9 | TECHNICAL RESOLUTION
9.1 | URBAN & ARCHITECTURAL CONCEPT

9.1.1 | PERMANENT ELEMENTS

[concrete] which should remain despite the future of the scheme. Service: ablutions, water tanks points, furnace landmarks, water drainage, solar panels.

9.1.2 | LIGHTER STEEL STRUCTURE

bolted for their potential disassembly and reassembly + precast infill elements which can also be re appropriated.

9.1.3 | STEREOTOMIC [CONCEAL] TO TECTONIC [REVEAL]

Figure 9.1. Table illustrating urban & architectural concept (Author, 2015)
9.2 | STRUCTURE

9.3.1 | PRIMARY & SECONDARY

PRIMARY > Urban: Concrete ground defining

PRIMARY > Services: Masonry permanent elements

SECONDARY > Structure: Steel (+ pergola?)

TERTIARY > Infill: Wall, roof, pergola

QUATERNARY > Programmes: Butchery, meat market, restaurant: cooking & eating, fruit & vegetable market, fruit & vegetable distribution, recycling.

URBAN > CONCRETE
Terracing at public seating & to deal with site slope;
Concrete footings & planters: ground defining elements & structural support for secondary structure.

SERVICES > MASONRY
Ablutions as universal programme necessity;
Furnaces as landmarks

SECONDARY ELEMENT
STRUCTURAL STEEL supported by urban defining elements;
ROOF SHEETING for shelter and water collection

TERTIARY ELEMENTS
INFL > PRECAST CONCRETE for stereotomic conditions & LIGHT WEIGHT STEEL for tectonic conditions.

Figure 9.2. Primary & secondary structure (Author, 2015)
9.3 | SUSTAINABILITY & NATURAL SYSTEMS

9.3.1 | WATER CATCHMENT

9.3.2 | WATER HEATING

9.3.3 | THERMAL HEATING

9.3.4 | NATURAL VENTILATION

9.3.4 | NATURAL VENTILATION & NATURAL LIGHT

9.3.5 | DISASSEMBLED STEEL STRUCTURE

9.3.1 | WATER CATCHMENT

Water catchment from roofs, through filtration system and into underground water storage tanks. From there it is pumped back up to jojo tanks ready for use.

Figure 9.3. Water catchment (Author, 2015)
9.3.2 | WATER HEATING
Water stored in jojo tanks is pumped through copper coils which are heated by the fire of the braai areas and hot water is stored in insulated tanks. This hot water is used in the restaurant for cooking as well as for cleaning of outdoor areas.

9.3.3 | THERMAL HEATING
Clean air bought in from geopipes is heated by the furnace and used to warm accommodation spaces when required via adjustable ducts.
9.3.4 | NATURAL VENTILATION
Cool air drops from the shower tower and is drawn up the furnace chimney creating natural ventilation.

9.3.4 | NATURAL VENTILATION & NATURAL LIGHT
A solar chimney ensures ventilation of meat market. Natural northern light is optimised for office spaces.
### 9.4 | MATERIALITY

<table>
<thead>
<tr>
<th>Responds to</th>
<th>Programme</th>
<th>Materiality</th>
<th>Colour</th>
<th>Type</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small scale, fine grain stereotomic</td>
<td>Historical fabric</td>
<td>Fruit &amp; Veg Market</td>
<td>Brick, bagged plastered</td>
<td>What bond? Different to that of existing</td>
<td>Concealed by plaster – stereotomic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ablutions</td>
<td>Exposed brick</td>
<td>What bond? Different to that of existing</td>
<td>Connections – revealed as in existing urban fabric</td>
</tr>
<tr>
<td>Large scale, large grain stereotomic</td>
<td>Belle Ombre</td>
<td>Meat market</td>
<td>Steel</td>
<td>Exposed steel expressing structural quality</td>
<td>Connections concealed – stereotomic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Offices</td>
<td>Concrete</td>
<td>Exposed concrete</td>
<td>Smoothed concrete concealing joints – stereotomic</td>
</tr>
<tr>
<td>Small scale tectonic</td>
<td>Pergola</td>
<td>Light steel members</td>
<td>Paint the members, start to conceal the materiality</td>
<td>Non-structural: C-channels and Angles</td>
<td>Connections revealed and concealed – stereotomic to tectonic</td>
</tr>
<tr>
<td>Large scale, tectonic</td>
<td>Sub-station</td>
<td>Restaurant</td>
<td>Steel</td>
<td>Exposed steel expressing structural quality</td>
<td>Connections revealed – tectonic language</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accommodation</td>
<td>Light weight steel</td>
<td>Exposed steel and panels</td>
<td>Pre-cast light weight steel members</td>
</tr>
<tr>
<td>Middle condition between: Stereotomic &amp; tectonic; Fine grain &amp; large grain; Small scale &amp; Large scale</td>
<td>New architectural intervention as mediation point</td>
<td>Fruit and vegetable distribution</td>
<td>Steel (&amp; timber: two materials showing the transition from stereotomic to tectonic)</td>
<td>Exposed steel expressing structural quality</td>
<td>Revealed connections - tectonic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Timber</td>
<td>Exposed</td>
<td>Used as cladding</td>
<td>Revealed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Butchery</td>
<td>Masonry walls responding to existing fabric</td>
<td>Red face brick</td>
<td>What bond? Different to that of existing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Steel member exposed but concealed by timber in some instances</td>
<td>Non-structural: C-channels and Angles</td>
<td>Revealed - tectonic</td>
</tr>
</tbody>
</table>

*Figure 9.8: Table illustrating materiality (Author, 2015)*
CONCEPTUAL & TECHNICAL APPROACH

MATERIALS

[A] MASONRY

[B] CONCRETE

[C] STEEL

[E] MASONRY/CONCRETE/STEEL

CONSTRUCTION

REVEAL

CONCEAL

TECTONIC

STEREOTOMIC

Figure 9.10. Conceptual & technical approach (Author, 2015)
9.6 | CONSTRUCTION

Figure 9.11. Concealed construction joinery (Author, 2015)

Figure 9.12. Concealed construction footing detail (Author, 2015)

Figure 9.13. Concealed construction column detail (Author, 2015)

Figure 9.14. Concealed construction beam detail (Author, 2015)

Figure 9.15. Revealed construction joinery (Author, 2015)

Figure 9.16. Revealed construction footing detail (Author, 2015)

Figure 9.17. Revealed construction column detail (Author, 2015)

Figure 9.18. Revealed construction beam detail (Author, 2015)
9.7 | TECHNICAL EXPLORATION

9.7.1 | MEAT MARKET, OFFICES & BUTCHERY
ITERATION_1
9.7.1 MEAT MARKET & OFFICES
ITERATION_2

Figure 9.20. Meat market & offices: Iteration_2
ITERATION_3

Figure 9.21. Meat market & offices: Iteration_3
9.7.2 | MEAT MARKET & OFFICES
ITERATION_4

Figure 9.22. Meat market & offices: Iteration_4
9.7.3 | FURNACE & ACCOMMODATION

ITERATION_1

Figure 9.23. Furnace & accommodation: Iteration_1
9.7.2 | THE FURNACE

Central braai area

Cylindrical shape:
- encourages sociable braaing activity of cookers
- structurally ...

Large chimney:
- as landmark
- to ensure effective removal of smoke

Figure 9.24. Furnce: Iteration_1
Ventilation

Using the heat generated by the fire chimney to ventilate surrounding spaces.
Structure

a) Brick buttresses and chimney with re-inforced concrete are the structural base for the chimney.

b) Cylindrical shape contributes structural stability.
Double brick course with reinforced concrete

**Smoke chimney design**

a) Creates an overhead cooking shelf

b) Ensures effective smoke removal by creating the venturi effect

Figure 9.27. Furnace: Iteration_4
Steel capping
a) attaches to brick chimney providing protection from rain
b) contributes to the venturi effect by creating pressure difference.

Pre-cast cylindrical concrete form
a) Brick shelf concals concrete materiality
b) Complicated concrete form
Steel chimney frame

a) Provides frame on which steel chimney sheeting is attached - sheet material easily cleaned.

b) Copper pipes heat up in the fire and steel frame creates space within the chimney for hot water geyser storage.

Corbelled brick

a) assists chimney shape for venturi effect
face brick running bond brick course

100 concrete with steel reinforcement

insulated chimney/duct for hot air escape, cladded with 0.6 galvanised sheet steel

0.6 galvanised sheet steel connected to steel frame

12 framed glazing as solar chimney engine

duct extracting hot air from butcher to solar chimney

Figure 9.30. Furnce: Iteration_8
Figure 9.31. Furnce: Iteration_Chimney

Figure 9.32. Furnce iterations

Figure 9.33. Furnce elevation

550 x 1470 x 2
2000 steel hot water geyser
600 off centre polyurethane foam
safety value at 93 - 98°C

braai area
0.6 galvanised sheet steel capping

1.06 concrete with steel reinforcement

face brick running bond brick course

insulated chimney/duct for hot air escape, clad with 0.6 galvanised sheet steel

0.6 galvanised sheet steel converted to steel frame

12 framed glass as solar chimney engine
dust extracting hot air from butcher to solar chimney

vents in duct to for hot air extraction

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Figure 9.34. Section: furnace, butchery, meat market
Figure 9.35. Section: taxi stop, offices, informal market
SECTION C-C
OFFICES
1:50
12 mm laminated safety glass in structural steel frame bolted to i-beam substructure

0.6 galvanised IBR steel roof sheet capping

framed steel vents bolted to i-beam

150 x 100 x 20 mm hot rolled galvanised steel l-section to form solar chimney substructure

0.6 galvanised IBR steel roofing sheeting

120 mm ISO board insulation spanning between purlins

masonry thermal mall supported laterally by steel plates

150 x 65 x 20 mm galvanised steel lipped channel purlin bolted to steel plate in masonry wall with 4 x M10 bolts

100 x 65 x 10 mm galvanised steel angle cleat bolted to purlin with M10 bolts

200 mm masonry wall

PU mastic (Sikaflex) sealer in cut

bituminous coated flashing @ min. 12 degrees into sawcut in masonry walls stepped and tapered to fall of roof fall

metal drive pins at 450 centres

steel flashing connected with 14 G metal tek capping screw at every purlin

DETAIL A
SOLAR CHIMNEY
1:10
0.6 galvanised IBR steel roof sheeting @ min 5 pitch laid on saturated felt underlay on plywood sublayer seam clamped @ 610 centres with 30 x 0.6 stainless steel

120 mm ISO board insulation spanning between purlins

150 x 65 x 20mm galvanised steel lipped channel purlin bolted to cleat with 4 x M10 bolts

Asphalt saturated felt underlay with 65mm sidellaps and 150mm endlaps fixed to plywood with steel nails @ max 300mm centre

16mm plywood

300 x 150 purpose made galvanised steel gutter laid to fall to 80 o/ galvanised mild steel rainwater downpipe

100 x 65 x 10mm galvanised steel angle cleat welded to gutter & bolted to steel frame with M10 bolts

225 x 100 x 20 x 2mm galvanised steel lipped channel girt bolted to cleat with 4 x M10 bolts

203 x 133 x 25 hot rolled galvanised steel I-section to form roof substructure

80mm o/ x 3mm mild steel rainwater downpipe

Mild steel bracket bolted to 5mm flat bar with M6 bolts

203 x 203 x 20? hot rolled galvanised steel H-profile column

**DETAIL B**

**CONCEALED ROOF GUTTER**

1:10
0.8 galvanised IBR steel roof sheeting

150 x 65 x 20 x 2.0 painted steel lipped channel purlin bolted to cleat with 4 x M12 bolts

150 x 100 x 20 x 2.0 galvanised steel lipped channel bolted to cleat with 4 x M12 bolts

Insulated ventilation duct connected to furnace solar chimney

80 precast concrete counters finished with 6mm abello polyurethane screed

100 in-situ concrete floor slab finished with 6mm abello polyurethane screed

SECTION F-F

BOVINE BUTCHERIES

1:100
THE BRAAI CHIMNEY

DETAIL C
THE FURNACE
1:20

- 150 x 65 x 20 mm lipped channel
- 90 mm face brick running bond brick course
- 100 mm concrete with steel reinforcement
- 80 x 80 mm galvanised steel angle bolted to angle with M10 bolts
- 80 x 80 mm galvanised steel angle bolted to i-profile ring beam with M12 bolts
- 253 x 133 x 30 mm galvanised steel i-profile ring beam cast in concrete
- 300 x 300 mm reinforced concrete ring beam
- 120 x 80 x 10 mm angled zipped steel profile as lintel over openings
- 300 x 300 mm reinforced concrete buttress columns with 90 mm external cladding

- 0.6 galvanised sheet steel capping
- Gauze air vent to allow hot air to escape from solar chimney & smoke from fires
- Insulated fire chimney for hot air & smoke escape, cladded with 0.6 removable stainless steel sheet panels connected to angle grid with metal drive pins/pop rivets
- 90 mm face brick running bond brick course as thermal mass for solar chimney
- 12 mm structural glazing as solar chimney engine
- Stainless steel structural curtain wall with internal hinges to allow access to solar chimney duct (maintenance & cleaning)
- 305 x 165 x 40 mm galvanised steel i-profile ring beam cast in concrete
- 550 x 1475 x 2 mm insulated 2001 steel hot water geyser 600 mm off centre polyurethane foam, safety valve at 53 - 99 C. Accessed via removable stainless steel chimney panels
- Duct concealed within c-channel extracting air from butchery and restaurant
- 150 x 100 x 20 mm i-profile concealing channel connection
DETAIL D
CHIMNEY:
LEVEL 17 600
1:20

DETAIL E
CHIMNEY:
LEVEL 20 800
1:20
CONCLUSION
PROJECT SUMMARY

Marabastad is dominated by formal and informal networks of trade and transport. Infrastructural support of existing informal activities and networks within Marabastad has, however, been largely neglected with its informality being too prolific to address. This has in turn hindered the economic and social establishment and growth of Marabastad.

Informality is so often seen to hinder the development of the formal, when in actual fact it has the potential to inform appropriate programme and architectural language.

The architectural design investigates the need for an opportunistic and responsive approach which adopts indigenous strategies while taking into account existing circumstances (Rustagi, 2014).

The intention of the dissertation is to explore resilience in architecture able to withstand change by critically observing the informal. There is value in the critical observation of informally developed systems as these remain adaptable and maintain a high degree of self-organisation. Tension between formal and informal have developed where informal seeks to adapt while formal remains static. The informal should not be romanticised - it remains a necessity and not a choice, however, by discovering patterns in informal activities and understanding what works and why, successful formal space can be created through architectural intervention. Resolving urban issues of inaccessibility, poor infrastructure and urban decay within Marabastad and the city of Tshwane will aid in creating inclusive environments - preventing growing inequalities of access to economic and social opportunity.

In alignment with the urban vision, the dissertation identifies social and economic opportunity within the informality of Marabastad and explores how these can inform a programme that is catalytic within its environment - characterising Marabastad as an anchor point within the city opposed to a transitory place and therefore enabling its resilience.

The site is located along 11th Street, south of Belle Ombre Metro Station and East of the sub-station. Lack of infrastructure on site for the informal bovine butchery and informal meat market resulted in unhygienic food preparation conditions. The programme rehouses and provides infrastructure for these existing economic activities while also incorporating a social platform through the design of the braai areas. The large scale of the braai chimneys become new landmarks within Marabastad, enabling a greater sense of legibility within the urban fabric.

The site becomes a point of convergence where the architecture responds to the large scale, stereotomic language of the Belle Ombre Metro Station, the large scale tectonic language of the sub-station as well as the small scale fine grain of Marabastad’s heritage fabric.

PROJECT CONCLUSION

The design is an enquiry into how formal architectural intervention can assist in and promote the socio-economic development and growth of informal activity, opposed to hinder it.

The programme responds directly to the existing activities on site by providing...
appropriate infrastructure that enables socio-economic establishment and growth of these activities, while also anticipating future infrastructural needs of the site. Pedestrian movement is an important design informant on site and the design intervention is located on site to accommodate faster pedestrian movement in the morning from North to South and slower pedestrian movement in the afternoon from South to North. Private programmes are placed on the East of the site further away from the public realm, while programmes which required public exposure and interaction are placed along public walkways and public spaces.

An important aspect of the design exploration is the provision of space which is able to constantly adapt to facilitate the needs of varying activities and site requirements. Providing infrastructure which allows for the adaptability and self-organisation of the space enables the site’s resilience. With this in mind the construction of the site happened in phases, along a scale of permanent to temporary and adaptable to programme specific:

1. The concrete urban defining elements which deal with the 4m site slope define various levels on the site by providing designated public walkways and stairs and ramps to each level. Regardless of future activities on site, the site slope will have been dealt with.
2. The provision of services and landmarks. Extension of the existing ablutions on the South of the site as well as the introduction of a new ablution block on the North ensures sufficient ablutions to accommodate the high pedestrian traffic as well as the site activities. The provision of new urban landmarks through the construction of the 2 brick braais and chimneys enable greater legibility within Marabastad by defining designated public space.
3. Construction of the steel structure and roof. The structural frame responds to the large grain of Belle Ombre, however, still allows for the fine grain condition by enabling self-organisation and adaptability of informality.
4. The infill of the steel structure. This phase is most adaptable, with the design of the infill left flexible and changeable according to specific site and programmatic needs.

The design intervention responds to the varying scale of surrounding buildings and mediates the contrast between Belle Ombre Metro Station, the city and the small scale of Marabastad fine urban fabric. The design intervention also responds to the contrast in architectural language between the stereotomic Belle Ombre Metro Station and the tectonic sub-station. The architectural design intervention morphs from stereotomic to tectonic. The stereotomic response of the architectural intervention on the North of the site, conceals materiality and construction joinery while expresses a skeletal and tectonic language along the South-East of the site by exposing materials and construction methodology.

The awareness of allowing space and place to be resilient by enabling change and adaptability in the future, offers endless possibility of what architecture should and could be. The simple provision of urban defining elements and core infrastructural elements allow for endless architectural solutions and re-configurations of space in time as the key to understanding informality and facilitating and providing for it.
FINAL MODEL
LA FIN!