

# Chapter 6 : Design Development

THE PRINCIPLE THAT EMERGED WAS SIMPLE.

DON'T INVEST IN BUILDING HOUSES THAT PEOPLE CAN DO IN ANY CASE FOR THEMSELVES AND COULD DO BETTER WITH A BIT OF HELP.

BUT RATHER INVEST IN THE COLLECTIVE GOOD THAT PEOPLE CAN'T PROVIDE FOR THEMSELVES.

NABEEL HAMDI

(Hamdi, 2010: 35)

STORAGE /RETAIL  
CONTAINER 1

PIONEER  
CONTAINER

TEMPORARY  
STRUCTURE  
BUILT OFF  
CONTAINER

BRICK STRUCTURE  
BUILT OFF TEMPORARY  
STRUCTURE

STORAGE  
CONTAINER 2

STORAGE  
CONTAINER 3

RETAIL SPACE CREATED

Illus: 98 A process of growth through temporality and permanence on-site (Author, 2011)

## 6.0.1 FORM FROM RESEARCH

Due to the inherent energies found in Mamelodi, traditional Architectural generators of form and programme were difficult to identify from the context. However, based on the themes uncovered in the process of engagement, a hypothetical 'spirit' of the intervention was rendered from the process.

This spirit of the intervention is intended to represent what, and how the intervention should grow and exist in order to respond to the dynamic and fluid nature of Mamelodi and thereby maximise the required level of appropriation.

These principles of genius are based on the positive factors discovered during the research process and the negative elements observed in various local precedents studied by the author during December 2010 (see Appendix Illus: 28 , on page 174).

## 6.0.2 GENIUS PRINCIPLES OF THE INTERVENTION

The intervention, while alien at first, is required to 'grow' within its immediate environment in order to allow the local context to witness and be part of this growth, further increasing the possible levels of appropriation. (see Illus: 100)

The intervention needs to embrace the mobility and flexibility inherent in Mamelodi, by responding through its own patterns of growth in a similar fashion.

The intervention needs to reach a point of symbiosis with its context and from this point begin to 'die', making way for future needs and unforeseen design challenges - leaving behind only a residue of necessity.

## 6.1 CONCEPTUAL STORYBOARD

The on-site research combined with the theoretical exploration of the themes derived from the research were explored in a small storyboard presentation for a film competition: (see Appendix Illus: 23)

*The film narrates the story of a character who finds himself in a foreign environment.*

*Seeking meaning and acceptance, the character begins to interact with the peoples he meets. Through this interaction the character grows through a series of trials and misfortunes, until he is finally accepted into this environment.*

*Unable to be truly accepted, the character leaves his place of comfort and while on a solitary journey of discovery, he begins to change and metamorphasize into something flexible and ever evolving, thus becoming a symbol of its context - in this case the South African township.*

## 6.2 TRANSITION OF STORYBOARD TO BUILDING

The story is a metaphor for the projected lifespan of the proposed building:

A structure was determined that arrives on-site, grows through engagement with its context and eventually moves away leaving behind elements symbolizing how its life on-site. (see Illus: 99)



Illus: 100 A conceptual image for the spirit of growth through temporality (Author, 2011)

THE STRUCTURE ARRIVES ON-SITE

IT BEGINS TO SEARCH FOR A CONNECTION WITH ITS IMMEDIATE ENVIRONMENT

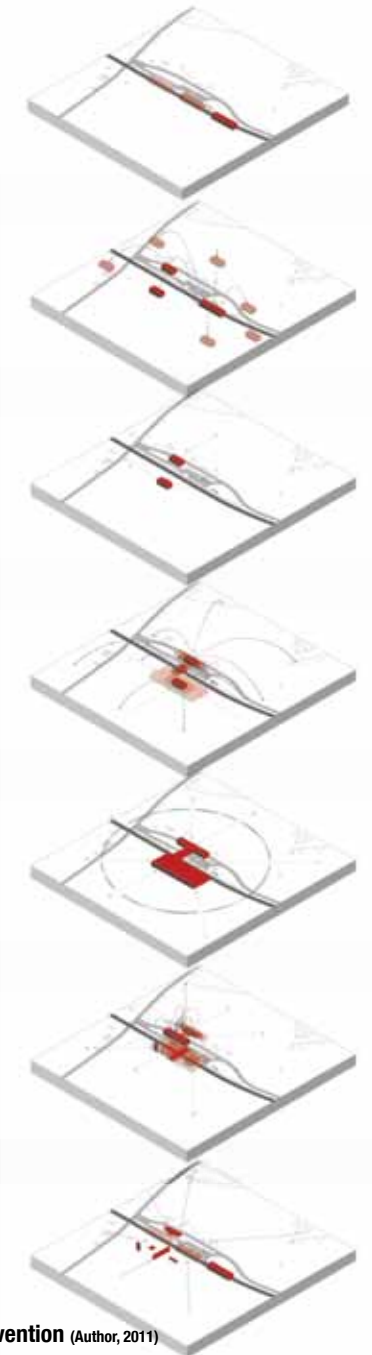
A CONNECTION IS ESTABLISHED

THE STRUCTURE BEGINS TO GROW THROUGH ITS ENGAGEMENT

A POINT OF EQUILIBRIUM IN GROWTH AND SYMBIOSIS IS REACHED

THE ORIGINAL FUNCTION OF THE INTERVENTION IS SUPERSEDED, IT BEGINS TO 'DIE' MAKING WAY FOR FUTURE NEEDS

ONLY A RESIDUE OF NECESSITY IS LEFT BEHIND AS THE LIFE CYCLE OF THE CONTEXT CONTINUES



Illus: 99 The spiritual principles of the intervention (Author, 2011)

### 6.3 PROGRAMME RE-INTERPRETED

A cement depot, subsidized by a coalition between the Tshwane Municipality and a cement supplier, was identified in Chapter 3.

The dissertation aims to re-examine a typical industrial facility's programmatic layout, and reinterpret it into the context of Mamelodi by separating the functions into the built fabric and allowing them to be re-linked through a central missing function. (see Illus: 102)

In this case the Infraset Cement Brick Factory in Midrand, Gauteng was analyzed and broken into its primary components (see Illus: 101). These components were then separated and local existing equivalents were found in Mamelodi. (see Illus: 104)

Storage and distribution of goods, mainly cement, has been chosen as the missing element in the de-centralised factory which was identified as a potential niche intervention in Chapter 3 (see Illus: 58). (see Illus: 106)

The schedule of requirement is then re-interpreted into factors of temporality and mobility in order to function in this context. (see Illus: 105)

### 6.4 AGENTS OF CONTROL

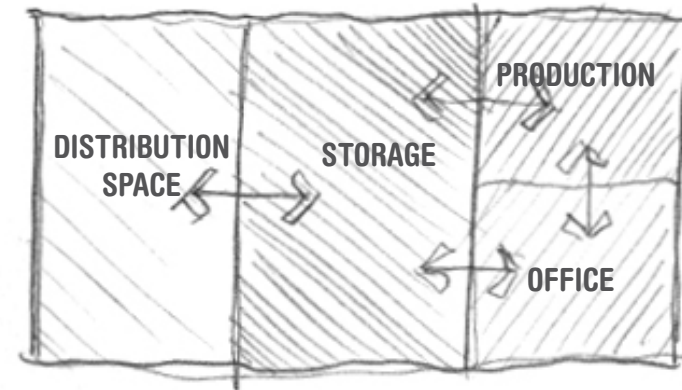
AfriSam is the most appropriate choice as central agent, as they are already involved in aiding the development through cement subsidies in Mamelodi.

As cement being the second most consumed material substance in the world, AfriSam have reason for developing a personal relationship with a developing areas like Mamelodi to establish an economic share of future business in such a fast growing area.

The City of Tshwane has already earmarked the site for major development as a key transport node for Mamelodi East. For this Spoornet and Transnet have been included as later agents of control. (see Illus: 103)



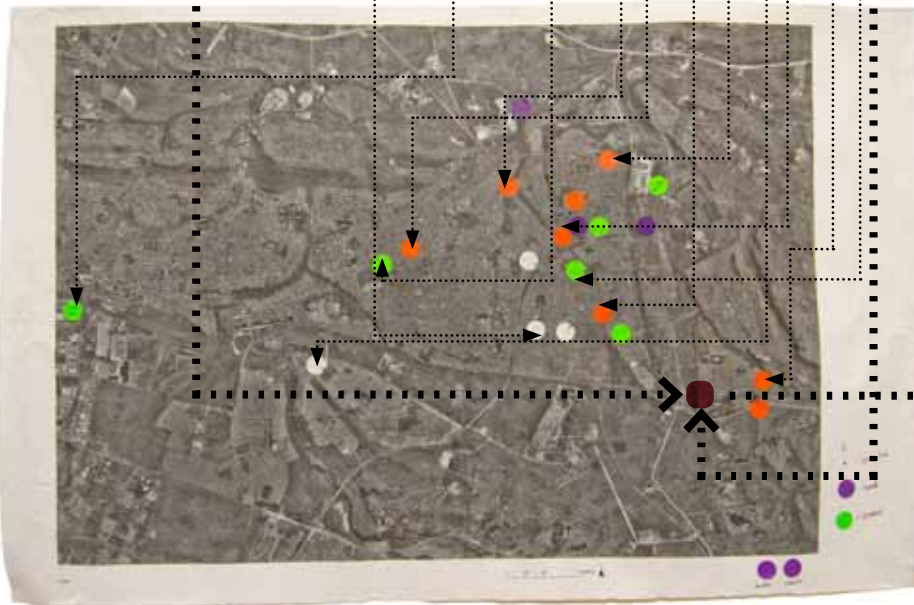
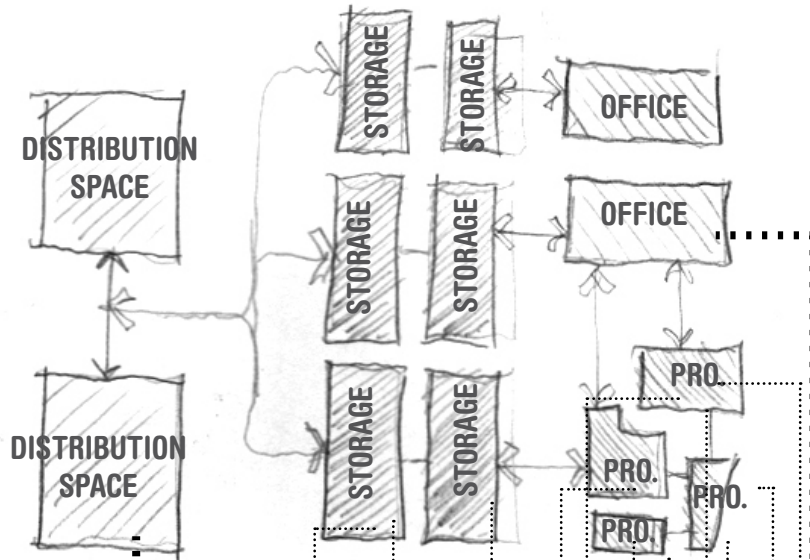
Illus: 101 The Infraset Cement Brick factory in Midrand, Gauteng (Author, 2011)



Illus: 102 Programmematic diagram of Industrial Building (Author, 2011)



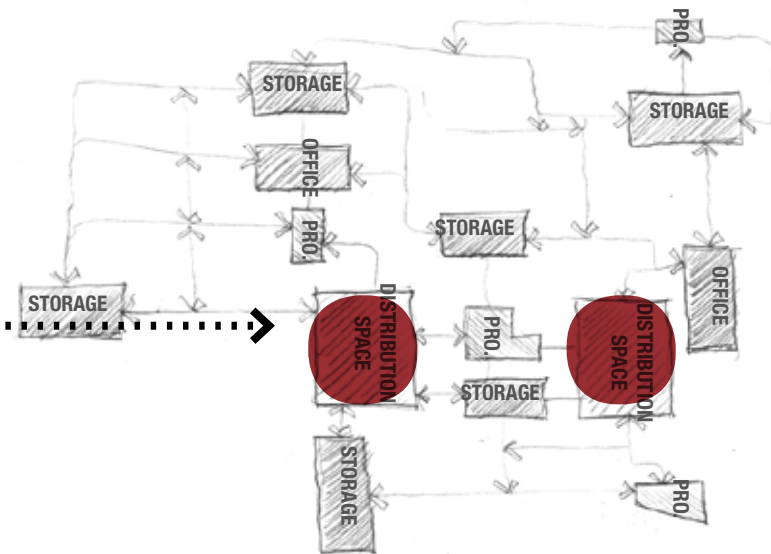
Illus: 103 Agents of Control (Author, 2011)



Illus: 104 A re-programming of the Industrial Typology into the Mamelodi Context (Author, 2011)

	HIGH MOBILITY	MEDIUM MOBILITY	LOW MOBILITY	TEMPORARY	SEMI TEMPORAL	PERMANENT
<b>DEPOT</b>						
COLLECTION SPACE	X			X		
DROP OFF SPACE	X			X		
STORAGE SPACE	X					X
MONEY EXCHANGE AREA			X		X	
TOOLS STORE			X			X
<b>TRAINING</b>		X	X		X	
PRODUCTION SPACE		X	X		X	
MATERIAL STORE			X			X
INFORMATION/DISPLAY AREA	X			X		X
LECTURE/TEACHING SPACE		X			X	
BREAK AWAY SPACES		X		X		
<b>RESEARCH</b>			X		X	
OFFICE			X		X	
<b>SHARED</b>			X		X	
FILE STORAGE			X		X	
RECEPTION	X				X	
MEETING ROOMS		X		X		
ABLUTIONS		X	X			X
<b>OBJECTIVES</b>						
SUPPORT OF CONSTRUCTION NETWORK	X				X	
CATALYST OF URBAN GROWTH		X		X		

Illus: 105 Re-Interpretation of Schedule into factors of mobility and temporality (Author, 2011)



Illus: 106 The warehouse typology in its new context, focussing on Distribution (Author, 2011)

## 6.5 CONCEPT OF FORM - THE PORTAL

Drawing from the process of participation and engagement, clues from the structures and materials in the context were analyzed and lessons drawn from each instance. (see Illus: 108)

What reoccurred in each form was the appearance of a 'portal' that was used temporarily until filled in a later stage. This portal structure allowed for flexibility of use while setting the demarcation of space for later stage at the same time.

It worked with temporary and permanent factors and by its placement responded to mobility in regard to the road networks and pedestrian paths.

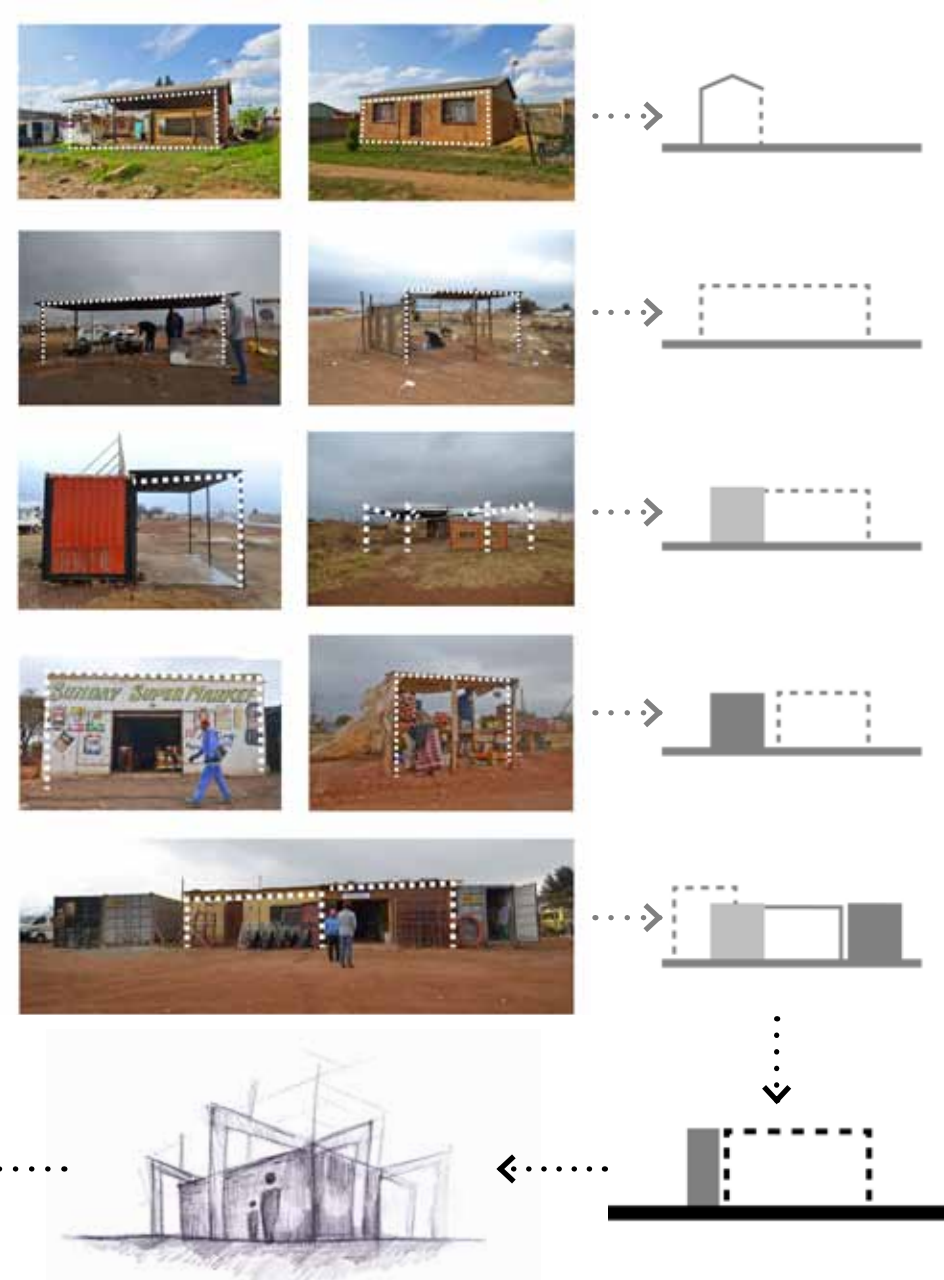
This portal became the conceptual tool from which to explore the idea of an organic de-centralised self-built factory. (see Illus: 107) If these components were then replaced with components on-site, a similar outcome could be reached with a different process and form. (see Illus: 109)

## 6.6 APPLYING THE PORTAL

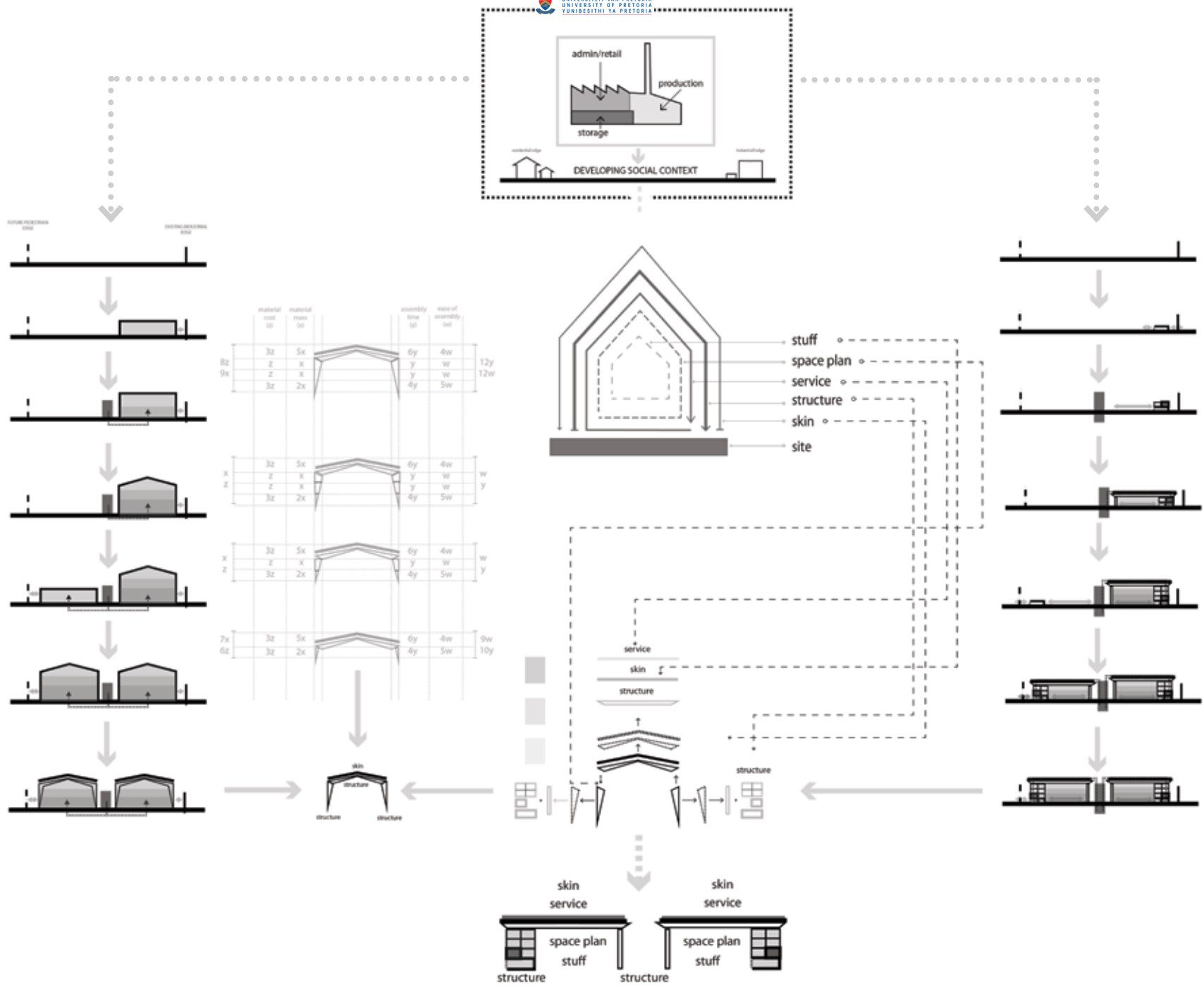
The factory typology was broken into its primary components of production distribution, storage and retail. The tectonics that made these spaces were then isolated and analyzed in order to understand the each element. This was then reinterpreted through Stewart Brand's definition of what makes up a 'building'.



Illus: 107 The 'Portal'. (Author, 2011)



Illus: 108 The process of research from where the portal emerged. (Author, 2011)



Illus: 109 The re-interpretation of the industrial portal through Stewart Brand classification of building elements. (Author, 2011)

## 6.7 ANALYSIS OF CONTEXTUAL ELEMENTS

In order to allow for an industrial building to grow by itself, the elements of growth needed to be clearly identified.

To facilitate this process of self-build, the elements from the context would need to be used efficiently to their maximum potential. (see Illus: 110)

### VERTICAL POINT PROVIDED ELEMENTS - GIVING LINE

**LAMP POSTS AND STREET SIGNS:** These elements displayed strong ordering principles, giving land-marked properties to area.

They lacked in examples of appropriation due to their social role in context.

### HIGH VOLUMETRIC SELF-BUILT ELEMENTS - GIVING VOLUME

**SELF-BUILT HOMES AND APARTMENTS:** Best examples of volumetric appropriation, responded to edge contextual issues and were the strongest element under consideration.

### LOW VOLUMETRIC PROVIDED ELEMENTS - GIVING PLANE

**GOVERNMENT SUBSIDIZED HOMES (RDP):** Worst examples of future appropriation and growth, difficult to attach to and gave only the basics of form for growth.

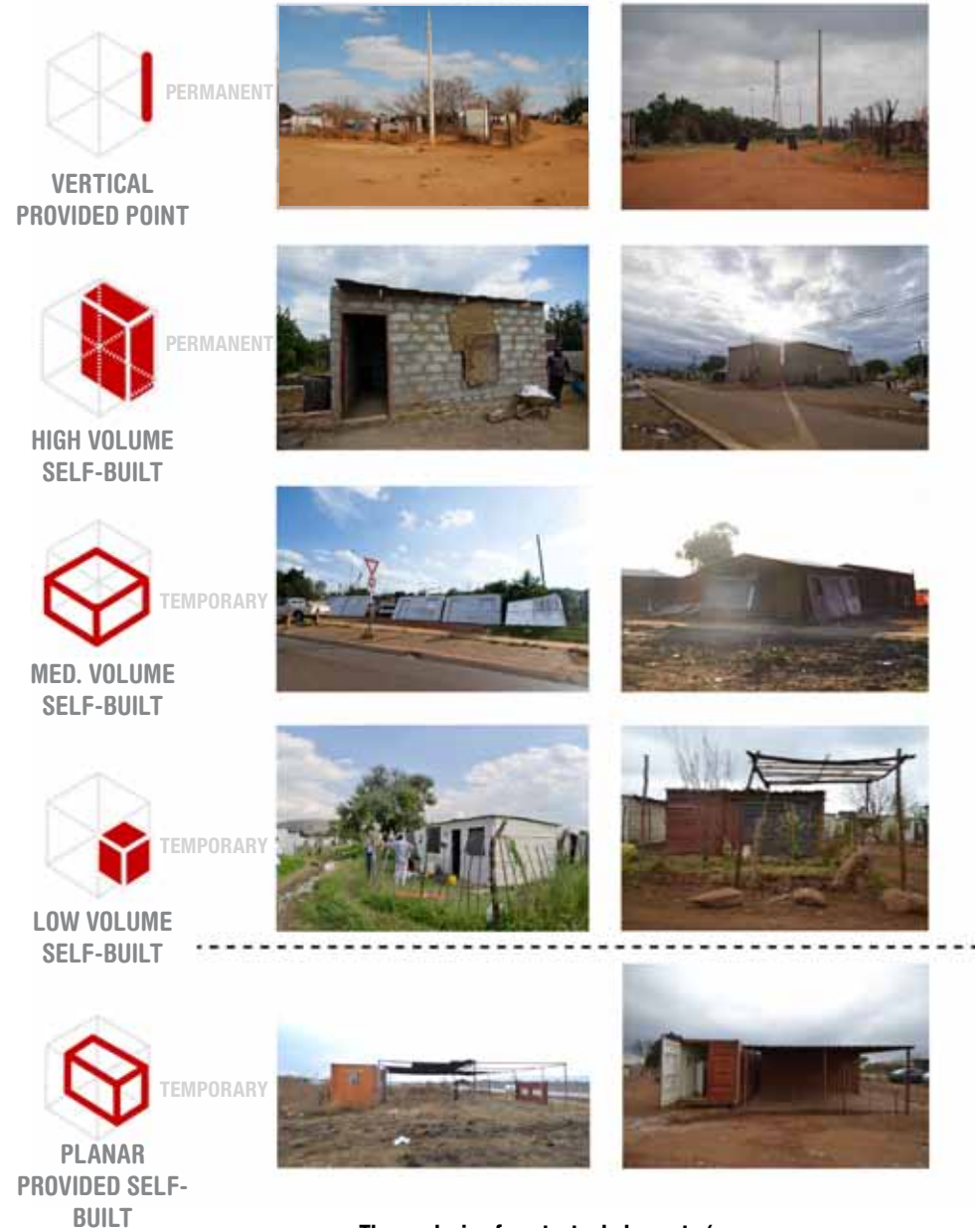
These elements did give some ordering principles by virtue of permanence.

### VERY LOW VOLUMETRIC SELF-BUILT ELEMENTS - GIVING VOLUME

**SHACKS/MOKHUKUS:** Strong example of self-built element, limited in verticality and ordering principles.

### LOW PLANAR SELF-BUILT/PROVIDED ELEMENTS - GIVING PLANE

**CONTAINERS:** Strong in ordering principles and gave a ready to use, easily maintainable and adaptable plane from which to appropriate.

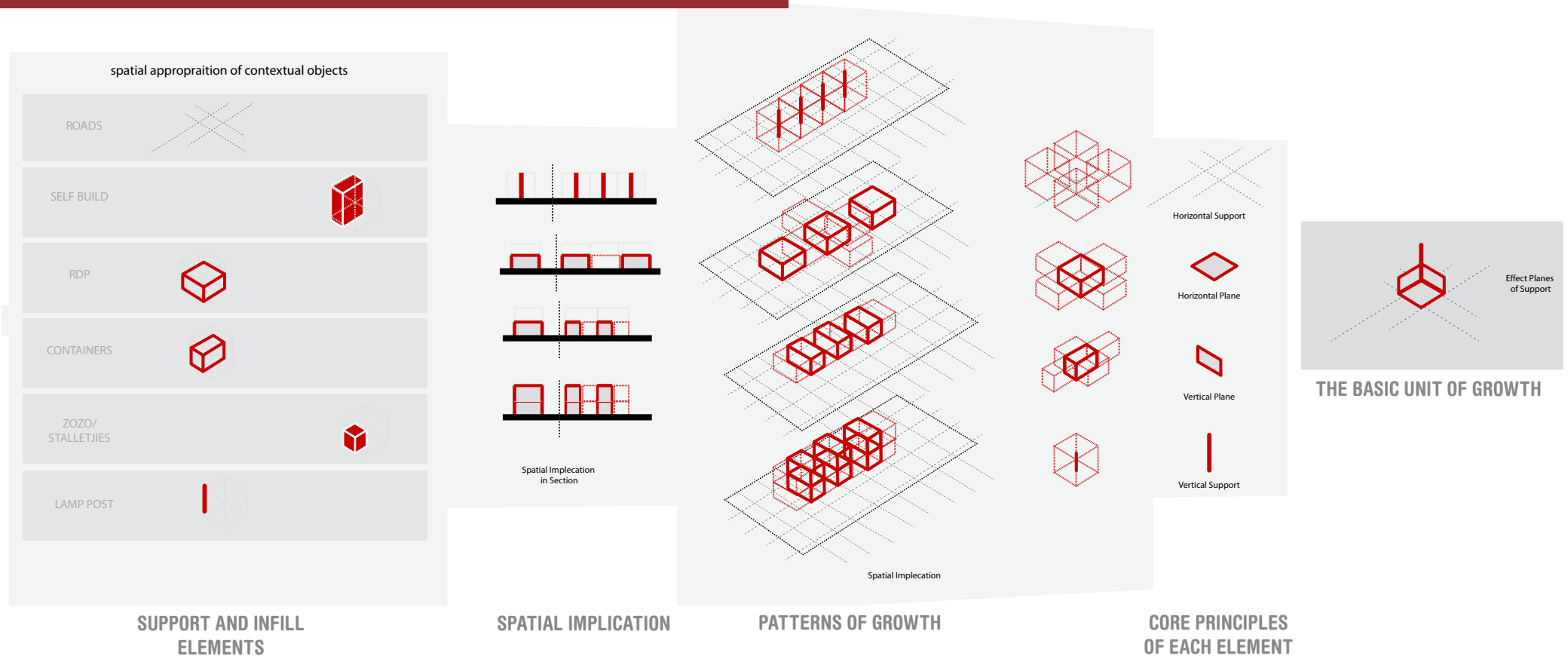


Illus: 110 The analysis of contextual elements (Author, 2011)

## 6.8 SUMMARY OF ELEMENT ANALYSIS

From the analysis of the patterns of growth that each element gave were explored to determine the most basic form from which to allow for a self-built structure.

This is summarized into two vertical planes (the corner) a vertical element potential (the point) and a large scale ordering principle (the grid). (see Illus: 111)



Illus: 111 An analysis of patterns of growth from contextual elements - culminating in the simplification of potential space (Author, 2011)



## 6.9 FACTORS IN SUSTAINABLE URBAN DEVELOPMENT

To allow the units of growth to develop in a positive and sustainable manner a structuring system is required.

This system embodies the proposed intervention and as previously discussed, will embrace the contextual patterns of growth while guiding this growth towards a more sustainable and flexible urban order.

Major issues in such developmental areas include:

### POTENTIALLY DANGEROUS LAYOUTS OF STRUCTURE WHICH MAY LEAD TO SHACK FIRES AND OTHER HEALTH RISKS.

Currently temporary housing, in the form of shacks, occurs un-serviced and unplanned where most needed. Typically these settlements are demolished and re-built when local government upgrades the area, effectively destroying the energy and spirit-of-place in the process. (CoT,2011:www.tshwane.gov.za)

To embrace patterns of growth, a system is required to guide developmental layouts and embrace temporal growth. This will maintain ownership on a holistic level while facilitating ground up construction and planning.

### UN-SUSTAINABLE SERVICE TYPOLOGIES: PIT LATRINES, COAL POWERED ENERGY, WATER FROM LONG DISTANCES ETC

While meeting the current needs of developing areas, the large scale future issues around resource use and provision should be addressed in order to add resilience to developing settlements.

### INADEQUATE STRUCTURAL TYPOLOGIES: BADLY INSULATED AND VENTILATED HOMES, LOW DENSITY STRUCTURES ETC

Due to economic and infrastructure availability of large scale machinery, buildings in developing areas generally do not grow higher than two metres. This is mainly determined by the maximum height a ladder-less person can reach in temporary housing and economic factors in foundations and structural member use.

In order to promote more efficient, denser structures, structural provision and support is needed, as well as a larger palette of material choice.

## 6.10 ADDING A STRUCTURAL, SERVICED ORDERING ELEMENT

Based on the research and on-site observations of the verticality provided point elements in the context, and the potential they offer for structural appropriation, they appear to be the most appropriate element to work with to promote the aforementioned principles for development. (see Illus: 113)

The pre-cast concrete lamp post are a stereotypical element in developmental areas as they are robust and elegantly simple elements of service provision.

These lamp posts present an opportunity to for designers to enhance its mono-function of illumination and with minimal changes convert them into a pioneering elements for participative growth in developing areas.

Although they are efficiently designed for mass production and simple light provision there is a fair amount of untapped potential in the engineering of the lamp post. (see Illus: 113)



Illus: 112 Vertical elements in developing contexts (Author, 2011)

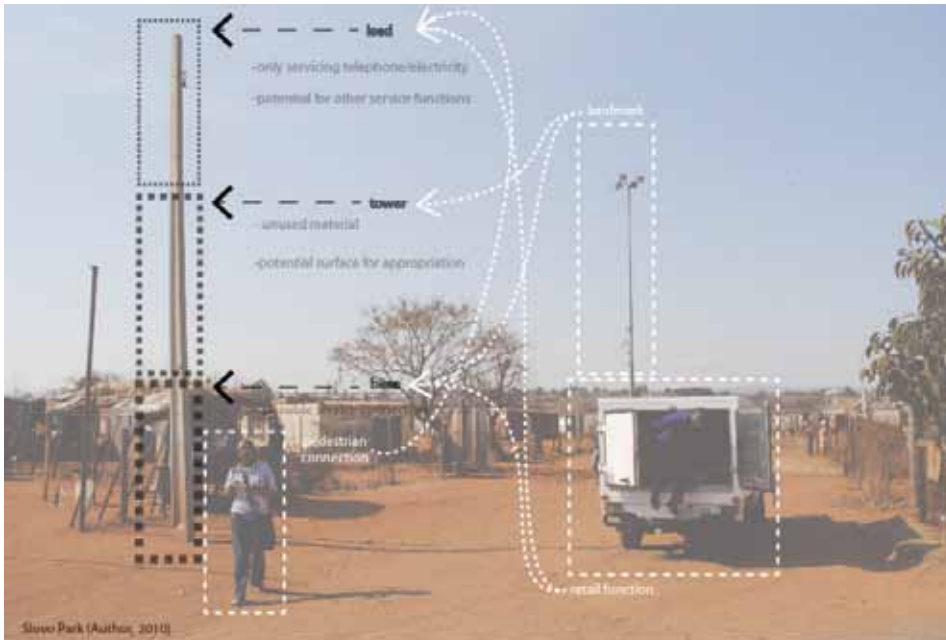
## 6.11 A VERTICAL ELEMENT OF SUPPORT

Light posts, electrical supports and street signs are the simplest urban infrastructural elements. By their inherent nature they respond to edge conditions and mobility routes as they provide lighting and unintentionally provide landmarked routes along these points.

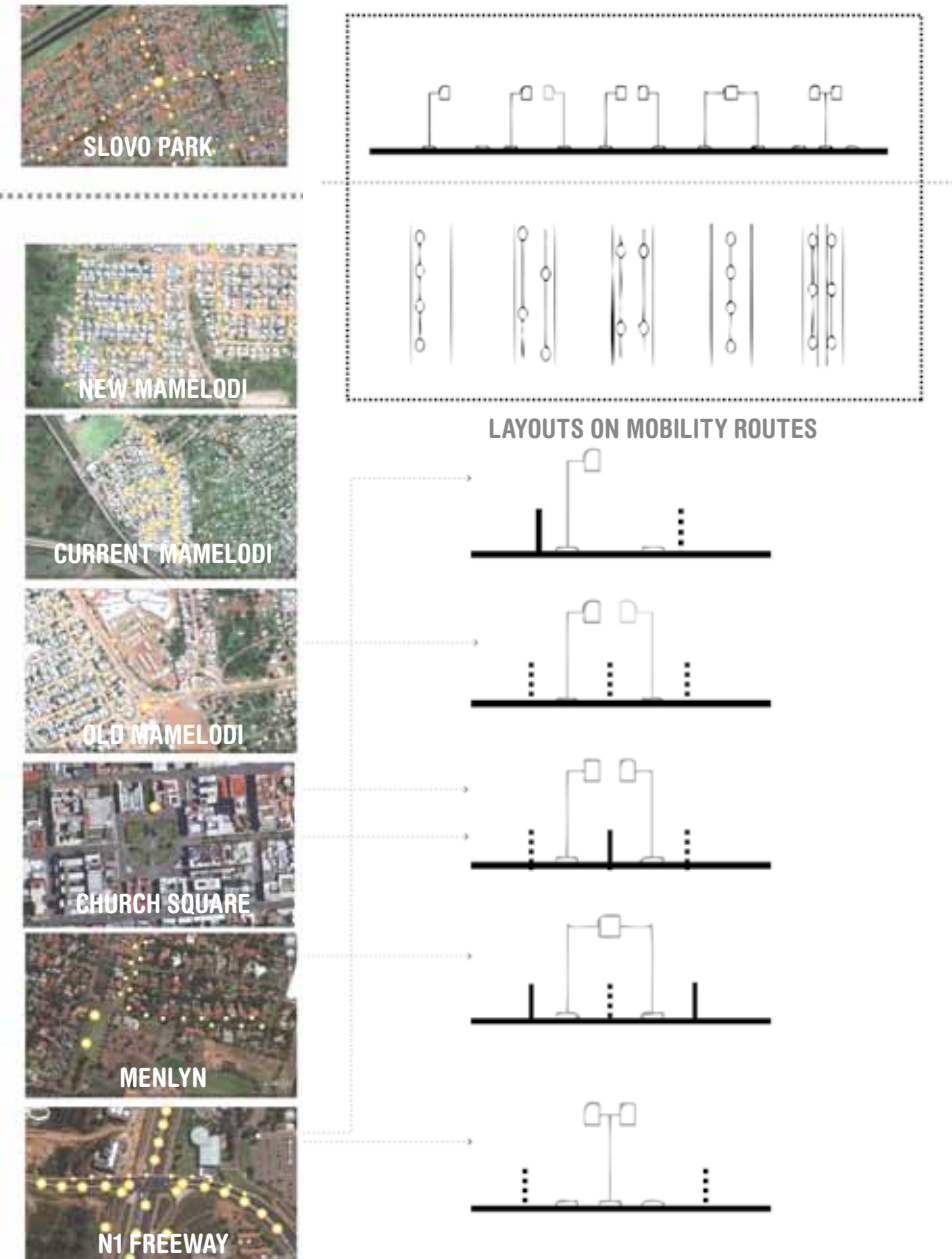
In developing contexts they are often the first elements to be added long before roads, water services or paving structures. In this way they are the ideal pioneers for developing contexts; surreptitiously guiding the urban grid long before other elements of infrastructure are considered. (CoT, 2011: www.tshwane.gov.za)

Although there is a negative stigma around the social role of the lamp posts during the apartheid era as control elements, they simultaneously provide protection by illumination at night, a large safety factor in developing areas.

Lamp posts layout and design is generally loosely arranged depending on the conditions of the mobility routes below, (see *Illus: 114*) thus making the lamp post the ideal component for a structural, serviced ordering element. (CoT, 2011: www.tshwane.gov.za)



Illus: 113 Analysis of potential in vertical element of support, service and structural ordering (Author, 2011)



Illus: 114 Analysis of Lamp post layout and edge response (Author, 2011)

## 6.12 DEVELOPMENT OF THE VERTICAL SUPPORT

The integration of the social and developmental potential of the typical pre-cast concrete lamp post necessitate small changes to the lamp post pole and its legislature. This will allow the pole to perform its typical function, while simultaneously facilitating major social and developmental changes.

A legislative change will have to be made first, to adjust the road reserve boundaries. (CoT,2011:www.tshwane.gov.za)

The reserve does not acknowledge the current condition of street retail and subsequent pedestrian movement experienced in developing areas. (see Illus: 115) h

A new road reserve limit is proposed using the lamp post to guide and demarcate this. (see Illus: 116)

### LIFTING

An analysis of the principles of cranes and lift revealed the basic principles inherent in mechanical lifting. (see Appendix Illus: 14 , on page 165)

By including an arm element into the structural diagram of the lamp post pole, then stabilizing this arm with which stays back to the base the pole could be used as a lifting device enabling self-build. (see Illus: 117) - A)

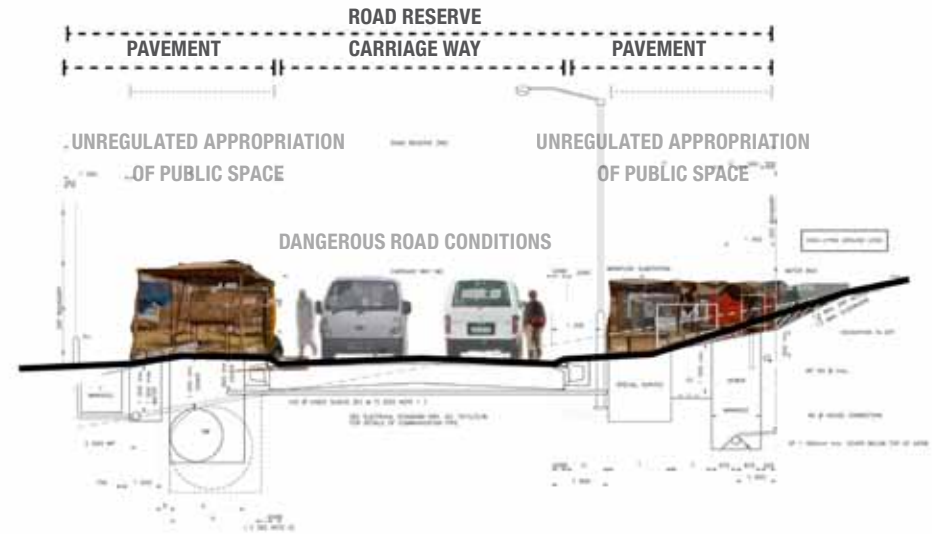
### POINTS & PLANES OF APPROPRIATION

By changing the manufacture of the lamp post pole and allowing for points of connection the pole can be used to support secondary structural growth, converting the pole into both an infrastructural and a service piece. (see Illus: 117) - B)

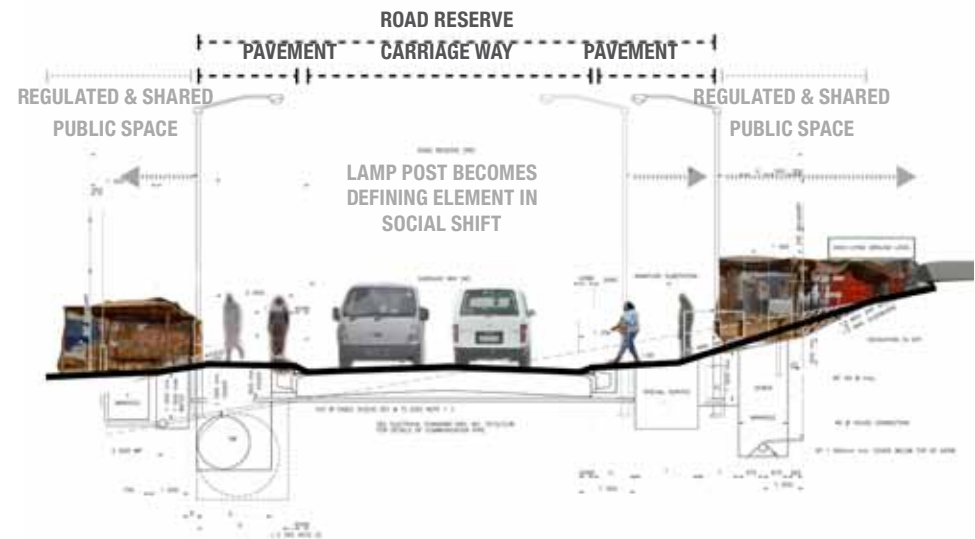
### ORDERING SYSTEM OF GROWTH

If this new unit is supported by a system of similar lamp posts in sequence, being pioneered by more serviced poles supporting less serviced infill poles, the structures can begin to guide development in areas. (see Illus: 117) - C)

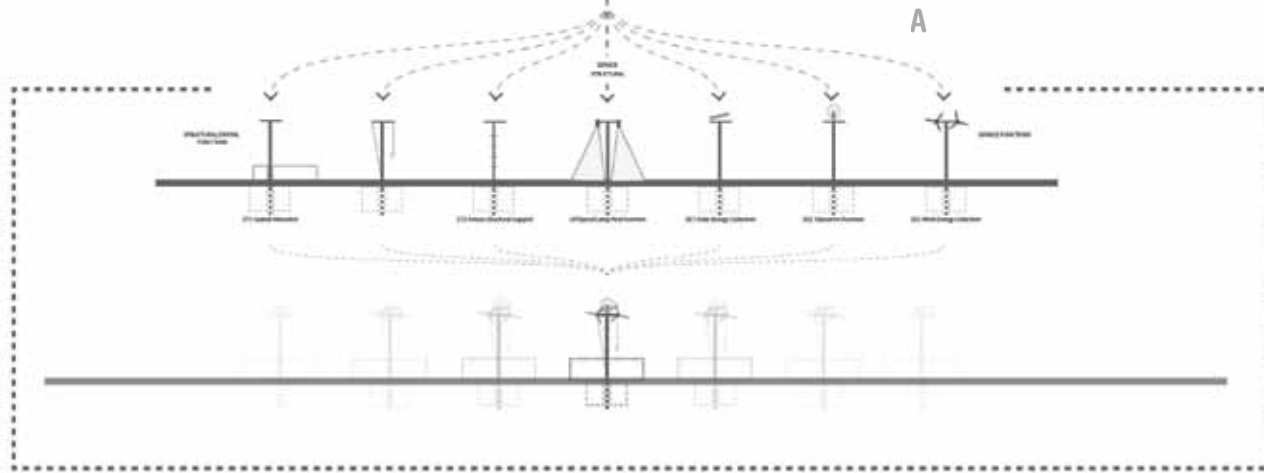
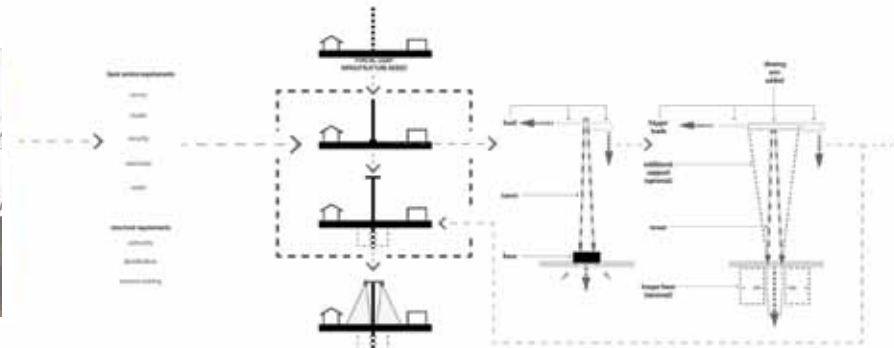
This allows the role of the lamp post-in the development process-to support and guide the growth of the various players in the Mamelodi context. (Illustration 111 - C)



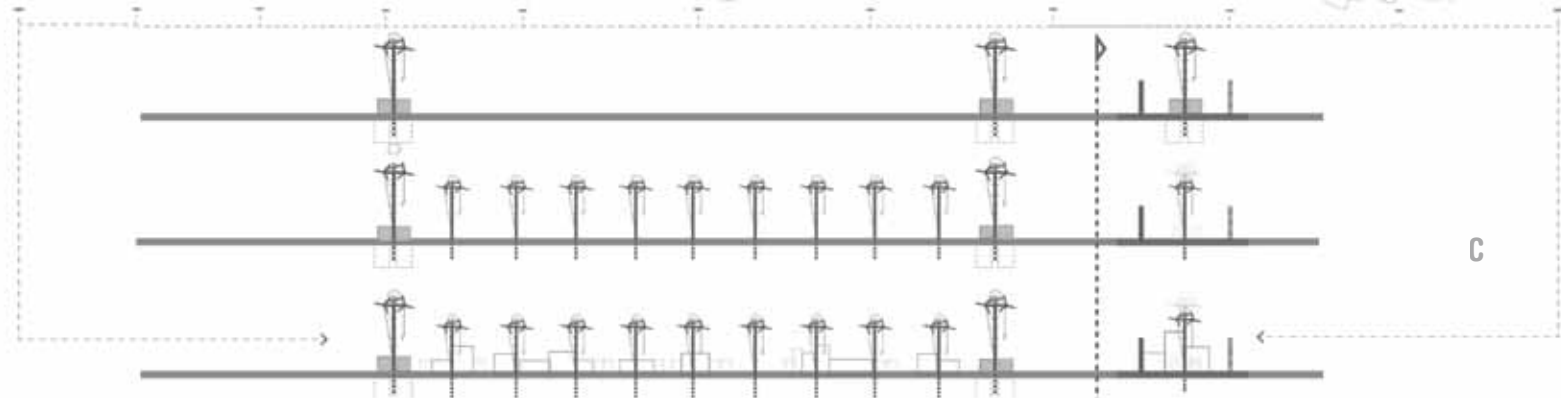
Illus: 115 Current condition brought on by road reserve limit, creating potentially dangerous scenarios (Author, 2011) (CoT,2011:www.tshwane.gov.za)



Illus: 116 Proposed adjustment of road reserve boundaries using lamp posts as ordering elements (Author, 2011)



B



C

Illus: 117 Re-configuring the pole towards service and infrastructural development (Author, 2011)

## 6.13 A UNIT OF APPROPRIABLE GROWTH

During the process of exploring various options of support and infill to generate an appropriate unit of growth, it became clear that the key was discovering which half of the support was required to allow for an appropriate infill.

By applying the rules determined in (see Illus: 110) the spatial diagram was further tested through several iterations explained in the appendix. (see Illus: 118)

It became an exercise in determining which parts of the element would be either the point, line, plane or volume, and how much of this element needed to either be support or infill, in order to create a form giving space. (see Illus: 118) - A)

The minimum element of form-giving space was determined to be three planes i.e. two vertical and a horizontal. (see Illus: 118) - B)

With the ground plane being a given horizontal it was seen that this corner element gave form to a system of triangle on various planes as directional and spatial drivers. (see Illus: 118) - C)

## 6.14 MULTIDIRECTIONAL-MULTIPLANAR UNIT

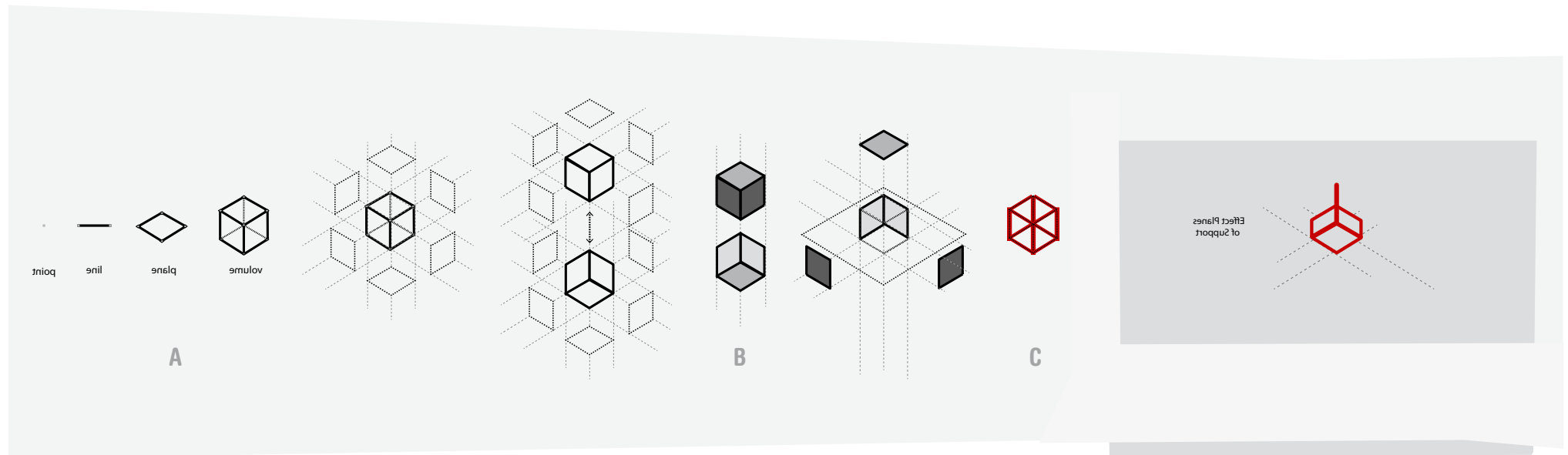
Through a historical and locally contextual exploration of these various planes, point and lines as drivers of form and grid organization, a unit of growth was determined. This resulted in the most appropriate multi-adaptable and flexible system derived from the process. (see Appendix Illus: 27 , on page 174)

The chosen form is based on the lamp post and its vertical role in place-making, form-giving and social function in the context, as discussed earlier. (see Illus: 119)

The pre-cast concrete lamp post is then modified to work as a structural and service element while maintaining its lighting function. (see Illus: 171 , on page 140)

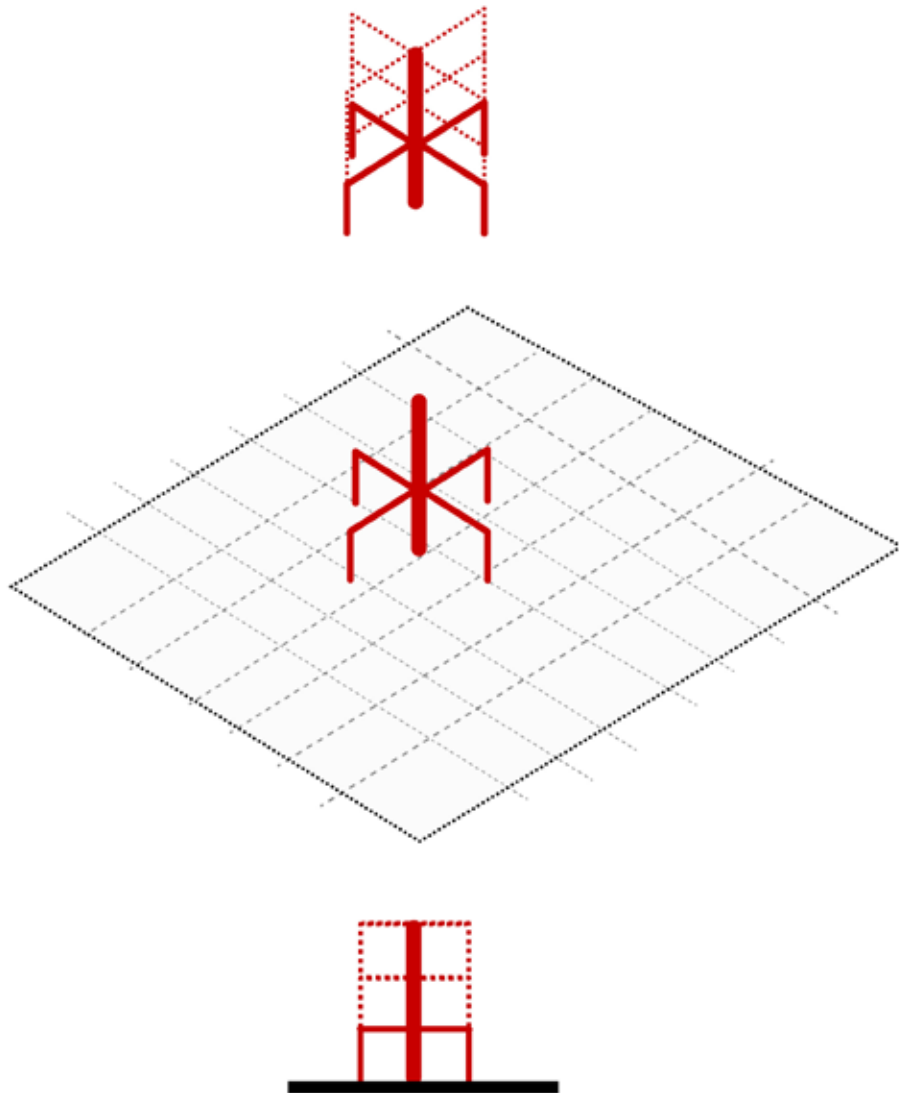
The form would be given with a minimum of two arms as a starting point, and depending on the required need, context and available energy, these elements could have pieces added as required, horizontally and vertically.

The lifting mechanism discussed earlier allows for the future occupant to grow the unit with the standard pieces, as well as speciality structural elements. (see Illus: 120)



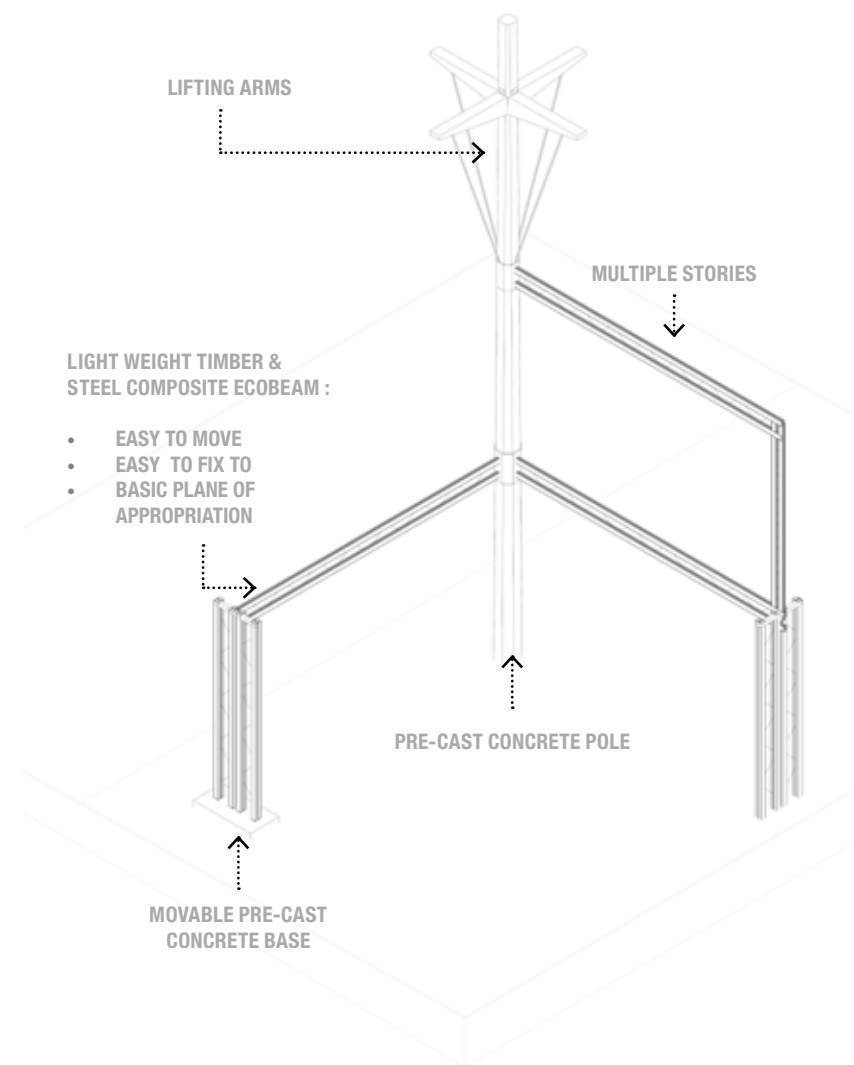
Illus: 118 Spatial exploration of point, line, plane and volume to determine spatial support and infill unit (Author, 2011)

## MULTIPLANAR, MULTIDIRECTIONAL UNIT OF GROWTH



Illus: 119 The multi planar multidirectional unit (Author, 2011)

## UNIT OF GROWTH



Illus: 120 The unit and its secondary structural and service pieces (Author, 2011)

## 6.15 RATIONALIZATION OF FORM

Structurally, the form is driven by the need to lift building elements heavier than human-lifting allows, in order to create stronger structures that allow for larger services and facilitate relatively easy vertical growth without disrupting ground level development.

By examining the deflection diagram of the typical concrete pole, the introduction of supports at various levels provides lateral support as well as space for planar appropriation. (see *Illus: 121*)

The octagonal profile was derived from the need to work in a full 360 degrees of options, but still direct growth in a controlled form. (see *Illus: 121* - A)

When tied down with a slew arm introduced, the unit can become a lifting piece, able to adapt as the user requires. (see *Illus: 121* - B)

When these units are placed in sequence they can synergistically create a larger building more flexibly and more in sync with the fluxual rhythms of the context than traditional large scale buildings. (see *Illus: 121* - C)

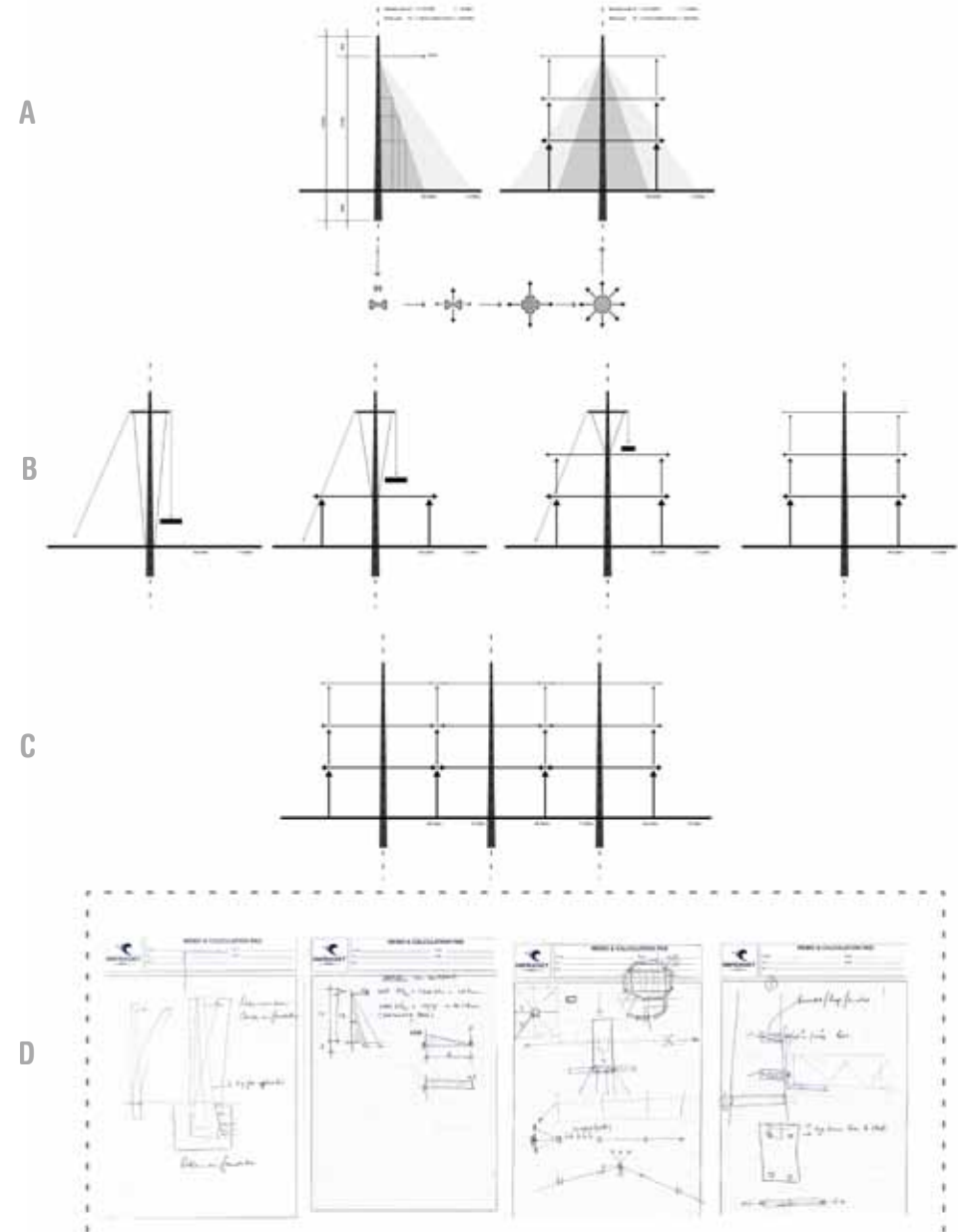
The form is primarily determined by the manufacturing process, as this element is included in any infrastructural pre-cast concrete manufacturing company's arsenal of products. The modifications were made under consultation with the engineer at Infraset's manufacturing plant. (see *Illus: 121* - D)

## 6.16 PROJECTED PATTERNS OF GROWTH

This system of growth embraces the spirit of place explained at the beginning of the chapter while still facilitating sustainable and ordered developmental growth.

While working with all contemporary methods of infill seen in the context the system provides autonomous and sustainable resources in energy and water collection. (see *Illus: 122*)

By creating the platform for engagement with the local municipality and the public realm, development can begin to grow from the ground up while still meeting the standards and resource use of more traditional buildings as seen in (see *Illus: 123*).



**Illus: 121** Structural resolve of element - Engineer notes supporting form, profile and lifting device (Author, 2011)



Illus: 122 Projected patterns of growth (Author, 2011)



Illus: 123 Rendering of possible manifestation of unit in context with structural and service components of unit (Author, 2011)



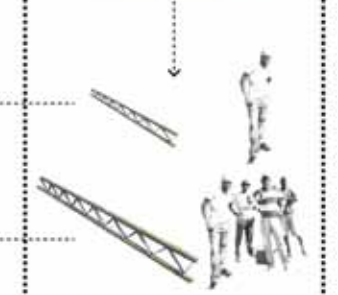
NIGHT TIME SECURITY



ELECTRICAL SUPPLY IN MICRO WIND TURBINE



ELECTRICAL SUPPLY IN SOLAR PV CELL



TIMBER AND STEEL COMPOSITE ECO-BEAM CHOSEN DUE TO WEIGHT AND EASE OF FIXING





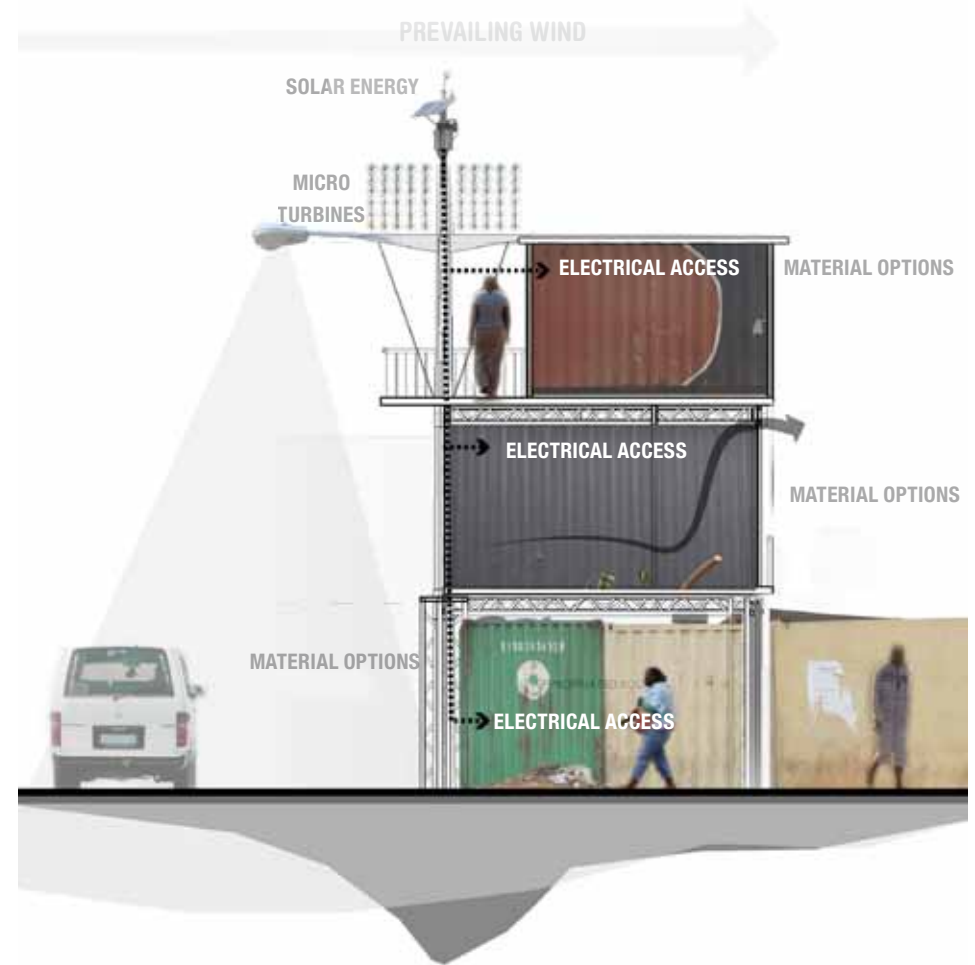
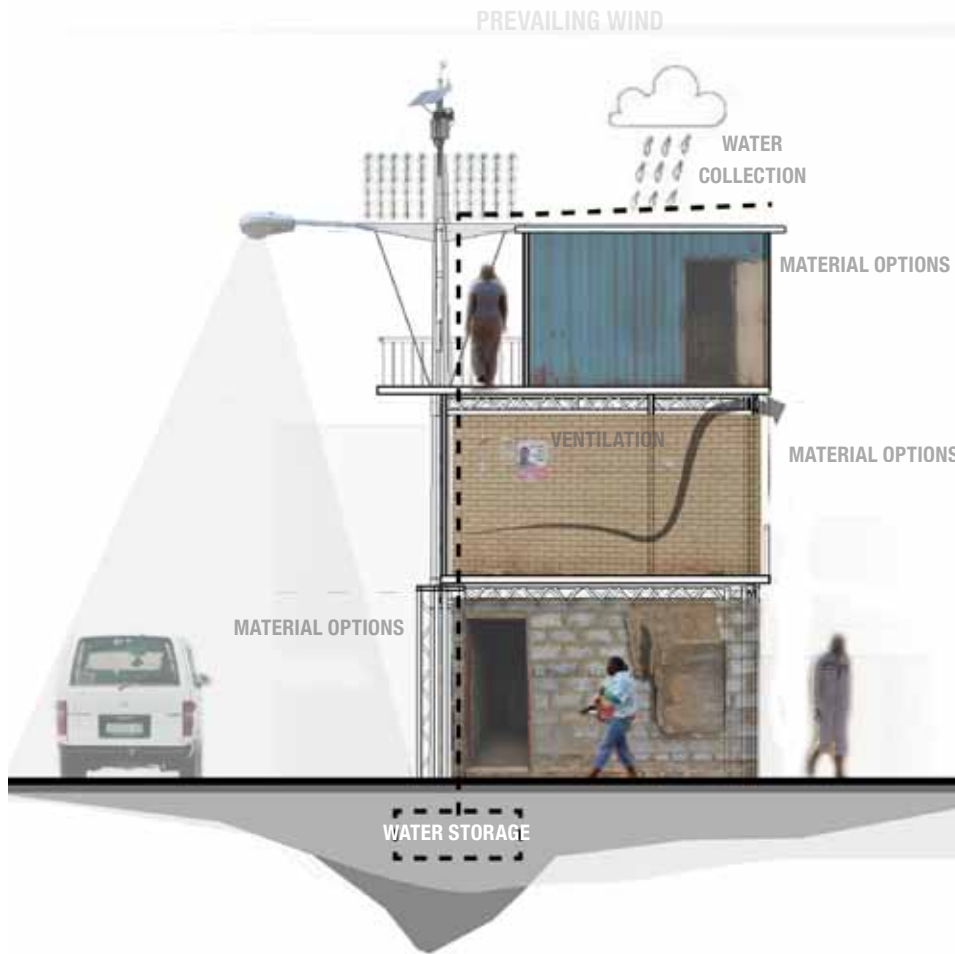
Illus: 124 Patterns of projected growth, ordering principles that allow for mobility routes and public infrastructure (Author, 2011)



Illus: 125 Patterns of projected growth, ordering principles that allow for mobility routes and public infrastructure (Author, 2011)



Illus: 126 Patterns of projected growth, ordering principles that allow for mobility routes and public infrastructure (Author, 2011)



Illus: 128 Analysis of potential in vertical element of support, service and structural ordering (Author, 2011) Illus: 127 Depicting the various material, service and programmatic options in the unit (Author, 2011)

## 6.17 CONTROL OF UNIT

The unit is intended to be shared by public retail ventures and owned by the local municipality.

Access to service and structures would be monitored and maintained by municipal officials, the agents of control. Each addition beyond certain scales would be regulated through the local municipality. (see Illus: 129) - A)

In developing contexts such as Mamelodi, the street and its edge become the major retail area as it is the most public space. Centralised retail venues, as seen with the failure of Max City Shopping Center, do not appear to work in environments such as Mamelodi. (see Illus: 129) - B)

Any individual or group could then buy units, and combine to allow for larger retail options in the form of co-operatives.

These agents of ownership could then rent out the spaces between the more vulnerable members of the context, thus creating a hierarchy of ownership and control of the public realm. (see Illus: 129) - C)

## 6.18 APPLICATION TO SITE - PIENAARSPORT

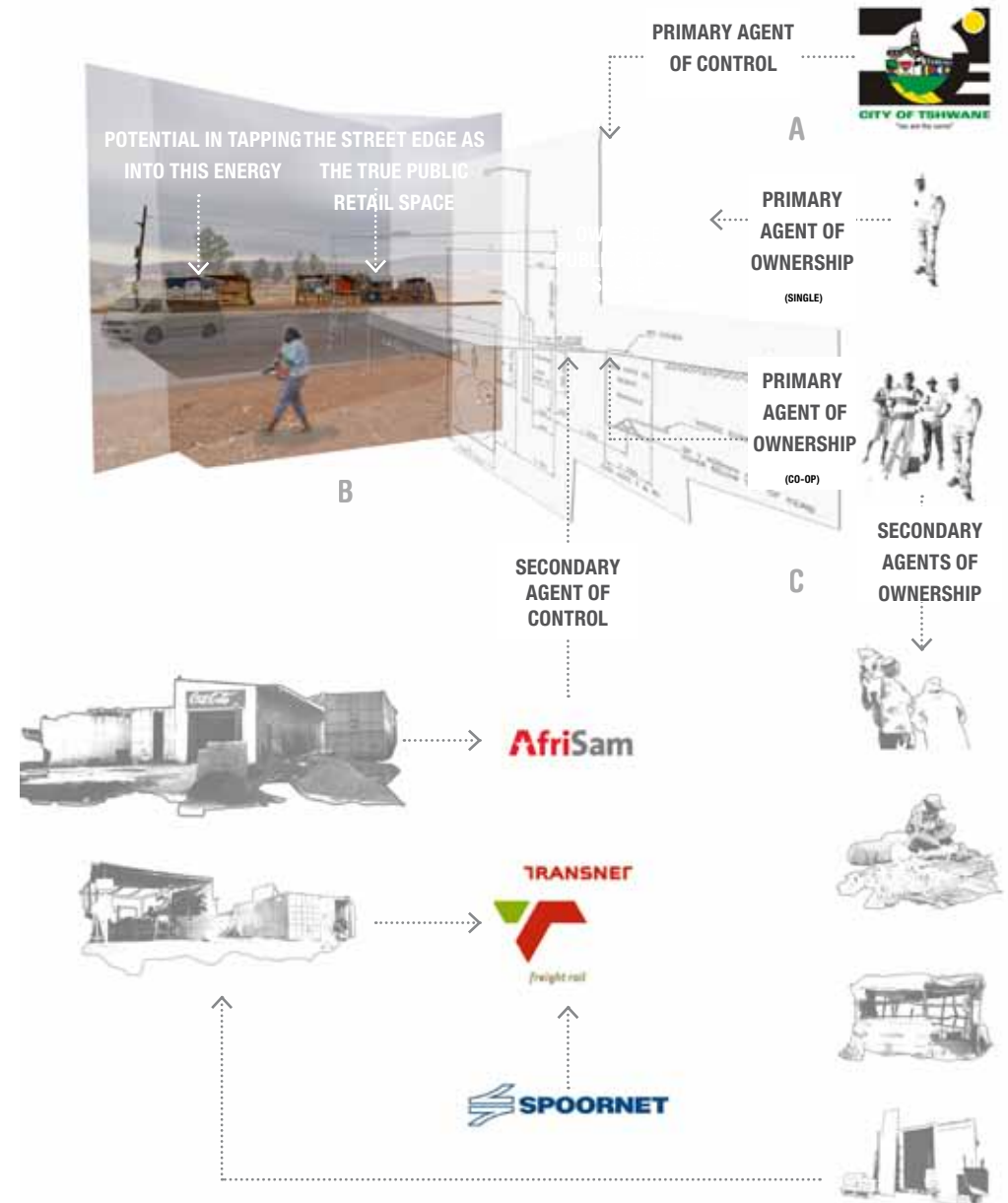
The unit is designed to work in any developing context, to test its potential the unit is applied to develop the Pienaarspoort Station Precinct.

As the current conditions reveal clues to the contextual requirements, a future for the site needs to be speculated and types of projected growth to be explored.

A set of 'rules' and principles of growth will be set down for the exploration, these being based on the on-site research and analysis of the context.

Cement retail and use has been chosen as the factor of development based on the findings of the contextual research. (see Illus: 58 , on page 56)

Working with cement use over a period of time and looking at previous patterns of growth, the project has been broken up into 5 phases. (see Illus: 130)



Illus: 129 Systems of control, ownership and growth facilitation (Author, 2011)

## 6.19 PHASES OF PROJECTION

**EARLY PHASES** - these phases reveal the intimate steps in the growth, and depict the flexibility of the unit in the process of support and infill of its placement.

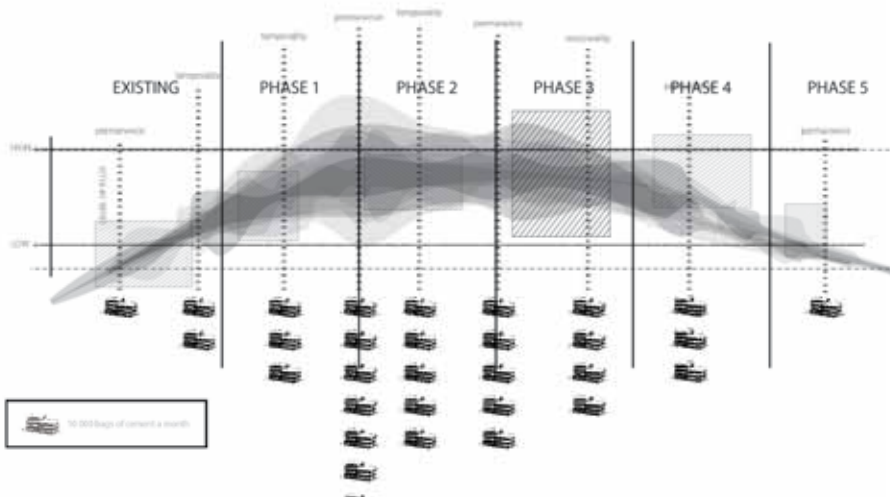
**PHASE 1** - Independent cement retailers mixed with other retail forms use the structures.

**PHASE 2** - Cement retailers form a consortium and get assistance from Afrisam.

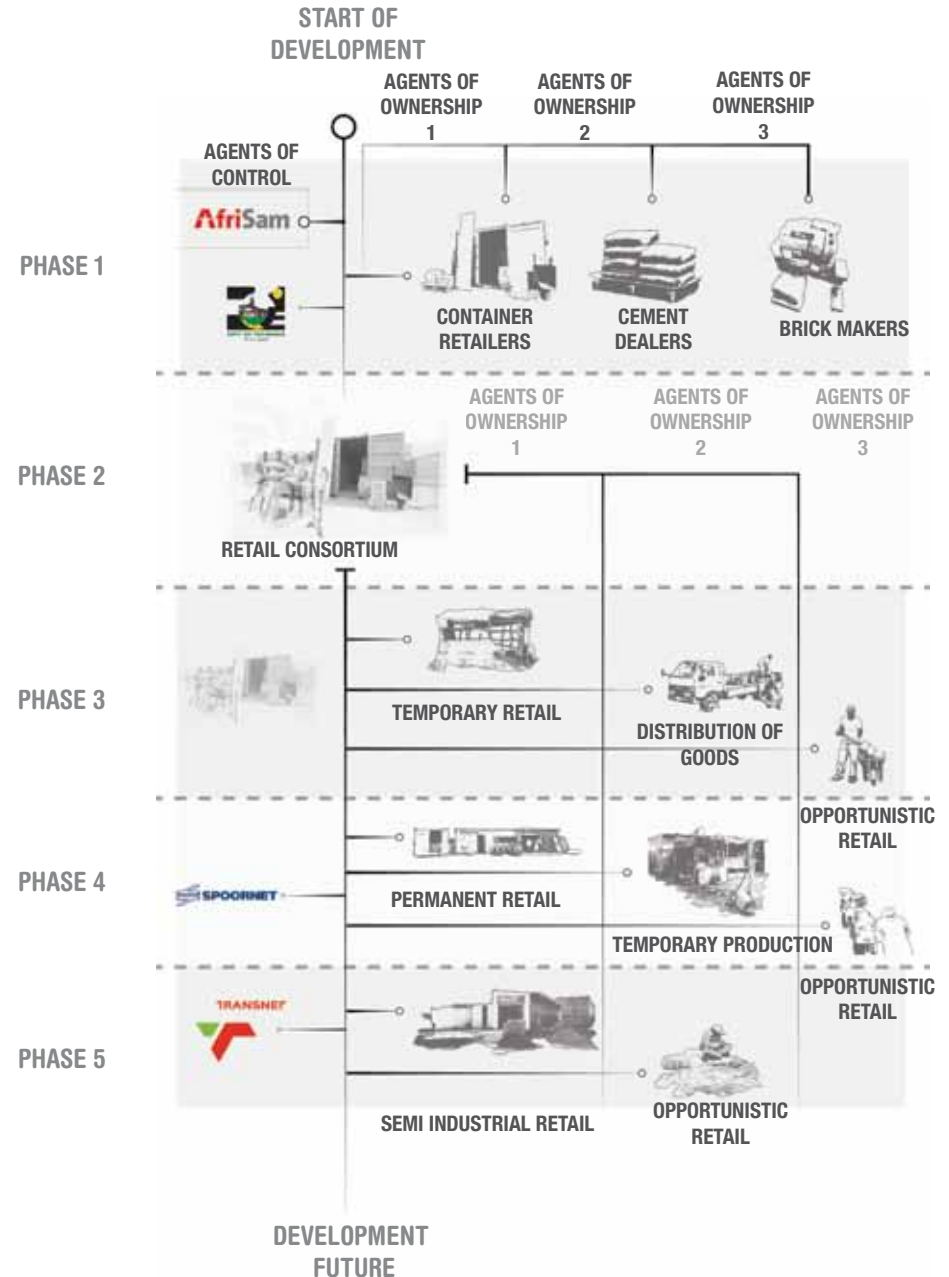
**PHASE 3** - Fueled by the cement distribution and collection, the site has become a larger retail depot for any consumable goods required in the area.

**PHASE 4** - Cement trade has died down, but the precinct has grown into an important retail and transport hub.

**PHASE 5** - The precinct has become the major transport station for the east linking to the transport interchange planned by the City of Tshwane and GAPP.



Illus: 130 Phased development based on cement use (Author, 2011)



Illus: 131 System of control and ownership during the development (Author, 2011)

## 6.20 NODAL GROWTH DEVELOPMENT

The placement of the lamp post units is intended to work with the typical procedure in placing infrastructure; that a series of lamp posts are placed by an appointed team, in sections at a time in an identified area.

The process will work in the same way, but varying in that two larger serviced public infrastructural pieces such as a public ablution, mobile clinic station, police unit or library will be placed first, as these are elements that the municipality is currently providing. (see Illus: 133)

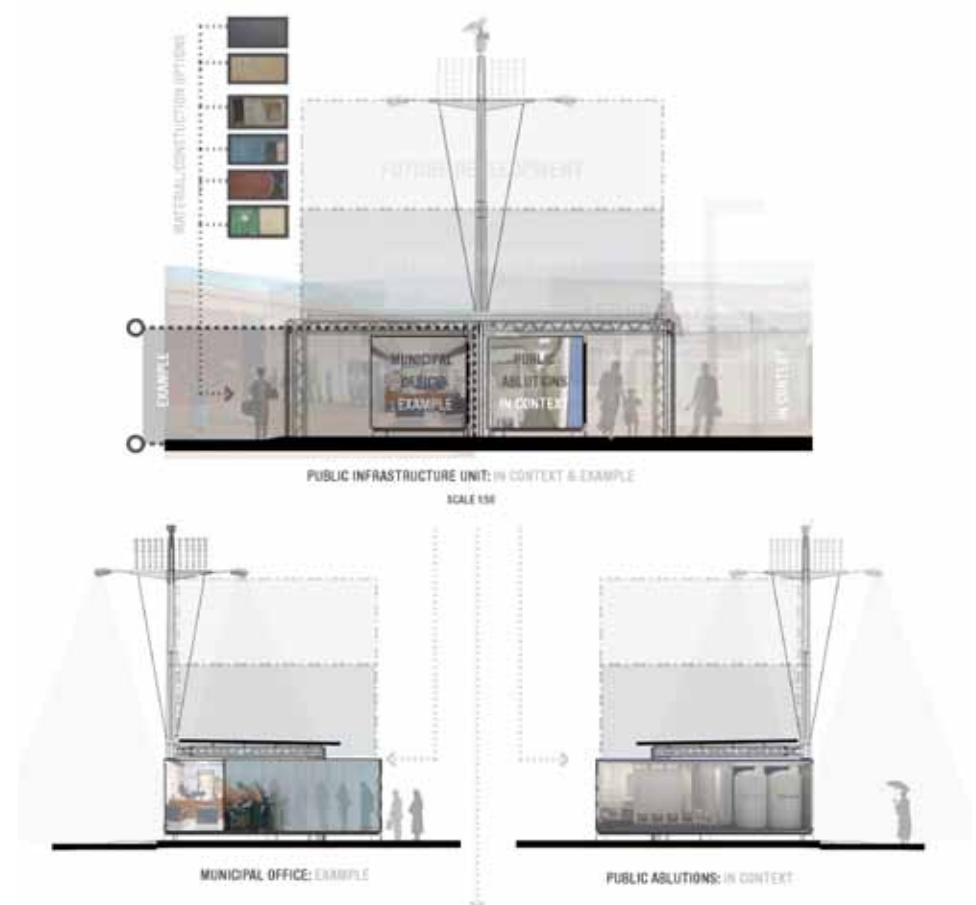
These larger infrastructural pieces would act as catalyst prototype pieces. Once they have been accepted by the immediate context and a relationship has been established, the infill pieces would then be added. These less serviced infill pieces would then be sold out to interested parties. (see Illus: 132) - A)

This process would continue as each unit begins to affect the next, until the precinct develops along the retail edges. (see Illus: 132) - C)

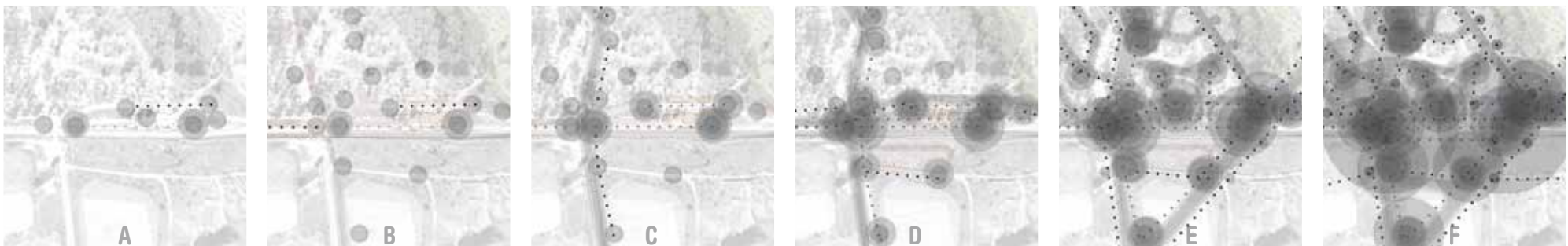
During this process of growth government, NGO's and private investors would intervene where needed, affecting growth, responding and reacting to the life of the building.

This process of development allows growth from the ground up, while embracing the energy of the context from the beginning of the intervention. (see Illus: 132) - F)

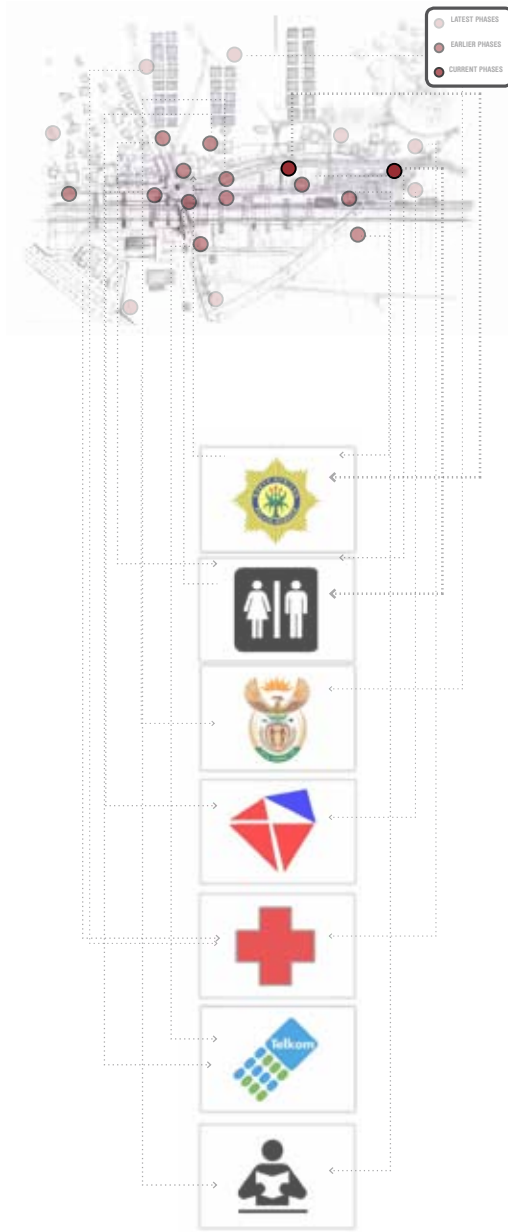
Responding to current edge conditions, (see Illus: 134), the growth patterns facilitate future edge conditions and limit change during the developmental process. (see Illus: 135)



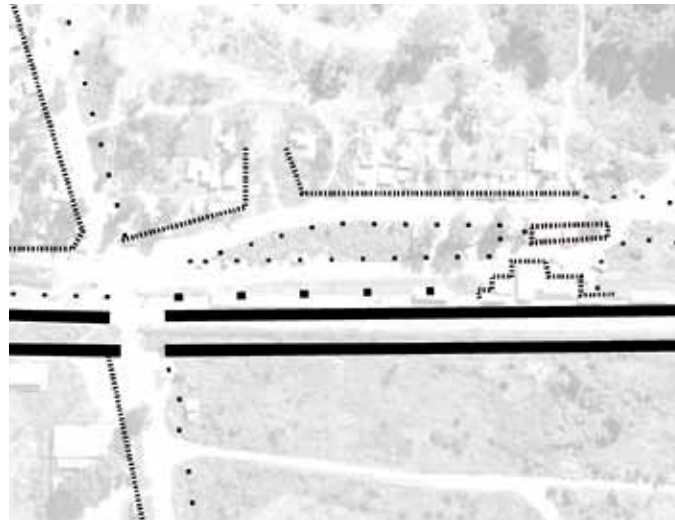
Illus: 133 Prototypical public infrastructural units used to guide development (Author, 2011)



Illus: 132 Analysis of potential in vertical element of support, service and structural ordering (Author, 2011)



CURRENT SITE AND EDGE CONDITIONS



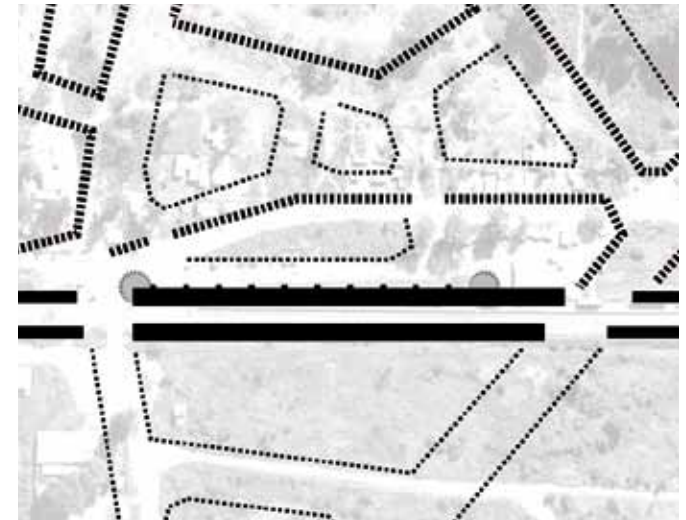
————— HARD EDGE

- - - - - NON INTERACTIVE  
EDGE

..... INTERACTIVE EDGE



FUTURE SITE AND EDGE CONDITIONS



Illus: 134 Key Infrastructural Support Elements (Author, 2011)

Illus: 135 Current vs Future edge conditions on-site (Author, 2011)