

Photorealistic visualisation of urban greening in a low-cost high-density housing settlement, Durban, South Africa

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Abstract

Apartheid housing policies of the pre-1994 South African government, and the low-cost high-density housing programmes of the post-1994 government, have given rise to numerous urban environmental problems, some of which could be addressed in a cost-effective and sustainable manner through urban greening, while simultaneously promoting biodiversity. Public participation in the planning of urban greening has been identified as being of vital importance, without which urban greening projects run a high, and expensive, risk of failure. Previous studies indicate that the greening priorities of residents in low-cost high-density housing settlements may differ considerably from those of managers and experts tasked with the protection and extension of the natural environment resource base. A system of participatory decision support is therefore required to reconcile the greening requirements of the community, and the ecological benefits of biodiversity. If language, literacy, map literacy and numeracy difficulties are to be avoided, and a sense of place or belonging is to be invoked, such a participatory decision support system should, ideally, be visually based and capable of generating realistic eye-level depictions of the urban landscape. New computer-based landscape visualisation applications, which can directly utilise geographical information systems (GIS), computer-aided design (CAD) and Digital Elevation Model (DEM) data to produce detailed photo-realistic viewsheds, were deemed better suited to the task of visualising urban greening than existing GIS-based mapping systems, CAD and traditional landscape visualisation methods. This paper examines the process of constructing a 3D computer model of the Mount Royal low-cost high-density housing settlement, situated in the eThekweni Municipality, KwaZulu-Natal, South Africa. Visualisations including terrain, natural features, indigenous vegetation, houses and roads were produced and submitted, with a questionnaire, to experts from different disciplines, Mount Royal residents and neighbours. Results from the expert survey indicate moderate support for visualisation in professional decision-making. Both experts and residents expressed strong support for the accuracy and credibility of the visualisations, as well as for their potential in a participatory decision support system.

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Introduction

Urbanisation in South Africa

In 2000, the level of urbanisation in South Africa was approximately 55% – considerably higher than the 40.5% average for developing countries. It is expected to reach 60.3% and 70.1% by 2010 and 2030, respectively (United Nations Department of Economic and Social Affairs: Population Division, 2005). The rapid process of urbanisation in South Africa has; however, been substantially distorted by the legacy of apartheid, with legislation dating back to 1913 severely restricting where black South Africans could live, work or own property. Within the ‘white’ cities, black people were viewed by the authorities as temporary migrant workers who were required to have permits to live or work there, and who were expected to eventually return to their ‘homelands’ (Tomlinson, 2002). Consequentially, legislation based on this premise deliberately limited access to, or land for, housing and basic municipal services (Department of Housing, 2004a). As the majority of employment opportunities were to be found in the ‘white’ urban areas, many rural black workers moved to the cities and, because of their illegal status, were forced to reside in the overcrowded ‘shacklands’ that mushroomed within the surrounding ‘black’ dormitory townships. The lifting of the racially based restrictions in the early 1990s, coupled with the shortage of affordable accommodation, saw the creation of numerous informal settlements on open urban lands. Knight (2004) notes that whereas there was one formal house per 3.5 whites, there was only one formal house per 43 blacks. In order to address the severe housing shortage, the post-1994 government embarked on a mass low-cost high-density housing exercise as part of the reconstruction and development programme (RDP); a socio-economic policy framework that seeks to integrate growth, development, reconstruction, redistribution and reconciliation into a unified programme (African National Congress, 1994). The RDP ostensibly incorporates sustainable development (Aliber, 2002), and requires government to ensure equitable access to natural resources, safe and healthy living/working environments, as well as the empowerment of communities to manage their natural environment through participatory decision-making (African National Congress, 1994). Since 1994, 1.6 million RDP houses for approximately six million people have been built (Department of Housing, 2004b), but the backlog has since grown from 1.5 million (in 1994) to 2.4 million houses (Boyle and Philp, 2004). Within the eThekweni Municipal Area (EMA) the City of Durban, like many other South African metropolitan areas, is currently experiencing a burgeoning informal settlement problem, which the Metro Housing unit plans to address through the building of at least 17 000 housing units

over the next 10 years (Durban Metro Housing Unit, 2004).

Environmental impacts

The environmental impacts of apartheid planning and legislation in respect of the pre-1994 formal townships include: high levels of air pollution as a result of proximity to industry, and the burning of fuel wood/coal for domestic heating and cooking; high levels of dust from unpaved roads, particulates generated by industry and wind blown mine tailings; pollution of rivers and contamination of ground water by sewerage, waste dumps/land fills and mining/industrial leachates; unsustainable and environmentally damaging patterns of resource use including illegal dumping on public open spaces; health problems related to the close proximity of the townships to industrial areas and waste dumps/land fills; health problems related to extreme overcrowding; and loss of access to agriculturally productive land and other natural assets for food production and livelihoods (African National Congress, 1994; Department of Environmental Affairs and Tourism, 1996; Mutume, 1998; Bullard, 2002; Paton, 2002; Department of Housing, 2004a). Informal settlements suffer similar environmental problems, aggravated by a complete lack of planning or municipal services and inappropriate location – often situated on steep inclines (leading to erosion) or in ecologically sensitive areas such as river floodplains, estuaries or indigenous forests (Department of Housing, 2000).

While it is difficult to evaluate the direct environmental impacts of the RDP housing programme, the replacement of informal settlements with planned and serviced housing should (in principle) benefit both the environment and public health (Aliber, 2002). Developers of housing projects are required to comply with national, provincial and local environmental/housing legislation, including the conducting of environmental impact assessments (Department of Housing, 2000). Unfortunately, the pressure to meet mass low-cost housing targets, coupled with the high cost of implementing services (water, sanitation, roads, electricity) within limited budgets, has relegated environmental impact concerns to a low order of priority (Mathiane, 2001). In order to minimise construction costs, sites are usually scraped clear of vegetation and topsoil (including the seed bank) prior to construction (Sowman and Urquhart, 1998; Mattson and Dalzell, 2002), and little or no effort is made to rehabilitate the area by way of landscaping or revegetation on completion. Adebayo (2001, p. 15) observes that “the existing natural environment has in many cases been destroyed beyond repair” and that “new housing, especially in the state low-cost projects, has turned areas of natural vegetation

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