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Compact Housing for Incremental Growth: The K206 RDP Project in Alexandra, Johannesburg

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Abstract

The South African Reconstruction and Development Programme (RDP) was initiated to provide subsidised housing for low-income families. However, the programme faced challenges in establishing adequate technical guidelines and standards, resulting in subpar housing quality. This article discusses the multifaceted nature of subsidised housing design, emphasising the importance of incorporating technical housing standards as well as the spatial needs of residents based on their context (at both domestic and neighbourhood scales). The article focuses on the K206 housing RDP project in Alexandra, Johannesburg, as a case study that transitioned from generic technical standards to a resident-responsive design scheme that was inspired by the backyard room incremental expansions that were already prevalent in the Alexandra context. A critical review of South Africa’s RDP housing design technical standards and policy is explored. The article also examines the density standards and allowances for incremental expansions introduced by the K206 project, analysing data derived from fieldwork observations, interviews, and the spatial analysis of 26 dwelling units. The study’s findings underscore the significance of maintaining an equilibrium between technical standards and resident-responsive design decisions. The results demonstrate that tailoring the RDP housing design solutions to unique contextual needs can significantly elevate the quality of life of residents concerning income generation and flexibility for incremental expansion. However, this balance is delicate and disparities between the RDP technical standards and user-initiated development over time also have the potential to ultimately impair residents’ living spaces.

Keywords

incremental housing; Reconstruction and Development Programme; South Africa; subsidised housing; technical norms; technical standards

1. Introduction

South Africa's Reconstruction and Development Programme (RDP), launched in 1994, aimed to provide fully subsidised state housing for low-income households following the country's independence. However, the programme encountered significant challenges in establishing adequate technical guidelines and standards, resulting in subpar housing quality, encompassing materials, design, and workmanship (Arrey, 2016; Lokko, 2013; Manomano et al., 2016; Mbatha, 2019). Tasked with the formidable responsibility of swiftly delivering housing to millions of low-income households within tight timeframes, the state hurriedly erected thousands of housing structures with insufficient attention to design and material quality.

The concept of subsidised housing design is multifaceted and varies across regions, with each country crafting its housing classifications based on constitutional practices, policies, and tenure preferences (Ozer & Jacoby, 2022; Susanto et al., 2020). Subsidised housing design is cost-sensitive, but international technical housing standards have been established to create a baseline for design standards (Gallent et al., 2010; Ishak et al., 2016; Ozer & Jacoby, 2022; Susanto et al., 2020). Ozer and Jacoby (2022) argue that these standards often revolve around minimum space requirements based on factors such as the number of bedrooms, the number of occupants per dwelling, or the functionality of the space.

In addition to technical housing standards, it is equally important for housing to reflect its sociocultural context and the spatial needs of its residents. Housing should consider the everyday life patterns unique to its inhabitants to complement, rather than hinder, their lifestyles (Canizaro, 2007; Frampton, 1983; Rapoport, 2000; Simone, 2004; Turner, 1976). Therefore, a critical approach to subsidised housing should incorporate technical housing standards, sociocultural context, and the spatial needs of the residents.

In South Africa, the most prominent form of subsidised housing is RDP housing, which is a programme fully subsidised by the state. This programme was a response to apartheid inequalities and an overhaul of previous state-funded and public housing norms and technical standards (Arrey, 2016; Greyling, 2009; Hickel, 2014; Hlatshwayo, 2016; Linstra, 2016). Although the South African government has undertaken initiatives to improve technical housing standards for subsidised housing during the democratic era, these enhancements have not effectively catered to the spatial requirements of residents (both the individual household and neighbourhood levels) in RDP housing designs, including the backyard rooms incrementally added by the residents to the original houses provided by the state. This inadequacy becomes apparent in the insufficient emphasis placed on the importance of state-subsidised housing being responsive to the sociocultural context and needs of residents across key technical standards in South Africa (CSIR, 2000; Department of Housing, 1994a; Department of Human Settlements [DoHS], 2004, 2009, 2014; National Upgrading Support Programme, 2015; National Planning Commission, 2012; Republic of South Africa, 1995). Despite policy improvements over time, a significant number of housing developments have suffered the consequences of inadequately built RDP houses, and because of this, the primary emphasis of RDP housing has been to meet technical housing standards, overlooking a more contextually responsive solutions to the residential preferences of its users. This results in mass housing that fails to meet the contextual requirements of its residents (Arrey, 2016; "Hundreds of RDP houses in Ekurhuleni to be revamped," 2008; Lokko, 2013; Manomano et al., 2016; Ntombela & Jili, 2020). Moreover, there is a lack of constructed instances and literature documenting RDP housing projects that have incorporated design strategies responsive to the local residents' aspirations.

In examining the complexities associated with subsidised housing in South Africa, particularly the lack of contextually responsive RDP housing projects, this article focuses on shedding light on the K206 housing project in Alexandra, Johannesburg. This initiative represents a departure from the conventional approach to state-subsidised housing, which often neglects design responsiveness to residents' needs and aspirations.

The K206 project addressed the spatial needs of its residents by incorporating Alexandra's backyard room culture, which supported incremental housing expansions initiated by the residents themselves. Backyard rooms in Alexandra play a crucial role in meeting the additional space requirements for RDP housing, which is typically too small for many families. Additionally, these rooms serve as rental spaces, providing a source of income for homeowners (Bank, 2007; Bonner & Nieftagodien, 2008; Harrison et al., 2014; Howe, 2020; Poulsen, 2010; Shapurjee & Charlton, 2013).

The K206 project, designed as a medium-density housing scheme, utilised cluster formations, innovative layouts, and units incorporating both single-storey and double-storey sections to address residents' aspirations. The most prevalent housing type of the scheme was specifically designed with additional backyard rooms, increased density, and provision for incremental housing expansions that aligned with residents' aspirations. The central research question guiding the exploration for this article is: How can a housing design approach be responsive to residents' aspirations and enhance subsidised housing design beyond mere technical standards?

The article will proceed to delve into the methods section, followed by an examination of the technical housing standards governing RDP housing. Subsequently, the exploration will shift to evolving densities and incremental housing in Alexandra township before delving into the resident-responsive design innovations of the K206 RDP project before its conclusion.

2. Methods

This research utilised a mixed-methods approach, integrating both a comprehensive literature review and an examination of housing technical standards. Furthermore, interviews were carried out with K206 management and industry experts to establish the historical context of the case study and RDP housing protocols. A spatial analysis of the incremental growth of standardised RDP units in Alexandra was performed as a benchmark for comparative analysis. Additionally, interviews were conducted with K206 residents and spatial analyses were undertaken to understand the incremental expansion of their homes.

A comprehensive review of technical housing standards in South Africa was carried out (see Table 1). The study also included an analysis of standard RDP housing types and incremental expansions (Figure 2). Furthermore, a comparison of design strategies between standardised RDP units and the K206 unit was explored (Figure 3). An analysis of the incremental expansion of the K206 unit was conducted (Figure 4), highlighting the unique context-responsive design of the K206 project that accommodated incremental expansion and density.

The mixed-methods approach encompassed data collection from diverse sources on technical housing standards and policies, including policy documents, the national building code, human settlement guidelines, academic literature and input from K206 project management, and construction industry experts (a total of

seven interviews). To understand the RDP housing landscape and its transformation, policy documents were studied alongside industry expert interviews.

For an in-depth understanding of the case study, 26 resident interviews, spatial surveys, and analyses of 26 K206 dwelling units were conducted and comprehensive data collection aimed to analyse the potential for the incremental development of the K206 units.

Given the focus of this study on contrasting two sets of RDP design approaches—one without contextual considerations (standard RDP typology) and the other complemented by resident-responsive adjustments accommodating density and incremental expansion (K206 model)—an analysis of standardised RDP house plans and a survey of the K206 unit were conducted in Figure 5, inspired by expansion illustrations included in Susanto et al. (2020). The formulation of Figure 5 aimed to identify differences in incremental expansion potential and density in spatial planning when contrasting standard RDP typologies with those of the case study.

3. RDP Housing Technical Norms and Standards

RDP housing emerged from the 1994 RDP policy framework, designed to provide fully subsidised housing for low-income households (Department of Housing, 1994b). Initially characterised by minimal technical norms and standards, the policy landscape underwent a significant transformation with the introduction of the National Home Builders Registration Council in 1997, and in 2004, the introduction of the Breaking New Ground (BNG) strategy (a strategy to improve RDP housing) that moved from a focus on housing only to a focus on sustainable human settlements (DoHS, 2004).

The RDP policy, established in 1994 within the framework of South Africa's new democratic constitution, was rooted in the six fundamental principles of integration and sustainability, people-driven processes, peace and security, nation-building, meeting basic needs and infrastructure, democratisation, and assessment and accountability (Department of Housing, 1994b). RDP housing materialised as a government initiative to provide fully subsidised housing and services to South African citizens facing housing needs. Despite the noble intent, RDP housing has encountered extensive criticism and scrutiny. Concerns have been raised regarding corruption, mismanagement in allocation, inadequate house sizes, subpar housing materials, design deficiencies that include repetitive mass housing design with little attention to the diversity of typology, challenges in service provision and maintenance, suboptimal project locations, limited stakeholder and beneficiary involvement, tenure insecurity, unemployment, and instances of housing beneficiary misuse (Arrey, 2016; Dugard, 2020; Greyling, 2009; Makgobi et al., 2020; Manomano et al., 2016; Moolla et al., 2011; Sekoboto & Landman, 2019).

Following the implementation of the BNG strategy in 2004, several changes were implemented such as more central locations for housing. Furthermore, the criteria for RDP housing eligibility were refined to include South African citizenship, marital status or cohabitation with a partner, financial dependents, a monthly household income not exceeding R3,500 (approximately €200), and qualification as a first-time government subsidy recipient, first-time homeowner, or single military veteran without financial dependents (DoHS, 2022). Applicants were required to apply through a housing waiting list system. The BNG policy aimed to foster sustainable human settlements over providing only housing provision in

isolation of the human settlement they were located in. In parallel, technical norms and standards for RDP housing were raised.

After the BNG policy, substantial improvements were made to technical housing standards concerning housing design, as detailed in the *Housing Code* (DoHS, 2009) and updates of the *Red Book* (CSIR, 2000; DoHS, 2019). These standards became more explicit and comprehensive. Table 1 shows the technical standards of RDP housing.

Table 1 demonstrates, except for a handful of established standards, South Africa's technical housing standards, particularly those related to subsidised RDP housing which are largely centred on minimum space standards and passive heating and cooling systems. These standards lack specificity and fail to adequately address the context-related diverse design needs of the residents in these developments. While certain standards, such as minimum size requirements and housing ventilation, are useful, the emphasis on passive heating and orientation, often reinforced by a grid-based road system, has resulted in a dearth of neighbourhood character within stereotypical grid RDP layouts.

Table 1. Summarised architectural technical housing standards and guidelines of subsidised RDP housing.

Design-based technical standard theme	Elaborated architectural technical housing standards and guidelines
House sizing	The 2009 <i>National Housing Code—Part 3</i> document from the DoHS establishes the minimum size of a house at 40 m² (DoHS, 2009, p. 25). According to the same document, the minimum room design standards encompass two bedrooms, a separate bathroom with a toilet, shower, and hand basin, and a combined living area and kitchen with a sink (DoHS, 2009, p. 25). For walls, the requirement is a minimum of 140 mm cement masonry units, as detailed in Section F.1(a) (DoHS, 2009, p. 29). Additionally, wall lengths and heights must conform to the specifications outlined in as indicated in the 2022 document from the South African Bureau of Standards (2022, pp. 75, 79). The DoHS mandates a minimum ceiling height of 2.4 m, as specified in Section J (DoHS, 2009, p. 31). This requirement is supported by the South African Bureau of Standards (2022, p. 52) in Section CC3.2. Moreover, the minimum slope level is governed by SANS 10400 (South African Bureau of Standards, 2022, p. 90).
Lighting and ventilation	The 2009 <i>National Housing Code—Part 3</i> document from the DoHS outlines requirements for lighting and ventilation in habitable rooms, bathrooms, shower rooms, and rooms containing a WC (DoHS, 2009, p. 32). According to this document, these rooms must be equipped with means of lighting and ventilation that allow for their intended use without compromising health and safety or causing nuisance. The minimum window area (light area) for each habitable room, including kitchens, is specified to be between 5% and 10% of the total floor area. Additionally, the document establishes that 5% of the floor area, with one opening having an area of at least 0.1 m², should constitute the minimum area of openable windows or controllable ventilation openings for each habitable room, including kitchens. Further details on window and ventilation positioning for optimal ventilation and light are also provided (DoHS, 2009, p. 32; South African Bureau of Standards, 2022, p. 102). Window positioning requirements are additionally governed by SANS 10400 (South African Bureau of Standards, 2022, p. 98).

Table 1. (Cont.) Summarised architectural technical housing standards and guidelines of subsidised RDP housing.

Design-based technical standard theme	Elaborated architectural technical housing standards and guidelines
Thermal efficiency	The <i>2009 National Housing Code—Part 3</i> document from the DoHS emphasises guidelines for dwelling orientation (DoHS, 2009, p. 35). According to this document, the longer axis of the dwelling should be oriented as close to east/west as possible. The plan of the dwelling should be compact, with the rooms that are most frequently used and the major areas of glazing strategically positioned on the northern side of the building. This arrangement is designed to facilitate the penetration of solar heat through the glazing during the winter months. Furthermore, the document stipulates that the roof overhang on the northern wall should be sufficient to shade the windows from midday summer sunshine. Additionally, windows facing east and west should be limited in number and confined in area to the minimum necessary for daylight and ventilation. These guidelines for dwelling orientation and window placement are in accordance with the standards outlined by the South African Bureau of Standards (2022) document, specifically in Chapter XA.
Sustainable design considerations	The <i>2009 National Housing Code—Part 3</i> document from the DoHS discusses energy-efficient housing considerations (DoHS, 2009, p. 37). According to this document, energy efficiency in housing is predominantly influenced by natural elements such as the sun, wind, and rain. Consequently, to optimise the impact of these natural forces on buildings, careful attention must be given to the planning, location, and orientation of the housing. On a micro-level, the layout of the house also plays a crucial role in maximising the influence of climatic forces, as outlined in Section 2.3.1 of the DoHS (2009) document.
House plan and layout	The <i>2009 National Housing Code—Part 3</i> document emphasises specific design considerations for housing (DoHS, 2009, p. 38). The plan of the house should be crafted to maximise interior space while minimising exterior wall area, which is prone to heat loss in winter. To enhance energy efficiency, living spaces should be strategically arranged, with rooms where people spend the majority of their time situated on the northern side of the unit. Uninhabited rooms, such as bathrooms and storerooms, can serve as screens for unwanted western sun or act as barriers to prevent heat loss on south-facing facades. Ideally, living rooms and kitchens should be positioned on the northern side. In accordance with the general considerations outlined in Section 2.4.3 of the DoHS (2009, p. 45) document, all housing units should incorporate robust insulation measures to further ensure energy efficiency.
General considerations	The <i>2009 National Housing Code—Part 3</i> document underscores a general consideration for housing units (DoHS, 2009, p. 45). It mandates that all housing units must incorporate effective insulation measures to guarantee optimal energy efficiency.
Average size of typical RDP stand size	The sizing typically aligns with town planning standards for standalone RDP housing, as indicated by Harrison et al. (2014, p. 356) and corroborated by the City of Johannesburg (2018) and information provided by M. Jackson in a personal communication (2023, October 3).

Table 1. (Cont.) Summarised architectural technical housing standards and guidelines of subsidised RDP housing.

Design-based technical standard theme	Elaborated architectural technical housing standards and guidelines
Enhancing the housing product	The BNG strategy by the DoHS (2004, p. 23) elaborates on enhancing the housing product: • Enhancing settlement design: Enhancing measures and incentives to include design professionals at planning and project design stages, and develop design guidelines for designers and regulators to achieve sustainable and environmentally efficient settlements. This is aimed at promoting the development of a dignified size of housing that supports the morality of family and society. • Enhancing housing design: Enhance the traditional technologies and indigenous knowledge which are being used to construct housing in rural areas. There is a need to focus on changing the face of the stereotypical RDP houses and settlements through the promotion of alternative technology and design. • Addressing housing quality: Audit and develop a programme to address the poor quality of houses built before the introduction of national norms and standards (DoHS, 2004, Section 3.7).

In addition to the *National Housing Code* and BNG policy, the *Red Book* series was introduced to address various neighbourhood-scale issues, encompassing considerations for road and block design options, public walkways, environmental factors, parking areas, public squares, pedestrian streets, and spatial dimensions. However, these guidelines also remained relatively broad and did not offer practical insights. For example, one guideline suggested the need to “ensure an appropriate sense of enclosure that is on a human scale and fits into the context within which the space is situated” (CSIR, 2000, p. 7).

The predominance of stereotypical grid-based RDP housing, coupled with a lack of diversity, lack of attention to building scale, and lack of public–private building transitions and public amenity design, reveals that the *Red Book* series, despite its intentions, lacked accessibility in translating its guidelines into actualised developments. These standards and guidelines also failed to provide tools, insights, or a necessity for the integration of spatial design in low-income areas. They did not offer insights on specifically creating RDP developments that are responsive to the everyday needs of residents and the characteristics of their surroundings. Context-responsive design, as described by Canizaro (2007) and Frampton (1983), is a fundamental architectural design principle that is not substantially addressed in South African technical standards and is something that is greatly missing in our low-income housing design guidelines.

Furthermore, a significant body of urban design literature underscores the pivotal role of spatial and social community development as well as safety. Advocates have called for more resilient and sustainable neighbourhood designs that prioritise safety through enhanced visibility, smaller building clusters, diversity, and multifunctional housing typologies (Alexander, 1977; Bibri & Krogstie, 2017; Jacobs, 1961; Meerow et al., 2016). While the *Red Book* national guidelines on human settlement and neighbourhood planning and design have started exploring these principles, these guidelines have yet to be grounded in the South African context. A national policy that addresses the specific challenges faced by low-income and RDP neighbourhoods on a neighbourhood scale or that caters to residents’ experiences through design is (still) missing (DoHS, 2014, 2019). Even though the BNG mandate aimed to transform RDP housing (DoHS, 2004),

there has been no comprehensive national-level intervention or guidelines to address critical issues related to informality, backyard rooms, township formations, and unemployment from a neighbourhood-scale spatial perspective (City of Johannesburg, 2016; CSIR, 2000; DoHS, 2019). It is worth noting that while the City of Cape Town passed an urban design policy in 2013 addressing informality at a neighbourhood scale, it has not been implemented in any other South African city (City of Cape Town, 2013).

After examining current guidelines and technical standards related to RDP housing, we have identified a deficiency in addressing design considerations that account for residents' needs and aspirations within their context. Section 4 will investigate contextually relevant design considerations in Alexandra, focusing on density and incremental housing.

4. Evolving Density and Incremental Housing Norms in Alexandra

Alexandra Township, which is located within 3 km of Sandton, Africa's richest square mile with many employment and economic opportunities, boasts one of the highest population densities, as high as 25,978 people per square kilometre. With an average of five persons per dwelling, this translates to up to a density of 160 dwelling units per hectare, and in 2009, the township had already accumulated more than 90,000 housing structures (Alexandra Renewal Project [ARP], 2009; Harrison et al., 2014; Howe, 2020; Mbanjwa, 2018; Sondzaba, 2019; Wazimap, 2011). This high density is largely related to informal housing infill and caused the layering of diverse housing typologies which include incrementally extended backyard rooms. The township comprises freehold tenure single-story houses, which were established as early as 1912, as well as a mix of RDP fully subsidised houses, flats, and workers' hostels. Notably, both freehold tenure and RDP housing often include multiple rental backyard units, incremental extensions to the initial house provided by the government, which were initiated by the residents themselves. This practice was historically rooted in the need to supplement income for freehold tenure houses due to high property prices driven up by the apartheid government. According to Bonner and Nieftagodien (2008), it also served as a political defence against forced removals during apartheid, as the greater the number of residents settled within a plot, the more challenging it became for the apartheid authorities to carry out forced relocations. Informal settlements, like the Sjewetla settlement, can also be found between established settlements and along riverbanks (Bonner & Nieftagodien, 2008; Harrison et al., 2014). In addition to these typologies are also hostels, flats, and accommodation in factory subdivisions. However, the most prominent form of housing in Alexandra, accounting for more than half of the total number of dwelling units, is the incrementally developed backyard rooms, as demonstrated in Figure 1.

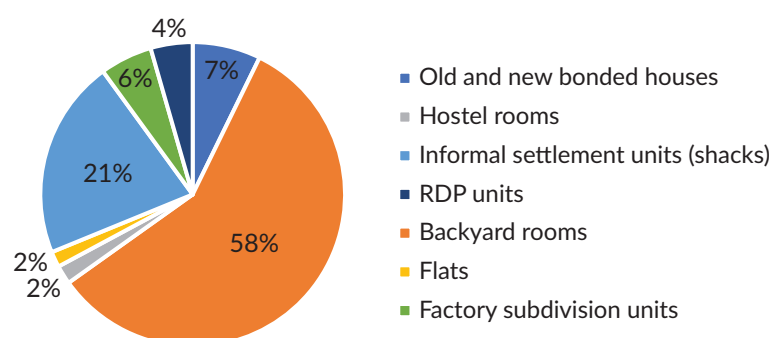


Figure 1. Typologies of Alexandra housing. Authors' work based on ARP (2009).

In summary, the history of Alexandra is characterised by resilience against forced removals, with the culture of backyard rooms serving as both a response to the need for affordable accommodation and as a form of resistance against displacement. These backyard rooms have incrementally expanded over time, providing space for family and economic opportunities to respond to the community's cultural history and residents' spatial needs over time (Bonner & Nieftagodien, 2008; Harrison et al., 2014; Mahlakanya & Willemse, 2022; Shapurjee & Charlton, 2013).

5. Resident Responsive Design Innovations in the K206 Housing Project

This section delves into the innovative resident-responsive design approaches of the K206 housing project, which employed contextually relevant solutions to tackle governance issues linked to informal settlement upgrading via state-subsidised housing. It will first examine the common housing practices involving incrementally constructed backyard rooms in Alexandra. Subsequently, it will explore the governance-related challenges tied to the K206 development, followed by an investigation into how resident-responsive design was employed to devise solutions addressing governance issues within the K206 development.

Alexandra has a high prevalence of incrementally built backyard room formations, as depicted in Figure 2. These spaces were not only intended for income-generating activities but also for expanding homes to accommodate extended family members when household sizes exceeded the limits set by technical norms

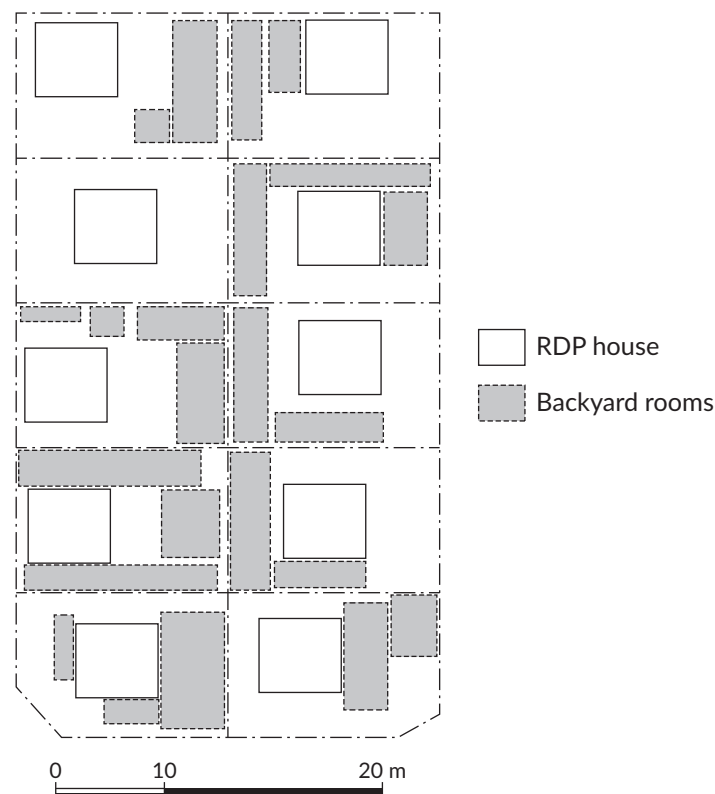


Figure 2. Mapping of RDP houses and backyard rooms between 1st Street and 2nd Street, Far East Bank, Alexandra.

(Table 1 outlines the minimum standards for a two-bedroom house, which in practice is significantly expanded upon with the addition of backyard rooms).

During the design and planning stages of the K206 development, it became evident that discerning significant developmental differences in informal settlement upgrading, especially within the densely populated housing environment of Alexandra, was a challenging goal to reach. Consequently, a departure from the conventional waiting list approach, commonly used for informal settlement upgrading in South Africa, was proposed and implemented (Harrison et al., 2014; Sondzaba, 2019). The block-by-block approach was introduced, which entailed the relocation of all residents from an informal settlement block to the K206 block (ARP, 2009; Harrison et al., 2014; Sondzaba, 2019). This informal settlement upgrading approach allowed for the complete redevelopment of the informal settlement area into new housing units and social facilities on the K206 site, thereby demonstrating a visible transformation in infrastructure development to the community (ARP, 2009; Harrison et al., 2014; Sondzaba, 2019).

While this concept appeared commendable in theory, as it allowed networks of residents to move, challenges surfaced when residents on waiting lists were informed of the change in systems. Now, not all residents in the earmarked informal settlement qualified for housing (for example those not having South African nationality), exacerbating the situation by granting access to housing for non-qualifying individuals (Public Protector South Africa, 2014). Despite these challenges, the strategy persisted in pursuit of the overarching goal of achieving tangible and visible improvements and development in the area for the residents.

To address this issue of accommodating both qualifying and non-qualifying residents, ARP management together with Anca Szalovitz architects developed an innovative house type, which was split in two components, devised to accommodate two forms of tenure. One owner-occupied double-storey two bedroom house, and an adjacent single-storey volume with two additional rooms to be rented out by the owners to non-qualifying households. This two-volume typology was distinctive in its capacity to respond to the need for housing densification through cluster formations. The K206 house type also acknowledged the prevalence of backyard rooms in Alexandra, incorporating opportunities for incremental expansion in response to the growing demand for housing and income generation in the area.

The K206 project allowed for vertical incremental extensions, above the single-storey volume dedicated to the rental rooms. The layout of this unit followed a medium-density cluster formation, drawing inspiration from the existing densities and incremental backyard room formations in Alexandra (J. Baskin, personal communication, December 1, 2022; S. Mkhonto, personal communication, August 5, 2022; A. Szalovitz, personal communication, March 29, 2022). These design innovations of the K206 unit were created in conjunction with RDP technical housing standards.

Sections 5.1 and 5.2 explore in detail these context-related design innovations (increased density and incremental growth) of the K206 project over and above the project's compliance with technical standards.

5.1. Density

The K206 housing project was inspired by the existing urban fabric of Alexandra, which exhibited significantly higher density compared to technical norms of RDP housing as demonstrated in Figure 3.

Elevated density proves especially advantageous in well-located areas, optimising the value of prime locations, typically superior to outlying ones (DoHS, 2004). Standard RDP housing plots adhere to a minimum size of 250 m² (Greyling, 2009; Harrison et al., 2014), corresponding to a maximum density of 40 dwelling units per hectare. Conversely, the K206 project, with its cluster layout and the unit incorporating both a single-storey and a double-storey section, was designed to accommodate six core units and six backyard room units (12 units) on a 750 m² plot when accounting for both core and rental units within a cluster, translating to a density of up to 160 dwelling units per hectare, four times higher than the standard densities of RDP housing as demonstrated in Figure 3.

The neighbourhood scale design quality of the K206 project was also considerably more thought out based on the evolved historical norms in Alexandra township (Harrison et al., 2014) than standardised RDP repetitive standalone neighbourhoods on a standardised grid system. It creatively adhered to several guidelines suggested in the *Red Book* that not only enabled increased density but also fostered smaller social groupings, enhancing social interactions among neighbours and providing additional safety and security opportunities. With more residents overlooking common areas where people enter and exit, the sense of community and surveillance was augmented. The arrangement of clustered buildings also enhanced the ability for individuals to orient themselves, despite the massive scale of the project.

It is important to note that despite managing to acquire considerably more density than most standardised norms of RDP housing as highlighted in Table 1, the K206 design also accommodated incremental extensions that responded to the existing incremental extensions in Alexandra based on its design form and site layout.

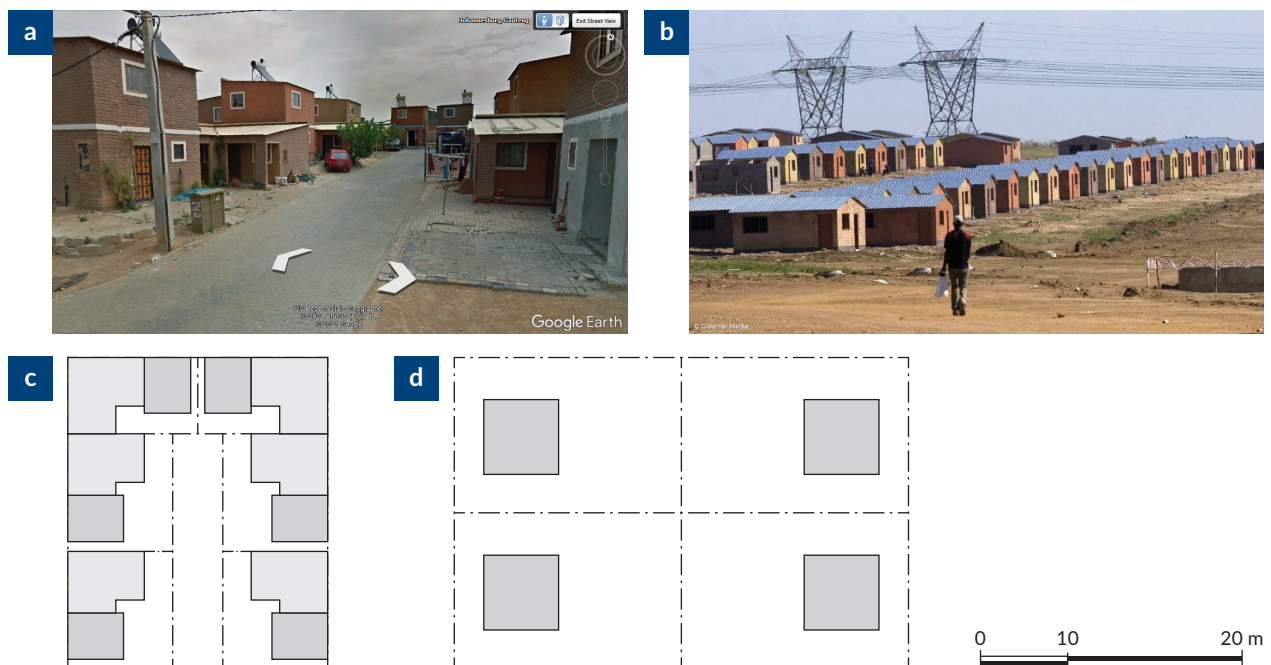


Figure 3. Density of K206 houses vs. RDP houses: (a) K206 houses (Google Earth Street view of K206 in 2013, accessed December 12, 2020); (b) the typical 40 m² standard single-storey RDP houses, design based on technical housing standards only (photo of Mogale City, Gauteng, by Daws in Odendaal, 2014); (c) K206 housing cluster plan that answers both technical standards and residents' contextual needs (layout inspired by drawings from ASA Architects); (d) typical 40 m² RDP houses plan (layout inspired by Mogale City RDP development).

5.2. Incremental Housing

Another K206 design innovation involved the design of a housing type incorporating both a single-storey and a double-storey volume as seen in Figure 4. This deliberate choice was made to facilitate the option of economic gain for residents, via two rental rooms, as well as allowing the vertical expansion of the single-storey volume, anticipating incremental growth. The government subsidised K206 project granted ownership to the beneficiary households for the double-storey core unit, and enabled income generation through the two additional rental rooms built in the single-storey volume (Public Protector South Africa, 2014).

The owners of these units were also given the option to vertically extend the single-storey volume, offering maximum flexibility with a flat timber roof. The internal housing layout was designed to allow a smooth transition between the entire house being occupied by the owner or the double-storey section being used by the owners while renting out the backyard rooms (Osman & Davey, 2011).

Although not initially foreseen by the designer and management (J. Baskin, personal communication, December 1, 2022; S. Mkhonto, personal communication, August 5, 2022; A. Szalovitz, personal communication, March 29, 2022), the remaining space allocated for gardens and parking could also be absorbed into the incremental expansion of the building and rental rooms as seen in Figure 4.

Overall, the layout's design flexibility proved particularly advantageous for various scenarios of incremental expansion. It allowed for internal merging to create larger units and provided owners with the option to utilise rental rooms for income generation. This income generation in many cases allowed residents to either improve the finishes of their homes or build even more rental rooms. Furthermore, the design anticipated the seamless development of a second storey above the single-storey rooms. Additionally, although not part of the original design intent, the plot size accommodated the addition of a garden and parking space next to the cluster driveway which unintentionally served as placeholders for residents to further extend into these

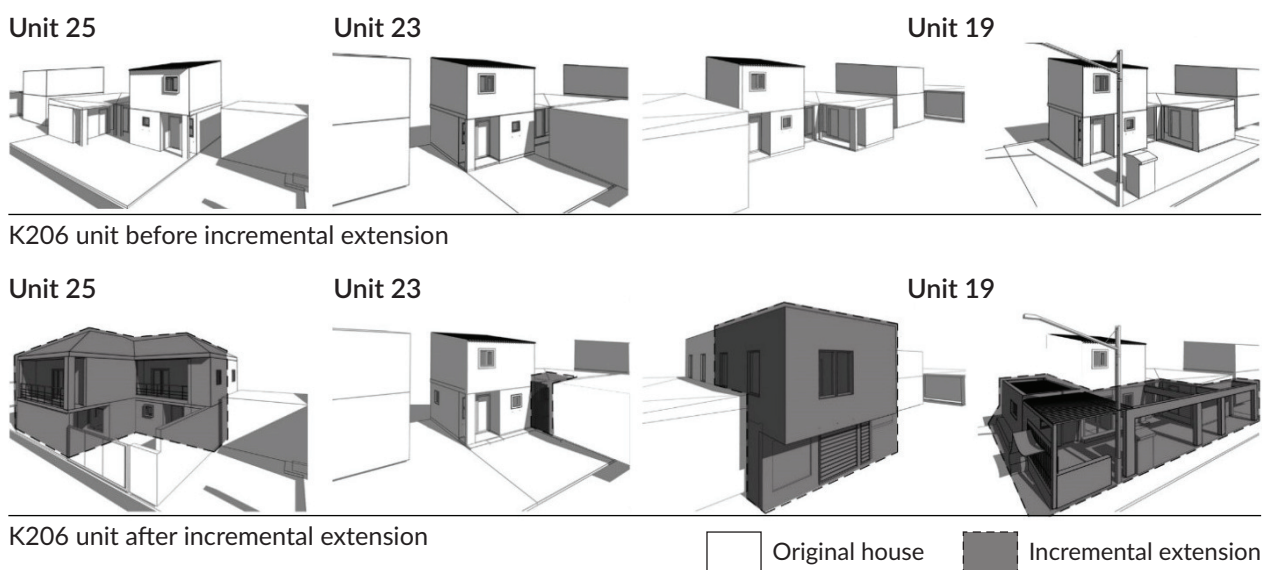


Figure 4. Representative examples of K206 units with incremental expansion.

open spaces (J. Baskin, personal communication, December 1, 2022; A. Szalovitz, personal communication, March 29, 2022).

The cluster layout of the K206 project facilitated a diverse range of opportunities for incremental expansion. As the spatial mapping indicated, the potential for such adaptation seemed to be influenced by the unit's position within the cluster (Wilcox et al., 2024). For instance, in cases where the unit's façade faced main roads, commercial opportunities like restaurants, chicken sales, or preschools became viable options. Moreover, the shape of the clusters often opened onto municipal land parcels that were not initially incorporated into the housing scheme. Many of these parcels were substantial in size and allowed residents to informally extend their homes. For example, one such land parcel accommodated an additional five backyard rooms, contributing to 50% of the owner's household income. In as much as the cluster composition allowed for opportunities to expand, periphery units had more opportunities to expand than internal units that did not border municipal land or street edges.

When comparing the K206 unit to the standard RDP unit in Figure 5, it is evident that the K206 unit generated a residential density much bigger than the standard RDP unit. The K206 project leveraged the minimum 40 m² requirement, providing two bedrooms, a bathroom, a living area, and a kitchen following the specified technical standards, all within the prescribed budget for an RDP house. Additionally, a special presidential budget allocation subsidised the RDP unit for the two extra backyard rooms (S. Mavundla, personal communication, September 30, 2020). These additional rooms were either occupied by two families at one room per family, or both rooms became a unit for a single family. The flat timber roof design encouraged vertical expansion, whereas standard RDP houses typically feature timber-pitched roofs, which are more challenging to modify for additional floors.

The potential for incremental expansion in the K206 unit exceeded initial expectations when compared to the standard RDP housing model. While standard RDP houses come with larger plot sizes, allowing for more space for backyard room expansion, our analysis of 26 K206 houses, in conjunction with national housing code regulations, reveals that single-story standalone houses on larger plots were less likely to expand vertically. Residents of single-storey stand-alone houses typically opted for horizontal incremental expansion due to the lower cost associated with single-story expansion. In contrast, K206 houses, which inherently offer opportunities for incremental vertical expansion, were more inclined to expand vertically. When site composition exercises were conducted comparing the potential for maximising incremental rooms in a K206 unit and plot with that in a standard RDP unit, plot, and incremental expansion, it was found that the outcomes were comparable in terms of the number of possible well-ventilated backyard rooms, as illustrated in the architectural analysis of incremental extensions in Figure 5. In terms of density, Table 2 demonstrates that with backyard extensions, and assuming each backyard room to be a dwelling unit, the K206 units allow for significantly more density potential than typical RDP units.

Observing Table 2, it is crucial to highlight that the K206 unit demonstrates greater efficiency in both density and backyard room outputs compared to standard RDP units.

Despite the considerable potential of the K206 project, particularly in its cluster-based design, many residents chose to gradually expand their homes by adding rooms with diverse housing quality and spatial configurations (typical of most backyard rooms; Poulsen, 2010). Some of these extensions utilised

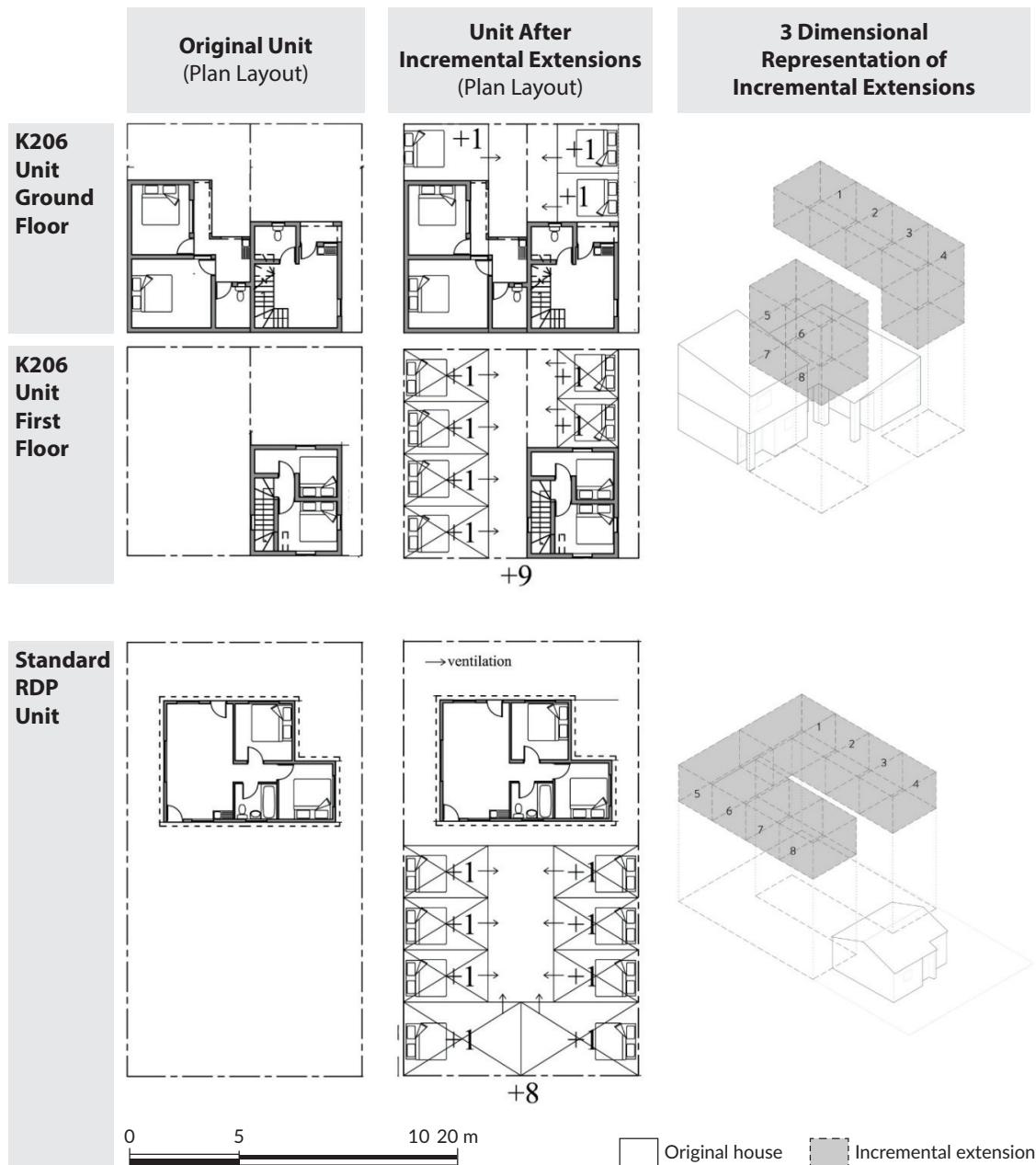


Figure 5. Density comparison of incremental potential between standard RDP unit and K206 unit.

Table 2. Comparative potential density of standard RDP unit to K206 unit with incrementally added backyard rooms based on Figure 5 layouts.

	Standard RDP unit	K206 unit
Density without backyard rooms	40 du/ha	160 du/ha
Density with one additional backyard room	80 du/ha	240 du/ha
Density with two additional backyard rooms	120 du/ha	320 du/ha
Density with 10 additional backyard rooms	440 du/ha	960 du/ha
Density with 11 additional backyard rooms	480 du/ha	1040 du/ha

Note: du/ha = dwelling units per hectare.

high-quality materials, providing adequate light and ventilation, while others were constructed with substandard materials and lacked proper lighting and ventilation. The decisive factors influencing material choices and spatial layouts were primarily driven by cost, with residents having additional income streams being more inclined to invest in higher-quality finishes. Residents and their builders played a pivotal role in determining most spatial layouts. Backyard room configurations typically included self-contained units where residents conducted various activities such as living, washing, sleeping, and cooking. A common toilet or toilets were shared among backyard room residents, and living areas were typically situated amid circulation areas around the rooms. The variation in housing and spatial design quality of incremental extensions highlights the challenge of achieving consistency in both the material quality and spatial quality of these extensions, despite the project's encouragement of incremental growth.

It is also worth noting that residents of the project still lack title deeds, rendering it even more difficult for the municipal authorities to regulate the quality of these extensions. Even willing residents cannot make housing extension applications because title deeds are required (S. Mkhonto, personal communication, August 5, 2022).

The K206 project's clustering approach was well-conceived in comparison to more standardised grid-like RDP configurations, both in terms of the unit's scale and its responsiveness to the local context, offering opportunities for incremental expansion. It also exhibited innovative neighbourhood design by implementing a cluster association of individual dwelling units, to enhance social integration among residents and safety within smaller clusters, as opposed to the conventional standalone houses on a grid system. Notably, despite the success of this design approach, which was completed in 2010, it has not gained widespread adoption or replication elsewhere. In the realm of RDP developments, standalone houses on a grid road network continue to dominate, despite policy recommendations advocating for housing typology diversity and intensification to mitigate urban sprawl.

The primary deterrent for broader adoption appears to be cost-related. The K206 project received additional special presidential funding for the creation of rental rooms, which would be challenging to replicate without subsidies. However, certain key principles inherent to this design, such as the clustering system, the balance of density with incremental expansion allowance, and the choice of roof design for vertical expansion, could still be adopted within the cost brackets of RDP housing. These principles facilitate the intensification and densification of urban areas, especially in regions with limited or expensive land availability.

While this model may not match the densities achieved by larger multi-story buildings, it responds to the everyday needs of residents and it provides residents with opportunities to incrementally expand their properties and accommodate the gradual changes that occur over time, including family growth and income generation through additional rooms. This distinguishes it from current multi-story RDP developments and their limitations in accommodating such incremental changes.

6. Conclusion

In conclusion, this study delves into the impact of resident-responsive design on improving state-subsidised housing beyond technical housing standards. The central research question guiding our exploration is: How can a design approach that is responsive to residents' aspirations enhance subsidised housing design beyond mere technical standards?

Using the K206 housing project as a case study, this article emphasises the urgency of enhancing technical housing standards and adjusting provisions to better align with the social, economic, and spatial needs of residents. This underscores the importance of implementing more detailed policies to ensure RDP housing design is contextually responsive. The K206 project, providing fully subsidised state housing for low-income families, extended beyond minimal technical design standards (traditional RDP housing design typically adheres only to basic technical design standards due to budget constraints). The project expanded on these standards to accommodate residents' aspirations and spatial needs rooted in the century-long tradition of Alexandra's backyard room culture and incremental housing expansions. The K206 unit typology and its cluster-based configuration, influenced by these spatial tendencies in Alexandra, demonstrated higher spatial efficiency, measured in terms of residential density, when compared to standard RDP housing.

Furthermore, interviews with residents and policymakers underscored the success of these design interventions, incorporating grassroots initiatives such as increased housing density and income-generating opportunities through incremental backyard room additions. The K206 project significantly elevated residents' quality of life by enhancing income prospects and providing flexibility for gradual expansion.

However, while the design interventions of the K206 project accommodated incremental growth, this study also sheds light on the conflicts and disparities arising when user-initiated developments deviate from established RDP technical standards. Although incremental spatial expansion brings positive economic benefits through income generation, it comes with trade-offs. The trade-offs include potential compromises in the quality of space and materials of the extensions that do not meet technical housing standards. Achieving the right balance between being responsive to local building practices and adhering to technical standards is a nuanced task, demanding careful consideration throughout the design and policy-making process.

The K206 project efficiently facilitated incremental expansion, surpassing the efficiency of standard RDP layouts. The K206 unit typology, featured a core double-storey home for the owner along with two additional rental rooms that exhibited good material and spatial design quality compared to resident-initiated backyard rooms typically associated with standardised RDP housing. Despite the positive aspect of the government-sponsored rental rooms, K206 residents continued to incrementally add more rooms of varying quality to their homes.

In summary, this research emphasises the importance of acknowledging and embracing the dynamic interplay between technical housing standards and addressing the social and economic needs of residents who live in subsidised housing. Achieving this equilibrium is crucial for addressing housing needs, enhancing the well-being of South Africa's low-income households, and remaining compliant with technical standards. Policymakers and practitioners, by embracing both the technical and social dimensions of housing design, can contribute to more effective and responsive housing solutions for vulnerable populations. The K206 housing project provides valuable lessons, highlighting the potential benefits of a holistic approach to subsidised housing design that combines the rigour of technical standards with the socio-cultural practices of its context.

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Conflict of Interests

The authors declare no conflict of interests.

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