STRATEGIC ACCESSIBILITY ASSESSMENT OF FACILITY NEEDS TO SUPPORT QUALITY LIVING ENVIRONMENTS: Identification of facility backlogs to develop integrated interventions

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ABSTRACT

Current settlement patterns and service provision inefficiencies in South Africa have resulted in the need to identify alternative planning approaches that will result in well-functioning, equitable and efficient human settlements. This paper describes an alternative methodology to those currently used in assessing service provision and developing integrated facility plans.

This new methodology has been illustrated by a case study undertaken for eThekwini Municipality. The case study example illustrates how the application of the service access planning methodology (incorporating the use of GIS related software) can significantly contribute to achieving a more accessible, integrated and equitable strategic facility location plan. The approach and tools provide a defensible empirical base for the determination of facility needs in the study area, irrespective of planning or administrative boundaries that may be in existence. The study also shows how a common analysis base can support co-location and the development of multi-purpose centres or nodal developments. It further shows how the outputs can be used to evaluate the impact of social housing development on facility demand.

This service access planning methodology and its associated tools can be used to improve the planning of both single facility and integrated services, thereby contributing significantly to improved integrated development planning (IDP) in South Africa and to the more efficient functioning of its cities in general.

STRATEGIESE TOEGANKLIKHEIDS OPNAME VAN FASILITEITS BEHOEFTES OM KWALITEITS LEEF OMGEWINGS TE ONDERSTEUN: Identifisering van fasiliteits agterstande om integrale ingrypings te ontwikkel

Huidige nedersettingspatrone en diensverskaffingsondoeltreffendheid in Suid-Afrika lei tot die behoefte om alternatiewe benaderings tot beplanning te identifiseer wat billike en doeltreffende menslike nedersettings wat goed funksioneer tot gevolg sal hê. Hierdie referaat beskryf 'n alternatiewe metodologie as dié wat tans gebruik word om diensverskaffing en die ontwikkeling van geïntegreerde fasiliteitsplanne te ontwikkel.

Hierdie nuwe metodologie word geïllustreer deur 'n gevallestudie wat namens die eThekwini-munisipaliteit onderneem is. Die gevallestudievoorbeeld illustreer hoe die toepassing van die beplanningsmetodologie vir dienstoegang (wat die gebruik van Flowmap-sagteware inkorporeer) beduidend kan bydra tot die behaling van 'n meer toeganklike, geïntegreerde en billike strategiese plan vir die ligging van fasiliteite. Die benadering en hulpmiddels verskaf 'n verdedigbare empiriese grondslag vir die bepaling van die behoefte aan fasiliteite in die studiegebied, ongeag die beplannings- of administratiewe grense wat moontlik kan bestaan. Die studie dui aan hoe 'n gemeenskaplike ontledingsgrondslag medevestiging en die ontwikkeling van veeldoelige sentrums of nodusontwikkelings kan ondersteun. Dit toon ook aan hoe die uitsette gebruik kan word om die impak van maatskaplike behuisingsontwikkeling op die vraag na fasiliteite te evalueer.

Hierdie beplanningsmetodologie vir dienstoegang en die verwante hulpmiddels kan gebruik word om die beplanning van geïntegreerde en enkelfasiliteitsdienste te verbeter. Só kan 'n beduidende bydrae gelewer word tot verbeterde geïntegreerde ontwikkelingsbeplanning (GOP) in Suid-Afrika en tot die doeltreffende funksionering van sy stede oor die algemeen.

1 Introduction

Current settlement patterns and service provision inefficiencies in South Africa have resulted in the need to identify alternative planning approaches that will result in well-functioning, equitable and efficient human settlements. This paper describes an alternative methodology to those currently used in assessing service provision and developing integrated facility plans.

This new methodology has been illustrated here by a case study undertaken for eThekwini municipality. The methodology encompasses three distinct elements that contribute to the empirical analysis of facility needs and which allow for the development of an integrated and more equitable facility investment plan with a common analysis base for a range of facility types. The elements include:

- A rational approach to auditing service access needs;
- The use of a regular set of area zones at a sufficiently small level of detail that allow for analysis on a common zone system; and,
- Using accessibility analysis software to match supply and demand via an actual transport network.

The authors contend that this service access planning methodology and its associated tools can be used to improve the integrated planning of services and thereby contribute significantly to improved integrated development planning (IDP) in South Africa and to the more efficient functioning of its cities in general.

1.1 The problem of dispersed development

Geographical dispersion and low density sprawl in South Africa has resulted from various factors. These include the separation of functional land uses, increased use of private transport and land availability at the urban edge. Racial and economic segregation have also led to uneven and dualistic development, characterised on the one hand by well-developed former White neighbourhoods usually found within the city limits and, on the other hand, sprawling under-developed settlements at the urban periphery for other racial groups.

At the same time, facility planning and provision has traditionally also been sector specific with little co-operation between the line departments that provide services, e.g. Health, Education, etc. A manifestation of such planning is the use of different planning and reporting areas by different departments, for example health districts, water catchments, municipal wards, etc. The consequence of such uncoordinated sectoral planning is a spatially dispersed pattern of facility provision.

This fragmented and coarse development pattern has two main implications for service delivery. Firstly, it results in poor general accessibility, where some available facilities are beyond the acceptable access ranges of users, or potential trip destinations are too widely scattered for multi-purpose trips. Secondly, the viability of facilities may be threatened due to insufficient demand in catchment areas in relation to facilities' minimum viability threshold levels.

From the perspective of transport services provision, a spatially dispersed development pattern has negative consequences which may include the related factors of:

- a tendency towards low occupancy vehicles;
- long trip lengths;
- congestion arising from a greater use of private vehicles;
- expensive public transport subsidies;
- inadequate agglomerations to support public transport. (Morojele, 2005)

The inefficiencies of existing development patterns have necessitated more efficient and sustainable alternative development strategies including the widely accepted integrated planning approach.

This paper argues that the use of a step wise accessibility auditing and analysis approach - incorporating the use of GIS or GIS related software - can improve facility planning and support integrated planning. The methodology makes use of a common analysis surface and thereby enables the assessment and planning of different facilities within the same context. This approach overcomes the problem of using different planning boundaries and hence isolated sectoral planning. Accessibility auditing and analysis also provides an empirical base for integrated planning that can be used together with other inputs, such as identified local needs and political mandates, to ensure the sustainability of capital investments in facilities.

The key linkage between the supply and demand for facilities is that of the travel network. The travel network can be constructed to include one or more movement types as long as the speed for each mode can be estimated. If a road network is used for the accessibility modelling it by implication eliminates all physical boundaries or adjusts for steep gradients as either there will be no road link or the travel speed will be adjusted to compensate for the gradient. If walking occurs in places other than the road network or in case the road network is incomplete Delaunay links can be added to the network (Tillema & de Jong, 2005)

1.2 Measuring service needs: The conventional method and its shortcomings

In terms of service equity, most of the historically disadvantaged and peri-urban neighbourhoods have a much lower quantity and/or quality of public service provision in comparison to neighbourhoods closer to traditional city centres (CBD) or in affluent suburbs. The extent of inequity is deceptively easy to measure in terms of aggregate indices of service availability per neighbourhood or suburb. Such measures, however, can give a distorted picture of the situation and can be too aggregate to provide adequate insight into accessibility issues. Even if the issue is only to improve local service equity, it is clearly necessary to develop and use measures that are less influenced by neighbourhood or suburb boundaries, but which examine the actual distribution of facilities in relation to the location of the demand.

The traditional means of measuring facility needs have made use of the ratio of people within a given administrative boundary without any consideration of the location of both users and service points. The uncritical use of large area-based measures (e.g. number of clinics per 10 000 population) can lead to distortions in data. Furthermore, the line departments (e.g. Health, Education, etc) responsible for providing and planning public facilities use planning areas which have different boundaries from each other.

The larger and more irregular the administrative unit, the greater the likelihood that the unit measure will poorly reflect the accessibility of users to the service in question. No consideration is generally given to transport networks, or the fact that a facility and the population may be spatially separated by a river or other barrier, or that a closer facility may exist across an 'invisible' administrative border. People also tend to make choices based on a range of factors. Rather than simply visiting the closest facility, they may choose to visit the one best located on their travel route, or where they can combine trips, or where they know the service provider. With the exception of visiting a Magistrates Court, where legal jurisdiction is applicable, people seldom consider the use of a facility based only on it being the one in their administrative unit of residence. Furthermore, the size of facilities is often determined on the basis of those who visit the facility rather than being based on more long term projections of urban development. For example, facility planners in many cases have to rely on the current usage of certain facilities, e.g. the number of children registered in a school, in order to support the expansion of area facilities.

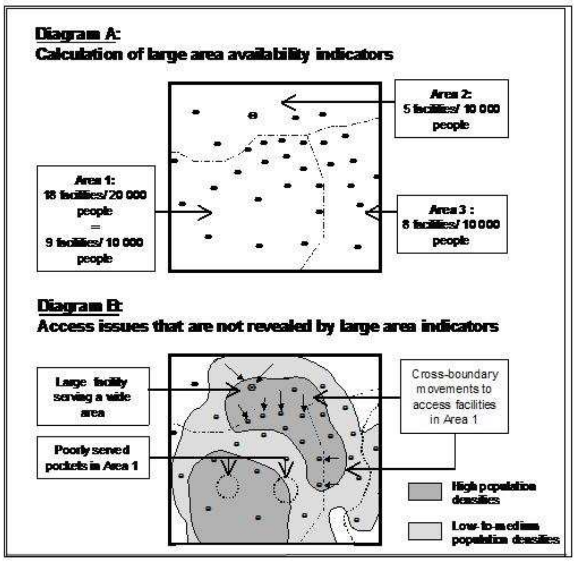

Figure 1 Hypothetical example of the limitations of aggregate facility availability indicators, and a partial solution

In their paper Morojele, Naudé & Green (2003) formally outlined the distortions that result from aggregate facility measurements. Figure 1 illustrates the potential targeting distortions that could result from the use of conventional facility availability measures. Diagram A gives a hypothetical example of the results of a conventional, area-based access index. According to this, Area 1 is indicated as the best-served area, and Area 2 as the worst. Hence, this could lead to the targeting of Area 2 as the highest priority investment area. However, for various reasons – such as indicated in Diagram B – the access conditions in Area 2 could actually be much better than indicated by the aggregate statistics, whereas the converse could apply to Area 1. Also conventional large area measures do not account for the spatial distribution of services in relation to the target population (Claeson, *et al*., 2001). Such measures do not therefore indicate whether there might be pockets of poorly served areas, such as those illustrated by Diagram B. This highlights the issue of poorly served or needy local communities imbedded in larger areas that appear to be relatively well served by summary statistics (Phillips, *et al.*, 2000).

The second issue is the susceptibility of area statistics to the so-called boundary problem. This is a basic problem of most area-based statistics, but is usually exacerbated when administrative or ward boundaries are chosen as analysis areas. The boundary problem occurs: “because geographical study areas are usually bounded in ways that do not correspond with the effects of spatial processes” (Maguire, 1995). The nature of some of these boundary problems can be illustrated with reference to Diagram B in Figure 1. Since several of the facilities within Area 1 are located close to the boundary of Area 2, one can expect considerable cross-boundary movements to access facilities ‘on the other side'. This is especially likely in cases where facilities are congested in one area and not in another.

A third general shortcoming of aggregate facility availability indices is that they often do not take account of variations in facility sizes, staffing levels and associated service delivery capacities. Area-based, ratio-type indicators do not provide a sufficient basis for differentiating or assessing the relative effectiveness of facilities with either ample capacity but poor accessibility or facilities that are under-capacitated with regard to their good accessibility.

By implication, this highlights a fourth general shortcoming of aggregate availability indices. The geographic or physical accessibility of facilities with respect to population density per area, versus facility supply per area, are not reflected except indirectly, neither is consideration given to travel routes and transport availability.

To overcome most of the shortcomings highlighted above, GIS[1] and related network analysis tools can be used to produce disaggregated availability indicators – for example by suburb, ward, postal code, facility catchment, or any other small areas for which disaggregate population or service demand statistics can be obtained. Secondly, GIS analysis can produce improved indicators of geographical accessibility or coverage by indicating, for example, the numbers of learners (in the relevant age classes) that would have to travel more than 3 kilometres to the nearest primary school. And thirdly, the tools can be used to allocate demand origins to one or more supply centres, and by this demarcate supply centre catchment areas or estimate the flows attracted by each centre. In terms of supporting integrated planning, these tools provide a mechanism for analysing facility needs using a common approach and analysis base. Hence, while different criteria may be used for evaluating the facility backlogs for each facility type, ultimately a common analysis surface and approach enables the needs to be expressed in a way that promotes integration of investment needs where practical.

Thus, using an accessibility assessment method that ignores artificial planning boundaries and allocates people to the closest available facility by taking into consideration appropriate transport networks and modes (as opposed to 'as the crow fly' measures), allows one to measure more scientifically the accessibility of a facility in respect to its user group. Although internal boundary issues are eliminated, the boundary problem on the edge of a study area will remain unless cross boundary data is available. The latter is often difficult to obtain.

1.3 Achieving integrated service provision

The provision of anything besides a very basic level of service to all areas is not always financially possible. This can be attributed to various reasons that generally include budgetary constraints and the high costs associated with servicing areas that are outside the existing bulk service corridors and where there are relatively low local demand densities in relation to the demand thresholds required for the viability of services.

Co-location of facilities can substantially cut down on the costs of providing services and bulk infrastructure, such as roads, water and electricity. Multi-purpose centres, or 'one-stop shops', are widely regarded as an important means of offering a broad range of services to communities and can be a key delivery mechanism for addressing service provision in areas of need (Green & Morojele, 2001). Furthermore, aligning such centres along the primary public transport system offers the dual advantage of improving access to services and enhancing the viability of the public transport system.

2 Accessibility Analysis Methodology in Facility Assessment Planning

The accessibility analysis methodology comprises both modelling tools and a specific approach.

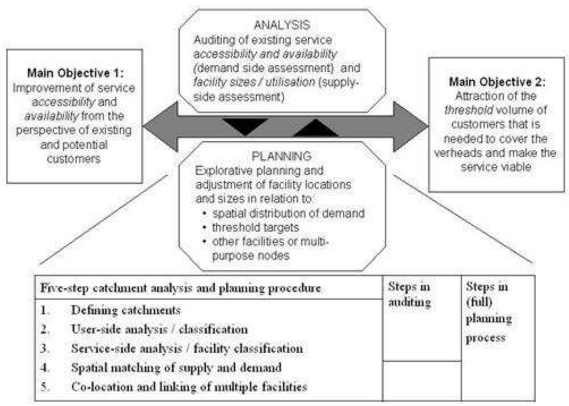

Figure 2 Overview of catchment-based analysis and planning

2.1 Approach

Figure 2 provides a summary overview of the objectives of catchment-based analysis and planning, and the key aims of each stage (i.e. the 'analysis' stage and the (explorative) planning stage). It also shows a combined five-step procedure developed by CSIR for facility auditing and planning (Naudé, 2001; Naudé, Green & Morojele, 2001).

The catchment-based approach is specifically designed to assist planners of nodal- or central place-type services and facilities to audit service *accessibility and availability* from the perspective of existing and potential customers. The approach also allows for planners to explore and plan ways to achieve a better match between supply and demand, and to achieve the best trade-off between improved service availability, accessibility and thresholds. The following are major components of this approach.

2.2 Tools

Some of the Flowmap[2] software tools developed by Utrecht University of the Netherlands are highly suitable for analysis of accessibility of service locations. Of relevance to this paper are the tools provided for accessibility analysis based on the concept of Spatial Rationality. Spatial rationality entails that the customers will make use of the nearest service location. In this case, "nearest" is

usually defined as the shortest or fastest or cheapest distance measured on some sort of digital transport network. The concept of spatial rationality is particularly suitable for the analysis of emergency services and also for frequently visited services like schools, primary health clinics, libraries and daily food shops. It is not suited to the analysis of leisure shopping and multipurpose trips. Also, regional planners can apply tools based on this concept to provide insight into the available minimum level of service provision and to evaluate whether or not this minimum level is adequate.
The available tools can be ordered in four categories, namely those for:

- evaluating the current or future level of service provision;
- identifying suitable (best) locations for service expansion;
- relocating service locations; and,
- identifying suitable (least bad) locations for service reduction.

The tools found to be most suitable for evaluating the current or future level of service provision are mainly catchment area analysis, proximity counting and catchment profiling. In catchment area analysis (or nearest facility analysis), all customer locations are allocated to the nearest facility and, if so desired, constraints can be set regarding capacity of the service provision and the maximum distance allowed between customer and service provider. Information resulting from this analysis comprises of, amongst others, the distance between customer location and the service location to which it was allocated. This information can be used to create a catchment profile or cumulative graph showing the total number of customers allocated as distance increases. If no constraints were set in the catchment area analysis then, at a certain distance, 100% of customers will be allocated to a nearest service location. Table 1 shows a typical catchment profile from various relevant accessibility statistics can be derived such as the worst case distance (1265 people live at 56 minutes from the nearest service location) or the average distance to the nearest service location for the population as a whole (21.9 minutes). Also, it can be read from the table that 58% of the population can reach a service location within 20 minutes but that it takes at least 45 minutes to be within reach of 95% of the population.

Table 1 Example of a Catchment Profile

Minutes Travel Time	Amount of Population	Cumulative Amount	Cumulative Percentage	Cumulative Average Distance
1	2810	2810	2.6	1.0
5	3495	7725	7.2	3.2
11	2990	29230	27.3	6.6
20	10190	62020	58.0	12.6
44	2355	91180	85.2	17.5
45	10795	101975	95.3	20.4
56	1265	107010	100.0	21.9

Catchment profiles like this can be constructed for any situation, be it the current situation or any scenario involving future developments. The accessibility statistics based on catchment profiles can be used to assess changes in the accessibility of service provision. Changes in service provision may have different effects on the various accessibility statistics; improvements regarding equity (reducing worst case distance) may have adverse effects on efficiency (average distance/total travel costs) and vice versa.

Using a catchment area analysis (a.k.a. nearest facility analysis), customers are allocated to an existing service location and the proximity count is then only applied to the unallocated customers to identify the next best service location. A procedure set up in this way will result in maximizing the customer coverage at each round. Alternatively, if the target is to minimize either the average distance or worst case distance, a 'Competition' tool must be applied. The principle of such a tool is to first apply a catchment area analysis without a distance constraint so that each customer location is allocated to the nearest service centre.

The simplest measure to expand the number of service locations is the 'Regular Proximity Count' (or cumulative opportunity index). A proximity count calculates, for each potential expansion location, the total number of customers that can be reached within a given distance range. The highest score found automatically qualifies as the best potential expansion location. In a Greenfield situation the proximity count can be applied on its own, but where facilities already exist, or where more than one expansion location is desired, then the proximity count can be used in combination with a catchment area analysis.

In line with the objective of the case study (discussed herein) to improve customer access/coverage within a set of pre-determined distance ranges, the remainder of this paper focuses on 'catchment area analysis' applied in combination with a 'regular proximity count'. The catchment area analysis in this case is essentially aimed at demarcating and distinguishing 'well-served areas' from 'poorly-served areas.' Proximity counting is used here to highlight locations within a study area that are the most accessible and, therefore, are potentially suitable for locating services. Such areas can be identified in two ways, either through analysing the total demand in an area - irrespective of current facility provision - or by analysing only the demand that is poorly served under existing facility provision and access standards.

In addition to the maps that are produced as outputs from the analysis, the catchment profile and its matching accessibility statistics can be used in combination with each other to develop statistics of the study area or sub-areas with respect to facility backlogs (numbers). These numerical outputs can then be used in conjunction with the spatial outputs (maps) to determine the size and number of facilities to be planned in areas that are being poorly served.

2.3 Integrated plan

If the analysis has been undertaken for a range of services in a single study area and a common set of tessellated zones was used the results can be used to develop an 'integrated plan'. Such a layer of zones can be used to measure and monitor progress with achieving desired levels of service access, such as average travel times achieved or percentage population served with set criteria.

3 The eThekwini Municipality Case Study

3.1 Background to eThekwini

The eThekwini Municipality is centred around the port city of Durban located on the east coast of South Africa. Durban was established as a British Colony in the 1800's. By 2001 the city had grown to 3.09 million people. Notwithstanding a strong colonial influence the diversity of culture provides for an attractive cosmopolitan atmosphere in a tropical coastal area.

The municipal area is approximately 242 000 hectares of which only about 40% can be considered urban with a further 10% being made up of densely populated rural settlements. This implies that almost half of the municipal area is comprised of sparsely populated rural and farming areas. These are extremely difficult and expensive to provide for with respect to municipal services and social facilities.

The area has a good road network while passenger rail is restricted along a single north-south axis with limited east-west services. Minibus taxis provide reasonable access to many parts of the Municipality, including the rural hinterland. Most transport is focussed on the area around the port and CDB with little cross movement taking place.

Industry is well developed but the key textile and manufacturing sectors declined in the late 1990's, and only 25% of the population are employed. This emphasises the need for the provision of social facilities close to places of residence so people can walk or at least limit their transport costs when accessing such facilities. (South Africa. Municipal Demarcation Board, 2006: online).

3.2 Assessments of facility backlogs (2001 and 2006)

The cost of developing residential areas and of providing housing extends beyond the provision of serviced sites and bulk services. To establish quality or total living environments residents should have access to a full range of services within reasonable travel times. To provide a rational basis for the delivery of social services, eThekwini Municipality commissioned a study in 2001 to identify the spatial location of facility backlogs (Green & Morojele, 2001). The project involved the access modelling of a range of public facilities with the aim of, firstly, auditing accessibility and, secondly, identifying potential sites for integrated facility provision close to public transport nodes and corridors so as to improve the accessibility to public services of poorly-served communities. The project focussed on social facilities and the need to provide facilities close to residential areas. In a follow up study in 2006, the CSIR completed an evaluation of proposed public sector housing projects in eThekweni with respect to their access to the social facilities analysed in the 2001 study so as to inform priorities and the budgeting process (Green, *et al.*, March 2006). Notwithstanding the fact that the housing priorities assessment was based on the findings of the 2001 assessment, it was still possible to provide an indication of the impact that the new housing projects and the residents would have on the capacities of nearby facilities. A follow-up accessibility assessment of 13 different facilities types was undertaken during 2006 (Green, *et al.*, Sept 2006).

3.3 Case Study Methodology

The methodology described above was applied in the 2001 and 2006 accessibility assessment studies undertaken for the eThekwini Municipal area, and this application will be used to illustrate the associated processes. Facilities included in the 2001 analysis were transport nodes, clinics, community halls, fire stations, public libraries, billing points, police services (including SAPS and Metro Police) and administration offices. A key consideration in the study was the delivery of services in an equitable way in residential areas. In the absence of other information on facility usage patterns, the demand for services was estimated from data indicating where people live. This data input could have been improved if information had been available on the number of people who visited facilities from their place of work. However, bearing in mind the strategic level of the analysis, the data was considered adequate for the purpose.

Table 2 Key variables used for the accessibility modelling of the various facility types 2001 (as determined by the policy requirements)

Facility type	Demand	Maximum access range	Mode of travel	Minimum facility size/threshold
Transport nodes	Weighted households based on annual income according to the following equation: *[Below R30k x 1] + [institutional pop/4.4] [R30k to R72k x 0.5] + [(above R72k + unspecified) x 0.25]*	15 minutes	Public transport	N/A
Clinics	Persons in households earning R3 500 per month and assuming 8 clinic visits per year per person	15 minutes	Public transport	Estimated using the number of nurses seeing 40 patients a day and a clinic operating 250 days a year: *Nursesx40x250= total supply*
Community halls	Persons in households earning R3 500 per month	15 minutes	Public transport	30 000
Fire Stations	N/A	23 minutes response time	Emergency fire trucks	N/A
Libraries	Total population	6 km	N/A	Varied according to 3 sizes of 20000, 40000 and 60000
Billing points	Total population	30 minutes	Public transport	N/A
Police Services	Total population	15 minute response time	Emergency vehicles	60 000

For each facility type, discussions were held with relevant service providers and planners in the Municipality to establish essential key variables required as input into the model. The variables are chosen to reflect as closely as possible predominant conditions, policies and standards that inform planning decisions. The key variables that were required included:

- maximum access ranges, depending on the level of facility in a service hierarchy (e.g. whether one is referring to clinics or hospitals);
- the relevant mode of travel, which for local access could include public transport and walking;
- feasible travel speeds (which are specific to the area being analysed);
- minimum facility sizes or threshold targets;
- planned capacities of new or upgraded facilities; and,
- an estimation of the demand for a facility.

The data and key variables used for each facility type are summarised in Table 2. It is noted that although the conventional planning concept is that facilities should be within walking distance, preliminary testing of this assumption found that providing facilities within walking distance of all residents was not affordable at this stage. It was thus decided to evaluate the relative supply under the assumption that most people could at minimum make use of a taxi and this is considered to be public transport. Taxis cover the entire route network in eThekwini. It is acknowledged that a different mode would have a major impact on the results, but for the strategic assessment of facility needs a uniform approach (that of the most common mode of transport) across the city was selected. At a latter stage the opportunity exists to test walking access should circumstances change

3.4 Case Study Example

To illustrate the application of the methodology the data, process and outputs for fixed primary health care clinics are described in greater detail. The actual analysis was preceded by data collection, which entailed logging all facility locations with GPS and the confirmation of relevant data as indicated in Table 2, particularly that pertaining to facility capacities.

The demand for clinics was based on the 1996 Census data provided by enumerator area. Since the population is not considered to be homogeneous the demand for clinics is based on income stratification. The clinics demand was thus taken to be all people living in households earning a maximum of R3 500 per month plus those living in institutions and include all those unlikely to have medical aid In a consequent study 50% of those in the next income bracket were also included. Based on the Quality of Life Survey undertaken by eThekwini prior to this study, an average household size of 4.4 was used to convert household data to persons. Due to increasing demand for clinic services, an assumption of eight visits per person per year was used. The total demand was then calculated resulting in approximately 14 800 000 potential clinic visits per year for the whole municipal area.

The capacity of the facilities was estimated using the number of nurses at each clinic. It was estimated that a nurse can see a maximum of 40 patients a day, and that a clinic operates 250 days per year. The total supply for the municipal area was estimated at 8 910 000 visits per year which, when compared to the demand, gives an approximate undersupply of 39.7% (based on 8 visits per year per person). The analysis comprised the following processes:

- Unconstrained catchment area analysis – to derive a travel time map irrespective of facility capacities;
- Constrained or qualified catchment area analysis based on facility capacities and 5 km and 7 km distance limits respectively – to demarcate the primary catchments; and,
- Proximity count – using the unserved population identified in the above process and a 5 km distance constraint.

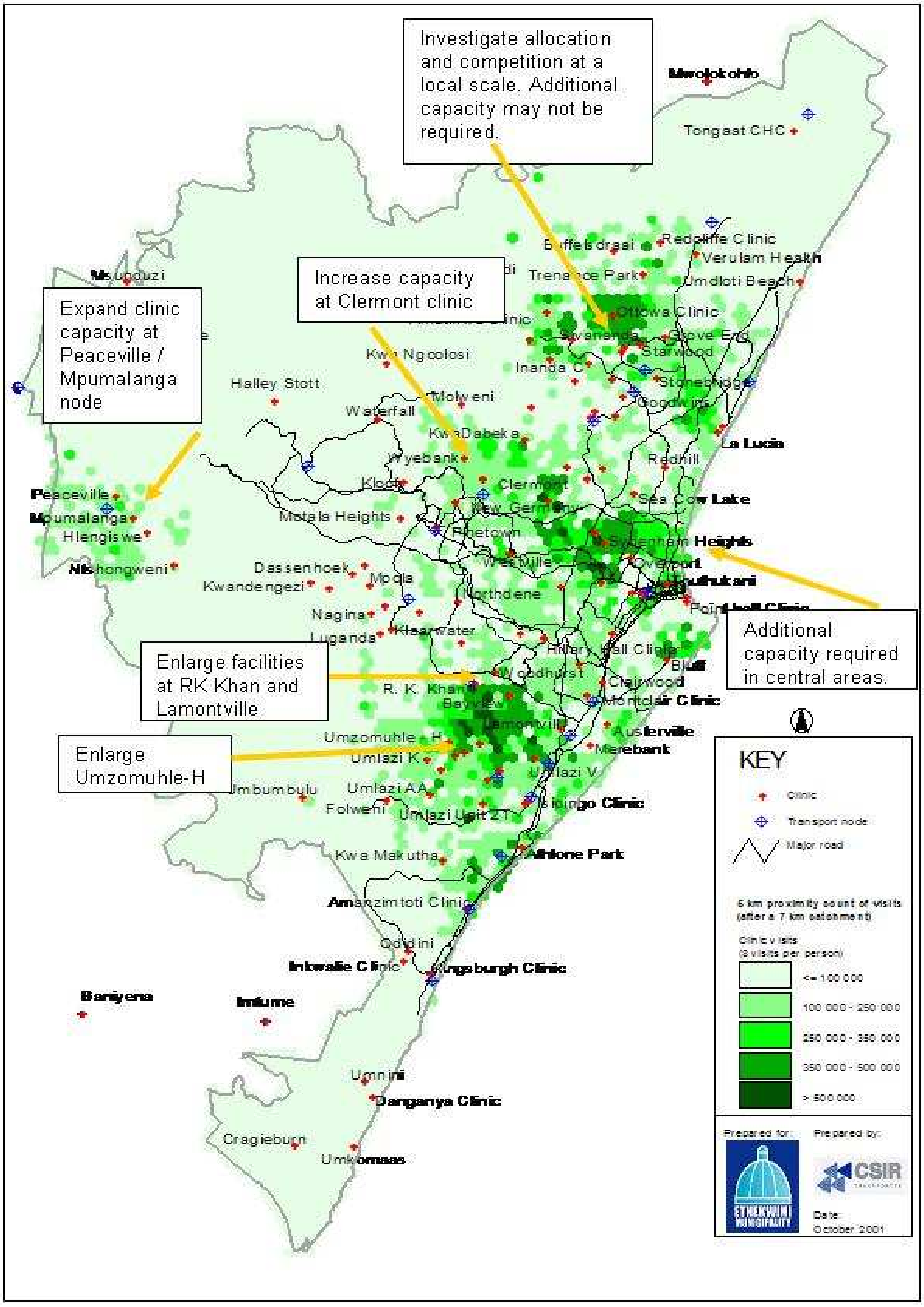

Figure 3 Demand for new clinic capacity

Table 3 summarises the overall coverage statistics in terms of land area covered and demand found at 5km and 7km clinic catchments respectively.

Table 3 Land area and clinic demand served within 5 km and 7 km distances

Distance (km)	% Land area served	% Clinic demand served
5	28.1	56.9
7	36.3	62.0

It was found there is general under capacity at the acceptable distance range, that most clinics operate at full capacity and in most cases would require an upgrade to be able to accommodate the present demand in their vicinity. In particular, six areas were recommended for increased facility supply owing to high concentrations of unserved demand in their vicinity. These are indicated in Figure 3 and include Chatsworth; the central areas of Cato Manor, Sydenham Heights, Overport and the CBD; Clermont; Inanda/KwaMashu; Umlazi and the Mpumalanga/Peaceville area.

4 Integrated Planning

To more fully support the development of integrated interventions a combined facility investment plan can be produced. The plan, in the form of a map, identifies locations where facility backlogs have been identified for different facility types. The quantities and size of the required facilities are informed by such factors as current usage patterns, provision standards and budget priorities. The identified needs can provide an empirical base for evaluating community identified facility needs.

An integrated plan was developed in 2001 for eThekwini based on individual facility needs maps. Where possible the need for facilities was combined into a cluster of facilities. In 2001, identified priority transport corridors and nodes were made the key focus for new facilities. Since then eThwekini has developed a set of hierarchical investment nodes to be used as the focus for new investment, as identified in the current (2006) study (Green, *et al.*, Sept 2006).

Figure 4 is the resultant integrated plan based on the analysis of the facilities as described above. The plan identifies:

- **priority investment hubs**, where coordinated investment in new social facilities will address the pent-up need for two or more types of facilities, and contribute significantly to multi-purpose development and clustering around public transport nodes;
- **focus areas for the development of one or two specific types of social facilities**, where there may be a lesser, or uncertain, potential for significant cluster development or nodal strengthening (i.e. compared with the priority investment hubs) but where there are still significant pockets of poorly-served social needs; and,
- **facilities or facility clusters that could be rationalised**, where surplus capacity possibly exists, or where capacity could be utilised for other or extended functions. An example may be the extension of services at libraries to provide study centres.

Such integrated plans can harness investment funding from a range of different sectors to act in concert to meet the facility needs of the area in a comprehensive and focussed way, and where facilities are most needed rather than to suit political expediency.

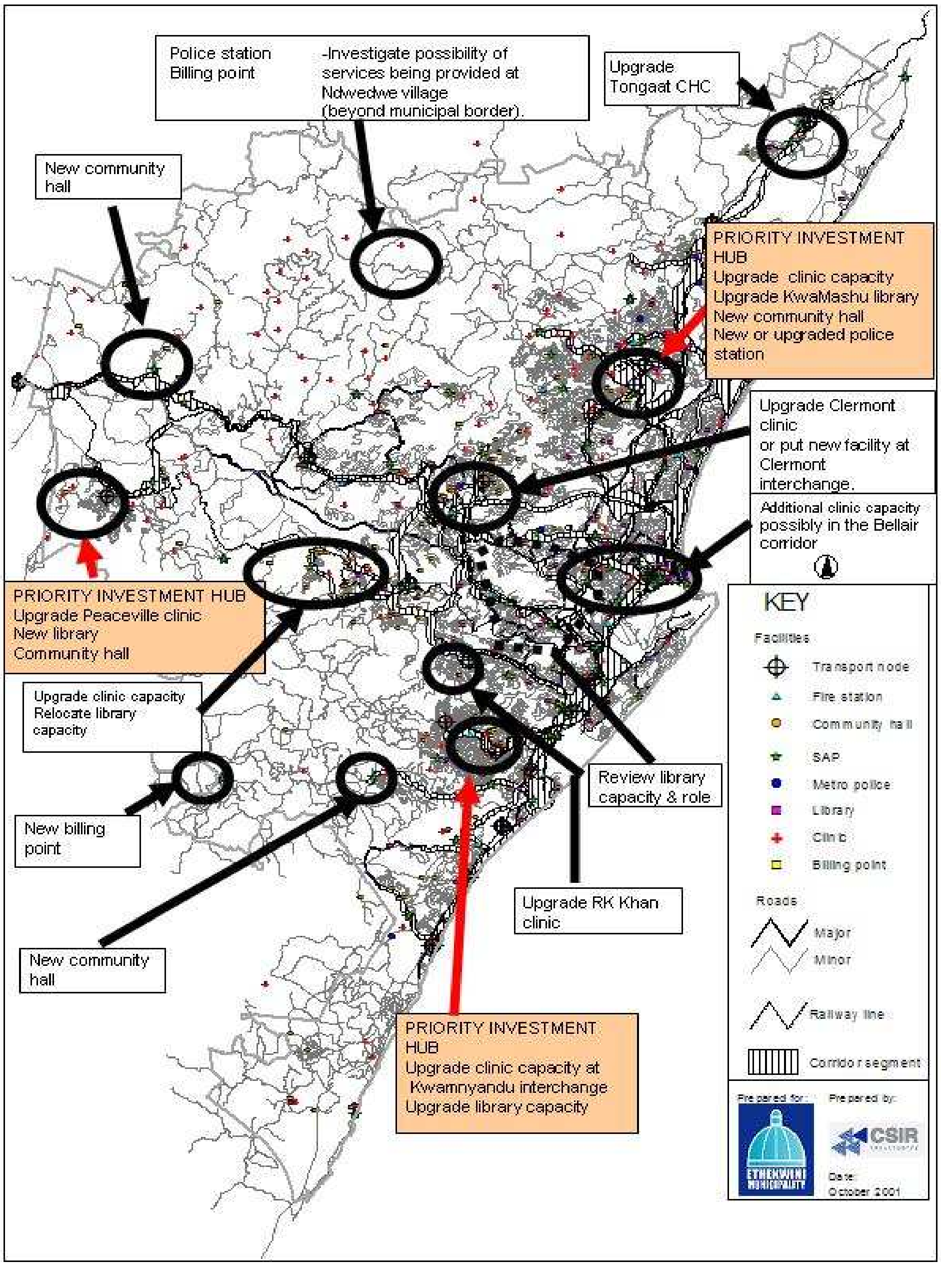

Figure 4 Integrated plan: eThekwini Municipality case study (2001

In a further step towards integration, the facility accessibility assessment was used to interrogate the planned public sector housing plan and provide input to the prioritisation process of each specific project. A key issue was the extent to which planned housing developments would impact on the capacity of facilities in the municipal area over the next five or more years. Of course, new housing projects that absorb spare capacity will have less impact on the service provision demand than those that required total new investment.

This assessment is now being used to determine the budget impacts of housing projects which will, in some instances, influence the timing of projects to fit in with budget constraints.

5 Successes of The eTthekwini Accessibility Study

The concept of multi-purpose nodes is generally acknowledged by the eThekwini Municipality to be an important delivery mechanism for providing services in areas of need. Thus the recommendations of the studies were welcomed and incorporated in the medium and long term planning of the respective service sectors that had been investigated. Positive aspects of the study, to date, are as follows:

- After 2001 some sectors took steps to implement the study recommendations. For example, the Health Department undertook to review clinic capacities in areas (such as KwaMashu, Clermont, and Umlazi) where the model indicated a need for capacity expansion. In 2006, the Municipality commissioned a follow-up and extended study in support of the Quality Living Environment strategy which amongst other issues includes the provision of basic social services.
- The data gathering exercise also enabled the creation of a central database of facilities. This has created a better understanding of the spatial distribution and capacities of facilities, especially in the areas that were previously not within the current municipal boundary. The database was extended in 2006 to cover a wider range of facilities to be audited.
- The Municipality is now able to corroborate the results of the modelling with a qualitative assessment of needs that has been obtained from the communities through other processes.

Additional benefits of the study to the Municipality include:

- Support to the implementation of the Quality Living Environments strategy through accessible social infrastructure;
- Support of land-use strategies aimed at improving the usage of the public transport system;
- Contribution to the development of viable development corridors and nodes that support the public transport system;
- Increased support in the planning for integrated service delivery; and,
- Informing the budgetary and planning process for facility provision in current and future housing projects.

Unlike the process used in this study the use of administrative or other planning boundaries in the estimation of facility backlogs does not take into consideration the locations of users of facilities and the facilities themselves. This can lead to erroneous spatial targeting of interventions. The model has successfully identified locations with facility needs based on population distribution rather than administrative boundaries. These modelled outputs will also be corroborated with actual visitor numbers at the facilities or local knowledge.

6 Considerations in Accessibility Analysis Methodology

The principle of co-location of facilities as used in the development of the strategic plans allows facility users to combine trips thereby saving time and travel costs. It also allows for the sharing of resources such as buildings and security. There are, however, a number of implementation constraints, not least the differing distribution configurations required by different sectors, their current levels of service and coverage, overlapping catchment areas, competition between service nodes, and widely different levels of household or personal mobility. The minimum thresholds of different facilities also vary. Moreover, the same facility may have a combination of low- and high-threshold services, e.g. a hospital with a heart unit (low threshold) and other 'high-threshold' facilities such as antenatal clinics where the demand is greater. A more mundane but critical factor in actual implementation is the availability of land in the areas requiring additional facilities. This is especially true in densely populated lower income settlement with a range of facility needs.

Notwithstanding the positive contribution the methodology and the tools can have, there are some constraints to the widespread use of the tools if facility and population datasets are not available at an appropriate scale or form. As with all detail empirical planning approaches service access planning is reliant on good data. Most of the problems experienced with the application of the models were related to data collection and verification. Some but not all data issues were of a GIS nature. In the main the issues were, incompatible and incomplete datasets which can be a legacy of the uncoordinated management of spatial data. In some areas even non-spatial record keeping is a problem due to uncontrolled development in remote areas of the city. In the update study significantly less data incompatibility was encountered, however new data sets needed to be captured to extend the analysis to a broader range of services.

Since a large proportion of costs is usually incurred during the data collection and set-up phase, the use of models such as described in this paper is most cost- effective if the activity can be sustained over a reasonable period of time (3 to 5 years), and if there is at least a certain degree of in-house capacity building and technology transfer. Ultimately, however, much of the potential benefits will depend on the capability of staff to interpret the maps and assimilate the report findings to influence facility investment decisions based on a rational assessment process.

7 Conclusions

The case study example illustrates how the application of the service access planning methodology (using the Flowmap software) can significantly contribute to achieving a more accessible, integrated and equitable strategic facility location plan. The approach and tools provide a defensible empirical base for the determination of facility needs in the study area, irrespective of planning or administrative boundaries that may be in existence. The tools were used to identify areas that are poorly served by the existing facilities and to identify potential locations from which they can be better served. The study also shows how a common analysis base can support co-location and the development of multi-purpose centres or nodal developments. It further shows how the outputs can be used to evaluate the impact of social housing development on facility demand.

Notes

[1] In this study the Flowmap software has been used developed by Utrecht University, Netherlands

[2] http://flowmap.geo.uu.nl Flowmap answers the questions your GIS did not think of!

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