MODERN BRICK CONSTRUCTION SYSTEMS
A Catalogue of Affordable Solutions Made in Rwanda

Construction costs starting from FRW 150,000 per m²
New solutions for challenging slope conditions
Featuring 12-in-1 garden houses for medium-high density locations
Introducing the Swiss Cube Typology System

THIRD EDITION

The book includes an insightful forward by Ban Ki-moon, former Secretary General of the UN, summarizing the author’s position that “income generation is closely associated with housing; it includes payments to construction works and construction suppliers, as well as home-based activities, some of which are linked to the global chain of production.” As such, he continues “housing makes a considerable contribution to the national economic development in a variety of ways, including increases in capital stock, fixed investment and savings. In addition, there are significant interactions with financial systems, through housing banks, mortgage schemes, interest rates and consumption of housing services.” In short, housing serves as an important generator for an economy to function properly and productively.

This cycle, from housing construction to employment and income generation, is the one of the main catalysts of the Catalogue of Affordable Solutions Made in Rwanda. This third edition offers an expanded range of solutions for Modern Brick Multiplexes, still featuring technologies that can be made in Rwanda for Rwandans.
LOCAL BUILDING MATERIALS CAN GENERATE VIABLE SOLUTIONS TO HOUSING SUPPLY CHALLENGES

Construction costs in Rwanda are higher than in most other countries in Africa. This is mainly due to its land-locked geographic position and the resulting high transportation costs of imported material, namely of steel and cement. Rwanda’s abundant clay deposits are of excellent quality and the massive demand of the country’s fast-growing cities are fertile grounds for the construction industry to produce and build with Modern Brick Technologies. For several years Rwandan SME’s, with the support of the Swiss Agency for Development and Cooperation, have started to produce machine-made Modern Bricks that allow for the construction of smart and cost-effective buildings. These technologies have the potential to significantly reduce the cost of housing and construction and bring tens of thousands of jobs back to Rwanda that were lost to the foreign cement industry.

![Price Segment of Modern Brick Dwellings](image)

- **Modern Brick Duplex Houses**
  - XXL-Size: FRW 14 mio
  - XL-Size
  - L-Size
  - M-Size
  - S-Size: FRW 9 mio

- **Modern Brick Apartments**
  - XXL-Size
  - XL-Size
  - L-Size
  - M-Size
  - S-Size

- **Modern Brick Studios**
  - XXL-Size
  - XL-Size
  - L-Size
  - M-Size
  - S-Size: FRW 5.5 mio

---

**Stock of available Dwelling Units per Income Bracket in Kigali**

- **Chambres-Salon**
  - Often built in unplanned settlements using substandard building material

- **Chambrettes**
  - Built of adobe or substandard walling material

---

**Cheapest House in formal real estate**

- **Batsinda II**

---

**Household Income:**

- FRW 600,000
- FRW 500,000
- FRW 400,000
- FRW 300,000
- FRW 200,000
- FRW 100,000
REASON N° 1: MODERN BRICK WALLS ARE CHEAPER THAN TRADITIONAL BRICK OR CEMENT BLOCK WALLS

MODERN BRICKS ARE SEMI-INDUSTRIAL BRICKS PRODUCED BY RWANDAN ‘SMEs’

| Material Type | Photo | Traditional Brick Wall | Modern Industrial Brick Wall | Modern Semi-Industrial Brick Wall | Modern Semi-Industrial Brick Wall
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand-moulded Cement Block Wall</td>
<td><img src="image1" alt="Hand-moulded Cement Block Wall" /></td>
<td><img src="image2" alt="Traditional Brick Wall" /></td>
<td><img src="image3" alt="Modern Industrial Brick Wall" /></td>
<td><img src="image4" alt="Modern Semi-Industrial Brick Wall" /></td>
<td><img src="image5" alt="Modern Semi-Industrial Brick Wall" /></td>
</tr>
</tbody>
</table>

- **Reason 1:**
  - Modern Brick Walls are cheaper than Traditional Brick or Cement Block Walls.
  - Modern bricks are semi-industrial bricks produced by Rwandan ‘SMEs’.

**Breakdown of Material Costs (per square meter of wall including taxes):**

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Cement Mortar</th>
<th>Bricks</th>
<th>Hand-moulded Cement Block Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRW 15.500</td>
<td>350 kg</td>
<td>206 kg</td>
<td>0 kg</td>
</tr>
<tr>
<td>FRW 15.500</td>
<td>350 kg</td>
<td>206 kg</td>
<td>0 kg</td>
</tr>
<tr>
<td>FRW 21.500</td>
<td>98 kg</td>
<td>98 kg</td>
<td>0 kg</td>
</tr>
<tr>
<td>FRW 14.000</td>
<td>98 kg</td>
<td>98 kg</td>
<td>0 kg</td>
</tr>
<tr>
<td>FRW 9.500</td>
<td>43 kg</td>
<td>43 kg</td>
<td>0 kg</td>
</tr>
</tbody>
</table>

**Structural Design Drives Cost Savings:**

The Modern Brick Multiplex System is a standardised structural design for urban low-rise buildings, using RCC-reinforced Rowlock-Bond made of Modern Bricks. Its simple details are easy-to-apply and well-suited to medium-skilled masons who undergo a short training.

**Reason N° 2: Modern Brick Multiplexes Are Cheaper Than Single-Storied Houses**

**Modern Brick Multiplex System**

- The Modern Brick Multiplex is particularly attractive for landlords who dream of a modern urban house and want to offer their middle-income tenants a modern and affordable house, apartment or studio.

- The 5-size shell of a Modern Brick House Duplex (58m2), ready for interior works, costs FRW 6 mio.
- A Modern Brick Duplex with 3 bedrooms costs less than FRW 10 mio (5 bedrooms: FRW 15 mio).
- Modern Brick Apartments can be built for less FRW 5 mio, Studios for less than FRW 3 mio.
- A common plot can accommodate up to 12 duplexes, 14 simplexes or even 28 equipped studios!
**Reason No 3: Landowners can compose their building by selecting sizes/standards they can afford**

Buildings are assembled from a catalogue of simplex, duplex and triplex units.

Overview of modern brick duplex sizes and related costs* and options on how they can be used.

<table>
<thead>
<tr>
<th>Size</th>
<th>Width (m) x Depth (m)</th>
<th>Area (m²)</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>XXL</td>
<td>5.25 x 8.3</td>
<td>86 m²</td>
<td>2 x 43 m²</td>
</tr>
<tr>
<td>XL</td>
<td>4.9 x 8.3</td>
<td>81 m²</td>
<td>2 x 41 m²</td>
</tr>
<tr>
<td>L</td>
<td>4.6 x 8.3</td>
<td>77 m²</td>
<td>2 x 38 m²</td>
</tr>
<tr>
<td>M</td>
<td>4.1 x 8.3</td>
<td>67 m²</td>
<td>2 x 33 m²</td>
</tr>
<tr>
<td>S</td>
<td>3.5 x 8.3</td>
<td>58 m²</td>
<td>2 x 29 m²</td>
</tr>
<tr>
<td>S*</td>
<td>3.5 x 8.3</td>
<td>58 m²</td>
<td>2 x 29 m²</td>
</tr>
</tbody>
</table>

*Calculated based on a simple plot in Kigali context that include all installations as well as tax and profit. Land excluded.

**Reason No 4: The interior of a modern brick multiplex can be customised and changed over time**

Rooms + walls can be built incrementally in response to evolving needs.

<table>
<thead>
<tr>
<th>Year</th>
<th>Neighborhood Services</th>
<th>Tenant Profile</th>
<th>Tenant Income per HH (FRW/month)</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>Water &amp; Electricity only</td>
<td>Shop Employees, Taximoto Drivers</td>
<td>100,000</td>
<td>16 stud.</td>
</tr>
<tr>
<td>2022</td>
<td>Pathways / drainage channels</td>
<td>Drivers, Artisans</td>
<td>200,000</td>
<td>8 Apt.</td>
</tr>
<tr>
<td>2028</td>
<td>Asphalt Road</td>
<td>Clerks, Junior Engineers, Shopkeepers</td>
<td>400,000</td>
<td>4 duplex</td>
</tr>
<tr>
<td>2036</td>
<td>Public Transportation</td>
<td>Civil Servants, Entrepreneur</td>
<td>600,000</td>
<td>2 rowhouses</td>
</tr>
</tbody>
</table>
REASON N° 5: MODERN URBAN BRICK MULTIPLEXES ARE SINGLE- PLOT SOLUTIONS FOR SMALL-SCALE LANDLORDS

ADAPTABLE TO ANY PLOT GEOMETRY, TOPOGRAPHY AND TENANT PROFILE

Adaptability
A standard plot size of 600 m² (20m x 30m) can accommodate a variety of duplex combinations (from rowhouses to apartment blocks), depending on the purchasing power of owners and tenants.

Optimisation
The flexible combination of units allows for optimized use of plot size, geometry and topography.

Sample 12-in-1 Building Configuration (left)
12-in-1 Stacked Duplex Solution
Estimated Construction Costs: 96 million FRW

Sample 9-in-1 Building Configuration (below)
Two or three neighbours come together to create a small city block with the architectural and environmental qualities of a small estate with sufficient parking, walkways, private courtyards and a recognizable address.

Sample Micro-Sized Block Configuration (2 standard plots)
Two or three neighbours come together to create a small city block with the architectural and environmental qualities of a small estate with sufficient parking, walkways, private courtyards and a recognizable address.

Sample Micro-Sized Block Configuration (4 standard plots)
Two or three neighbours come together to create a small city block with the architectural and environmental qualities of a small estate with sufficient parking, walkways, private courtyards and a recognizable address.

REASON N° 6: MODERN BRICK MULTIPLEXES ARE SUITABLE FOR SMALL NEIGHBORHOOD-LEVEL MICRO ESTATES

LANDOWNERS WHO JOIN HANDS TO UPGRADE THEIR ENVIRONS CAN FORMALISE THE BUILT ENVIRONMENT

78% of urban dwellings are in unplanned neighbourhoods and informally constructed due to the lack of affordable formal construction solutions. The formalisation of these neighborhoods becomes affordable through the Modern Brick duplex housing solution.

Upgrading begins at the plot level with individuals or small groups of landowners without disrupting existing tenancy patterns. This method minimises the need for government intervention or expropriation.

Sample Micro-Sized Block Configuration (4 standard plots)
Neighbours organise themselves into cooperatives to create 20 Modern Brick Duplexes accommodating anywhere from 20 to 80 dwelling units, including shops, services and small private offices.
MODERN BRICK MULTIPLEX HOUSES ARE SUITABLE FOR MANY DIFFERENT ZONING DESIGNATIONS

REASON № 7: LANDLORDS BUILDING MODERN URBAN BRICK MULTIPLEXES CAN HOUSE TWICE THE NUMBER OF TENANTS

50 Dwelling Units / Ha

60 Dwelling Units / Ha

120+ Dwelling Units / Ha

REASON № 8: SMART DENSIFICATION ALLOWS SMALL LANDOWNERS TO SELF-FINANCE NEIGHBORHOOD UPGRADING

LAND VALUE IN INFORMAL AREAS CAN BE UNLOCKED THROUGH COMPACT AFFORDABLE BUILDING SOLUTIONS

Irregular plot and building distribution
Typical Unplanned Settlement in Kigali
Built up area as shown totals 5000 m².

Existing building coverage is low
Study of building footprints reveals that less than 80% of land is occupied.

Storied houses can improve land use
Building an additional floor and compacting structures can free up land for development.

Compact development can unlock value of land
Available land can be sold to co-finance the in-situ resettlement of land owners and tenants into storied modern brick houses (left).

After self-financing, the floor area could be increased as per below.
REASON N° 9: MODERN BRICKS CAN BE PRODUCED
BY LOCAL SMEs AND SUBSTITUTE IMPORTED CEMENT

PRODUCTION UNITS IN AND AROUND THE SECONDARY CITIES COULD RESPOND TO THE DEMAND FOR MATERIALS

Even though the current production of Modern Bricks is still low, they can be - and are - produced by existing small and medium-scale upgraded brickyards. 100 more could be upgraded and produce bricks for 3,000 houses per year. Given the annual demand of 40,000 - 50,000 new urban houses, 50 new medium-scale brick factories could profitably produce Modern Bricks to substitute the expensive and substandard traditional ones. In the case where houses currently made of imported cement would be built with Modern Bricks instead, up to 150 brick factories could operate profitably.

Even though the current production of Modern Bricks is still low, they can be - and are - produced by existing small and medium-scale upgraded brickyards. 100 more could be upgraded and produce bricks for 3,000 houses per year. Given the annual demand of 40,000 - 50,000 new urban houses, 50 new medium-scale brick factories could profitably produce Modern Bricks to substitute the expensive and substandard traditional ones. In the case where houses currently made of imported cement would be built with Modern Bricks instead, up to 150 brick factories could operate profitably.

Brickyard Type | XL Semi-Industrial | L Artisanal | M Artisanal | S Upgraded Tile Kiln
--- | --- | --- | --- | ---
Annual Output | 1,000,000 Bricks (200-350 houses) | 1,000,000 Bricks (70-110 houses) | 489,000 Bricks (40-70 houses) | 300,000 Bricks (20-35 houses)

New brickyards required for substituting:
A. Traditional Bricks
   - 50 brickyards - or - 150 brickyards - or - 198 brickyards - or - 380 brickyards
B. Cement Blocks
   - 161 brickyards - or - 484 brickyards - or - 441 brickyards - or - 1,221 brickyards

Even though the current production of Modern Bricks is still low, they can be - and are - produced by existing small and medium-scale upgraded brickyards. 100 more could be upgraded and produce bricks for 3,000 houses per year. Given the annual demand of 40,000 - 50,000 new urban houses, 50 new medium-scale brick factories could profitably produce Modern Bricks to substitute the expensive and substandard traditional ones. In the case where houses currently made of imported cement would be built with Modern Bricks instead, up to 150 brick factories could operate profitably.

Even though the current production of Modern Bricks is still low, they can be - and are - produced by existing small and medium-scale upgraded brickyards. 100 more could be upgraded and produce bricks for 3,000 houses per year. Given the annual demand of 40,000 - 50,000 new urban houses, 50 new medium-scale brick factories could profitably produce Modern Bricks to substitute the expensive and substandard traditional ones. In the case where houses currently made of imported cement would be built with Modern Bricks instead, up to 150 brick factories could operate profitably.

REASON N° 10: LOCAL BRICKS GENERATE LOCAL JOBS AND INCREASE THE MEDIUM INCOME

SUBSTITUTING FOREIGN CEMENT WITH MODERN BRICK COULD GENERATE UP TO 20,000 CONSTRUCTION JOBS

Concrete blocks are mostly composed of imported cement (Cimerwa production is sufficient for concrete work and mortar only). The capital spent for concrete blocks is mainly lost to the foreign cement industry and does not further circulate in the country or create local jobs.

Modern Bricks Replace Concrete Blocks

The introduction of 50 new modern brick facilities in proximity to Kigali and the secondary cities reduces the need for imported cement. With more production facilities in operation, the number of local jobs available in the building material and construction sector increases exponentially. The capital remains in-country, the job growth translates to higher demand.

Site and Clay Analysis | Business Design Support | Access to Technologies + Skills | Marketing Support
TAXONOMY

THE SWISS CUBE SYSTEM

THE SWISS CUBE SYSTEM IS SUITABLE TO MOST PLOT AND TERRAIN CONFIGURATIONS

WHAT IS A SWISS CUBE?
The ‘Swiss Cube’ is a term used to describe an optimised architecture, simple in shape, elegant in appearance and made of high quality materials.

STRETCH
Extend or expand the cube to accommodate bigger families/budgets

SPLIT
Maximize plot area by subdividing cube into smaller units

STACK
Superimpose the cube to maximize plot development without compromising on space minimizing

MULTIPLY
Maximize plot development and reduce construction costs by sharing partition walls and infrastructure services

SPLIT ON A SLOPE
Take advantage of slope to move

STACK ON A SLOPE
Maintain private garden access on either for every house

SPLitted On A slope
Take advantage of slope to move

XXL duplex Corner House

S Duplex
Superimposed simplex

Stacked S duplex

Stretch
Extend or expand the cube

S Plit
Maximize plot area

Stacked
Superimposed

Stacked
S Plit

Traditional plot developments are difficult to density

STACKED split-level simplex, duplex and triplex houses allow for increased density, height and luxury on challenging terrains.

STRETCHED corner duplex houses are suitable for landlords or commercial spaces

Anatomy of a building
The 9-in-1 Multiplex suitable for sloped terrains

THE SWISS CUBE SYSTEM

THE SWISS CUBE SYSTEM IS SUITABLE TO MOST PLOT AND TERRAIN CONFIGURATIONS

The ‘Swiss Cube’ is a term used to describe an optimised architecture, simple in shape, elegant in appearance and made of high quality materials.

Anatomy of a building
The 9-in-1 Multiplex suitable for sloped terrains

WHAt is A swiss cube?
The ‘Swiss Cube’ is a term used to described an optimised architecture, simple in shape, elegant in appearance and made of high quality materials.
XXL SHELL

- Interior Dimensions: 5.20m x 8.34m
- Room Height: 2.40m
- Walling Material: Fully Facing Modern Bricks
- Slab: Maxspan
- Flooring: Cement Screed
- Roofing Material: Iron Sheet

XXL DUPLEX

- Interior Dimensions: 86m²
- Living Room/Dining Room: 20
- Master Bedroom: 10
- Additional Bedrooms (x4): 32
- Kitchen: √
- Bathroom: √
- Storage: √
- Garden: √

XXL SIMPLEX (1 unit per floor)

- Interior Dimensions: 43m²
- Living Room/Dining Room: 17
- Master Bedroom: 10
- Additional Bedrooms (x1): 8
- Kitchen: √
- Bathroom: √
- Storage: √
- Garden: √

XXL STUDIO (2 units per floor)

- Interior Dimensions: 21m²
- Living Room/Dining: 13
- Kitchen: √
- Bathroom: √
- Garden: √

XXL Simple Duplex

XXL Apartment

Double Split-level duplex
### XL SHELL

Interior Dimensions: 4.92m x 8.34m  
Room Height: 2.40m  
Walling Material: Fully Facing Modern Bricks  
Slab: Maxspan  
Flooring: Cement Screed  
Roofing Material: Iron Sheet

### XL DUPLEX

<table>
<thead>
<tr>
<th>Feature</th>
<th>FRW</th>
<th>Sqm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room/Dining Room</td>
<td>21</td>
<td>81m²</td>
</tr>
<tr>
<td>Master Bedroom</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Additional Bedrooms (x3)</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Kitchen</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Bathroom</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Garden</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

### XL SIMPLEX

<table>
<thead>
<tr>
<th>Feature</th>
<th>FRW</th>
<th>Sqm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room/Dining Room</td>
<td>15</td>
<td>40m²</td>
</tr>
<tr>
<td>Master Bedroom</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Additional Bedroom (x1)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Kitchen</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Bathroom</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Garden</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

### XL STUDIO (1 of 2 units)

<table>
<thead>
<tr>
<th>Feature</th>
<th>FRW</th>
<th>Sqm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room/Bedroom</td>
<td>14</td>
<td>20m²</td>
</tr>
<tr>
<td>Kitchen</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Bathroom</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Garden</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
L SHELL

- 77m²
- Interior Dimensions: 4.63m x 8.34m
- Room Height: 2.40m
- Walling Material: Fully Facing Modern Bricks
- Slab: Maxspan
- Flooring: Cement Screed
- Roofing Material: Iron Sheet

FRW 9,500,000

L DUPLEX

- 77m²
- Living Room/Dining Room: 20
- Master Bedroom: 10
- Additional Bedrooms (x3): 24
- Kitchen: √
- Bathroom: √
- Storage: √
- Garden: √

L SIMPLEX

- 38m²
- Living Room/Dining Room: 15
- Master Bedroom: 10
- Additional Bedrooms: 8
- Kitchen: √
- Bathroom: √
- Storage: √
- Garden: √

FRW 7,500,000

L STUDIO (1 of 2 units)

- 19m²
- Living Room/Bedroom: 14
- Kitchen: √
- Bathroom: √
- Garden: √

FRW 3,800,000 / unit
**M SHELL**

- Interior Dimensions: 4.06m x 8.34m
- Room Height: 2.40m
- Walling Material: Fully Facing Modern Bricks
- Slab: Maxspan or Timber Floor
- Flooring: Cement Screed
- Roofing Material: Iron Sheet

**M DUPLEX**

- Living Room/Dining Room: 20
- Master Bedroom: 10
- Additional Bedrooms (x2): 16
- Kitchen: √
- Bathroom: √
- Storage: √
- Garden: √

**XS Simplex**

**M Simplex**

**M Studio**

**M SIMPLEX**

- Living Room/Dining Room: 15
- Master Bedroom: 9
- Kitchen: √
- Bathroom: √
- Storage: √
- Garden: √

**FRW 8,100,000**

**FRW 10,700,000**

**FRW 6,500,000**

**FRW 3,600,000 / unit**

**M STUDIO (1 of 2 units)**

- Living Room/Bedroom: 11
- Kitchen: √
- Bathroom: √
- Garden: √
**S SHELL**

- Interior Dimensions: 3.50m x 8.34m
- Room Height: 2.40m
- Walling Material: Fully Facing Modern Bricks
- Slab: Timber Floor / Maxpan between units
- Flooring: Cement Screed
- Roofing Material: Iron Sheet

*FRW 7.500.000*

<table>
<thead>
<tr>
<th>Room/Space</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room/Dining</td>
<td>20</td>
</tr>
<tr>
<td>Master Bedroom</td>
<td>9 - 11</td>
</tr>
<tr>
<td>Additional Bedrooms</td>
<td>16 or 7+7</td>
</tr>
<tr>
<td>Kitchen</td>
<td>√</td>
</tr>
<tr>
<td>Bathroom [x2 or X3]</td>
<td>√</td>
</tr>
<tr>
<td>Storage</td>
<td>√</td>
</tr>
<tr>
<td>Garden</td>
<td>√</td>
</tr>
</tbody>
</table>

**S SINGLE SPLIT-LEVEL DUPLEX**

- Area: 63m²

**FRW 10.500.000**

<table>
<thead>
<tr>
<th>Room/Space</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room/Dining</td>
<td>20</td>
</tr>
<tr>
<td>Master Bedroom</td>
<td>9 - 11</td>
</tr>
<tr>
<td>Additional Bedrooms</td>
<td>16 or 7+7</td>
</tr>
<tr>
<td>Kitchen</td>
<td>√</td>
</tr>
<tr>
<td>Bathroom [x2 or X3]</td>
<td>√</td>
</tr>
<tr>
<td>Storage</td>
<td>√</td>
</tr>
<tr>
<td>Garden</td>
<td>√</td>
</tr>
</tbody>
</table>

**S STACKED SIMPLEX**

- Area: 31m²

*FRW 5.000.000*

<table>
<thead>
<tr>
<th>Room/Space</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room/Bedroom</td>
<td>13</td>
</tr>
<tr>
<td>Master Bedroom</td>
<td>12</td>
</tr>
<tr>
<td>Kitchen</td>
<td>√</td>
</tr>
<tr>
<td>Bathroom</td>
<td>√</td>
</tr>
<tr>
<td>Storage</td>
<td>√</td>
</tr>
<tr>
<td>Garden</td>
<td>√</td>
</tr>
</tbody>
</table>

**S STACKED DUPLEX**

- Area: 63m²

*FRW 9.500.000*

<table>
<thead>
<tr>
<th>Room/Space</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room/Bedroom</td>
<td>19</td>
</tr>
<tr>
<td>Master Bedroom</td>
<td>10</td>
</tr>
<tr>
<td>Kitchen</td>
<td>√</td>
</tr>
<tr>
<td>Additional Bedrooms</td>
<td>16</td>
</tr>
<tr>
<td>Bathroom [x1]</td>
<td>√</td>
</tr>
<tr>
<td>Garden</td>
<td>√</td>
</tr>
</tbody>
</table>
XS SHELL

Interior Dimensions: 3.50m x 8.76m
Room Height: 2.40m
Walling Material: Fully Facing Modern Bricks
Slab: Timber Floor / Maxpan between stacked units
Ground Floor Slab: Cement Screed
Roofing Material: Iron Sheet

XS SIMPLE DUPLEX 58m²

Living Room/Dining Room 19
Master Bedroom 8
Additional Bedrooms (2x) 15
Kitchen ✔
Bathroom (1x) ✔
Storage ✔
Garden ✔

XS STUDIO (1 of 2 units) 14m²

Living Room/Dining Room 11
Kitchen ✔
Bathroom ✔
Additional Bedrooms (x2) 15
Garden ✔

XS DOUBLE SPLIT-LEVEL DUPLEX (1 of 2 units) 43m²

Living Room/Bedroom 12.5
Master Bedroom 8
Additional Bedrooms (x2) 15
Kitchen ✔
Bathroom (x1) ✔
Garden ✔
CASE STUDY

KIGALI PSF EXPO HOUSE (2017)

THE "SWISS CUBE" DEMONSTRATES THE POTENTIAL OF THE LOCAL INDUSTRY TO SUPPLY AFFORDABLE HOUSING

Area: 50 m²
Unit Cost: FRW 8 million [basic finishes]
Cost includes all features except land and engineering. Profit and labor are included.
Cost per square meter: 190 USD

Elements Tested:
- RCC Reinforced Rowlock Bond Wall
- Timber Slab + Timber Stairs

Innovation:
- Illustrated Construction Guide (layer by layer details)

THE DEMO BRICK HOUSE FOR THE KIGALI FAIR

A Draft Construction Manual
KIGALI CITY, JULY 2017 BY WED CONSULTING

The Kigali PSF Demonstration House introduces the “S.M.A.R.T. Tafali Etage” concept to the general public. Made entirely of local materials, it displays the possibility of what the Rwandan construction industry would be capable of supplying on mass scale, if all relevant stakeholders, from the brickmaker to engineers and architects, worked together to address the high demand for quality, affordable construction for rapidly urbanizing districts, cities and towns.
Built in 2015, the Rusizi Modern Brick Duplex Shophouse serves as a testing/display unit for cost-effective housing solutions built of Modern Bricks. It also serves as a model for a mixed-use building for urban contexts.
ANNEX 1

RCC REINFORCED ROWLOCK BOND WALLING SYSTEM

ROWLOCK BOND: A TIME-TESTED CONSTRUCTION METHOD

Rowlock Bond walling is a cost-effective walling system for houses up to 2.5 stories. It was popular during the industrial revolution in both the UK and United States. In the last three decades, the system has made a resurgence in South Asia. A damage assessment after the Kathmandu Earthquake (Nepal 2015) proved the strength and good para-seismic performance of the Rowlock Bond walling system. The system has now been officially endorsed by the Nepalese government.

Canada, 1858

ANNEX 2

MODERN BRICK MULTIPLEX CONSTRUCTION SYSTEM

STRUCTURAL INTEGRITY ALLOWS FOR MAXIMUM FLEXIBILITY

The Modern Brick Multiplex Construction System is a “strong box” held together by concrete reinforcement (tie beams). The result is a structural frame within which flooring and walling elements can be adjusted and modified at will. All typologies are suitable for maxpan floor slabs, while the narrower models, M and S, can be outfitted with a timber floor. Both systems can be applied without modification to the structural “box.”

Maxpan Slab Option

Hidden RCC Reinforcement

Timber Floor Option

Maxpan Slabs are suitable for all unit sizes (XXL through S).

Timber Floors suitable for unit sizes M and S.
The Service Portal “Made in Lakes” offers access to information on various sectors and products in the Great Lakes Region relevant for building material producers, contractors, developers and authorities. Key features include real-time data on brick supply, downloadable demand and supply scenario projection tools and a list of regional construction industry events.

**KEY PORTAL FEATURES:**

- **Document Library** featuring urban planning codes, regulations and laws
- **Tenders** for construction and infrastructure projects in the Secondary Cities and Districts
- **Training Manuals** on construction material production and application
- **National Maps** of Zones Suitable for Semi-Industrial Brick Production in the Great Lakes
- **Location services** allowing construction firms to locate modern brick makers next to their sites
- **Production Zones of Building Material Producers and Resellers** displayed on a map of clay areas suitable for semi-industrial production.
- **Address Book** of construction industry stakeholders
- **Statistics** on regional building material production quantities;
- **Downloadable tools** used to simulate building material demand and to cost compare of construction costs

**PORTAL INCLUDES REAL-TIME BRICK SUPPLY DATA, STATISTICS AND ESTIMATION TOOLS**

The Portal displays maps and data collected and analysed by the programme, in particular potential sites for clayish soils extraction, and suitable fuels. One of the newest features is the Comparative Construction Cost Calculator, which allows technicians and clients to compare relative costs of different construction technologies and building materials for any given project.

In addition to the Excel-based tools, the WebPortal features access to information about affordable housing construction value chains, training manuals for designers, planners and builders, along with a link to Buildapedia, the PROECCO project’s online database of building material producers and construction techniques.
Since 2012, the PROECCO project has consistently collected data and mapped location information for producers of brick and tiles across Rwanda. This information is overlaid on land use plan to facilitate the urbanization agenda. It follows that in 2016, the project introduced the Scenario Maker Tool, a tool that estimates the future demand of building materials in City of Kigali and the 6 Secondary Cities.

Since 2012, the PROECCO project has consistently collected data and mapped location information for producers of brick and tiles across Rwanda. This information is overlaid on land use plan to facilitate the urbanization agenda. It follows that in 2016, the project introduced the Scenario Maker Tool, a tool that estimates the future demand of building materials in City of Kigali and the 6 Secondary Cities.

Since 2012, the PROECCO project has consistently collected data and mapped location information for producers of brick and tiles across Rwanda. This information is overlaid on land use plan to facilitate the urbanization agenda. It follows that in 2016, the project introduced the Scenario Maker Tool, a tool that estimates the future demand of building materials in City of Kigali and the 6 Secondary Cities.

Since 2012, the PROECCO project has consistently collected data and mapped location information for producers of brick and tiles across Rwanda. This information is overlaid on land use plan to facilitate the urbanization agenda. It follows that in 2016, the project introduced the Scenario Maker Tool, a tool that estimates the future demand of building materials in City of Kigali and the 6 Secondary Cities.

Since 2012, the PROECCO project has consistently collected data and mapped location information for producers of brick and tiles across Rwanda. This information is overlaid on land use plan to facilitate the urbanization agenda. It follows that in 2016, the project introduced the Scenario Maker Tool, a tool that estimates the future demand of building materials in City of Kigali and the 6 Secondary Cities.

Since 2012, the PROECCO project has consistently collected data and mapped location information for producers of brick and tiles across Rwanda. This information is overlaid on land use plan to facilitate the urbanization agenda. It follows that in 2016, the project introduced the Scenario Maker Tool, a tool that estimates the future demand of building materials in City of Kigali and the 6 Secondary Cities.

Since 2012, the PROECCO project has consistently collected data and mapped location information for producers of brick and tiles across Rwanda. This information is overlaid on land use plan to facilitate the urbanization agenda. It follows that in 2016, the project introduced the Scenario Maker Tool, a tool that estimates the future demand of building materials in City of Kigali and the 6 Secondary Cities.

Since 2012, the PROECCO project has consistently collected data and mapped location information for producers of brick and tiles across Rwanda. This information is overlaid on land use plan to facilitate the urbanization agenda. It follows that in 2016, the project introduced the Scenario Maker Tool, a tool that estimates the future demand of building materials in City of Kigali and the 6 Secondary Cities.