THE APPLICATION OF PERMACULTURE DESIGN CONCEPTS FOR SUSTAINABLE HOUSING ENVIRONMENTS

Ezio Gori
M.Sc. Construction Management, MCIOB
E. Gori & Associates - Project Management and Development Consultants
P.O. Box 1409, Umkomaas, 4170, South Africa
Telephone & Fax : +27 (39) 973 0308, Fax : +27 (86) 671 8572,
Mobile : +27 (83) 300 2385, E-mail : whatabuz@iafrica.com

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ABSTRACT

The delivery of low cost greenfield housing development in South Africa is generally characterised by low density, dysfunctional, monoculture environments that fosters urban sprawl, and which in turn, hinders opportunities for socio-economic upliftment. This reality has developed as a result of a recalcitrant norm of placing a detached house in the middle of a small site, which at times, is substantially reduced to fit budget norms. In fact, the post apartheid dream of addressing the injustices of the past by housing the nation in vibrant sustainable neighbourhoods has more than often replicated the same dormitory townships of the previous dispensation. This paper uses Permaculture design concepts to show how sustainable and holistic greenfield housing developments can be designed to cater for more functional and safer housing with greater opportunities for urban agriculture, open space systems and community facilities.

INTRODUCTION

Since the establishment of democracy in South Africa some 11 years ago, the government has delivered approximately 1,5 million low cost houses funded from the national housing subsidy scheme. Although much of this housing has contributed substantially towards upgrading informal settlements, most of the conventional greenfield housing developments have fostered urban sprawl and created dormitory settlements which are not sustainable. Furthermore, many so called slums clearance housing developments merely contribute to urban sprawl.

The major problem with conventional greenfield housing developments is that they are amorphous and disconnected monoculture environments that inhibit the establishment of socio-economic activities, which in turn, perpetuate a "western lifestyle" that requires a substantial transport network to move people around to consumption centres that are fed on global trade. This scenario is exacerbated when a large proportion of people are unemployed and virtually become trapped in these dormitory settlements wherein the urban fabric provides very little opportunity for local economic employment. This poverty trap eventually starts to undermine the social and community fabric of society and eventually leads to a downward spiral of despondency, delinquency, crime, malnutrition and HIV/AIDs.

This paper looks at Permaculture as a design tool for creating sustainable human settlements wherein the form and shape of town plan layouts can be designed in a holistic and integrated manner to provide for a mixture of residential, public, social and commercial facilities that blend in with areas for urban agriculture and environmental open space systems. This Permaculture designed urban fabric provides for safe and secure settlements and also local economic development opportunities for sustaining threshold socio-economic activities that can keep poverty at bay.

This paper initially outlines the institutional problems with housing delivery and thereafter the consequential problems with dysfunctional and unsustainable conventional greenfield housing developments. The concept of row housing is then introduced as a means of comparison and thereafter integrated within a Permaculture design approach before the paper's conclusion.

INSTITUTIONAL PROBLEMS WITH HOUSING DELIVERY

In order to understand the malaise with many conventional greenfield housing developments, the background to the national housing subsidy and problems experienced with its implementation by developers is briefly outlined.

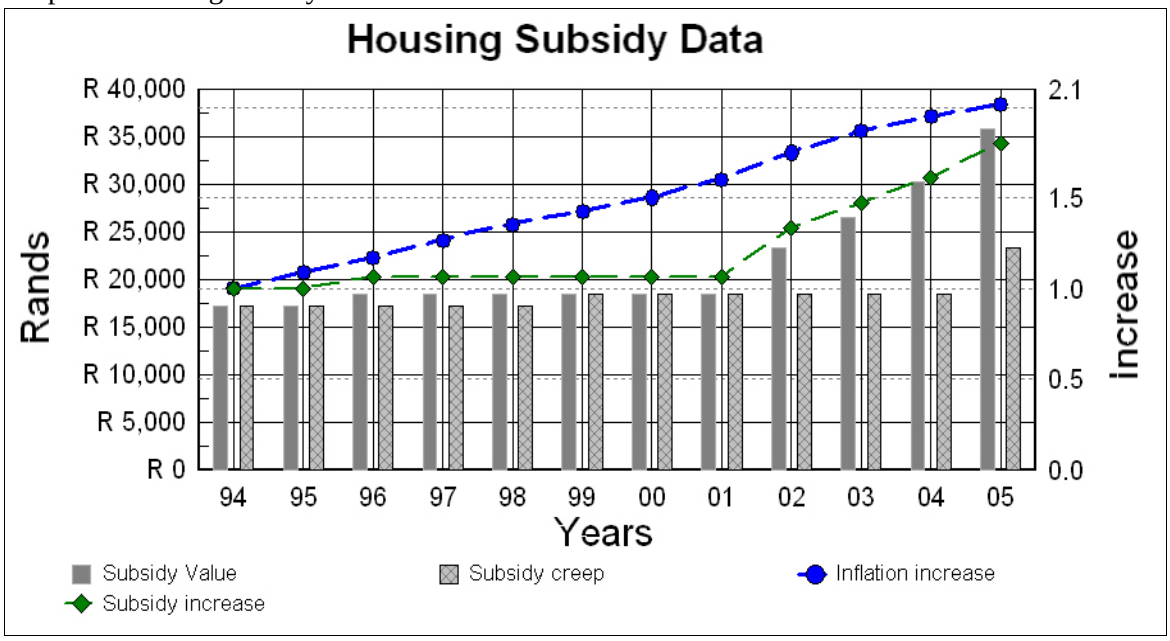
At its inception, this subsidy was worth a maximum of R15,000 per beneficiary with the current value at some R31,200, excluding an extra 15% allowance if motivated by adverse geotechnical conditions, steep slopes, and/or, closeness to work opportunities or major transport routes. Up until 2000, this subsidy had been accessed primarily by private sector housing developers, NGOs, and CBOs. From 2000 onwards, changes in housing policy instated local municipalities as the developer. If all goes well, the typical housing project cycle of 1,000 subsidies is approximately 4 to 5 years with the first two years taking up the necessary land acquisition and land assembly; followed by town planning, engineering design, environmental, township establishment and general plan approvals; all of which only spend some 10% to 15% of the subsidy amount. Thereafter, the construction of services and housing in years 3, 4 and 5 spend the bulk of the subsidy.

During the past 5 years or so, the provincial housing departments have continually underspent their budget allocations from the national housing department. Although this rollover of funds is not publicised, it lies between 25% to 50% of available funds despite the existing massive backlog of housing needs. In fact, housing expenditure has only been able to maintain some respectability due to the inflationary increase of the subsidy and not really the increase in housing delivery. It is interesting to note that whilst some years ago statistics on housing delivery were frequently published on the webpage of the national department of housing, this webpage has now been totally revamped and hardly contains any meaningful statistics, policy updates, etc., but rather publishes the speeches of the minister and other media publications. In other words, there is no transparency as to what is really happening and how the department is performing. It is no secret that housing delivery has slowed down significantly in recent years for a number of reasons.

Perhaps one of the major reasons for this slow down in housing delivery, is the change in the status of the housing developer from the private sector to the municipalities which has thrust major responsibility on many fledgling municipalities that are barely coping to manage themselves not to mention the complex nature of housing delivery. An added complexity is the Peoples Housing Process, which as noble and empowering as it is intended, merely added another layer of confusion, especially insofar as the contribution required by beneficiaries. The responsibility of local municipalities as the developer from 2000 onwards has also resulted in a large withdrawal of skilled housing professionals from the industry. The initial dearth of housing skills within the municipalities has seen a recruitment scramble for housing officials with the right credentials, who being rare to find, more than often leave huge gaps when job hopping, all of which results in low levels of institutional memory within provincial and municipal housing departments to maintain continuity of service.

The consequential result of the aforementioned institutional problems, has extended the normal project cycle of 4 to 5 years to one of 5 to 7 years. This extended project cycle plays havoc when the subsidy is fixed but has to include anticipated inflation. This has resulted in the subsidy creep effect wherein the subsidy approved at the inception of a project is severely undermined by the time the last house in the project is completed. In order to circumvent the obvious result of under expenditure, the national department of housing has in recent years been increasing the value of the subsidy substantially compared to the earlier years as shown in Graph 1. However, even though the subsidy has increased, there are few projects, if any, that have been competed with the new subsidy levels due to the 5 to 7 year project cycle described earlier.

Graph 1 - Housing subsidy data

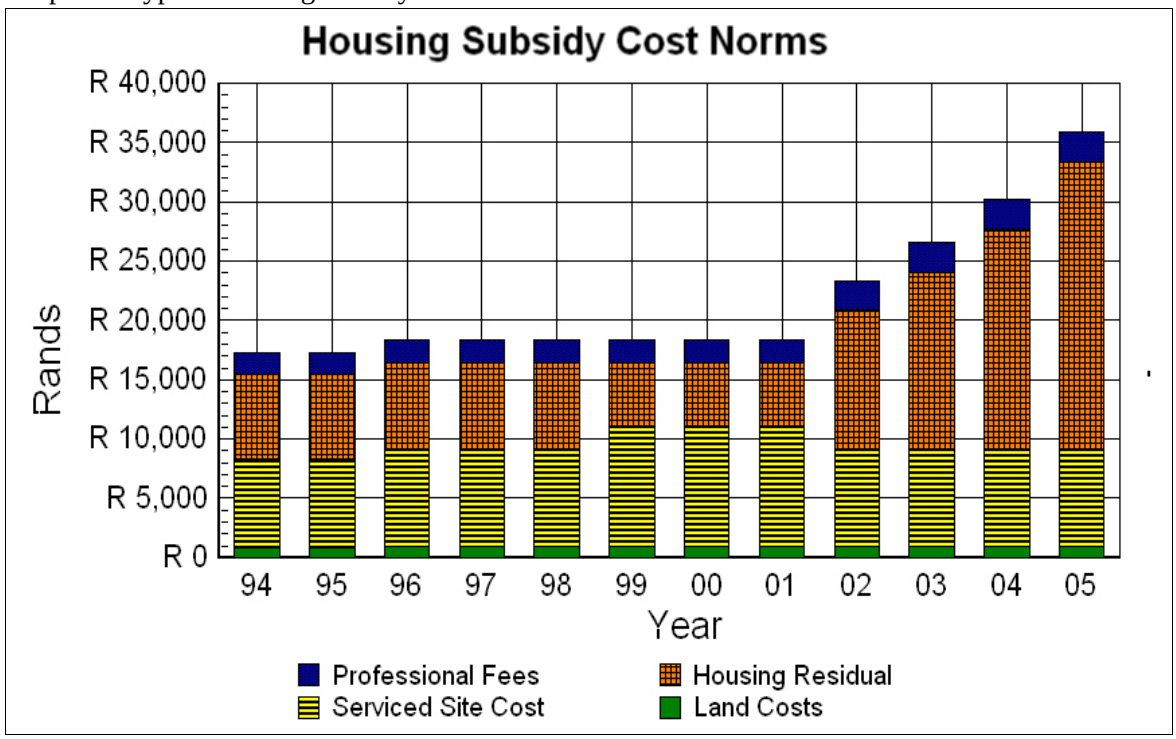


DYSFUNCTIONAL GREENFIELD HOUSING DEVELOPMENTS

The aforementioned institutional problems with housing delivery have had some major implications for the design of conventional greenfield housing developments, which typically consists of a serviced site with a detached housing unit in the middle of a site. In particular, since the basic subsidy remained unchanged for many years, the projects undertaken during this period resulted in smaller and smaller houses being built within a smaller and smaller lot size. Graph 2 illustrates the typical cost norms of the housing subsidy on a 250 m^2 serviced site with water borne sanitation and asphalt roads. This graph shows that during the time when the subsidy remained static, the housing residual diminished since most of the other costs increased, namely, the cost of a serviced site and professional fees.

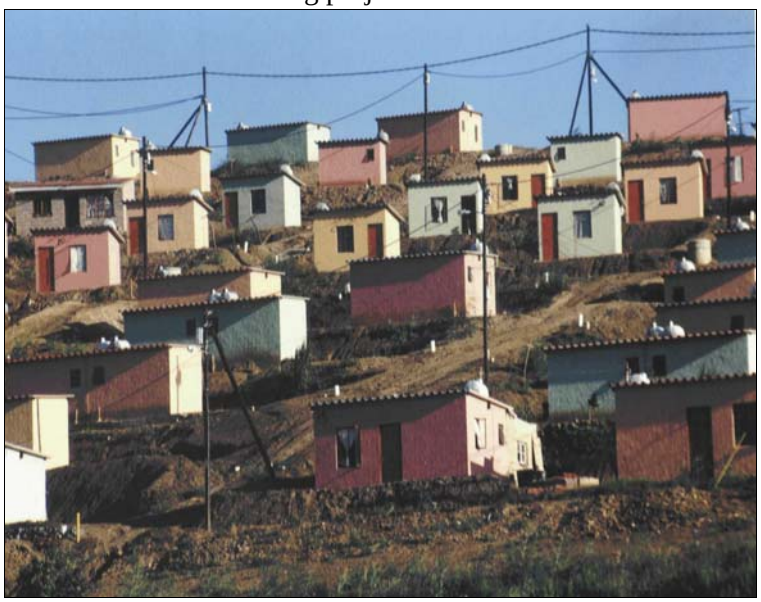
Although the national housing department eventually capped the cost of services at R8,000 per site for a pit latrine, gravel roads and water supply stand pipes, many projects had already been approved and constructed with a higher servicing cost. There are some cases wherein no houses were built at all because all construction was invested in the services. Nevertheless, the R8,000 cap on services did allow a window of opportunity for the housing residual to initially achieve a 24 m^2 house. The increase of the housing subsidy in 2002 changed the policy to a 30 m^2 which remains the current norm. This means that the municipalities are now required to provide funding for any additional services, such as undertaken by some of the larger and richer municipalities, notably, eThekwini Municipality. However, the funds for this top up of services is quickly running out and it is doubtful this type of funding can be sustained in the long term, especially with the ever increasing influx of marginalised rural people to urban areas.

Graph 2 - Typical housing subsidy cost norms



The period around the Millennium was a crisis period wherein municipalities and developers grappled with the funding dilemma of how to make the subsidy work given the shrinking housing residual. As a result, some of the worst examples of government housing was completed during this period which also coincided with the withdrawal of many private sector developers and housing professionals from the industry. With this radical dearth of housing skills, the new crop of aspiring housing professionals do not have the vision and experience of their predecessors and usually replicate previous housing schemes. And herein lies the problem, in that the form and shape, albeit smaller and smaller, of previous dormitory housing schemes are being replicated since there is no known alternative to serve as an example.

Plate 1 - Waterloo housing project



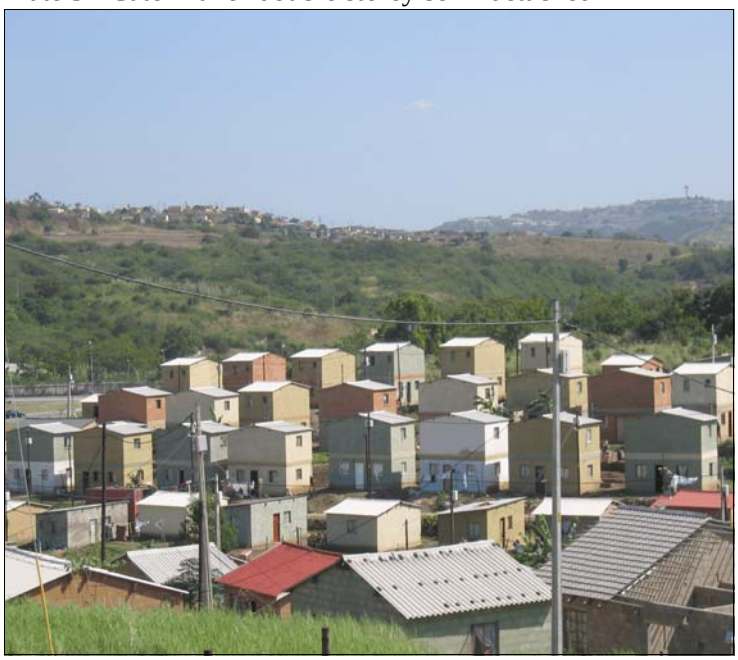
The examples in Plates 1 and 2 show some of the typical greenfield housing developments. The latter shows a really abysmal project wherein the housing residual was just enough to provide a 16 m^2 steel frame that covered a wetcore in one corner. This latter project has been severely vandalised and many of its beneficiaries have refused to move in when they realised the end result of their housing subsidy.

The real tragedy of these typical greenfield housing developments, is that apart from the small house, there is very little functional space around the perimeter of the house, especially in KwaZulu-Natal wherein many such developments are perched on very steep slopes. Privacy is also affected since a side opening window often peers directly into a neighbours dwelling a short distance away. These physical restrictions, often lead to social distress as experienced in high rise housing apartment blocks elsewhere in the world.

Plate 2 - Illovu housing project

Even the example in Plate 3 from a double story housing development in Cato Manor may appear as if it achieves housing density requirements but at what cost to future expansion and the socio-economic fabric.

Plate 3 - Cato Manor double storey semi-detached

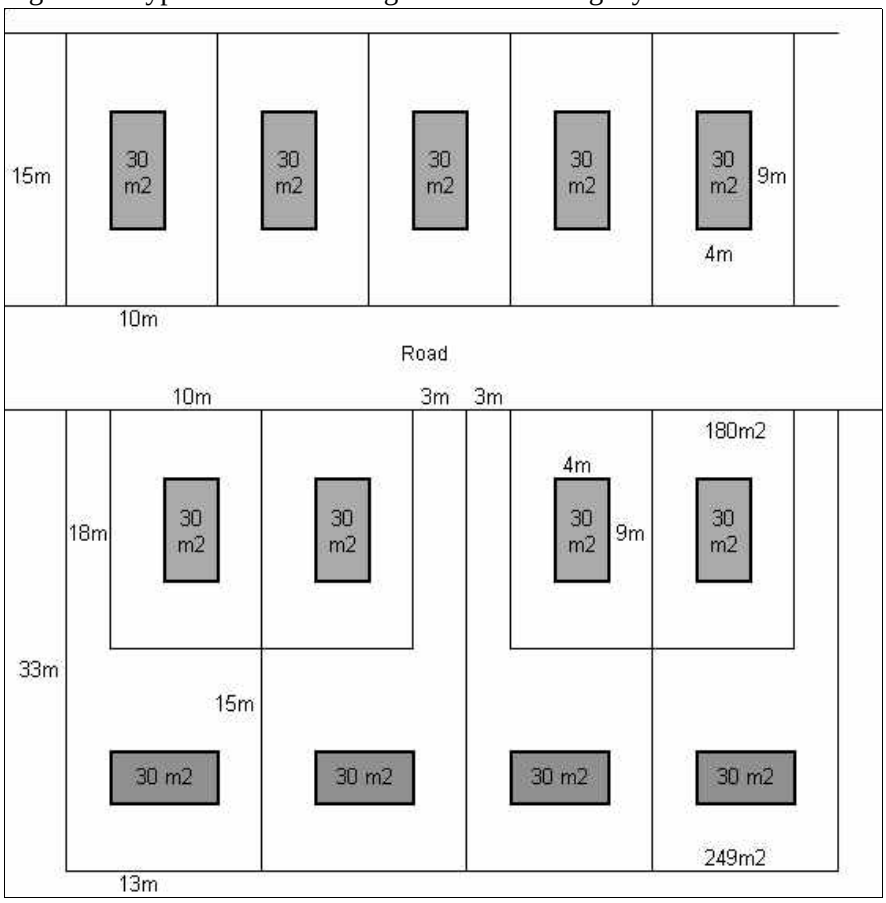


The layout of these typical housing projects is shown in Figure 1 wherein the form and shape of the housing footprint demands a high site serving cost as a direct result of the length of road frontage. In other words, a typical 10 metre road frontage at a cost of R1,000 to R1,200 per metre quickly adds up to R10,000 to R12,000 for a serviced site. Consequently, the housing residual is barely sufficient to muster a $30m^2$ top structure.

These high site servicing costs are often defended by engineers who say that the steep slopes in KwaZulu-Natal need adequate stormwater management systems. This form of housing also has lower densities, and consequently, lower economic thresholds for any form of small neighbourhood businesses to take root.

The critique outlined above is often defended by many housing professionals who insist that lack of funding has limited the scope of a project. However, the author contends that it is a lack of imagination and experience that results in history repeating mistakes. Nevertheless, despite this critique, a substantial amount of housing has still been delivered, but hopefully lessons can be learnt on how not to repeat mistakes.

Figure 1 - Typical conventional greenfield housing layout



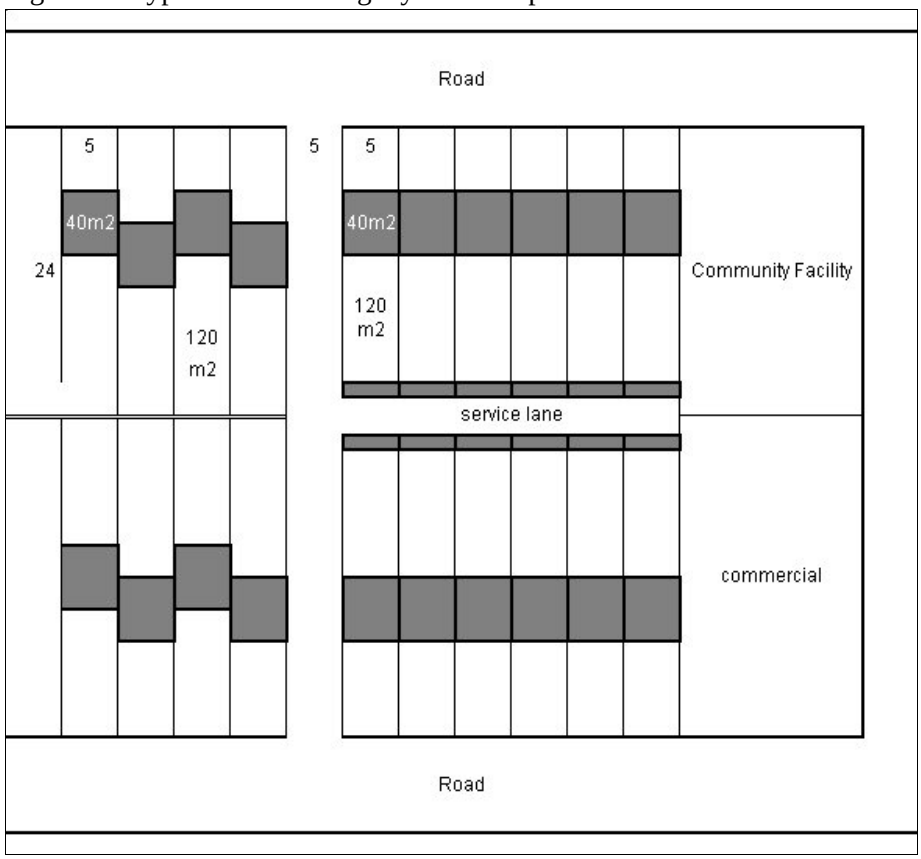
- higher servicing cost
- less housing residual
- less privacy
- less functional space
- predominantly on steeper land
- lower densities
- unsafe neighbourhoods
- lower economic thresholds
- high energy use
- $30m^2$ house

THE ROW HOUSE CONCEPT

The dilemma of many conventional greenfield housing developments paints a daunting picture insofar as future housing projects are concerned. To this end, an increase of the housing subsidy to simply perpetuate the current reality, ought to be strongly resisted. Nonetheless, there are opportunities for "making the subsidy work", especially now that it has caught up with inflationary expectations. In fact what is required to achieve these new opportunities, is a paradigm shift in the way that greenfield and infill housing projects are planned. This paradigm shift requires a leap of faith amongst housing professionals, away from the small detached house site in the middle of a site towards the row housing concept.

The basic financial and social economies of the row housing scheme was long grasped in Europe and the USA at a time when urban centres were under severe strain during the onset of the industrial revolution. The solution in this instance is depicted in Figure 2. This sketch illustrates how the row housing scheme only consumes a 5 metre frontage, hence less serving costs which at R1,000 to R1,200 per metre amounts to R5,000 or R6,000 per site. This then leaves a greater housing residual for a top structure shell of up to at least $40m^2$. The cost of a typical row housing scheme with a $125m^2$ serviced site with water borne sanitation and asphalt roads is therefore as follows ;- professional fees ± R2,500; land ± R600; services ± R6,000; housing residual ±R22,900; with total ± R32,200, excluding the 15% allowance for adverse terrain and/or locality. Even though the R22,900 housing residual is hardly enough for a $30m^2$ top structure, it is sufficient to provide the basic housing footprint for a $40m^2$ concrete box structure shelter with a concrete floor slab and concrete roof for expansion, thereby leaving the householder to complete the house with sweat equity. Any increase in the housing subsidy should then be used to provide a complete $40m^2$ dwelling unit.

Figure 2 - Typical row housing layout concept



- lower servicing cost
- more housing residual
- more privacy
- more functional space
- predominantly on flatter land
- higher densities
- safe neighbourhoods
- higher economic thresholds
- lower energy use
- 40m^2 house

The row house concept also has relatively higher densities which in turn, raises economic thresholds for local businesses. It should be noted that in Europe, the standard road frontage for row housing schemes was 4,6 metres for a double storey structure and 5,4 metres for a four storey structure, the difference allowing for a 0,8 metre stairwell. Invariably, the row housing scheme has less social problems since there is more privacy, a larger house, more functional space in front and behind the house, more security, and a better neighbourhood environment. Since the densities are also relatively higher in the row housing scheme, the land required should only make use of the flatter slopes, with the steeper slopes being used for passive open space and urban agriculture, thereby promoting the theme of integrated development. The basic difference between the row house and the detached house lies in the frontage to depth ratio.

Given the aforementioned advantages of row housing against the current predominantly small dwelling site within a small site, the resistance amongst housing professionals towards row housing is perplexing. This may be perhaps due to the engineering dominated housing industry, rather than a planning driven industry. Alas, the typical engineering comment on row housing is that the steep slopes of KwaZulu-Natal generally do not cater for such an approach. Nonetheless, engineers ought to be reminded that the cost of bulk earthworks is comparatively cheap in creating the necessary landscape to accommodate row housing. Naturally, once the landscaping has been achieved, higher densities and lower

Plate 4 - Shayamoya, Cato Manor

serving costs can be accomplished. In fact, real construction economies of scale can be achieved since row housing lends itself to mass concrete in house floor slabs, walling and roof coverings, in lieu of small buildings scattered infinitely in urban sprawl.

The example in Plate 4 shows a row housing development in Cato Manor which is decidedly more pleasing and habitable than the earlier examples. However, at the time, this particular development did receive funding in addition to the housing subsidy. Perhaps if the frontage was reduced the overall costs may have been contained.

PERMACULTURE DESIGN APPROACH

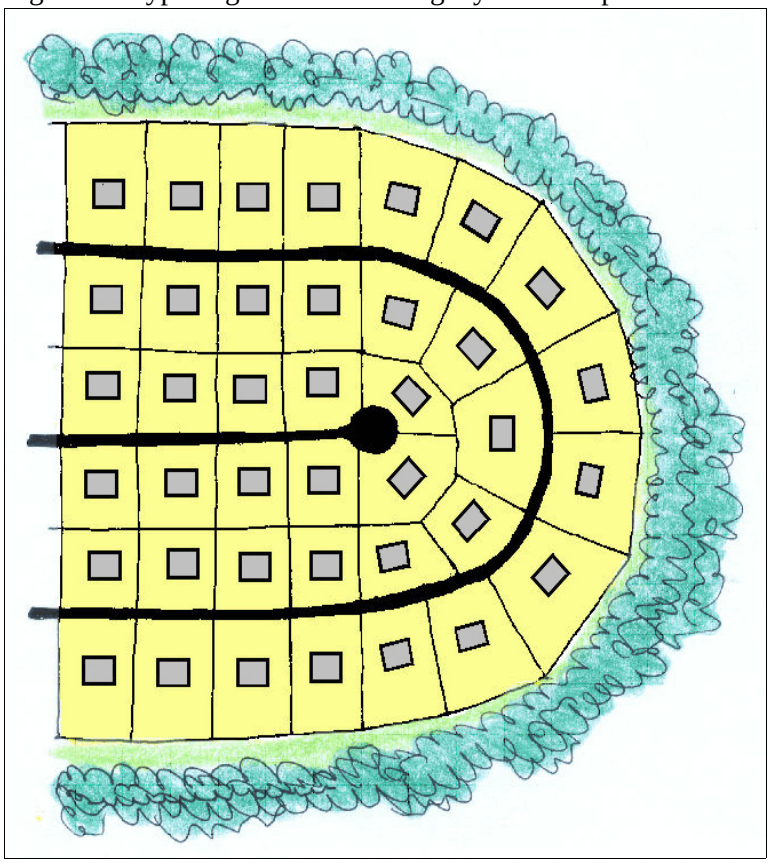
The comparative illustrations shown in Figures 1 and 2 are replicated for a typical spur type development in Figures 3 and 4 respectively. Figure 3 shows how current town planning layouts typically envelope a spur with the built environment leaving little space for urban agriculture and natural open space systems. Alternatively, Figure 4 shows how a compact arrangement of row housing not only yields approximately the same number of housing as in Figure 3, but also, allows sites for commercial and public facilities within a village centre and creates opportunities for urban agriculture and an open space system. The design principles embraced within Figure 4 are those of Permaculture, which is a term coined during the late 1970s to describe permanent systems of agriculture and culture integrated within towns and country. Permaculture is therefore modelled on nature, which thrives in diversity, in comparison to modern lifestyles which are based on monocultures that basically destroy life.

The illustration in Figure 4 shows how the Permaculture zone system for a typical home garden or small holding is adapted for a village node development. The Permaculture zone system identifies the home as Zone Zero; thereafter, Zone 1 is the immediate environment around the home which caters for domestic self sufficiency; Zone 2 allows for small domestic stock and an orchard; Zone 3 makes provision for the main crops, forage and stored food; Zone 4 is where gathering, forage, forestry and pastures are located; and, Zone 5 blends in with the natural environment. In Figure 4, Zone Zero is the inner core or home centre of the community, such as, the central park and town square, which in turn, is surrounded by Zone 1 where commercial, public and entertainment facilities are provided for "social self sufficiency". The surrounding residential sites can be viewed as Zone 2 which cater for "human stock" and homestead gardens. Farther out, the residential areas are surrounded by agricultural allotments that graduate from crops to orchards from Zone 3 to Zone 4. The latter is then integrated within Zone 5, the natural vegetation of the open space system in the valley lines \ riverine areas. The natural vegetation is also encouraged to form a "spike" that reaches to the residential areas from which walking trails commence. This adaption of a Permaculture design for a homestead applied to a village node is outlined in Table 1.

Table 1 - Permaculture zone system

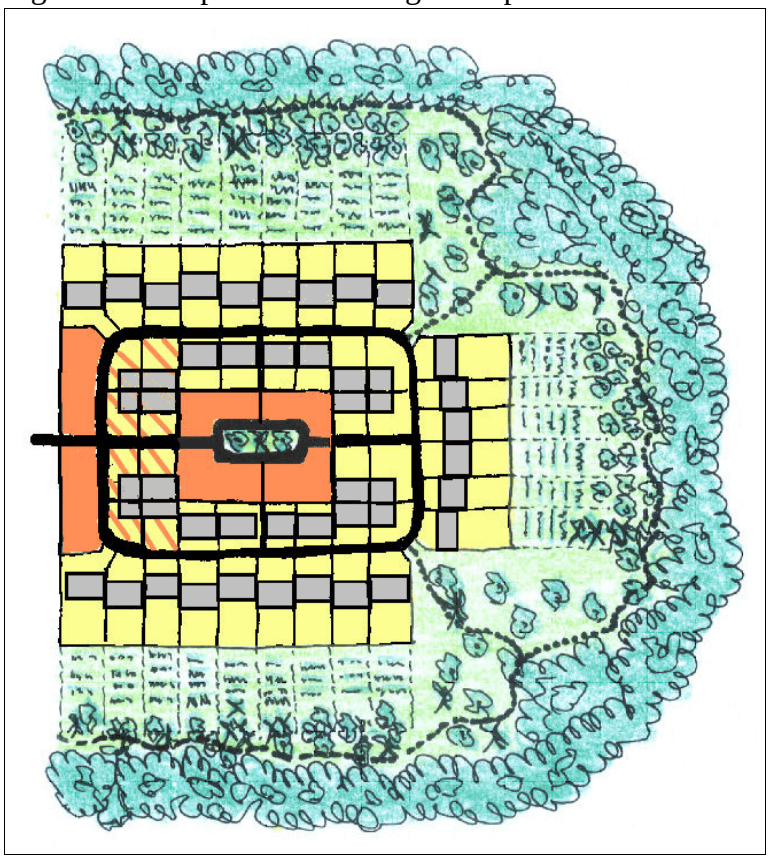
Zone	Permaculture zones for homesteads	Permaculture zones for village clusters
Zone 00	The Individual	The People
Zone 0	Home dwelling	Central park and town square
Zone 1	Domestic self sufficiency - pick and pluck plants for daily usage	Social self sufficiency - commercial, public and entertainment facilities
Zone 2	Small domestic stock and an orchard	Human stock and homestead gardens
Zone 3	Crops, forage and stored food	Agricultural allotments
Zone 4	Gathering, forage, forestry and pastures	Orchards and passive open space
Zone 5	Natural environment	Natural environment

Figure 3 - Typical greenfield housing layout on a spur



A sterile, unhealthy, unsafe, mono-culture built environment that subdues community spirit and forms a barrier to the natural environment.

Figure 4 - Compact row housing on a spur



A vibrant, diverse and safe built environment that promotes a sense of community, urban agriculture and an appreciation of the natural environment..

CONCLUSION

The comparison between Figures 3 is 4 is stark, yet housing professionals continue to repeat the mistakes of the past. The illustration in Figure 3 shows the typical current reality of the dysfunctional greenfield housing development, and in fact, a perpetuation of apartheid style planning. The announcement of major slum clearance programmes by the national and provincial departments of housing will most likely continue this unsustainable urban sprawl of greenfield housing developments unless an urgent paradigm shift occurs amongst housing professionals to realise the benefits of applying Permaculture design principles to create sustainable housing settlements. All that it takes is a paradigm shift to realise that the current reality needs a major overhaul and some bold new pilot projects to show the way that sustainable housing settlements can indeed be delivered within the current housing subsidy norms. In particular, the basic concept of reduced road frontage will promote row housing, which in turn, need only be developed on the flatter slopes, thereby preserving the more steeper slopes for urban agriculture and passive open space systems. The row house concept within a Permaculture design approach also provides for greater community security, more privacy, more scope for house extensions, and, a more beneficial socio-economic urban fabric for promoting local economic development opportunities. One needs to look no further for inspiration than the classic and timeless, A Pattern Language by C. Alexander et al, and, Permaculture : A Designers' Manual by Bill Mollison.

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