

**Adaptable residential architecture in South Africa:
exploring the possibilities of technological and cultural transfer in partnership with
small-scale, local industries in Mamelodi, Pretoria**



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ABSTRACT

This paper explores the possibility of increasing adaptability in low- and medium- cost residential buildings in South Africa. The suitability of the concept to this particular context will be tackled in terms of existing industries, the need for sustainable and labour intensive technologies, participation and changing ideas regarding professionalism.

The urban design principles of phasing, privacy, variety and integration in the creation of dynamic urban contexts are emphasised. It is also attempted to challenge the perception that limited funds mean poor quality or that low cost means that a flexible, enabling, inclusive, accessible environment catering for the needs of all sectors of the target population cannot be addressed through creative design.

At the core of this argument is the understanding that housing is not just the individual living unit but encompasses all aspects in the macro- and micro- environment. Within these urban structures, the house is seen as a flexible/adaptable product rather than a fixed final product. The idea of urban design as an inseparable component of housing is reinforced as well as the acknowledgment of the various levels of the environment differing in the degree of permanence and changeability thus allowing for more involvement and affordability. This allows for an understanding of informal economies, settlements and structures and our role as professionals in interacting with these alternative systems and “ways of doing/living”.

Modular coordination may facilitate quicker construction and save costs. A rudimentary form of modularisation is already being used in the townships of South Africa and in this paper collaboration between academics and these simple construction industries is proposed, using local technologies to adapt open building to the South African context. Partnering with existing industries could possibly increase the chances of acceptance and affordability.

Some examples of local industry from the area of Mamelodi, a historically-designated black township near Pretoria, are investigated. A plan for meaningful partnerships and intervention is proposed. The value of this approach is that local technology and “what exists on the ground” is taken as a point of

departure for research and intervention, and not some obscure and possibly irrelevant theory far removed from reality.

The Housing Research Field at the Department of Architecture has had good relationships with community members and representatives in Soshanguve, Nelmapius, Mamelodi and Ivory Park in Tembisa. The contacts that we have built up in these townships have added much value to our teaching and have assisted us in bringing an aspect of realism to our student projects.

It has proved to be a process of mutual learning. Community members have contributed in project criticisms and our students have made presentations to government subsidy beneficiaries, local councilors and various government officials where we hope we have managed to portray a more enlightened approach to housing issues and design.

Our partners in the townships have assisted us in identifying student projects; they have been our guides and have helped us gain more insight and understanding into a context that we ourselves and many of our students are far removed from. One student researched a builder's yard in Mamelodi township and proceeded to offer a proposal on how to develop shacks (or zozos). This a paper acknowledges that contribution as well as the contribution of our Italian research partner with whom we are investigating implementation of projects in the township.

A workshop approach will be followed "knowing by doing", through using the builder's yards and the building sites as locations for technological and cultural exchange. This will potentially create more understanding between academic institutes and emergent township enterprises. Appropriate solutions to housing systems may be identified from the everyday realities of a specific context. Taking locally available skills as a starting point for a design process needs to be tested, in a sense reinforcing the idea that technological innovation has to adapt to local capacities and not vice-versa.

This is a three year project funded by a research programme of the University of Pretoria, with the ultimate aim of achieving long-term collaboration between the university, local industries and communities in the region. This would provide for excellent learning opportunities for ourselves and our students.

2 Theoretical premise

The argument at the core of this paper is the understanding that housing is not just the construction of individual living units but encompasses all aspects in the macro- and micro- environment, including communal facilities, job creation and entrepreneurship. Within urban structures, the house is seen as a flexible/adaptable product rather than a fixed final product. Urban design is an inseparable component of housing [Dewar & Uytendogaardt 1991] and this acknowledges the various levels of the environment differing in the degree of permanence and changeability thus allowing for more involvement and affordability. This challenges our understanding of informal economies, settlements and structures and our role as professionals in interacting with these alternative systems and "ways of doing/living".

Current development and housing policy claims to be "pro-poor" and with a focus on "in-situ" up-grading of informal settlements. While a world-renowned housing programme is in full swing in South Africa, the housing backlog is not decreasing. Informality, emergence and the so-called "2nd economy" are aspects of the South African social/economic scene that will probably remain for many years to come. Designed and emergent systems [Hamdi 2004], are equally important and it is strongly believed that any approach that does not acknowledge the presence of the 'informal' as a force that cannot be eradicated and as a legitimate power, energy and form of expression is doomed to fail. Current debates regarding development, in general, and housing, in particular, attempt to position the issues in the broader perspective of the 'south', the African continent and new policy directions in South Africa.

The built environment is not static: it is interesting to study the relationship between stability and transformation [Habraken 1998]. These notions, however, take on a different meaning when speaking of informal settlements. In squatter settlements transformations happen at an enormous rate compared to formal (more static) designed environments. Furthermore, the relationship between structural supports and detachable units is unclear. There is a degree of permanency in a squatter settlement – such as the layout of the site, but the overall set up is experienced as short term. Any design intervention will need to support a process, which will evolve quickly over a short period. Transformations will not only apply to structural elements but also to location and function. Because there is no security of tenure, shack owners are reluctant to invest substantially to convert an informal dwelling into something more permanent. This often results in people living in structurally compromised buildings for years. This volatile nature of squatter settlements inhibits long-term development, thus professional interventions are essential.

3 The description of the context

Mamelodi, the mother of melodies, is a large, historically designated black township in Pretoria. It is similar to other townships on the peripheries of all South African cities planned by the apartheid authorities as temporary dormitory zones for black labour. Its problems are typical of other townships that are mono-functional residential areas, isolated from the CBD and job opportunities, with poor quality housing and a large component of informal settlements. As a typical dormitory town it is dependent on the city of Pretoria and does not have an economic core and sufficient job opportunities. A density of 15 dwellings per hectare estimated in 1997 probably hides a higher occupancy density [van Stigt & Verhoef 1997]. Almost 10 years later Mamelodi has expanded uncontrollably, perhaps only stopped by natural ridges on the north and eastern sides. And with large tracts of land being occupied illegally as well as many backyard shacks in formal dwellings it is difficult now to estimate what the real population of the township is. Yet, it is unofficially estimated at one million, a very large proportion of the total population of the city, in about 10% of its area.

The socio-economic dynamics of the area are not clearly evident and still need to be fully appreciated and understood. There is no cohesive industrial centre or business centre. An initial analysis of the area, in consultation with a resident of the area assisted us in identifying some of the small-scale, informal industries. We had initially assumed that there would be a concentration of industries and businesses at various nodes which we assumed were important in the structuring of the township. We identified the nodes as follows:

1. Mamelodi Extension 15 along Tsamaya Avenue being a main access route into the township from the city.
2. Mamelodi Extensions 20, 8, 11, 18, 22 along Han Strydom Avenue as the area further east with a concentration of informal dwellings.
3. Mamelodi Extensions 3, 4, 5, 6 on Hans Strydom Avenue and near and around the satellite campus of the University of Pretoria and very close to a large informal settlement.

We were quickly proved wrong in our assumptions as the industries were scattered with no apparent structure that can easily be detected, many of them located in the middle of residential areas even though some were quite noisy and disruptive. We however documented the locations and types of industries that we could partner with, with the ultimate aim of participating, on location, in the development of the rudimentary techniques in use to benefit the construction of houses, communal facilities and the exploration of other possibilities such as the development of partitioning systems and furniture. It is acknowledged that emergent systems could become catalysts for future development interventions.



Figure 1. A building material supplier.



Figure 2. A typical shack construction yard.



Figure 3. A canopy maker – it is evident from the collected scrap that they also recycle old vehicles for various uses.



Figure 4. A metal welding workshop.



Figure 5. An upholstery workshop.



Figure 6. A cement block making yard.



Figure 7. A rubbish recycling yard.



Figure 8. A wooden door workshop.

3.1 Shack-making yards: the zozos

The most visible industry as one drives through the area is no doubt that of the zozos or shacks. Many people in Mamelodi live in shacks, either in areas occupied through illegal land invasions or on legalised plots still awaiting the queue for government-provided houses or in backyard shacks. Backyard shacks on legal plots provide rental accommodation for many and are an additional source of income for informal landlords.

Construction yards provide squatters with prefabricated walls that can be put together in more or less standardised sizes of shelters. When a house is bought, the walls and the roof are transported to the plot of the new owner, where it is assembled first, then the floor is finished with a sand cement mix. It lays on the ground surface with no foundations. A simple roof of corrugated sheeting is nailed on purlins and the gaps between the walls and the roof sheet are filled in with a plaster mix – this is according to Cedric who sells his zozo components on the side of a main road in the area. These flimsy shacks are built with slight variations depending on the construction yard and the availability of materials. Despite this, one can assume that the sizes of the zozos are roughly similar – and basically standardized; and although the types of materials used may not be exactly the same, the features are the same.

The price of a zozo depends on the size. One yard has the following pricelist:

1. 1-roomed house (3m x3 m) for R900 (app. \$140)
2. one and a half roomed house (3m x 4m) costs R1150 (app. \$177)

3. 2-roomed house (3m x 6m) costs R1500 (app. \$230)

The materials that are used for the construction of the zozo are the following: galvanized corrugated metal sheeting, coated metal sheeting and timber frames. Some of these are purchased from stores, such as the corrugated galvanised sheets, the rest is discarded material, such as the coated metal sheeting which is comes from a refrigerator factory close by – it is bought as scrap metal (priced per kg). Most of the timber is bought, but smaller pieces are waste material from the crates of the Ford factory in the neighbourhood; this is obtained for free, thus only transport costs need to be covered. This system seems to not be as profitable as initially assumed as much of the scrap is discarded because of unsuitable sizes or poor quality. Corrugated sheets are nailed onto the frames to form an exterior barrier. The assembling of the four “walls”, and only in conjunction with each other, creates a relatively stable structure. Windows and a door are only made in the front side of a zozo, which is generally higher than the back side – so that a slightly sloped roof is formed.

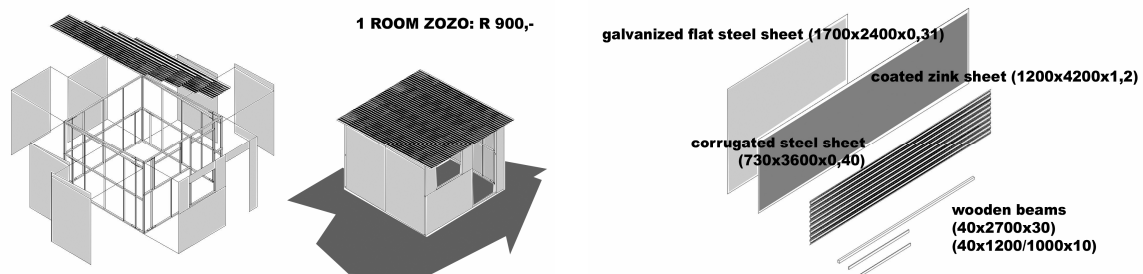


Figure 9. This is a typical 1-roomed zozo as it is being constructed now and the materials used in its construction.

3 The research project: informality and emergence

The fact that many people live in shacks, be they on legally-owned land or not and be they a part of the formal rental market or not means that there is a potential for academic involvement in meaningful ways. Firstly, in learning from what is happening on the ground, thus changing our mindset and ridding ourselves of professional arrogance. Secondly, in being able to work with students on location in developing the quality of the buildings that in any case house so many people and community functions. Thirdly, in investigating the possibility of these informal industries in having a role in achieving adaptability and affordability in the local residential market. It is also hoped that these small industries may play a role in formal, government-subsidised housing projects planned in the vicinity. The possibilities are endless and through this 3-year project we hope to investigate to what extent academics can play a role in making these possibilities a reality.

A workshop approach will be followed “knowing by doing”, through using the builder’s yards and the building sites as locations for technological and cultural exchange. A main research question being addressed is the need to re-direct professional efforts towards the needs of the poor rather than the ideals of the middle class. Traditional “expert”-driven design approaches are questioned in terms of their relevance. Taking locally available skills as a starting point for a design process needs to be tested, in a sense reinforcing the idea that technological innovation has to adapt to local capacities and not vice-versa.

Through the above research questions and processes it is hoped that innovative solutions could be arrived at a long-term partnership established between the Department of Architecture, UP and our Italian and Belgian partners and township enterprises in Mamelodi. It is hoped that a process for application of knowledge can be established and that the results of this project may be seen, on the ground in real projects at the end of the 3-year period through specific technological solutions.

4 Student projects

4.1 A proposed new zozo building system

Modular coordination may facilitate quicker construction and save costs. As explained above, a rudimentary form of modularisation is already being used in the township. It is hoped that through using local technologies, open building principles can be adapted to this particular context. One student analysed the system used at a specific shack-builders yard and proposed modifications to the system in order to improve the quality of the shelter. Using the same materials, it is proposed that the panels be broken up into smaller modules which are then staggered to achieve more stability. They thus become easier to transport and easier to use for alternative combinations which may ultimately offer more variety. The modules are, as far as possible, based on the dimensions of existing materials in the workshop or yard. The juxtaposition of smaller panels offers more stability and allows for space for insulation or various coverings to be applied. At the junctions of these panels, hollow columns may be formed which may be filled with loose sand, offering more stability without losing the potential to move the structure easily. Current entrepreneurial initiatives of the shack-builders yards were discussed and a strategy for convincing existing yards to adopt the new system was devised as follows: The new shelters maintain the benefits of existing zozos by being easily transportable, re-sellable, extendable and adaptable. The proposed system may ensure a better quality shelter immediately that also has more potential to be up-graded into a more permanent house with complete facilities and services.

Solutions however need to be proposed for a specific “yard”, at a specific time, depending on availability of materials and need. In this context, a pre-determined and measured response may be inappropriate. The cost implications of this system still have to be researched. Groups of students have already researched and designed alternative panel construction systems including the one described above. The intention is to test these out on site in agreement with yard owners that we have already identified. How the system may be adapted to other uses such as the construction of trading stalls, partitioning systems for formal housing, furniture (see 4.2 below), multi-functional boundary structures (see 4.3 below) or play equipment is still being investigated. Art works or follies may also assist in creating landmarks and creating interest, variety and excitement in a somewhat bland landscape.

4.2 Out of context: targeting a wider group with furniture and partitions at the zozo yards

Having looked at the materials in use at the zozo yards, one group of students decided to investigate the possibilities of building furniture and partitioning systems with which they could target a wider, perhaps higher-income, consumer group from outside of Mamelodi. By surveying the surrounding areas in the vicinity of Mamelodi it is noticed that there is already a flourishing market for garden furniture and shelters for the wealthier residents of these areas. It makes entrepreneurial sense for the yard owners to try and access that market.

This project is being presented for a student competition in South Africa titled: The Legacy of Tectonics in Architecture where the notion of tectonics as a constructional craft is being encouraged. The competition also calls for a need to be identified in a community and a solution to emerge from the available resources of the locale. The brief calls for: “The development of an appropriate tectonic tradition informed by a search for architectural legacy... essential for the future development of architecture in our region... Legacy in this instance also refers to the power of architecture to evoke an awareness of a common past and a collective memory.” (Des Baker Competition brief, 2006).

Five pieces of furniture have already been built from the same materials used at the yards or easily obtained from the surrounding industrial and commercial areas. The process of skills sharing and technical transfer still needs to be implemented at a later date during the year at selected yards.

4.3 A multi-purpose “wall”

Again, as a combination of the research project and the competition project mentioned above, a group of students propose to build a multi-purpose wall in Nellmapius, near Mamelodi. The intention is to show, through built example, the possibilities of locally-sourced materials and simple construction

techniques to create a wall with the potential for many uses within a certain setting. A wall, as a support structure may be used for seating, storage, planting, partitioning and as a children's play area. Thus, in the process also manipulating certain functions and levels of intervention in the neighbourhood: including both support and infill, furniture and partitioning, being controlled and adjusted by various agents such as the public on the one side and the residents on the other. The possibilities are numerous. A site and client have already been identified and the project will be reconciled with a garden project to be developed on the site by the Botanical Institute in Pretoria through community participation.

5 The way forward

This study is in its preliminary stages. The intention at this stage is to propose an approach to the problem rather than to suggest a conclusive resolution. A calculated and precise response would be inappropriate in this context and the research needs to be approached through an adaptive method. The proposals need to be tested through actual application and a response from the community needs to be obtained. This study believes that enterprises emerging from informal settlements are more suitable for low-income groups and that support of the informal sector better addresses the urgent need for poverty eradication.

The interesting aspect of the project could prove to be the skills sharing and cultural/social transfer that happens between historically-disadvantaged, black, emerging entrepreneurs and white students from historically-advantaged settings with the main interaction happening on site rather than on campus. The students appear to be overwhelmed by the context of Mamelodi and they perceive it as an alien setting that does not seem to be functioning according to their understanding of how they believe cities should operate. The concept of mutual learning is not easy to grasp and the idea that the township is a worthwhile setting to implement projects of architectural merit is being promoted through the research project. We are challenged as professionals to investigate beauty and efficiency in informality as an anti-thesis of a middle-class interpretation of how life should be lived.

6 Acknowledgments

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