

Evaluating Compliance Levels of Informal Housing Construction Practices with Building and Environmental Regulations in South Africa

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Abstract

South Africa's rapid urbanization and economic struggles have led to informal settlement growth. While informal housing provides shelter, construction practices often do not comply with building and environmental regulations, causing safety, health, and sustainability concerns. This study aims to determine compliance levels of informal settlement construction practices with these regulations. The research uses a qualitative approach, collecting data on construction practices, materials, builders' skills, and regulatory awareness through observations, interviews in Khayelitsha, Gugulethu, Langa, and Ocean View, while the focus group included informal builders from various locations. Data is analyzed using thematic analysis to identify compliance-related patterns, challenges, and opportunities. Key findings show that residents and informal builders have limited understanding of and adherence to regulations due to socioeconomic constraints, lack of formal training, and the informal nature of settlements. Non-compliant practices create environmental, health, and safety risks. The study highlights the need for context-sensitive policies addressing non-compliance causes such as poverty, lack of affordable housing, and low institutional capacity. Recommendations include improving builders' access to quality materials and training, supporting community-driven initiatives, and implementing flexible approaches to informal settlement upgrading. The findings contribute to knowledge on enhancing living conditions and promoting sustainable urban development in South Africa's informal settlements.

Keywords: informal settlements, construction practices, building regulations, environmental regulations, alternative building technologies

1. Introduction

Building and environmental regulations are important because they establish minimum standards for safe, healthy, and sustainable construction. In South Africa, building regulations include the National Building Regulations and Building Standards Act 103 of 1977, which sets requirements related to structural integrity, fire safety, sanitation, ventilation, energy efficiency, and accessibility (Gazette, 1985; Cecilia, 2020). Environmental regulations, including the National Environmental Management Act 107 of 1998 and the National Environmental Management: Waste Act 59 of 2008, are intended to ensure that construction activities align with environmental protection and sustainability goals (Gazette, 1999; Gazette, 2009; Zhang et al., 2021). Compliance with these regulations is therefore central to protecting occupants, builders, surrounding communities, and the environment.

However, informal housing construction often takes place outside formal systems of approval and inspection. The shortage of affordable formal housing forces many low-income households to build dwellings in informal settlements (Hasgöl, 2016). These structures are commonly built using salvaged materials

such as corrugated metal, wood, and plastic, while builders often rely on rudimentary techniques and trial-and-error methods rather than formal construction standards (Frediani, Cociña & Roche, 2023; Hasgöl, 2016). Consequently, there is limited understanding of the quality of materials used, the construction practices followed, the specifications applied, and the extent to which these practices comply with building and environmental regulations.

This lack of knowledge creates an important research gap. Without clear information on informal housing construction practices, it is difficult to assess whether these dwellings are safe for occupants, builders, and surrounding communities. It is also difficult to determine whether the construction process creates wider health and environmental risks. Therefore, this study investigates the compliance levels of informal housing construction practices with building and environmental regulations in South Africa. By examining the construction methods, materials, builder skills, and working and living conditions in informal settlements, the study seeks to provide insights that can support safer, healthier, and more sustainable informal housing interventions.

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2. Literature Review

Informal construction practices reflect these socio-economic and spatial conditions. Informal dwellings are commonly built using salvaged or low-cost materials such as corrugated metal sheets, wood, plastic, and scrap materials (Frediani et al., 2023; Milford et al., 2019). These materials are accessible and affordable for urban poor communities, but they contribute to substandard and hazardous living conditions (Milford et al., 2019). Builders often rely on rudimentary methods and trial-and-error approaches rather than recognised construction standards (Hasgöl, 2016; Milford et al., 2019). The construction process is often incremental, with rooms or portions added as needs arise and as resources become available (Milford et al., 2019). Common challenges include the absence of proper foundations, inadequate roof support, poor ventilation, and limited professional design input, all of which affect safety and habitability (Milford et al., 2019).

Builder skills and training are central to compliance. Most informal settlement builders acquire skills through observation, imitation, and hands-on learning within communities (Hasgöl, 2016). Although such knowledge may respond to immediate shelter needs, it does not necessarily align with formal regulations or best practices. The absence of formal training and certification raises concerns about quality, safety, and sustainability because builders often depend on personal judgement, estimation, and available materials rather than standard plans and regulations (Kovacic et al., 2019). Limited awareness of safety protocols, including personal protective equipment and the handling of hazardous materials, also creates risks for builders and occupants (Kovacic et al., 2019). Efforts such as the People's Housing Process have provided construction skills training, project management training, and social support to low-income households, but their reach has been constrained by inadequate resources, weak coordination, and the scale of the informal housing challenge (Department of Human Settlements, 2009; Chege et al., 2021).

2.1. Comparison to formal housing practices

Informal construction differs sharply from formal housing construction. Formal housing projects are subject to building standards and regulations covering structural integrity, fire safety, sanitation, and environmental impacts (Kovacic et al., 2019). They also involve architects, engineers, building inspectors, quality materials, specialised equipment, and skilled labour, which support durability and safety (Kovacic et al., 2019). Informal housing, by contrast, is usually produced outside the formal regulatory framework with limited professional input or oversight (Kovacic et al., 2019). This can result in structurally unsafe dwellings, poor ventilation, fire and flood vulnerability,

inadequate foundations, weak roof support, and poor drainage (Hasgöl, 2016; Milford et al., 2019; Kovacic et al., 2019). The layout of informal settlements can also be dense and unplanned, with irregular access routes and limited open spaces, which may restrict emergency access and increase public health risks (Kovacic et al., 2019).

2.2. Overview of key standards and regulations

Building regulations provide the formal benchmark against which informal construction practices can be assessed. South Africa has a system of building regulations and standards intended to protect the safety, health, and well-being of occupants and builders while supporting sustainable development and environmental preservation. The primary legislation is the National Building Regulations and Building Standards Act 103 of 1977, which sets minimum requirements for the design, construction, and maintenance of structures in South Africa. The National Building Regulations cover structural stability, fire safety, sanitation, ventilation, lighting, and energy efficiency, and are supported by South African National Standards that provide technical specifications for construction components such as concrete, steel, masonry, and timber. Other relevant instruments include the Occupational Health and Safety Act 85 of 1993, which addresses worker safety, personal protective equipment, safe work practices, and hazardous material management, and the National Environmental Management Act 107 of 1998, which addresses environmental sustainability in construction.

The implementation of building regulations is generally the responsibility of local authorities such as municipalities and city councils (Khumalo and Choga, 2019). The process includes submission of building plans, assessment by building control officers, regular inspections during construction, final inspection, and the issuing of an occupancy certificate where compliance is achieved (Windapo and Rotimi, 2012; Watermeyer and Milford, 2003). However, implementation is constrained by limited resources, lack of technical capacity, corruption, and political interference (Windapo, 2016). These challenges are especially serious in informal settlements because illegality, insecure land tenure, lack of formal planning, and inadequate infrastructure make it difficult to monitor construction and enforce compliance.

2.3. Challenges and barriers to compliance

Barriers to building regulation compliance include socio-economic constraints, institutional capacity, technical knowledge, and cultural norms. Poverty, unemployment, high housing costs, insecure tenure, and the threat of eviction limit residents' ability and willingness to invest in compliant materials and construction practices (Marutlulle, 2021; Lemanski,

2009; Durand-Lasserve and Royston, 2002). Local authorities may lack the staff, resources, and technical expertise needed to supervise construction activity in informal settlements (Windapo, 2016; Khumalo and Choga, 2019). Builders often lack formal construction training and professional support, which contributes to substandard materials, poor workmanship, and weak awareness of structural stability, fire safety, and ventilation requirements (Hasgöl, 2016; Milford et al., 2019; World Bank, 2020). Cultural norms and traditional construction methods may also conflict with formal regulatory requirements (Maluleke et al., 2021; Massey, 2013). Table 1 shows Environmental regulation that adds a further compliance dimension. Also, Table 2 presents factors influencing compliance.

absent, low-quality materials are used, settlements expand into natural areas, and waste accumulates in open spaces and waterways (Mararakanye and Le Roux, 2012; Sibanda, 2022).

Environmental compliance is constrained by limited awareness of environmental regulations, weak institutional capacity, socio-economic pressures, and settlement location. Residents and builders may not understand technical regulations related to waste, water, and air quality (Zhang et al., 2021; Sibanda, 2022). Environmental authorities may also have limited presence in informal settlements and may struggle to respond to rapid settlement growth (Kovacic et al., 2019). Poverty and lack of basic services push residents to prioritise immediate survival needs such as shelter,

Table 1: Different Environmental Regulations to be considered in a construction project

Environmental Regulation	Description	Purpose	References
The National Water Act (Act No. 36 of 1998)	Governs water resource use and management on a project, including pollution control and aquatic environment protection if the project is going to affect the oceans	To ensure sustainable and equitable use of water resources while protecting the aquatic environment	(Department of Water and Sanitation, 2021)
The National Environmental Management: Waste Act (Act No. 59 of 2008)	Establishes regulations for waste minimization, reuse, recycling, and safe disposal of waste materials on and off-site, including waste from construction and demolition on a project	To promote sustainable waste management practices and minimize the environmental impact of waste generated by construction activities	(Department of Environment, Forestry, and Fisheries, 2021)
The National Environmental Management: Air Quality Act (Act No. 39 of 2004)	Regulates air pollution emissions and sets environmental air quality requirements, including dust and other emissions from construction operations	To prevent and control air pollution and maintain acceptable air quality standards during construction activities	(Department of Environment, Forestry, and Fisheries, 2021)
The National Heritage Resources Act (Act No. 25 of 1999)	Seeks to protect and manage cultural heritage resources such as archaeological and paleontological sites, graves, and historically significant structures in South Africa	To conserve and protect the nation's cultural heritage resources and ensure their responsible management during construction projects	(South African Heritage Resources Agency, 2021)

Table 2: Factors Influencing Compliance and Non-Compliance.

Factor	Description	Reference
Political will and commitment	The level of political will and commitment to solve the issues of informal housing and urban poverty in order to prioritize the interests and rights of marginalised groups	(Lombard, 2021)
Legal and administrative support	The availability and accessibility of legal and administrative support for resolving disputes and conflicts relating to land, housing, and the environment to maintain the rights and interests of informal settlement residents	(Durand-Lasserve and Royston, 2002)

Informal construction can create environmental impacts at local and global scales. Local impacts include soil erosion, water pollution, air pollution, biodiversity loss, and waste generation, especially where vegetation is cleared, sanitation systems are

food, and water over environmental considerations (Marutlulle, 2021; Kovacic et al., 2019). Many informal settlements are also located in floodplains, wetlands, steep slopes, and other sensitive or hazardous areas, despite regulatory restrictions and environmental

risks (Pharoah, 2014; Satterthwaite et al., 2020; Kovacic et al., 2019).

The literature therefore shows several gaps. There is limited clear information on the extent and causes of non-compliance, insufficient attention to residents' lived experiences and behaviours. Therefore investigation that includes deeper case studies, adequate theoretical integration, understanding of actual compliance levels and implications, sufficient investigation of barriers and effective responses, and a lack of comprehensive policy analysis becomes a need. These gaps justify further research into the compliance of informal housing construction practices with building and environmental regulations in South Africa.

3. Methodology

This study adopted a constructivist research philosophy to examine the compliance levels of informal housing construction practices with building and environmental regulations in South Africa. Constructivism was appropriate because the study sought to understand informal housing practices through the experiences, perceptions, values, and social contexts of stakeholders involved in informal housing and construction (Guba & Lincoln, 1994; Schwandt, 2000). The study used a qualitative research approach, suitable for exploring the lived experiences and practices of builders, occupants, and surrounding community members in relation to regulatory compliance (Williams, 2007; Manomano, 2013).

The research was conducted in informal settlements in South Africa Cape Town (including community members from Khayelitsha, Gugulethu, Langa, and Ocean View, while the focus group included informal builders from various locations), where inadequate infrastructure, limited services, environmental risks, and substandard living conditions are common (UN Habitat, 2015; Govender et al., 2011; Ziblim et al., 2013). The study population included informal builders, residents, and members of surrounding communities. Participants were selected using purposive sampling, supported by criterion and snowball sampling. Criterion sampling ensured that participants were directly involved in, affected by, or knowledgeable about informal housing construction, while snowball sampling helped identify additional participants within hard-to-reach communities (Patton,

2015; Palinkas et al., 2015; Noy, 2008). The final sample comprised 15 interviews and one focus group discussion, at which point data saturation was reached (Saunders et al., 2018).

Data were collected through participant observations, semi-structured interviews, and focus group discussions. Observations allowed the researchers to document construction practices, materials, and site conditions in their natural setting (Emerson et al., 2011; DeWalt & DeWalt, 2011). Semi-structured interviews enabled participants to explain their experiences, knowledge, and perceptions of informal housing construction and regulatory compliance (Kallio et al., 2016). Focus group discussions provided collective insights from informal builders regarding construction practices and compliance challenges (Morgan, 1996; Krueger & Casey, 2015).

The data were analysed using thematic analysis, supported by NVivo software. The process involved familiarisation with the data, coding, theme development, theme review, and reporting of key patterns (Braun & Clarke, 2006; Saldaña, 2015; Woolf & Silver, 2017). Trustworthiness was strengthened through triangulation, audit trails, and reflexivity (Patton, 2015; Denzin, 2017; Carcary, 2009; Berger, 2015). Ethical considerations included informed consent, confidentiality, anonymity, secure data handling, and participants' right to withdraw.

4. Results

4.1. Interviewee and Observation Profiles and descriptive result

This section presents the findings from interviews and observations conducted in the informal settlements of Khayelitsha, Langa, and Gugulethu in Cape Town. The study focused on evaluating the compliance levels of informal housing construction practices with building and environmental regulations. Respondents included occupants of informal housing, members of surrounding communities, hardware-related respondents, and informal builders. Fifteen individual interviews and one focus group discussion were conducted. The individual interviews lasted about ten minutes, while the focus group discussion lasted approximately one hour. The data were analysed thematically around construction practices, material use, safety, environmental awareness, and regulatory compliance as summarized in Table 3 and 4

Table 3: Different types of people profiles

Group	Role	Perspective
Occupants	Residents living in informal settlements	Challenges face in compliance with building and environmental regulations
Surrounding	Residents	Impacts of informal housing
Informal builders	Builders involved in informal construction	Practical construction methods, awareness of regulations, and barriers to compliance
Field Observation	Observing construction practices	Firsthand observation of building processes, materials used, and compliance challenges

Table 4: Codes of interviewees and profiles

Code	Location	Role	Gender	Professional Background
K1	Khayelitsha	Occupant	Female	Creditor's clerk
K2	Khayelitsha	Occupant	Female	Cleaner
K3	Khayelitsha	Occupant	Female	Nanny
K4	Khayelitsha	Surrounding community	Male	Pastor
K5	Khayelitsha	Surrounding community	Male	Professional Builder
M1	Khayelitsha	Hardware owner	Male	Self-employed
M2	Khayelitsha	Hardware worker	Male	Shop keeper
G1	Gugulethu	Occupant	Female	Self-employed
G2	Gugulethu	Occupant	Female	Nanny
G3	Gugulethu	Occupant	Male	Security guard
G4	Gugulethu	Occupant	Male	Freelance photographer
L1	Langa	Occupant	Female	Street vendor
L2	Langa	Occupant	Female	Street vendor
L3	Langa	Occupant	Female	Cleaner
O1	Oceanview	Occupant	Female	Unemployed
F1-F10	Various Locations	Informal Builders	Male	Informal Builders

Participants represented different perspectives on informal housing. Occupants described the lived experience of informal dwellings and the challenges of maintaining homes under limited resources. Surrounding community members explained broader safety and environmental impacts. Informal builders described construction methods, material availability, building knowledge, and awareness of regulations. Field observation in Khayelitsha provided direct evidence of the techniques, materials, and compliance challenges visible during construction.

The interview profiles show that most respondents were occupants or community members from Khayelitsha, Gugulethu, Langa, and Ocean View, while the focus group included informal builders from various locations. The informal builders had construction experience acquired through informal and community-based learning rather than formal training. The findings therefore reflect both practical construction knowledge and lived experience.

The first finding concerns the naming of informal housing types. Respondents used terms such as Umkhukhu, Ityotyombe, and Hoki to describe shack dwellings. Although names varied, they referred to similar informal dwellings made from accessible materials such as corrugated iron and wood. Respondents explained that the names may differ according to size, sturdiness, or local expression, but the underlying housing condition remains largely the same. The dwellings are usually small, quickly constructed, and shaped by immediate need rather than formal design.

4.2. Materials Used

The most common construction materials were corrugated iron sheets, wooden planks, plastic sheeting, cardboard, and other scrap materials. Corrugated iron was preferred for walls and roofs because it was

considered relatively strong and weather resistant. However, most sheets were obtained second-hand from scrapyards, demolition sites, or residents and were often rusted or damaged. Plastic and wood were therefore used to patch defects, reducing the structures' durability and weather resistance.

Wood was primarily used for the structural frame. Although strong timber was considered necessary for stability, its cost limited access. Builders consequently used second-hand planks and leftover timber. Cardboard, blankets, chipboard, and other makeshift materials were used to cover gaps when proper materials were unavailable. These practices demonstrated residents' resourcefulness but also explained the difficulty of meeting construction standards.

4.3. Construction methods

Construction methods were informal, rapid, and based on improvisation. Builders learned through observation and experience without formal manuals, templates, or approved specifications. Construction generally started with a timber frame, with wooden members placed directly into the ground without a formal foundation. Uneven ground was addressed by adjusting timber lengths or digging parts of the site. Corrugated iron sheets were then nailed or tied to the frame.

The primary objective was to provide immediate shelter, with many shacks completed within one or two days. However, rapid construction often resulted in leaks, cracks, unstable walls, and loose roofs. Corrugated iron roofs were secured using nails or wire to resist Cape Town's strong winds. Windows and other openings were improvised and sometimes covered with clear plastic, resulting in limited ventilation and natural light.

Builders relied on experience and community knowledge rather than building plans or official guidance. Each dwelling was adapted to the available space, land slope, materials, and the household's financial capacity. Although this flexibility enabled rapid construction, it placed the structures outside formal regulatory and inspection systems.

4.4. Building Regulation knowledge and challenges

Respondents had limited knowledge of formal building regulations but understood practical risks such as fire, inadequate sanitation, unsafe electrical connections, structural weakness, and poor waste management. Fire was considered a major danger because shacks were closely spaced and residents commonly used candles, paraffin stoves, and unsafe electricity connections. Although builders sometimes attempted to maintain spaces between structures, overcrowding and housing demand made this difficult.

Most shacks lacked private toilets, proper sewage systems, and drainage. Residents depended on communal facilities, while rainfall and flooding created additional health risks. Weak materials and informal construction methods also affected structural safety. Builders used additional timber, plastic, and available materials to reinforce structures, but recognised that these measures were temporary and vulnerable to storms.

Although residents understood the environmental harm caused by burning and dumping waste, formal waste-management services were limited or irregular. Plastic, metal offcuts, timber, and other construction waste were commonly left on sites, dumped in open areas, or burned. Environmental compliance was therefore difficult despite respondents' awareness of pollution and health risks.

The main construction challenges were financial constraints, limited access to quality materials, overcrowding, harsh weather, and inconsistent local-authority support. Financial limitations influenced dwelling size, material quality, and repairs. Residents understood that better materials would improve safety and durability but could not afford them. Limited land also increased fire risks by forcing structures to be built close together, while rain and wind caused flooding, leaks, roof damage, and instability.

Common post-construction problems included leakage, instability, and poor durability. Leaks resulted from old or poorly sealed corrugated sheets, while instability was associated with uneven ground, weak timber, thin metal sheets, and absent foundations. Residents reported shaking roofs and unstable walls during strong winds. Builders attributed these problems mainly to low-quality materials and clients' inability to afford stronger alternatives.

4.5. Observation of Construction Process in Khayelitsha

The Khayelitsha observation confirmed the interview findings. Three local builders constructed a shack using salvaged and second-hand materials. They had no formal training and had acquired their skills through community experience. The structure was completed in approximately four hours but was built directly on sandy ground without a foundation or insulation. Corrugated iron sheets, wooden beams, and nails were used, while improvised tools were adopted when proper equipment failed.

The site had no formal boundaries, management arrangements, safety equipment, or waste-disposal system. Builders handled sharp materials without helmets, gloves, or protective clothing. Scrap materials were left around the site, and excess waste was commonly burned or dumped. Although the completed shack provided immediate shelter, it remained vulnerable to leakage, temperature changes, strong winds, and movement because it lacked a foundation and insulation.

5. Discussion

The findings from interviews and observations in Khayelitsha, Gugulethu, and Langa show that compliance with building and environmental regulations in informal housing construction is shaped by linked material, safety, environmental, regulatory, and socio-economic constraints. The discussion is organised around five themes: access to materials and financial constraints, safety and structural integrity, environmental awareness and waste management, knowledge of regulations and compliance gaps, and social and economic pressures.

First, limited access to good-quality building materials emerged as a central barrier to compliance. Builders and residents reported that financial constraints forced them to rely on second-hand, cheap, or salvaged materials, even when they understood that stronger and more durable materials would improve housing quality. This finding reflects Durand-Lasserve and Royston's (2002) argument that limited access to formal housing markets and financial resources pushes informal settlements toward makeshift construction. In this context, non-compliance is not simply a technical failure but is connected to poverty and limited material choices.

Second, safety and structural integrity were major concerns. Builders acknowledged that shacks were vulnerable to collapse, fire, and weather-related damage, especially during Cape Town's rainy season. Site observations in Khayelitsha showed that some structures were built without foundations, leaving them exposed to shifting, flooding, and wind damage. These findings are consistent with Patton (2015), who

identifies fire hazards and structural failures as common features of overcrowded and unregulated informal settlements. They also support Denzin (2017) view that the absence of foundations increases collapse risks in informal settings.

Third, environmental awareness existed, but practical waste-management options were limited. Builders and residents recognised that burning or dumping waste was harmful, yet they reported that formal systems for waste collection, recycling, and disposal were absent or inadequate. This finding aligns with Carcary (2009), who notes that informal settlements often lack formal waste-management systems, and with Berger (2015). argument that environmental degradation in such areas is linked to neglect by local authorities.

Fourth, the study found a gap between awareness of regulations and the ability to comply with them. Builders and residents knew that formal rules existed, particularly regarding safety and environmental protection, but viewed these regulations as designed for formal housing rather than informal settlement conditions. This supports Huchzermeyer's (2008) argument that formal housing frameworks often fail to respond to the realities of informal settlements, creating a disconnect between legal requirements and what residents can practically achieve.

Finally, social and economic pressures were found to drive non-compliance. The need for immediate shelter, overcrowding, unemployment, and poverty meant that residents prioritised short-term survival over long-term safety or sustainability. This reflects Moola and Kotze (2021) view that economic survival strategies shape urban informal development. Overall, the findings show that non-compliance is produced by structural constraints rather than by a lack of concern for safety or the environment.

6. Conclusion

The study concludes that non-compliance with building and environmental regulations is widespread in informal settlements. This is mainly linked to financial constraints, lack of access to compliant materials,

limited formal infrastructure, overcrowding, and the urgent need for shelter. Builders often rely on cheap, second-hand, or salvaged materials that do not meet required standards for structural safety or environmental sustainability. As a result, many homes remain vulnerable to collapse, fire hazards, extreme weather, leaks, and frequent repair needs. The findings also show that informal builders generally do not use formal building templates or guides. Although some builders and residents are aware of safety and environmental risks, compliance remains difficult because regulations are viewed as unattainable within their economic and spatial conditions. Improper waste disposal and the burning or dumping of leftover materials further contribute to environmental degradation. The study therefore recommends improving access to affordable and compliant building materials, establishing practical training and capacity-building programmes for informal builders, and introducing waste management systems and environmental awareness programmes. It also recommends context-sensitive regulations that reflect the realities of informal housing construction, supported by government incentives, microloans or grants, and collaborative policy development involving community leaders, builders, NGOs, private-sector actors, and government authorities.

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