS information. In certain areas a backlog on data entry in excess of two years exists. The reason for this backlog cited by the CCP, is the burning down of the CCP offices in the late nineties. Many of the

hard copy maps that still needed to be input were destroyed in the fire. As a result areas such as the east entrance to Pretoria from the N4 have undergone radical changes that are not reflected on the CCP database.

The fourth major source of error in the CCP Geobase is that multiple entry, editing and backup points exist throughout the organisation. Different departments are responsible for the spatial and tabular updating of the database. Concurrency issues exist, as the spatial data needs to be updated before the database can be corrected. Once the spatial database has been corrected this information needs to be made available to the department responsible for the alphanumeric data updating. Lack of communication and a possible lack of urgency to maintain concurrency fuels this problem.

As part of the DOACCP project to implement a digital (GIS based) SAMOAC procedure, IGIS were mandated with reviewing the integrity and error issues covered in the four points above. All typographic errors were corrected in the database, and the vast majority of the spatial inaccuracies and holes were flagged and corrected. Furthermore, integrity controls were suggested to prevent further corruption of the database but to date, these have not been implemented. The reasons cited by the CCP for this are that integrity controls are too restrictive for personnel who update the information. Further clarification for these comments was never elicited. Whilst the number of sources for error is high, the actual error percentage is relatively low. The Geobase which contains roughly 128 000 records has an error rate well below 0.1%

7.2.7 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to accurately retrieve relevant guideline information for a specific sign type.

This requirement is successfully performed by both systems at evaluation time. The major difference that exists is that the GIS has pre-computed guideline information for every land parcel on the system, and can graphically represent PERMISSIBLE and NOT PERMISSIBLE areas for any sign type as a colour coded thematic map for the entire Pretoria area. This function is possibly the single biggest advantage of the GIS over the paper based system as it allows advertisers to test scenarios prior to application, reducing the time and money wasted on futile applications, and also reducing the work load of the DOACCP officials.

A speculated draw back of the system is that it immediately presents opportunities where previously there may have appeared to be none, saturating the advertising capacity of the city very quickly. The other side to this argument is that since all the areas demarcated are legal and acceptable in terms of SAMOAC anyway, this will not present any additional

visual degradation or problems. The system has however not been in existence long enough to ascertain the answer to this debate.

7.2.8 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to provide various pieces of information for any land parcel in its jurisdiction in graphic map format prior to the application being submitted.

In theory, the paper-based system can supply the same information for a land parcel that the GIS based system can. However, in practice, the GIS system is superior as its capability to interpret this information, displaying it as maps and at the same time understanding the adjacency relationships between land parcels with differing (often conflicting) information, far outweighs the performance of the paper-based system.

The hard copy data of the paper-based system can be displayed graphically, but creating maps is time consuming and the accuracy is limited both by scale and production duration. Key information such as ANNEXURE B files need to be sourced separately for each land parcel, making map composition an incredibly arduous and as a result, seldom performed task.

The GIS system can display any field of information in a variety of ways (thematic, graded colour, composite colour) at the touch of a button. Any of the more than 100 fields of information available can be displayed with up to the minute accuracy. Scale reproduction is also vastly improved as maps can be zoomed and plotted at any required scale.

The GIS really comes into a class of its own when interpretation of information is required. Through topology, the GIS can be made aware of adjacent erven and information, and this facility can be incorporated into data interpretation, a process known as spatial data manipulation. Thus, maps such as display opportunities for a sign class or zoning controls of MAXIMUM, PARTIAL and MINIMUM control areas that incorporate both tabular (database) and spatial (maps such as gateways and crests) information can be displayed and updated on the fly.

The use of GIS allows information to be assimilated and tied together extremely effectively, presenting information from a variety of sources in one succinct user interface.

7.2.9 A requirement of a system that aims to successfully apply SAMOAC at local scale is that it must demonstrate that it is able to establish where conflicts between areas of MAXIMUM and MINIMUM control occur and be able to alleviate these conflicts according to a set methodology.

With this aspect of control, the paper-based system was effectively a non-starter whilst the GIS based system fully met the requirements. The reason for this is that the paper-bases system stores each erven's information separately, and establishing information about adjacent erven is very time consuming. Through build in topology, the GIS can display and query based on adjacency, allowing for easy programming of a rule-based problem solving strategy. The current system has been automated such that conflict areas are automatically defined and the conflict resolution methodology is applied as part of the application process. This saves time and hassle and ensures that conflicts are prevented prior to an application being passed.

In comparing the paper based and GIS based system, four key aspects need to be highlighted. These key differences will be discussed under the headings time saving, ease of use, human aspects such as adoption speed and accuracy and finally cost benefit analysis, which will address implementation, maintenance and training costs as well as possible sources of funding.

From a time perspective, the analyses compiled in Figure 9: Time Line of the Paper Based Evaluation System and Figure 10: A Flow Diagram of the GIS Based Application Processing Procedure, highlight the differences in absolute terms. The GIS based implementation procedure has introduced a time saving of roughly 50%. This time saving removed the entire backlog of applications in approximately two months. The majority of time saving stemmed from two sources. The first was the reduction in time to complete the on site building inspection. This reduction was made by transferring the on site evaluation to a desktop study using 360 degree photography. The second source of time saving was the reduction of the average time the committee required on each application. This time saving is a spin off of being able to complete applications without the help of the committee. Smaller timesavings were realised on sign classification and evaluation of opportunities as a result of electronic processing. Timesavings not measured were reductions as a result of decreased numbers of litigation proceedings.

The second category of comparison is termed ease of use. Once the initial hurdle of operating on a digital system had been overcome, the GIS system was found to far easier to use than the paper based system. The number of disruptions in work process caused by having to source and retrieve paper information from various locations was vastly reduced with the GIS based system. Empirical context based human interaction usability studies were not conducted as part of this dissertation but feedback in terms of satisfaction with the new process indicated that it was definitely easier to use.

The third category of comparison deals with the human aspects of the two processes. Adoption speeds were briefly reviewed as were levels of accuracy on data capture. The staff members interviewed at the DOACCP were all somewhat computer literate and as a result, adopted the

new technology extremely quickly. Informal tests of the GIS application on subjects with little or no computer skills produced a slightly slower rate of efficiency and willingness to adopt. The basic level of computer literacy established through subjective evaluation appeared to be the ability to navigate using a web browser such as Internet Explorer, Netscape Navigator or Opera. Users who could successfully navigate through a website could quite easily submit an evaluation request and interpret what to do with the output from the GIS.

The curve to achieve a relative level of production speed in terms of processing applications was far steeper with the GIS than with paper-based system. It is speculated that this is as a result of the background evaluation and processing that the GIS performed automatically. The second important human consideration was the relative levels of accuracy and resultant variance in decisions made. The accuracy of the data processing through the many steps in the application process was found to be much higher with the GIS than with the paper-based system. This was most likely due to the fact that the human factor was removed from any mundane decision-making. The majority of the errors made by the GIS system were a result of data incapacities as opposed to human error during the application processing procedure. Errors in both the spatial and alphanumeric information, as detailed above, resulted in erroneous advertising zonings and resultant decisions. Most of the errors in both the paper based and GIS based systems were prevented prior to the final release of a critical decision during one of several cross checks programmed into both the GIS and paper-based processes. Desktop and on site inspections as well as review of Annexure B information either in digital or paper based form captured most of the errors produced by either system. The major human centred difference between the two systems was that the evaluations produced by the GIS remained constant across time and space. Both officials and applicants felt that the computer based evaluations were more fair and less subjective leading to higher levels of confidence and lower levels of strain on both parties. From an academic perspective this result is most likely due to a decrease in the variance of the evaluations of applications, leading to a higher level of internal validity.

The final aspect of comparison between the paper-based and GIS-based systems is a cost benefit analysis. This analysis takes initial cost of implementation, maintenance costs and sources of funding into account. The initial cost between the two systems needs to be defined somewhat prior to analysing the two figures. It is taken as a given that the data required to perform either the paper-based or GIS-based procedure is already largely present in some way or form. Furthermore the legislature required to enforce either of the two systems is also assumed to fall outside of the implementation costs. With these two points taken into consideration, the paper-based system, being a simple application of the SAMOAC document, simply entailed buying the document from the Department of Environmental Affairs and Tourism (DEAT). With the document in possession, the only remaining costs entailed training of staff and streamlining of access to available site information. The GIS procedure on the other hand required a fair amount of initial effort and with this come resultant costs. The GIS data required

verification prior to the programming of the entire database structure. Validation of data output followed by the development of a web-based interface was also required. The entire cost of developing and implementing the GIS-based system was therefore several thousand times more than the paper based system. The maintenance costs of the GIS system are also far higher than the paper-based system. Monthly updating of the system costs around R10 000. This maintenance fee effectively replaces the entire outdoor advertising database with a fresh copy and adds any new photographs that were required through the previous month. This R10 000 can be offset against the relatively high fixed running costs of the paper-based system. Due to the time saving of 50% the number of staff required to process applications is halved. Further running costs are saved with the GIS-based implementation in that the number of site visits required to evaluate applications is vastly reduced. A less tangible cost benefit of the GIS-based system is that a higher percentage of applications are passed. DOACCP revenue and status is directly linked to the income they can produce for the CCP. Processing of applications is a really small ticket item when compared to the income generated from legal outdoor advertising signage. By increasing the percentage of successful applications, the DOACCP indirectly improves its bottom line. This non-tangible source of passive income is a magnitude larger than the income generated from large numbers of applications being processed. Indications are that the savings from implementing the GIS-based system will cover the implementation costs within six months of implementation. A further source of motivation to implement a GIS-based system is that outdoor advertising contractors are more than willing to fund the development and implementation costs of such a system. In fact, members of OAASA largely funded the OACSPMA system developed for the DOACCP. When the relative costs of developing and implementing a GIS-based system are compared to the costs of constructing a type 1A billboard (around R500 000) or the revenue that one of these boards can generate (up to R70 000 per month) it is not surprising that outdoor advertisers are keen on providing development funding. If the GIS tool streamlined or improved their application success rate by only a single application the entire costs of development would be recouped in less than a year.

When the above points are considered the conclusion is drawn that HYPOTHESIS 3, which states:

> *HYPOTHESIS 3: The GIS system is more effective than a paper based system when measured against requirements needed to implement SAMOAC at municipal level.*

is supported by the findings of the study.

This support is seen as a very exciting step towards a new breed of environmental management techniques. This dissertation is the first of its kind to deal with the everyday fieldwork as well as the theory of the "environmental management document" known as SAMOAC. By reviewing the

use of SAMOAC on ground level, valuable insights into the workings of OA control have been documented.

Armed with an understanding of SAMOAC and a few hypotheses, this study started out (as most studies do) with a cut and dried process of set goal, develop hypothesis, collect data, interpret data and draw conclusions. However as the study progressed, this simple linear process became entangled in a problem set that required a continuous cyclical review of these steps, redefining the problem several times. The fact that the study entailed real world research, conducted with active parties, each with individual political motives and high financial stakes, made the process even more interesting.

That SAMOAC's implementation was experiencing problems, is a relatively obvious statement. Drilling down and understanding these problems, which differed from party to party, was one of the prime motives for employing an interview based qualitative research procedure. Existing literature on the topic of OA was sparse to say the least, and problems being experienced by OA parties were firstly very current and secondly not of a nature that would have them documented in any literature. The employment of an objective interview procedure where parties were given the single broad requirement of providing step by step feedback on the implementation process, followed by an assimilating of this information, derived the most comprehensive set of implementation guidelines documented to date. This set of guidelines is invaluable to any local authority wishing to implement the SAMOAC guidelines on an erf by erf basis, a process being investigated across South Africa.

The evaluation of both the paper-based and GIS based systems was again performed using a series of interviews. By requesting "opposing" sides namely regulating officials (the DOACCP) and OA contractors (the OAASA) to review the procedures, a representative and balanced set of feedback was generated. This information seldom conflicted, and when assimilated was extremely successful at drilling down to the issues in each of the processes.

Having maintained equal representation, interviewed the parties from both opposing outdoor advertising camps, the integrity of the data collected is solid enough to base industry wide conclusions upon. The fact that the data from both parties was highly correlated with very little variance suggests that the platform upon which the conclusions for all three hypotheses are based is even more solid. This platform is of extreme importance in determining whether the study is academically rigorous enough to draw conclusions from. Furthermore, this base is important for a set of findings that can be used as building blocks in further studies on OA

The findings presented in item 7.1 illustrate that the methodology laid out in item 2.5 on page 11 prove adequate to place the study in a position to state clearly whether hypothesis one, two and three are supported or refuted. The qualitative methodology used in this document (and found to

be common in many areas of Landscape Architectural Research) was successful and without this methodology, proving or disproving the stated hypotheses would have been extremely difficult. For this reason, a suggestion is made that "the manual for research and postgraduate studies" be updated to include qualitative research methods in terms of more recent documentation such as Leedy. 1995. as opposed to that listed in the bibliography, viz Leedy. 1974.

The array of problems experienced by the DOACCP and the OAASA with the implementation of SAMOAC cast shadows of doubt on the effectiveness of SAMOAC. This study shows that the implementation of a GIS similar to the one documented in ANNEXURE D - Data from the IGIS (PTY) LTD. Consultants, alleviates these problems. More importantly for SAMOAC, these gaps, rather than the principles suggested in the document appear to cause conflict and implementation problems with the guidelines. The finding that problems experienced with SAMOAC stem from omissions and poor implementation rather than a shaky set of principles bodes well for the future of the SAMOAC document. This study clearly shows that, if the gaps are plugged with correct procedure and implementation, SAMOAC is very successful.

When the paper based and GIS based systems are placed side by side as this document has done, the benefits of the digital system heavily outweigh those of the manual one. The GIS provides a higher level of functionality and integration and is more efficient, transparent and user friendly than the paper based system. It is speculated here that this is true as the GIS system meets most of the requirements to make GI successful. In "Beyond Chorley – Current Geographic Information Issues", (1998) Ian Heywood, a leading GIS specialist and researcher compiled a list of aspects that, if achieved, will make GI more successful. The DOACCP GIS has been extremely successful as it meets every one of the points listed by Heywood. He stated that GI is successful if:

1 It becomes essential to the efficient operation of an organisation.

The DOACCP GIS has completely replaced the paper-based system. The GIS implementation is now used to evaluate every single OA application submitted to the DOACCP. The system instantly became a core tool used on a daily basis, completely replacing the paper-based system. Furthermore, the system has expanded the services that the DOACCP can provide, allowing a symbiotic relationship between advertisers and officials, a previously frustrating and often antagonistic relationship.

2 The organisation could afford some experimental work and trials.

The DOACCP initiated the project with a budget that would allow for experimentation and trials. The system went through several phases, each one being tested and reviewed by both the DOACCP and the OAASA.

3 There was a corporate approach to GI and a tradition of sharing and exchanging of information.

The entire DOACCP system was build on a GI database that is owned and maintained by the CCP. Data updating and exchanging was encouraged throughout the project. The end result being that the CCP database improved in scope and accuracy and the public received access to information that was paid for by TAX dollars.

4 Strong leadership and enthusiasm from the top with a group of enthusiasts at working level.

The director of the DOACCP and the CEO of IGIS (PTY) LTD led the entire project from start to end. Both organisations committed time, expertise and resources to develop a superior product, ensuring that expert staff worked on the development at all stages.

5 Some experience of and commitment to IT and the use of existing digital databases.

The CCP had experienced some success with GI in the past, and realised ahead of time that use of IT and digital data was the way of the future. The DOACCP project was a pioneer in a series of developments that are designed to leverage the value of real time GIS information.

As a result of its binary nature, the GIS based system has helped to iron out many of the grey areas found in the SAMOAC guidelines. Most specifically, the GIS based system has made the leap required to implement SAMOAC on an erf by erf basis, a vital requirement when legally attempting to control OA. Monitoring and storing vast quantities of information on everything from erf boundaries through to environmental controls is literally what a GIS was designed to do. The fact that all decisions made by the GIS are based on concrete information means that subjectivity in decision-making has been vastly reduced. Reasons for decisions can be illustrated and more importantly repeated. Removing the human element has ensured that a uniform non-biased implementation of the SAMOAC guidelines is almost guaranteed.

Furthermore, the process driven nature of the system ensures that information is not omitted, incorrectly weighted or variant, as it is all part of an automated linear programme, based on a set of request-response interactions. Human error, a critical factor, when large quantities of detailed repetitive work such as application evaluation are required, is reduced to almost zero by the GIS.

Access to information is greatly improved. The GIS allows both text based and map based information to be generated and distributed quickly and easily. This allows OA contractors to plan their strategies in advance, and the transparency that the system creates undoubtedly eases some of the tensions that exist between the OA contractors and the controlling authorities. The ability to test and reject scenarios provides a previously impossible level of forward planning helping OA contractors to cut down on application time and cost. DOACCP also cut down on the number of submissions they are required to process, explaining the rapid decrease in applications submitted and the rapid increase in successful applications processed.

Departmental efficiency and scalability is improved greatly. The GIS has enabled information on OA control to be available to all officials that require the information, and since the system is centrally updated, any changes in land zoning or other cadastral data is immediately reflected in the OA controls. Data redundancy and out datedness, which often lead to incorrect decisions is minimised throughout the CCP organisation.

As a summary, the following points are considered a contribution by the study:

1) The study documents feedback from officials and industry representatives that use SAMOAC on a daily basis. This is the first time that such feedback has been compiled. (Jordaan 2000)
2) This study documents solutions to many of the problems that have been holding the full-scale implementation of the SAMOAC document back. It is hoped that this dissertation will motivate councils to update SAMOAC and promulgate by-laws that provide the required leverage to implement SAMOAC effectively.
3) Information supporting the hypothesis that GIS and information technology could be used to successfully implement SAMOAC has been substantially bolstered by this study. Implementing a GIS (such as the one documented in this study) can alleviate the current problems experienced with SAMOAC on local scale.
4) The allocation of funds to develop GIS and IT solutions to implement SAMOAC can be motivated far less subjectively as a result of this study.
5) The functioning of the GIS based system at the DOACCP has never been documented and, prior to this studies completion, any evaluation of and recommendations for or against the GIS system could be dismissed as hearsay.
6) Although the origins of GIS spatial data processing date back almost as far the computer itself, GIS can still be viewed as an emerging technology. This study extends the use of GIS into the field of OA control. The development and documentation of the GIS based evaluation procedure extends the boundary of GIS applications. As can be seen in the past, incremental expansions such as this have often contributed to future revolutionary developments in GIS technology.

7.3 RECOMMENDATIONS FOR FURTHER STUDY

1) Conduct a study that documents the development of the GIS system at the DOACCP. The system is approached as a given in this study, but its development remains uncharted knowledge. Academic substantiation of the system will greatly aid its widespread implementation and use.
2) Ascertain whether the pre planning facility of the GIS system has caused an explosion of advertising in theoretically legal areas of control.
3) Conduct a study that reviews and updates SAMOAC by compiling and integrating solutions to problems experienced by local councils throughout SA. SAMOAC has been field tested since April 1998, and as with Pretoria, slight changes such as those presented in CHAPTER 4 will vastly improve its effectiveness.
4) Conduct a study that establishes relevant statutory criteria for the safe relaxation of the 250m zone of MAXIMUM control along National and Provincial roads.

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Http://www.esri.com/base/products/arcview/faq.html ***March 1999***

9 ANNEXURE A – GLOSSARY OF TERMS

ACCESS RIGHTS are the privileges accorded a user for reading, writing, deleting, updating and executing files on a disk. Access rights are stated as 'no access', 'read only' and 'read/write'.

ACCURACY means the comparative correctness and datedness of information; verification is usually determined by ground-truthing

ADVANCE SIGN means a sign indicating the direction of a facility, locality, activity, service or enterprise.

ADVERTISEMENT means any visible representation of a word, name, letter, figure, object, mark or symbol or of an abbreviation of a word or name, or of any combination of such elements with the object of transferring information.

ADVERTISING means the act or process of notifying, warning, informing, making known, or any other act of transferring information in a visual manner.

ADVERTISING DEVICE means any physical device which is used to display an advertisement or which is in itself an advertisement.

ADVERTISING STRUCTURE means any physical structure built to display an advertisement.

AERIAL SIGN means any sign which is affixed to or produced by any form of aircraft and which is displayed in the air.

ALPHANUMERIC DATA means a digital table of information comprising characters and numbers. The arrangement of the table is such that each row represents a land parcel found in the Pretoria Metropolitan Area, and each column represents a set of information relating to all the land parcels in the table.

AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE (ASCII) is a set of codes for representing alphanumeric information (e.g., a byte with a value of 77 represents a capital M). Text files, such as those created with the text editor of a computer system, are often referred to as ASCII files.

ANIMATION means a process whereby an advertisement's visibility or message is enhanced by means of moving units, flashing lights or similar devices.

ANNOTATION

1. Descriptive text used to label coverage features. It is used for display, not for analysis.

2. One of the feature classes in a coverage used to label other features. Information stored for annotation includes a text string, the location at which it is displayed, and a text symbol (colour, font, size, etc.) for display.

ARC is an ordered string of vertices (x,y coordinate pairs) that begin at one location and end at another. Connecting the arc's vertices creates a line. The vertices at each endpoint of an arc are called nodes.

ARCHIVE is any storage of digital data, usually in compressed (Zipped or RARed) format.

AREA

1. An homogeneous extent of the Earth bounded by one or more arc features (polygon) or represented as a set of polygons (region). Examples: states, counties, lakes, land-use areas, and census tracts.
2. The size of a geographic feature measured in unit squares. ArcInfo stores an area measure for each polygon and region.

AREA OF CONTROL refers to the degree of advertising control to be applied in a specific area, i.e. maximum, partial or minimum control, in accordance with the visual sensitivity of the area and traffic safety conditions. Area of control is also used to express the "degree of landscape sensitivity" of specific areas.

ARTERIAL ROAD means a road, which in the opinion of the roads authority, functions as a main carrier of traffic within an urban area.

ATTRACTIVENESS is the property or properties of a location that create an incentive for trips to be made to that location.

ATTRIBUTE

1. A characteristic of a geographic feature described by numbers, characters, images and CAD drawings, typically stored in tabular format and linked to the feature by a user-assigned identifier (e.g., the attributes of a well might include depth and gallons per minute).
2. A column in a database table. See also item.

ATTRIBUTE TABLE is a tabular file containing rows and columns. In a GIS, attribute tables are associated with a class of geographic features, such as wells or roads. Each row represents a geographic feature. Each column represents one attribute of a feature, with the same column representing the same attribute in each row.

BACKLIGHT UNITS (BACKLIT) means advertising structures or devices which house illumination in a box to throw light through translucent advertising printed on plastic or heavy duty paper for higher visibility and extended night viewing.

BACKUP is a copy of a file, a set of files, or whole disk for safekeeping in case the original is lost or damaged.

BALCONY means a platform projecting from a wall, enclosed by a railing, balustrade or similar structure, supported by columns or cantilevered out and accessible from an upper-floor door or window.

BASE MAP is a map containing geographic features used for locational reference. Roads, for example, are commonly found on base maps.

BASIC LANDSCAPE SENSITIVITY indicates the visual or aesthetic sensitivity of the landscape with regard to outdoor advertising and signs in terms of three basic landscape types, which are, in order of sensitivity, "natural, rural and urban landscapes".

BILLBOARD means any screen or board larger than 4.5m2, supported by a free-standing structure, which is to be used or intended to be used for the purposes of posting, displaying or

exhibiting an advertisement and which is also commonly known as an advertising hoarding. The main function of a billboard is to advertise non-locality bound products, activities and services.

BINARY LARGE OBJECT is the data type of a column in an RDBMS table, which can store large image or textual data as attributes.

BINARY ARITHMETIC[1], that in which numbers are expressed according to the binary scale, or in which two figures only, 0 and 1, are used, in lieu of ten; the cipher multiplying everything by two, as in common arithmetic by ten. Thus, 1 is one; 10 is two; 11 is three; 100 is four, etc. – (Davies & Peck.)

BIT is the smallest unit of information that a computer can store and process. A bit has two possible values, 0 or 1, which can be interpreted as YES/NO, TRUE/FALSE, or ON/OFF. See also byte.

BLIND means a vertical screen attached to shop windows or verandas in order to keep sun and rain from shop fronts and sidewalks, and which may be rolled up when not in use.

BOOLEAN EXPRESSION is a type of expression that reduces to a true or false (logical) condition. A Boolean expression contains logical expressions (e.g., DEPTH > 100) and Boolean operators. A Boolean operator is a keyword that specifies how to combine simple logical expressions into complex expressions. Boolean operators negate a predicate (NOT), specify a combination of predicates (AND), or specify a list of alternative predicates (OR). For example, DEPTH > 100 AND DIAMETER > 20. See also logical selection.

BUFFER is a zone of a specified distance around coverage features. Both constant- and variable-width buffers can be generated for a set of coverage features based on each feature's attribute values. The resulting buffer zones form polygons-areas that are either inside or outside the specified buffer distance from each feature. Buffers are useful for proximity analysis (e.g., find all stream segments within 100 metres of a proposed wetland area).

BUG is an error in a computer program or in a piece of electronics that causes it to malfunction.

BUILDING means any structure whatsoever with or without walls, with a roof or canopy and a means of ingress and egress underneath such roof or canopy.

BYTE is a memory and data storage unit composed of contiguous bits, usually eight. For example, file sizes are measured in bytes or megabytes (one million bytes). Bytes contain values of 0 to 255 and most often represent integer numbers or ASCII characters (e.g., a byte with an ASCII value of 77 represents a capital M). A collection of bytes (often 4 or 8 bytes) represents real numbers and integers larger than 255.

CAD DRAWING is the digital equivalent of a drawing, figure or schematic created using a CAD system. For example, a drawing file or DWG file in AutoCAD.

CANOPY means a structure in the nature of a roof projecting from the façade of a building and cantilevered from that building or anchored otherwise than by columns or posts.

CARTESIAN COORDINATE SYSTEMS is a two-dimensional, planar coordinate system in which x measures horizontal distance and y measures vertical distance. Each point on the plane

[1] http://www.dictionary.com/cgi-bin/dict.pl?term=binary

is defined by an x,y coordinate. Relative measures of distance, area, and direction are constant throughout the Cartesian coordinate plane.

CD-ROM or Compact Disk-Read Only Memory is an optical media. A CD-ROM 5.25-inch disk can hold about 650 megabytes of information. The ISO 9660 standard defines the format of data held on CD-ROM.

CHARACTER is a letter (e.g., a, b, c, or d), digit (e.g., 1, 2, or 3), or special graphic symbol (e.g., *, |, or -) treated as a single unit of data.

CLEAR HEIGHT means the vertical distance between the lowest edge of a sign and the level of the ground, footway or roadway immediately below such sign.

CLIENT/SERVER software system is said to have a client/server architecture when there is a central process (server), which accepts requests from multiple user processes (clients). ArcStorm is one example of a client/server architecture within Arcinfo.

COLUMN is the vertical dimension of a table. A column has a name and a data type applied to all values in the column.

COMBINATION SIGN means a single free standing advertising structure for displaying information on various enterprises and services at locations such as roadside service areas, urban shopping centres and other urban complexes.

COMMAND is a specific instruction to a computer program, issued by the user to perform a desired action.

COMPUTER AIDED DRAFTING/DESIGN (CAD) is an automated system for the design, drafting, and display of graphically oriented information.

CONDITIONAL OPERATOR is a symbol or keyword specifying how to compare values. Conditional operators are used to query a database. Examples from SQL include: = (equal to) BETWEEN < (LESS THAN) LIKE > (greater than) CONTAINING

CONSTRAINTS are limits imposed on a model. For example, in an interaction model, specifying that the number of trips generated from an origin to all destinations cannot exceed the origin's production capacity.

CONTOUR is a line connecting points of equal surface value.

CONTOUR INTERVAL is the difference in surface values between contours.

CONTROLLING AUTHORITY means any government institution at any level of government, which is entitled to exercise control over outdoor advertising.

COORDINATE is a set of numbers that designate location in a given reference system, such as x,y in a planar coordinate system or an x,y,z in a three-dimensional coordinate system. Coordinates represent locations on the Earth's surface relative to other locations. See also vector and Cartesian coordinate system.

COORDINATE SYSTEM is a reference system used to measure horizontal and vertical distances on a planimetric map. A coordinate system is usually defined by a map projection, a spheroid of reference, a datum, one or more standard parallels, a central meridian, and possible shifts in the x- and y-directions to locate x,y positions of point, line, and area features. In Arcinfo,

a system with units and characteristics defined by a map projection. A common coordinate system is used to spatially register geographic data for the same area.

COPY means the complete advertising message to be displayed on the advertising structure.

COVERAGE is a set of thematically associated data considered as a unit. A coverage usually represents a single theme such as soils, streams, roads, or land use.

COVERAGE EXTENT refers to the coordinates defining the minimum bounding rectangle (i.e., *xmin,ymin* and *xmax,ymax*) of a coverage or grid. All coordinates for the coverage or grid fall within this boundary.

CREST means an area with a high level of visibility as a result of comparatively higher altitude or steeper gradient than the position of the viewer. Crests should be calculated based on a view-shed analysis at an accuracy of a maximum of 5metres in the Z direction, with an 80% exposure.

CURSOR

1. A graphic pointer used with a mouse to point to a location on a terminal screen.
2. An internal pointer to a record in a table, which provides a mechanism for processing a selected set of records. The cursor is moved one by one through the set while operations such as display, query and update are performed.

CUT-OUTS mean letters, packages, figures or mechanical devices attached to the face of an outdoor sign, which might extend beyond the rectangular area for greater attention value, can provide a three-dimensional effect and are also commonly known as add-ons or embellishments.

DATABASE refers to a logical collection of interrelated information, managed and stored as a unit, usually on some form of mass-storage system such as magnetic tape or disk. A GIS database includes data about the spatial location and shape of geographic features recorded as points, lines, areas, pixels, grid cells, or tins, as well as their attributes.

DATABASE DESIGN is the formal process of analysing facts about the real world into a structured database model. Database design is characterized by the following phases: requirement analysis, logical design and physical design.

DATA DICTIONARY is a catalogue of all data held in a database, or a list of items giving data names and structures. Also referred to as DD/D for data dictionary/directory. Commercial RDBMS's have online data dictionaries stored in special tables called system tables.

DATA EXCHANGE FORMAT (DXF) is a format for storing vector data in ASCII or binary files. Used by AutoCAD and other CAD software for data interchange.

DATA INTEGRITY refers to maintenance of data values according to data model and data type. For example, to maintain integrity, numeric columns will not accept alphabetic data. See referential integrity.

DATA MODEL refers to:

1. The result of the conceptual design process. A generalized, user-defined view of the data related to applications.
2. A formal method of describing the behaviour of the real-world entities. A fully developed data model specifies entity classes, relationships between entities, integrity rules and operations on the entities.

DATA SET is a named collection of logically related data items arranged in a prescribed manner.

DATA TYPE refers to the characteristic of columns and variables that defines what types of data values they can store. Examples include character, floating point and integer.

DATABASE MANAGEMENT SYSTEM (DBMS) is a set of computer programs for organizing the information in a database. A DBMS supports the structuring of the database in a standard format and provides tools for data input, verification, storage, retrieval, query, and manipulation.

DATUM refers to a set of parameters and control points used to accurately define the three-dimensional shape of the Earth (e.g., as a spheroid). The datum is the basis for a planar coordinate system.

DEEMED CONSENT (PERMITTED WITH) means a sign, which is deemed, approved without controlling authority having to provide specific consent.

DEGREE OF LANDSCAPE SENSITIVITY means a refinement of basic landscape sensitivity, which may include, apart from a refined visual sensitivity, traffic safety conditions as a criterion for sensitivity rating. Degree fo landscape sensitivity is expressed in terms of area of control, i.e. areas of minimum, partial and maximum control which are superimposed onto the three basic landscape types, i.e. natural, rural and urban landscapes.

DENSITY OF RESIDENTIAL AREA refers to both population density, number of people per hectare and the nature of the units, e.g. high rise, low rise or detached, as well as to the presence of non-residential functions.

DESCRIPTIVE DATA refers to tabular data describing the characteristics of geographic features. It can include numbers, text, images, and CAD drawings about features. Also referred to as attribute data.

DIGITISE refers to:

1. To encode geographic features in digital form as x,y coordinates.
2. The process of using a digitiser to encode the locations of geographic features by converting their map positions to a series of x,y coordinates stored in computer files. Pushing a digitiser button records an x,y coordinate. A digitised line is created by recording a series of x,y coordinates.

DIGITISER refers to:

1. A device that consists of a table and a cursor with crosshairs and keys used to digitise geographic features.
2. Title of the person who uses a digitising device.

DIRECTION SIGN means a type of guidance sign provided under the South African Road Traffic Sign System and used to indicate to the road user the direction to be taken in order that they reach their intended destination.

DIRECTORY is a computer term identifying a location on a disk containing a set of data files and other directories (subdirectories). Operating systems use directories to organize data. The location of a directory is specified with a pathname.

DISCRETE DATA refers to geographic features containing boundaries: point, line or area boundaries.

DISPLAY OF A SIGN includes the erection of any structure if such structure is intended solely or primarily for the support of such sign.

DISPLAY OPPORTUNITY refers to the deemed or specific consent that a sign receives, making it legal to display that sign within the boundaries of a given land parcel.

DISPLAY PERIOD means the exposure time during which the individual advertising message is on display.

DOACCP Department of Outdoor Advertising of the City Council of Pretoria

DOMAIN in a database is the set of allowed values for a table column, for example all positive integers.

DOUBLE PRECISION refers to a high level of coordinate accuracy based on the possible number of significant digits that can be stored for each coordinate. ArcInfo data sets can be stored in either single- or double-precision coordinates. Double-precision coverages, store up to 15 significant digits per coordinate, retaining the accuracy of much less than one meter at a global extent. See also single precision.

EDIT is to correct or modify errors within a computer file, a geographic data set, or a tabular file containing attribute data.

EMBEDDED SQL refers to SQL statements that are embedded in a host language program.

ENTITY is a collection of objects (persons, places, things) described by the same attributes. Entities are identified during the conceptual design phase of database and application design.

ENTITY RELATIONSHIP DIAGRAM is a graphical representation of the entities and the relationships between them. Entity relationship diagrams are a useful medium to achieve a common understanding of data among users and application developers.

EQUATOR is the parallel of reference 0 north or south.

ERF is an acronym for the European Redistribution Facility and refers to a garden plot, usually about half an acre. [Cape Colony]

ERF NOT REGISTERED refers to erven in the City Council GIS database that have not been registered with the deeds office, and therefore do not contain zoning information.

EVALUATION REASON refers to the control measures that each land parcel receives as generated by a combination of the City Council of Pretoria's zoning and the environmental overrides generated as part of this study. Evaluation reasons influence the display opportunities that a land parcel has.

FIELD In a database, another term for column.

FIELD DATA COLLECTOR is an electronic device that collects and stores observation information from survey instruments. Two types of devices are available: one records x,y,z coordinates using a satellite-based global positioning system (GPS), and the other device records distance and bearing

FILE refers to a set of related information that a computer can access by a unique name (e.g., a text file, a data file, a DLG file). Files are the logical units managed on disk by the computer's operating system. Files may be stored on tapes or disks.

FILE TRANSFER is the process of copying data from one computer to another or one DBMS to another.

FONT is a logical set of related patterns representing text characters or point symbols. Courier, Helvetica and Times are three types of font.

FOREIGN KEY is one or more table attributes that can uniquely identify a record in another table. A foreign key is the primary key of another table. Foreign key-primary key relationships define a relational join. See also relate.

FORMS INTERFACE is a graphic user interface characterized by user-controlled movement of a cursor from one data field to another. Contrast to command line interface.

FAÇADE means the principal front or fronts of a building.

FLASHING SIGN means a sign in which the visibility of the contents is enhanced by their intermittently appearing and disappearing or being illuminated with varying intensity or colours.

FLAT SIGN means any sign which is affixed to any external wall of a building used for commercial, office, industrial or entertainment purposes, but excluding a parapet wall, balustrade or railing of a veranda or balcony of any such building, which at no point projects more than 300mm from the surface of such wall and which may consist of a panel or sheet or of individual numbers, letters or symbols.

FREE-STANDING SIGN means any immobile sign which is not attached to a building or to any structure or object not intended to be used for the purpose of advertising.

FREEWAY means a road designated as a freeway by means of a road traffic sign.

GATEWAY means a prominent entrance to or exit from an urban area or a specific part of an urban area, consisting of man-made or natural features and creating a strong sense of arrival or departure.

GEOGRAPHIC DATA refers to the locations and descriptions of geographic features and the composite of spatial data and descriptive data.

GEOGRAPHIC DATABASE is a collection of spatial data and related descriptive data organized for efficient storage and retrieval by many users.

GEOGRAPHIC FEATURE is a user-defined geographic phenomenon that can be modelled or represented using geographic data sets. Examples of geographic features include streets, sewer lines, manhole covers, accidents, lot lines, and parcels.

GEOGRAPHIC INFORMATION SYSTEM refers to an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyse, and display all forms of geographically referenced information.

GEOMETRY deals with the measures and properties of points, lines and surfaces.

GEOREFERENCE refers to the establishment of the relationship between page coordinates on a planar map and known real world coordinates.

GEORELATIONAL MODEL is a geographic data model that represents geographic features as an interrelated set of spatial and descriptive data.

GLOBAL POSITIONING SYSTEM is a system of satellites and receiving devices used to compute positions on the Earth. GPS is used in navigation, and its precision supports cadastral surveying.

GRAPHIC USER INTERFACE (GUI) is a method of controlling how a user interacts with a computer to perform various tasks. Instead of issuing commands at a prompt, the user performs desired tasks by using a mouse to choose from 'a dashboard' of options presented on the display screen. These are in the form of pictorial buttons (icons) and lists. Some GUI tools are dynamic and the user must manipulate a graphical object on the screen to invoke a function; for example, moving a slider bar to set a parameter value (e.g., setting the scale of a map).

HARDWARE refers to the physical components of a computer system-the computer, plotters, printers, terminals, digitisers, and so on.

HEIGHT OF A SIGN means the vertical distance between the uppermost and lowest edges of the sign.

HEURISTIC is a computational method that uses trial and error methods to approximate a solution for computationally difficult problems.

HUMAN LIVING ENVIRONMENT refers to all human settlements such as villages, towns or cities, which may consist of various components such as residential, employment and recreation areas and which require environmental management to provide services such as water, public spaces and waste removal and to protect the quality of the environment.

ILLUMINATED means an advertising structure which has been fitted with electrical or other power for the purpose of illumination of the message of such sign.

ILLUMINATED SIGN means a sign the continuous or intermittent functioning of which depends upon it being illuminated.

IMAGE is a graphic representation or description of a scene, typically produced by an optical or electronic device. Common examples include remotely sensed data (e.g., satellite data), scanned data, and photographs. An image is stored as a raster data set of binary or integer values that represent the intensity of reflected light, heat, or other range of values on the electromagnetic spectrum.

IMPEDANCE is the amount of resistance (or cost) required to traverse a line from its origin node to its destination node or to make a turn (i.e., move from one arc through a node onto another arc). Resistance may be a measure of travel distance, time, speed of travel times the length, and so on. Higher impedance indicates more resistance to movement, with 0 indicating no cost. Often, a negative impedance value indicates a barrier. Impedance is used in network routing and allocation. An optimum path in a network is the path of least resistance (or lowest impedance).

INDEX refers to a special data structure used in a database to speed searching for records in tables or spatial features in geographic data sets. ArcInfo supports both spatial and attribute indexes. See also *item indexing*, *cross-tile indexing* and *spatial indexing*.

INTEGER is a number without a decimal (0, 1, 25, 173, 1032, etc.). Integer values can be less than, equal to, or greater than zero.

INTERACTION is a measure of the estimated number of trips that will be generated between origins and destinations for a particular activity. Interactions depend upon the properties of the origin to generate a trip, the property of the destination to attract a trip and the cost of travelling between them.

INTERFACE with reference to data communication, is a hardware and software link that connects two computer systems, or a computer and its peripherals.

INTERNATIONAL ORGANISATION FOR STANDARDISATION (ISO) is a worldwide federation of national standards bodies (e.g., SABS from South Africa) that develops international standards. A Technical Committee (ISO/TC211) is developing international Geographic Information/Geomatics standards. Among many other computing standards, ISO maintains an SQL standard and is developing an extended version, SQL3, which will support queries on geographic data sets.

INTERNET is an international consortium of wide area networks that operate using a standard set of addresses allowing machine-to-machine connectivity on a global scale. The Internet is an outgrowth of a Defense Advanced Research Projects Agency (DARPA) research project in the early 1970s to provide connectivity between scientists running computer simulations in different locations. Additional regional, private, and public networks have joined the Internet over time. At this point there are over two million computers that now have direct access to the resources on the Internet.

ISOLINE refers to a line on a surface connecting points of equal value.

ITEM INDEXING is a means of accelerating logical queries and tabular 'relates' by creating an index on an item in a database table.

LANDSCAPE SENSITIVITY refers to the visual or aesthetic sensitivity of the landscape with regard to outdoor advertisements and signs, is expressed in terms of basic landscape sensitivity and degree of landscape sensitivity and may also take traffic conditions into account.

LAND PARCEL Refers to any portion of land demarcated in terms of the town planning scheme of the City Council of Pretoria. I.e. Farms, Farms not registered, plots, plots not registered, erven and erven not registered.

LATITUDE-LONGITUDE is a spherical reference system used to measure locations on the Earth's surface. Latitude and longitude are angles measured from the Earth's centre to locations on the Earth's surface. Latitude measures angles in a north-south direction. Longitude measures angles in the east-west direction.

LEAST-COST PATH is the path, among possibly many, between two points which has the lowest traversal cost, where cost is a function of time, distance, or other user-defined factors. See also *impedance*.

LEGEND refers to:

1. The reference area on a map that lists and explains the colours, symbols, and line patterns, shadings, and annotation used on the map. The legend often includes the scale, origin, orientation, and other map information.
2. The symbol key used to interpret a map.

LIMITED USE AREA means an area of 50 metres outside the road reserve boundary of a freeway to which the same restrictions apply as the actual freeway reserve but where consent is given under certain circumstances for the display of specific sign types in order to indicate enterprises situated in such a limited use area.

LINE refers to:

1. A set of ordered coordinates that represents the shape of geographic features too narrow to be displayed as an area at the given scale (e.g., contours, street centrelines, or streams), or linear features with no area (e.g., state and county boundary lines).
2. A single *arc* in a coverage.
3. A line on a map (e.g., a neatline).

LINE-IN-POLYGON is a spatial operation in which arcs in one coverage are overlaid with polygons of another coverage to determine which arcs, or portions of arcs, are contained within the polygons. Polygon attributes are associated with corresponding arcs in the resulting line coverage.

LINE SYMBOL is a symbol for drawing coverage arcs.

LINEAR FEATURE is a geographic feature that can be represented by a line or set of lines. For example, rivers, roads within a pizza delivery area, and electric and telecommunication networks are all linear features.

LITERAL is a string, a number, or a date, which directly represents a constant value. 'XYZ123', '1234' and '6/10/57' are examples of a string literal, a numeric literal and a date literal, respectively.

LOCAL AREA NETWORK (LAN) is a computer data communications technology that connects computers at the same site. Computers and terminals on a LAN can freely share data and peripheral devices, such as printers and plotters. LANs are composed of cabling and special data communications hardware and software.

LOCALITY BOUND SIGN means a sign displayed on a specific site, premises or building and which refers to an activity, product, service or attraction located, rendered or provided on that premises or site or inside that building.

LOCATION SIGN means a type of guidance sign provided under the South African Road Traffic Sign System and used to identify places or locations which either provide reassurance during a journey or identify destinations such as towns, suburbs or streets near the end of a journey.

LOGICAL CONNECTOR refers to one of the reserved words AND, OR and XOR used to build complex *logical expressions* in a query.

LOGICAL EXPRESSION is a combination of items, system items, system variables, literals and arithmetic logical operators from which a value of TRUE or FALSE is derived.

LOGICAL SELECTION is the process of selecting a subset of features from a coverage using logical expression that operates on the attributes of coverage features (e.g., AREA GT 16000). Only those features whose attributes meet the criteria are selected. Also known as feature selection by attribute.

LONG TRANSACTIONS support applications where changes to a database might span several days, weeks or months and may involve several sessions. Many planning and design activities, such as subdivision development, require long transactions.

MACRO is a text file containing a sequence of commands that can be executed as one command.

MAIN ROOF OF A BUILDING means any roof of a building other than the roof of a veranda or balcony.

MAIN WALL OF A BUILDING means any external wall of a building, but does not include a parapet wall, balustrade or railing of a veranda or a balcony.

MANY TO ONE RELATE is a relate in which many records in one table are related to a single record in another table.

MAP is an abstract representation of the physical features of a portion of the Earth's surface graphically displayed on a planar surface. Maps display signs, symbols, and spatial relationships among the features. They typically emphasize, generalize, and omit certain features from the display to meet design objectives (e.g., railroad features might be included in a transportation map but omitted from a highway map).

MAP EXTENT refers to:

1. The rectangular limits (xmin,ymin and xmax,ymax) of the area of the Earth's surface displayed using a GIS. Map extent is specified in the coordinate system of the coverage or other geographic data set used. Typically, the extent of the geographic database (or a portion of it defined by a zoomed-in view) defines the map extent for display.
2. The geographic extent of a geographic data set specified by the minimum bounding rectangle (i.e., xmin,ymin and xmax,ymax).

MAP PROJECTION is a mathematical model that transforms the locations of features on the Earth's surface to locations on a two-dimensional surface. Because the Earth is three-dimensional, some method must be used to depict a map in two dimensions. Some projections preserve shape; others preserve accuracy of area, distance, or direction. See also *coordinate system*. Map projections project the Earth's surface onto a flat plane. However, any such representation distorts some parameter of the Earth's surface be it distance, area, shape, or direction.

MAP QUERY is the process of selecting information from a GIS by asking spatial or logical questions of the geographic data. Spatial query is the process of selecting features based on location or spatial relationship (e.g., select all features within 300 metres of another; point at a set of features to select them). Logical query is the process of selecting features whose attributes meet specific logical criteria (e.g., select all polygons whose value for AREA is greater

than 10,000 or select all streets whose name is 'Main St.'). Once selected, additional operations can be performed, such as drawing them, listing their attributes or summarizing attribute values.

MAP SCALE is the reduction needed to display a representation of the Earth's surface on a map. A statement of a measure on the map and the equivalent measure on the Earth's surface, often expressed as a representative fraction of distance, such as 1:24,000 (one unit of distance on the map represents 24,000 of the same units of distance on the Earth). Map scale can also be expressed as a statement of equivalence using different units; for example, 1 inch = 1 mile or 1 inch = 2,000 feet.

MAP UNITS are the coordinate units in which a geographic data set (e.g., a coverage) is stored in a GIS. Map units can be inches, centimetres, feet, meters, or decimal degrees.

MARKER SYMBOL is a symbol used to represent a point location such as an airport.

MERIDIAN is a line running vertically from the North Pole to the South Pole along which all locations have the same longitude. The Prime Meridian (0) runs through Greenwich, England. From the Prime Meridian, measures of longitude are negative to the west and positive to the east up to 180, halfway around the globe.

MOBILE OR TRANSIT SIGN means an advertisement attached to or displayed on a vehicle, vessel, or craft on land, on water or in the air.

MODEL is a representation of reality used to simulate a process, understand a situation, predict an outcome, or analyse a problem. A model is structured as a set of rules and procedures, including spatial modelling tools available in a geographic information system (GIS). See also *spatial modelling*, *data model*, *analysis* and *spatial analysis*.

NATURAL LANDSCAPE means relatively unspoilt areas outside urban areas such as natural parks, game reserves, marine reserves, wilderness areas and extensive agricultural and scenic corridors.

NODE refers to:

1. The beginning and ending locations of an arc. A node is topologically linked to all arcs that meet at the node. See also *network node*.
2. In graph theory, the location at which three or more lines connect.
3. The three corner points of each triangle in a tin. Every sample point input to a tin becomes a node in the triangulation. A triangle node is topologically linked to all triangles that meet at the node.

NULL VALUE refers to the absence of a value. If a particular column of a row in a table is null, that means there is no value stored. Null is not the same as blank or zero.

OAASA Outdoor Advertising Association of South Africa

OACSPMA will mean the Outdoor Advertising Control Scheme for the Pretoria Metropolitan Area.

OBJECT LINKING AND EMBEDDING (OLE) developed by Microsoft allows objects from one application to be embedded within another (e.g. taking an Excel spreadsheet and putting it into a Word document).

ONE TO MANY refers to a relate in which one record in a table is related to many records in another table.

OPEN DATABASE COMMUNICATION (ODBC) is a standard API (application program interface) used to communicate with database management systems, developed by Microsoft.

ONLINE ACCESS refers to direct access to data that does not involve file transfer.

OPERATING SYSTEM refers to computer software designed to allow communication between the computer and the user. The operating system controls the flow of data, the application of other programs, the organization and management of files, and the display of information.

OUTDOOR ADVERTISING means the act of process of notifying, warning, informing, making known or any other act of transferring information in a visible manner and which takes place out of doors.

PAPER BASED SYSTEM means the manual processing of outdoor advertising applications by applying the SAMOAC document.

PARALLEL refers to:

1. A property of two or more lines that is separated at all points by the same distance.
2. A horizontal line encircling the Earth at a constant latitude. The Equator is a parallel whose latitude is 0. Measures of latitude range from 0 to 90 north of the Equator and from 0 to -90 to the south.

PATHNAME refers to the path to a file or directory located on a disk. Pathnames are always specific to the computer operating system.

PIXEL stems from a contraction of the words picture element. The smallest unit of information in an image or raster map. Referred to as a cell in an image or grid.

POINT refers to:

1. A single x,y coordinate that represents a geographic feature too small to be displayed as a line or area; for example, the location of a mountain peak or a building location on a small-scale map.
2. A coverage feature class used to represent point features or to identify polygons. It is not possible to have point and polygon features in the same coverage. When representing point features, the x,y location of the label point describes the location of the feature. When identifying polygons, the label point can be located anywhere within the polygon. Attributes for points are stored in a *PAT*.

POLYGON refers to a coverage feature class used to represent *areas*. A polygon is defined by the arcs that make up its boundary and a *point* inside its boundary for identification. Polygons have attributes (*PAT*) that describe the geographic feature they represent.

POLYGON OVERLAY refers to a *topological overlay* procedure which determines the spatial coincidence of two sets of polygon features and creates a new set of polygons based on *identity*, *intersect*, or *union*.

POST-GIS means any date after the implementation of phase three of the OACSPMA.

POSTER means any placard announcing or attracting public attention to any meeting, event, function, activity or undertaking or to the candidature of any person nominated for election to

parliament, local government or any similar body or to a referendum, or any placard advertising any product or service or announcing the sale of any goods, livestock or property.

PROJECTED SIGN means any sign projected by a cinematograph or other apparatus, but does not include a sign projected onto the audiences side of a drive-in cinema screen during a performance.

PROJECTING SIGN means any sign which is affixed to a main wall of a building which is used for commercial, office, industrial or entertainment purposes and which projects more than 300mm from the surface of the main wall and is affixed at a right angle to the street line.

PRE-GIS means any date prior to the implementation of phase three of the OACSPMA.

PRECISION refers to the number of significant digits used to store numbers, and in particular, coordinate values. Precision is important for accurate feature representation, analysis and mapping. ArcInfo supports *single precision* and *double precision.*

PRE-PLANNING refers to the procedures performed by advertising agencies and contractors prior to the submission of an advertising application.

PRETORIA METROPOLITAN AREA refers to the geographical areas represented by the twelve planning zones of the City Council of Pretoria.

PRIMARY KEY is one or more attributes whose values uniquely identify a row in a database table. See also *foreign key.*

PROBLEMS EXPERIENCED will refer to those issues highlighted by the DOACCP and OASSA.

PROCESSING TIME will mean the time taken by the DOACCP to review an outdoor advertising application prior to passing it on to another department for evaluation.

RELATIONAL DATABASE MANAGEMENT SYSTEM is a database management system with the ability to access data organized in tabular files that can be related to each other by a common field (item). An RDBMS has the capability to recombine the data items from different files, providing powerful tools for data usage. See also *relate.*

REAL NUMBERS is decimal numbers (e.g., 3.1417, 0.25, 1.8992, 6.0).

RECORD refers to an attribute table, a single 'row' of thematic descriptors. In SQL terms, a record is analogous to a tuple.

REFERENTIAL INTEGRITY refers to the capability to ensure that changes to one table that affect other tables are transmitted to those other tables. For example, a table will not be given a *foreign key* value that does not exist as a *primary key* in another table.

RELATIONAL DATABASE is a method of structuring data as collections of tables that are logically associated to each other by shared attributes. Any data element can be found in a relation by knowing the name of the table, the attribute (column) name, and the value of the primary key. See also *relate, relate key*, and *relational join.*

RELATIONAL JOIN refers to the operation of relating and physically merging two attribute tables using their common item.

ROAD TRAFFIC SIGN means any road traffic sign as defined in the Road Traffic Act, 1989 (Act No. 29 of 1989), the detailed dimensions and applications of which are controlled by the

regulations to this Act and the South African Road Traffic Signs Manual (Note: Act 29 will be replaced by The National Road Traffic Act, Act 93 of 1996 in the near future).

ROOF SIGN means a sign on the main roof of a building lower than fifteen floors and which building is used or partially used for commercial, office, industrial or entertainment purposes.

ROTATING SIGN means a sign, which rotates on any axis.

ROW refers to:

1. A record in an attribute table. The horizontal dimension of a table composed of a set of columns containing one data item each.
2. A horizontal group of cells in a grid, or pixels in an image.

RUN-LENGTH ENCODING is a data compression technique for storing raster or gridded data. Run-length encoding stores data by row. If two or more adjacent cells in a row have the same value, the 'run' is recorded, as opposed to recording an individual value for each cell. The more adjacent columns having the same value, the greater the compression.

RUNNING LIGHT SIGN means a sign of portion of a sign in the form of an illuminated strip the illumination of which varies periodically in such a way as to convey the impression of a pattern of lights moving steadily along such strip.

RURAL LANDSCAPE refers to areas of transition between developed urban areas and relatively unspoiled natural areas. Typical rural land use forms include intensive agriculture, subsistence agriculture and peri-urban smallholdings of a rural nature with a relatively low population density.

SAMOAC will mean the South African Manual for Outdoor Advertising Control

SENSITIVE URBAN AREAS will mean gateways to the city and visually prominent ridges.

SIGN is a more comprehensive term than advertisement and refers to any advertisement or object, structure or device, which is in itself an advertisement of which is used to display an advertisement.

SINGLE PRECISION refers to a level of coordinate accuracy based on the number of significant digits that can be stored for each coordinate. Single-precision numbers store up to 7 significant digits for each coordinate, retaining a precision of 5 meters in an extent of 1,000,000 meters. ArcInfo data sets can be stored as either single- or double-precision coordinates. See also *double precision.*

SKY SIGN means a very large sign between 75m² and 300m² on top of a skyscraper in a metropolitan area and which may form an important landmark.

SLOPE is a measure of change in surface value over distance, expressed in degrees or as a percentage. For example, a rise of 2 meters over a distance of 100 meters describes a 2% slope with an angle of 1.15. Mathematically, slope is referred to as the first derivative of the surface.

SNAPPING refers to the process of moving a feature to coincide exactly with coordinates of another feature within a specified snapping distance, or tolerance.

SPATIAL ANALYSIS refers to the process of modelling, examining, and interpreting *model* results. Spatial analysis is useful for evaluating suitability and capability, for estimating and predicting, and for interpreting and understanding. There are four traditional types of spatial

analysis: *topological overlay* and contiguity analysis, surface analysis, linear analysis, and raster analysis.

SPATIAL DATA refers to information about the location and shape of, and relationships among, geographic features, usually stored as coordinates and topology.

SPATIAL MODELING is an analytical procedures applied with a GIS. There are three categories of spatial modelling functions that can be applied to geographic features within a GIS: (1) geometric models, such as calculating the Euclidean distance between features, generating buffers, calculating areas and perimeters, and so on; (2) coincidence models, such as *topological overlay*; and (3) adjacency models (pathfinding, redistricting, and allocation). All three model categories support operations on spatial data such as points, lines, polygons, tins, and grids. Functions are organized in a sequence of steps to derive the desired information for analysis.

SPECIFIC CONSENT (PERMITTED WITH) means the written approval of the controlling authority after the review of the guidelines in this manual.

SPECTACULAR means a custom made billboard, which incorporates special effects such as internal illumination, cut-outs and three-dimensional representations.

SPLINE is a mathematical curve used to smoothly represent spatial variation. A spline operation inserts vertices to create a curve in an arc. See also *grain tolerance* and *densify*.

STANDARD QUERY LANGUAGE (SQL) is a syntax for defining and manipulating data from a relational database. Developed by IBM in the 1970s, it has become an industry standard for query languages in most relational database management systems.

STRING is a series of alphanumeric characters of any length enclosed by quotes.

SUSTAINABLE DEVELOPMENT means development that delivers basic environmental, economic and social services to all without threatening the viability of natural, built and social systems upon which such services depend.

SYBASE is a relational database management system currently in use at the CCP. A database integrator allows REGIS to access SYBASE information directly.

TCP/IP (TRANSMISSION CONTROL PROTOCOL/INTERNET PROTOCOL) Transmission Control Protocol (TCP) is a communication protocol layered above the Protocol (IP). These are low-level communication protocols, which allow computers to send and receive data.

TEMPORARY SIGN means a sign not permanently fixed and not intended to remain fixed in one position.

TERMINAL is a device, usually a display monitor and a keyboard, used to communicate with the computer.

TEXT SYMBOL refers to a text style defined by font, size, character spacing, colour, and so on, used to label maps and coverage features in ArcInfo.

THEME refers to a user-defined perspective on a coverage, grid, tin or image geographic data set specified, if applicable, by a coverage name and feature class or data set name, attributes of interest, a data classification scheme, and theme-specific symbology for drawing.

TOPOGRAPHIC MAP refers to:

1. A map containing contours indicating lines of equal surface elevation (relief), often referred to as topo maps.
2. Often used to refer to a map sheet published by the U.S. Geological Survey in the 7.5-minute quadrangle series or the 15-minute quadrangle series.

TOPOLOGICAL OVERLAY refers to an analysis procedure for determining the spatial coincidence of geographic features.

TOPOLOGY refers to the spatial relationships between connecting or adjacent coverage features (e.g., arcs, nodes, polygons, and points). For example, the topology of an arc includes its from- and to-nodes, and its left and right polygons. Topological relationships are built from simple elements into complex elements: points (simplest elements), arcs (sets of connected points), areas (sets of connected arcs), and routes (sets of sections, which are arcs or portions of arcs). Redundant data (coordinates) are eliminated because an arc may represent a linear feature, part of the boundary of an area feature, or both. Topology is useful in GIS because many spatial modelling operations don't require coordinates, only topological information. For example, to find an optimal path between two points requires a list of the arcs that connect to each other and the cost to traverse each arc in each direction. Coordinates are only needed for drawing the path after it is calculated.

TRANSPARENCY means a qualitative gauge of how easily the general public can access information about any stage of an outdoor advertising application.

TRI-VISION means a display embellishment, which, through the use of a triangular louver construction, permits the display of three different copy messages in a pre-determined sequence.

URBAN AREA means a human settlement with a population of more than 2500 people.

URBAN LANDSCAPE means an urban area or any part of an urban area.

VECTOR is a coordinate-based data structure commonly used to represent linear geographic features. Each linear feature is represented as an ordered list of *vertices*. Traditional vector data structures include double-digitised polygons and arc-node models.

VEHICULAR ADVERTISING means advertising on self-driven vehicles which are normally driven on land or water and which are moving.

VERANDA means a structure in the nature of a roof attached to or projecting from the façade of a building and supported along its free edge by columns or posts.

VERTEX is one of a set of ordered x,y coordinates that constitutes a line.

VIEW refers to a logical table whose data are not physically stored. You define a view to access a subset of the columns stored in a row, access a set of columns stored in different rows, or avoid creating a redundant copy of data that is already stored.

VISUAL ZONE refers to a zone considered to be an area of maximum control, visible from an urban freeway, extending a distance of 250 metres in any direction from the freeway reserve boundary, but which excludes all visually isolated space, which cannot be seen from the freeway.

WIDE AREA NETWORK (WAN) refers to computer data communications technology that connects computers at remote sites. WANs are composed of special data communications hardware and software and usually operate across public or dedicated telephone networks.

WORLD WIDE WEB (WWW) was developed by the European Laboratory for Particle Physics (CERN).Consortium in Switzerland as a distributed hypermedia server. It allows one to prepare electronic documents that are composites of, or pointers to, many different files of potentially different types scattered across the world. It employs a hypertext markup language (html) to create the documents it serves and to follow "links" known as Universal Resource Locators (URLs) to fetch the document from elsewhere on the Internet. A WWW server does not provide search capabilities, rather it provides explicit linkage between files on the Internet using hypertext. This allows one to organize information in a particular way, but, unless the links exist, does not permit the discovery of other information that was not associated by the author. WWW can be accessed by Mosaic (see *Mosaic*).

WINDOW SIGNS means signs, which are permanently painted on or attached to the window-glass of a building.

ZOOM means to enlarge and display greater detail of a portion of a geographic data set.

10 ANNEXURE B – SAMOAC GUIDELINES FOR CONTROL OF OA

This annexure is included to fulfil two roles. Firstly it is written as a stand-alone chapter that briefly describes the SAMOAC document. Secondly, it is written as a set of references to support the discussion in section 3.1.3.3. As a result of the second objective, the reading flow of this annexure may seem compromised somewhat. For ease of reading SAMOAC is used in place of the full reference: Department of Environmental Affairs and Tourism. 1998. "The South African Manual for Outdoor Advertising Control".

10.1 OBJECTIVES OF SAMOAC

Prior to developing the National code of practice, the DEAT task group defined a set of goals and objectives to be met. These goals and objectives were carried through when the National Code of Practice for Outdoor Advertising was converted into the SAMOAC document.

The main objectives of SAMOAC was to establish control systems and mechanisms to:

- Contribute to the conservation of tourism resources in natural, rural and urban environments;
- contribute to the creation of more acceptable human living environments;
- promote traffic safety;
- promote sustainable economic growth and sustainable development; and
- foster a balanced approach between economic development, on the one hand, and traffic safety and the conservation of visual resources, on the other hand. (Such an approach should recognise the individual's right to economic freedom and freedom of expression and his or her right to live in an acceptable and safe environment.)

10.2 DETERMINING THE GUIDELINES A PUBLIC PARTICIPATION PROCESS

The realisation of the objectives of SAMOAC culminated in the development of the SAMOAC model. The starting point of the study however was an in depth review of international case studies. The results and success of these case studies were incorporated in the initial structure of the control procedure. SAMOAC was put through a rigorous set of public participation workshops so that all interested and affected parties could have input. These workshops highlighted a range of additional advantages that SAMOAC would provide when compared to current control procedures. The following list of advantages is quoted from Page 7 of DEAT 1998 section 1.1.4:

- *"SAMOAC will facilitate the processing and approval/disapproval of outdoor advertising applications by the relevant controlling authority and*
- *can be used by prospective advertisers, to plan their advertising strategies.*

- *SAMOAC will facilitate pre-planning on the part of controlling authorities*
- *providing a reference document for dealing with outdoor advertising issues.*
- *SAMOAC provides advice and assistance for advertisers in preparing specific applications as well as being a set of*
- *guidelines, which will enable the controlling authorities to evaluate applications on their merits and make an informed decision based on the guidelines.*
- *SAMOAC will encourage standardisation of assessment criteria and uniformity in the application of these criteria, eventually*
- *leading to uniformity in legislation."*

10.2.1 A MODEL FOR SAMOAC

SAMOAC is based on a theoretical model process, which synthesised pertinent issues by means of the following steps.

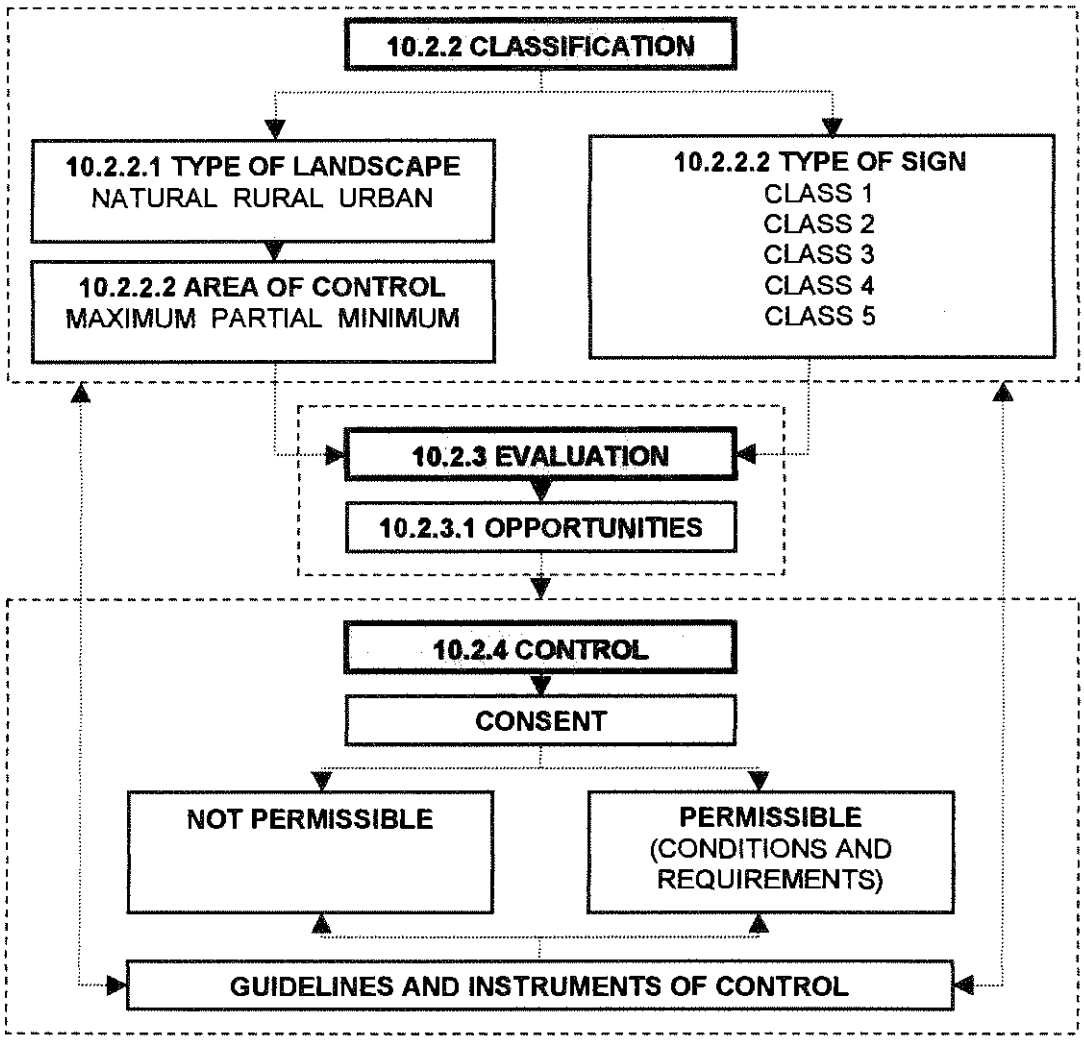

FIGURE 12: A MODEL FOR SAMOAC (SAMOAC 1998)

10.2.2 CLASSIFICATION

Central to the whole process of applying guidelines is the concept of classification. Two distinct areas are important here. The first is classifying the type of sign and the second is classifying the type of landscape. SAMOAC (DEAT 1998) states that classification of sign type and landscape type is important, as *"The type of sign will give an indication of the potential impact of such a sign. The basic character of the landscape in which a sign is displayed will affect the degree of control and therefore the area of control to be applied." (DEAT 1998 Page 12)* In order to fully understand their importance, these two classification requirements need to be expanded upon.

10.2.2.1 TYPE OF LANDSCAPE

Landscape classification is important as it provides the basis upon which changes in landscape aesthetic are physically defined. This is necessary as level of impact that a disturbance causes varies with landscape type.

"Landscape character is expressed in terms of the intensity of human activity and influence, viz. NATURAL, RURAL and URBAN landscapes." (DEAT 1998 Page 12)

As mentioned in the delimitations, the extent of this dissertation is the boundaries of the Pretoria Metro Area. The entire study area (including farm and plot cadastres falling within the Pretoria metropolitan area) falls under the SAMOAC heading of URBAN landscape. NATURAL and RURAL landscape classifications as determined by SAMOAC therefore fall outside the bounds of this study and are not discussed further.

SAMOAC classifies any URBAN area as either MAXIMUM, PARTIAL or MINIMUM control. The determination of this classification is made according to specifically identified landscape types.

The first area of control under urban landscape is **MAXIMUM control**. In an urban area, the following precincts are defined in SAMOAC as being visually sensitive and are therefore zoned as MAXIMUM control.

- CONSERVATION AREAS: such as areas of natural open space and urban conservation areas; the interface between natural landscape and build fibre, in the form of natural edges like water bodies, rivers, ridges and forests.
- RECREATION: Open areas for passive recreation such as parks and non commercial squares.
- SCENIC: scenic areas; characteristic vistas across built up areas or down streets or avenues.
- ARCHITECTURAL AND HISTORICAL: National or local heritage sites or buildings; special tourist areas; historical or contextual streetscapes, skylines seen from viewing points; areas or facilities of strong architectural context or historical scale.

- RESIDENTIAL: Exclusively residential areas for higher to middle income groups, mostly low density single.
- GATEWAYS: features of scenic, historical or architectural significance.
- TRANSPORTATION: Visual zones along freeways, unless the responsible roads authority, after an EIA process, identifies areas along such freeways, in which relaxation may be allowed.

The second area of control under the Urban Landscapes is PARTIAL control. The following precincts are defined by SAMOAC as having a higher degree of integration and complexity of land use, thereby allowing greater flexibility for advertising.

- RESIDENTIAL: areas with high-rise apartment blocks, interspersed with shops and offices, mostly high density mixed. Medium density residential areas in transition as well as residential areas where office and commercial encroachment has taken place. Low density, lower income suburbs.
- COMMERCIAL: small commercial enclaves in residential areas. Suburban shopping centres and office parks. Ribbon development along main streets
- EDUCATION: all educational institutions.
- RECREATIONAL: sports fields or stadia and commercialised squares.
- INSTITUTIONAL: government enclaves, including diplomatic or civic amenities.
- SMALL HOLDINGS of an urban nature with a higher population density than rural smallholdings.

The third area of control under Urban Landscapes is **MINIMUM** control. The following precincts are defined by SAMOAC as areas of minimum control due to their highly commercial nature, whose dominant concern and motivation is the conducting of business.

- COMMERCIAL: commercial districts, central shopping centres and central office precincts. Commercial enclaves and shopping centres in lower income suburbs.
- INDUSTRIAL: industrial areas or industrial parks
- ENTERTAINMENT: entertainment districts or complexes
- TRANSPORTATION: Includes prominent public transport nodes such as railway stations, larger bus stations, and taxi ranks, airports and harbours, excluding nodes of exceptional historical and architectural value.

10.2.2.2 AREAS OF CONTROL

In the preceding section, landscape types were classified based on their potential to be negatively impacted upon by OA. The classes chosen were relatively simplistic, being either MAXIMUM, PARTIAL or MINIMUM control. These classes are described in SAMOAC as areas of control, and represent clearly demarcated polygons, based on the town and regional planning scheme. Each polygon has a control measure assigned to it, and this control measure regulates

which sign classes are applicable for display. SAMOAC describes why areas of control are an effective step in the regulation of OA:

"The potential interaction between basic landscape sensitivity and sign impact can most effectively be dealt with by means of areas of control. Three areas of control should apply, viz. areas of MAXIMUM, PARTIAL and MINIMUM control. On the one hand, an area of control reflects the degree of control to be applied in a certain landscape or part of such a landscape. On the other hand, being a spatial entity an area of control may also imply a spatial superimposition on a specific landscape type. This concept therefore also has to do with the degree of landscape sensitivity, which can be seen as a refinement of the basic sensitivity of a landscape. Traffic safety conditions should also be taken into consideration when it comes to the classification of areas of control." (SAMOAC 1998 Page 12)

Area of control is thus a regulation measure, which is based on an active interpretation of the vulnerability of a piece of land to visual degradation by OA. The next step is the classification of signs into classes based on varying degrees of visual impact, and the linking of each of these classes to areas of control.

10.2.2.3 TYPE OF SIGN

In the preceding section, landscape types and areas of control were defined, and a series of "rules" generated from the town and planning scheme were implemented to segment the landscape into categories of MAXIMUM, PARTIAL or MINIMUM control. The next step is to categorise all the different OA sign types into logical classes and sub classes. This process in essence segments OA signs into classes that have distinct levels of impact on an environment. Logically, a "beware of the dog" sign on a garden gate has a far smaller negative aesthetic impact than an 81m^2 illuminated billboard. The opportunity to display these two sign classes should therefore logically be different. Classification of sign type allows regulations to apply to specific levels of impact.

"In order to lessen the complexity of outdoor advertisements and signs and in order to determine the potential impact of signs on the environment, they should be classified into classes and sub-classes based on visual character, function and necessity." (SAMOAC 1998 Page12

SAMOAC divides all advertising signs into five major classes based primarily on visual impact. These classes are then split into sub classes, based on size, construction, and a host of performance standards. Classification in the field entails a step-by-step branched tree structure. Once classified, the sign needs to meet a set of performance criteria that evaluate safety, amenity and decency and a host of requirements that ensure the sign is suitable for public exposure. Should these general principles and conditions be met, the opportunity to display the sign on a specific landscape type is evaluated

10.2.3 EVALUATION

In the preceding sections, classification of landscape into areas of control and classification of sign types into classes brings us to the point where we can make decisions as to which sign types should be allowed to be displayed on which landscape types (display opportunities). This process was obviously somewhat subjective, and prior to finalising the control measures, each sign type was publicly work shopped, until consensus was reached as to the level of control. A precautionary approach was taken (Rofail 1999), in that where indecision existed, the higher level of control was adopted.

"The evaluation of the sign type versus the area of control (i.e. degree of impact versus degree of sensitivity) facilitates the establishment of actual advertising opportunities and constraints. The evaluation process also facilitates the implementation of specific control measures." (SAMOAC 1998 Page 12)

The evaluation discussed, that determines which signs could be displayed in which area of control is labelled as the evaluation of advertising opportunities in SAMOAC.

10.2.3.1 EVALUATION OF ADVERTISING OPPORTUNITIES

The evaluation of advertising opportunities (linkage of sign type to landscape type) was compiled in a matrix format with each sign type given a YEA or NEA for each area of control. The tables of display opportunities are presented below.

"The potential for outdoor advertising may therefore be determined by linking area of control with landscape type and sign type." (SAMOAC 1998 Page 13)

The evaluation legend for the advertising opportunities is as follows:

TABLE 7: EVALUATION LEGEND FOR ADVERTISING OPPORTUNITIES

RATING	EXPLANATION
X	Not permissible
✓	Permissible (subject to compliance with principles and conditions)
-	Not Applicable on the specified level

The following is a list of sign classes that SAMOAC covers.

Class 1 are Billboards and other high impact freestanding signs

TABLE 8: CLASS 1 ADVERTISING OPPORTUNITIES (SAMOAC 1998)

TYPE OF SIGN		AREA OF CONTROL		
		MAX	PAR	MIN
1A	Super Billboards	X	X	✓
1B	Custom Made Billboards	X	X	✓
1C	Large Billboards	X	X	✓
1D	Small Billboards and Tower Structures	X	✓	✓

Class 2 are Posters and General Signs

TABLE 9: CLASS 2 ADVERTISING OPPORTUNITIES (SAMOAC 1998)

TYPE OF SIGN		AREA OF CONTROL		
		MAX	PAR	MIN
2A	Large posters and advertisements on street furniture	✓	✓	✓
2B	Banners and flags	✓	✓	✓
2C	Suburban ads	✓	✓	✓
2D(1)	Estate agents boards	✓	✓	✓
2D(2)	Sale of goods and livestock (non-commercial premises)	✓	✓	✓
2D(3)	Pavement posters and notices	X	✓	✓
2D(4)	Project boards	✓	✓	✓
2D(5)	Temporary window signs	✓	✓	✓
2E	Street name advertisements	X	✓	✓
2F	Neighbourhood watch and similar schemes	✓	✓	✓
2G	Product replicas and three-dimensional signs	X	✓	✓

Class 3 are Signs on Buildings, structures and Premises

TABLE 10: CLASS 3 ADVERTISING OPPORTUNITIES (SAMOAC 1998)

TYPE OF SIGN		AREA OF CONTROL		
		MAX	PAR	MIN
3A	Sky signs	X	✓	✓
3B	Roof signs	X	✓	✓
3C	Flat signs	✓	✓	✓

3D	Projecting signs	✓	✓	✓
3E	Veranda, balcony, canopy and under-awning signs	✓	✓	✓
3F	Signs painted on roofs and walls	X	✓	✓
3G	Window signs	✓	✓	✓
3H	Signs incorporated in the fabric of a building	✓	✓	✓
3I	Advertisements on forecourts of business premises	✓	✓	✓
3J	Miscellaneous signs for residential oriented land use and community services	✓	✓	✓
3K	On-premises business signs	✓	✓	✓
3L	Advertising on towers, bridges and pylons	X	✓	✓
3M	Advertisements on construction site boundary walls and fences	X	✓	✓

Class 4 are Signs for the Tourist and Traveller

TABLE 11: CLASS 4 ADVERTISING OPPORTUNITIES (SAMOAC 1998)

TYPE OF SIGN		AREA OF CONTROL		
		MAX	PAR	MIN
4A	Sponsored road traffic projects	✓	✓	✓
4B	Service facility signs	✓	✓	✓
4C	Tourism signs	✓	✓	✓
4D	Functional advertisements by public bodies	✓	✓	✓

Class 5 are all Mobile Signs

TABLE 12: CLASS 5 ADVERTISING OPPORTUNITIES (SAMOAC 1998)

TYPE OF SIGN		AREA OF CONTROL		
		MAX	PAR	MIN
5A	Aerial signs	✓	✓	✓
5B	Vehicular advertising	✓	✓	✓
5C	Trailer advertising	X	✓	✓

10.2.4 CONTROL

With the classification and evaluation determined, an advertiser or controlling body could classify a sign, classify a landscape into one of the three areas of control and determine whether the given sign could legally be displayed on the specified landscape. However, from a control point of view every sign from a "beware of the dog" to a super billboard would have to evaluated and passed by the controlling authority. This would obviously result in an unfeasible situation where

large quantities of time would be wasted reviewing applications for trivial sign classes. To prevent this, DEAT instituted two mutually exclusive categories of control. These two categories were labelled as deemed or specific consent. In essence, each sign class either had deemed consent and could be erected without a full scale application or specific consent in which case a predetermined process of application, review and permission would be required. The two classes allowed for different levels of control for sign types that had high impact potential and those that had low impact potential. In addition, all signs erected had to comply with a set of general requirements, guidelines and instruments, which were geared towards ensuring the safety of the public.

SAMOAC (page 13) states *"Control measures should be applied by means of type of consent, and by means of general and specific conditions and requirements. Conditions and requirements will have to be established for all permissible signs".*

Considering Consent, SAMOAC (page 13) states *"Certain sign types may be deemed to have a limited or negligible impact on the environment and will consequently be permitted within the appropriate area of control. Other sign types may be deemed to have an unacceptably high potential impact on the environment and will consequently not be permitted within the area of control concerned. The type of control needed for permissible signs may be imposed in terms of specific or deemed consent."*

Regarding Conditions and Requirements for control, SAMOAC (page 14) states, *"A sign in the permitted category has to be subject to general and detailed conditions and regulations as to shape, height, position, colour, illumination and animation. Aspects such as safety, design and construction and maintenance provisions also have to be regulated. "*

On Guidelines and Instruments for control, SAMOAC states *"This theoretical model provides a framework for the development of the necessary guidelines and instruments for control. Such instruments will give controlling authorities a clear indication of what is allowed and where it is allowed and how an advertisement may be displayed."*

With the control structure in place, each sign class has a set of preconditions it must meet which entail location (area of control) permissibility (display opportunity) and safety regulations (guidelines for control), providing controlling authorities with a comprehensive, enforceable arsenal to regulate outdoor advertising.

11 ANNEXURE C - DATA FROM THE GIS DEPARTMENT OF THE CCP

11.1 CADASTRAL SCALES IN USE AT THE CITY COUNCIL OF PRETORIA

In order to evaluate whether the GIS is well designed to suite Pretoria's conditions, it is necessary to ascertain whether the system was designed at the correct scale. The following sections are a discussion of the various scales of sub-division that occur in the Pretoria Town Planning Scheme. Section 11.1 provides an explanation of the Town Planning Scheme development, and the methods used to arrive at the various scales.

Section **Error! Reference source not found.** highlighted the procedures used in the evaluation of landscaped areas by SAMOAC. In order to generate the classification of areas of control as shown in section **Error! Reference source not found.**, land use zoning information is required.

The information available is in GIS format, and errors in this information may be present. A further aspect in the evaluation of the suitability of scale is thus a review of the errors present in the available information

11.1.1 REASONS WHY A LEGISLATED CADASTRAL BOUNDARY IS THE MOST EFFECTIVE WAY TO IMPLEMENT SAMOAC

As discussed in 3.1.3.4 SAMOAC seeks to Classify, Evaluate and Control. These three actions lead to a set of display opportunities and constraints (SAMOAC 1998). For each of the above tasks, it is necessary to define exact boundaries (Velcich 2000). Since the regulation of SAMOAC relies on the application of legislation and bylaws, which in turn require linking to a defined boundary, within which they apply, a logical conclusion is to apply SAMOAC according to the preset boundaries of the town-planning scheme (Rofail 1999, personal communication). By doing this, the control measures, display opportunities and bylaws generated for/by SAMOAC will automatically apply to legislated land parcels.

Since the control measures are uniform thematic, a single control measure is generated for each land parcel. Limitations of this system are that subtle changes of sign display opportunities on large land parcels are not picked up. The end result is that these large land parcels may have unrealistically "strict" controls imposed on them. Display opportunities that are overridden as a result of this system can be corrected using sub zonings; in a similar way that land use zoning is relaxed on portions of a site. (IGIS (PTY) LTD. survey 1999)

11.1.1.1 DISCUSSION OF THE VARIOUS LEGISLATED CADASTRAL UNITS USED IN THE TOWN PLANNING SCHEME OF THE CITY COUNCIL OF PRETORIA

Information contained in section 11.1.1.1 is a synopsis of information gathered during discussions with Mrs Marita Odendaal and Miss Salome Minnie from the GIS and cartographic department of the City Council of Pretoria during 1999.

11.1.1.1.1 FARM BOUNDARIES

Pretoria's Farm Boundaries date back as far as the term that Paul Kruger served in office. Many of the farm boundaries present in Pretoria were put in place as far back as the late 1800's.

Areas denoted as farms in the current Town Planning Scheme of Pretoria lie mostly on the outskirts of the built up areas of Pretoria and are undeveloped. Farmhouses, rural dwellings, agriculture and some institutions are found on these farms

11.1.1.1.2 PLANNING ZONES

Pretoria is divided into eleven planning zones, each administered by its own planning zone forum.

Planning zones were used to split the GIS database into manageable units for display over the City Council Ethernet.

11.1.1.1.3 TOWN AREA/SUBURB

There are approximately 300 town areas or suburbs in Pretoria. Town areas are used for administrative and taxonomic reasons and form a set of management units that the City Council manages.

The Town Code for each Town area forms part of the compound GISKEY used to identify each of the land parcels in the City Council Database.

11.1.1.1.4 PLOTS

Plots refer to cadastral units that were derived from farm subdivisions passed prior to or during the development and sub divisions of the same area into erven. Plots generally have the same zoning status and use as farms, but can be found in between dense urban (erven) areas.

11.1.1.1.5 ERVEN

Erven are the most detailed and finely grained divisions in the Town Planning Scheme. Erven too contain the most detailed and diverse sets of zoning information. As the city of Pretoria expands, more and more farms and plots are sub divided into erven. (CCP1999)

11.1.1.1.6 SUB ZONINGS

Sub Zonings were developed to allow portions of a farm, plot or erf to receive several land zonings for different parts of the same cadastral unit. Sub Zonings are not title deeds, and the legal boundaries cannot be used as sub divisions. Sub Zonings are applied on a site-by-site basis, and application procedures are similar to those for re-zonings.

Sub Zonings are identified by the addition of a two-character length field to the end of the fourteen-character Town Planning GISKEY.

11.2 DETAILED EXPLANATION OF THE CITY COUNCIL ZONING INFORMATION

11.2.1 UNIQUE IDENTIFICATION OF LAND PARCELS USING A GISKEY

In order to generate controls for each of the land parcels in the City Council Database, it is necessary to distinguish between land parcels. This is done by means of a GISKEY. A Regis GISKEY, unlike an ArcView GISKEY can be either SIMPLE (created from one field) or COMPLEX (more than one field used to Generate the GISKEY). The City Council of Pretoria's GISKEY is generated by combining three fields, Town Code, Erf Number and Portion. By stringing these three fields together, a unique fourteen-character CODE (GISKEY) is generated for each land parcel.

11.2.1.1 TOWN CODE

As discussed in 11.1.1.1.3 town areas are the largest units of the town-planning scheme. TOWNCODE is a three-character field comprising mostly, but not exclusively numeric characters. Each of the numbers corresponds to a town area. Table 13: Details the town codes in use in Pretoria:

TABLE 13: LISTS OF THE TOWN CODES AND NAMES IN THE PRETORIA GIS DATABASE

TOWNCODE	TOWN/SUBURB NAME
0	MUNISIPALE GEBIED
2	ONDERSTEPOORT 478-JR
3	STERREWAG
4	ALPHENPARK
5	MONTANA PARK
5	MONTANA PARK 1
5	MONTANA PARK 2
5	MONTANA PARK 3
5	MONTANA PARK 4
5	MONTANA PARK 5
5	MONTANA PARK 6

TOWNCODE	TOWN/SUBURB NAME
5	MONTANA PARK 7
5	MONTANA PARK 8
6	PERSEQUOR
7	GOLFBAAN 602-JR
8	ANNLIN
8	ANNLIN 1
8	ANNLIN 2
8	ANNLIN 3
8	ANNLIN 4
8	ANNLIN 5
8	ANNLIN 6

TOWNCODE	TOWN/SUBURB NAME
8	ANNLIN 7
8	ANNLIN 8
9	NELPARK 603-JR
10	TECHNIKONRAND 604-JR
11	TECHNIKONRAND 662-JR
12	ANDEON AH
14	SAMCOR PARK
15	EQUESTRIA
15	EQUESTRIA 1
15	EQUESTRIA 2
15	EQUESTRIA 3

TOWNCODE	TOWN/SUBURB NAME
15	EQUESTRIA 4
15	EQUESTRIA 5
15	EQUESTRIA 6
15	EQUESTRIA 7
15	EQUESTRIA 8
16	ANDRESRUS AH
18	ONDERSTEPOORT
19	ANDEON
19	ANDEON 1
20	ARCADIA
22	PHILIP NEL PARK
23	LOTUS GARDENS
24	ASHLEA GARDENS
28	ASIATIC BAZAAR
30	ATTERIDGEVILLE
30	ATTERIDGEVILLE 1
35	ATTERIDGEVILLE 607-JR
36	BASHEWA AH
40	BAVIAANSPOORT 330-JR
48	BELLEVUE
50	BELLE OMBRE 636-JR
54	BERGTUIN
56	BLACKMOOR 347-JR
58	BON ACCORD AH
60	BOOYSENS
64	BROEKSCHEUR 318-JR
68	BROOKLYN
72	BRUMMERIA
72	BRUMMERIA 1
76	BRYNTIRION
78	BRYNTIRION 348-JR
84	CAPITAL PARK
85	CELTISDAL
96	CHRISTIAANSVILLE AH
100	CHRISTOBURG
102	CHRYSLER PARK 422-JR
103	CHRYSLER PARK 423-JR
104	CLAREMONT
108	CLAUDIUS
109	CLUBVIEW
110	ANNLIN-WES
110	ANNLIN-WES 1
110	ANNLIN-WES 2
112	COLBYN
116	CONSTANTIA PARK
117	CRANBROOKVALE
118	CYNTHIA VALE AH
120	DANVILLE
122	DANVILLE 599-JR
124	DANVILLERAND 464-JR
128	DASPOORT

TOWNCODE	TOWN/SUBURB NAME
128	DASPOORT 1
138	DASPOORT ESTATE
140	DASPOORT 319-JR
144	DE BEERS
148	DEERNESS
150	DELTODIA AH
152	DE ONDERSTEPOORT 300-JR
156	DERDEPOORT 326-JR
160	DERDEPOORT 327-JR
161	DERDEPOORT PARK
162	DERDEPOORT 605-JR
164	DESPATCH
165	DIE HOEWES
166	DIE WILGERS
166	DIE WILGERS 1
166	DIE WILGERS 2
166	DIE WILGERS 3
166	DIE WILGERS 4
166	DIE WILGERS 5
166	DIE WILGERS 6
170	DORANDIA
170	DORANDIA 1
171	DORINGKLOOF
172	DOORNPOORT
172	DOORNPOORT 1
172	DOORNPOORT 2
172	DOORNPOORT 3
174	DOORNPOORT 295-JR
175	DOORNKLOOF 391-JR
176	EAST LYNNE
177	EASTCLYFFE
179	EASTWOOD
192	EERSTERUST INDUSTRIAL
196	EERSTERUST
198	EKKLESIA
199	ELANDSFONTEIN 352-JR
200	ELARDUSPARK
200	ELARDUSPARK 1
200	ELARDUSPARK 2
201	ELARDUS PARK 443-JR
202	ELANDSPOORT 357-JR
203	ELANDSPOORT
204	ELOFFSDAL
204	ELOFFSDAL 1
205	ELDORAIGNE
212	ELOFF ESTATE 320-JR
214	ELZIMARI
216	ERASMIA
220	ERASMIA 350-JR
221	ERASMUSKLOOF
222	ERASMUSPARK

TOWNCODE	TOWN/SUBURB NAME
224	ERASMUSRAND
226	FAERIE GLEN
226	FAERIE GLEN 1
226	FAERIE GLEN 2
226	FAERIE GLEN 3
226	FAERIE GLEN 4
226	FAERIE GLEN 5
226	FAERIE GLEN 6
227	FLORAUNA
228	FRANSPOORT 332-JR
229	FORT
230	GARSTKLOOF 595-JR
232	GARSTFONTEIN 374-JR
236	GARSTON AH
238	GARSFONTEIN
238	GARSFONTEIN 1
240	GEORGEVILLE
241	GERHARDSVILLE AH
244	GEZINA
248	GLEN LAURISTON
260	GROENKLOOF
268	GROENKLOOF 358-JR
272	HATFIELD
276	HAZELWOOD
280	HARTEBEESTFONTEIN 324-JR
284	HARTEBEESTPOORT 328-JR
288	HARTEBEESTPOORT 362-JR
292	HATHERLEY 331-JR
294	HEATHERDALE
295	HENNOPSPARK
296	HERMANSTAD
297	HEUWELOORD
298	HIGHVELD
300	HILLCREST
301	IRENE
303	KASTEEL 609-JR
304	PRETORIA INDUSTRIAL
305	JAN NIEMANDPARK
306	KENLEY AH
307	KILBERRY
308	KILNER PARK
309	DERDEPOORT 615-JR
310	KIRKNEY
310	KIRKNEY 1
310	KIRKNEY 2
311	KLOOFZICHT
312	KOEDOESNEK 341-JR
315	KOEDOESPOORT
316	KOEDOESPOORT INDUSTRIAL
320	KOEDOESPOORT 325-JR
322	KOEDOESPOORT 456-JR

TOWNCODE	TOWN/SUBURB NAME
326	KOLLEGERAND 600-JR
328	KOPKRAP 316-JR
330	KOSMOSDAL
332	KOZENI AH
336	KWAGGASRAND
340	LA CONCORDE
342	LA MONTAGNE
342	LA MONTAGNE 1
342	LYNNWOOD RIDGE
346	LA MONTAGNE 426-JR
348	LAUDIUM
352	LEKKERHOEKIE 411-JR
354	LEKKERHOEKIE 450-JR
356	LES MARAIS
359	LINDO PARK
359	LINDOPARK
362	LISDOGAN PARK
364	LUKASRAND
368	LYDIANA
372	LYNNRODENE
376	LYNNWOOD
384	LYNNWOOD GLEN
385	LYTTELTON AH
386	LYNNWOOD PARK
387	LYTTELTON MANOR
388	LYNNWOOD MANOR
389	LYNNWOOD RIDGE
389	LYNNWOOD RIDGE 1
390	SAS LAAITEREINE
391	SAS SPOORWEGSTASIES
392	MAGALIESKRUIN 323-JR
393	MAGALIESKRUIN
393	MAGALIESKRUIN 1
393	MAGALIESKRUIN 2
393	MAGALIESKRUIN 3
393	MAGALIESKRUIN 4
393	MAGALIESKRUIN 5
394	MAMELODI SUN VALLEY
400	MAMELODI
400	MAMELODI 1
400	MAMELODI 2
401	MAHUBE VALLEY
401	MAHUBE VALLEY 1
403	MAMELODI 608-JR
404	MAROELANA
406	MARLENA AH
412	MAYVILLE
418	MENLO PARK
418	MENLYN
418	MENLYN 1
424	MEYERSPARK

TOWNCODE	TOWN/SUBURB NAME
424	MEYERSPARK 1
425	MNANDI AH
426	MONAVONI AH
432	MONRICK AH
434	MONTANA
434	MONTANA 1
434	MONTANA 2
434	MONTANA 3
434	MONTANA 4
434	MONTANA 5
434	MONTANA 6
436	MONTANA AH
442	MONTANA TUINE
442	MONTANA TUINE 1
442	MONTANA TUINE 2
442	MONTANA TUINE 3
442	MONTANA TUINE 4
444	MONUMENTPARK
444	MONUMENTPARK 1
456	MOREGLOED
460	MOOIPLAATS 355-JR
464	MOPANI 342-JR
466	MORELETAPARK
466	MORELETAPARK 1
466	MORELETAPARK 2
466	MORELETAPARK 3
466	MORELETAPARK 4
466	MORELETAPARK 5
466	MORELETAPARK 6
467	MORETELE VIEW
468	MOUNTAIN VIEW
476	MUCKLENEUK
484	MURRAYFIELD
488	MURRAYFIELD 343-JR
492	NAVORS
494	NELLMAPIUS
496	NEWLANDS
498	MOOIKLOOF
500	NIEUW MUCKLENEUK
504	NICOMAR
505	OLIEVENHOUTBOS AH
512	ONDERSTEPOORT AH
516	PARK TOWN ESTATE
520	PIENAARSPOORT 339-JR
522	RIETVALLEIPARK
524	PTA T&T/LANDS 346-JR
528	PTA T&T/LANDS 351-JR
530	PREDUSTRIA
532	PRETORIA NORTH
536	PRETORIA
536	PRETORIA 1

TOWNCODE	TOWN/SUBURB NAME
544	PRETORIA GARDENS
550	PRETORIUSPARK
550	PRETORIUSPARK 1
554	PRINSHOF 280-JR
556	PRINSHOF 349-JR
560	PROCLAMATION HILL
564	PUMULANI AH
568	QUEENSWOOD
569	RASLOUW AH
570	ROOIHUISKRAAL
572	TILEBA
580	RIETFONTEIN
584	RIETFONTEIN 321-JR
586	RIETFONTEIN 375JR
588	RIETONDALE
590	RIETVALLEIRAND
590	RIETVALLEIRAND 1
592	RIETVALLEI 377-JR
604	RIVIERA
606	ROOIWAL
608	ROSEVILLE
616	SALIESHOEK
617	SALVOKOP
618	SAULSVILLE
620	SCHURVEBERG 488-JQ
624	SCIENTIA 416-JR
625	SCIENTIA 606-JR
626	SCIENTIA 627-JR
628	SILVERTON
628	SILVERTON 1
628	SILVERTON 2
628	SILVERTON 3
628	SILVERTON 4
628	SILVERTON 5
628	SILVERTON 6
630	SELBORNE 222-JR
632	SILVERTONDALE
633	SIMARLO AH
640	SINOVILLE
640	SINOVILLE 1
644	SKOUGRONDE 648-JR
646	SKINNER COURT 254-JR
647	SKUILKRANS AH
648	SKURWEPLAAS 353-JR
649	SOSHANGUVE
652	STRULANDS AH
658	SUIDERBERG
659	SUNDERLAND RIDGE
660	SUNNYSIDE
661	SUNDERLAND RIDGE AH
662	SUNSET VIEW AH

TOWNCODE	TOWN/SUBURB NAME
665	TAMARA PARK
667	THE REEDS
668	THE WILLOWS 340-JR
669	TIMSRAND AH
670	TOWNLANDS
672	TRANSPARK 639-JR
676	TREVENNA
678	TWEEFONTEIN 372-JR
680	VAL-DE-GRACE
680	VAL-DE-GRACE 1
688	VALHALLA
692	VALLEY FARM AH
694	VERWOERDBURGSTAD
695	VILLAROSA
696	VALLEY FARM 379-JR
700	VILLIERIA
708	VLAKFONTEIN 329-JR
710	VOORTREKKERHOOGTE
712	WALTLOO
713	WALTLOO 667-JR
714	WAPADRAND
714	WAPADRAND 1
714	WAPADRAND 2
714	WAPADRAND 3
716	WATERKLOOF
724	WATERKLOOF 345-JR
725	WATERKLOOF 360-JR
726	WATERKLOOF GLEN
730	WATERKLOOF 376-JR
732	WATERKLOOF 378-JR
734	WATERKLOOF 428-JR
736	WATERKLOOF AH
738	WATERKLOOF HEIGHTS
738	WATERKLOOF HEIGHTS 1
740	WATERKLOOFPARK
744	WATERKLOOF RIDGE
752	WAVERLEY
758	WEAVIND PARK
759	WEBLYNN AH
760	WEST PARK
761	WINGATE PARK
762	WIERDA PARK
764	WILLOWBRAE AH
768	WILLOWGLEN AH
772	WILLOW PARK AH
773	WILLOW PARK MANOR
773	WILLOW PARK MANOR 1
773	WILLOW PARK MANOR 2
773	WILLOW PARK MANOR 3
773	WILLOW PARK MANOR 4
774	WITFONTEIN 301-JR

TOWNCODE	TOWN/SUBURB NAME
775	WITKOPPIES 393-JR
776	WOLMARANSPOORT AH
780	WOLMER
784	WONDERBOOM AH
786	WONDERBOOM
792	WONDERBOOM 302-JR
798	HIGH TENSION ACCOUNTS
800	WONDERBOOM SOUTH
804	ZANDFONTEIN 317-JR
808	ZWARTKOP 356-JR
810	ZWARTKOPPIES 364-JR
811	ZWARTKOP
834	HORNSOORD AH
835	LEOKAVILLE AH
836	MONT LORRAINE AH
837	MAGALIESMOOT AH
838	OLYMPUS AH
839	PYRAMID AH
841	RYNOUE AH
842	SHERE AH
843	SWACINA PARK AH
844	SWARTKOP 383-JR
849	SILVER LAKES
851	HONINGNESTKRANTS 269-JR
852	ROOIWAL 270-JR
853	VASTFONTEIN 271-JR
854	GROOTVLEI 272-JR
855	WATERVAL 273-JR
856	PYLPUNT 276-JR
857	HAAKDOORINGBOOM 277-JR
858	KAMEELDRIFT 294-JR
860	ZEEKOEGAT 296-JR
861	KAMEELFONTEIN 297-JR
862	KAMEELDRIFT 298-JR
863	LEEUFONTEIN 299-JR
865	KAMEELDRIFT 313-JR
866	BOEKENHOUTSKLOOF 315-JR
870	TYGER VALLEY 334-JR
872	VLAKPLAATS 354-JR
876	MOOIPLAATS 367-JR
877	KLEINFONTEIN 368-JR
879	ZWAVELPOORT 373-JR
881	ONBEKEND 398-JR
901	KRUISFONTEIN 259-JR
902	KRUISFONTEIN 262-JR
903	TRIANGLE 264-JR
904	ONDERSTEPOORT 266-JR
905	HAAKDOORNBOOM 267-JR
906	KLIPFONTEIN 268-JR
907	BEETGESBERG 279-JR
908	HERMON 289-JR

TOWNCODE	TOWN/SUBURB NAME
910	HARTEBEESTHOEK 303-JR
911	VREDE 304-JR
912	WITFONTEIN 305-JR
913	STRYDFONTEIN 306-JR
914	STRYDFONTEIN 307-JR
915	HARTEBEESTHOEK 312-JR
941	DOREG AH
943	KLERKSOORD
944	WINTERNEST AH
945	ROSSLYN AH
946	PATRYSHOEK AH
947	FUNDUS AH
971	AMANDASIG
972	CHANTELLE
973	CLARINA
974	ELDORETTE
975	HESTEAPARK
976	KARIN PARK
977	NINAPARK
978	ROSSLYN
979	THERESAPARK
980	THE ORCHARDS

11.2.1.2 ERF NUMBER

As discussed in 11.1.1.1.5 Erven form the most detailed cadastral divisions in the Pretoria town-planning scheme. Each ERF in a given town area is identified by means of a five-character text field comprising mostly, but not exclusively of numeric characters.

Many ERVEN share the same Erf Number, but no two erven in the same town area have the same number.

11.2.1.3 PORTION

The portion number is a six-character text field, and denotes the sub-division number of any given erf.

The numeric system of cadastral sub-division functions as follows. All erven that have not been subdivided do not possess a portion code. The GIS system substitutes this code with a "null" value. When an erf is subdivided into two, the larger portion receives a portion code of /1 and the smaller portion receives a portion code of /R (remainder). If the /1 portion receives a further subdivision, its code becomes /1/1 and the smaller portions code becomes /1/R and so on.

11.2.2 CITY COUNCIL ZONING INFORMATION

This section details the available zoning information that the CCP database contains. As discussed in section 3.2.11.2, this information is pieced together to generate land use zoning controls.

11.2.2.1 DETAIL OF THE CITY COUNCIL DATA FIELD "ZONING"

This data field comprises 26 possible zoning types. Each land parcel receives a single zoning type with an associated ID number. Numeric zoning ID's are used to reduce the working size of the GIS database.

11.2.2.1.1 EVALUATION OF THE ZON_CODE VALUES IN THE TOWN PLANNING SCHEME

The first step in developing OA control ratings is to apply a blanket evaluation based on ZON_CODE. Each of the 26 ZON_CODE categories receives an OA value of MAXIMUM, or MINIMUM control. This value is stored in the CCP_CNTRL field of the evaluation query.

Notably, none of the categories receives a PARTIAL control value. Consolidating control values into two classes prevents fragmentation. (IGIS (PTY) LTD. 1999)

All control values shown in Table 14 have been through a series of public work-shops run by the DOACCP. Primary motives behind the evaluation are in keeping with guidelines provided by SAMOAC. Each zone code was then evaluated and where sufficient merit existed, deviations from the SAMOAC document were put in place (Rofail 1999).

Of particular interest are land parcels zoned 14, SPESIAAL. This is a zoning class that contains special residential, special business and special institutional. As a result of the mixed used found in this zoning class, it was impossible to assign a single control value. These areas received a ZON_CODE control value of NONE, and the ZONING INTERPRETATION field of the City Council Database replaced the ZON_CODE field to generate control ratings for each of the land parcels with a ZON_CODE of 14. A detailed discussion of this process is covered in section 11.2.2.2.1.

TABLE 14: ZONE CODE EVALUATIONS

ZON_CODE	DESCRIPTION	CCP_CNTRL
1	SPESIALE WOON	MAX
2	GROEPSBEHUISING	MAX
3	DUPLEKSWOON	MAX
4	ALGEMENE WOON	MAX
5	OPVOEDKUNDIG	MAX
6	INRIGTING	MAX
7	SPESIALE BESIGHEID	MIN
8	ALGEMENE BESIGHEID	MIN
9	MUNISIPAAL	MAX
10	STAAT	MAX
11	BEPERKTE NYWERHEID	MIN
12	ALGEMENE NYWERHEID	MIN
13	LANDBOU	MAX
14	**SPESIAAL**	**NONE**
15	ONBEPAALD	MAX
16	BESTAANDE STRATE	STRAAT
17	NUWE STRATE & VERBREDINGS	STRAAT
18	BEST. OPENBARE OOPRUIMPTE	MAX
19	VOORGEST. OPENBARE OOPRUIMPTE	MAX
20	BEST. PRIVAAT OOPRUIMPTE	MAX
21	VOORGEST. PRIVAAT OOPRUIPTE	MAX
22	DORPSTIGTINGSGEBIEDE	MAX
23	RIOOLSLYKWERKE	MAX
24	BEGRAAFPLAAS	MAX

ZON_CODE	DESCRIPTION	CCP_CNTRL
25	VLIEGVELD	MAX
26	SUID AFRIKAANSE SPOORWEE	SPOORWEE

The following zone codes have been added to deal with errors in the City Council Database.

TABLE 15: ADDITIONS TO THE ZONE_CODE TABLE TO CATCH ERRORS

ZON_CODE	DESCRIPTION	CCP_CNTRL
0	RECORD VALUE IS ZERO	ZCODE_0
29	RECORD WITH A NULL VALUE (REPLACED MANUALLY WITH 29)	ZCODE_NUL

All records with a value of Zero were zoned as 'ZCODE_0'.

All records with a "Null" value were filled with a ZONE_CODE of 29, and received a zoning of ZCODE_NUL.

The objective of this was to handle rather than ignore the error. If not put in place, the evaluations performed at a later time would not know what to do with these records, and they would be omitted.

11.2.2.2 DETAIL OF THE CITY COUNCIL DATA FIELD "ZONING INTERPRETATION"

This data field comprises ninety-four possible values. The CCP assign each land parcel with a single ZONING_INTERPRETATION type. As with ZON_CODE, the CCP have substituted each of the ninety-four text values with numeric ID's in an attempt to reduce the working size of the GIS database.

11.2.2.2.1 EVALUATION OF THE ZON_INT VALUES IN THE TOWN PLANNING SCHEME

The CCP_CNTRL field contains control values similar to those suggested by SAMOAC.

As with the ZON_CODE table, the DOACCP assigned and linked each of the ninety-four ZON_INT categories with either a MAXIMUM or MINIMUM control rating. Values of PARTIAL control were not assigned to any of the ZON_INT categories. Consolidating control values into two classes prevents fragmentation.

All control values shown here have been publicly work-shopped by the Department of Outdoor Advertising at the City Council of Pretoria. Primary motives behind the evaluation are in keeping with guidelines provided by SAMOAC. Each ZONING_INTERPRETATION was then evaluated and where sufficient merit existed, deviations from the SAMOAC document were put in place.

TABLE 16: ZONING INTERPRETATION EVALUATIONS

ZON_INT	DESCRIPTION	CCP_CNTRL
AD	ADMINISTRATEURSGOEDKEURING	MAX
ASF	ASFALT-VERVAARDIGING	MIN
AT	ATELJEE	MAX
BD	BUSDEPOT	MIN
BEL	BELANDSKAPPING	MAX
BIB	BIBLIOTEEK	MAX
BIER	BIERTUIN/SAAL	MIN
BR	BROUERYE	MIN
CRE	CRECHE	MAX
DHOS	DIEREHOSPITAAL	MAX
DU	DUET	MAX
DW	DUPLEKS WOON	MAX
FIS	FISIOTERAPEUTIESE SENTRUM	MAX
GAS	GASTEHUIS	MAX
GD	GODSDIENSDOELEINDES	MAX
GEM	GEMEENSKAPSDOELEINDES	MAX
GES	GESELLIGHEID	MIN
GIM	GIMNASIUM	MAX
GO	GESONDHEIDSOORD	MAX
GRAF	BEGRAAFPLAAS	MAX
GSM	GRAFSTEENMAKERY	MIN
HOS	HOSPITAAL	MAX
HOT	HOTEL	MAX
HS	HOERSKOOL	MAX
IN	INRIGTING	MAX
INRY	INRY	MIN
KA	KANTORE	MAX
KIN	KINDERBESKERMINGSEENHEID	MAX
KLI	KLINIEK	MAX
KLU	KLUB	MAX
KO	KOMMERSIEEL	MIN
KON	KONFERENSIEGERIEWE	MAX
KUL	KULTUURSENTRUM	MAX
KUN	KUNSGALLERY	MAX
KWE	KWEKERY	MIN
LB	LANDBOU	MAX
LS	LAERSKOOL	MAX
MDS	MOTORDIENSSENTRUM	MIN

ZON_INT	DESCRIPTION	CCP_CNTRL
MDW	MEDIUMDIGTHEIDWOONEENHEDE SIMPLEKS EN DUPLEKS GEMENG)	MAX
MED	MEDIESE SPREEKKAMERS	MAX
MODS	MODELSKOOL	MAX
MOT	MOTORVERKOPE	MIN
MRB	MOTORRENBAAN	MAX
MSW	MOTORSLOOPWERF	MIN
MU	MUNISIPAAL	MAX
MUS	MUSEUM	MAX
MW	MOTORWAS	MIN
NAT	NATUURRESERVAAT	MAX
NAV	NAVORSING	MAX
NYW	NYWERHEID	MIN
OG	OPENBARE GARAGE	MIN
ONB	ONBEPAALD	MAX
OP	OPVOEDKUNDIG NIE HOER- OF LAERSKOOL)	MAX
OR	OOPRUIMPTE	MAX
OU	OUETEHUIS	MAX
PA	PARKERING	MIN
PAD	BESTAANDE STRAAT	STRAAT
PAK	PAKHUIS	MIN
PAR	PARKEERTERREINE	MIN
POS	POSKANTOORDOELEINDES	MAX
PVD	PADVINDERS	MAX
REK	COMPUTER DIENSTE	MIN
RES	RESTAURANT	MIN
SG	STADSRAADGOEDKEURING	MAX
SIM	SIMPLEKS	MAX
SLAG	SLAGHUIS	MIN
SPR	SPOOR	MIN
SPT	SPORTKOMPLEKS	MAX
SPV	SPORTVELD	MAX
SPY	SPYSENIERING	MIN
SR	STADSRAAD	MAX
ST	STAAT	MAX
STO	STORTINGSTERREIN	MAX
SWG	SWART GEBIEDE	MAX
TB	TUINBOU	MAX
TEG	TEGNOPARK	MAX
TEL	TELEFOONSENTRALE	MAX
TGB	TOEGANGSBEHEER	MAX

ZON_INT	DESCRIPTION	CCP_CNTRL
TOE	TOEGANG	MAX
TOER	TOERISME-OORD	MAX
TS	TUINSENTRUM	MAX
TT	TEETUIN	MIN
TUIN	TUINBOUDOELEINDES	MAX
VEI	?UNKNOWN?	ERR_ZINT
VER	VERVAARDIGING	MIN
VM	VERMAAKLIKHEID	MIN
VT	VOETGANGERSLAAN	MAX
VV	VLIEGVELD	MAX
WE	WOONEENHEDE	MAX
WG	WOONGEBOUE	MAX
WH	WOONHUIS	MAX
WIL	WILD-FASILITEITE	MAX
WM	WINKELSENTRUM	MIN
WS	WOONSTELLE	MAX

On inspection of the CCP database, the ZON_INT categories listed in Table 17 were found to exist in the ZON_INT field. These categories do not correlate with the CCP's predefined ZON_INT options. In order to catch any errors that may result from these erroneous additions, IGIS (PTY) LTD. added descriptions and CCP_CNTRL values for each of the categories. Thus, when the GIS encounters these values, it continues to function smoothly.

TABLE 17: ADDITIONS TO THE ZONE_CODE TABLE TO CATCH ERRORS

ZON_INT	DESCRIPTION	CCP_CNTRL
0	RECORD VALUE IS ZERO	Z_INT_0
0R	?UNKNOWN?	ERR_ZINT
DRUK	?UNKNOWN?	ERR_ZINT
FOT	?UNKNOWN?	ERR_ZINT
KOM	?UNKNOWN?	ERR_ZINT
KRV	?UNKNOWN?	ERR_ZINT
MOD	?UNKNOWN?	ERR_ZINT
R	?UNKNOWN?	ERR_ZINT
R11	?UNKNOWN?	ERR_ZINT
S1M	?UNKNOWN?	ERR_ZINT
SW	?UNKNOWN?	ERR_ZINT
TOEG	?UNKNOWN?	ERR_ZINT
W	?UNKNOWN?	ERR_ZINT

ZON_INT	DESCRIPTION	CCP_CNTRL
W11	?UNKNOWN?	ERR_ZINT
WK	?UNKNOWN?	ERR_ZINT
HOTR	?UNKNOWN?	ERR_ZINT
MUN	?UNKNOWN?	ERR_ZINT
R1	?UNKNOWN?	ERR_ZINT
ROL	?UNKNOWN?	ERR_ZINT
S	?UNKNOWN?	ERR_ZINT
OND	?UNKNOWN?	ERR_ZINT
29	RECORD WITH A NULL VALUE (REPLACED MANUALLY WITH 29)	ZINT_NULL

All records with a value of Zero were zoned as 'ZINT_0'.

All records with a "Null" value were filled with a ZONE_INT of 29, and received a control zoning of ZINT_NULL.

All records shown with a REASON of ?UNKNOWN? are records where the ZON_INT value was entered incorrectly.

The objective of Table 17 was to handle rather than ignore errors. Evaluations performed without error catching causes bugs or even worse, records might be unknowingly omitted.

11.2.2.3 DETAIL OF THE CITY COUNCIL DATA FIELD "LAND_USE"

This data field is undoubtedly the most detailed in terms of varying categories. With approximately one hundred and fifty categories, land_use far exceeded the requirements of SAMOAC in terms of category specification. IGIS (PTY) LTD. performed tests on implementing SAMOAC using land use, and found that the zoning controls were extremely fragmented. A further problem was highlighted in that LAND_USE often supplied information on what was actually happening on the site concerned, be that activity legal or illegal. "SAMOAC needs to be based on legal rather than existing zonings." (Rofail 1999, personal communication). For this reason, LAND_USE was deemed unsuitable for the implementation of SAMOAC.

11.3 GIS DATA AVAILABLE FROM THE CITY COUNCIL OF PRETORIA

In order to better understand the rationale behind the choice of erven as a base level for the development of the GIS system, it is necessary to document the extent of the information available for the various scales and legal boundary units.

11.3.1 ALPHANUMERIC INFORMATION AVAILABLE FOR PLANNING ZONES

Planning Zones are a relatively new set of boundaries instituted to aid the management of the Pretoria City.(CCP GIS Dept 1999)

The planning zones are currently available in REMAP CAD format. The zones have as yet not been featurised (included in the GIS Geobase). No database information is thus available for this feature class. Planning Zones were therefore not suitable to implement SAMOAC (IGIS (PTY) LTD. 1999).

11.3.2 ALPHANUMERIC INFORMATION AVAILABLE FOR TOWN AREAS / SUBURBS

"Dorpsgebiede" or Town Areas is a feature class in the CCP Regis Geobase. Table 18 illustrates the structure and detail of the information available for this feature class.

TABLE 18: DESCRIPTION OF THE AVAILABLE TOWN AREA DATABASE INFORMATION

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
GEOCODE	TEXT	6	INTERNAL CODE USED TO REFERENCE ADDRESS INFORMATION
NUM	INTEGER	3	UNIQUE IDENTIFYER FOR EACH TOWN AREA, USED TO LINK DATABASE TABLE TO GEOBASE FEATURES
NAME	TEXT	30	DETAILED NAME OF THE AREA
EXTENTION	INTEGER	2	USED TO IDENTIFY TOWN AREAS THAT HAVE BEEN SUB DIVIDED OR EXPANDED

Since no zoning information is available for this feature set, it was not considered adequate to develop the GIS.

11.3.3 ALPHANUMERIC INFORMATION AVAILABLE FOR TOWN PLANNING INFORMATION TABLE - (FARMS PLOTS AND ERVEN)

As discussed in section 11.1.1.1 "Discussion of the Various Legislated Cadastral Units Used in the Town Planning Scheme of the City Council of Pretoria" on page 140, farms, plots and erven combined make up the complete spatial coverage of land ownership in Pretoria. This combined coverage forms the basis of cadastral legislation implementation system in the city.

In order to cover the entire Pretoria Municipal region on "cadastral level detail", Geobase information for Farms, Plots, Erven, Farms not registered, Erven not registered, and Plots not Registered need to be viewed as portions of a single coverage.

Thus, when evaluating the CCP Geobase suitability for Cadastral Scale suitability, all six of these datasets need to be evaluated simultaneously.

11.3.3.1 ALPHANUMERIC INFORMATION AVAILABLE FOR FARM PORTIONS AND PLOTS

"VBPL_FRM" or Town Planning of Farm Portions is a feature class in the City Council Regis Geobase. The detail of data in Table 19 is completely adequate to implement SAMOAC in GIS format.

TABLE 19: DESCRIPTION OF THE STRUCTURE AND DETAIL OF AVAILABLE FARM PORTION DATABASE INFORMATION

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
FARMCODE	TEXT	3	PARTIAL GISKEY EQUAL TO THE TOWNCODE THAT THE UNIT IS FOUND IN
PORTION	TEXT	5	PARTIAL GISKEY PROVIDING UNIQUE IDENTITY TO THE UNIT
REMAINDER	TEXT	6	PARTIAL GISKEY PRESENT IF THE FARM PORTION HAS BEEN SUBDIVIDED
LATITUDE	NUMBER	DOUBLE	LO29 LATITUDE OF THE WEIGHT POINT OF THE LAND PARCEL
LONGITUDE	NUMBER	DOUBLE	LO29 LONGITUDE OF THE WEIGHT POINT OF THE LAND PARCEL
STR_NAME	TEXT	30	STREET NAME AS DISPLAYED IN THE PRETORIA STREET ATLAS
STR_NUM	NUMBER	INTEGER	STREET NUMBER AS ASSIGNED BY THE TOWN PLANNING SCHEME
STR_NUM_B	TEXT	1	STREET NUMBER LETTER FOR ENTRANCE A, B ETC.
FARMNUMBER	TEXT	6	ORIGINAL SG CODE AS FOUND ON 1:50 000 TOPOGRAPHIC MAP SERIES
FARMNAME	TEXT	30	DETAILED FARM NAME
EXTENTION	INTEGER	2	NUMERIC VALUE EQUAL TO TOWNCODE EXTENTIONS
LEGAL_AREA	LONG INTEGER	10	AREA IN SQUARE METRES AS DETERMINED BY THE SURVEYOR GENERAL
ZON_CODE	INTEGER	2	ONE OF 26 CATEGORIES PRESENT IN THE TOWN PLANNING SCHEME. ZONING IS THE COURSEST LEVEL OF LAND USE INFORMATION
DENSITY	INTEGER	2	IS A CODE DETAILING THE LEGAL DEVELOPMENT DENSITY FOR THE SITE
COVERAGE	TEXT	2	IS A CODE DETAILING THE MAXIMUM % OF ROOF COVERAGE FOR THE SITE
VRV	TEXT	2	UNKNOWN
HEIGHT	TEXT	2	IS A CODE DETAILING THE MAXIMUM NUMBER OF STOREYS THAT A BUILDING ON THE SITE MAY HAVE
UNITS_PER_HECTARE	INTEGER	2	IS A RATIO DETAILING THE MAXIMUM NUMBER OF STRUCTURES PER ANY ONE HECTARE OR PART THEREOF THAT CAN BE BUILT ON THE SITE
UNITS_ALLOWED	INTEGER	2	IS A NUMBER SPECIFYING THE MAXIMUM NUMBER OF STRUCTURES THAT CAN BE BUILT ON THE SITE
ZONING_INTERPRETATION	TEXT	2	IS A CODE PROVIDING A MORE DETAILED EXPLANATION THAN ZONING, OF THE LEGAL ACTIVITIES THAT CAN BE PERFORMED ON THE SITE
LAND_USE	TEXT	3	IS A CODE PROVIDING A HIGHLY DETAILED EXPLANATION OF THE CURRENT LAND USE THAT A SITE CONTAINS

11.3.3.2 ALPHANUMERIC INFORMATION AVAILABLE FOR ERVEN

Alphanumeric information for ERVEN is more detailed than that for farms and plots. In order to solve the issue covered in section 11.3.3, the two tables can be merged, as the GISKEY information structure is identical for both farms and erven. This fact will make simultaneous cross feature selections possible.

TABLE 20: DESCRIPTION OF THE AVAILABLE ERVEN DATABASE INFORMATION

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
TOWNCODE	TEXT	3	PARTIAL GISKEY EQUAL TO THE TOWNCODE THAT THE UNIT IS FOUND IN
ERFNR	TEXT	5	PARTIAL GISKEY PROVIDING UNIQUE IDENTITY TO THE UNIT
PORTION	TEXT	6	PARTIAL GISKEY PRESENT IF THE ERF HAS BEEN SUBDIVIDED
LATITUDE	NUMBER	DOUBLE	LO29 LATITUDE OF THE WEIGHT POINT OF THE LAND PARCEL
LONGITUDE	NUMBER	DOUBLE	LO29 LONGITUDE OF THE WEIGHT POINT OF THE LAND PARCEL
STR_NAME	TEXT	30	STREET NAME AS DISPLAYED IN THE PRETORIA STREET ATLAS
STR_NUM	NUMBER	INTEGER	STREET NUMBER AS ASSIGNED BY THE TOWN PLANNING SCHEME
STR_NUM_B	TEXT	1	STREET NUMBER LETTER FOR ENTRANCE A, B ETC.
LEGAL_AREA	LONG INTEGER	10	AREA IN SQUARE METRES AS DETERMINED BY THE SURVEYOR GENERAL
DIAGRAM_NR	FTP HOTLINK	13	LINK TO REMAP CAD DRAWINGS OF THE SITES CADASTRAL INFORMATION
EXTENTION	INTEGER	2	NUMERIC VALUE EQUAL TO TOWNCODE EXTENTIONS
GENERAL_PLAN_NR	FTP HOTLINK	12	LINK TO CAD DRAWINGS OF THE SITE LAYOUT AND BUILT STRUCTURES INFORMATION
ZON_CODE	INTEGER	2	ONE OF 26 CATEGORIES PRESENT IN THE TOWN PLANNING SCHEME. ZONING IS THE COURSEST LEVEL OF LAND USE INFORMATION
ANNEX_B	TEXT	9	LINK TO LEGAL INFORMATION RELATING TO THE SITE
DENSITY	INTEGER	2	IS A CODE DETAILING THE LEGAL DEVELOPMENT DENSITY FOR THE SITE
COVERAGE	TEXT	2	IS A CODE DETAILING THE MAXIMUM % OF ROOF COVERAGE FOR THE SITE
VRV	TEXT	2	NO DATA AVAILABLE
HEIGHT	TEXT	2	IS A CODE DETAILING THE MAXIMUM NUMBER OF STOREYS THAT A BUILDING ON THE SITE MAY HAVE
ZONING_INTERPRETATION	TEXT	2	IS A CODE PROVIDING A MORE DETAILED EXPLANATION THAN ZONING, OF THE LEGAL ACTIVITIES THAT CAN BE PERFORMED ON THE SITE
LAND_USE	TEXT	3	IS A CODE PROVIDING A HIGHLY DETAILED EXPLANATION OF THE CURRENT LAND USE THAT A SITE CONTAINS
RIGHTS	TEXT	2	IS A CODE LINKING TO LEGAL ASPECTS RELATING TO USAGE RIGHTS ON THE SITE
USE	TEXT	2	IS A CODE RELATING TO PERMITTED USES ON THE SITE

OWNERSHIP	TEXT	2	PARTIAL GISKEY LINKING TO THE OWNERSHIP AND TITLE DEEDS FOR THE SITE
TAX	TEXT	2	PARTIAL GISKEY LINKING TO THE TAXATION INFORMATION FOR THE SITE
IMPROVED_VALUE	NUMBER	LONG INTEGER	VALUE IN RANDS OF THE SITE AND BUILD STRUCTURES
SITE_EVALUATION	NUMBER	LONG INTEGER	VALUE OF THE SITE EXCLUDING THE VALUE OF BUILD STRUCTURES

11.3.3.3 ALPHANUMERIC INFORMATION AVAILABLE FOR SUB ZONING

Alphanumeric information for SUB ZONINGS is only available for a handful of ERVEN, PLOTS and FARM PORTIONS. SUB ZONINGS carry the identical set of information as that shown in Table 20.

SUB ZONINGS are identified by means of a two character partial GISKEY added onto the end of the 14 character long COMPOUND GISKEY.

The SUB ZONING tables cannot be merged with the ERVEN, PLOTS and FARMS tables, as the GISKEY information structure is different. This fact makes simultaneous cross feature selections impossible. Should Sub Zoning information be incorporated, a parallel database system would need to be developed similar to the one shown in Figure 13.

11.3.3.4 ALPHANUMERIC INFORMATION AVAILABLE FOR ROADS

The street information for Pretoria is available in the form of a LINE feature class, delineating the road centrelines. Table 20 details the information available for this feature class.

TABLE 21: DESCRIPTION OF THE AVAILABLE STREETS DATABASE INFORMATION

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
LINKNR	TEXT	6	UNIQUE GISKEY LINKING THE DATABASE TO THE GEOBASE
SUBURB	TEXT	30	TEXT DESCRIPTION OF THE TOWNCODE
STREETNAME	TEXT	30	TEXT NAME OF THE STREET AS IT APPEARS IN THE PRETORIA STREET GUIDE
BEGINSTREET	NUMBER	30	TEXT NAME OF THE STREET THAT THIS STREET INTERSECTS AT ITS START
ENDSTREET	NUMBER	30	TEXT NAME OF THE STREET THAT THIS STREET INTERSECTS AT ITS END
LENGTH	NUMBER	LONG INTEGER	LENGTH OF THE STREET IN METRES
WIDTH	NUMBER	LONG INTEGER	WIDTH OF THE STREET IN METRES

11.4 KNOWN ERRORS AND OMISSIONS IN THE CITY COUNCIL GIS DATABASE

In order to evaluate whether the GIS is generating accurate outdoor advertising zoning controls and associated display opportunities, the baseline data being fed into the system needs to be checked for accuracy and datedness.

It must be understood that any database will have a margin of error or out datedness (Wachowitz, 1999). Errors present need to be highlighted so that procedures written to "self correct" the system can be evaluated. This is known as error catching.

Included in the list of errors is data or features that have been omitted.

The IGIS (PTY) LTD. team noted the following errors during the projects development.

11.4.1 DATA BASE ERRORS

Duplicate records exist, (records where GISKEY's are identical). In general duplicates do not present a major problem, but errors do arise when the information is edited in one of the records and not any of the other duplicates. REGIS functions best with a one to one relationship between spatial features and non-spatial records (IGIS (PTY) LTD. 1999). Although not documented in this dissertation, routines were developed by the author to correct the problems. This SQL queries have been forwarded to the relevant staff at the CCP.

11.4.2 GEO-BASE ERRORS

In terms of the theoretical model of the town planning scheme, any one point in the Metropolitan Area can only be exclusively an erf a plot or a farm (CCP GIS Dept. 1999). On investigation, areas were found with zonings for more than one cadastral unit type. This is as a result of farm and plot boundaries not being removed once sub-division into erven has taken place. (CCP GIS Dept. 2000)

Areas exist where: ERVEN, FARMS, PLOTS, ERVEN NOT REGISTERED, FARMS NOT REGISTERED and PLOTS NOT REGISTERED overlap.

IGIS (PTY) LTD. is currently contracted to correct these problems, and the databases and Geobases at the CCP should be corrected by November 2000.

Further errors in the Geobase were encountered when repacking and re-indexing operations were performed. These errors cause complex selection procedures involving cross border feature sets to crash.

11.4.3 LAND PARCELS NOT REGISTERED

Many of the land parcels, particularly Farm Portions do not have any alphanumeric information whatsoever. This is due to the fact that the City Council of Pretoria suffered a severe fire during the data capture phase of the GIS systems development. Much of the original paper based information was burned before it could be digitised.

Three feature sets, labelled ERF NOT REGISTERED, PLOT NOT REGISTERED and FARM NOT REGISTERED were created by the landplaning department at the CCP to highlight areas that do not have any information (CCP GIS Dept. 1999). These feature sets form part of the CCP Geobase.

11.4.4 MISSING ZONING AND ZONING INTERPRETATION INFORMATION

Many of the land parcels are missing zoning code and zoning interpretation information. SQL Update queries were developed as part of this study to generate zoning code and zoning interpretation information. A new category, 29, was inserted into all empty database cells in these two fields. The value 29 was then used in further queries that required either zon-code or zoning interpretation information. This error catching procedure generates advertising controls and reasons where required.

This is partially due to the fact that this information is removed when sub-zonings are implemented. This principle however has been applied haphazardly and there are many areas where data is either missing or was not removed. These two fields will be used extensively in the GIS system development and error-catching procedures will be required to ensure the system is comprehensive (CCP GIS Dept. 1999).

11.4.5 DATEDNESS OF THE GIS SYSTEM

The nature of a Town Planning Scheme is that it is dynamic (Wachowitz 1999). Continuous updating of the GIS system to process re-zoning and sub division applications is required. The City Council of Pretoria's GIS database is anything from two weeks to eighteen months behind schedule, and many land use changes have occurred that are not present on the GIS system.

11.4.6 LAND PARCELS LABELLED AS "ONBEPAALD"

Many areas are zoned ONBEPAALD (Not Yet Established). These areas present a problem in that they have no system whereby zoning can be ascertained (CCP GIS Dept. 1999). The result is large tracts of land that have to be zoned MAXIMUM control so as to maintain a precautionary approach (IGIS (PTY) LTD. 2000).

12 ANNEXURE D - DATA FROM THE IGIS (PTY) LTD. CONSULTANTS

This ANNEXURE provides explanations of each of the elements of the GIS database presented in Figure 13: Data Flow Diagram of the GIS on page 159.

Figure 13 is to be used as a reference for 12.8, 12.9 and 12.10.

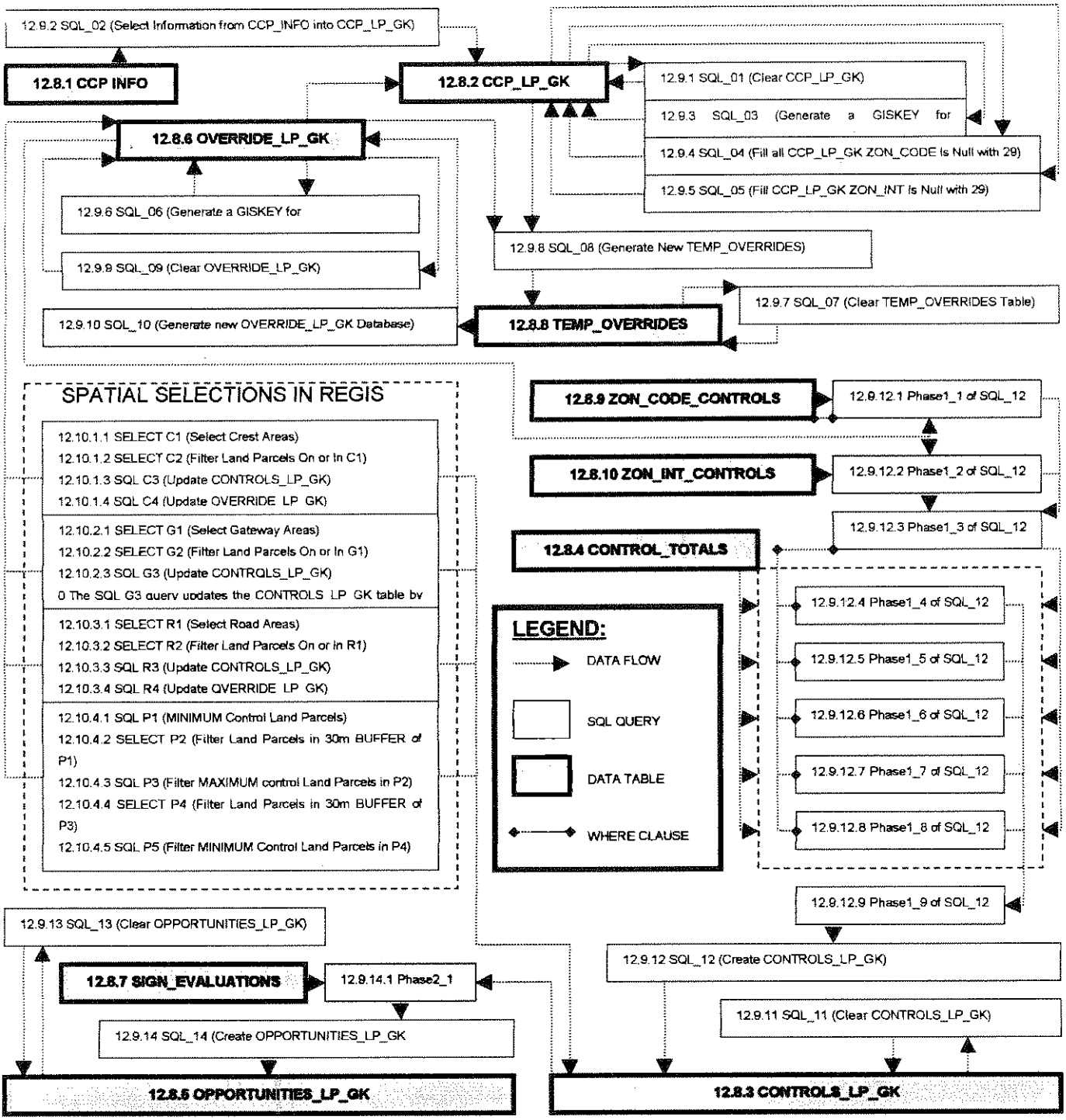

FIGURE 13: DATA FLOW DIAGRAM OF THE GIS

The remaining sections in this chapter provide a brief explanation of the objects and processes shown in Figure 13. Cross-references to each of the objects and processes are provided so that a more detailed understanding of the system can be attained if necessary.

12.1 DATA RECEIVED FROM THE PRETORIA CITY COUNCIL

Tabular Data in *.DBF format is received from the Pretoria City Council as detailed in 11.2 on page 141 (See 12.8.1 CCP INFO on page 164 for a detailed explanation of the relevant fields in the *.DBF table).

The data received requires pre-processing to manipulate it into a tabular format optimised for the database system detailed in Figure 13.

First, a table is prepared to receive the City Council Information. (See 12.9.1 SQL_01 (Clear CCP_LP_GK) on page 174.) 12.9.2 SQL_02 (Select Information from CCP_INFO into CCP_LP_GK) on page 174 details how the City Council information is inserted into item 12.8.2, labelled CCP_LP_GK on page 165.

12.2 GENERATE A GISKEY FOR THE CITY COUNCIL INFORMATION

The data provided by the City Council of Pretoria contains a compound GISKEY as illustrated in Table 19. In order to easily identify each land parcel, a unique, single field GISKEY needs to be generated.

Once item 12.8.2 (CCP_LP_GK) has been populated by means of item 12.9.2 SQL_02 (Select Information from CCP_INFO into CCP_LP_GK) on page 174, a GISKEY is generated using the SQL process detailed in section 12.9.3, SQL_03 (Generate a GISKEY for CCP_LP_GK) on page 174.

12.3 BACKUP OF CONTROLS

This phase is only applicable for updates to the zoning control system. It is assumed that the process of updating will be required, and any manual controls or updates need to be maintained (not erased during zoning control generation). For this reason a method of backup has been designed that maintains any manual overrides implemented between updates. These overrides can be removed (or updated) during the spatial selections performed with REGIS, as detailed in item 12.10, Implementation of additional "Environmental Overrides" on page 183.

Two data tables are used in the backup process, item 12.8.6, OVERRIDE_LP_GK on page 169 and item 12.8.8,
TEMP_OVERRIDES on page 172. The procedure of backup is as follows.

Data table 12.8.6, OVERRIDE_LP_GK has a GISKEY generated for each of its records using query 12.9.6, detailed on page 175.

In order to deal with ZON_CODE records that are empty, the SQL query detailed in item 12.9.4 labelled SQL_04 (Fill all CCP_LP_GK ZON_CODE Is Null with 29) performs an error catching routine that fills all empty ZON_CODE records with the value 29. 29 is an arbitrary number selected to fall outside of the values 0 to 26 which are already in use in the ZON_CODE field (see item 12.8.9 for more detail).

In order to deal with ZON_INT records that are empty, the SQL query detailed in item 12.9.5 labelled SQL_05 (Fill CCP_LP_GK ZON_INT Is Null with 29) performs an error catching routine that fills all empty ZON_INT records with the value 29. 29 is an arbitrary number selected to fall outside of the text values which are already in use in the ZON_INT field (see item 12.8.10 for more detail).

SQL_06 (Generate a GISKEY for OVERRIDE_LP_GK) detailed on page 175 and Query 12.9.7, SQL_07 (Clear TEMP_OVERRIDES Table) (see page 175) are run to prepare item 12.8.8, TEMP_OVERRIDES to receive backup information. Query 12.9.8, SQL_08 (Generate New TEMP_OVERRIDES) detailed on page 176 selects all the records from the backed up information in data table 12.8.6, OVERRIDE_LP_GK and adds any records from data table 12.8.2, CCP_LP_GK that are not found in item 12.8.6, OVERRIDE_LP_GK and inserts them into data table 12.8.8, TEMP_OVERRIDES. Thus a full dataset of all original zoning control information and any new records requiring zoning control information are created in data table 12.8.8, TEMP_OVERRIDES without producing duplicate records.

Once the new temporary data set (populated data table 12.8.8, TEMP_OVERRIDES) has been created, the old backup can be cleared. This is done with query 12.9.9, SQL_09 (Clear OVERRIDE_LP_GK). Once data table 12.8.6, OVERRIDE_LP_GK has been cleared; the temporary data from data table 12.8.8, TEMP_OVERRIDES is copied across to data table 12.8.6, OVERRIDE_LP_GK using query 12.9.10, SQL_10 (Generate new OVERRIDE_LP_GK Database).

GISKEYS for 12.8.6, OVERRIDE_LP_GK are then generated, using query 12.9.6, SQL_06 (Generate a GISKEY for OVERRIDE_LP_GK).

The backup procedure is now complete, and any records added since the previous updates are incorporated in data table 12.8.6, OVERRIDE_LP_GK. This data table is now ready to be used in the generation of level one zoning controls.

12.4 LEVEL ONE CONTROLS, BASED ON THE CITY COUNCIL LAND ZONING

Level one controls are based solely on the land use zonings information contained in the CCP GIS Geobase. After several months of testing, IGIS (PTY) LTD. came to the conclusion that the

following set of procedures would most effectively utilise the land use data in terms of the guidelines set out in the SAMOAC document.

12.4.1 ZON_CODE

The ZON_CODE field data is used to provide the first level of land use based zoning controls.

The data table in item 12.8.9, ZON_CODE_CONTROLS is inner right joined to the data table in item 12.8.6, OVERRIDE_LP_GK, (discussed in item 12.3 contains an updated set of land use controls) by means of the data query detailed in item 12.9.12.1, Phase1_1 of SQL_12. All classes are right joined except for those where ZON_CODE is equal to 14. This class is labelled as "special" and contains a variety of re-zoning information.

12.4.2 REASONS WHY ZONING ON ITS OWN IS NOT SUFFICIENT TO IMPLEMENT SAMOAC

ZON_CODE class 14 contains land parcels that range from special residential to special commercial. This class contains many of the land parcels that have, for one reason or another been rezoned. As a result of the variety of often conflicting land uses (in terms of SAMAOC), no single value of MAXIMUM, PARTIAL or MINIMUM control can be allocated to this class. It is this reason that requires the use of ZON_INT information.

12.4.3 ZON_INT CONTROLS

As with item 12.4.1, an SQL query is used to right join (link) data to the 12.8.6, OVERRIDE_LP_GK data table. In this case, ZON_INT information is linked by using 12.9.12.2, Phase1_2 of SQL_12 to right join data table 12.8.10, ZON_INT_CONTROLS onto data table 12.8.6, OVERRIDE_LP_GK. A "where clause" is instituted to limit the join procedure to only those records with ZON_CODE equal to 14. This way, when recombined using the union query 12.9.12.3, SQL_14 (Create OPPORTUNITIES_LP_GK), a full data set with no duplicates is recreated.

Since the data queries reference and "Call" data from one another, running data query 12.9.12.3 will generate a table that lists each land parcel, and provides a DOACCP land use control of either MAXIMUM, PARTIAL or MINIMUM control for each of the land parcels. The next stage of development is to incorporate the Environmental Overrides discussed in item 12.10, Implementation of additional "Environmental Overrides".

12.5 LEVEL TWO CONTROLS THAT IMPLEMENT SPATIAL OVERRIDES

As discussed in item 12.10, REGIS is used to implement environmental overrides. Each land parcels is given a true or false value for CRESTS, GATEWAYS, ROADS and PROXIMITY CONTROLS. The generation of level two controls entails the automatic conversion, ranking and evaluation of the various combinations of TRUE and FALSE values for the environmental

overrides, to arrive at a final set of OA ZONING CONTROLS. From this final set of ZONING CONTROLS,a thematic map of finalised MAXIMUM, PARTIAL and MINIMUM control ratings is generated.

12.5.1 CRESTS

SQL data query 12.9.12.4, Phase1_4 of SQL_12 on page 178, selects all land parcels where CREST is MAXIMUM (TRUE), and inner joins data table 12.8.4, CONTROL_TOTALS on page 166 to data selected "Called" from item 12.9.12.3, Phase1_3 of SQL_12.

12.5.2 GATEWAYS

SQL data query 12.9.12.5, Phase1_5 of SQL_12 on page 178, selects all land parcels where GATEWAYS is MAXIMUM (TRUE) and CRESTS is FALSE (the CRESTS <> MAX clause is inserted to prevent duplication of records already dealt with in 12.5.1), and inner joins data table 12.8.4, CONTROL_TOTALS on page 166 to data selected "Called" from item 12.9.12.3, Phase1_3 of SQL_12.

12.5.3 NATIONAL AND PROVINCIAL ROADS

SQL data query 12.9.12.6, Phase1_6 of SQL_12 on page 179, selects all land parcels where ROADS are MAXIMUM (TRUE) and CRESTS and GATEWAYS are FALSE (the CRESTS <> MAX AND GATEWAYS <> MAX clauses are inserted to prevent duplication of records already dealt with in 12.5.1 and 12.5.2), and inner joins data table 12.8.4, CONTROL_TOTALS on page 166 to data selected "Called" from item 12.9.12.3, Phase1_3 of SQL_12.

12.5.4 ELIMINATION OF CONFLICT BETWEEN ZONES

SQL data query 12.9.12.7, Phase1_7 of SQL_12 on page179, selects all land parcels where PROXIMITY are PARTIAL (TRUE) and CRESTS, GATEWAYS and ROADS are FALSE (the CRESTS <> MAX AND GATEWAYS <> MAX and ROADS <> MAX clauses are inserted to prevent duplication of records already dealt with in 12.5.1, 12.5.2 and 12.5.3), and inner joins data table 12.8.4, CONTROL_TOTALS on page 166 to data selected "Called" from item 12.9.12.3, Phase1_3 of SQL_12.

12.5.5 DOACCP LAND USE ZONING OF REMAINING LAND PARCELS

SQL data query 12.9.12.8, Phase1_8 of SQL_12 on page 180, selects all land parcels where CREST <> (is not) 'MAX' AND GATEWAY <> 'MAX' AND ROAD <> 'MAX' AND PROXIMITY <> 'PAR'; and thereby selects all of the remaining records not already dealt with in 12.5.1, 12.5.2, 12.5.3 and 12.5.4, and inner joins data table 12.8.4, CONTROL_TOTALS on page 166 to data selected "Called" from item 12.9.12.3, Phase1_3 of SQL_12.

The 12.9.12.8, Phase1_8 of SQL_12 query is an error catching query that filters and grabs and records not zoned for any the previous overrides. The TOTAL control field data is programmed to assume the CCP_CNTRL generated in PHASE1_1 and PHASE1_2 based on the CCP land use zonings

12.6 Final Zoning Control Compilation

Once the controls in items 12.4 and 12.5 have been generated, the data table 12.8.3, which contains a list of the control ratings for each land parcel can be compiled.

First, the UNION SQL data query 12.9.12.9, Phase1_9 of SQL_12, is used to combine the data sets generated in items in 12.5.1, 12.5.2, 12.5.3, 12.5.4 and 12.5.5.

SQL data query 12.9.11, is used to prepare data table 12.8.3, which is then populated using the data query detailed in item 12.9.12. This data query formats and then inserts data into the CONTROLS_LP_GK data table.

12.7 Generation of Sign Display Opportunities

Prior to generation of the sign display opportunities, data query 12.9.13 is run to clean and prepare the OPPORTUNITIES_LP_GK table, covered in section 12.8.5 on page 167, to receive data.

Data query 12.9.14.1, inner joins data from the CONTROLS_LP_GK data table and the SIGN_EVALUATIONS data table, covered in section 12.8.7 on page 170.

Data query 12.9.14, SQL_14 (Create OPPORTUNITIES_LP_GK), then "calls" and formats the data from data query 12.9.14.1, and inserts it into data table OPPORTUNITIES_LP_GK.

12.8 Tables Required In the Database

The following sections provide descriptions of the data fields in each of the tables used in the development of the RDBMS that implemented SAMOAC.

12.8.1 CCP INFO

Information received from the GIS department of the CCP.

TABLE 22: CCP INFO IMPORTED INTO THE GIS

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
TOWNCODE	TEXT	3	PARTIAL GISKEY EQUAL TO THE TOWNCODE THAT THE UNITIS FOUND IN
ERFNR	TEXT	5	PARTIAL GISKEY PROVIDING UNIQUE IDENTITY TO THE UNIT
PORTION	TEXT	6	PARTIAL GISKEY PRESENT IF THE ERF HAS BEEN SUBDIVIDED
LATITUDE	NUMBER	DOUBLE	LO29 LATITUDE OF THE WEIGHT POINT OF THE LAND PARCEL
LONGITUDE	NUMBER	DOUBLE	LO29 LONGITUDE OF THE WEIGHT POINT OF THE LAND PARCEL
STR_NAME	TEXT	30	STREET NAME AS DISPLAYED IN THE PRETORIA STREET ATLAS
STR_NUM	NUMBER	INTEGER	STREET NUMBER AS ASSIGNED BY THE TOWN PLANNING SCHEME
STR_NUM_B	TEXT	1	STREET NUMBER LETTER FOR ENTRANCE A, B ETC.
LEGAL_AREA	LONG INTEGER	10	AREA IN SQUARE METRES AS DETERMINED BY THE SURVEYOR GENERAL
EXTENTION	INTEGER	2	NUMERIC VALUE EQUAL TO TOWNCODE EXTENTIONS
ZON_CODE	INTEGER	2	ONE OF 26 CATEGORIES PRESENT IN THE TOWN PLANNING SCHEME. ZONING IS THE COURSEST LEVEL OF LAND USE INFORMATION
DENSITY	INTEGER	2	IS A CODE DETAILING THE LEGAL DEVELOPMENT DENSITY FOR THE SITE
COVERAGE	TEXT	2	IS A CODE DETAILING THE MAXIMUM % OF ROOF COVERAGE FOR THE SITE
VRV	TEXT	2	
HEIGHT	TEXT	2	IS A CODE DETAILING THE MAXIMUM NUMBER OF STOREYS THAT A BUILDING ON THE SITE MAY HAVE
ZONING_INTERPRETATION	TEXT	2	IS A CODE PROVIDING A MORE DETAILED EXPLANATION THAN ZONING, OF THE LEGAL ACTIVITIES THAT CAN BE PERFORMED ON THE SITE
LAND_USE	TEXT	3	IS A CODE PROVIDING A HIGHLY DETAILED EXPLANATION OF THE CURRENT LAND USE THAT A SITE CONTAINS
USE	TEXT	2	IS A CODE RELATING TO PERMITTED USES ON THE SITE

12.8.2 CCP_LP_GK

This Table consists of information stored in the backup table OVERRIDE_LP_GK, supplemented by any additions or changed from the selected CCP_INFO table. A GISKEY is generated and all empty ZON_CODE and ZON_INT are filled with 29.

TABLE 23: CCP_LP_GK: SELECTED INFORMATION FROM CCP INFO

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
GISKEY	TEXT	14	UNIQUE IDENTIFICATION FIELD
TOWNCODE	TEXT	3	PARTIAL GISKEY EQUAL TO THE TOWNCODE THAT THE UNITIS FOUND IN
ERFNR	TEXT	5	PARTIAL GISKEY PROVIDING UNIQUE IDENTITY TO THE UNIT
PORTION	TEXT	6	PARTIAL GISKEY PRESENT IF THE ERF HAS BEEN SUBDIVIDED
ZON_CODE	INTEGER	2	ONE OF 26 CATEGORIES PRESENT IN THE TOWN PLANNING SCHEME. ZONING IS THE COURSEST LEVEL OF LAND USE INFORMATION

ZONING_INTERPRETATION	TEXT	4	IS A CODE PROVIDING A MORE DETAILED EXPLANATION THAN ZONING, OF THE LEGAL ACTIVITIES THAT CAN BE PERFORMED ON THE SITE
LAND_USE	TEXT	4	IS A CODE PROVIDING A HIGHLY DETAILED EXPLANATION OF THE CURRENT LAND USE THAT A SITE CONTAINS

12.8.3 CONTROLS_LP_GK

This table contains all the zoning controls for outdoor advertising control scheme. This table forms part A of the final information that will be accessed to evaluate an application.

TABLE 24: CONTROLS_LP_GK: FINAL OA ZONING INFORMATION

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
GISKEY	TEXT	14	UNIQUE IDENTIFICATION FIELD
TOWNCODE	TEXT	3	PARTIAL GISKEY EQUAL TO THE TOWNCODE THAT THE UNITIS FOUND IN
ERFNR	TEXT	5	PARTIAL GISKEY PROVIDING UNIQUE IDENTITY TO THE UNIT
PORTION	TEXT	6	PARTIAL GISKEY PRESENT IF THE ERF HAS BEEN SUBDIVIDED
CCP_CNTRL	TEXT	10	CONTROL RATING GENERATED FROM THE CCP ZONING
CREST	TEXT	5	CONTROL RATING FOR LAND PARCELS ON PROMINENT CRESTS
GATEWAY	TEXT	5	CONTROL RATING FOR LAND PARCELS IN CITY GATEWAYS
ROAD	TEXT	5	CONTROL RATING FOR LAND PARCELS WITHIN 250m OF A NATIONAL OR PROVINCIAL ROAD
PROXIMITY	TEXT	5	CONTROL RATING FOR MINIMUM CONTROL LAND PARCELS THAT FALL WITHIN 30m OF A MAXIMUM CONTROL LAND PARCEL
TOTAL	TEXT	9	CONTROL RATING FOR THE LAND PARCEL GENERATED FROM THE MOST RESTRICTIVE CONTROL THAT A LAND PARCEL CONTAINS IN TERMS OF THE PREVIOUS CONTROL RATINGS

12.8.4 CONTROL_TOTALS

This table contains all the relationships between the various control ratings and the total control field. The information in this table is used to generate the final control ratings for a land parcel.

TABLE 25: CONTROL_TOTALS: GENERATION OF CONTOLS_LP_GK

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
KEY	AUTONUMBER	2	UNIQUE IDENTIFICATION FIELD
CCP_CNTRL	TEXT	9	DATA CONTROLLING THE LINK BETWEEN THE CCP INFORMATION AND THE TOTAL CONTROL RATING.
CREST	TEXT	9	DATA CONTROLLING THE LINK BETWEEN THE CREST INFORMATION AND THE TOTAL CONTROL RATING.
GATEWAY	TEXT	9	DATA CONTROLLING THE LINK BETWEEN THE GATEWAY INFORMATION AND THE TOTAL CONTROL RATING.

ROAD	TEXT	9	DATA CONTROLLING THE LINK BETWEEN THE ROAD INFORMATION AND THE TOTAL CONTROL RATING.
PROXIMITY	TEXT	9	DATA CONTROLLING THE LINK BETWEEN THE PROXIMITY INFORMATION AND THE TOTAL CONTROL RATING.
TOTAL	TEXT	9	CONTROL RATING FOR THE LAND PARCEL GENERATED FROM THE DATA IN THE PRECEDING DATA FIELDS

12.8.5 OPPORTUNITIES_LP_GK

This table contains PART B of the final information required to implement SAMOAC. Display opportunities for each sign type on each land parcel are contained in this table. The sign type being evaluated is matched against the land parcel (record) and the sign type (field) and the answer is either yes, the sign may be displayed or no. the sign may not be displayed.

TABLE 26: OPPORTUNITIES_LP_GK: DISPLAY OPPORTUNITIES FOR ALL SIGN TYPES

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
GISKEY	AUTONUMBER	2	UNIQUE IDENTIFICATION FIELD
TOWNCODE	TEXT	9	
ERFNR	TEXT	9	
PORTION	TEXT	9	
TOTAL	TEXT	9	CONTROL RATING FOR THE LAND PARCEL GENERATED FROM THE DATA IN THE PRECEDING DATA FIELDS
L1_1A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_1A
L1_1B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_1B
L1_1C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_1C
L1_1D	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_1D
L1_2A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2A
L1_2B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2B
L2_2B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2B
L3_2B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2B
L1_2C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2C
L1_2D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D1
L2_2D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D1
L3_2D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D1
L1_2D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D2
L2_2D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D2
L3_2D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D2
L1_2D3	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D3
L2_2D3	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D3
L3_2D3	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D3
L1_2D4	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D4
L2_2D4	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D4
L3_2D4	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D4
L1_2D5	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D5
L2_2D5	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D5
L1_2D6	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D6
L2_2D6	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D6

L3_2D6	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D6
L1_2D7	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D7
L2_2D7	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D7
L3_2D7	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D7
L1_2E	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2E
L1_2F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2F
L2_2F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2F
L3_2F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2F
L1_2G	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2G
L2_2G	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2G
L3_2G	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2G
L3_3A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3A
L3_3B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3B
L1_3C1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3C1
L2_3C1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3C1
L1_3C2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3C2
L2_3C2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3C2
L1_3D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3D1
L2_3D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3D1
L3_3D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3D1
L1_3D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3D2
L2_3D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3D2
L3_3D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3D2
L1_3E1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3E1
L2_3E1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3E1
L1_3E2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3E2
L2_3E2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3E2
L1_3F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3F
L2_3F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3F
L3_3F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3F
L1_3G1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3G1
L2_3G1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3G1
L1_3G2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3G2
L2_3G2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3G2
L1_3H1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3H1
L2_3H1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3H1
L3_3H1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3H1
L1_3H2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3H2
L2_3H2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3H2
L3_3H2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3H2
L1_3I	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3I
L1_3J	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3J
L2_3J	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3J
L3_3J	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3J
L1_3K	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3K
L2_3K	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3K
L3_3K	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3K
L1_3L	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3L

L2_3L	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3L
L3_3L	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3L
L1_3M	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3M
L2_3M	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3M
L3_3M	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3M
L1_3N	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3N
L2_3N	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3N
L3_3N	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3N
L1_3O	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3O
L2_3O	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3O
L3_3O	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3O
L1_4A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_4A
L2_4A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_4A
L3_4A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_4A
L1_4B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_4B
L2_4B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_4B
L3_4B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_4B
L1_4C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_4C
L2_4C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_4C
L3_4C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_4C
L1_4D	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_4D
L2_4D	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_4D
L3_4D	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_4D
L1_5A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_5A
L2_5A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_5A
L3_5A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_5A
L1_5B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_5B
L1_5C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_5C

12.8.6 OVERRIDE_LP_GK

This table contains a compilation of the CCP INFO and the backup data. This table also contains all the environmental overrides captured using spatial selections in REGIS. OVERRIDE_LP_GK is specifically designed to contain control ratings enforced by environmental overrides. The majority of these overrides are recalculated every time IGIS (PTY) LTD. updates the system. The table's unique function is to maintain a list of overrides "anomalies" that have for one reason or another been inserted manually. Should the overrides not be backed up in this table, the amount of manual labour to reinsert every override "anomaly" would be extensive. The risk of error or omission is also increased. Essentially, the overrides held in this table are recycled during the generation process of items OPPORTUNITIES_LP_GK and CONTROLS_LP_GK.

TABLE 27: OVERRIDE_LP_GK

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
GISKEY	TEXT	14	UNIQUE IDENTIFICATION FIELD
TOWNCODE	TEXT	3	PARTIAL GISKEY EQUAL TO THE TOWNCODE THAT THE UNITIS FOUND IN

ERFNR	TEXT	5	PARTIAL GISKEY PROVIDING UNIQUE IDENTITY TO THE UNIT
PORTION	TEXT	6	PARTIAL GISKEY PRESENT IF THE ERF HAS BEEN SUBDIVIDED
ZON_CODE	INTEGER	2	ONE OF 26 CATEGORIES PRESENT IN THE TOWN PLANNING SCHEME. ZONING IS THE COURSEST LEVEL OF LAND USE INFORMATION
ZONING_INTERPRETATION	TEXT	4	IS A CODE PROVIDING A MORE DETAILED EXPLANATION THAN ZONING, OF THE LEGAL ACTIVITIES THAT CAN BE PERFORMED ON THE SITE
LAND_USE	TEXT	4	IS A CODE PROVIDING A HIGHLY DETAILED EXPLANATION OF THE CURRENT LAND USE THAT A SITE CONTAINS
CREST	TEXT	5	CONTROL RATING FOR LAND PARCELS ON PROMINENT CRESTS
GATEWAY	TEXT	5	CONTROL RATING FOR LAND PARCELS IN CITY GATEWAYS
ROAD	TEXT	5	CONTROL RATING FOR LAND PARCELS WITHIN 250m OF A NATIONAL OR PROVINCIAL ROAD
PROXIMITY	TEXT	5	CONTROL RATING FOR MINIMUM CONTROL LAND PARCELS THAT FALL WITHIN 30m OF A MAXIMUM CONTROL LAND PARCEL
TOTAL	TEXT	9	CONTROL RATING FOR THE LAND PARCEL GENERATED FROM THE MOST RESTRICTIVE CONTROL THAT A LAND PARCEL CONTAINS IN TERMS OF THE PREVIOUS CONTROL RATINGS

12.8.7 SIGN_EVALUATIONS

This table contains all the advertising opportunities for the various control ratings. This table is used to generate the data in Table 26.

TABLE 28: SIGN_EVALUATIONS

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
NUM	TEXT	50	UNIQUE KEY
TYPE	TEXT	10	CONTROL RATING OF THE LAND PARCEL
L1_1A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_1A
L1_1B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_1B
L1_1C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_1C
L1_1D	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_1D
L1_2A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2A
L1_2B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2B
L2_2B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2B
L3_2B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2B
L1_2C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2C
L1_2D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D1
L2_2D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D1
L3_2D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D1
L1_2D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D2
L2_2D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D2
L3_2D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D2
L1_2D3	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D3

L2_2D3	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D3
L3_2D3	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D3
L1_2D4	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D4
L2_2D4	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D4
L3_2D4	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D4
L1_2D5	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D5
L2_2D5	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D5
L1_2D6	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D6
L2_2D6	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D6
L3_2D6	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D6
L1_2D7	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2D7
L2_2D7	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2D7
L3_2D7	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2D7
L1_2E	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2E
L1_2F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2F
L2_2F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2F
L3_2F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2F
L1_2G	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_2G
L2_2G	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_2G
L3_2G	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_2G
L3_3A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3A
L3_3B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3B
L1_3C1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3C1
L2_3C1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3C1
L1_3C2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3C2
L2_3C2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3C2
L1_3D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3D1
L2_3D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3D1
L3_3D1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3D1
L1_3D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3D2
L2_3D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3D2
L3_3D2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3D2
L1_3E1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3E1
L2_3E1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3E1
L1_3E2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3E2
L2_3E2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3E2
L1_3F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3F
L2_3F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3F
L3_3F	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3F
L1_3G1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3G1
L2_3G1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3G1
L1_3G2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3G2
L2_3G2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3G2
L1_3H1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3H1
L2_3H1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3H1
L3_3H1	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3H1
L1_3H2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3H2
L2_3H2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3H2

L3_3H2	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3H2
L1_3I	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3I
L1_3J	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3J
L2_3J	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3J
L3_3J	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3J
L1_3K	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3K
L2_3K	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3K
L3_3K	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3K
L1_3L	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3L
L2_3L	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3L
L3_3L	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3L
L1_3M	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3M
L2_3M	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3M
L3_3M	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3M
L1_3N	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3N
L2_3N	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3N
L3_3N	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3N
L1_3O	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_3O
L2_3O	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_3O
L3_3O	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_3O
L1_4A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_4A
L2_4A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_4A
L3_4A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_4A
L1_4B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_4B
L2_4B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_4B
L3_4B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_4B
L1_4C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_4C
L2_4C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_4C
L3_4C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_4C
L1_4D	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_4D
L2_4D	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_4D
L3_4D	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_4D
L1_5A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_5A
L2_5A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L2_5A
L3_5A	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L3_5A
L1_5B	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_5B
L1_5C	BOOLEAN	1	DISPLAY OPPORTUNITIES FOR SIGN TYPE L1_5C

12.8.8 TEMP_OVERRIDES

This table is used in the process of generating the backup data in OVERRIDE_LP_GK. Data is passed through this table using SQL as detailed in section 12.9.

TABLE 29: TEMP_OVERRIDES

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
GISKEY	TEXT	14	UNIQUE IDENTIFICATION FIELD

TOWNCODE	TEXT	3	PARTIAL GISKEY EQUAL TO THE TOWNCODE THAT THE UNITIS FOUND IN
ERFNR	TEXT	5	PARTIAL GISKEY PROVIDING UNIQUE IDENTITY TO THE UNIT
PORTION	TEXT	6	PARTIAL GISKEY PRESENT IF THE ERF HAS BEEN SUBDIVIDED
ZON_CODE	INTEGER	2	ONE OF 26 CATEGORIES PRESENT IN THE TOWN PLANNING SCHEME. ZONING IS THE COURSEST LEVEL OF LAND USE INFORMATION
ZONING_INT	TEXT	4	IS A CODE PROVIDING A MORE DETAILED EXPLANATION THAN ZONING, OF THE LEGAL ACTIVITIES THAT CAN BE PERFORMED ON THE SITE
LAND_USE	TEXT	4	IS A CODE PROVIDING A HIGHLY DETAILED EXPLANATION OF THE CURRENT LAND USE THAT A SITE CONTAINS
CREST	TEXT	5	CONTROL RATING FOR LAND PARCELS ON PROMINENT CRESTS
GATEWAY	TEXT	5	CONTROL RATING FOR LAND PARCELS IN CITY GATEWAYS
ROAD	TEXT	5	CONTROL RATING FOR LAND PARCELS WITHIN 250m OF A NATIONAL OR PROVINCIAL ROAD
PROXIMITY	TEXT	5	CONTROL RATING FOR MINIMUM CONTROL LAND PARCELS THAT FALL WITHIN 30m OF A MAXIMUM CONTROL LAND PARCEL

12.8.9 ZON_CODE_CONTROLS

This table contains information that is used to evaluate each of the land parcels zoning information. OA control ratings are generated using this table's data

TABLE 30: ZON_CODE_CONTROLS

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION
KEY	AUTONUMBER	2	UNIQUE IDENTIFICATION FIELD
ZON_CODE	INTEGER	2	ONE OF 26 CATEGORIES PRESENT IN THE TOWN PLANNING SCHEME. ZONING IS THE COURSEST LEVEL OF LAND USE INFORMATION
REASON	TEXT	50	EXPLANATION OF THE ZON_CODE NUMBER
CCP_CNTRL	TEXT	10	OA CONTROL RATING

12.8.10 ZON_INT_CONTROLS

This table contains information that is used to evaluate each of the land parcels zoning interpretation information. OA control ratings are generated for all land parcels where ZON_CODE is 14 (special) using this tables data

TABLE 31: ZON_INT_CONTROLS

FIELD NAME	DATA TYPE	LENGTH	DESCRIPTION

KEY	AUTONUMBER	2	UNIQUE IDENTIFICATION FIELD
ZONING_INT	TEXT	4	IS A CODE PROVIDING A MORE DETAILED EXPLANATION THAN ZONING, OF THE LEGAL ACTIVITIES THAT CAN BE PERFORMED ON THE SITE
REASON	TEXT	50	EXPLANATION OF THE ZON_CODE NUMBER
CCP_CNTRL	TEXT	10	OA CONTROL RATING

12.9 SQL Rules Required to Develop Land Use Based Zoning Controls and Associated Sign Display Opportunities

SQL is used to manipulate data in the tables detailed in section 12.8. SQL programming explanations are not discussed. It is assumed that in order to evaluate the information presented, the reader has a working knowledge of SQL.

12.9.1 SQL_01 (Clear CCP_LP_GK)

The SQL_01 query is used to delete any existing information in the CCP_LP_GK table, and thus prepare the table to receive new information.

```
DELETE CCP_LP_GK.*
FROM CCP_LP_GK;
```

Figure 14: SQL_01 (Clear CCP_LP_GK)

12.9.2 SQL_02 (Select Information from CCP_INFO into CCP_LP_GK)

The SQL_02 query is used to filter required information from the CCP_INFO table, and insert this information into table CCP_LP_GK

```
INSERT INTO CCP_LP_GK ( GISKEY, DORPKODE, ERFNR, GEDEELTE, ZON_CODE,
ZON_INT, LANDUSE )
SELECT CCP_INFO.GISKEY, CCP_INFO.DORPKODE, CCP_INFO.ERFNR,
CCP_INFO.GEDEELTE, CCP_INFO.ZON_CODE, CCP_INFO.ZON_INT,
CCP_INFO.LANDUSE
FROM CCP_INFO;
```

Figure 15: SQL_02 (Select Information form CCP_INFO into CCP_LP_GK

12.9.3 SQL_03 (Generate a GISKEY for CCP_LP_GK)

The SQL_03 query generates a single field GISKEY for the CCP_LP_GK table.

```
UPDATE CCP_LP_GK SET CCP_LP_GK.GISKEY = [CCP_LP_GK].[DORPKODE] &
[CCP_LP_GK].[ERFNR] & [CCP_LP_GK].[GEDEELTE]
```

```
WHERE CCP_LP_GK.GISKEY Is NULL;
```

FIGURE 16: SQL_03 (GENERATE GISKEY FOR CCP_LP_GK)

12.9.4 SQL_04 (FILL ALL CCP_LP_GK ZON_CODE IS NULL WITH 29)

The SQL_04 query converts all records with ZON_CODE = "Null" to ZON_CODE = 29. This query is required, as null values cannot be passed between tables and queries as easily as numerical values.

```
UPDATE CCP_LP_GK SET CCP_LP_GK.ZON_CODE = 29
WHERE (([CCP_LP_GK].[ZON_CODE]) Is Null);
```

FIGURE 17: SQL_04 (FILL ALL CCP_LP_GK ZON_CODE IS NULL WITH 29)

12.9.5 SQL_05 (FILL CCP_LP_GK ZON_INT IS NULL WITH 29)

The SQL_05 query converts all records with ZON_INT = "Null" to ZON_INT = 29. This query is required, as null values cannot be passed between tables and queries as easily as numerical values.

```
UPDATE CCP_LP_GK SET CCP_LP_GK.ZON_INT = 29
WHERE (([CCP_LP_GK].[ZON_INT]) Is Null);
```

FIGURE 18: SQL_05 (FILL CCP_LP_GK ZON_INT IS NULL WITH 29)

12.9.6 SQL_06 (GENERATE A GISKEY FOR OVERRIDE_LP_GK)

The SQL_06 query generates a single field GISKEY for the OVERRIDE_LP_GK table.

```
UPDATE OVERRIDE_LP_GK SET OVERRIDE_LP_GK.GISKEY =
[OVERRIDE_LP_GK].[DORPKODE] & [OVERRIDE_LP_GK].[ERFNR] &
[OVERRIDE_LP_GK].[GEDEELTE]
WHERE OVERRIDE_LP_GK.GISKEY Is NULL;
```

FIGURE 19: SQL_06 (GENERATE A GISKEY FOR OVERRIDE_LP_GK)

12.9.7 SQL_07 (CLEAR TEMP_OVERRIDES TABLE)

The SQL_07 query deletes information in the TEMP_OVERRIDES table to prepare the table to receive new information from the SQL query in section 12.9.8.

```
DELETE *
FROM TEMP_OVERRIDES;
```

FIGURE 20: SQL_07 (CLEAR TEMP_OVERRIDES TABLE

12.9.8 SQL_08 (GENERATE NEW TEMP_OVERRIDES)

The SQL_08 query populates the TEMP_OVERRIDES table with data from the CCP_LP_GK table and then left joins the OVERRIDE_LP_GK table onto the CCP_LP_GK by matching the GISKEY of the two tables.

```
INSERT INTO TEMP_OVERRIDES ( GISKEY, DORPKODE, ERFNR, GEDEELTE,
ZON_CODE, ZON_INT, LANDUSE, GATEWAY, ROAD, PROXIMITY, CREST )
SELECT CCP_LP_GK.GISKEY, CCP_LP_GK.DORPKODE, CCP_LP_GK.ERFNR,
CCP_LP_GK.GEDEELTE, CCP_LP_GK.ZON_CODE, CCP_LP_GK.ZON_INT,
CCP_LP_GK.LANDUSE, OVERRIDE_LP_GK.GATEWAY, OVERRIDE_LP_GK.ROAD,
OVERRIDE_LP_GK.PROXIMITY, OVERRIDE_LP_GK.CREST
FROM CCP_LP_GK LEFT JOIN OVERRIDE_LP_GK ON CCP_LP_GK.GISKEY =
OVERRIDE_LP_GK.GISKEY;
```

FIGURE 21: SQL_08 (GENERATE NEW TEMP_OVERRIDES)

12.9.9 SQL_09 (CLEAR OVERRIDE_LP_GK)

The SQL_09 query deletes information from the OVERRIDES_LP_GK table and prepares the OVERRIDE_LP_GK table to receive new information.

```
DELETE OVERRIDE_LP_GK.*
FROM OVERRIDE_LP_GK;
```

FIGURE 22: SQL_09 (CLEAR OVERRIDE_LP_GK)

12.9.10 SQL_10 (GENERATE NEW OVERRIDE_LP_GK DATABASE)

The SQL_10 query transfers the newly compiled TEMP_OVERRIDES table data into the OVERRIDE_LP_GK table

```
INSERT INTO OVERRIDE_LP_GK
SELECT TEMP_OVERRIDES.*
FROM TEMP_OVERRIDES;
```

FIGURE 23: SQL_10 (GENERATE NEW OVERRIDE_LP_GK DATABASE)

12.9.11 SQL_11 (CLEAR CONTROLS_LP_GK)

The SQL_11 query clears the CONTROLS_LP_GK table and prepares it to receive new zoning control information

```
DELETE CONTROLS_LP_GK.*
FROM CONTROLS_LP_GK;
```

FIGURE 24: SQL_11 (CLEAR CONTROLS_LP_GK)

12.9.12 SQL_12 (CREATE CONTROLS_LP_GK)

The SQL_12 query populates the CONTROLS_LP_GK table with new zoning controls for each land parcel. This query comprises several phases that select from, pass to and manipulate data from several tables and queries.

```
INSERT INTO CONTROLS_LP_GK
SELECT *
FROM Phase1_9;
```

FIGURE 25: SQL_12 (CREATE CONTROLS_LP_GK)

12.9.12.1 PHASE1_1 OF SQL_12

The PHASE1_1 SQL query selects data from the OVERRIDE_LP_GK table and inner joins the ZON_CODE_CONTROLS table by linking the GISKEY of the two tables. All records with the exception of those with ZON_CODE=14 (Special) are inner joined.

```
SELECT OVERRIDE_LP_GK.GISKEY, OVERRIDE_LP_GK.DORPKODE,
OVERRIDE_LP_GK.ERFNR, OVERRIDE_LP_GK.GEDEELTE, OVERRIDE_LP_GK.ZON_INT,
OVERRIDE_LP_GK.ZON_CODE, ZON_CODE_CONTROLS.CCP_CNTRL,
OVERRIDE_LP_GK.CREST, OVERRIDE_LP_GK.GATEWAY, OVERRIDE_LP_GK.ROAD,
OVERRIDE_LP_GK.PROXIMITY
FROM OVERRIDE_LP_GK INNER JOIN ZON_CODE_CONTROLS ON
OVERRIDE_LP_GK.ZON_CODE = ZON_CODE_CONTROLS.ZON_CODE
WHERE (((OVERRIDE_LP_GK.ZON_CODE)<>14));
```

FIGURE 26: PHASE1_1 OF SQL_12

12.9.12.2 PHASE1_2 OF SQL_12

The PHASE1_2 SQL query selects the same data as Phase1_1 except that only records with ZON_CODE =14 (special) are selected. The ZON_INTCONTROLS table is then inner joined on the OVERRIDE_LP_GK table by matching the GISKEY fields of the two tables.

```
SELECT OVERRIDE_LP_GK.GISKEY, OVERRIDE_LP_GK.DORPKODE,
OVERRIDE_LP_GK.ERFNR, OVERRIDE_LP_GK.GEDEELTE, OVERRIDE_LP_GK.ZON_INT,
OVERRIDE_LP_GK.ZON_CODE, ZON_INT_CONTROLS.CCP_CNTRL,
OVERRIDE_LP_GK.CREST, OVERRIDE_LP_GK.GATEWAY, OVERRIDE_LP_GK.ROAD,
OVERRIDE_LP_GK.PROXIMITY
FROM OVERRIDE_LP_GK INNER JOIN ZON_INT_CONTROLS ON
```

```
OVERRIDE_LP_GK.ZON_INT = ZON_INT_CONTROLS.ZON_INT
WHERE (((OVERRIDE_LP_GK.ZON_CODE)=14));
```

FIGURE 27: PHASE1_2 OF SQL_12

12.9.12.3 PHASE1_3 OF SQL_12

The PHASE1_3 SQL query unions (merges) the data sets created in PHASE1_1 (ZON_CODE<>14) and PHASE1_2 (ZON_CODE=14) to generate a single complete data set.

```
SELECT GISKEY, DORPKODE, ERFNR, GEDEELTE, ZON_CODE, ZON_INT, CCP_CNTRL,
CREST, GATEWAY, ROAD, PROXIMITY
FROM Phase1_1

UNION SELECT GISKEY, DORPKODE, ERFNR, GEDEELTE, ZON_CODE, ZON_INT,
CCP_CNTRL, CREST, GATEWAY, ROAD, PROXIMITY
FROM Phase1_2;
```

FIGURE 28: PHASE1_3 OF SQL_12

12.9.12.4 PHASE1_4 OF SQL_12

The PHASE1_4 SQL query generates TOTAL control values for all records where an environmental override for CREST exists.

```
SELECT Phase1_3.GISKEY, Phase1_3.DORPKODE, Phase1_3.ERFNR,
Phase1_3.GEDEELTE, Phase1_3.ZON_CODE, Phase1_3.ZON_INT, Phase1_3.CCP_CNTRL,
Phase1_3.CREST, Phase1_3.GATEWAY, Phase1_3.ROAD, Phase1_3.PROXIMITY,
CONTROL_TOTALS.TOTAL
FROM Phase1_3 INNER JOIN CONTROL_TOTALS ON CONTROL_TOTALS.CCP_CNTRL =
Phase1_3.CCP_CNTRL
WHERE (([Phase1_3].[CREST])='MAX');
```

FIGURE 29: PHASE1_4 OF SQL_12

12.9.12.5 PHASE1_5 OF SQL_12

The PHASE1_5 SQL query generates TOTAL control values for all records where an environmental override for GATEWAYS exist that were not already zoned in terms of the CREST override in PHASE1_4.

```
SELECT Phase1_3.GISKEY, Phase1_3.DORPKODE, Phase1_3.ERFNR,
Phase1_3.GEDEELTE, Phase1_3.ZON_CODE, Phase1_3.ZON_INT, Phase1_3.CCP_CNTRL,
Phase1_3.CREST, Phase1_3.GATEWAY, Phase1_3.ROAD, Phase1_3.PROXIMITY,
```

```
CONTROL_TOTALS.TOTAL
FROM Phase1_3 INNER JOIN CONTROL_TOTALS ON CONTROL_TOTALS.CCP_CNTRL =
Phase1_3.CCP_CNTRL
WHERE (([Phase1_3].[CREST])<>'MAX') AND (([Phase1_3].[GATEWAY])='MAX');
```

FIGURE 30: PHASE1_5 OF SQL_12

12.9.12.6 PHASE1_6 OF SQL_12

The PHASE1_6 SQL query generates TOTAL control values for all records where an environmental override for ROADS exist that were not already zoned in terms of either the CREST override in PHASE1_4 or the GATEWAY override in PHASE1_5.

```
SELECT Phase1_3.GISKEY, Phase1_3.DORPKODE, Phase1_3.ERFNR,
Phase1_3.GEDEELTE, Phase1_3.ZON_CODE, Phase1_3.ZON_INT, Phase1_3.CCP_CNTRL,
Phase1_3.CREST, Phase1_3.GATEWAY, Phase1_3.ROAD, Phase1_3.PROXIMITY,
CONTROL_TOTALS.TOTAL
FROM Phase1_3 INNER JOIN CONTROL_TOTALS ON CONTROL_TOTALS.CCP_CNTRL =
Phase1_3.CCP_CNTRL
WHERE (([Phase1_3].[CREST])<>'MAX') AND (([Phase1_3].[GATEWAY])<>'MAX') AND
(([Phase1_3].[ROAD])='MAX');
```

FIGURE 31: PHASE1_6 OF SQL_12

12.9.12.7 PHASE1_7 OF SQL_12

The PHASE1_7 SQL query generates TOTAL control values for all records where an environmental override for PROXIMITY exists that were not already zoned in terms of either the CREST override in PHASE1_4 the GATEWAY override in PHASE1_5 or the ROADS override in PHASE1_6.

```
SELECT Phase1_3.GISKEY, Phase1_3.DORPKODE, Phase1_3.ERFNR,
Phase1_3.GEDEELTE, Phase1_3.ZON_CODE, Phase1_3.ZON_INT, Phase1_3.CCP_CNTRL,
Phase1_3.CREST, Phase1_3.GATEWAY, Phase1_3.ROAD, Phase1_3.PROXIMITY,
CONTROL_TOTALS.TOTAL
FROM Phase1_3 INNER JOIN CONTROL_TOTALS ON CONTROL_TOTALS.CCP_CNTRL =
Phase1_3.CCP_CNTRL
WHERE (([Phase1_3].[CREST])<>'MAX') AND (([Phase1_3].[GATEWAY])<>'MAX') AND
(([Phase1_3].[ROAD])<>'MAX') AND (([Phase1_3].[PROXIMITY])='PAR');
```

FIGURE 32: PHASE1_7 OF SQL_12

12.9.12.8 PHASE1_8 OF SQL_12

The PHASE1_8 SQL query is an error catching query that filters and grabs and records not zoned for any the previous overrides. The TOTLA control field data is programmed to assume the CCP_CNTRL generated in PHASE1_1 and PHASE1_2 based on the CCP land use zonings.

```
SELECT Phase1_3.GISKEY, Phase1_3.DORPKODE, Phase1_3.ERFNR,
Phase1_3.GEDEELTE, Phase1_3.ZON_CODE, Phase1_3.ZON_INT, Phase1_3.CCP_CNTRL,
Phase1_3.CREST, Phase1_3.GATEWAY, Phase1_3.ROAD, Phase1_3.PROXIMITY,
CONTROL_TOTALS.TOTAL
FROM Phase1_3 INNER JOIN CONTROL_TOTALS ON CONTROL_TOTALS.CCP_CNTRL =
Phase1_3.CCP_CNTRL
WHERE (Phase1_3.CREST <> 'MAX') AND (Phase1_3.GATEWAY <> 'MAX') AND
(Phase1_3.ROAD <> 'MAX') AND (Phase1_3.PROXIMITY <> 'PAR');
```

FIGURE 33: PHASE1_8 OF SQL_12

12.9.12.9 PHASE1_9 OF SQL_12

The PHASE1_9 SQL query combines the data sets selected in PHASE1_4 to PHASE1_8 to once again created a complete set of records for each of the land parcels in the GIS.

```
SELECT GISKEY, DORPKODE, ERFNR, GEDEELTE, CCP_CNTRL, CREST, GATEWAY,
ROAD, PROXIMITY, TOTAL
FROM Phase1_4

UNION SELECT GISKEY, DORPKODE, ERFNR, GEDEELTE, CCP_CNTRL, CREST,
GATEWAY, ROAD, PROXIMITY, TOTAL
FROM Phase1_5;

UNION SELECT GISKEY, DORPKODE, ERFNR, GEDEELTE, CCP_CNTRL, CREST,
GATEWAY, ROAD, PROXIMITY, TOTAL
FROM Phase1_6;

UNION SELECT GISKEY, DORPKODE, ERFNR, GEDEELTE, CCP_CNTRL, CREST,
GATEWAY, ROAD, PROXIMITY, TOTAL
FROM Phase1_7;

UNION SELECT GISKEY, DORPKODE, ERFNR, GEDEELTE, CCP_CNTRL, CREST,
GATEWAY, ROAD, PROXIMITY, TOTAL
FROM Phase1_8;
```

FIGURE 34: PHASE1_9 OF SQL_12

12.9.13 SQL_13 (CLEAR OPPORTUNITIES_LP_GK)

The SQL_13 query deletes information in the OPPORTUNITIES_LP_GK table and prepares the table to receive new data.

```
DELETE *
FROM OPPORTUNITIES_LP_GK;
```

FIGURE 35: SQL_13 (CLEAR OPPORTUNITIES_LP_GK)

12.9.14 SQL_14 (CREATE OPPORTUNITIES_LP_GK)

The SQL_14 query transfers data from the PHASE2_1 query into the OPPORTUNITIES_LP_GK table.

```
INSERT INTO OPPORTUNITIES_LP_GK
SELECT *
FROM Phase2_1;
```

FIGURE 36: SQL_14 (CREATE OPPORTUNITIES_LP_GK)

12.9.14.1 PHASE2_1 OF SQL_14

The PHASE2_1 SQL query builds a data set that details the display opportunities for each sign class on each land parcel (record). This data is then transferred into the OPPORTUNITIES_LP_GK table by the SQL_14 statement.

```
SELECT CONTROLS_LP_GK.GISKEY, CONTROLS_LP_GK.DORPKODE,
CONTROLS_LP_GK.ERFNR, CONTROLS_LP_GK.GEDEELTE, CONTROLS_LP_GK.TOTAL,
SIGN_EVALUATIONS.L1_1A, SIGN_EVALUATIONS.L1_1B, SIGN_EVALUATIONS.L1_1C,
SIGN_EVALUATIONS.L1_1D, SIGN_EVALUATIONS.L1_2A, SIGN_EVALUATIONS.L1_2B,
SIGN_EVALUATIONS.L2_2B, SIGN_EVALUATIONS.L3_2B, SIGN_EVALUATIONS.L1_2C,
SIGN_EVALUATIONS.L1_2D1, SIGN_EVALUATIONS.L2_2D1, SIGN_EVALUATIONS.L3_2D1,
SIGN_EVALUATIONS.L1_2D2, SIGN_EVALUATIONS.L2_2D2, SIGN_EVALUATIONS.L3_2D2,
SIGN_EVALUATIONS.L1_2D3, SIGN_EVALUATIONS.L2_2D3, SIGN_EVALUATIONS.L3_2D3,
SIGN_EVALUATIONS.L1_2D4, SIGN_EVALUATIONS.L2_2D4, SIGN_EVALUATIONS.L3_2D4,
SIGN_EVALUATIONS.L1_2D5, SIGN_EVALUATIONS.L2_2D5, SIGN_EVALUATIONS.L1_2D6,
SIGN_EVALUATIONS.L2_2D6, SIGN_EVALUATIONS.L3_2D6, SIGN_EVALUATIONS.L1_2D7,
SIGN_EVALUATIONS.L2_2D7, SIGN_EVALUATIONS.L3_2D7, SIGN_EVALUATIONS.L1_2E,
SIGN_EVALUATIONS.L1_2F, SIGN_EVALUATIONS.L2_2F, SIGN_EVALUATIONS.L3_2F,
SIGN_EVALUATIONS.L1_2G, SIGN_EVALUATIONS.L2_2G, SIGN_EVALUATIONS.L3_2G,
SIGN_EVALUATIONS.L3_3A, SIGN_EVALUATIONS.L3_3B, SIGN_EVALUATIONS.L1_3C1,
SIGN_EVALUATIONS.L2_3C1, SIGN_EVALUATIONS.L1_3C2, SIGN_EVALUATIONS.L2_3C2,
```

```
SIGN_EVALUATIONS.L1_3D1, SIGN_EVALUATIONS.L2_3D1, SIGN_EVALUATIONS.L3_3D1,
SIGN_EVALUATIONS.L1_3D2, SIGN_EVALUATIONS.L2_3D2, SIGN_EVALUATIONS.L3_3D2,
SIGN_EVALUATIONS.L1_3E1, SIGN_EVALUATIONS.L2_3E1, SIGN_EVALUATIONS.L1_3E2,
SIGN_EVALUATIONS.L2_3E2, SIGN_EVALUATIONS.L1_3F, SIGN_EVALUATIONS.L2_3F,
SIGN_EVALUATIONS.L3_3F, SIGN_EVALUATIONS.L1_3G1, SIGN_EVALUATIONS.L2_3G1,
SIGN_EVALUATIONS.L1_3G2, SIGN_EVALUATIONS.L2_3G2,
SIGN_EVALUATIONS.L1_3H1, SIGN_EVALUATIONS.L2_3H1, SIGN_EVALUATIONS.L3_3H1,
SIGN_EVALUATIONS.L1_3H2, SIGN_EVALUATIONS.L2_3H2, SIGN_EVALUATIONS.L3_3H2,
SIGN_EVALUATIONS.L1_3I, SIGN_EVALUATIONS.L1_3J, SIGN_EVALUATIONS.L2_3J,
SIGN_EVALUATIONS.L3_3J, SIGN_EVALUATIONS.L1_3K, SIGN_EVALUATIONS.L2_3K,
SIGN_EVALUATIONS.L3_3K, SIGN_EVALUATIONS.L1_3L, SIGN_EVALUATIONS.L2_3L,
SIGN_EVALUATIONS.L3_3L, SIGN_EVALUATIONS.L1_3M, SIGN_EVALUATIONS.L2_3M,
SIGN_EVALUATIONS.L3_3M, SIGN_EVALUATIONS.L1_3N, SIGN_EVALUATIONS.L2_3N,
SIGN_EVALUATIONS.L3_3N, SIGN_EVALUATIONS.L1_3O, SIGN_EVALUATIONS.L2_3O,
SIGN_EVALUATIONS.L3_3O, SIGN_EVALUATIONS.L1_4A, SIGN_EVALUATIONS.L2_4A,
SIGN_EVALUATIONS.L3_4A, SIGN_EVALUATIONS.L1_4B, SIGN_EVALUATIONS.L2_4B,
SIGN_EVALUATIONS.L3_4B, SIGN_EVALUATIONS.L1_4C, SIGN_EVALUATIONS.L2_4C,
SIGN_EVALUATIONS.L3_4C, SIGN_EVALUATIONS.L1_4D, SIGN_EVALUATIONS.L2_4D,
SIGN_EVALUATIONS.L3_4D, SIGN_EVALUATIONS.L1_5A, SIGN_EVALUATIONS.L2_5A,
SIGN_EVALUATIONS.L3_5A, SIGN_EVALUATIONS.L1_5B, SIGN_EVALUATIONS.L1_5C
FROM SIGN_EVALUATIONS LEFT JOIN CONTROLS_LP_GK ON
SIGN_EVALUATIONS.TYPE = CONTROLS_LP_GK.TOTAL;
```

FIGURE 37: PHASE2_1 OF SQL_14

12.9.15 SQL_15 (CONTROLS_LP_GK SPLIT ZONES) EXPORT TO ZONE 1

The SQL_15 to SQL_25 queries are used to split the OA ZONING controls into the various planning zones. This is done to speed up access to the data during application processing.

```
SELECT CONTROLS_LP_GK.*, OVERRIDE_LP_GK.PLANZONE
FROM CONTROLS_LP_GK, OVERRIDE_LP_GK
WHERE ((([OVERRIDE_LP_GK]![PLANZONE])=1));
```

FIGURE 38: SQL_15 (CONTROLS_LP_GK SPLIT ZONES) EXPORT

12.9.16 SQL_26 (OPPORTUNITIES_LP_GK SPLIT PLAN ZONES) EXPORT TO ZONE 1

The SQL_26 to SQL_36 queries is used to split the OA Display Opportunities into the various planning zones. This is done to speed up access to the data during application processing.

```
SELECT OVERRIDE_LP_GK.PLANZONE, OPPORTUNITIES_LP_GK.*
```

```
FROM OVERRIDE_LP_GK, OPPORTUNITIES_LP_GK
WHERE ((([OVERRIDE_LP_GK]![PLANZONE])=1));
```

FIGURE 39: SQL_26 (OPPORTUNITIES_LP_GK SPLIT PLAN ZONES) EXPORT

12.10 IMPLEMENTATION OF ADDITIONAL "ENVIRONMENTAL OVERRIDES"

Environmental overrides were developed to protect environmentally sensitive areas that SAMOAC failed to protect adequately (Rofail 1999). SAMOAC, written for implementation nationally, does not cover specific local conditions for all areas in South Africa. Once identified, polygons with associated alphanumeric information were captured to demarcate the various environmental override areas. The following environmental overrides were developed to supplement the controls that SAMOAC suggested (IGIS (PTY) LTD. 1999).

12.10.1 RIDGES AND CRESTS

A desktop analysis was initially conducted, to ascertain whether or not to implement additional controls for the ridges in the Pretoria area. This desktop study, together with the newly implemented ridges and rivers policy of the department of the environment, suggested that additional protection for prominent ridges was required.

The study to identify prominent ridges was conducted as follows. Contours for the Pretoria metro area were captured at 5m intervals. A Triangulated Irregular Network (TIN) was generated, and views from various points in the metro area were simulated. Rapid change in elevation combined with increase in the steepness of slope was the two criteria that influenced visible prominence most. A qualitative study was then performed to mark all areas where steep slopes or rapid changes in elevation occurred. The results were then draped over the TIN, to test whether areas marked were correct. Small additions and subtractions were performed to arrive at the final set of crests. Spatial selections in REGIS were used to transfer crest information to the relevant land parcels.

12.10.1.1 SELECT C1 (SELECT CREST AREAS)

This select queries the CCP Geobase and creates a selection set of all the polygons identified as being prominent crests.

12.10.1.2 SELECT C2 (FILTER LAND PARCELS ON OR IN C1)

This select queries the CCP Geobase and creates a selection set of all land parcels that fall inside or touch a polygon identified as a crest.

12.10.1.3 SQL C3 (UPDATE CONTROLS_LP_GK)

The SQL C3 query updates the CONTROLS_LP_GK table by converting data in the CREST field from NONE to MAX control, for all land parcels that spatial SELECT C2 filtered out.

12.10.1.4 SQL C4 (UPDATE OVERRIDE_LP_GK)

The SQL C4 query updates the OVERRIDE_LP_GK table by converting data in the CREST field from NONE to MAX control, for all land parcels that spatial SELECT C2 filtered out.

12.10.2 GATEWAYS TO THE CITY

SAMOAC identifies GATEWAYS to a city as visually sensitive areas requiring additional protection and therefore stricter advertising controls. SAMOAC, being a document written for national scale does not clarify where gateways to the various cities in South Africa exist.

The guidelines discussed by by Kevin Lynch (1981) in his book *Image of a City* combined with the principles discussed by Venturi et al (1977) in *Learning from Las Vegas* were used to identify the gateways to the city of Pretoria. (Velcich, P. 1999, personal communication).

An initial desktop study was performed to identify the extents of visual basins at prominent entrances to the city. These basins were then ground-truthed, and the boundaries were finalised on paper. The boundaries were digitised and featurised in a similar way to the crests.

The results were then draped over the TIN generated for the crests, to test whether areas marked were correct. Spatial selections in REGIS were used to transfer the gateways control information to the relevant land parcels.

12.10.2.1 SELECT G1 (SELECT GATEWAY AREAS)

This select queries the CCP Geobase and creates a selection set of all the polygons identified as being gateway areas.

12.10.2.2 SELECT G2 (FILTER LAND PARCELS ON OR IN G1)

This select queries the CCP Geobase and creates a selection set of all land parcels that fall inside or touch a polygon identified as a gateway.

12.10.2.3 SQL G3 (UPDATE CONTROLS_LP_GK)

The SQL G3 query updates the CONTROLS_LP_GK table by converting data in the GATEWAY field from NONE to MAX control, for all land parcels that spatial SELECT G2 filtered out.

12.10.2.4 SQL G4 (UPDATE OVERRIDE_LP_GK)

The SQL G4 query updates the OVERRIDE_LP_GK table by converting data in the GATEWAY field from NONE to MAX control, for all land parcels that spatial SELECT G2 filtered out.

12.10.3 NATIONAL AND PROVINCIAL ROADS

SAMOAC (1998), backed by the National Roads Agency (Vide NRA regulations, identify advertising along NATIONAL roads as a severe safety hazard. Although not stipulated by SAMOAC, ROFAIL 1999, together with the DOACCP felt that advertising along PROVINCIAL roads with speeds of 80Km/hour and above posed a similar safety hazard. This assumption has never been proven correct or incorrect. Conflicting reports support both viewpoints (see report reviews in Velcich 2000).

The development of environmental overrides for NATIONAL and PROVINCIAL roads outlawed any non locality bound large media advertising within a 250m buffer along N and R routes.

These controls were implemented by placing a 250m buffer around the road reserve of all N and R routes that passed through the CCP metropolitan area. Exceptions were made where the N4 passes through the Pretoria CBD. In terms of the new NRA legislation, these roads are labelled N or R routes, but upon entering a built up (urban area), they no longer carry the status of NATIONAL or PROVINCIAL roads, and jurisdiction lies with the local authority.

Exact positions where the switch from N and R route status to local road network status can be found on the CCP Geobase.

Once the 250m buffers were generated, there boundaries were featurised as polygons, the same way that CRESTS and GATEWAYS were captured. Spatial selections in REGIS were used to transfer the ROADS control information to the relevant land parcels.

12.10.3.1 SELECT R1 (SELECT ROAD AREAS)

This select queries the CCP Geobase and creates a selection set of all the polygons identified as being road buffer areas.

12.10.3.2 SELECT R2 (FILTER LAND PARCELS ON OR IN R1)

This select queries the CCP Geobase and creates a selection set of all land parcels that fall inside or touch a polygon identified as a road buffer.

12.10.3.3 SQL R3 (UPDATE CONTROLS_LP_GK)

The SQL R3 query updates the CONTROLS_LP_GK table by converting data in the ROAD field from NONE to MAX control, for all land parcels that spatial SELECT R2 filtered out.

12.10.3.4 SQL R4 (UPDATE OVERRIDE_LP_GK)

The SQL R4 query updates the OVERRIDE_LP_GK table by converting data in the ROAD field from NONE to MAX control, for all land parcels that spatial SELECT R2 filtered out.

12.10.4 PARTIAL VALUE PROXIMITY CONTROLS TO PREVENT CONFLICT

SAMOAC (1998), relies on a sound town planning scheme in order to ensure that minimal conflict occurs between areas of MAXIMUM and MINIMUM control. However, what SAMOAC did not anticipate is the move towards new urbanism that promotes multifunctional mixed land use patterns. Problems arise when land zonings in the town planning scheme no longer zone large areas as one single land use. As a result of the urban design shift, cases in Pretoria developed where, areas of MINIMUM control (in terms of control zonings by SAMOAC 1998) bordered on residential areas, zoned as MAXIMUM control. As a result of this juxtaposition of control zonings, the visual character of residential areas was being compromised by "legal" advertising signage at commercial nodes in residential areas.

Proximity Environmental controls were developed by the IGIS (PTY) LTD. consultants to alleviate the conflict being experienced.

The procedure adopted was to convert all MINIMUM control areas that fell within or touched a 30m buffer around all MAXIMUM control land parcels to PARTIAL control. With this control in place, no MAXIMUM control area is ever closer than 30m to a MINIMUM control area.

When putting this control in place on the GIS, a limitation with REGIS was found. Due to the large number of MAXIMUM control land parcels in Pretoria (+/- 175000) the virtual memory on the PC running the GIS system was not sufficient to buffer each MAXIMUM control land parcel with a 30m buffer.

The problem was overcome by buffering all MINIMUM control land parcels by 30m (+/- 7000). All MAXIMUM control land parcels falling in this buffer were selected, and these MAXIMUM control land parcels were used to put the 30m buffer in place. This procedure optimised the selection and buffer procedures by eliminated all MAXIMUM control land parcels that were surrounded entirely by land parcels with the same MAXIMUM control zoning.

12.10.4.1 SQL P1 (MINIMUM CONTROL LAND PARCELS)

The SQL P1 selection grouped all MINIMUM control land parcels into a selection set.

12.10.4.2 SELECT P2 (FILTER LAND PARCELS IN 30M BUFFER OF P1)

The P2 spatial selection grouped all land parcels that fell within or touched a 30m buffer around any land parcel in the SQL P1 selection set.

12.10.4.3 SQL P3 (FILTER MAXIMUM CONTROL LAND PARCELS IN P2)

The SQL P3 selection filters out all land parcels with MAX control in the P2 selection. Once complete, the P3 selection set represents all MAX control parcels that could possibly alter surrounding MIN control parcels from MIN to PAR control. SQL queries and spatial selects up to this point were performed to correct the REGIS issue of not being able to perform selections on the full (and very large) Geobase.

12.10.4.4 SELECT P4 (FILTER LAND PARCELS IN 30M BUFFER OF P3)

SELECT P4 spatially selects all land parcels (MAX and MIN) that fall within or touch a 30m buffer placed around the selection set in SQL P3.

12.10.4.5 SQL P5 (FILTER MINIMUM CONTROL LAND PARCELS IN P4)

SQL P5 filters all land parcels in SELECT P4 that have a control rating of MIN control. This is the final selection set that will be altered from MIN to PAR control.

12.10.4.6 SQL P6 (UPDATE CONTROLS_LP_GK)

SQL P6 is an update query that changes the control ratings of all land parcels in the SQL P5 selection set form MIN to PAR. This data update performed changes on the CONTROLS_LP_GK table (see Table 24 on page 166 for an explanation of this table).

12.10.4.7 SQL P7 (UPDATE OVERRIDE_LP_GK)

SQL P6 is an update query that changes the control ratings of all land parcels in the SQL P5 selection set form MIN to PAR. This data update is performed on the OVERRIDE_LP_GK table (see Table 27 on page 169 for an explanation of the OVERRIDE_LP_GK table).