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
August 2017

By Skat Consulting, Ltd.
Daniel Wyss
Fatou Dieye
Ban Ki-moon, former Secretary General of the UN:

“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.”

“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.”

Source: Foreword from Dr. Anna Kajumulo Tibajuka’s Building Prosperity: Housing and Economic Development, 2009
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**XXL** Technical Specifications Sheet (solutions for sloped terrains)  
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**L** Technical Specifications Sheet  
**M** Technical Specifications Sheet  
**S** Technical Specifications Sheet  
**S** Technical Specifications Sheet (solutions for sloped terrains)  
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Case Study: Kigali PSF Expo House (2017)  
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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.
**REASON № 1: MODERN BRICK WALLS ARE CHEAPER THAN TRADITIONAL BRICK OR CEMENT BLOCK WALLS**

MODERN BRICKS ARE SEMI-INDUSTRIAL BRICKS PRODUCED BY RWANDAN 'SMEs'

<table>
<thead>
<tr>
<th>Material</th>
<th>FRW</th>
<th>Cement mortar</th>
<th>Bricks</th>
<th>Other</th>
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<tbody>
<tr>
<td>Hand-moulded Cement Block Wall</td>
<td>FRW 15.500</td>
<td>350 kg</td>
<td>121</td>
<td>0</td>
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<tr>
<td>Traditional Brick Wall</td>
<td>FRW 15.500</td>
<td>206 kg</td>
<td>121</td>
<td>0</td>
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<tr>
<td>Modern Semi-Industrial Brick Wall</td>
<td>FRW 21.500</td>
<td>98 kg</td>
<td>121</td>
<td>0</td>
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<tr>
<td>Modern Semi-Industrial Brick Wall</td>
<td>FRW 14.000</td>
<td>98 kg</td>
<td>121</td>
<td>0</td>
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<tr>
<td>Modern Semi-Industrial Brick Wall</td>
<td>FRW 9.500</td>
<td>41 kg</td>
<td>101</td>
<td>0</td>
</tr>
</tbody>
</table>

**BREAKDOWN OF MATERIAL COSTS**

**PER SQUARE METER OF WALL (INCLUDING TAXES)**
REASON Nº 2: MODERN BRICK MULTIPLEXES ARE CHEAPER THAN SINGLE-STORIED HOUSES

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.

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 S-size shell of a Modern Brick House Duplex (58m2), ready for interior works, costs FRW 6mio
- A Modern Brick Duplex with 3 bedrooms costs less than FRW 10 mio (5 bedrooms: FRW 15mio)
- Modern Brick Apartments can be built for less FRW 5mio, Studios for less than FRW 3mio
- A common plot can accommodate up to 12 duplexes, 14 simplexes or even 28 equipped studios!
**REASON N° 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>Dimensions (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</td>
<td>10.2 mio 14.4 mio 8.6 mio 4.2 mio</td>
</tr>
<tr>
<td>XL</td>
<td>4.9 x 8.3</td>
<td>81</td>
<td>9.8 mio 13.6 mio 8.0 mio 4.0 mio</td>
</tr>
<tr>
<td>L</td>
<td>4.6 x 8.3</td>
<td>77</td>
<td>9.5 mio 13.0 mio 7.5 mio 3.8 mio</td>
</tr>
<tr>
<td>M</td>
<td>4.1 x 8.3</td>
<td>67</td>
<td>8.1 mio 10.7 mio 6.5 mio 3.6 mio</td>
</tr>
<tr>
<td>S</td>
<td>3.78 x 8.3</td>
<td>63</td>
<td>7.5 mio 10.2 mio 5.9 mio 3.3 mio</td>
</tr>
<tr>
<td>XS</td>
<td>3.5 x 8.3</td>
<td>58</td>
<td>6.1 mio 9.2 mio 5.1 mio 2.9 mio</td>
</tr>
</tbody>
</table>

*S*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

2016
Neighborhood Services: Water & Electricity only
Tenant Profile: Shop Employees, Taximoto Drivers
Tenant Income per HH: 100.000 FRW/month
16 Studios @ 35.000 FRW/month (8 per floor)

2022
Neighborhood Services: Pathways / drainage channels
Tenant Profile: Drivers, Artisans
Tenant income per HH: 200.000
8 Apartments @ 65.000/month (4 per floor)

2028
Neighborhood Services: Asphalt Road
Tenant Profile: Clerks, Junior Engineers, Shopkeepers
Tenant income per HH: 400.000
4 duplexes @ 130.000/month

2036
Neighborhood Services: Public Transportation
Tenant Profile: Civil Servants, Entrepreneur
Tenant income per HH: 600.000
2 rowhouses @ 200.000/month
**REASON N° 5: MODERN URBAN BRICK MULTIPLEXES ARE SINGLE-LOT SOLUTIONS FOR SMALL-SCALE LANDLORDS**

ADAPTABLE TO ANY PLOT GEOMETRY, TOPOGRAPHY AND TENANT PROFILE

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**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.

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: Starting from 96 million FRW

**Sample 9-in-1 Building Configuration (below)**

2 - Split-level back-to-back duplex
2 - Double Split-level duplex
1 - Split-level triplex (T*)
1 - Stacked split-level duplex
1 - Stacked Duplex
1 - Stacked Simplex
1 - Duplex

Estimated Construction Costs: Starting from 92 million FRW

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Axonometric of double split-level triplex duplex
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 multiplex 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.

Ideally, two or three neighbours would 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 Neighborhood Development (right)**

The flexibility of the Modern Brick Multiplex system allows for the design of a dense neighborhood, with a variety of house sizes, configurations and architectural expression, given rise to a truly mixed-use and mixed-income neighborhood.
**REASON № 7: LANDLORDS BUILDING MODERN URBAN BRICK MULTIPLEXES CAN HOUSE TWICE THE NUMBER OF TENANTS**

Modern brick multiplex houses are suitable for many different zoning designations.

High-densities are achievable even on challenging and sloped terrains.

- 50 Dwelling Units / Ha
- 60 Dwelling Units / Ha
- 120+ Dwelling Units / Ha

20% Slope
**REASON N° 8: SMART DENSIFICATION ALLOWS SMALL LANDOWNERS TO SELF-FINANCE NEIGHBORHOOD UPGRADING**

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

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**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 No 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.

<table>
<thead>
<tr>
<th>Brickyard Type</th>
<th>XL Semi-Industrial</th>
<th>L Artisanal</th>
<th>M Artisanal</th>
<th>S Upgraded Tile Kiln</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Output</td>
<td>3,000,000 Bricks (200-350 houses)</td>
<td>1,000,000 Bricks (70-110 houses)</td>
<td>600,000 Bricks (40-70 houses)</td>
<td>300,000 Bricks (20-35 houses)</td>
</tr>
<tr>
<td>New brickyards</td>
<td>50 brickyards - or -</td>
<td>150 brickyards - or -</td>
<td>190 brickyards - or -</td>
<td>380 brickyards</td>
</tr>
<tr>
<td>required for</td>
<td>161 brickyards - or -</td>
<td>484 brickyards - or -</td>
<td>661 brickyards - or -</td>
<td>1,221 brickyards</td>
</tr>
<tr>
<td>substituting:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Current Situation**

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.

The transformation of Rwanda’s brick industry will require targeted interventions and investments all along the value chain. The Swiss Agency for Development Cooperation has therefore mandated Skat Consulting to offer the following services to entrepreneurs, investors and technicians in the following areas:

- 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

HOW DOES IT WORK?
The modular Swiss Cube system is completely flexible and inter-changeable, while maintaining one core principle: 1 house with road access and at least 1 private garden per family

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 sacrificing precious liveable area

...can be stacked one on top of the other...
...and assembled into one volume...

9 different split-level Swiss Cube configurations...
THE SWISS CUBE SYSTEM IS SUITABLE TO MOST PLOT AND TERRAIN CONFIGURATIONS

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

(Standard plot 20m x 30m)

STACK ON A SLOPE
Increase density by superposing one unit on another.

SPLIT ON A SLOPE
Maintain private garden access by introducing split-level units.

STRETCHED corner duplex houses are suitable for landlords or commercial spaces.

STACKED split-level simplexes, duplexes and triplexes allow for increased density, height and luxury on sloped terrains.

Traditional plot developments are difficult to densify, especially on sloped terrains.

ANATOMY OF A BUILDING
Multiple units can be assembled on a standard plot without sacrificing basic amenities like direct road access and private gardens.

...creating an attractive urban multiplex.
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

- Living Room/Dining Room: 20
- Master Bedroom: 10
- Additional Bedrooms (x4): 32
- Kitchen: ✓
- Bathroom: ✓
- Storage: ✓
- Garden: ✓

XXL SHELL 86m²

XXL DUPLEX 86m²
<table>
<thead>
<tr>
<th>XXL SIMPLEX (1 unit per floor)</th>
<th>43m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room/Dining Room</td>
<td>17</td>
</tr>
<tr>
<td>Master Bedroom</td>
<td>10</td>
</tr>
<tr>
<td>Additional Bedrooms (x1)</td>
<td>8</td>
</tr>
<tr>
<td>Kitchen</td>
<td>√</td>
</tr>
<tr>
<td>Bathroom</td>
<td>√</td>
</tr>
<tr>
<td>Storage</td>
<td>√</td>
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<tr>
<td>Garden</td>
<td>√</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XXL STUDIO (2 units per floor)</th>
<th>21m²</th>
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<tbody>
<tr>
<td>Living Room/Dining</td>
<td>13</td>
</tr>
<tr>
<td>Kitchen</td>
<td>√</td>
</tr>
<tr>
<td>Bathroom</td>
<td>√</td>
</tr>
<tr>
<td>Garden</td>
<td>√</td>
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</table>

Starting from FRW **8,600,000**

Starting from FRW **4,200,000**
**XXL Split-level Duplex and Triplex**

### XXL 8-in-1 DUPLEX

<table>
<thead>
<tr>
<th>Area</th>
<th>Count</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room / Dining Room</td>
<td>16</td>
<td>√</td>
</tr>
<tr>
<td>Master Bedroom</td>
<td>8</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 (x3)</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>

- **Size**: 64m²
- **Starting Price**: FRW 12,000,000

### XXL 8-in-1 TRIPLEX

<table>
<thead>
<tr>
<th>Area</th>
<th>Count</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Living Room/Dining Room</td>
<td>43</td>
<td>√</td>
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<tr>
<td>Master Bedroom</td>
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<td>√</td>
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<tr>
<td>Additional Bedrooms (x4)</td>
<td>35</td>
<td>√</td>
</tr>
<tr>
<td>Kitchen / Storage</td>
<td>8</td>
<td>√</td>
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<tr>
<td>Bathroom (x3)</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>

- **Size**: 130m²
- **Starting Price**: FRW 25,000,000
XXL BACK-TO-BACK DUPLEX (1 of 2 units) 43m²

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

XXL DOUBLE SPLIT LEVEL DUPLEX (1 of 2 units) 64m²

- Living Room/Dining Room: 16
- Master Bedroom: 8
- Additional Bedrooms (x3): 24
- Kitchen: √
- Bathroom (x3): √
- Storage: √
- Garden: √
**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**

- Living Room/Dining Room: 21
- Master Bedroom: 10
- Additional Bedrooms (x3): 24
- Kitchen: ✓
- Bathroom: ✓
- Storage: ✓
- Garden: ✓

---

**Renovation Options**

- XL Duplex
- XL Simplex
- XL Studio

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Starting from FRW 9,800,000

Starting from FRW 13,600,000
<table>
<thead>
<tr>
<th>XL SIMPLEX</th>
<th>40m²</th>
<th>XL STUDIO (1 of 2 units)</th>
<th>20m²</th>
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<tbody>
<tr>
<td>Living Room/Dining Room</td>
<td>15</td>
<td>Living Room/Bedroom</td>
<td>14</td>
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<tr>
<td>Master Bedroom</td>
<td>10</td>
<td>Kitchen</td>
<td>√</td>
</tr>
<tr>
<td>Kitchen</td>
<td>√</td>
<td>Bathroom</td>
<td>√</td>
</tr>
<tr>
<td>Bathroom</td>
<td>√</td>
<td>Garden</td>
<td>√</td>
</tr>
<tr>
<td>Storage</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garden</td>
<td>√</td>
<td></td>
<td></td>
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</tbody>
</table>

Starting from FRW 8,000,000

Starting from FRW 4,000,000
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

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

L Single Duplex

L Simplex

L Studio

Level 0

Level 1
L SIMPLEX

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

38m²

starting from FRW 7,500,000

L STUDIO (1 of 2 units)

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

19m²

starting from 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: 27
- Master Bedroom: 9
- Additional Bedrooms (x2): 16
- Kitchen: √
- Bathroom x1 (or x2): √
- Storage: √
- Garden: √

**Dimensions**

- **M SHELL**: 67m²
- **M DUPLEX**: 67m²

**Prices**

- **M SHELL**: FRW 8,100,000
- **M DUPLEX**: FRW 10,700,000

**Additional Features**

- **M DUPLEX**:
  - Interior Dimensions: 10.700.000
  - Starting from: FRW 8,100,000

- **M SHELL**: Interior Dimensions: 4.06m x 8.34m
**M SIMPLEX**  
33m²  
- Living Room/Dining Room: 15
- Master Bedroom: 9
- Kitchen: ✔
- Bathroom: ✔
- Storage: ✔
- Garden: ✔

Starting from FRW 6,500,000

**M STUDIO (1 of 2 units)**  
16m²  
- Living Room/Bedroom: 11
- Kitchen: ✔
- Bathroom: ✔
- Garden: ✔

Starting from FRW 3,600,000 / unit
**S SHELL**  
63m²

Interior Dimensions: 3.78m 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

**S SINGLE SPLIT-LEVEL DUPLEX**  
63m²

Living Room / Dining Room: 20  
Master Bedroom: 9 - 11  
Additional Bedrooms (x2): 16 (or 7+7)  
Kitchen: √  
Bathroom (x2 or x3): √  
Storage: √  
Garden: √
S SIMPLEX 31m²

- Living Room / Dining Room: 13
- Master Bedroom: 8
- Additional Bedroom (x1): 8
- Kitchen: ✓
- Bathroom: ✓
- Storage: ✓
- Garden: ✓

starting from FRW 5,000,000

S DUPLEX 63m²

- Living Room / Dining Room: 19
- Master Bedroom: 10
- Additional Bedrooms (x2): 16
- Kitchen: ✓
- Bathroom (x1): ✓
- Garden: ✓

starting from FRW 9,500,000
**S SLOPE SPLIT LEVEL DUPLEX (Unit 1)**  
54m²

<table>
<thead>
<tr>
<th>Feature</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room/Dining Room</td>
<td>13.5</td>
</tr>
<tr>
<td>Master Bedroom</td>
<td>9</td>
</tr>
<tr>
<td>Additional Bedrooms (x2)</td>
<td>15</td>
</tr>
<tr>
<td>Kitchen</td>
<td>√</td>
</tr>
<tr>
<td>Bathroom (x2)</td>
<td>√</td>
</tr>
<tr>
<td>Storage</td>
<td>√</td>
</tr>
<tr>
<td>Garden</td>
<td>√</td>
</tr>
</tbody>
</table>

**S SLOPE SPLIT LEVEL TRIPLEX (Unit 2)**  
107m²

<table>
<thead>
<tr>
<th>Feature</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Room / Dining Room</td>
<td>36</td>
</tr>
<tr>
<td>Master Bedroom</td>
<td>10</td>
</tr>
<tr>
<td>Additional Bedrooms (x3)</td>
<td>24</td>
</tr>
<tr>
<td>Kitchen / Storage</td>
<td>8</td>
</tr>
<tr>
<td>Bathroom (x3)</td>
<td>√</td>
</tr>
<tr>
<td>Garden</td>
<td>√</td>
</tr>
</tbody>
</table>

Starting from FRW 9,000,000

Starting from FRW 18,000,000
S BACK-TO-BACK DUPLEX (1 of 2 units) 31m²
Living Room/Dining Room 13
Bedroom (1 or 2) 12
Kitchen √
Bathroom [x1] √
Garden √

S DOUBLE SPLIT-LEVEL DUPLEX (1 of 2 units) 54m²
Living Room 16
Master Bedroom 9
Additional Bedrooms [x2] 16
Kitchen √
Bathroom [x1] √
Garden √

Unit 1
Level 0 - L1
Unit 2
L0 - L2

S Back-to-Back

S Double Split-level Duplex
XS SHELL

58m²

Starting from FRW 7.500.000

- Interior Dimensions: 3.50m x 8.34m
- 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

Starting from FRW 9.200.000

- 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 ✓
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)

A DETAILED ILLUSTRATED CONSTRUCTION GUIDE FACILITATES EXECUTION AND SUPERVISION

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 TRADE FAIR
A Draft Construction Manual
KIGALI CITY, JUNE 2017 BY SKAT CONSULTING/PROECCO

THE 8 MILLION HOUSE
Brick Technology Infopoint

Elevation of a 5-in-1 Rental Building on a 15m x 25m plot: 280m² / FRW 45 mio

The Owners’s Corner house or Shop
80-95m²: FRW 13-15 mio
Rental Unit 1
50m²/8 mio
Rental Unit 2
50m²/8 mio
Rental Unit 3
50m²/8 mio
Rental Unit 4
50m²/8 mio

Don’t wash it with dirty cement

The cavities for the vertical concrete reinforcement (around the vertical steel rods) need to be kept empty until the brick layer 6 is completed.

Important!
KEEP THE BRICK CLEAN FROM MORTAR. DON'T WASH IT WITH DIRTY (CEMENT) WATER! REPLACE THE BRICK IF IT GETS DIRTY!!

RCC reinforcement
(10cm x 12cm):
Vertical RCC reinforcement: 8.5cm x 12cm
Horizontal RCC reinforcement: 12cm x 12cm
CASE STUDY

KIGALI PSF EXPO HOUSE (2017)

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

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 potential 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.
CASE STUDY

RUSIZI MODEL BRICK DUPLEX SHOPHOUSE (2015)

SHOPHOUSE SERVES AS EXAMPLE OF ANCHOR BUILDING FOR ROWHOUSE TYPOLOGY

Area: 117 m²
Unit Cost: FRW 20 million (basic finishes)
Cost includes all features except land and engineering. Profit and labor are included.
Cost per square meter: 206 USD

Elements Tested:
RCC Reinforced Rowlock Bond Wall
Timber Slab with Terracotta + Plastic Finish
Timber Stairs
Strawtec Partitioning Walls

Tranverse Cross Section (above)
Longitudinal Cross Section (right)

Ground Floor Plan
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

Joint Detail of Modern Semi-Industrial RCC Reinforced Rowlock Bond Brick Wall
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 Slabs are suitable for all unit sizes (XXL through S).

Timber Floors suitable for unit sizes M and S.
The Service Portal “Made in Great 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 near project 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
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 PROECO 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.
ANNEX 5 OVERVIEW ON MODERN BRICK PRODUCTION FACILITY TYPOL OGY S

THE ZIG ZAG KILN TECHNOLOGY IS A KEY FEATURE FOR ENVIRONMENTALLY FRIENDLY BRICK PRODUCTION

Rugende, Rwanda 2017

Top: Semi-industrial factory in Rugende, on the outskirts of Kigali. Projected annual capacity between 2.5 and 3.5 million bricks per annum. First firing scheduled for September 2017.

Middle: 3D Visualizations of ZigZag Kilns in the planning (2 in Bugesera Districts and 1 in Huye) and construction (Bujumbura and Ngozi, Burundi) phases.

Bottom: Plan of ZigZag kiln factory based on an optimized workflow.
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Skat Swiss Resource Centre
and Consultancies for Development
PROECCO Promoting Off-Farm Employment and Income in the Great Lakes Region through Climate Responsive Construction Material Production

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