07

Fig. 88 Shack

Fig. 89 Next page: Brickyard

BUILDING TECHNOLOGIES

Appropriate technology within an informal settlement may present itself as current existing technologies, skills and materials used within the environment. It may also be new technologies which could be transferred to the communities informing future development.

The following materials and their building technologies are believed to be appropriate technologies for the first phase of the project.


Fig. 90


Fig. 91


Fig. 92


Fig. 93

90 Dislocated timber pallets to be used in structural framework
91 Brickyard in Mamelodi
92 Concrete blocks.
93 Timber frame construction
94 Concrete block house construction
95 Zozo hut panel
96 Zozo hut panels being sold

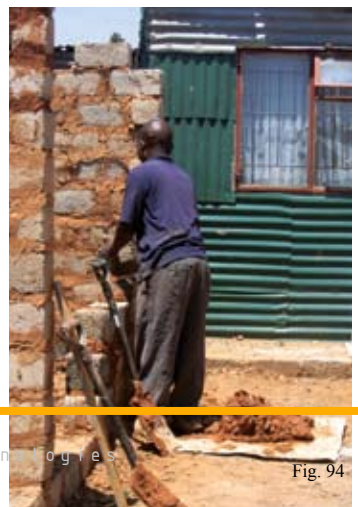
Fig. 94


Fig. 95

Fig. 96

existing building technologies

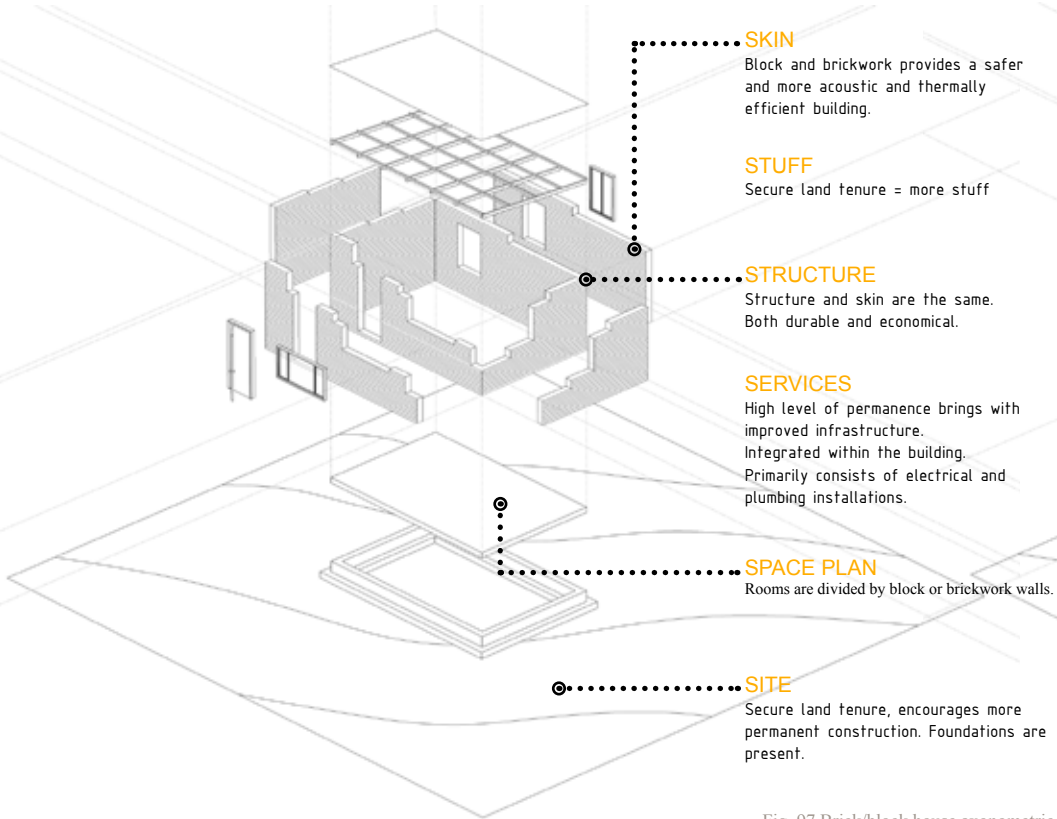

Fig. 97 Brick/block house axonometric

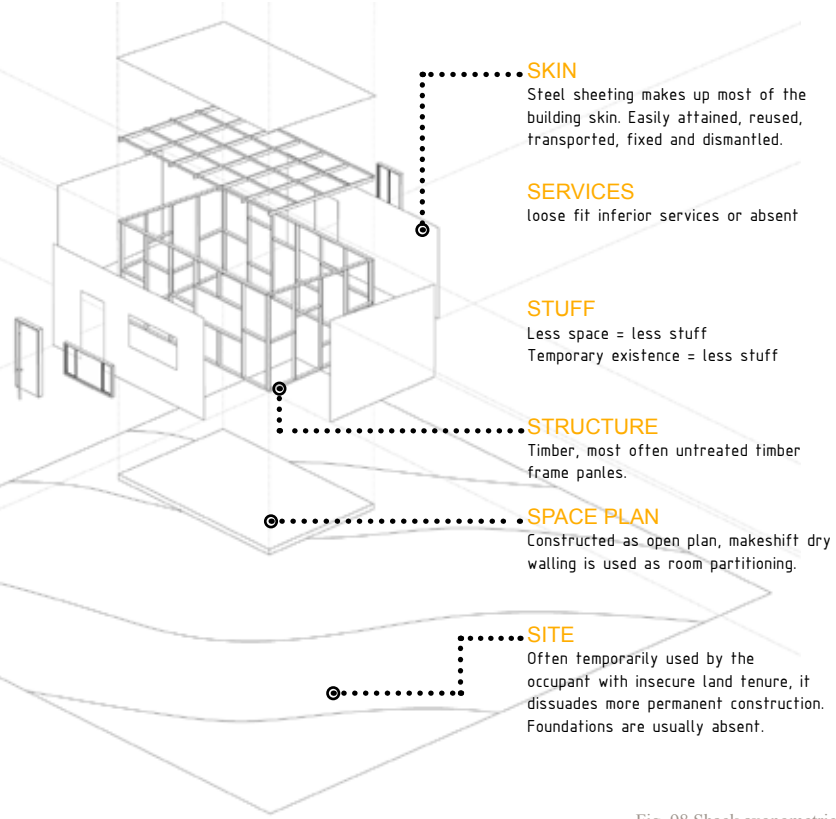

Fig. 98 Shack axonometric

THE BLOCK OR BRICKWORK HOUSE

This stereotomic building system is primarily used in the construction of government subsidised housing within the area of Mamelodi. Wet works construction typically represents a more permanent and thus settled solution to housing. It is widely used for additions and alterations by land owners in the more established wards.

THE SHACK

This tectonic construction method usually comprises of a timber or steel framed structure and cladding with steel sheeting. It provides in the essentials of architecture; enclosure and protection of man and his/her possessions. The system is quick to assemble and widely practiced by the informal community. The Zozo Hut, is constructed in a similar fashion and has established itself amongst the informal business enterprises. It is commonly erected on stands by the occupier and used as a rentable outbuilding. This system is perceived as a temporary solution and it has ability to be relocated with the user. The informal community places high premium on the ownership of building material.


Fig. 99


Fig. 100


Fig. 101


Fig. 102


Fig. 103


Fig. 104


Fig. 105


Fig. 106


Fig. 107

99-100 Finnbuilder construction
101 Abeco water tanks
102 Hydraform wall
103 Downhole drilling rig
104 Mobile Hydraform block making machine
105 Cold-formed steel truss
106 Fasteners
107-108 Hydraform wall
109 Brownbuilt cladding
110 Long span cold-formed steel truss
111 Abeco water tanks


Fig. 108


Fig. 109


Fig. 110


Fig. 111

CRITERIA FOR MATERIAL CHOICE

- Ease of transport
- On-site assembly using local labour
- Self-informing assembly method by unskilled labour
- Labour intensive
- Piece assembly and construction
- On-site assembly and erection
- Skills transfer
- Low skills operation
- Economically viable
- Little or no heavy machinery to be used (due to remoteness of sites)
- Majority of work to be done by manual labour (limited electrical supply)
- No welding
- Steel fixed with nut and bolt assembly
- Ability to reuse the material upon disassembly, relocation or manipulation of the structure

MATERIALS

LIGHTWEIGHT COLD-FORMED STEEL:

Cold-formed steel sections are formed from steel sheet, flat bars, plates or strip in roll-forming machines, by press-brake or bending brake operations. Thickness of structural members vary from 0,4 mm to 6,4 mm. Thicknesses of 25 mm are capable of being formed (Wei-Wen Yu, 1985: 2).

Main advantages:

- Lightweight
- High strength-to-weight ratio
- High stiffness
- Various shapes and sections can be formed
- Allows for additions and alterations
- Minimal wastage
- Ability to erect structure in piece assembly allowing for transport of components to remote sites
- Little or no heavy machinery is needed on site

In the publication *Cold-formed Steel Design*, the author Wei-Wen Yu lists the following additional advantages:
(Wei-Wen Yu, 1985: 2)

- Nestable sections can be produced, allowing for compact packaging (and transport)
- Ease of prefabrication and mass production
- Fast and easy erection and installation
- Substantial elimination of delays due to weather
- More accurate detailing
- Nonshrinking and noncreeping at ambient temperatures
- Uniform quality
- Non-combustibility

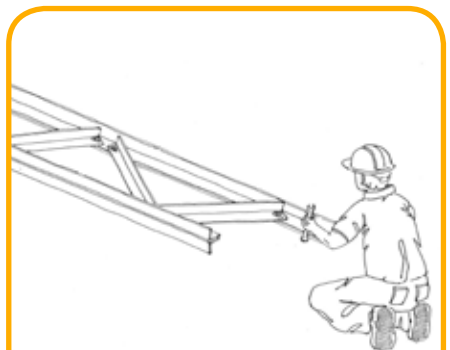

Fig. 112 Nut and bolt piece assembly of steel structure

Nut and bolt piece assembly of steel structure

HYDRAFORM DRY-STACKING BLOCKS:

Hydraform dry-stacking 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. Block dimensions comprise 120-240mm long x 220 or 140mm wide x 115mm high. Typical strength values of 4-7MPa are achievable.

Main advantages:

- Mobile block making machines
- Blocks produced on-site
- Low-skilled operation with little or no dependence on higher skills
- Labour intensive with almost all of the production and construction process occurring on-site
- Cost-effective, fast to use and ideal for remote rural areas

Fig. 113 Hydraform interlocking dry-stacking concrete blocks

FINNBUILDER BUILDING TECHNOLOGIES:

Finnbuilder is a slip form shuttering system whereby a hand operated shuttering mechanism is filled with the necessary cement, sand and aggregate mix. Upon compaction the shuttering is slid to the next area along the length or height of the wall/column. 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.

Main advantages:

- Produced on site
- Labour-intensive
- On-site soil may be used
- Low skills necessary
- Skills transfer
- Low cost - high strength

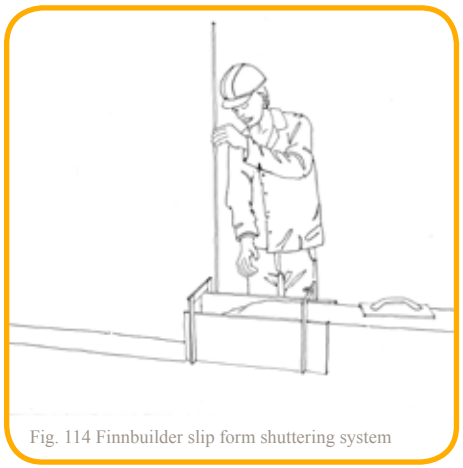

Fig. 114 Finnbuilder slip form shuttering system

BROWNBUILT PROFILE 406 mm:

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. Produced in widths of 406 mm the lengths are specified by client and only limited by transport (usually 18,6 m).

Main advantages:

- Sheeting may be reused
- No damage incurred by fixing holes
- It can be used in conjunction with other sheeting profiles by using the relevant flashings
- Easy construction

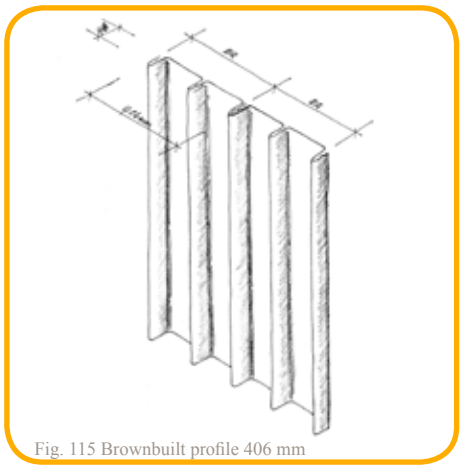

Fig. 115 Brownbuilt profile 406 mm

BROWNBUILT THERMACLAD “25”:

Prefabricated, insulated, interlocking leak-free roofing panels with integral ceiling boards.
Outer skin: brownbuilt profile 406 mm 0,58 mm thick galvanised Z275 steel sheeting with a Globalcoat™ finish to one side.
Insulating core: low-smoke emitting, self-extinguishing foamed polyisocyanurate 40 mm thick (U value 0,44w/m²°C)
Ceiling boards: masonite standard presswood 3,2 mm thick or Chromaprep.

Main advantages:

- Compatible with brownbuilt profile 406 mm sheeting and brownbuilt fixing clips
- No damage incurred by fixing holes
- Reusable.

ABECO TANKS:

Abeco 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). Hot dip galvanising aids is corrosion resistance. Panels can be painted on.

Main advantages:

- Lightweight
- Ease of transport to site
- Erected by manual labour
- Quick and easy to install

FASTENERS:

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. The limited spectrum of fasteners aims to save time and ease of assembly.

1] M8 NUT + BOLT:

8 mm dia hot-dipped galvanised, high tensile grade nut and bolt.

2] GUARD-NUT TAMPER-PROOF FASTENING SYSTEM:

Tamper proof nuts and bolts such as the Guard-Nut tamper-proof fastening system may be used to prevent vandalism and theft. Guard-Nut fasteners require no special tools on installation. It is produced with conventional hex head and conforms the relevant ISO standards.

The SERIES 76 Guard nut and bolt is a high security bolt/screw with tamper evident protective free turning sleeve. The uniquely shaped head accurately controls torque. It is surrounded by a patented, free turning protective sleeve (tapered sleeve optional, non-removable) It may be removed with a special removal tool. A further option is a highly visible red plastic security seal sleeve as well as locking additives on threads

3] 8 mm DIAMETER GALVANISED GUTTER BOLT

The gutter bolt is to be used for fixing non-structural

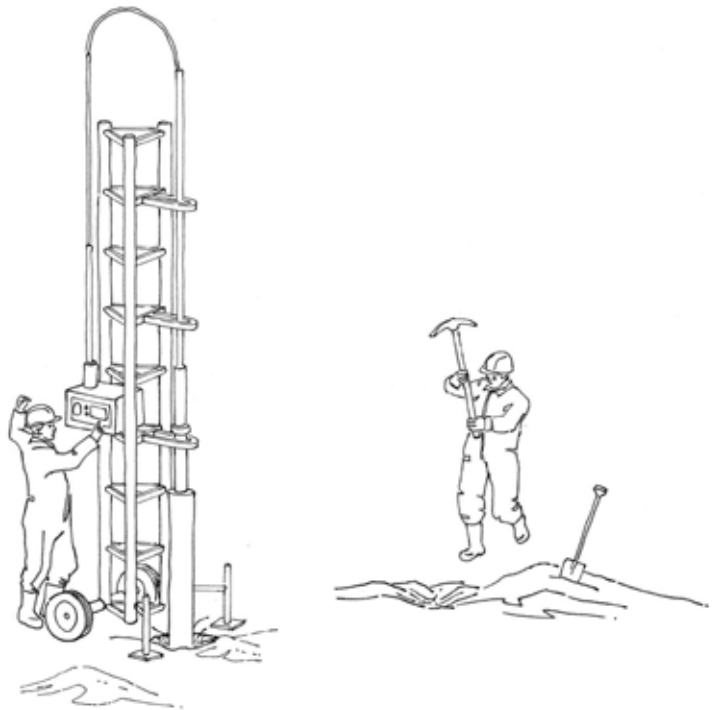

Fig. 117 Downhole drilling rig used to drill boreholes or alternatively for reinforced concrete piles

Fig. 116 Borehole/downhole drilling rig