EFFECTS OF ILLUMINATION ON ACCESSIBILITY OF PUBLIC PARKS IN SOUTH AFRICAN CITIES

J. HONIBALL & D. DAS
CENTRAL UNIVERSITY OF TECHNOLOGY, FREE STATE

Abstract

Public parks (PP) and open recreational facilities are essential elements in cities particularly in the residential areas. Evidence from literaure suggests that PPs have a positive influence on the social and physical health of the people who have access to them. Although, PPs have been located in the residential areas of South Africa according to urban planning guidelines and rules, they are observed to be underutilised. Many factors including location, accessibility, and social issues like crime or fear of crime, life style, and lack of time are generally attributed for such a scenario. Therore ,the objective of this study is to explore how illumination levels in the public parks influence the utilisation of public parks in the residential areas of South African cities. The investigation was conducted by using Bloemfontein city as a case study folowing a survey research method. The study revealed that more people use the PPs during evening hours, higher illumination is one of the most important factors that contributes to the accessibility of the PPs in the residential areas and the utilisation of parks are enhanced with higher level of artificial illumination.

Keywords: Public parks; Recreational facilities; Accessibility; Residential areas; Vibrancy, Illumination

1. INTRODUCTION

Public parks (PPs) and recreational facilities (RFs) offer people the opportunities for a wide range of leisure, sport and recreational activities. They are crucial for the social and economic health of the cities and towns (Sallis, Frank, Saelens, & Kraft, 2004). It is observed that the habitation areas including residential areas of South Africa in general and in the cities in particular have been going through transformations since the establishment of its new constitution in the year 1994. In the process transformations in urban functions and consequent land uses are observed in many cities of the country. Consequently a hierarchical change in the pattern of residential areas in urban areas has been experienced (Spocter, 2004). For instance, the residential areas have been expanded to develop suburban areas. The suburban areas, which were essentially started for residential purposes, gradually incorporated other urban functions such as commercial, civic and recreational activities. Besides, a stress was laid upon to create organized open spaces including public parks and open recreational facilities in the residential areas of the cities. They become one of the core land uses in the city development plan offering urban social and recreational functions.

Although, a number of such public parks and recreational facilities have been developed in most of the South African cities, it is observed that except a few major and organized ones, majority of the public parks in residential areas scarcely utilized. The reason of underutilization these public parks are attributed to may factors that includes lack of amenities, inappropriate location, lack of attractiveness lack of accessibility, behavioural issues like lack of time and life style, social issues like crime or fear of crime to name a few. Therefore, the objective of the of study is to explore how illumination levels in the public parks influence the accessibility and consequent utilisation of public parks in the residential areas of South African cities.

The study was conducted by using Bloemfontein city of South Africa as a case study. A survey research method and regression modelling were used for the purpose. A hypothesis that availability of improved level of artificial illumination in the public parks in residential areas of cities improves their utilisation is tested. Findings suggest that majority of the people use the parks during evening hours. Artificial illumination is one of the most important factors that influences accessibility of the public parks, and utilisation of the public parks increases with higher level of artificial illumination.

2. LITERATURE REVIEW

2.1 Role and indicators of success of public parks

Public parks are crucial roles to play in cities. Some of the important roles they play are that they offer open recreational facilities to people, bring people together, increases social bonding, make intergenerational interaction, develop contact with nature (especially if it is natural green spaces), compliment the architectural articulation of the surrounding built areas, improve the value and desirability of the surrounding residential areas, and create an area for people to orientate themselves with the greater part of the city or town (Dempsey, 2012). Public parks have many design aspects, which positively contribute to the well-being and value of the surrounding spaces. Properly planned and designed open green spaces (OGSs) and public parks greatly add to the aesthetic quality of the surrounding areas and satisfaction inhabitants around them. Also, they create a restorative environment, which cannot be neglected as they positively influence the inhabitant's well-being and health.(Ariane, Bedimo-Rung, Andrew, Mowen, Deborah, Cohen, 2005)

The project for public spaces (2013) evaluated thousands of public spaces around the world and has found that successful public parks and recreational facilities have four key qualities. Firstly, they are accessible; secondly, the people are engaged in activities there; thirdly, the space is comfortable and has a good image; and lastly, it is a sociable place where people meet each other and take people when they come to visit (PPs, 2011).

Based on such studies, a tool called “The Place Diagram (Figure 1)” was developed to aid people to judge whether any public place is good or bad. One of the important aspects, which have been emphasized in it is the access and linkages of parks and recreational facilities, which essentially influence the success of the public parks and open recreational areas (Project for Public Spaces, 2013).

Fig. 1: The Place diagram for public parks (Project for Public Spaces, 2013)

2.2 Forms of Accessibility to Public Parks

The accessibility of public parks is related to the ability of people to reach the space by means of public transport, private transport or pedestrian infrastructures. Accessibility is often considered as a crucial factor to make a public park function as purposed. For instance, a public park that is set on a busy road may draw more people that are passing by as well as people using services and facilities that are nearby (Dempsey, 2012).

Although, there is no unanimity on the definition of accessibility of public parks because of the various roles it plays and its effect on the vibrancy and usefulness of public parks, it can be categorized into three forms such as, physical access, visual access, and symbolic access (Sendi and Golicˇnik Marusˇic, 2012).

2.2.1 Physical Access

Physical access to public parks requires the space to have proper linkage from neigbouring spaces as well as no barriers preventing pedestrians to enter the space. According to (Sendi and Golicˇnik Marusˇic, 2012) physical access to public parks should be easy for children and elderly people to make use of. Houses and residential areas next to the public parks should also have relatively easy access to the space. Physical access is hampered by vehicular movements around the public parks. The physical accessibility of parks is also influenced by the density of the neighbourhood which surrounds it, and perhaps by the shape of the park. Besides, convenient access for physically challenged people is an essential element of the physical access of the public parks (Dempsey, 2012).

2.2.2 Visual Access

The visual access of a public park refers to the visual connection a user would have with the park they are heading towards. Visual access contributes to the safety of the user due to the proper visibility needed to safely navigate to the park. Not only must a public park be easily visible to its users, it must also ensure that the users are visible when accessing as well as when using the parks (Sendi and Golicˇnik Marusˇic, 2012). According to (Peña-García, Hurtado, & Aguilar-Luzón, 2015), artificial illumination of a public park is a key element in making sure that the visual access of a public park is adequate.

2.2.3 Symbolic Access

Symbolic access to public parks is becoming more and more important in defining the full accessibility and vibrancy of the public parks. Symbolic access can be defined by the level and quality of signs and marks that share information to prospective users on who or what is welcome and who or what is not in the areas and territories of the space. These markings and signs can also be elements like structures, landmarks, monuments, sculptures, etc. Public display areas and programs, such as, pavilions, galleries, and other theme objects can also be seen as features contributing to symbolic access. Users such as group, (teenagers, small children, dog walkers, etc.) maintenance workers, and security staff visible in the public parks are also contributors to the symbolic access of the public parks (Sendi and Golicˇnik Marusˇic, 2012).

2.3 Issues of Accessibility to Public Parks

The issue of accessibility to the public parks is becoming more and more debated with regards to sustainable urban planning. Accessibility to the public parks is essential for the health, well-being and cultural equality of the societies. This awareness can mainly be attributed to the awareness about the health and well-being benefits that are gained from the successful use of the public parks (ThomPPon, Aspinall, & Roe, 2014). Access to the public parks is particularly useful to children, lower socioeconomic group, and people with physical/mental disabilities (La Rosa, 2014).

Challenges of accessibility to public parks vary according to the different access needs people. If accessibility to the public parks is considered as the degree of ease at which a user can reach their destination, then fully determining the factors and variables affecting the accessibility of public parks should be a pre-requisite for further analysis on planning for vibrant and sufficient public parks (La Rosa, 2014; Sendi and Golicˇnik Marusˇic, 2012).

In addition to the spatial accessibility of public parks, Weiss et al., (2011) suggests that there are many other variables of the environment that might negatively affect the use and accessibility of the public parks. In this regard, the research conducted in the perspective of environmental justice highlights the linkage between the inequalities in the spatial distribution of public parks and natural hazards in the environment. For example communities with less or limited accessibility to public parks face exposure to environmental ailments such as air pollutions (Evcil, 2012). Besides, it is also found that fear of crime or concerns for personal safety limits the accessibility of the parks as it discourages the users to make use of the available modes of access to the public parks. For instance, these fears and concerns may lead users to rather seek out other recreational facilities, which are perceived to be safer to access (Weiss et al., 2011). However, Painter (1996) observed that adequate levels of illumination in public parks are often a deterrent for crime and inadequate levels of illumination in the parks are often a deterrent for potential users of the parks.

Evidence from the literature suggests that most of the researches on the accessibility to public parks that have been carried out until now are mostly on industrialized nations, which have well-established infrastructure. However, on the contrary very little is known about accessibility of public parks, their use, preferences and efficiency in fast growing cities of developing countries (Wright, Zarger, & Mihelcic, 2012). Therefore, an effort has been made in this study to understand the relationship between illumination as an accessibility parameter and use of public parks by in a city of a developing country.

3. STUDY AREA

Bloemfontein city of South Africa is used as a case study for this investigation. It is comprised of 35 suburban residential areas. The city has an adequate number of hierarchical public parks and recreational facilities, which includes central park and stadiums at the city level, public parks at the neighbourhood level and residential area level. However, most of the parks in the residential areas are observed to be lacking in vibrancy and more so found to be underutilized. Accessibility, perception of safety, actual safety, lack of entertainment amenities, lack of maintenance, and comfort are some of the suggested factors, which discourage the higher use of these parks. Therefore, it was felt relevant to explore the relevant factors, particularly the accessibility factors that influence the utilisation of the public parks in the city.

4. RESEARCH METHODOLOGY

The investigation followed a survey research methodology and development of a regression model. Data was collected through household survey and physical and park use surveys. The surveys were conducted in four representative suburbs of the city such as Universitas (South-Western part of Bloemfontein), Langenhovenpark (Western part of Bloemfontein), Batho (Eastern part of Bloemfontein, and Lourier Park (Southern part of Bloemfontein). The suburbs were selected on the basis of a set of selection criteria such as, geographic location, population, social demographic condition, availability of number and type public parks, type of accessibility through road network, and size. These selected suburban residential areas vary from each other in terms of its diverse demographics, size, location, and accessibility via road networks. Household survey with a sample size of 150 was conducted by using systematic stratified random sampling process though semi-structured interview method. Physical and park use survey were conducted by using continuous digital photography and videography. Fourteen public parks located in the four selected residential areas were identified for the physical and park user survey. For this purpose a camera was set up at each of the identified public parks, which filmed the park for 7 days non-stop to monitor the daily use of each Parks and various accessibility issues. Table 1 presents the attributes of the surveyed parks such as location, usage, service area, public parks area, and population in the service area.

Table 1: Attributes of the public parks surveyd in Bloemfontein

Ref #	Average # Users Per Month	GPS Coordinates	Area of Park (Km²)	Service Area of Park (Km²)	Population in Service Area
BATHO					
BP1	706	29°08'07"S ; 26°13'42"E	0.016	0.4	2413
BP2	206	29°07'55"S ; 26°13'38"E	0.006	0.33	1991
BP3	134	29°08'29"S ; 26°13'49"E	0.002	0.15	905
LANGENHOVEN PARK					
LHPP1	294	29°05'06"S ; 26°09'24"E	0.005	0.32	698
LHPP2	168	29°06'25"S ; 26°09'21"E	0.006	0.21	458
LHPP3	34	29°06'02"S ; 26°09'41"E	0.015	0.16	350
LHPP4	34	29°05'39"S ; 26°09'17"E	0.005	0.4	873
LOURIE PARK					
LPP1	882	29°11'17"S ; 26°10'43"E	0.241	0.78	1116
LPP2	147	29°11'08"S ; 26°10'37"E	0.033	0.12	172
LPP3	294	29°10'56"S ; 26°10'40"E	0.06	0.36	515
UNIVERSITAS					
UP1	34	29°07'0"S ; 26°10'11"E	0.054	1.44	2437
UP2	294	29°07'2"S ; 26°10'30"E	0.008	0.33	559
UP3	13	29°06'58"S ; 26°10'48"E	0.009	0.24	406
UP4	38	29°07'19"S ; 26°10'31"E	0.006	0.19	321

5. FINDINGS AND DISCUSSION

Table 2 presents the level of illumination in the public parks in the study area. It is observed that the level of illumination varies between 2.35 lumens (lux) to 9.43 lumens (lux), which are much below than the minimum acceptable standards.

Table 2: Measured Lumens of PPs during Ideal Usage Time

Public park reference number	Illumination of park in evenings measured in lumens (lux)
BP1	9.43
BP2	2.36
BP3	7.07
LHPP1	4.81
LHPP2	4.75
LHPP3	2.34
LHPP4	2.35
LPP1	7.05
LPP2	2.35
LPP3	4.92
UP1	2.35
UP2	4.74
UP3	2.35
UP4	2.38

A correlation between the average number of users and recorded level of lighting was conducted and it is observed that with a correlation coefficient of 0.79, the level of illumination and use of the parks (umber of users) are fairly correlated.

A regression model was attempted to establish the relationship between the level of illumination and use of the public parks. The relationship as obtained from regression model is given by Equation 1 (Eq.1) and presented by Figure 2. Figure 2 clearly shows that there exist a linear relationship between the level of illumination and number of users of the public parks.

$y = 89.732x - 145.62$ ..... Eq. (1)
$R^2 = 0.6291$

Where:

y = Average Number of Monthly Users
x = Level of Artificial Lighting Measured in Lux

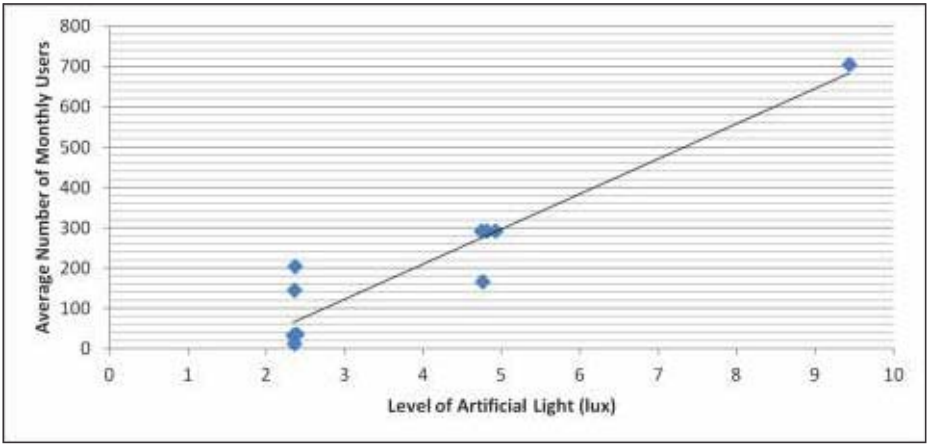

Fig. 2: Relationship between public park users and level of artificial illumination

Simulation scenarios suggested that with increase in artificial illumination level, the number users to parks are expected to increase. It is revealed that if the illumination level is increased to at least 20 lux, then the number of users would increase by at least 50%.

6. CONCLUSION AND FURTHER RESEARCH

Accessibility of public parks in residential areas in the South Africa cities is a challenge. This study revealed that illumination is major parameter, which influences the accessibility and consequent use of the parks.

The relationship between the illumination and use of parks is established by a linear regression model and it is found that number of users of the public pars increases with the increase in illumination. However, there are various other factors, such as physical access, social and cultural issues which also influence use of public parks, which is the further scope of the research. However, at its current state, it is revealed that there is a need to improve the artificial lighting infrastructure in the public parks in residential of Bloemfontein city in order to improve their use.

7. ACKNOWLEDGEMENT

The authors would like to take this opportunity to acknowledge the Central University of Technology (CUT), Free State, the Central Research Committee, the Faculty Research Committee and the Department of Civil Engineering of CUT, for their whole-hearted support during this research work.

8. REFERENCES

Ariane L. Bedimo-Rung, PhD, Andrew J. Mowen, Deborah A. Cohen, M. (2005), ''The Significance of Parks to Physical Activity', 28. doi:10.1016/j.ampre.2004.10.024.

Dempsey, N. (2012), Neighbourhood Design: Green Space and Parks, International Encyclopedia of Housing and Home, Vol. (5), pp. 12–20. doi:10.1016/B978-0-08-047163-1.00540-3.

Evcil, A. N. (2012), 'Raising Awareness about Accessibility', Procedia - Social and Behavioral Sciences, Vol. (47), pp. 490–494. doi:10.1016/j.sbspro.2012.06.686

La Rosa, D. (2014), 'Accessibility to greenspaces: GIS based indicators for sustainable planning in a dense urban context', Ecological Indicators, Vol. (42), pp. 122–134. doi:10.1016/j.ecolind.2013.11.011.

Painter, K. (1996), 'The influence of street lighting improvements on crime, fear and pedestrian street use, after dark, Vol. (35), pp.193–201.

Peña-García, Hurtado., & Aguilar-Luzón, M. C. (2015), 'Impact of public lighting on pedestrians' perception of safety and well-being', Safety Science, Vol.(78), pp. 142–148. doi:10.1016/j.ssci.2015.04.009.

Project for Public Spaces. (2013), No Title. What Makes a Successful Place? Retrieved September 18, 2013, from https://www.pps.org/reference/grplacefeat

Sallis, J. F., Frank, L. D., Saelens, B. E., & Kraft, M. K. (2004), 'Active transportation and physical activity: opportunities for collaboration on

transportation and public health research, Transportation Research Part A: Policy and Practice, Vol. 38(4), pp. 249–268. doi:10.1016/j.tra.2003.11.003.

Sendi, R. and Golicˇnik Marusˇic, B. (2012), 'Neighbourhood Design' Public Spaces, pp.21–28. doi:10.1016/B978-0-08-047163-1.00541-5.

Spocter, M. (2004), 'A macro analysis and GIS application of urban public space closures in Cape Town', 1975-2004, pp. 90–113.

Thompson, C. W., Aspinall, P., & Roe, J. (2014), 'Access to Green Space in Disadvantaged Urban Communities: Evidence of Salutogenic Effects Based on Biomarker and Self-report Measures of Wellbeing', Procedia - Social and Behavioral Sciences, Vol. (153), pp. 10–22. doi:10.1016/j.sbspro.2014.10.036.

Weiss, C. C., Purciel, M., Bader, M., Quinn, J. W., Lovasi, G., Neckerman, K. M., & Rundle, A. G. (2011), 'Reconsidering access: park facilities and neighborhood disamenities in New York City', Journal of urban health: bulletin of the New York Academy of Medicine, Vol. 88(2), pp. 297–310. doi:10.1007/s11524-011-9551-z

Wright Wendel, H. E., Zarger, R. K., & Mihelcic, J. R. (2012), 'Accessibility and usability: Green space preferences, perceptions, and barriers in a rapidly urbanizing city in Latin America', Landscape and Urban Planning, Vol. 107(3), pp. 272–282. doi:10.1016/j.landurbplan.2012.06.003