Chapter 8

The Development and Evaluation of a Democratised SDSS

8. The Development and Evaluation of a Democratised SDSS

8.1. Introduction

This chapter presents the development and evaluation of a tenant's Spatial Decision Support System to assist tenants to make relocation choices. The problem of public housing relocation described so far has been shown to require a solution that promotes the residential satisfaction, and hence wellbeing, of tenants. As discussed in Chapter Two, all Australians have the right to an adequate place to live in peace, dignity, and security. The adequacy of the home can be judged in terms of the structure and location of the dwelling; its affordability and cultural adequacy; and the facilities and services surrounding it (UNHCS, 2001). At the most essential level, the degree to which the home meets the needs of those who live within it, is reflected in the level of residential satisfaction that they experience. Public housing tenants, as residents of Australia's welfare housing, are at risk of having lower levels of residential satisfaction than members of the majority home-owning population. The residential satisfaction of each tenant household should therefore be a most important housing outcome in each residential relocation from The Parks.

The relocation of public housing tenants should include the aim to either maintain, or preferably improve, the residential satisfaction of each individual household that is moved. Maintaining or improving this residential satisfaction among the study population is likely to be more difficult than relocating other groups with less complex needs in our society. The study population, as described in Chapter Six, are especially vulnerable to the negative effects of forced relocation; they tend to be older, poorer, more likely to be migrants, and more likely to have a disability than the total population. As a result, they have lower levels of accessibility, less financial resources, and a higher need for services and social networks. Forced relocation of this disadvantaged population risks increasing their current level of marginalisation.

While the relocation of this largely disadvantaged population requires caution to prevent a decrease in residential satisfaction, it is also a time of opportunity to substantially improve the residential satisfaction and wellbeing of these tenants. New housing can be selected to better meet their individual needs, and a process can be employed where resident participation in the relocation decision process is increased, thereby creating a perception of control over personal outcomes for tenants. The level of perceived control that individuals experience during their relocation is known to improve residential satisfaction outcomes (Schwirian and Schwirian, 1993; Bruin and Cook, 1997; Fuller, 1995; Day, 2000), especially among populations that traditionally experience powerlessness. In addition, perceived control over outcomes helps to avoid the effects of sadness, depression, and a lost sense of security (Rohe and Mouw, 1991; Sayegh, 1987).

Residential satisfaction, as the expression of housing needs met, is composed differently by each individual and their household. A large component of residential satisfaction involves the individual perception of needs and the degree to which they are met. Therefore it is difficult to accurately formulate an ideal housing bundle for another individual. Each individual is an 'expert' in their own residential satisfaction, and their expert knowledge should be incorporated into the relocation decision process in order that outcomes best meet individual needs. At the gross level, only the tenant can properly define their exact housing needs, and at a finer level, only the tenant can judge between relative trade-offs, for example, if close proximity to a doctor is more important than having a dwelling with fewer stairs.

In order to increase the level of control that tenants have over their own residential relocation and include their expert knowledge, it is suggested that tenants should take part in the relocation decision-making process. This participation enables both an increase in the perception of control over outcomes, as well as a better quality of outcome from involving the expert in their own relocation decision. This chapter suggests a means of approaching the problem of public housing relocation in this way. A relocation process involving the tenant is described, as well as a Spatial Decision Support System that allows the tenant to combine their expert knowledge of their own requirements, with existing spatial datasets, in an easily approachable, 'user-friendly' computer program. The construction of a prototype SDSS is described in this chapter, followed by an evaluation of the system by key stakeholders involved in The Parks relocation process. The chapter begins with a discussion of the concept of SDSS and their usefulness.

8.2. Decision Support Systems with a Spatial Capability

At the individual level, relocation is a complex, ill-structured problem that requires subjective knowledge. Arias (1996, p. 1832, after Rittel and Webber) calls these type of problem 'wicked' because they are ill behaved, hard to handle, and do not have one correct answer. Put simply, relocation is the type of problem where there are multiple variables and the outcome will be based upon subjective preferences. This type of problem is difficult for human problem solvers, and unsuited to purely computer-based solutions. Decision Support Systems (DSS) have evolved since the late 1950s as promising means of addressing this type of problem (Densham, 1991). DSS assist the decision process by presenting and structuring large amounts of complex information in a simple and interactive way. They allow the problem solver to effectively sort and categorise much larger amounts of information than would be possible alone. The information that DSS provide is able to be interactively combined by the decision maker and analysed using their own subjective, expert knowledge, this assists the decision-maker to calculate the best choice between alternatives. A DSS supports, rather than calculates, the outcome decision.

DSS can be enhanced with spatial capability using Geographic Information Systems (GIS) to form a Spatial Decision Support System (SDSS). A SDSS therefore enables essentially spatial problems to be simplified and presented to the decision maker visually, flexibly, and simply (Laaribi *et al.*, 1996, p. 353). In the case of tenant relocation, a SDSS could enable the tenant to visualise possible outcomes of different decisions and make a spatial relocation decision, based on a large amount of information that can be presented in an easily interpreted form. A GIS combined with a DSS is particularly useful for solving essentially spatial problems like relocation decisions, but the combination also provides a means for better relaying and simplifying complex information. Because "evolution has endowed all intelligent creatures with an instinctive understanding of geographic relationships" (Couclelis, 1998, p. 209), the ability to combine and interpret information in terms of geographic relationships is an extremely powerful means to knowledge. The addition of a spatial component therefore provides significant problem solving assistance to a DSS.

As the spatial engine in a SDSS, GIS are powerful "tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes" (Burrough and McDonnell, 1998, p. 11). Any data that has some spatial component (for example an address, spatial coordinate, or map location) can be added to a GIS. This data can include cadastral information, such as residential parcels of land, social characteristics that occur over space, such as ethnicity, or even subjective information, such as the area an individual considers as their neighbourhood. In the case of a relocation SDSS, the locations of housing, local services, and environmental characteristics can be shown.

In developing a new and powerful technology such as GIS, a discussion of potential risks and ethical dilemmas has emerged (for example Goss, 1995). Because GIS is such a powerful tool for knowledge creation, there is significant debate about a potential widening gap between those with access to the skills and tools to use it, and those without that access. Sawicki and Craig are an example, they state that, "potential accessibility, together with the recent ascendancy of Internet, has made the serious question of information 'haves' and have nots' more urgent" (1996, p. 3). This call for GIS, from the beginning, to be democratised and hence be used to empower communities has been loud (for example, Harris and Weiner, 1998; Chrisman, 1987; Taylor, 1990; Obermeyer, 1998; Sawicki and Craig, 1996; Elwood and Leitner, 1998), but in reality this is more difficult than just making the technology available. In recent years, the hardware and software required to construct and perform GIS has rapidly become fast, cheap, and easy to use (Sawicki and Craig, 1996). As a result, the tools for performing GIS analysis are becoming increasingly accessible across the population

(Arias, 1996). Accessibility to the tools for GIS is, however, only one of the requirements needed to make GIS accessible. Individuals also need access to the data and to the skills to manipulate and interpret the analysis. Access to spatial data is an ongoing problem. Data collection and the conversion of existing datasets into useable formats is expensive and time consuming, and ownership of datasets also potentially makes useful datasets unaffordable[19]. In addition, because spatial data describes the real world, there are significant privacy issues involved in the production and distribution of these datasets (Goss, 1995, p. 176). The third group of requirements is access to the skills to use geographic information and GIS tools, and this is becoming increasingly possible. As the technology develops, more accessible 'front-ends' or interfaces are being placed upon the software. In recent years, the development of 'Desktop GIS' has meant that GIS can be accessed through an ordinary personal computer in the familiar Windows-based environment, making it accessible to many home computer users. This has perhaps been the greatest development for increased public participation in GIS.

Many authors believe that because GIS is potentially such a powerful tool for ordinary individuals and their communities, that GIS should be actively used by governments to facilitate a more "bottom-up" approach to planning (for example, Talen, 2000; 1999). By enabling communities and their residents the ability to access, use, and even generate spatial data, GIS can turn around the traditional 'top-down' methods of planning, where 'experts' make decisions for the populace. As discussed above, in many cases, top-down experts are unlikely to have much knowledge of the preferences of individuals, and there is much to be gained from involving all affected parties in a planning process. Government acceptance of the need to promote public participation in GIS is strong in the United States, where large scale programs such as Community 2020 (US Department of Housing and Urban Development, 1999) have been set up to empower communities with GIS data, skills and tools. The Australian Government is yet to officially address the problem of public participation in GIS to any significant extent, but as GIS technology is increasingly adopted here, there is an

[19] This is especially the case in Australia, where government collected data is not made freely and publicly available, as it is more often in countries like the US.

evolving push to broaden the accessibility of this technology. A most notable recent example is the development of CANRI, the Community Access to Natural Resource Information project (Government of New South Wales, 2000), which provides a web-based opportunity for creating knowledge using spatially referenced natural resource data. The data is made freely available, and so is the technology. The skills to use the technology have been simplified and made more accessible using an internet-based interface. This simplification of the interface is a similar approach to that used in a SDSS to promote accessibility.

The issues described above, which emerge from discussion within the GIS research community, are highly relevant to the understanding and development of a SDSS. In fact, SDSS are one promising means of packaging GIS to make them more accessible. SDSS are particularly powerful tools for assisting the vulnerable and powerless in our society, they provide a means for accessing essential and complex information, present the information so that it may be most simply interpreted, and structure the decision process. As knowledge creation tools, the essential differences between GIS and SDSS are their structure and end use. Choosing between the two is a trade-off between flexibility and complexity. SDSS are built to fulfil specific purposes, and assist with explicit, predefined questions. SDSS require that the architecture of the system is predetermined, but the end user requires little or no knowledge or training in spatial analysis. A GIS must be operated by a trained user, who has access to spatial data. The result is a flexible environment, where the user defines the topic and structure of the inquiry.

In the case of the relocation of public housing tenants from The Parks, a SDSS, rather than a pure GIS, is the better tool to provide information for the relocation decision process to tenants. The study population have a specific problem, which involves an individual, largely subjective decision. They are also likely to have low levels of computer literacy, and most would have little future use for comprehensive training in the use of GIS. A question remains, would it be more useful to assist these tenants on an individual basis using GIS technology, and a trained user who could translate their requirements into GIS analysis? Probably not. This would have some value, but existing relocation officers would be able to operate a SDSS, but not a GIS. In addition, the value of a SDSS is the structured decision making ability that it provides. Addressing the problem of individual relocation actually requires limited GIS analysis, the major usefulness of a SDSS is that it can help the residents to structure their problem, and also feel that they personally have some control over its outcome.

This section has highlighted the importance of, and large amount of current research occurring in, community-focussed applications of GIS and decision support. Very little research has focussed on household locational planning, and there has been only one significant application of these ideas to the problem of public tenant relocation (Johnson, 2001). While Johnson's research differs from the current research in supporting more strategic locational decisions, such as assisting tenants to isolate a general area of preference, it is nevertheless an important demonstration of the usefulness of this technology for public tenants. The research described in this thesis differs from Johnson's work in another important way, in that this research is more focussed on the importance of public participation and technological accessibility for public tenants and also to developing an improved approach to the process of tenant relocation.

8.3. Content of the Prototype Tenant's SDSS

The previous chapters have investigated the concepts of relocation, mobility, and the formation of residential satisfaction. They have presented a profile of the relocation and location decision process, and the individual considerations included in making such a decision. These considerations should be the core of any SDSS constructed. Section 8.1 has discussed spatial decision making systems, and this section summarises the potential inputs to a relocation SDSS, based on the findings of the previous chapters.

A SDSS should provide information to tenants about the structure of potential dwellings, such as whether the dwelling is attached or detached. This will also provide insight to the likely density of development and potential level of privacy from neighbours, which are also important in locational decisions. An additional consideration for inclusion into the SDSS is information about the size of the dwelling. Space was shown to be a key characteristic in the selection of housing for tenants, and the number of bedrooms a dwelling contains is a reasonable proxy for this variable. In addition to the size of the dwelling, some indication of the physical quality of the dwelling should be able to be made. Tenants have been shown to desire housing that is of reasonable overall quality, as well as dwellings that are well maintained. Special features of a dwelling, such as modifications that have been made to assist the aged or disabled are important residential selection criteria and should feature in the decision process. The presence of a yard, and its size should also be included.

An individual's perceptions of the quality of the neighbourhood are also important considerations to be included in the decision system (as discussed in Chapters Three and Four). Public tenants have been shown to prefer areas that are clean and well maintained, away from industry, and that have low levels of crime. Public tenants will desire areas that have amenity, and areas that they prefer for personal or historical reasons. They will also be likely to choose areas that are familiar and close to their pre-move address. Information about the immediate area surrounding the house is important for locational decisions; locational aspects such as noise from roads and encroaching development affect the relocation consideration. The proximity to green areas and open space is likely to be a relocation consideration for some.

The proximity of a dwelling to important local services and facilities, or accessibility that the location provides, is paramount in a location decision. Access to local shopping is perhaps the most important accessibility consideration for the majority of tenants. Access to facilities such as recreation, education, and medical services is also important to many tenants. Education will be a special consideration to families with school-aged children, and schools with special programs need to be able to be identified. Public transport accessibility is of importance, especially where the household has no access to a private car. Access to employment is another important component of the potential SDSS. There are also a number of other important facilities and services, such as restaurants, and the central business district.

Care needs to be taken in any relocation to maintain important social networks if the tenant values them. Access to social contacts is crucial to many relocation decisions, and must therefore be incorporated into the system. Among social contacts, familial ones are likely to be the most important. Access to friendship and neighbour networks is also a relocation consideration for many tenants. As well as maintaining social networks after relocation, the opportunity needs to be given to relocating tenants to continue their social involvement and attachment, such as in recreational clubs or churches, by either allowing them to locate near the current place of social involvement or to locate near another similar one. The amount of information that could be contained in a relocation SDSS is limited only by data availability and the need for simplicity in the decision process.

8.4. Construction of the Prototype Tenant's SDSS

A prototype SDSS, to assist and involve public housing tenants from The Parks in their relocation decisions, was constructed as part of this research. The SDSS drew on the knowledge gained in the preceding chapters about the mobility choices and preferences of public housing tenants, and the formation of residential satisfaction. This knowledge was incorporated into a portable system that would allow the relocation decision process to be undertaken by tenants in their own homes. Portability of the system was believed important to increasing the perception of control that tenants had in the relocation process, and to decreasing the disruption associated with the process. A system that was easy to use was necessary because it was designed to be operated by South Australian Housing Trust relocation officers who were likely to have limited computer experience. These officers would also be required to run the software in remote locations (in tenant homes), and any technical problems could quickly decrease the confidence of the relocating tenant in the outcome decision. The system also needed to be easily understood by tenants who were likely to be unfamiliar with computers.

Five main objectives led the construction of the SDSS.

1) That it be portable and easy to use.

2) That it simplify the decision process and provide increased information to the decision maker than would otherwise be available.

3) That it be a means of including tenants and their expert knowledge in the selection of a new dwelling and location.

4) That it increases tenant's perception of control over outcomes in the relocation process.

5) That it appear simple, and not technologically threatening to users, especially those unfamiliar with computer use.

The SDSS was designed as a program to be installed on a laptop computer. This laptop would then be taken by the SAHT relocation officers to tenant houses. A tenant about to be relocated would be visited by a Trust officer carrying the laptop, who would then guide them through a relocation decision process. During this decision process, tenants would be asked to select important elements of a residential location, and their preferred proximity to facilities and services from a menu of possibilities. They would then be shown a series of Housing Trust dwellings that meet a number of their criteria. The local area of each dwelling would be displayed, as well as a photograph, and some information about the dwelling and its local environment.

The SDSS described in this thesis was designed and developed as a prototype 'proof of concept', to investigate the usefulness of this approach to tenant relocation. While the structure of the system is fully functional, the residential choices are limited. In a fully functioning version of this system, a wider number of residential choices would be available. The residential elements included in this prototype were selected by a combination of their relative importance in a relocation decision, as well as data availability and the quality of the available datasets. There are six decision streams displayed in the prototype, they are discussed below and summarised in table 8.1.

Table 8.1: Summary of Datasets Contained in the Working Prototype

Decision Stream	Dataset Name	Data Source	Data Fields Contained
Education	Education	South Australian Department of Transport, Urban Planning, and the Arts (DTUPA)	• Institution Name • Institution Address • Institution Suburb • Education Type (Pre-School, Primary, Secondary, Tertiary)
Medical	Medical	Combines information from 2 sources: • Dataset containing hospital information supplied by DTUPA • Dataset containing doctors information (proxy) constructed for this project using the South Australian Government Gazette as a template for approximation of the number and distribution of practitioners.	• Service/Practitioner Name • Service/Practitioner Address • Service/Practitioner Suburb • Medical Service Type (Hospital, Male Doctor, Female Doctor)
Work	Suburbs	Dataset sourced from TransportSA	• Suburb Name
Shops	Inactive		
Transport	Inactive		
Church	Inactive		
	Regions	Generated for the SDSS	Contains four overlapping regions, covering the entire metropolitan area of Adelaide.
	Vacancies	From SAHT vacancies file, a snapshot taken August 2001.	• Vacancy Address • Construction Type • Number of Bedrooms • Construction Year • Presence of a Rear Yard • Presence of a Back Yard • Presence of a Rainwater Tank • Presence of Washing Machine • Presence of Disabled Ramps • Presence of Lever Taps • Presence of a Lawn • Disabled Access Indicator • Main Road Location • Pets Allowed Indicator
	UBD Images	Pacific Access Limited	Images containing information such as road maps, suburb boundaries, the location of local services such as police stations, Post Offices, and green areas. An example can be seen in Figure 8.19 below.

8.4.1. The Residential Elements

Education was known to be a potentially important component of the SDSS. This dataset was obtained from the South Australian Department of Transport, Urban Planning and the Arts. The GIS dataset included information about the locations, names, and types of educational institution across the whole of the metropolitan area.

All levels of public and private education were included: pre-schools, primary schools, high schools, and tertiary institutions.

The location of doctors and hospitals was selected for incorporation into the prototype SDSS. A dataset was obtained from the South Australian Government Department of Human Services, which showed the location of hospitals across the metropolitan area of Adelaide. A dataset containing the names and locations of all doctors in the metropolitan area is under construction by the Department of Human Services, but does not currently exist. For the purposes of this research a proxy file was created, based upon a list of all medical practitioners and their locations, registered to the Medical Board of South Australia and published in the South Australian Government Gazette. The proxy doctors file represented a similar number and distribution of doctors across the metropolitan area. Information about the gender of the doctor was also represented in this dataset, because many older and ethnic women prefer to select female doctors (Whittle and Williams, 2002). The use of a proxy dataset for the purposes of testing the potential usefulness of a SDSS was justified by the fact that the usefulness of the system was being tested, not actual locational outcomes.

The location of place of work was added to the SDSS as a residential element. Underlying this element was a GIS database containing the geographic centroid of all suburbs in the metropolitan area. In the program, when a user selects a work suburb, the centroid of that suburb is used by the SDSS as a proxy for their work location. It was envisaged that in later development of the system, the actual location of the workplace would be selected by the user. This would require the incorporation of a digital cadastral database with an address component, which is readily available.

Public transport was selected as another component of the SDSS. Information about bus, train and tram routes, stops and directions was gathered for incorporation. The quality of available spatial data for this element was judged too low for full integration into the system. The concept has been added, but it is portrayed as a 'dead-end' decision stream in the SDSS. This element would make a useful component of any future system, and a good quality spatial dataset is currently being constructed by the South Australian Transport Authority.

The location of places of worship such as churches and mosques was also selected as a component of the SDSS. This element was of high importance to a small number of the survey population, and a good quality dataset existed, and it was hence included as an example decision stream. The dataset was obtained from The Government of South Australia, through the Department of Transport, Urban Planning and the Arts. This dataset showed the location and denomination of all places of worship across the metropolitan area. In the prototype version of the SDSS, this component was not activated; it was contained only as an example dataset.

Information about shopping and facilities that were located nearby was collected for incorporation into the SDSS. The Government of South Australia, through the Department of Transport, Urban Planning and the Arts has constructed a spatial Retail Database. Published in 1999, this database contained the spatial boundaries and details of all retail businesses in the metropolitan area. This database included most of the major nominated shop types, such as supermarkets and corner shops, banks and hairdressers, as well as the social security offices and post offices that were nominated as important facilities. This database was examined for inclusion. While it was found to be of good quality and potentially very useful to later developments of the SDSS, it is inactive in the prototype.

8.4.2. Design and Architecture of the System

The first phase in the design of the SDSS was to develop a conception of the decision process based on thee earlier analysis of important components in a relocation decision. An initial structure for the system was constructed separating all of the potential relocation factors into a series of choices and decisions that could be made by the user. The initial SDSS structure also set out a methodology for re-combining all user decisions at the end of the decision sequence. The design principle guiding the decision process was to progressively select from the total pool of available dwellings a number of suitable dwellings, each of which could be evaluated individually by the tenant in detail. This SDSS trial structure was tested and refined from June to August 2001. The final visual structure for the system and a flow chart of the decision process was then established. These are summarised in Appendix 8.1 and 8.2.

To meet the objective of simplicity and low-level technical appearance, the system was designed to avoid the traditional Microsoft© appearance that many computer programs possess. Once learned, the common computer environment is readily understandable, but the learning curve is slow at first. Many of the potential users of the SDSS will have never used a computer before, and many would be unlikely to use one again. Therefore, it was judged most effective for the purposes of this research to design a simplified user interface that was relatively inflexible, but quickly understandable and not technologically threatening. The result is an interface drawn from an understanding of the techniques of visualisation, one that was bright and extremely simplified, and hid a relatively complex GIS capability underneath.

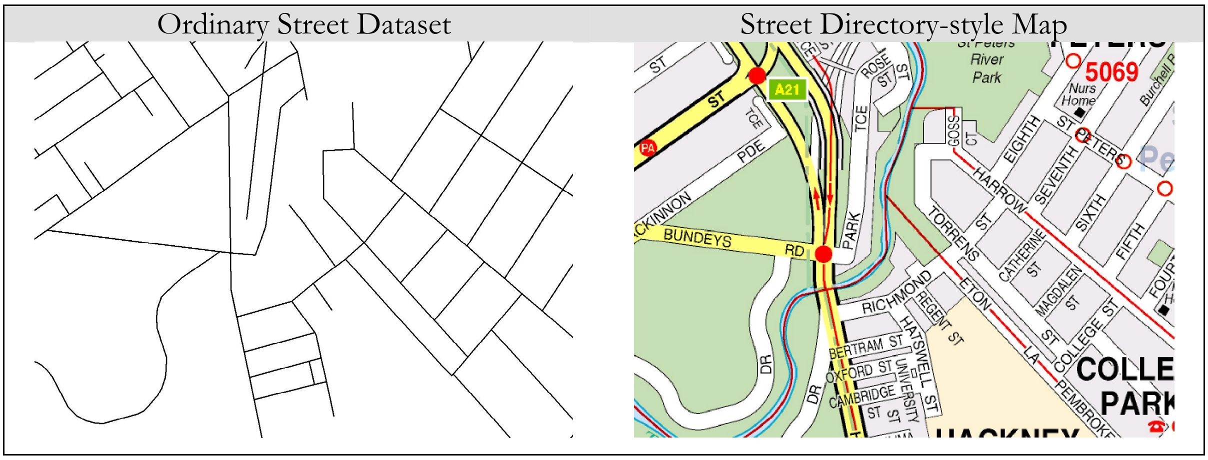
During the design of the SDSS structure, it became apparent that much of the information complexity from the program could be removed and included in the dialogue between the relocating tenant and their relocation officer. This would make the end product much simpler and easier to use, and would enable a large amount of text to be removed from the screen. In addition, dialogue is often easier to understand when it is spoken, rather than written, especially for those whose first language is not English, or individuals with impaired vision. Through this process of simplification, many of the parts of the SDSS program structure were redesigned to prompt discussion between the tenant and their relocation officer. For example, an early screen in the program (shown later in Figure 8.3) was designed as a prompt for a discussion between the tenant and their relocation officer about the relocation decision process and the possibilities and limitations of the SDSS, rather than explaining it to them using text written on the screen.

Underlying the interface of the SDSS, the collection of GIS compatible databases enabled spatial processing to occur. As discussed above, because the aim was to test the concept of a SDSS by constructing a prototype, the specific datasets selected for inclusion were of decreased importance, and hence their selection was based upon expected usefulness to a relocation decision, as well as data availability and quality. If the SDSS were to be developed further, and a fully functioning system were to be used for actual tenant relocations, good quality datasets would need to be assembled that reflect the exact relocation needs of tenants. For example, public transport has been shown in the literature, as well as in the current evaluation of the SDSS, to be highly important to relocating tenants. This dataset is included in the prototype, but it is inactive because at the time of writing a high quality spatial dataset describing public transport was being created but was unavailable for metropolitan Adelaide, nevertheless it would be essential for inclusion in a working tenant SDSS.

The whole of the metropolitan area of Adelaide was selected as the spatial extent of the system (as shown in Figure 6.1). During the initial design phase, the system was planned to cover only the area that the majority of tenants from The Parks area were expected to relocate to. This was an area extending approximately five kilometres from the relocation zone, with an additional buffer to allow for travelling distances. By including information for the whole of the metropolitan area, tenants relocating from The Parks could examine a wider selection of potential relocation dwellings and locations. An additional benefit of this wide spatial extent was that the prototype system could potentially be used by all relocating any metropolitan Adelaide SAHT tenants, not just tenants from The Parks area.

In order to increase the visual familiarity and 'understandability' of the system, a background dataset in a format familiar to tenants was sought. In recent years, a series of geo-referenced images in the same format as the familiar street directory have been produced. Access to this data was provided by its owners in Australia, Pacific Access, for the construction of this prototype. It was hoped that, for individuals unused to interpreting maps and two-dimensional representations of space, the familiar street directory format would improve understanding. An example is presented in Figure 8.1 below.

Figure 8.1: Comparison of Background Map Styles



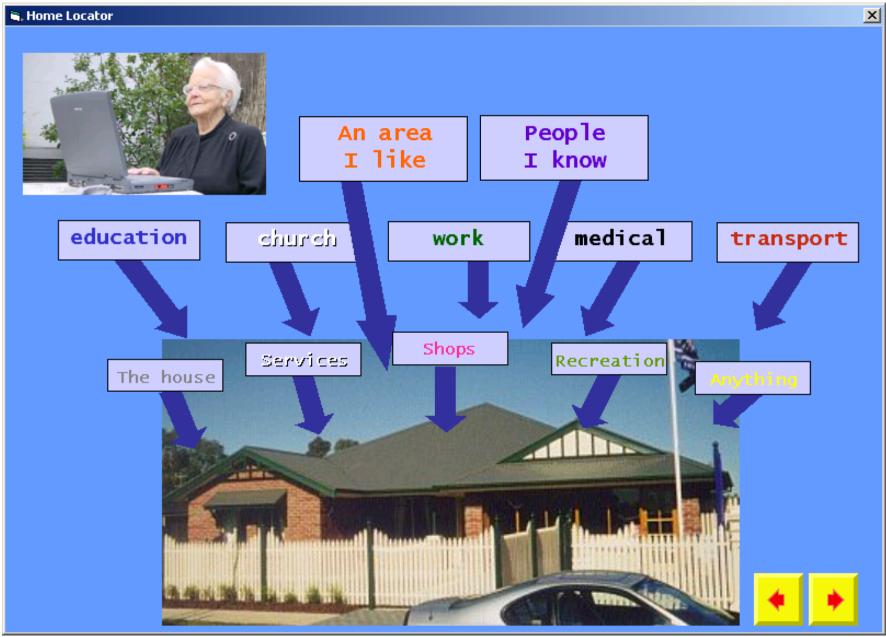
The system was constructed using a series of images as the framework. These images set out the exact structure and content of the program, and composed the basis for the user interface of the SDSS (Appendix 8.1). The computer program was written in Microsoft Visual Basic 6.0 language, using ESRI's MapObjects, to provide the GIS capability. A consultant programmer, working with the author, performed the programming for the SDSS. The consultant was supplied with a detailed brief that prescribed the exact structure and processes that would occur in the SDSS. The programmer was also supplied with all GIS datasets that were to be used, incorporated into a functioning GIS program. The datasets underwent error checking and correction, and were manipulated to a common projection, so that they could be displayed together.

8.5. Demonstration of the Tenant's SDSS

This section describes the content of the SDSS, using an example decision process. The working SDSS program is included on a CD Rom as Appendix 8.3. This can be explored by installing it on a desktop computer. The program is named HomeLocator.

Figure 8.2: Introductory Slide

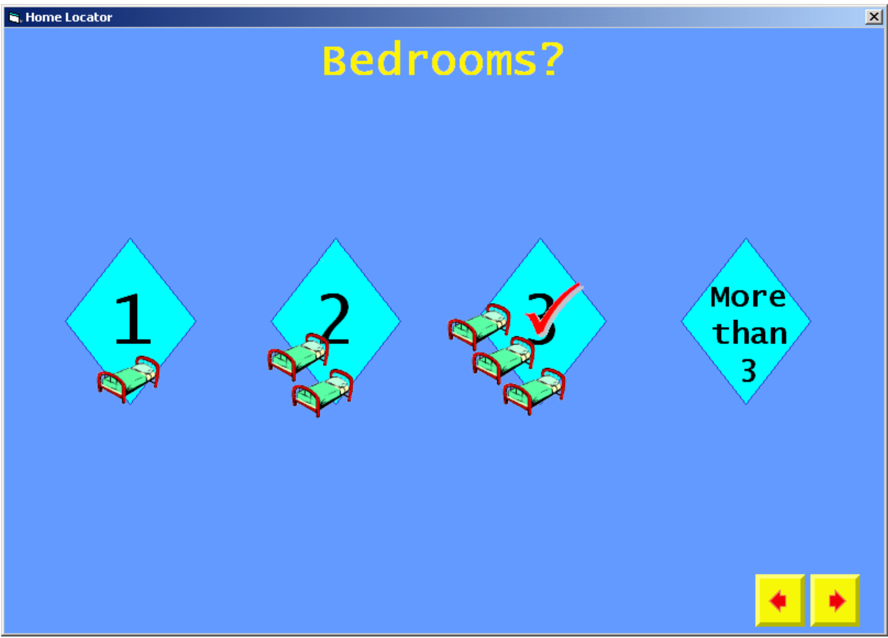
Figure 8.3: Describing the Decision Process



In this example, the introductory slide (shown in Figure 8.2) starts the program with images of relocating as a positive process. During this slide, the relocation officer introduces the system as a tool to help the tenant make a decision about where they might like to live. It leads on to the second slide (shown in Figure 8.3), which describes the decision process. This slide is presented to initiate a discussion between the tenant and the relocation officer about the way that the program structures the decision making process. The image on this slide portrays relocation decision making as a decision process where there are many variables and the best outcome will be different for every tenant. At this stage a button appears on the screen that allows the decision maker to go back to an earlier part of the decision process. This is available throughout the rest of the program.

Following the discussion of the way that the SDSS works, and an explanation of what it can and cannot do, the tenant is able to move on to the next slide, "Bedrooms?" (Figure 8.4). The number of bedrooms allocated to SAHT tenants is traditionally a value judgement made by the relocation officer in consultation with the tenant household, and not solely made on the basis of how many individuals there are in the household. The relocation officer generally discusses how many bedrooms are required by tenant households, taking into account the need for a study, sewing room, or reasons such as the fact that grand children often visit. The structure of the South Australian public housing stock has historically allowed this to occur, because there are an over-supply of three bedroom dwellings, and a dominance of one and two person households (this information is taken from verbal communications with various SAHT relocation officers).

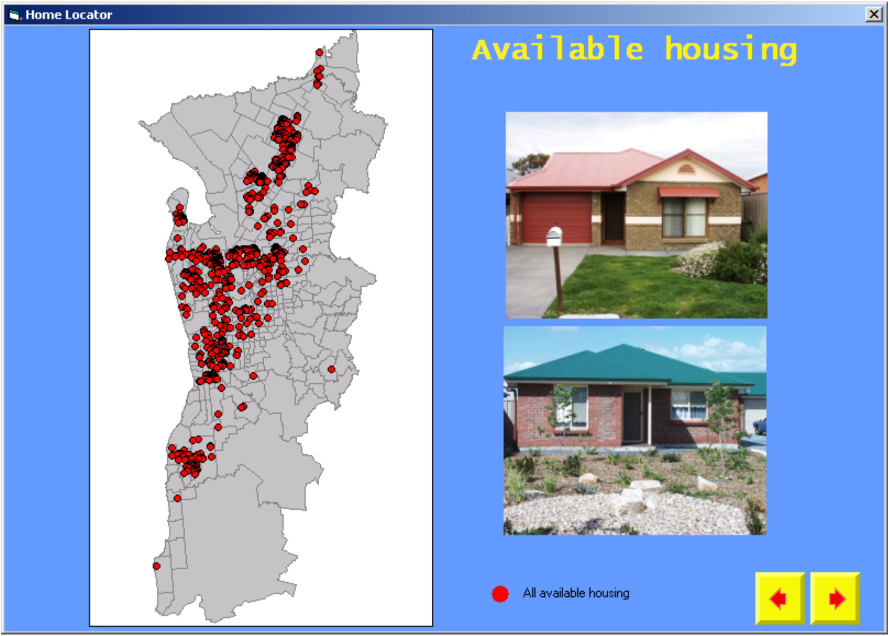
Figure 8.4: Number of Bedrooms



After selecting how many bedrooms are required, the user clicks the mouse on the appropriate number on the screen. Underlying this selection is a database that contains the total vacant Housing Trust dwellings for the metropolitan area. This information is stored 'live' within the SAHT computer system. The SAHT has a central information server, so that, as stock updates are made, such as a dwelling becoming vacant, or maintenance performed, this information is added from regional offices to the central server. Any subsequent queries to the central server will include this updated information. Because the SDSS is designed to be taken out into tenant homes, and for simplicity not connected to the central server for that interview duration, it is planned that the SAHT officer will download a 'snapshot' dataset of vacancies from the central server to the SDSS at the beginning of each day. A snapshot dataset in the same format has been used in the development of this prototype SDSS.

Currently the SAHT is in the process of improving the information that they hold about their stock. Each time a dwelling becomes vacant or has maintenance performed, a large amount of additional information about the dwelling, such as specific disabled modifications, the presence of ramps for wheelchair access, the size and condition of the yard, etc., is collected and added to a dataset. This dataset is still being constructed, and therefore there are many incomplete fields of information. It was judged important to include this current and potential information in the prototype SDSS because it would allow a more informed relocation decision. In addition, the SAHT is preparing to embark on a large-scale project to photograph all dwellings in their stock. Though this project is currently incomplete, it has been included in the development of the SDSS. For the prototype generic photographs, classified by their construction type, were used to indicate the appearance of the dwelling. In future developments of the SDSS, genuine photographs of each dwelling would replace these generic images as they are collected.

Figure 8.5: Available Housing



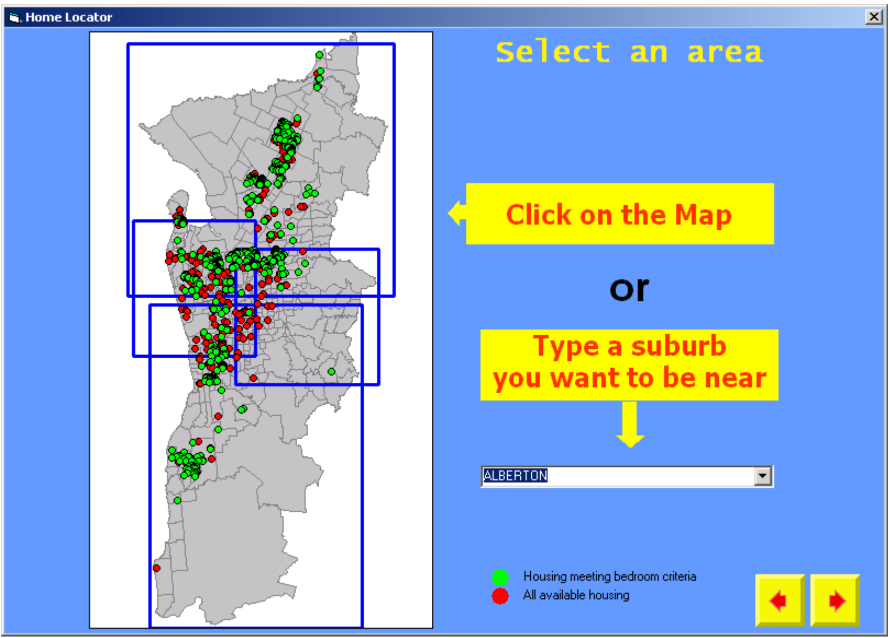
The action of clicking on the number of bedrooms icon, selects from the vacant dwellings database, those dwellings with the appropriate number of bedrooms, in this example, three. The following slide (shown in Figure 8.5), displays a map of the metropolitan area showing all of the vacant public dwellings[20]. The reasons for presenting this information are twofold. Firstly, to provide information about the quantity and distribution of available dwellings, and secondly, to provide a realistic picture of what is **not** available. For example, there are very few dwellings in the eastern part of the metropolitan area, and it was judged better to provide this information at the beginning of the decision process so that tenants are permitted to make their relocation decisions from within realistic boundaries.

After selecting the number of bedrooms, the user has the option to continue forward, to select an area (shown in Figure 8.6). The ability to select a residential area, allows tenants to centre their search for a new dwelling around areas that they like, are familiar with, or contain important social networks. At any time during the decision process, the user can return and select another area to examine. The selected area can be a zone of the metropolitan area, or can be a smaller area surrounding a particular

[20] In future development of the system, this would need to be refined to display only vacant dwellings with the selected number of bedrooms.

suburb. The zones overlap, so that if an area at the boundary of a zone is preferred, then the user can select which zone best meets their needs. If a suburb is selected, the system automatically selects that suburb as the centre of the search area; the boundary of the search area then extends roughly five kilometres from that central point. This wider area than a specific suburb was built into the system because many users would be unsure of the exact boundaries of particular suburbs, but have a general perception of the local area that they would prefer, often surrounding suburbs would be appropriate. In addition, Adelaide suburbs can be as small as 0.1 km^2, and many of these smaller suburbs contain no public housing stock. A consideration in the construction of the SDSS was that there should preferably be dwellings to select from in the latter stages of the decision process; therefore a wider selection area is preferable to a smaller one. The selection is detailed in Figure 8.7, with vacant dwellings of the appropriate bedroom number shown, as well as all vacant dwellings.

Figure 8.6: Area Selection



The following screen (Figure 8.8) asks the user to nominate important elements of their residential environment by removing those elements that are not important. This method was chosen to allow the user to eliminate, rather than choose from between a small number of options. This was hoped to empower the tenant user by giving them control, rather than choice between a limited numbers of options. During the programming phase it was unclear whether this structure actually increased the perceived power felt by the user, or only served to confuse them. This will be examined in the evaluation, described in section 8.5. As discussed in section 8.3, six experimental residential elements are incorporated in the prototype SDSS. The user can select any number of these elements as important to their relocation, and underlying each is a series of GIS databases.

Figure 8.7: Display of Area Selected

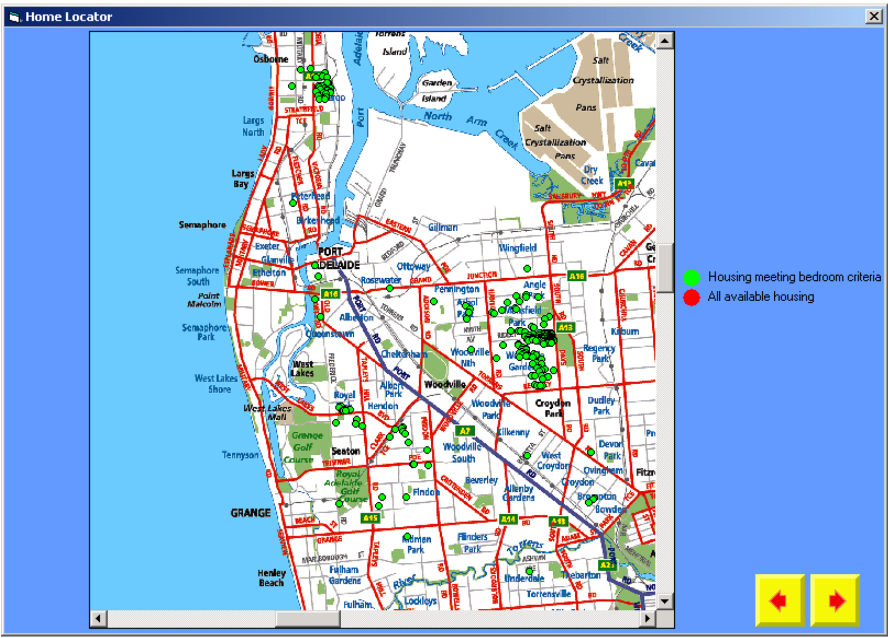
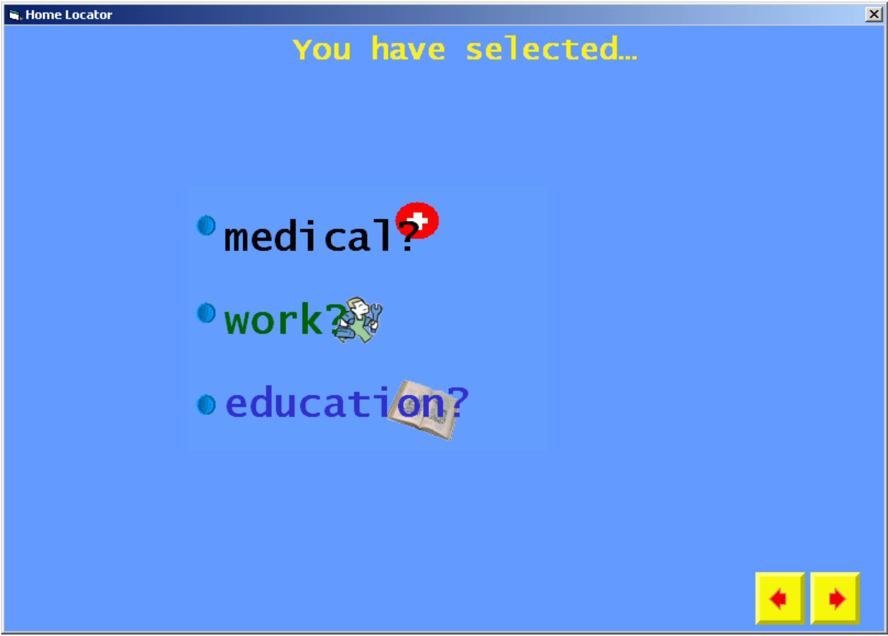


Figure 8.8: Residential Elements

Once the user has eliminated those elements that are not important to their relocation decision, in this example, Shops, Transport, and Church (Figure 8.9), they are presented with a summary of their selections (Figure 8.10), and then can continue through the decision sequence.

Figure 8.9: Eliminate Unimportant Elements

Figure 8.10: Selected Residential Elements



In the following step in this example of the SDSS, the user is asked to select what medical services are important to them. The system allows them to select between public hospitals, GPs, and female GPs, or specific medical practitioners or facilities, such as their own doctor or cardiologist[21]. The lower part of the screen allows the user to nominate how far they would be prepared to travel to get to the selected medical service. They can either select walking distance or define a specific distance, such as 5 kilometres. Walking distance was set at 500m in this prototype. A literature search found 400-500m to be a reasonable walking distance (Gibson, 1997), based on the commonly held belief that reasonable walking distance is the distance travelled by a normal person in around five minutes. Underlying the medical decision screen is a series of spatial datasets that describe the location of medical services across the metropolitan area as described above. The SDSS combines these medical selections with the information already selected, in this case, three-bedroom vacant dwellings in the selected area (shown in Figure 8.12).

[21] In this version of the prototype, the user is able to select specific medical practitioners by their address. It would be beneficial in future developments of the system to adjust this function to allow a search by medical practitioner's name.

Figure 8.11: Medical Decision Screen

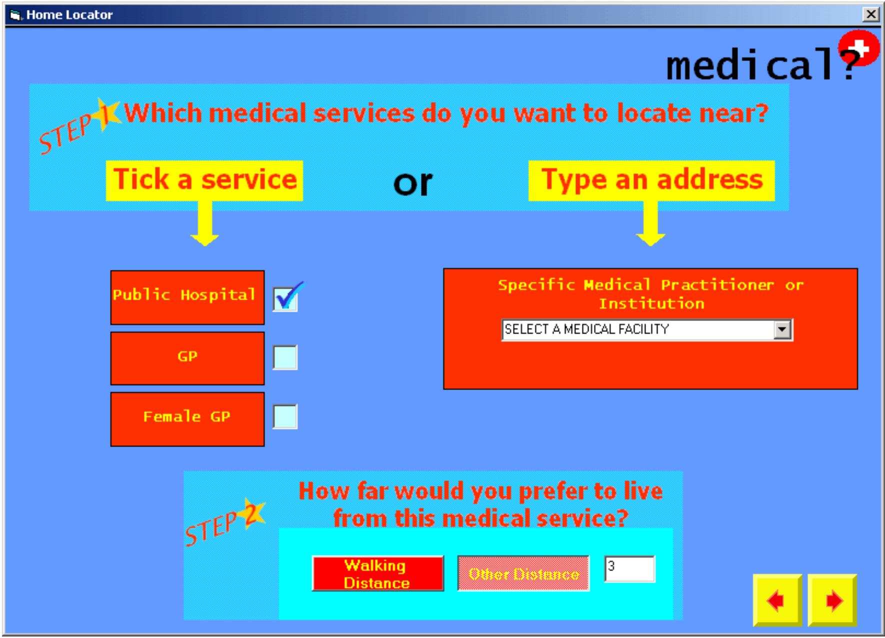


Figure 8.12: Medical Choices Displayed

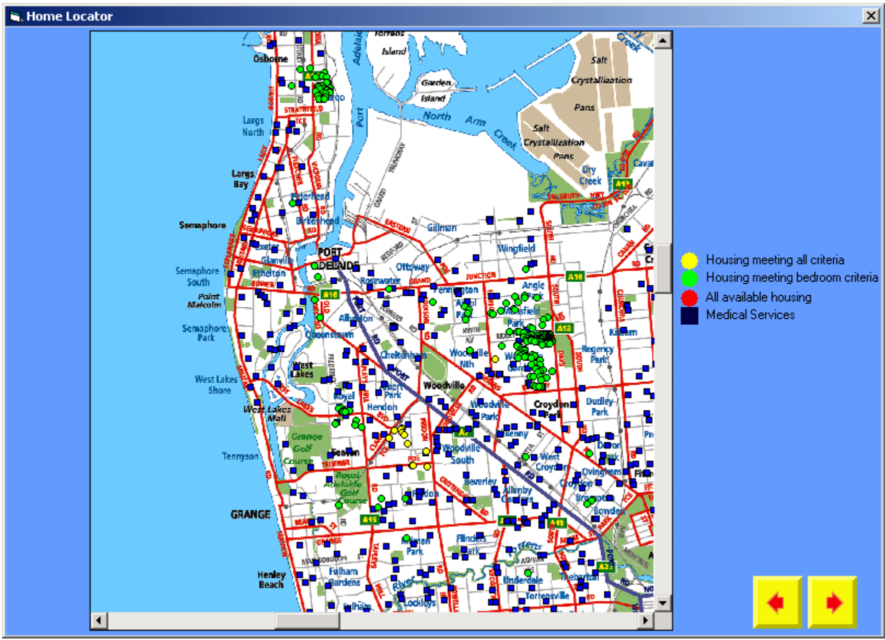
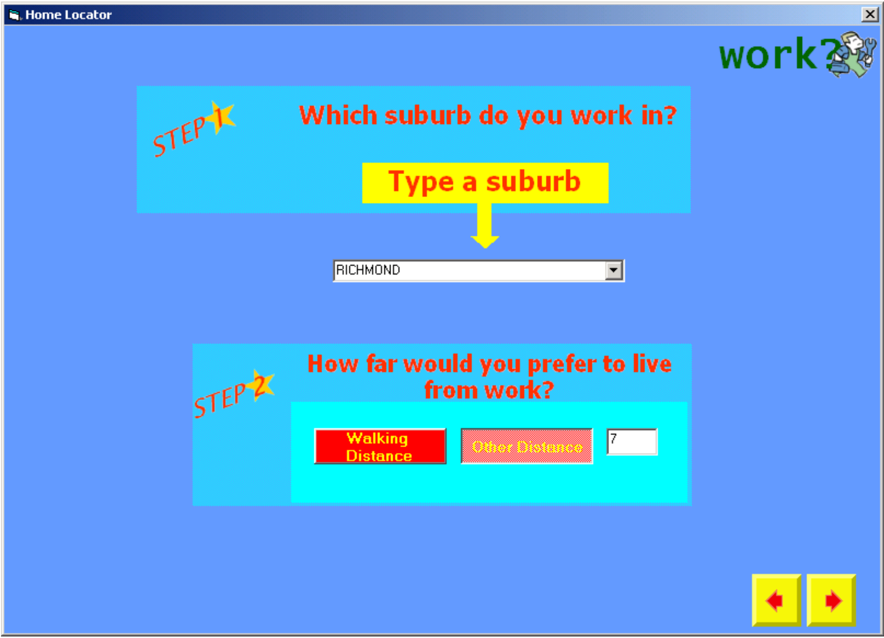


Figure 8.13: Work Decision Screen



Figures 8.13 and 8.14 represent the work decision sequence. Figure 8.13 collects information about the employment location of the user, and distance they are prepared to travel to work. If the selected distance is greater than the distance between work and the selected local area, the user is prompted to select a greater travelling distance. Figure 8.14 again shows the additive map of the local area, with work location, the location of selected medical services, and vacant dwellings with three bedrooms displayed.

Figure 8.14: Work Choice Displayed

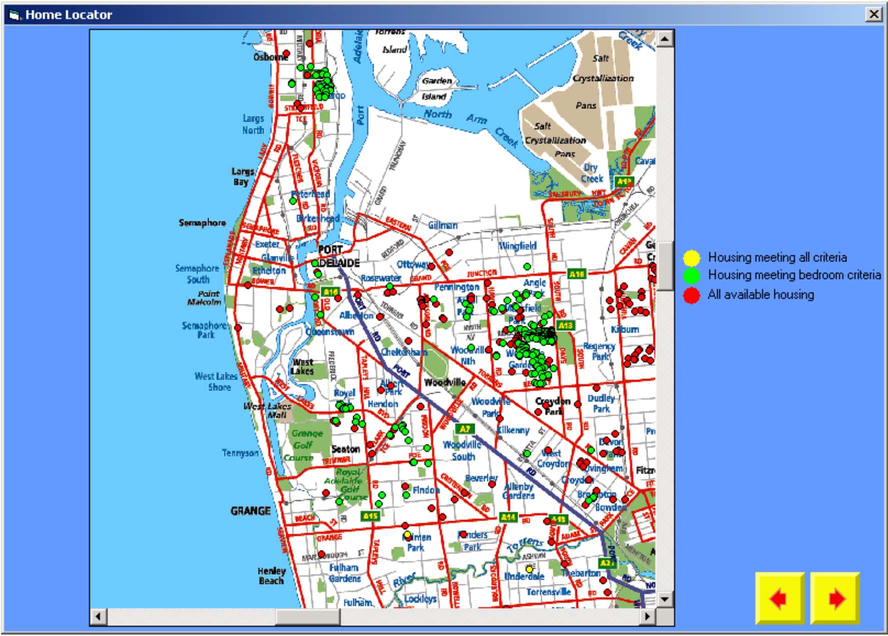


Figure 8.15: Education Decision Screen

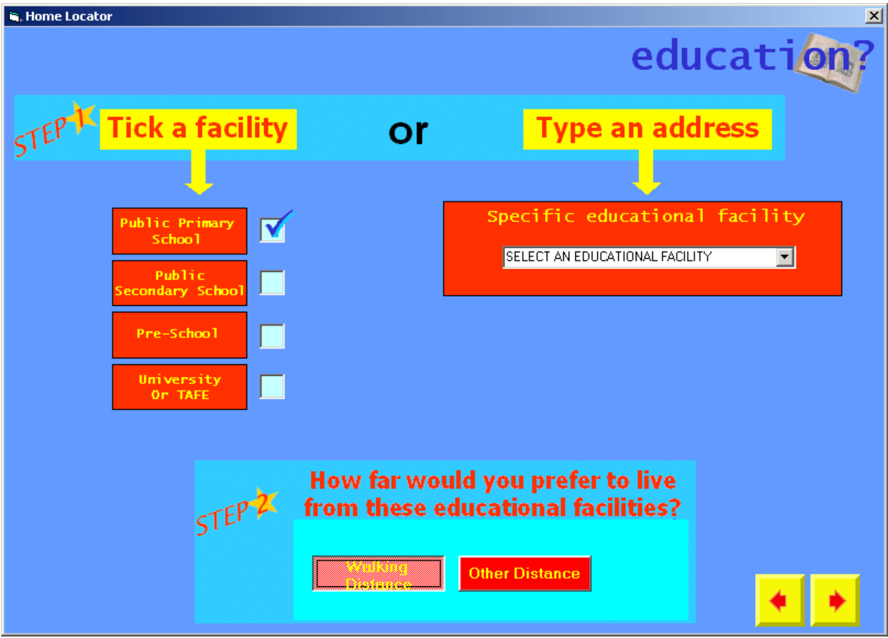
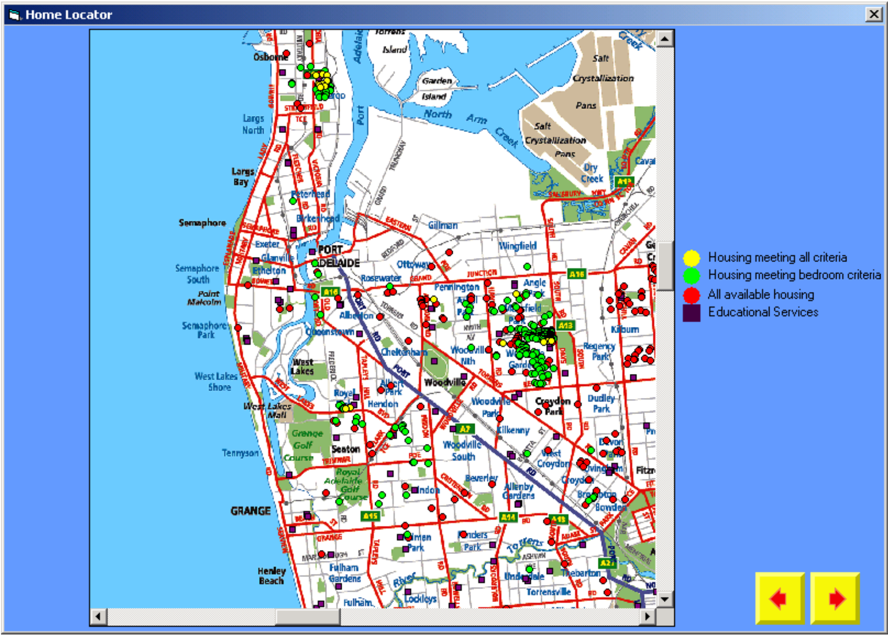


Figure 8.16: Education Decision Displayed



Following the same logic, Figures 8.15 and 8.16 collect and display user choices about education services. They are able to select general levels of educational facility, or a specific facility, and the distance to it. Again the additive map of the local area is shown, this time with the addition of the selected educational facility information.

Figure 8.17: Decision Summary

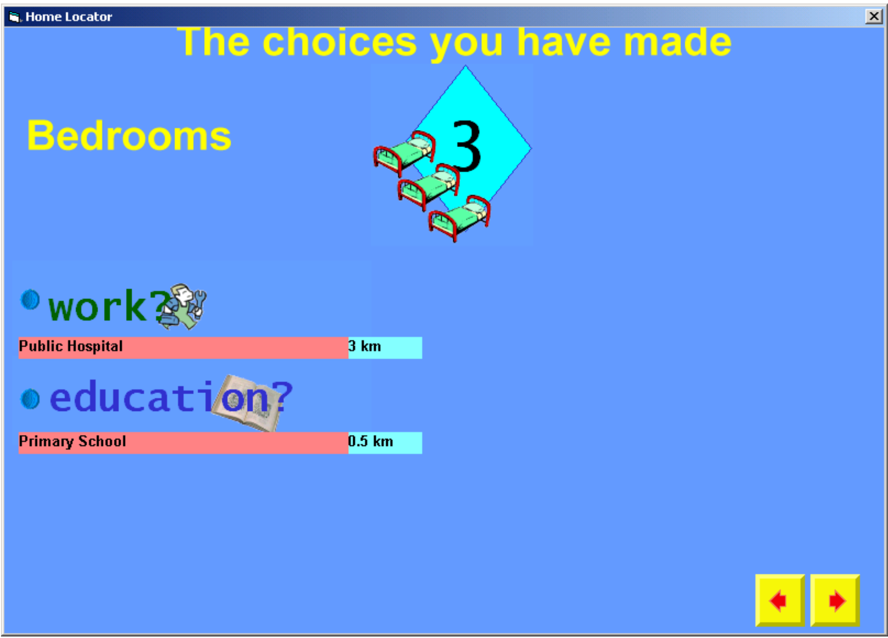


Figure 8.17 shows the decision summary screen, this displays all of the choices that have been made and allows the user the opportunity to return and change any of

their choices[22]. Progressing from this screen, the SDSS then processes all of the information that has been added by the user, the object of this calculation is to isolate dwellings that meet any or all of the criteria that have been selected. In the case of this example, the following selections have been made:

Area Selected:	**Western Zone**
Number of Bedrooms:	3
Residential Requirement A:	Medical
Type of service selected:	Public Hospitals
Distance to selected service:	3km
Residential Requirement B:	Work
Suburb selected:	Richmond
Distance to selected suburb:	7km
Residential Requirement C:	Education
Type of service selected	Primary schools
Distance to selected suburb:	Walking distance (500m)

These criteria are combined in the following way.

- Select all 3-bedroom dwellings that fall within the Western Zone, from among these selected dwellings;
- Calculate which of these dwellings fall within 3km of a public hospital (=A)
- Calculate which of these dwellings fall within 7km of the suburb centroid of Richmond (=B)
- Calculate which of these dwellings fall within 0.5km of a primary school (=C)

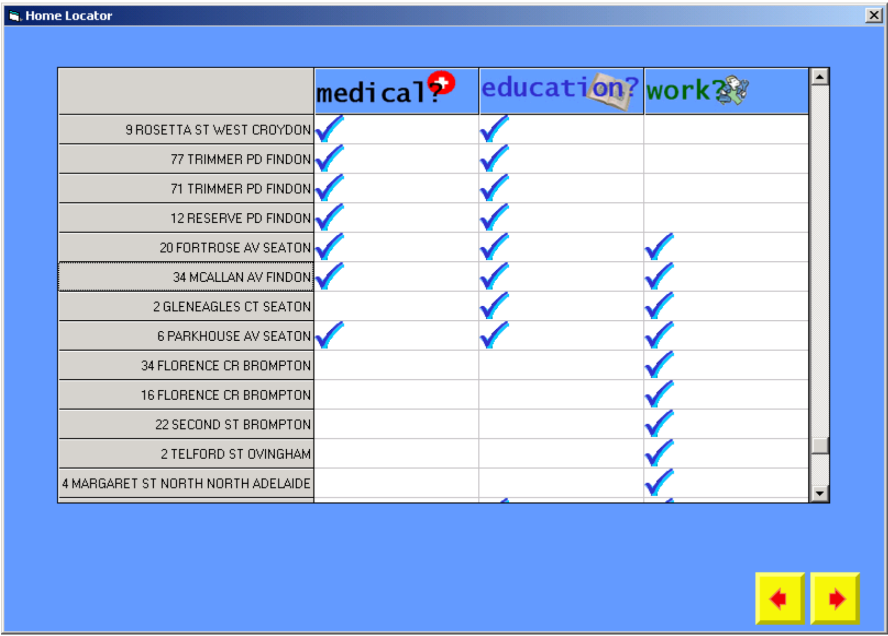
Therefore, the vacant 3-bedroom dwellings in the Western Zone can be categorised in four ways, as either:

- Meeting all three residential requirements (A & B & C);
- Meeting two of the residential requirements (A & B), or (A & C), or (B & C);
- Meeting only one of these residential requirements (A) or (B) or (C) or (D) or
- Meeting none of the residential requirements.

[22] Note: Figure 8.17 does not show medical choices in this example. This is due to a programming error.

The first three categories are carried into the next stage of the decision process, and the final category is eliminated from the analysis because it represents entirely unsuitable dwellings.

Figure 8.18: Suitable Dwellings Summary

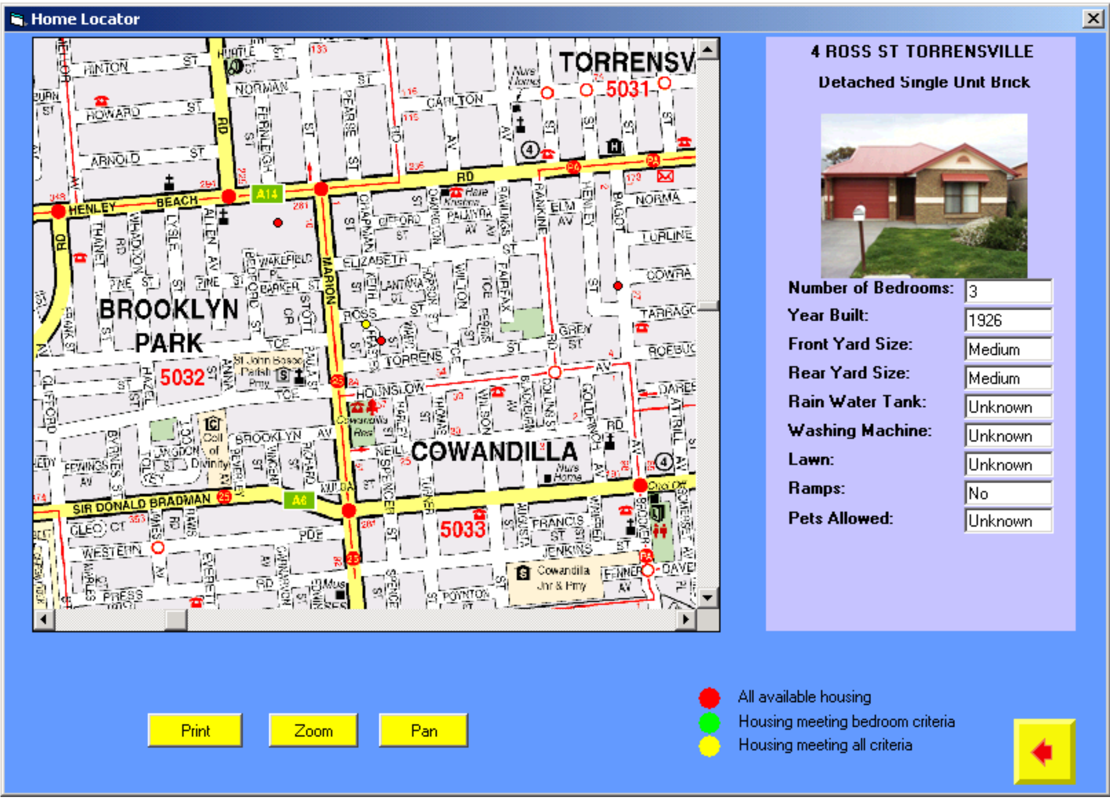


The following screen (shown in Figure 8.18) provides a summary table of all suitable dwellings. For each suitable dwelling, its address is shown, as well as the selection criteria that it meets. In this slide, the user can select any number of dwellings that they would like to examine in detail. Each selected dwelling can then be shown to the user in turn, as displayed in Figure 8.19. This screen provides information about the dwelling and its surrounding environment that can be interrogated, and finally, printed. The map on the left hand side shows the dwelling in the centre, with a street directory style background. This map is also enabled with basic GIS capabilities, so that the user is able to zoom in or out, pan to the surrounding area[23]. Included in the background map is a large amount of information about the surrounding area, including, open space, main roads, and public telephone box locations. This gives the user a valuable impression of the local area. On the right hand side of the screen a photograph of the dwelling is shown (in this prototype

[23] It is also anticipated that the locations of specific local services could be selected by the user and displayed at this stage, enabling, for example, the supermarkets surrounding a potential dwelling to be shown.

system, a generalised dwelling type image is displayed in its place, as discussed above). Below the dwelling photograph is a series of information about the dwelling itself, such as what disabled modifications have been made, how old the dwelling is, and whether pets are allowed to be kept on the premises. Each of these detailed dwelling information slides is designed to be printed, allowing a set of possible relocation options to be left for the tenant to consider or discuss with family or friends.

Figure 8.19: Dwelling Detail



8.6. Evaluation of the SDSS

In order to evaluate the potential usefulness of the SDSS to assist relocating tenants, and the degree to which it met the design objectives, selected tenants and other key stakeholders evaluated the system. Participating key stakeholders were selected to represent significant players from The Parks in the relocation process. Their selection meant that interview respondents had a close knowledge of the community and its needs, as well as the formal process of relocation in the Parks, and could reflect this wider knowledge in their responses (as suggested by Rossi *et al.*, 1979). The key stakeholder group was composed of two tenants who had recently been relocated, two SAHT relocation officers, the manager of the Parks project, and a former senior policy director from the SAHT.

The recently relocated tenants were active community leaders, having leadership roles in the two main residents groups: the independent Parks Community Voice Redevelopment Action Group, and the official Parks Community Consultative Team. These tenants also had recent personal experience of the relocation process. In addition, they formally and informally represented all tenants involved in the relocation program. SAHT relocation officers were selected to evaluate the usefulness of the SDSS because of their close knowledge of the needs of relocating tenants, and of the process of relocation. These two relocation officers had been involved in the relocation decisions of most of the Parks tenants who had already been relocated. In addition, the SDSS was designed to be operated by them. The manager of the Parks project and the former senior policy director were selected for their knowledge the relocation process and their long-term involvement in meeting the relocation needs of public tenants. As well, they could evaluate its usefulness from the organisational perspective. The former senior bureaucrat was closely involved with the original design and development of the Parks Urban Regeneration Project, from the early planning stages.

The SDSS was demonstrated to key stakeholders during a series of structured interviews, where each respondent was asked a series of open-ended questions about the degree to which the SDSS met its set objectives (detailed in section 8.3). The schedule of interview is presented in appendix 8.4. The interviews lasted between one and one and a half hours, and a report of interview was written up directly after each was concluded. Following is an analysis of those reports, structured around the five objectives of the SDSS.

8.6.1. Evaluation of Objective 1:

That it be "portable and easy to use".

The ease of use of the system is most relevant to the relocation officers who will potentially transport and operate the system. One of the relocation officers, who was at the end of her career, expressed a reticence to "learn any new tools" and hoped that the system would not be implemented until after her retirement. She did, however, judge that the system was easy to use. The other relocation officer was more willing for change to occur. He believed that the system would be easy to use, and could see value in the approach being applied to wider administration and planning functions of the relocation process.

Evaluation of the portability of the SDSS was not included in the interview. Because the system was housed in a laptop computer, its portability was believed established. The evaluation process did, however, highlight the need to consider the battery life of the computer in any future implementation of the SDSS. Where long periods of SDSS use are required, provision should be made for extension cabling to run the system on mains electricity, and still enable the computer to be located in a comfortable place for the resident.

8.6.2. Evaluation of Objective 2:

That it "simplify the decision process and provide increased information to the decision maker"

There was general agreement among all respondents that the system did simplify the decision process. The structuring of this process appealed to users, especially during the latter stages of the decision sequence when the outcomes of earlier decisions could be seen. One respondent noted that the system "applied science to emotion", logically assisting tenants to simplify a complex decision. Respondents were asked if the use of maps was a valuable way of providing additional information to the decision maker. Overwhelmingly, the respondents found this to be true. The use of maps was found to already be unofficially incorporated in the relocation decision process, where relocation officers reported that they commonly carry street directories to show tenants where suburbs are in relation to the tenant's current address. The most useful mapping in the SDSS was generally the smaller-scale maps that showed the local area around selected dwellings, here the familiar street directory background made the information most easily interpreted. In the earlier stages of the decision process, the whole of the metropolitan area was difficult for some respondents to interpret, or they expected that it would be difficult for other, future users to interpret. Of specific concern were migrants and the sight impaired, who would be either unfamiliar with two-dimensional representations of the metropolitan area, or could not see the full detail. It was suggested that the addition of landmarks to the map might be beneficial in this case. Two respondents from the SAHT saw an additional benefit of the metropolitan area map, suggesting that the initial display of available dwellings across the metropolitan area would promote realistic decision-making. At the beginning of the decision process, the tenant would be made aware of where available dwellings were, but also importantly, where they were not. This addresses a common problem for the relocation of tenants because the Trust's stock tends to be concentrated in specific suburbs of the metropolitan area, meaning that if a tenant wishes to relocate to, for example, an eastern suburb, they will be unlikely to find a vacant dwelling. By providing this information at the beginning of the decision process, the SDSS was believed to encourage the tenant to widen their search zone.

As well as the additional information provided in the form of maps, information about the location of services and the characteristics of the dwelling is provided in the system. All respondents believed that the SDSS enabled the provision of more information than was normally given in the relocation process. This information was also useful to the relocation officers; being potentially more comprehensive than the reference information they currently had access to.

8.6.3. Evaluation of Objective 3:

That it be a means of "including tenants and their expert knowledge in the selection of a new dwelling and location".

The SDSS was positively viewed as being able to incorporate the expert knowledge of tenants, but some respondents highlighted additional information that a future, operational system should include. While outside the testing of the objectives, it is important to record this information for future SDSS development. The presence of sheds, garages, and concrete paths were important features for a tenant in the selection of a dwelling. Inside the dwelling, floor coverings, window dressings, and the position of power points were nominated as important by one recently relocated tenant. In addition, if the dwelling was on a corner block it was preferred by many tenants, so this information should also be included. All of the above data are currently collected and stored in the SAHT vacancies database (which the SDSS includes) and could be easily incorporated. The dwelling photographs were found to be a particularly useful part of the SDSS, and the incorporation of real photos was considered of special benefit to the decision system. Being able to see the appearance of the dwelling would tell the user a large amount about the quality and suitability of the home, without having to travel to see it.

One Trust relocation officer also highlighted that the system failed to incorporate much of the expert knowledge that relocation officers added to the process. Providing two examples: firstly, the relocation officer often makes value decisions about which tenants can be relocated to which properties most cheaply, and secondly, that relocation officers often hold back desirable properties for relocations of specific tenants that are expected to move in the future. To incorporate a consideration of these comments into the SDSS would work against the central objectives of the system, and perpetuate a lack of transparency in the process. This is an important point, and will be further discussed in section 8.5.4.

8.6.4. Evaluation of Objective 4:

That it "increases tenants perception of control over outcomes in the relocation process".

There was widespread agreement that the SDSS would increase the level of control that tenants perceived over the relocation process. This was seen as a major benefit of using the SDSS. One tenant respondent viewed the system as "very useful for creating a feel for an involvement in the process". He suggested that tenants currently felt that they were being 'talked at', and that the SDSS would return some of the power back to them, enabling them to see exactly what was being offered, and provide a potent tool for empowerment. The other tenant respondent suggested that because the tenant was in control, and the process was 'instant', the SDSS would reduce the level of trauma associated with relocation. Under the current system, the time spent in the relocation process between the initial relocation interview, the selection of an appropriate dwelling by the relocation officer, and then the offer of an acceptable dwelling, was sometimes months. This waiting is known to be particularly stressful for older tenants. By being able to find an acceptable dwelling and decide upon it more quickly, those potential months of anxiety were eliminated.

A tenant respondent also suggested that, especially in the case of elderly tenants, they "like to see and read information at their own pace to feel on top of it". The SDSS would firstly enable them to, move slowly through, and understand all of the information they were given, and secondly, to print the results and slowly look over them after the relocation officer has left.

From the Housing Trust's perspective, the placing of the decision process into the hands of tenants was viewed as potentially useful to encourage tenants to make a decision more quickly. From the Trust's perspective also, the process of relocation decision-making can take many months, and this is often because the tenant cannot make a decision about the properties that they are offered. It was believed that by seeing acceptable dwellings, and knowing that the first relocating tenant to accept them would get them, that tenants would be encouraged to make a decision more quickly once they had found a dwelling that met a majority of their needs.

Two Housing Trust respondents believed that the program could actually lead to the unintended but beneficial side effect of increased "accountability and transparency in relocations". By transferring some of the control over the relocation process from the relocation officer to the tenant, the relocation process, which traditionally occurred largely behind the closed doors of the Trust, was opened up and occurred in the tenant's home. As discussed in Chapter Seven, there is a 'regionalisation' of the allocation process, where relocation zones, are administered by separate relocation officers. If a tenant wishes to relocate outside of their zone, then the availability of dwellings must be negotiated between the relocation officers from the two separate zones. This structure tends to lead to a hoarding of more desirable properties by each zone's relocation officers, a situation which leads to inequities for tenants. By treating the whole metropolitan area as one zone, the playing field is levelled for all tenants, and the process becomes more transparent.

8.6.5. Evaluation of Objective 5:

That it appear "simple, and not technologically threatening to users, especially those unfamiliar with computer use".

All respondents thought that the visual appearance of the system was simple and relatively easy to understand. During the interview with one elderly tenant, it appeared that he was having difficulty seeing the screen. When questioned, he replied that he could see the screen clearly. Nevertheless, this points to a potential problem with the size of the visuals for elderly and sight-impaired individuals. One means of addressing this problem would be view the screen through the television in the tenant's homes. This would be easily achieved through the use of a simple cable connection. The ability to print the screen can also assist with this potential problem, allowing the images to be enlarged in the printed output.

One useful suggestion made by a relocation officer, was that the system was approachable once the whole process was known, therefore, an initial demonstration of the way that the system worked would make it easier to understand. The lack of large blocks of text was judged important for the approachability of the system, and the use of images and pictures to represent elements was also well received.

8.6.6. Additional Findings

In addition to assessing the objectives, a number of other issues were raised in the interviews that are important to a consideration of the development of the SDSS. The first of these is that the process of relocation decision-making should be a household, rather than an individual tenant, process. One tenant, who had been recently relocated, experienced the relocation process as the representative of his household. He suggested that there were a number of competing relocating desires among members of his family, and that all should have been included in the process. Consideration of this could be integrated into the relocation process using the SDSS, where each member of the household could represent their relocation choices, and the household decide together which dwellings met the majority of their requirements.

One Trust respondent questioned the updating of information contained in the system. This issue would need to be thoroughly addressed in any working SDSS. If tenants were promised proximity to a service, and that strongly influenced their relocation decision to relocate there, if that service was found to be no longer present, then the relocation could potentially be sub-optimal. All datasets describing services and facilities that were examined for incorporation into this system were owned and maintained by the state government. They are currently well maintained and regularly updated, so this is not a current problem, but should remain a future consideration if the SDSS concept were to be developed. Nevertheless, as any automated system will always be, at best, a slightly delayed representation of the real world, the status of any key services would have to be checked by the relocation officer or the tenant, before a relocation occurs.

A Trust relocation officer also noted that a large amount of data collected for the SDSS decision process was also required to be collected by relocation officers. He suggested that an additional module of the system would be a 'Trust-Centred' database, which collected the tenant information and allowed Trust employees to input additional information. This module could be used for reporting, administration, and analysis of tenant requirements for future planning.

The SDSS described here has obvious uses as a web-based application. Though web-based mapping technology is a promising and rapidly developing area of public participation GIS, it is less applicable to this current application. This SDSS is designed to be self-contained, so that the Trust officer can arrive at the tenant dwelling and require no power or telephone connection. Not all tenants in The Parks have a telephone connection, and this would make the system unsuitable for those tenants. In addition, the system is designed so that Trust officers need little technical training. The additional burden of having to set up a modem connection risks confusion, and confidence in the system could easily be degraded if it cannot be made to work first time. In addition, a self-contained system generally runs faster than one that is getting information 'live' down a telephone line. All of these considerations pointed to a self-contained, rather than live, web-mapping system as the appropriate medium for the SDSS.

Users positively received the elimination, rather than the selection, of residential elements. Contrary to a concern developed before the evaluation of the SDSS, users were not confused by the, probably unusual, elimination process. These effects would however have to be tested on a much wider selection of users for this to be reliably established.

8.7. Conclusion

This chapter has presented the development process, construction, and evaluation of a prototype tenant's SDSS. Such a system has been shown to be a promising tool for the problem of relocating public housing tenants. An SDSS, incorporating increased access to information, problem solving assistance, a means of involving tenants and their expert knowledge in that decision, and providing an increased perception of control for tenants over their relocation process, would have significant benefits for individual tenants, but also assist government housing authorities to better meet their social justice obligations to provide residential satisfaction from adequate housing.