

Environments of Change: A Design Solution for an Informal Settlement in Mamelodi

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Abstract

It is not necessary to emphasise the poor living conditions and lack of basic services within informal settlements. Informal settlements are unstable by nature. Even within relatively stable settlement boundaries, change in fabric continually manifests through altering dwelling configurations. Deemed unstable by formal criteria, these environments disclose schizophrenic characteristics, yet beyond the condemnation exists functional societies capable of survival and self-regulation. Public and private sector investment within informal settlements is restricted as a result of the illegal status, for the same reason inhabitants of these settlements have no incentive to invest their own resources where they have no formal tenure over the land. The inhabitants of these environments require improved service delivery through immediate solutions. However, the growing epidemic of informal settlements shows little signs of creative resolution – perhaps what is required is a service delivery core, a catalyst, stimulating growth and improved living conditions. This core catalyst may allow for the amelioration of the surrounding environment. The study presents a design for this catalyst as a possible generic solution – with specific application in the context of Mamelodi Township near Pretoria in South Africa. The design makes provision for the informal economic sector. Ultimately the design is not limited to fixed mono-functional facilities but rather offers several platforms allowing for diverse interpretation and use. Construction of these catalysts acts to showcase technologies, materials and methods relevant to context. Communication with users through visual observation and tactile interaction is considered essential. The design possesses the potential to be disassembled and relocated elsewhere, but depending on the needs of a specific setting could also be absorbed within a new expanding urban fabric giving direction to future township development. Public space shaped by the architectural intervention is essential as a socio-economic stimulus inviting private informally-run micro-enterprises to operate within certain parameters: it offers opportunity, enhanced chances for survival and provides a platform for social activity, conversation, exchanging of gossip and a place of gathering.

Keywords: informal settlements, service delivery core, catalyst, Mamelodi, South Africa

1. Introduction

“In developing countries, the term ‘slum’...simply refers to lower-quality or informal housing. Large, visible tracts of squatter or informal housing have become intimately connected with perceptions of poverty, lack of access to basic services and insecurity. Terms such as slum, shanty, squatter settlement, informal housing and low income community are used somewhat interchangeably by agencies and authorities” (UN-Habitat, 2003, p. 9).

There is a growing epidemic of informal settlements, albeit by different names occurring throughout the world with little sign of a cure. Perhaps what is required in this time of searching for a cure is an interim held service delivery core, a catalyst, stimulating growth to improved living conditions.

The negative connotations of informal settlements persist. In order to remove this demeaning overtone it is essential for an architectural design intervention not to be condescending, but rather uplifting and empowering, initiating a change in outsiders’ perception of informal settlements and their inhabitants as well as stimulating self-help strategies of the inhabitants. Thus the proposed design for a specific case study area in South Africa acts as both symbol of hope and progressive change.

2. A need for building systems suitable for environments in constant flux

Informal settlements are flux by nature. Even when settlement boundaries have been met, a change in urban fabric continually manifests through altering dwelling configurations. The disassembly and recycling of structures together with new informal extensions frequently remodels the dwelling units for increased practicality. Existence is treated as temporary by higher authorities while in the reality of the situation existence of both the settlement and its inhabitant is for a delayed period of time. Most often located on the outer periphery of cities and industrial areas, the residents are near enough to serve but not close enough to be served.

The difficulty in defining slums is that “slums change too fast to render any criterion valid for a reasonably long period of time” (UN-Habitat, 2003, p. 11). This gives reason, motivated by the changing settlement patterns within the study area of Mamelodi, Tshwane, South Africa, that an architectural solution for progress may have to be impermanent and possibly relocate once it has served its purpose on site or adopt a new programme capable of merging into a new, upgraded urban fabric.

There is a need for a built system that is capable of learning and evolving in time; the capacity for change is integrated within the design system. It is necessary to design for future scenarios by “devising an ‘adaptive’ strategy that is exceptionally alert to changing events and can adjust quickly” (Brand 1995, p. 183). The Mechano like steel structure of the design intervention is thus adaptable and flexible throughout its life in order to best respond to ever-changing conditions. The built

configuration encompasses both concepts of adaptability: “capable of different social uses” (Groak 1992, p.15) and flexibility: “capable of different physical changes” (Groak 1992, p.15).

3. The South African informal settlement

Informality exists on the peripheries of South African cities. These cities, despite political change since Apartheid still maintain the patterns of segregation imposed by the previous eras. This pattern has led to numerous social and political problems and has led to violence, crime, service delivery protests and xenophobia. Thus the problems faced by these areas need to be urgently addressed if political stability is to be achieved.

Deemed unstable by formal criteria, these informal environments disclose schizophrenic characteristics: below the smog of condemnation lies a functional pragmatic society capable of self-regulation and self-order, responding to the very use of the user. There is a deeper intrinsic understanding within an informal setting. “Planning” of informal settlements within South Africa is gradual and is determined by the intensity of use and forces (the user and environment). Street grids are established, organic by nature and true to the energy which shaped them, the grid is often more suited to a pedestrian scale as it is determined by the main mode of transport within the settlement, the foot.

The way of constructing the ubiquitous ‘tin’ shack reminiscent of many informal settlements throughout the world is inadequate yet affordable. A rain-screening shelter no doubt, the nailed timber structure with the usual steel sheet clad exterior offers the user only the bare essentials to shelter.

Through investigation it was found that the inhabitants of informal settlements throughout Tshwane, South Africa, are resourceful and innovative. There exists a certain order within the apparent chaos of informality. Internal policing, construction and trading are all resolved and carried out on a scale suited to its environment. Informal settlements establish roots: cultural, social and individual while the occupants conceive of methods for survival with only a limited degree of permanence (stability), which in turn supports the greater structure of the settlement and the community.

4. The informal sector in Mamelodi, Tshwane

Mamelodi is an expanding area capable of absorbing older informal settlements within its new fabric, yet at the same rate giving rise to new informal offspring. These settlements offer limited infrastructure and lack the public amenities needed for improved social and health conditions.

Mamelodi is a residential suburb approximately 25km² in area and was originally established in the 1940s as a township for black workers near the train station at Eerste Fabrieken. In time Mamelodi expanded to the East beyond the Pienaars Rivier, locally known as the Moretela River. Informal residents located on the erratic edges would either move into the new formal housing or together with newer immigrants would again relocate to the shifting outskirts of the township. Settlement patterns

have been predominantly to the East. These informal settlements have been continuously uprooted and displaced by the expanding formal urban fabric of the township. The informal settlements in the extreme East and South-East of Mamelodi (informally known as Lusaka and Phumolong) were identified as areas in urgent need of basic services with high fire risks and poor sanitary conditions.

Mamelodi is divided into two sectors by the Pienaars Rivier, Mamelodi West and Mamelodi East. Mamelodi West shares a distinct border with the established township of Eersterust to the West and the industrialised area of Silverton to the South-West. The Magaliesberg mountain range defines the northern perimeter of the greater Mamelodi. Mamelodi East is bound by the North-South lying branch of the Magaliesberg mountains and new commercial and residential development to the South in the Willows. Mamelodi East contains a great deal of informal dwellings, particularly in the extreme East where there is significantly less formal housing and limited infrastructure.

Mamelodi shows traces of its numerous growth patterns, both from its pre-apartheid and post-apartheid era's. It displays evidence of the diverse urban planning typologies practised during the changing years of government and the fusion of incongruent road grids bearing testimony to the many contrasting forms of housing typologies implemented within the township. There is also much unconstrained growth in the form of informal housing shacks depicted by the smaller informal grid patterns.

The informal sector of Mamelodi located to its east predominantly consist of wards 10, 16 and 17 respectively. Collectively these wards comprise more than one third of the area of Mamelodi served by 1 clinic in ward 17. Sanitation is of a concern in these areas with poor health circumstances as result. Much of the material used to construct the inferior shacks is obtained from the surrounding industries, much of it from the Ford manufacturing plant in Silverton.

Much of the current formalised township of Mamelodi East is composed of consolidated informal settlements, in which land previously subdivided without approval is usually sold or leased to the informal residents and has overtime been recognised as part of the township. Improved infrastructural networks are provided and these informal settlements are merged within the recognised township. In contrast, squatters have been relocated and the land been developed for new Reconstruction Development and Plan (RDP) houses subsidised by the government. Current South African Government aims to provide formalised housing and services to these informal communities, however priority is given to the informal settlements "of the most vulnerable and disadvantaged groups" (UN-Habitat 2003, p.129) and those established during the apartheid regime and pre-1994 (Metroplan, 2006), thus excluding the specific site under investigation due to its recent establishment, post 2003.

These informal dwellings encroach upon the Magaliesberg on the eastern front. The threat of shack fires exists due to the high combustion rate of the building material used together with the internal contents and the high densities of informal dwellings within small proximities to one another.

5. The site: Phumolong informal settlement

Phumolong is located in ward 16, extension 6, Mamelodi, Tshwane, South Africa at coordinates 25° 44'00" S 28° 25'00" E. It is almost completely surrounded by the township of Mamelodi (figure 1) except to its south where the municipal boundaries of the City of Tshwane and Metsweding meet (both situated in the province of Gauteng).

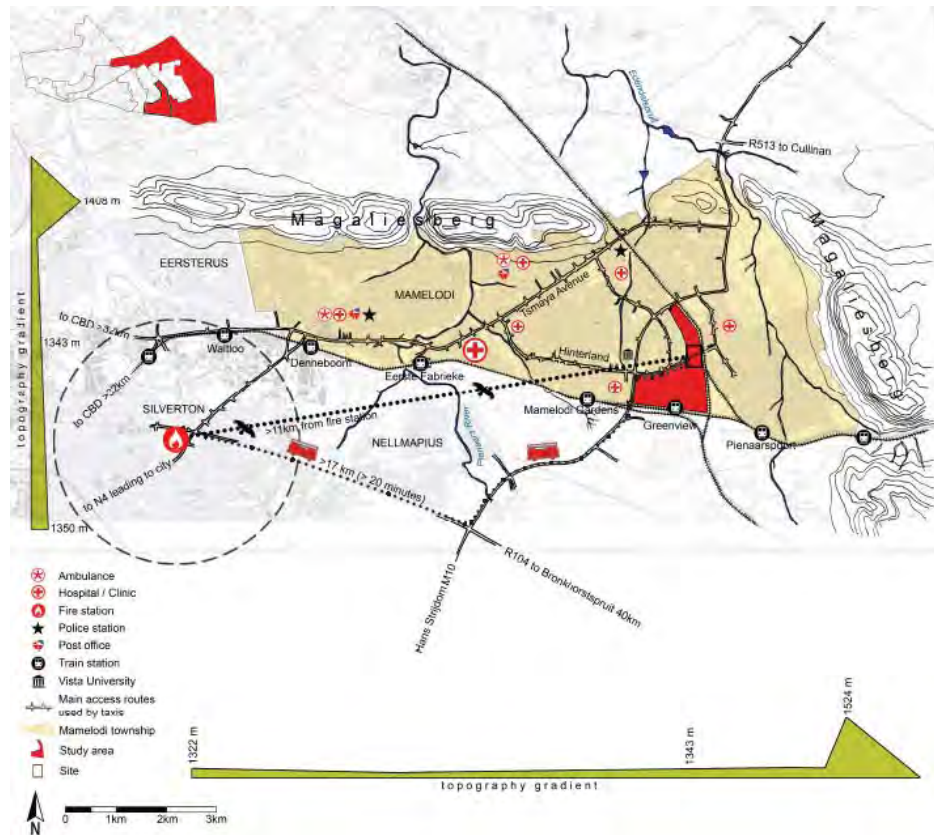


Figure 1: Location of Phumolong informal settlement within Mamelodi and distances from critical services.

‘Phumolong’, Sotho for ‘resting place’ is the local name for the piece of land occupied entirely by informal settlers and shacks with almost no municipal services provided. The area of Phumolong is located along the curved main road of Hans Strijdom (M10) defining both its Northern and Western boundary while two converging railway tracks demarcate its Eastern and Southern limits (figure 1). This area is locally referred to as ‘bridge to bridge’ and is managed by a community elected ward leader and committee. The older neighbouring community to the North-West, known as Marabastad by the locals, also belongs to Mamelodi extension 6 and boasts RDP housing together with the necessary infrastructure. The few services found in Phumolong are circulated from its neighbours by means of illegal ‘izinyoga’ (sotho for ‘snake’) connections. Hose pipes are connected to garden taps within the neighbouring Marabastad and transverse the last dividing asphalt roads unseen and largely

overlooked by the municipality before entering Phumolong where the hose pipes meander down the gravel roads serving the community of Phumolong. The minor amount of electrical connections found on the outskirts closest to Marabastad occurs likewise.

Through further investigation of the Mamelodi context and mapping of public services, it was identified that Mamelodi had no fire station yet had high amounts of fires, the highest among any other wards in Tshwane for the year's 2007 and 2008 (City of Tshwane Disaster Management Services 2008). A fire station was deemed necessary by both the authors and the Chief Fire Warden of the Pretoria Central Fire Station (J Pieterse 2009, 25 May). A central location would offer greatest access to fires within Mamelodi and the neighbouring areas of Nellmapius, Eersterust, Waltloo and the area of the Willows.

Inadequate vehicular access and the absence of fire hydrants within Mamelodi and its informal sectors delay the process of extinguishing fires. This gives fires time to spread, many times having deadly consequences. The provision of a water reservoir, sorely needed by the informal residents for human consumption, could also co-function as a 'fire filling station', operating as fire hydrant in times of fire. This idea gave rise to the concept of a servant core with its primary activities based around the provision of water (figure 2).

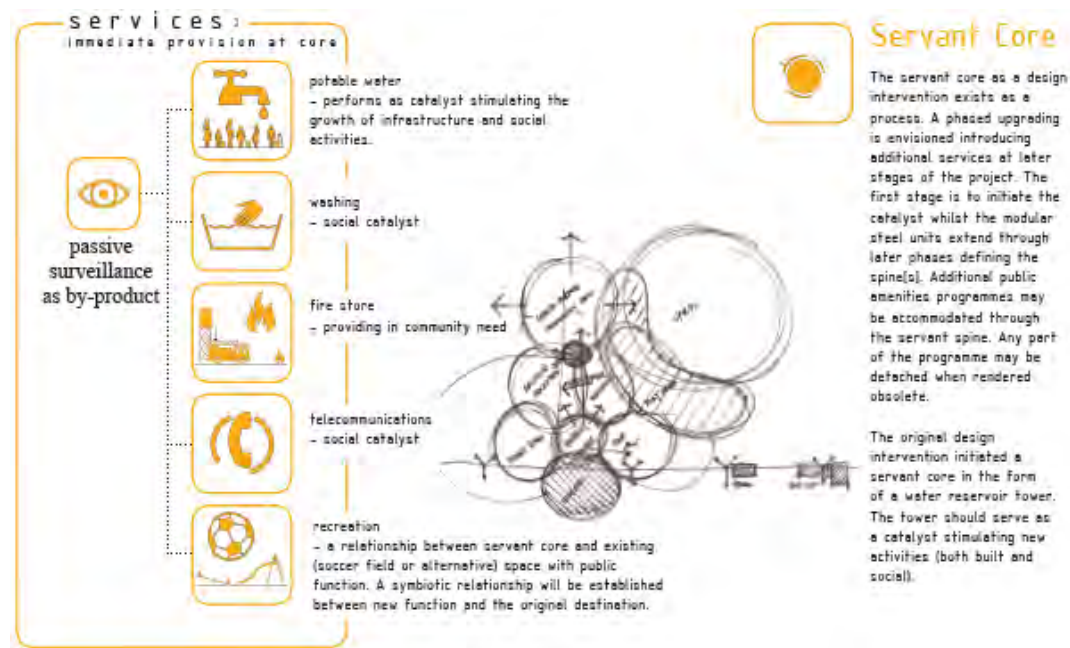


Figure 2: Services to be accommodated during first phase of catalyst

Location is suggested along the edge of a well-used football pitch (figure 3). This allows for easy access to water in times of fire and also guarantees a constant presence of people and will hopefully create a sense of pride and ownership in the structure.



Figure 3: View of the informal settlement showing the football pitch along which the intervention is proposed.

6. The project brief

The project aims to develop a design intervention improving service delivery as well as social well-being within the informal settlement of Phumolong. The design scheme acts as catalyst for social growth as well as system and services growth; responding to both the individuals and the community needs.

Design is to be the generator that promotes an ordering structure within the urban fabric, acting as common thread binding both fabric and the societal life. The design aims to realise improved infrastructure and services, improved social relations and general well being of individuals, a sense of community pride and participation as well as giving emphasis to the importance of positive public space.

Through this process lack of public amenities and services is addressed. Also, in the process, architecture is investigated as a responsive system composed of participatory parts, as a changing relationship of form and programme and as having the potential to achieve a higher degree of independency from off-site energy systems through the integrated design of energy inclusive systems and infrastructure. In other words infrastructure as architecture is explored resulting in an adaptable and flexible architectural plug-in system.

The design intervention also serves as a symbol of renewed hope and support. It establishes an improved identity within the settlements and informal sector. The service core provides place and opportunity for the local business owners and surrounding residents and is capable of expanding according to future needs, allowing new and changing programmes to be attached to the system. The intervention is a public services building integrating public space with public services and amenities. The users are the informal occupants, business owners and the community as a whole. The phased growth of the design intervention (figure 4 and 8) incorporates various clients at different stages. The

first client[s] will be responsible for construction of the primary structure and necessary infrastructure and will most probably be the Government and its relevant departments such as; the Department of Human Settlements, Department of Energy and the Department of Rural Development and Land Reform.

The secondary clients are responsible for construction of buildings having civic importance and serving as public amenities. Such programmes and clients may change depending on need of the community but may typically be healthcare, educational facilities or even a post office or place of worship. The lifespan of such programmes depends on the needs and position of the community at a given time. Other clients such as small, medium and micro-enterprises will be responsible for their own building construction and attachment to the servant spine. They too influence the growth of the servant spine. Advertisements and branding attached to the building structure may generate further capital needed for maintenance and systems growth.

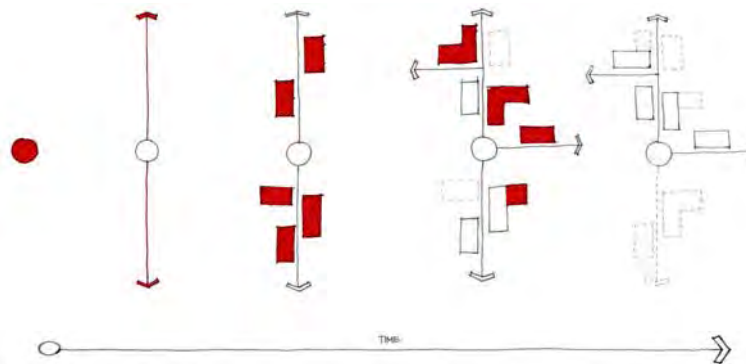


Figure 4: Phased growth of service core to servant spine

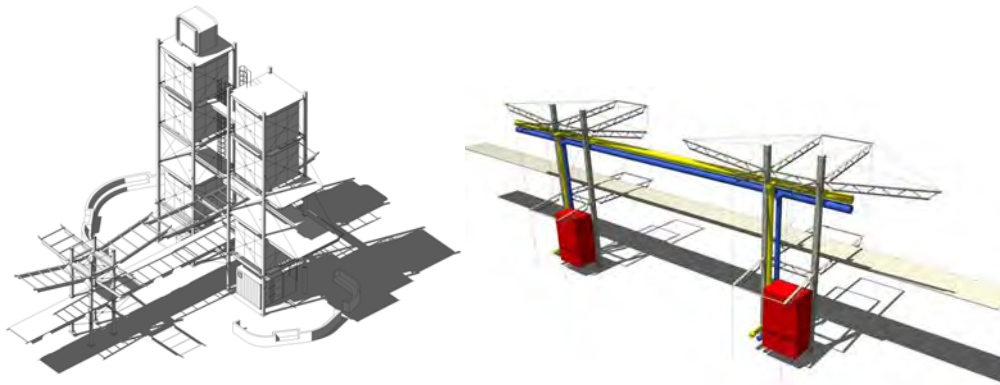
Possible funding and material can also to be obtained from sponsors such as steel manufacturer Arcelor Mittal. This company has partnered with the South African Department of Education to build ten schools throughout the country using new steel technology. “Mamelodi Primary School, in Tshwane, is scheduled for completion at the end of the year and is built using insulated panels technology, which relies on steel as a building material with the argument that it can withstand extreme weather conditions, is fire resistant and quicker to erect than when using conventional building technologies” (Shirley 2009).

7. The suggested construction method

It is important to note that the proposed structural configuration is not a “one size fits all” but rather an assembly of easily attained, transported, manipulated and fastened parts. Future construction methodologies with changing appropriate technologies may be attached and fixed to the structure, thus it is not limited to a specific kit of parts but is rather a structural configuration undergoing constant evolution according to best practice at a particular moment in time.

The common construction method in the townships is that of the block/brickwork house and the shacks. The former, constructed through government subsidies, uses wet works construction and typically contributes to the establishment of more permanent settlements. It is also widely used for additions and alterations in the more established wards of Mamelodi by land owners. The latter is usually comprised of a timber framed structure and clad with steel sheeting; it provides no more than the essentials to housing. Construction is quick to assemble and widely practiced by the informal community. Its counterpart, the 'Zozo Hut', is constructed in like fashion and has established itself amongst the informal business enterprises. It is also commonly erected on formal stands and is used as a rentable outbuilding. It is often seen as a temporary solution to housing due to its ability to be relocated with the user.

For this project, these two systems are taken into consideration with regards to achieving a degree of permanence and changeability. Thus the criteria for material and construction demands ease of transport, on-site assembly using local labour, self-informing assembly by unskilled labour, labour-intensive operation, piece assembly and erection, skills transfer, low skills operation, economic viability, little or no heavy machinery to be used, limited need for electricity (thus requiring the majority of work to be done by manual labour with no welding). This has led to the consideration of a steel structure fixed with nuts and bolts (figures 5 and 6), assembled on site with the ability to reuse the components upon disassembly, relocation or manipulation of the structure.



Figures 5 and 6: Flexible steel structure composed of modular parts

Lightweight cold-formed steel sections are ideal as a building material. The advantages are that this form of structure is lightweight, has a high strength-to-weight ratio, high stiffness and comes in various shapes and sections which can allow for additions and alterations with minimal wastage. The material allows for compact packaging (and transport) and can be mass-produced. "Accurate detailing can be achieved and the result is not prone to shrinking and creeping and thus achieves a uniform quality and is non-combustable" (Wei-Wen Yu, 1985, p.2).

Hydraform dry-stacking blocks have the following dimensions 120-240mm long x 220 or 140mm wide x 115mm high with typical strength values of 4-7MPa. This method is considered as infill in this project as these blocks are ideal for remote regions as they are produced on-site by means of a mobile

or stationary block-making machine. The interlocking dry-stacking blocks require minimal mortar and are produced from Laterite (building sand/sub soil) and 5-10% cement. Hydraform uses soil cement Compressed Earth Block (CEB) technology. Blocks do not need to be burnt and need a minimum of 7 days curing. Hydraform equipment is made locally and the franchise provides full training and support. Mobile block making machines need low-skilled operation with little or no dependence on higher skills. Thus it is labour intensive with almost all of the production and construction process occurring on-site. It is thus cost-effective and fast to use.

Finnbuilder box shuttering dimensions are 480 mm (length) x 220, 150 or 110 mm (wall thickness) x 240 mm high and allow for straight as well as circular walls. Finnbuilder is a slip form shuttering system whereby a shuttering mechanism is filled with the necessary cement, sand and aggregate mix and upon compaction is slid to the next area along the length or height of the wall/column. The main advantages are that it is produced on site, is labour-intensive, on-site soil may be used, low skills necessary, skills transfer and is thus a low cost-high strength option.

Brownbuilt is used as roofing or cladding material. The interlocking profile together with its clip-fixing require no fixing holes for screws or nails, thus eliminating the damage incurred to the sheeting by such holes and allowing it to be reused. Produced in widths of 406 mm the lengths are specified by client and only limited by transport (usually 18,6 m). The sheeting can be used in conjunction with other sheeting profiles by using the relevant flashings and is easy to construct.

Abeco hot-dipped galvanised lightweight pressed steel tanks are composed of prefabricated modular panels. These panels are used to erect tanks for water storage and are ideal for remote areas where access is limited and their small modular size and robustness allow for easy access and undemanding transport. Panel sizes are 1220 mm x 1220 mm or 610 mm x 1220 mm half panels produced in 3 mm, 4.5 mm and 6 mm thicknesses. Max depth restricted to 4 panels (4880 mm). Panels can be painted on by various children and artists belonging to the community helping establish community pride, deter vandalism as well as aid in corrosion resistance.

Only 3 types of fasteners, all 8 mm in diameter, are to be used on the steel structure reducing the need for a variety of fasteners and chances of error. These are hot-dipped galvanised, high tensile grade nuts and bolts, guard-nut tamper-proof fastening system (in accessible areas to prevent vandalism and theft), and galvanised gutter bolts.

Using these materials and technologies as the basis for the building parts, an adaptive system emerges, a system capable of reacting, growing, shrinking and learning. The steel structure undergoes a structural and programmatic evolution (figure 7), reacting to need and growth intensity. This prevents an initial high capital cost as well as allowing the layout to be tested by the users and then respond appropriately.



Figure 7: Evolution of modular steel structure

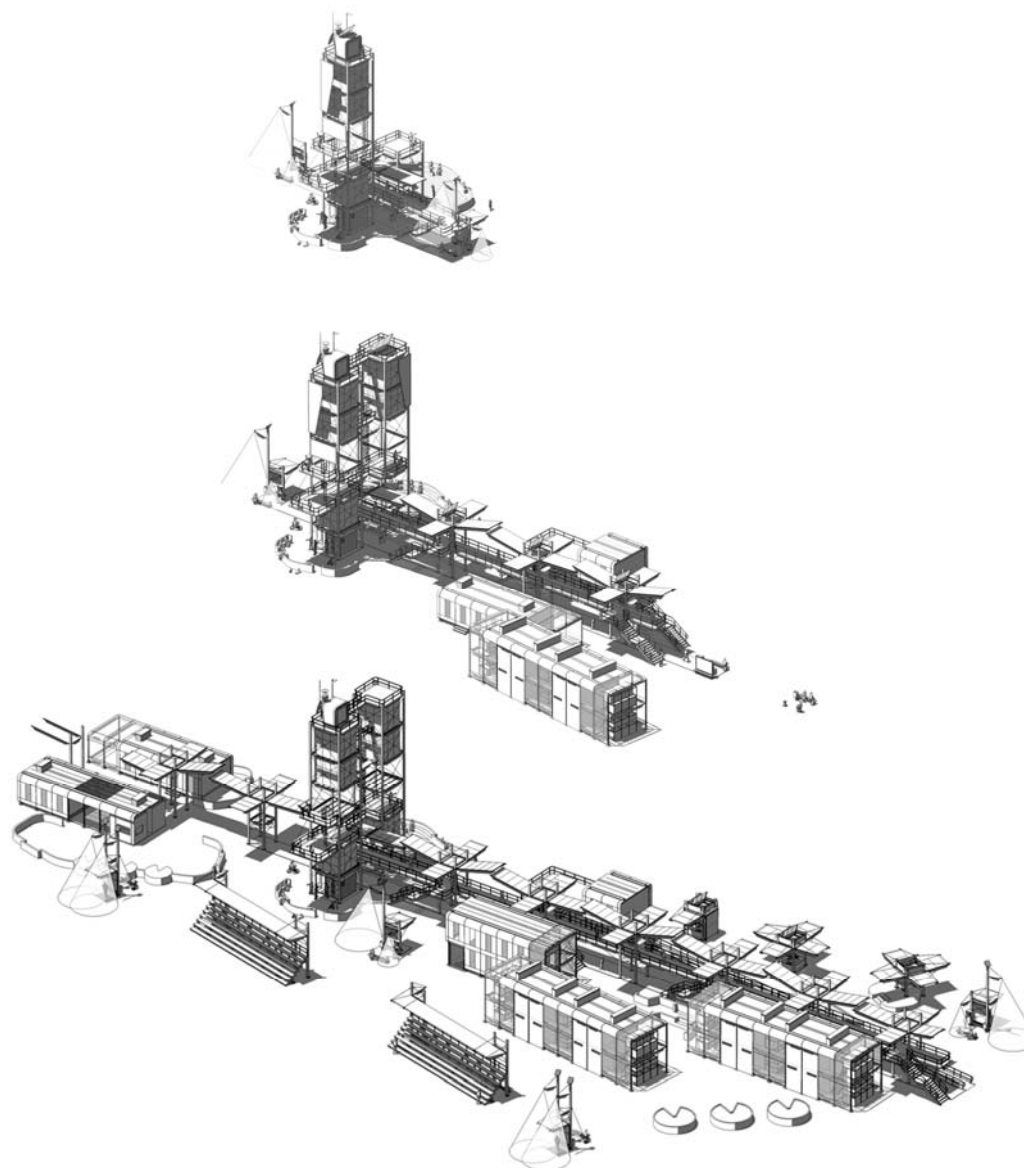


Figure 8: Phased growth of building system

8. Conclusion

For this proposed system to be successful, the community of Phumolong needs to be fully involved from the outset. A strategic site is crucial in establishing the service core as a catalyst, which will trigger off more activity and construction, either attached to the service core or in close proximity to it. The design intervention is limited by the willingness of clients to invest into such a project. However, as discussed above, the initial intervention need not be an immediate, large, capital-intensive intervention, but rather an ongoing process. Ultimately the aim of the servant core is to serve the community by providing the necessary services while acting as generator for social upliftment. In conclusion, the architectural approach encourages the design intervention to be treated as a process of progressive change.

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