Advanced computing for evaluating facility needs and enhancing sustainable development of public facility investment plans

Chéri A. GREEN
Senior Planner
CSIR: Built Environment
11 Jan Cilliers Street
Stellenbosch 7600
South Africa
Tel: (+27 21) 888 2657
Fax: (+27 21) 888 2694
E-mail: cgreen@csir.co.za

Gerbrand MANS
Researcher: Urban Geography & GIS Specialist
CSIR: Built Environment
11 Jan Cilliers Street
Stellenbosch 7600
South Africa
Tel: (+27 21) 888 2546
Fax: (+27 21) 888 2694
E-mail: gmans@csir.co.za

Ken BREETZKE
Strategic Executive
Engineering Department
5th Floor, City Engineers
eThekwini Municipality
166 (Old Fort) KE Masinga Road
Durban 4001
South Africa
Tel: (+27 31) 311 7176
Fax: (+27 31) 305 6952
E-mail: breetzkek@durban.gov.za

Abstract: This paper describes the use of a GIS-based methodology for assessing and planning social facility provision and developing an integrated facility plan which is defensible and impacts meaningfully on resource allocation. A case study of community hall investment for eThekwini municipality in South Africa is used to illustrate the methodology of matching supply and demand spatially across urban and rural areas.

The South African constitution stipulates that every citizen should have access to basic services. Accordingly, it is a legislated requirement that local authorities in South Africa prepare Integrated Development Plans and develop performance management systems to promote development and deliver services effectively. Planning and implementation flowing from this occurs in an environment full of pressures relating to insufficient resources to deal with the quantum of the development challenge, critical skills shortages, competing political and administrative priorities and the need to maintain existing infrastructure and at the same time 'build new' to eradicate backlogs.

The Service Access Planning Approach, developed for use with GIS-based accessibility analysis and incorporating various aspects of relational spatial analysis, has proved to be a very effective tool in eThekwini for development planning. In this approach, demand data is based on the population distribution, at a fine scale, along with attributes such as age and income. The supply data includes the location of the relevant facilities along with attribute data which reflects the capacity to service the population. This is all linked together by a connected road network that realistically reflects the topography and travel speeds.

The use of Geographic Information Systems to evaluate access to public facilities, based on agreed provision standards across both urban and rural settlement contexts, has lead to improvements in governance and has largely directed capital investment to areas of greatest need. Used in tandem, facility planning standards and GIS accessibility analysis has enabled more effective provision; management and monitoring of publicly provided facilities through a transparent planning process. The GIS analysis ensures that the evaluation of backlogs and proposals for new facilities are based on real needs related to population distribution and are not unduly influenced by political pressures. It also allows for the visualisation of geographic variations in service provision and allows one to report on the state of service provision as an indicator of service provision.

Keywords: accessibility modeling, GIS facility planning

1. INTRODUCTION

Advanced computing technologies which support GIS-based analysis, together with the application of the Service Access Planning approach developed by the CSIR[1], have been significant contributors to an effective and integrated means of identifying and eradicating facility backlogs, and developing equitable and defensible facility investment plans in post-apartheid South Africa. They have provided a transparent platform for decision making that ensures that new facilities are constructed in locations which have the greatest impact. The approach and tools enable clear prioritisation in an environment of competing priorities and insufficient resources.

Prior to the establishment of a majority democratic government in South Africa in 1994, facility provision was often subject to variations in investment policy based on different implementation agencies, racial policies and the un-coordinated development and planning of facilities by different organs of state. This was exacerbated by the neighbourhood planning approach of the day which embedded facilities within neighbourhoods – making sharing difficult across areas – and facility numbers were based on a blue-print approach to facility provision standards. In many instances, provision was based on what can be called a silo approach. This approach considered the number of facilities per administrative unit, irrespective of population need or distribution. As a result, facilities were poorly located and unequally distributed. Some areas were adequately provisioned, while in some areas there was under-provision across the facility spectrum or a gross over-supply of certain facilities. Often facilities were poorly located with respect to the broader community and the transport network.

Political changes in 1994 coincided with a new approach to planning which did away with the top-down approach in favour of greater community involvement and a community-led needs approach to planning. In addition, the Constitution guarantees all communities certain basic services such as health, education and water. This implies that communities must be able to reach such services to receive the minimum service level at the point of service. The community needs driven approach did not, however, always lead to a more equitable provision of facilities. At that time little or no consideration was overtly given to standards or technical evaluations of need. In fact, a normative approach to planning was considered outdated in academic circles. The outcome has been that in many instances those with the greater voice or

[1] Centre for Scientific and Industrial Research, South Africa.

personality are able to influence investment decisions, and the establishment of new facilities is sometimes used by councillors to win political votes and by officials to win political favour or to avoid being seen as 'obstructing the will of the people'. The influence of the ward councillor and the needs of the ward (administrative or voting unit) have to date often driven facility construction.

An additional negative factor is that, in the absence of any agreed future development plan for new facilities, foreign donors and non-governmental organizations often build facilities at locations which have been earmarked by the community. After commissioning, the facility is often handed over to the local authority to operate and maintain, even though the authority may not have been involved in the forward planning. In this manner the operational budget is burdened by a new facility that may do little to eliminate service backlogs. All these aforementioned factors lead to a mismatch of supply and demand.

For planners to play a significant role in shaping the future of SA cities and to redress the imbalances in facility provision, new ways of planning that are transparent and defensible are required to evaluate the social facility needs of all municipal residents, especially in an environment with limited resources. Such an approach that incorporates GIS-based accessibility analysis and planning decision support has been implemented in eThekwini.

2. SERVICE ACCESS PLANNING APPROACH

The utilisation of a Service Access Planning approach developed for use with GIS-based accessibility analysis, incorporating various aspects of relational spatial analysis, has proved to be a very effective tool in eThekwini. The basic Service Access Planning approach that has been developed over several years by CSIR uses Flowmap to audit service levels and availability by matching the supply of, and demand for, specific services within a spatial context.

The key data requirements include:

1) a detailed fine grained population layer as the major determining factor of demand;
2) a transport network as the key accessibility input; and
3) the capacity of each individual facility as the supply input.

In addition to this data, it is also necessary to have standards of access and threshold against which the measurement of facility access and sufficiency can occur. A set of standards or guidelines that 'talk to' the provision, and distribution of public facilities makes service provision and backlog determination processes possible, quantifiable and transparent. The setting of standards which include spatial parameters allows for the more accurate measurement and balancing of supply versus demand and through this the identification of backlogs within a spatial context. Thus meaningful application of GIS-based accessibility is only possible when standards for provision (which include aspects of distance and a measure of capacity of supply) have been established and agreed upon (Green, Breetzke and Argue 2008). Application of standards enables consistent monitoring and evaluation with respect to progress in achieving equitable access levels across the city.

Besides the geographical locations of the facilities, the service capacities (sizes) are used. In the absence of such data, other available information is used to estimate capacities, i.e. number of nurses or teachers employed. In general, the demand is based on the population or a subgroup of the population. For example, people living in households earning less than R3 500 per month have been identified as potential users of primary health-care clinics and community halls.

In order to simulate the different transport modes, a fully connected road network is required. The main set of tools applied for accessibility modelling and auditing are the Service Access Planning procedures developed by CSIR (described below) and Flowmap[2] software, developed at Utrecht University in the Netherlands. The results of the analysis are then mapped using ESRI (Environmental Systems Research Institute) products. The accessibility analysis relies on three techniques, namely that of catchment area analysis, proximity counting and optimisation.

The following step-wise process forms the basic Service Access approach to enable an accessibility audit and to plan the location of new facilities.

STEP 1:	Catchment area analysis - used to undertake Steps 2 and 3.
STEP 2:	User-side analysis classification (to map served and un-served areas and make travel time maps).
STEP 3:	Service-side facility classification based on modelled capacity utilization (Create tables or maps of possible utilisation/ allocation).
STEP 4:	Analysis of under- or poorly-served demand and backlog quantification.
STEP 5:	Identification of new facility locations using optimisation analysis and/or proximity counting depending on accuracy required.
STEP 6:	Development of integrated facility plans and communication of results though presentations. Latterly, also the use of an integrated map viewer to support decision making at a broader level.

3. ETHEKWINI – DURBAN THE CASE STUDY AREA

eThekwini is a coastal metropolitan area on the eThekwini Service Access Viewer east coast of South Africa, with a population of 3.5 million people (in 2006) living in a range of settlement and housing types. Development is centred around the main city in the area – Durban. It is one of 4 large metropolitan areas in South Africa and is one of the strongest municipalities in the country from the point of view of human and financial resources; however, the metropolitan area is characterized by high levels of poverty and unemployment (35.5% in 2006). Due to the country's legacy of apartheid or separate development of the various race groups, the socio-economic divides are highly racialized. Extensive formal and informal low-income housing settlement is found on the periphery of the formal core metropolitan area. With the establishment of the new metropolitan city region, the area of municipal responsibility doubled and the 'new' metropolitan council area incorporates an extensive rural area. In fact only 40% of the total 242,000 hectares can be considered urban. Population densities vary considerably with densities of 200 dwellings/ hectare found in informal settlements while some rural areas have densities lower than 1 dwelling/ha. This makes it challenging to provide social services equitably in all areas. For the purposes of social facility provision, 3 main settlement categories were distinguished

[2] www.flowmap.geog.uu.nl

which are illustrated in Figure 1. Council must budget and plan facilities for the entire area, which given the heterogeneity, produces many challenges with respect to the equitable provision of services.

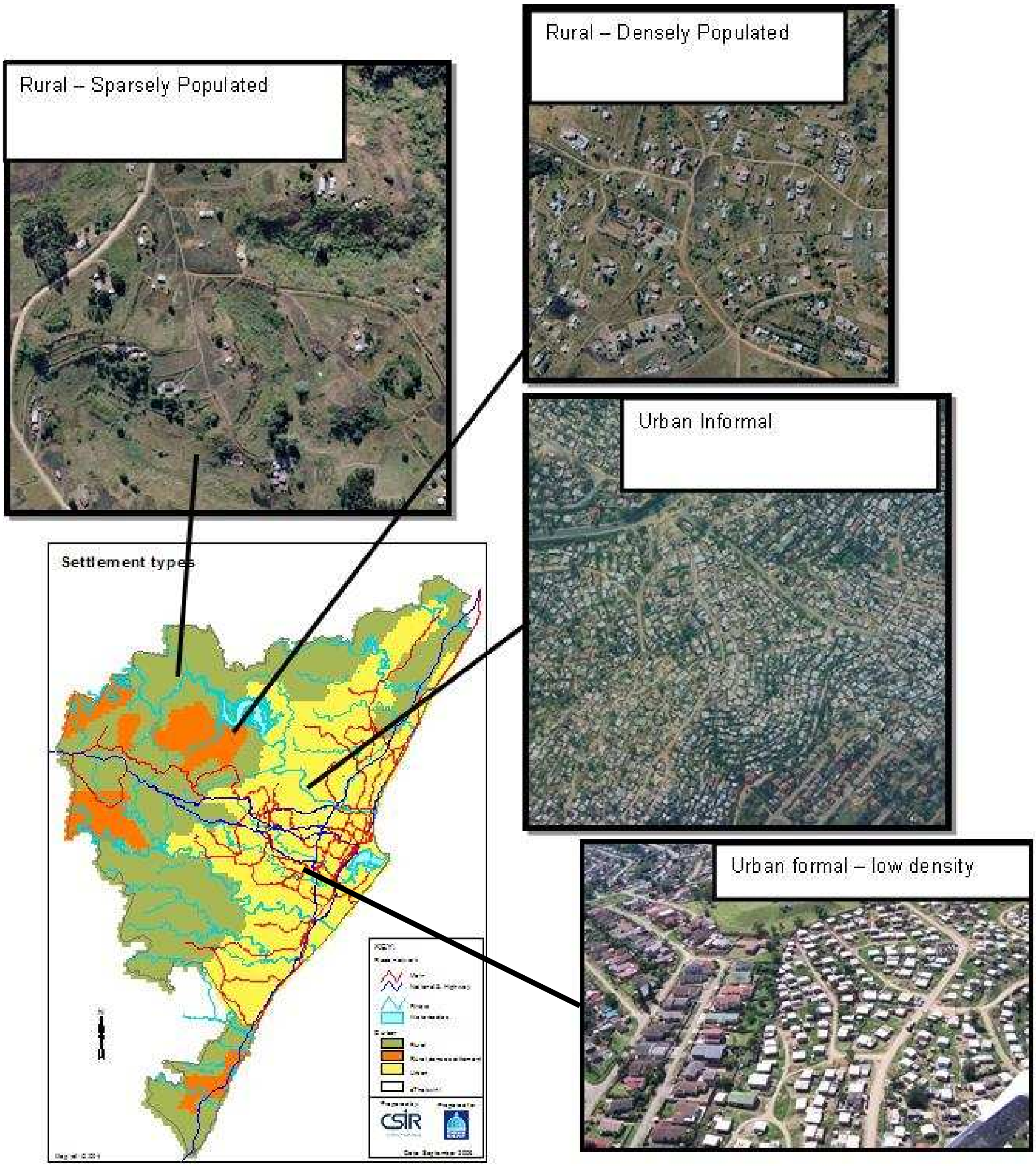

Figure 1: Different Settlement types and housing densities which must be evaluated with respect to social facility need.

4. THE ETHEKWINI CASE STUDY: COMMUNITY HALLS

The analysis of community halls in eThekwini is used to illustrate the Service Access Planning methodology, tools and outputs.

4.1 The approach

Within eThekwini an evaluation of all social facilities has been undertaken including the provision of community halls. There is the perception that some areas are over supplied, while in other areas some halls are over used; leading to problems of vandalism and lack of access. The full project involved the access modelling of 11 different public facilities to spatially identify facility backlogs and identify potentially optimal sites for new facilities. The analysis mainly focused on social facilities and the requirement to site facilities near residential areas due to limited personal mobility.

For each facility type, discussions were held with the relevant service providers to agree on acceptable access standards (either that of a travel time or distance) and a transport mode for access to each facility type. In some cases, facility capacity standards also had to be agreed upon. Where relevant, different criteria were developed and applied for the urban or rural section within the City boundaries.

4.2 Data Preparation

The population data, i.e. total population, as well as other socio-economic variables were used in the model. It was necessary to update the population data since the census data was seven years old. This was adjusted to reflect 2006 population levels by Council staff making use of the informal dwelling count undertaken by the Water and Engineering services, whilst in the case of formal areas, housing representatives assisted with updating the data. Data was only available at planning unit level (406 units) which is very coarse.

The entire study area was tessellated into hexagons to achieve the fine grain analysis zones required for spatially accurate facility location planning. A weighted spatial overlay procedure was developed to allocate the population and relevant social information, e.g. age and income, to the hexagons. The allocation was based on the underlying land-use layer (including land-use type and size and relative population density) using a weighted proportional allocation procedure (Green, Breetzke & Jacobs 2008). The resultant distribution formed the basis for most of the demand scenarios. A further population layer was developed to show the population 'shifts' caused by the 5-year public housing programme.

Social facility data is obtained (specifically the geographical coordinates of facilities) together with attribute data reflecting facility type, use and capacity. The data was used as point data or assigned to the hexagon layer depending on the level of accuracy required and/or processes to be run.

Since the software relies on computing the shortest distance to facilities, a fully connected road network as well as speeds on each road segment is a further critical dataset. Road network speeds are adjusted based on a combination of modelled speeds and road class. The modelled speeds are derived from the output of an EMME/2[3] transport model. For each road segment, average high and low speeds are assigned based on perceived traffic conditions during peak and off-peak periods. In the case of emergency response services, e.g. fire and police services, a special layer is developed reflecting emergency vehicle speeds.

The analysis criteria used for halls are contained in Table 1.

---

[3] EMME is an interactive multi-modal transport planning modeling package offering a comprehensive set of tools for demand modeling and multi-modal network modeling (www.inro.ca).

Table 1: Analysis criteria for Community Halls

Facilities analysed	**All A, B and C grade Community Halls**
Demand	**Entire city with two sets of population figures:** • All population in households earning less than R 38 000 per year (2006) • All population in households earning less than R 38 000 per year (2006) plus adjustments for future increase in population based on proposed low cost housing plan
Supply	**Three scenarios were tested:** • Current Community Halls with a capacity of 30,000 persons. • Current Community Halls plus 8 proposed Community Halls to serve the 2006 population. • Current Community Halls plus 8 proposed Community Halls to serve the population adjusted to include the impact of the proposed low cost housing projects. • All proposed halls had a projected capacity of 30,000.
Travel mode and access time	**Public transport** – up to a maximum travel time of 15 minutes for Urban and Dense Rural areas. In Rural areas the catchment area analysis processes used a 30 minute maximum travel time.
Analysis undertaken	• Unconstrained travel time analysis • Catchment area analysis • Optimisation of 8 new facility locations for 2 scenarios at 15 minutes access time.

4.3 STEP 1: Defining current catchments

The first step in the process is to define current catchments, or the areas of influence of existing facilities, by using a set of basic catchment area analysis procedures. The model allocates the demand to the closest facility which still has capacity, but which is within a selected travel distance. This is done in competition and no double counting occurs. Choices regarding the transport mode, the maximum acceptable travel distance and, if applicable, facility size constraints need to be determined before embarking on an analysis for each facility. Unconstrained, fully constrained (time and capacity) and time-only constrained catchment area analysis techniques can be used. In the case of halls, the time constraint was 15 minutes in urban areas and 30 minutes in rural areas. Urban halls had a capacity of 30,000 while rural hall capacity was set at 15,000.

The analysis produces a set of indicators that reflects the current service provision of areas and the utilisation rates of specific facilities. The indicators, some of which are shown in Table 2, include:

- average travel time to reach a facility with capacity;
- number and percentage of persons served;
- area and percentage of land area served; and
- number of persons allocated to facilities.

Table 2: Accessibility statistics for existing Community Halls based on the 2006 population by settlement type

Constrained catchment within 15 min for Urban and Dense Rural and 30 min for Rural				
	Urban	Dense Rural	Rural	Total
Average travel time (mins)	4,5	5,8	9,8	7,1
Population served	2,114,027	169,309	104,715	2,388,051
Population earning less than R38 000	2,447,994	319,536	267,044	3,034,573
% population served	86,4	53,0	39,2	78,7
Un-served population	333,967	150,227	162,329	646,522
Land area covered (ha)	77,568	10,808	46,599	134,975
% land area	77,6	43,9	39,8	55,8

4.4 STEP 2: User-side analysis classification

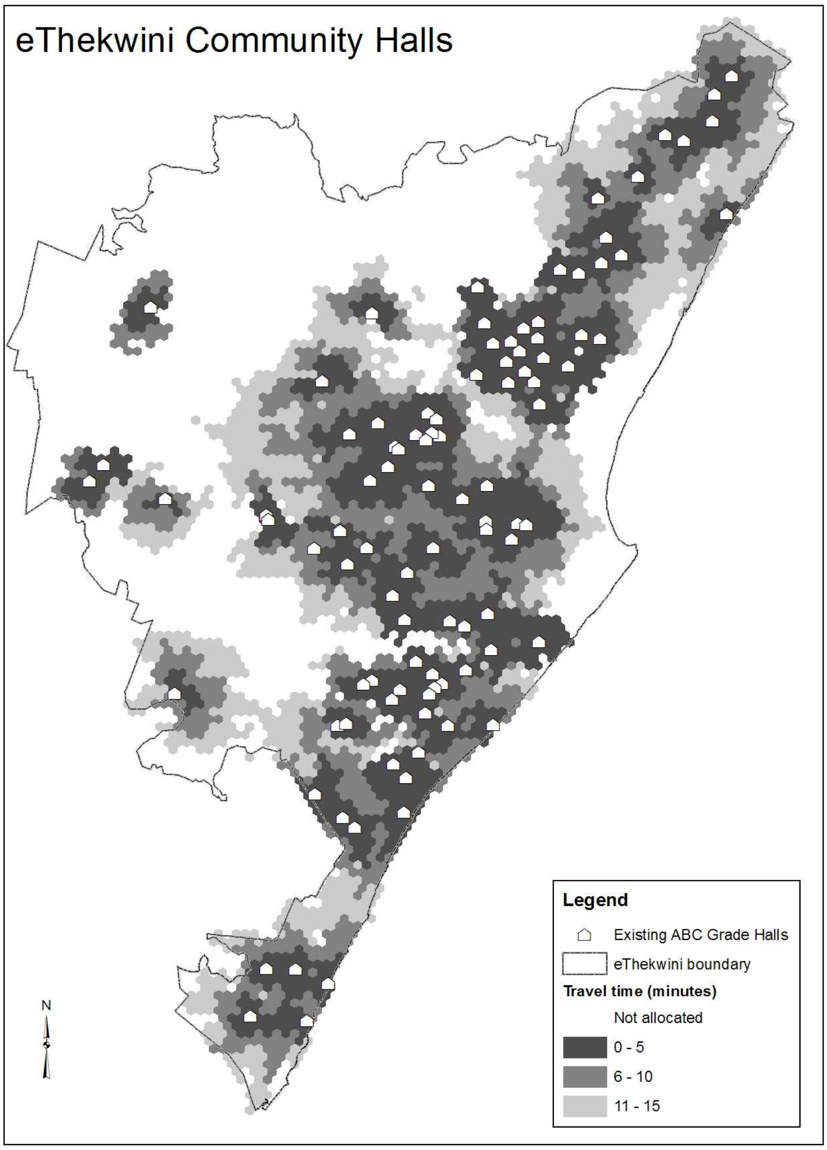

Figure 2: Currently served population

Making use of the catchment area analysis process, the study area can then be divided into sufficiently served areas and un-served areas as shown on Figure 2, which represents the served catchment and un-served areas for community halls in eThekwini.

The maps showing served and un-served areas are invaluable for community and councillor interaction, as well for in-house communication and discussions regarding needs and or future development plans.

Thus, the analysis enables the categorisation of **residential** areas in terms of service and accessibility according to the following three categories:

- Well-served areas – areas where facilities are well located, users are within an acceptable access range, the total demand is met and above the minimum threshold for a viable facility;
- Poorly-served areas – areas where facilities are out of reach or overburdened and all demand cannot be met owing to capacity constraints;
- Over-serviced areas – areas with more facilities than required, and where one or more facility does not reach its full capacity due to competition. This may require rationalisation as it is likely to be unsustainable and inefficient.

4.5 STEP 3: Service-side facility classification based on modelled capacity utilization

Using the model outputs, each **facility** can be classified as well-located; poorly located; underutilised; or over-burdened. This is done by comparing the current capacity to the modelled allocation of the demand. It is sometimes necessary to do this under capacity constrained and unconstrained conditions and in combination with right-brained inspection of the catchment areas sizes. Very small catchment areas indicate over-burdened facilities while tables of allocation quickly indicate under-utilised capacities.

The following table extract shows some examples of under-utilized halls. These halls are shown in Figure 3 which deals with halls identified for rationalization.

Table 3: Extract of list of potentially underutilized halls due to poor location

Name	2010 Scenario (with extra community halls)		
	Capacity	Demand	Spare capacity
Belvedere Community Hall	30,000	14,269	15,731
Ewushini Hall	30,000	14,161	15,839
Chesterville Extension Hall	30,000	14,158	15,842
Hambanathi Resource Centre	30,000	13,996	16,004
36th Avenue Hall	30,000	13,534	16,466
Amanzimtoti Civic Hall	30,000	13,510	16,490
Pinetown Civic Hall	30,000	13,177	16,823
Lovu Community Hall (Lovu C)	30,000	12,998	17,002
Craigieburn Community Hall	30,000	12,626	17,374
Magabheni Community Hall	30,000	11,293	18,707
Lovu Hall (Lovu B)	30,000	10,918	19,082
Hlanzeni Hall	30,000	10,501	19,499
Kloof Town Hall	30,000	9,798	20,202
Cowies Hill Hall	30,000	5,847	24,153
Westville Civic Hall	30,000	4,235	25,765
New Germany Hall 1	30,000	2,895	27,105
Umkomaas HALL	30,000	2,740	27,260
Solomon MaHlangu Hall	30,000	1,521	28,479
New Germany Hall 2	30,000	1,457	28,543

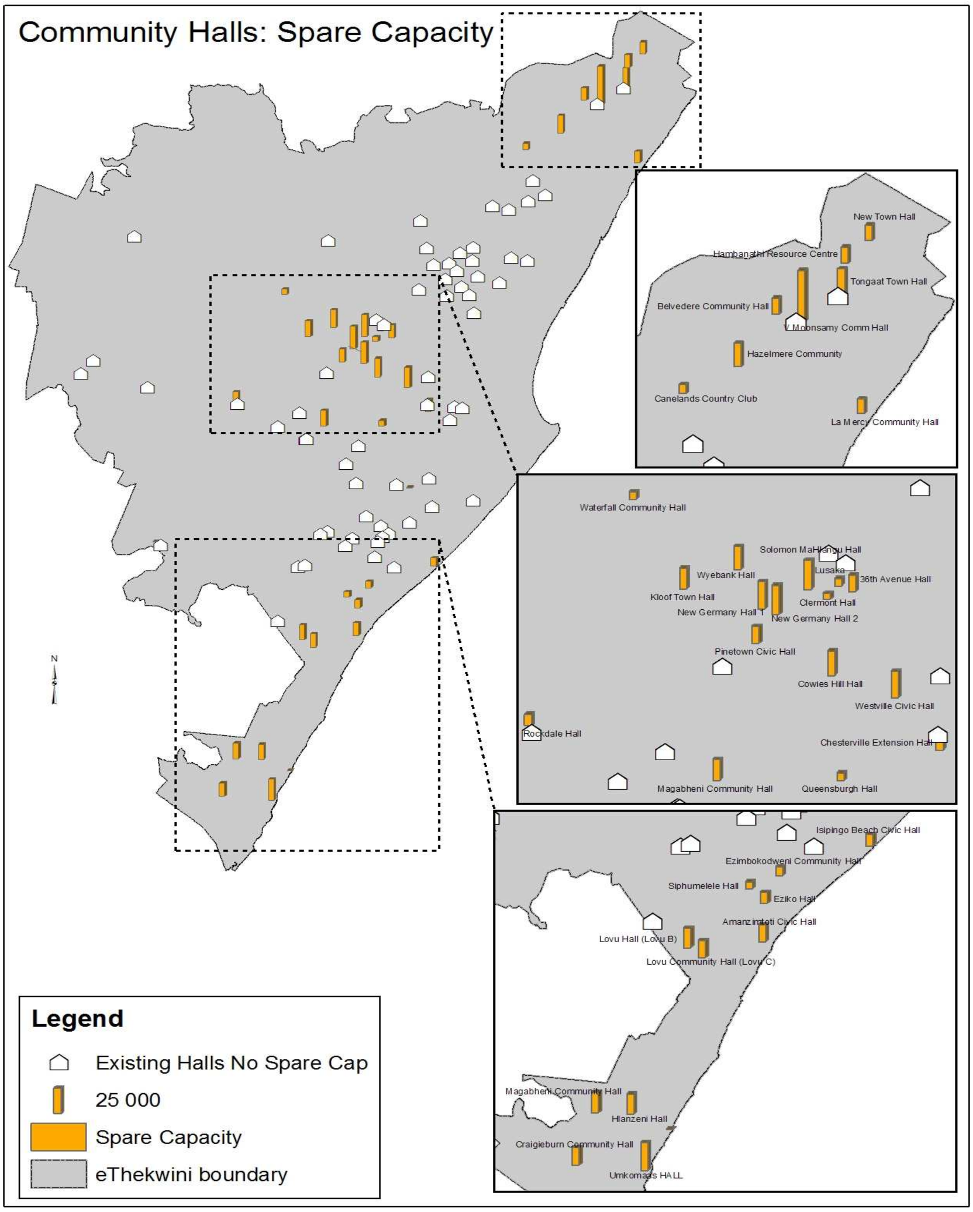

Figure 3: Map of hall rationalization

4.6 STEP 4: Analysis of under- or poorly-served demand and backlog quantification

Based on the outputs of the catchment analysis the un-served demand is identified. In Step 4 it is analysed to assist in identifying locations for new facilities. The un-served demand can firstly be analysed, by directly mapping the density of the un-served demand or by undertaking proximity counting to achieve a map showing the concentration of un-served demand within an assigned travel time. Generally proximity counts can be done either by counting the number (frequency) of the origins or by summing up a variable attached to origin locations, such as population. In proximity counting the model sums all (un-served) demand within a cut-off distance of all selected points or zone centroids. Thus double counting occurs and the result is a map or table of relative demand, or ability to be within reach of a number of un-served persons for each hexagon. This is a excellent sketch planning tool and can be used to estimate a suitable number of new facilities to use in the optimization analysis or as a rough estimate of new sites. The outputs enable the identification of those locations where there is a sufficient concentration of un-served demand to support new facilities of a specified size. However, it does not allow ranking of the best locations which can, however, be done using optimisation analysis.

4.7 STEP 5: Identification of new facility locations using optimization analysis

Using the proximity count a rough estimate of the number and location of new facilities is possible. However, if greater accuracy is required to locate facilities and only a limited number of facilities can be built, optimisation analysis is used. Discussions should be held with officials to determine the level of coverage required and the number of facilities permitted by the budget. In the case of halls it was agreed to seek potential locations for 8 new halls.

Within the specified number of new facilities required, the optimization software seeks out the optimal placing for these facilities based on the principle of maximising the number of still un-served people that can reach the new locations based in this instance on an average travel time of 15 minutes. The model uses a looped process to seek the top locations that meet the criteria and in competition with existing facilities will have sufficient catchment to be viable. As a result of the optimisation, a map showing a set of 'best' locations is developed for each sector. See Figure 4.

Where there is insufficient demand to fully support a new facility other options need to be considered. These could include establishing whether:

- existing facilities can be increased in size or operational capacity;
- longer access time ought to be considered;
- mobile or piggy-back services can be considered.

4.8 STEP 6: Development of integrated facility plans and communication of results

Once optimisation analysis or proximity counting has been completed for all sectors, an integrated facility plan is developed and communicated to stakeholders. In some instances the development of a facility cluster is indicated, (e.g. an education or sport precinct), or in other instances a multi-purpose facility. A key element in the successful development of multi-facility centres is to situate them in highly accessible areas, such as development and transport nodes.

Results are communicated at presentations through the use of maps and tables. More recently the packaging of the results in an eThekwini Service Access Viewer has facilitated communication and implementation to a wider audience.

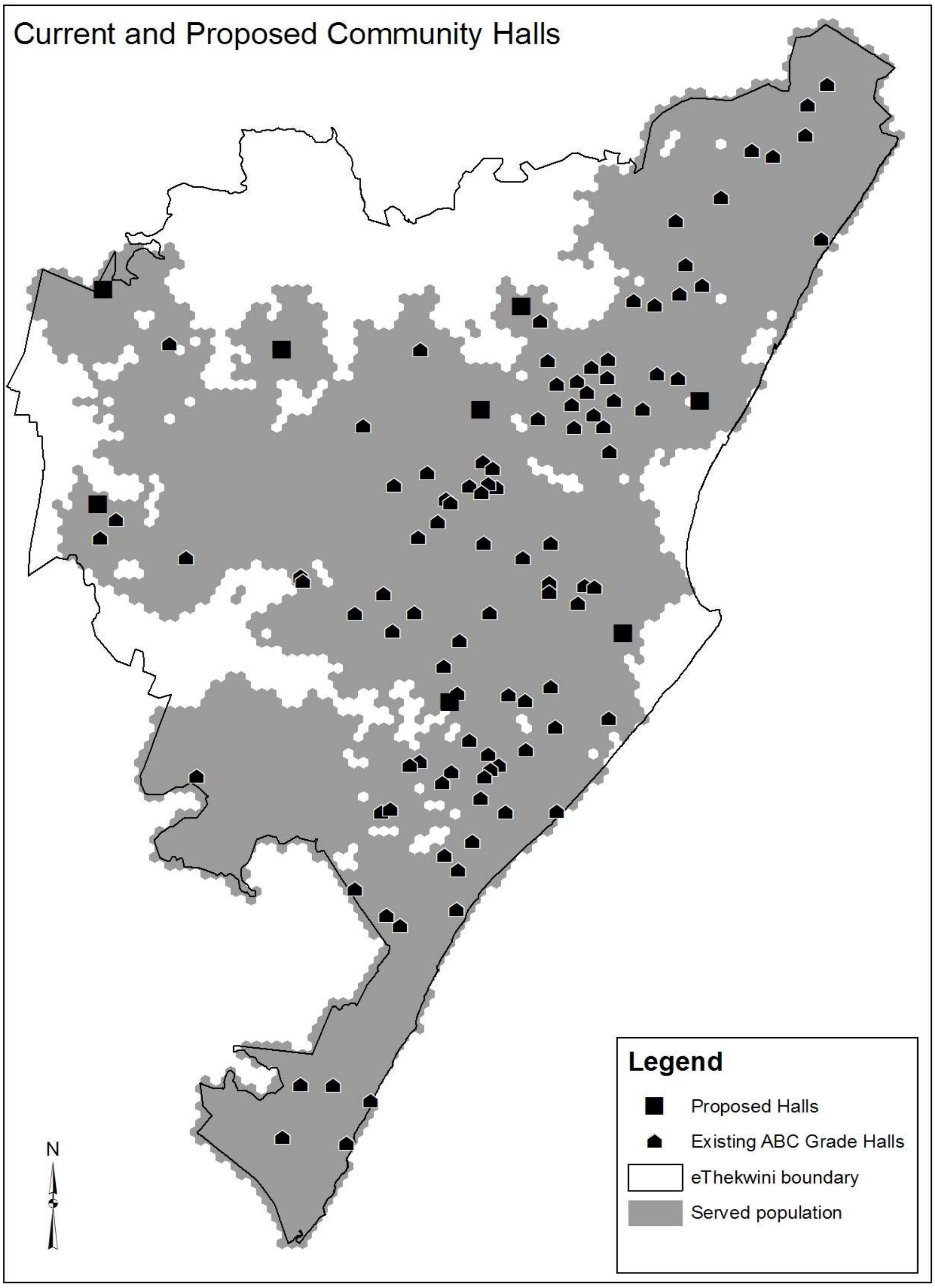

Figure 4: Map of new hall locations

4.9 Discussion of Results

The analysis indicated where there are sufficient facilities (Halls graded A, B and C – higher grade halls in which the council wishes to invest), where there are too many and where new or upgraded facilities are required. Where new facilities are required, the locations of existing D and E grade halls (which are lower grade halls) have been considered as suitable sites for upgrading should the site be large enough for this. An inference regarding areas where the lower grade halls should remain under Council control because of poor access to grade A, B or C halls can also be made using the analysis results.

The overall coverage of community halls under the current dispensation is shown in (Table 2 page 8) and 79% of the total population can reach a facility with sufficient capacity within an average 7 minutes travel time. The Urban population is well served; 86% reach a facility within an average travel time of 5 minutes or less. The Dense Rural population is 53% served and the Rural area 39% served. The overall assessment is that this facility type is generally well provided for in terms of population, although the area coverage is somewhat low.

It was agreed that since there was some shortfall, sites for 8 new halls would be sought to increase coverage further. In the analysis the impact of the future public housing developments was included. It was found that the addition of 8 new higher grade halls, optimally located, will improve access such that almost 88% of the population could be served, with the worst case being that only 70% of rural people will be within 30 minutes of a facility (Table 4).

Table 4: Accessibility statistics by settlement type for existing and proposed Community Halls optimised for backlog eradication based on the population adjusted for the low cost housing plan

Constrained catchment within 15 min for Urban and Dense Rural and 30 min for Rural				
	Urban	Dense Rural	Rural	Total
Average travel time (mins)	4,5	5,9	12,8	8,9
Population served	2,256,310	241,831	240,115	2,738,257
Population earning less than R38 000	2,481,119	304,436	343,706	3,129,260
Un-served population	224,808	62,605	103,591	391,004
% population served	90,9	79,4	69,9	87,5
Land area covered (ha)	81,434	18,124	71,249	170,807
% land area	81,5	73,6	60,8	70,6

Based on the remaining un-served demands there is still a theoretical shortfall of 12-13 additional halls. This is specific to the northern and western areas, despite an apparent oversupply in the same area. Poor location and clustering of facilities results in competition for the same users while other facilities are located too far from their potential users.

4.10 Recommendations

Figure 4 indicates the 8 locations where A, B or C grade halls are required to meet current backlogs while also accommodating the impact of the 5-year low cost housing plan. Of these locations, 3 are in close proximity to lower grade current D or E grade halls while another is within 2km radius of such a hall so upgrades should be considered if space allows at these locations.

As noted earlier, some rationalisation should be considered and those areas where detailed investigation is required are indicated on Figure 3. It is stressed that before rationalisation is considered, visitor numbers/ usage of each hall must be reviewed. The map shows three distinct groupings of community halls which have a total combined spare capacity of more than 600,000 persons. This is a significant amount of spare capacity and some of these halls should be considered for closure or change of use in a rationalisation process. Since data on actual usage of facilities is not available, these recommendations with regard to rationalisation are subject to confirmation based on ‘on-the-ground’ investigations within each sector.

5. APPROACH TO INTEGRATION

An analysis similar to that discussed for halls was undertaken for 11 different facility types including fire services, libraries, health care, schools, and parks and recreation facilities. Each facility type was analysed individually to determine backlogs and locations identified for the construction of new facilities to eradicate this backlog in an optimal manner. The analysis process was customised for each facility type.

Figure 5 shows a summary of the optimised locations for all facilities. This figure indicates a distinct clustering of facility needs in five areas and gives clear strategic direction to municipal officials, donors and provincial and national government departments responsible for health, education and library services. At a glance one can identify where the greatest backlogs exist, and therefore where the greatest return on investment in serving eThekwini residents is to be achieved.

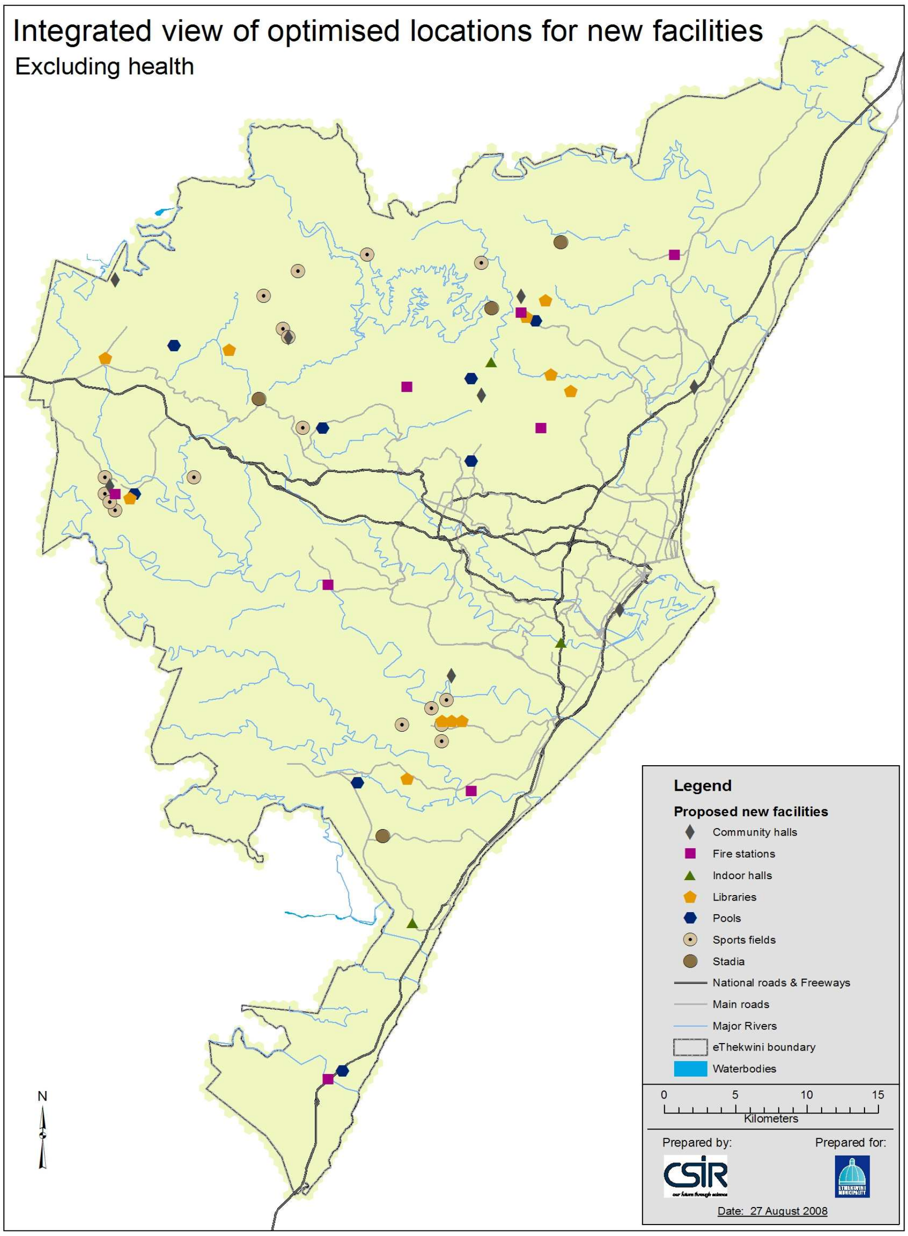

Figure 5: Joint plan of investment

To provide easy reference on a day-to-day basis to the detail of the social facility plan results and related information, a map viewer has been compiled for distribution to all line-departments who were then trained in the use of the viewer and the principles of co-location. Thus, the eThekwini Facility Access Viewer will enable all line departments to see spatially where the greatest shortage in service provision occurs for their services and the most cost-effective locations for eradicating backlogs. It will also allow line departments to identify opportunities for mixed and multi-use developments and the sharing of existing and proposed facilities with other departments.

The setting up of a basic desktop GIS viewer that is accessible to all has turned out to be a very useful tool in that it has allowed for:

- Communication, between and within municipal departments that supports the debate regarding proposed new facilities or those ear-marked for upgrading versus rationalisation. In this way, one can in a transparent and reasonable manner withdraw support from proposals which have limited impact or in turn support ‘high impact’ proposals.
- Support to projects being run for the municipality by private sector consultants through integrating the model results into plans at an early stage – rather than arguing about the social facility proposals after the plans are complete. This tool has already proved its worth in the collaboration between the public and the private sector to achieve an integrated plan of social facility investment in the Umlazi node (a densely populated and previously disadvantaged area).

In essence, the Viewer has proved to be of immense value in achieving implementation of the results of the Service Access Planning.

6. CONCLUSION

The case study shows how the Service Access Planning methodology, when used in an environment with advanced computing, can contribute significantly to enhancing both current decisions and longer term planning. Further, the goal of providing access to services for all citizens can be accurately measured and monitored, thus achieving equity over time in a transparent manner. Planning officials are provided with solid technical decision support in an environment where politicians, communities and even municipal departments vie to have their particular needs met and where funds are scarce. The primary output of this work has been the adoption of a long term social facility plan which is one of the pillars of the eThekwini Quality Living Environment strategy which is a key strategy of the long term development plan for the city.

An equitable strategic level spatial facility location plan can be developed because of the following:

- The GIS tools enable accurate spatial disaggregation of population demand data at a fine grain.
- Greater computing ability enables use of complex algorithms that simultaneously match thousands of origins (supply) and destinations (demand).
- Using a transport network, with speeds per link adjusted according to travel mode for the purpose of modelling, approximates real links and accounts for topography and/or major barriers as opposed to defining catchments.
- The analysis informs the budgetary process for facility provision.

- The plan provides guidance to all developers, private and public sector, in terms of where facility investment is most critical and can thus significantly reduce the construction of 'white elephants' or under-utilised facilities
- The approach and tools provide a defensible empirical base for the determination of facility needs amongst different wards and planning regions and sectors.
- The approach enables the co-location of different facility types as part of a multi-purpose centre or priority investment hub since a common analysis base is used.
- The approach enables backlogs to be spatially determined in relation to population need. Although theoretical in nature, the model has very successfully identified areas with facility backlogs which have been corroborated by officials. The outputs support the planning of facilities where they are needed and where people live irrespective of ward boundaries and political processes.
- Longer term monitoring and planning is possible based on established procedures allowing progress to be monitored.

Notwithstanding the major contribution of the approach and the use of its associated tools, there are some constraints to its widespread use if the facility databases do not exist or are not maintained and updated. Most of the problems experienced with the application of the models were related to data collection and verification.

The use of the Service Access Planning approach 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.

As illustrated by this case study, the GIS accessibility analysis together with the availability of facility provision standards and guidelines are major elements in support of planning now and into the future. However, the process followed in government to implement the results and ensure these results impact on capital budget choices are critical steps in ensuring that development needs are addressed in pragmatic, efficient and sustainable ways. The approach indicates how past imbalances in service provision to specific communities can be identified and redressed through computer based GIS decision support tools thus significantly supporting planning and governance processes.

REFERENCES

a) <u>Papers Presented in Conferences</u>

Green, C.A., Breetzke, K. and Argue, T. (2008) **Standards for improved governance and performance measurement in the eradication of backlogs and delivery of public facilities.** Paper presented at the 11th International Winelands Conference, Stellenbosch, 16-18 April.

Green, C.A., Breetzke, K. and Jacobs, N. (2008) **Urban rural demarcation within a metropolitan area – a methodology for using small area disaggregation.** Paper presented at SAPI Plan Africa Conference, Sandton, 14-16 April.

b) <u>Other Documents</u>

Green, C.A., Mans, G. and McKelly, D. (2008) **Accessibility mapping and optimization of community social services in eThekwini.** Contract report CSIR/BE/PSS/ER/2008/055/B. eThekwini Municipality, Durban.

Green, C.A., Morojele, N.I. and van der Merwe, J.M.P. (2006) **Accessibility mapping for community social services 2006.** Contract report CSIR/BE/IPDS/ER/2006/0069/B. eThekwini Municipality, Durban.

Naudé, A.H. (2001). **Introduction to planning support systems and procedures for service access planning** (AccessPSG-1 DP-2001/1).

Naudé A.H., Green, C.A and Morojele, N. (2001) **Multi-criteria spatial profiling and catchment area analysis.** AccessPSG-2. DP-2001/2 (Final Draft), CSIR Transportek, Pretoria.

CURRICULUM VITAE: CHERI ADELE GREEN

Chéri Green is a Town and Regional Planner with a special interest in the land use and transport interface. Recent project encompass service access planning in eThekwini and Cape Town, two of the major metropolitan regions in South Africa. These projects involve the strategic identification of key facilities shortages using GIS-based accessibility and the identification of the tops locations for the development of new facilities to focus development within identified need areas within investment nodes and corridors. This can be seen as ‘Action Research’; the results are implemented and the research methodology refined / adapted constantly to the changing needs within the municipal environment. A review of standards for social facility provision has been undertaken.

A further specialisation is the development of rural mobility strategies for remote sparsely populated areas where focus has been placed on the transport issues for learners and farm workers as well as general access to social facilities.