

# Sustainable Housing for Resilient Communities: The Impact on our Environment



## Architecture shall:

1. *Be a human right and claim to dignity of habitat for all.*
2. *Build communities of cultural and ecological resilience, in which the planet is a permanent stakeholder of our imagination and ambitions.*
3. *Aspire to reflect the culture of time, place and space.*
4. *Be a vehicle for cultural dialogue, and the articulation of habitat.*
5. *Be a co-custodian and guardian of natural ecologies.*
6. *Record the values of the present for future generations.*
7. *Bring delight to the senses and be inclusive in impact.*
8. *Counter inequality in the production and ecology of cities*
9. *Celebrate technology and progressive knowledge*
10. *Be a reiterative, Self-Critical and fundamentally creative endeavour.*





# FLOW

The Future of Living for One World

**23%**

Three materials – concrete, steel, and aluminum – are responsible for 23% of total global emissions (most of this used in the built environment).

There is incredible opportunity for embodied carbon reduction in these **high-impact** materials through policy, design, material selection, and specification.

**40%**

of global energy-related GHG emissions are due to the construction sector.

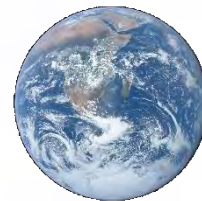
**35%**

of final energy use is accounted for by buildings and construction.

**2.3%**

annual increase of global floor area.

**At current consumption rates, we will need the resources of 2.3 planets by 2050**





## Africa has a vast infrastructure and housing opportunity....

*“Investment in African infrastructure is a global public good in the context of the worldwide significance of Africa’s demographic evolution and its necessary productive transformation.*

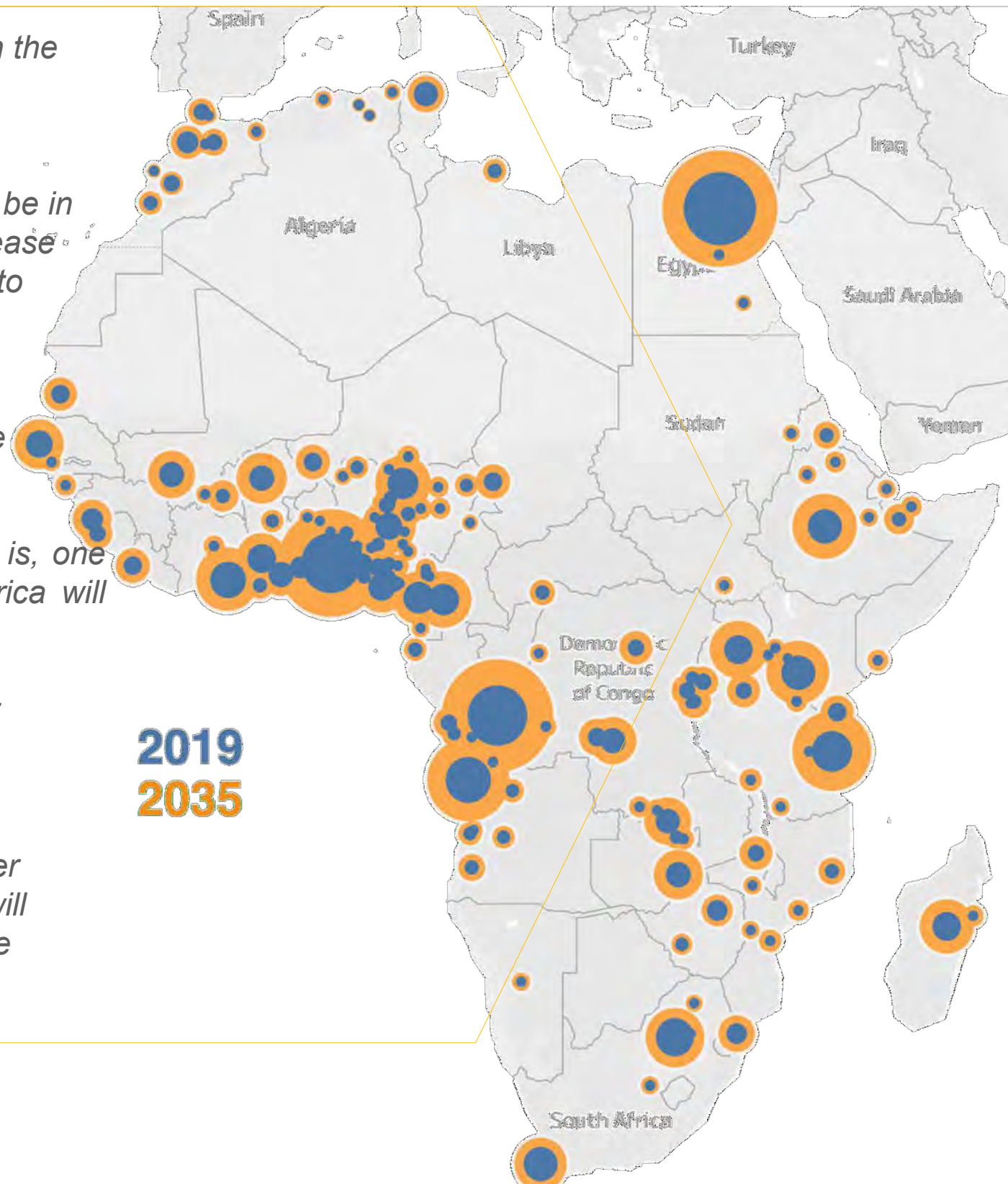
*The largest addition to the workforce in the 21st century will be in the African continent, which is set to experience a 40% increase in its working age population in just the 12 years from 2018 to 2030.*

*In 25 years from now, Africa’s population will be 70% larger, adding nearly as much as the entire current population of the Americas, which is 1 billion. By 2050, Africa’s population will reach 2.4 billion, the share of African people increasing from 17% of the global population in 2018 to 26% in 2050, that is, one quarter of the world’s total. Population in Sub-Saharan Africa will more than double by above 1 billion in just these 30 years.<sup>1</sup>*

*Urban population is projected to increase from 472 million or 40% of the total in 2015 to 1.3 billion or 56% in 2050.*

*There will be some 120 cities of more than 1 million people, including several megacities and a significant number of other very large cities, although two-thirds of the urban transition will take place in smaller intermediary cities and towns, alongside new kinds of rural agglomerations.”*

<https://www.oecd.org/dev/Africa-Quality-infrastructure-21st-century.pdf>







But there is a bigger picture....

## Architecture and design can impact on climate change



According to the U.N. Environment Program, 50 metric gigatons of greenhouse gases are released each year into the atmosphere. To reach the goal of 100% of all buildings (new and existing) to operate at net-zero carbon by 2050 (with net-zero embodied carbon), by 2030, at the latest, all new buildings must operate at net-zero carbon with a [40% reduction of embodied carbon](#). According to the [UN Global Status Report](#), buildings and construction account for more than 35% of global final energy use and nearly 40% of energy-related CO2 emissions. The buildings that we live, and work in can address existential and practical need without locking-in a legacy of high-carbon infrastructure. The average human spends up to 70% of their life inside architecture or building of one form or another.







**Urban Inequality is driver of social, environmental instability and carbon intense lifestyles**





# Components of Sustainable Human Settlement

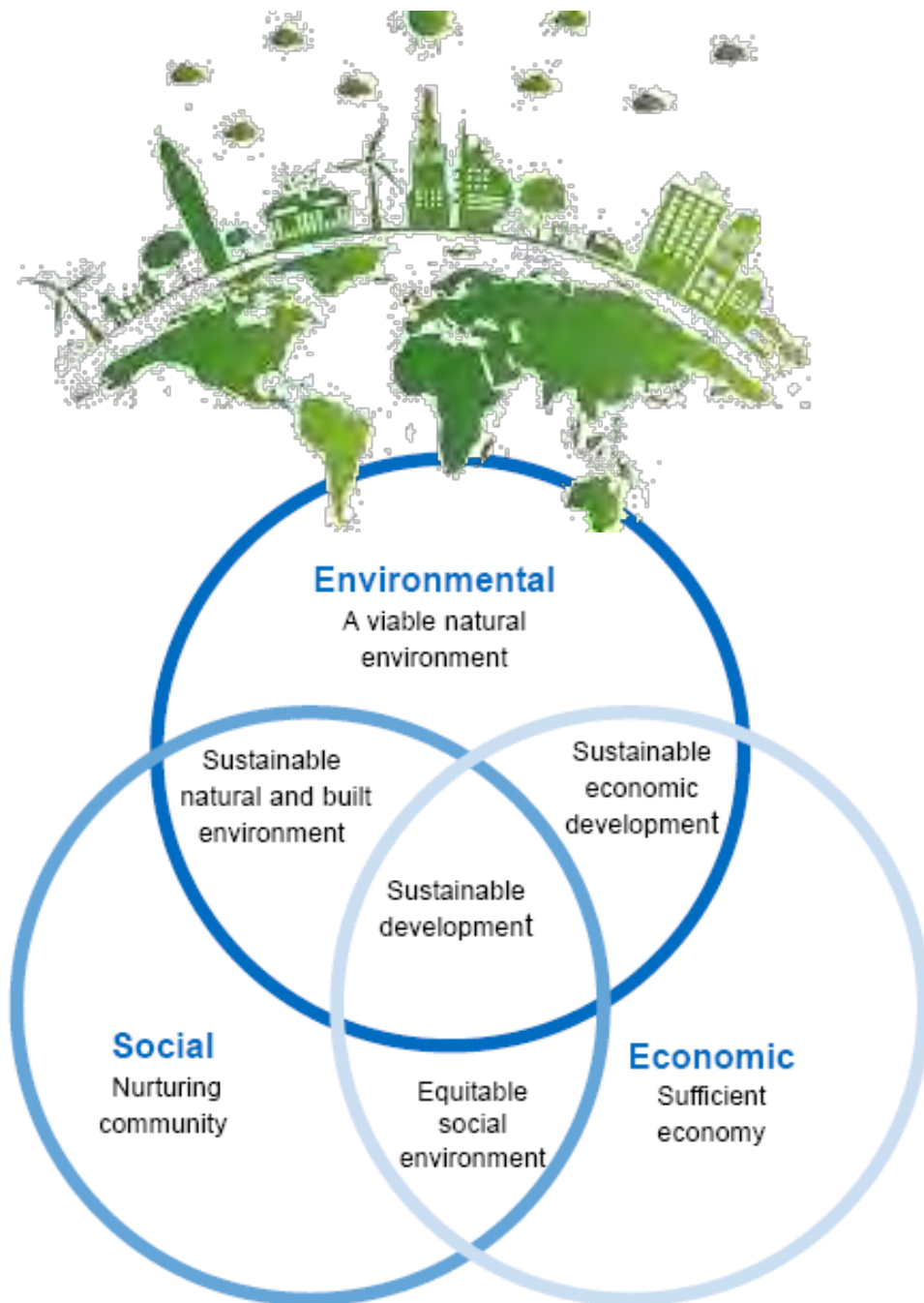
✓	Housing
✓	Public streets
✓	Semi-public space
✓	Shared public streets
✓	Integration with commercial opportunity
✓	Integration with local community
✓	Contextual Place making + nature
×	Gated community
✓	Publically accessible
×	Emphasis on Private streets
✓	Public transport dominated
×	Private car dominated
×	Private space dominated

# Components of Housing Project

✓	Housing
×	Public streets
✓	Semi-public space
×	Shared public streets
×	Integration with commercial opportunity
×	Integration with local community
?	Contextual Place making + nature
✓	Gated community
×	Publically accessible
✓	Emphasis on Private streets
×	Public transport dominated
✓	Private car dominated
✓	Private space dominated



# Net-zero is the key to carbon development finance....



# DESIGNING GREEN CITIES

12 GUIDELINES TO CREATING HAPPIER, HEALTHIER, AND MORE SUSTAINABLE CITIES

## 2 TRANSIT-ORIENTED DEVELOPMENT

Cities should match transit capacity to population density. Areas near transit should be mixed-use and provide good walking and biking connections. This provides better access to public transit and decreases car use.

## 3 MIXED-USE

The intermingling of commercial and residential uses guarantees residents access to amenities.

## 4 SMALL BLOCKS

Smaller blocks create a dense mesh of a narrower streets and paths that are more pedestrian-friendly.

## 5 PUBLIC GREEN SPACE

Attractive public spaces can bring economic vitality to any city space. Public green space helps high-density cities feel less crowded and more comfortable.



Design and content by CC Huang

## 6 NON-MOTORIZED TRANSIT

The most attractive cities in the world emphasize the pedestrian environment. Walking and biking require less land and energy use than any other type of transportation.

## 1 URBAN GROWTH BOUNDARY

Every city should have an urban growth boundary to prevent sprawl, encourage infill development, and preserve land resources.

## 12 WATER

Water-efficient fixtures, appliances, and plants can easily decrease water use. Rainwater collection can also improve water availability for cities.

## 11 WASTE

A significant amount of waste can be diverted from landfills through composting and recycling. Waste can also be recovered as energy.

## 10 RENEWABLE AND DISTRICT ENERGY

District energy can result in a 30-50% reduction in primary energy consumption. Renewable energy is also falling rapidly in cost and increasing in efficiency, which cities can benefit from.

## 9 GREEN BUILDINGS

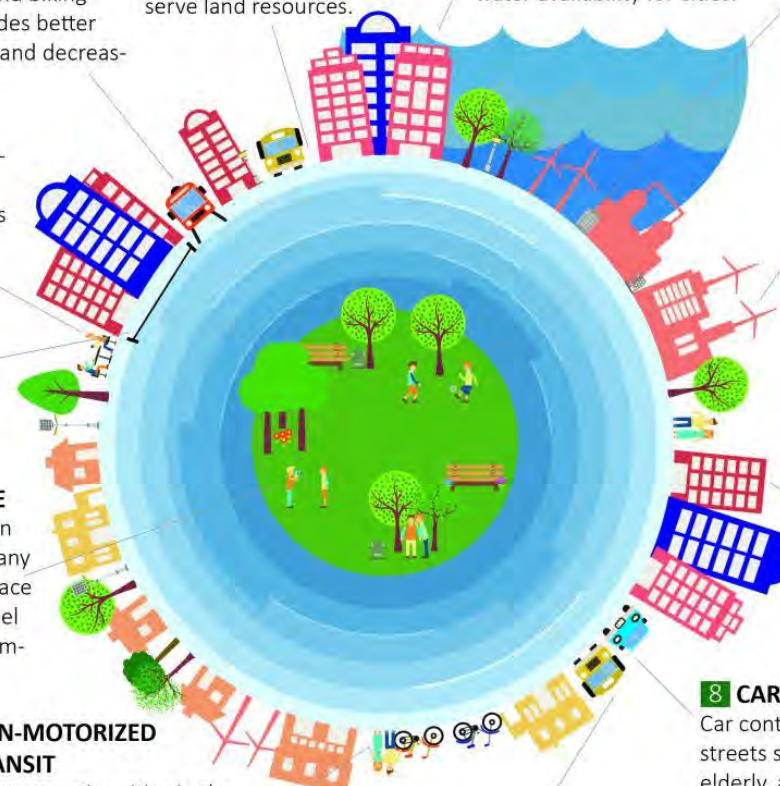
Buildings account for about 25% of China's energy consumption and carbon emissions. Green buildings have health benefits in addition to climate benefits.

## 8 CAR CONTROL

Car control is essential to make streets safer for children and the elderly, alleviate costly congestion and pollution, and rejuvenate street life.

## 7 PUBLIC TRANSIT

People will choose not to drive as often if public transit is a first-class option. Public transit should also be well integrated with biking and walking.





## Six senses of regenerative landscapes

**Sense of justice,**

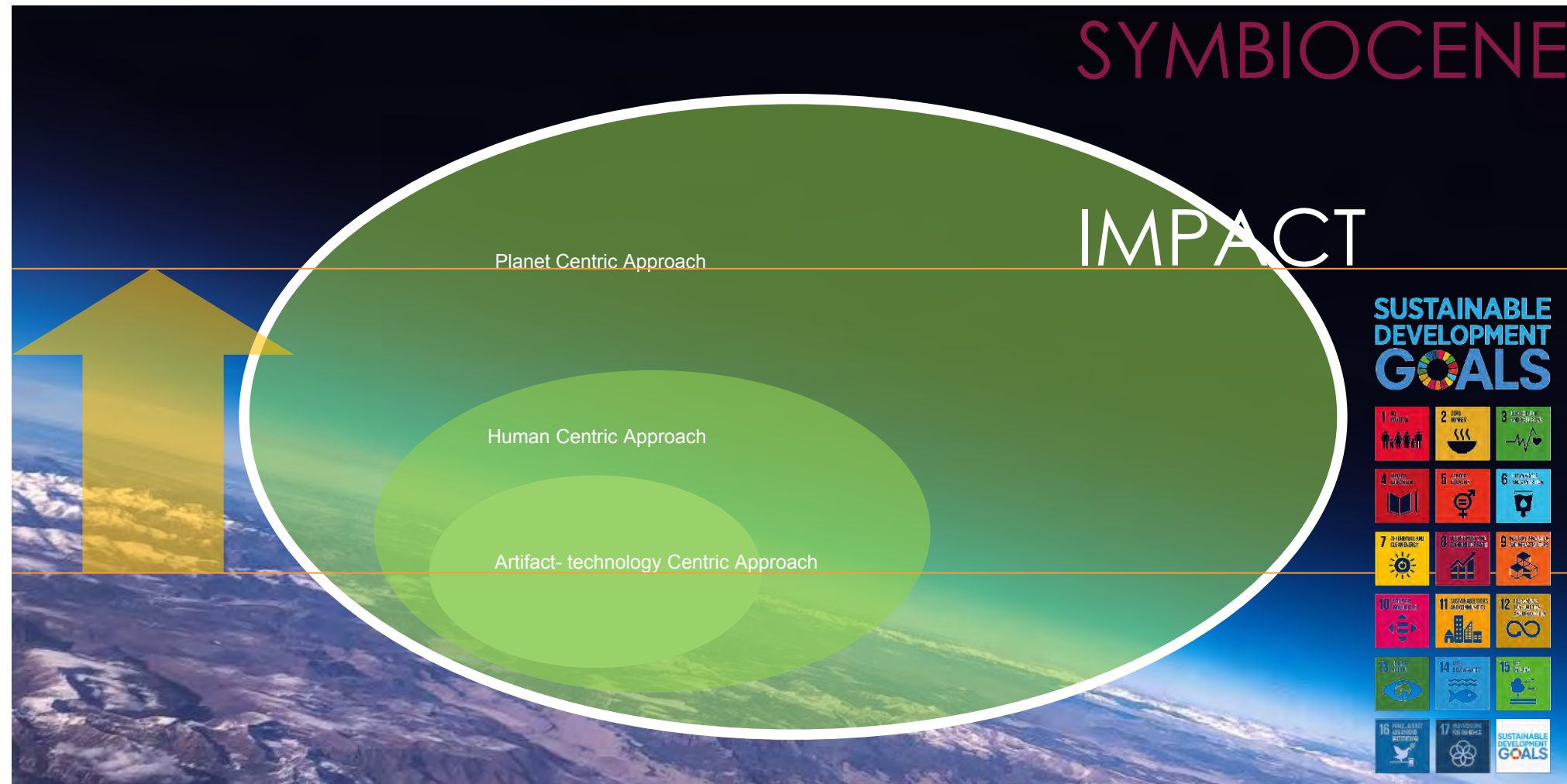
**Sense of limits,**

**Sense of place,**

**Sense of history,**

**Sense of design**

**Sense of nature.**



**We must no longer make housing. We must design for future communities. A new sensibility is required**



## 5 High-impact ideas for climate Smart sustainable human settlements



**1: Develop a Trust/Climate Smart fund that protects rainforests, saving the ecosystem through partnerships and community engagement with a focus on integrated housing**



**2a: Develop an incubator/accelerator supporting enterprises and/or NGOs focused on developing local/community-based solutions to tap into carbon offset markets**



**2b: Develop a business offering to catalyze funding from actors across the public, private and social sectors on reforestation and employment efforts**



**2c: Launch a global collaborative that develops a win-win value proposition for emerging market governments, agricultural and livelihood CSOs, and green businesses/investors**



**3: Develop a data dashboard for consumers, entrepreneurs, companies and financiers that can monitor the potential effectiveness of productive appliances in different locations and the feasibility and potential returns of investment in such appliances**



**4: Develop an entity that advocates for, is a center of expertise on, and facilitates, the creation of Feed-in Tariffs for renewable energy and smart housing across the continent**



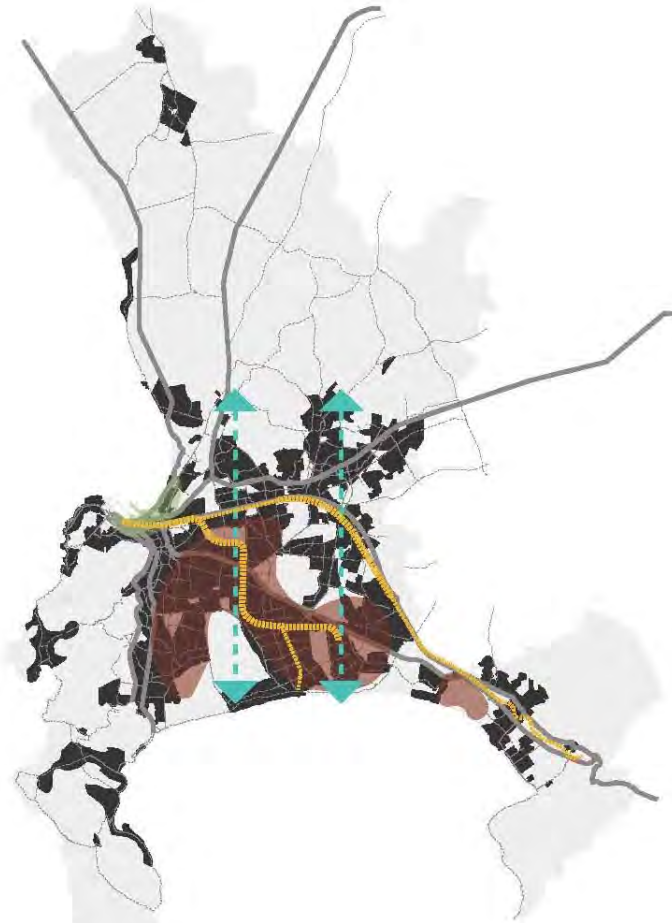
**5: Make an analytical case for the use of CLT as construction material to solve for both climate change and affordable housing challenges in Africa**





### FIVE YEARS SPATIAL DEVELOPMENT

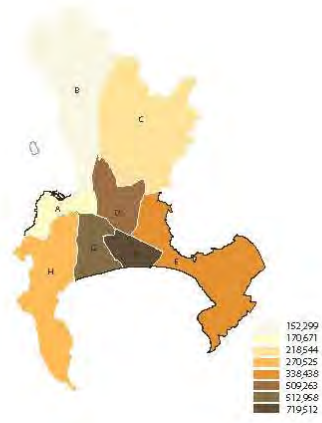
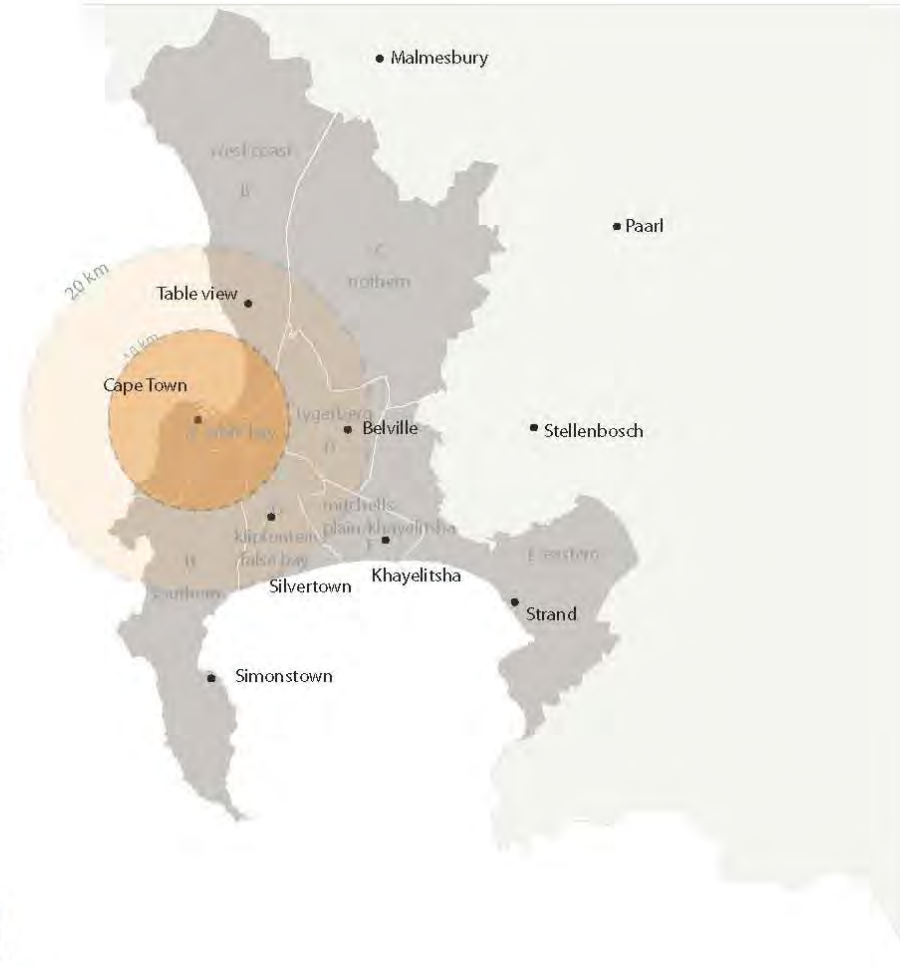
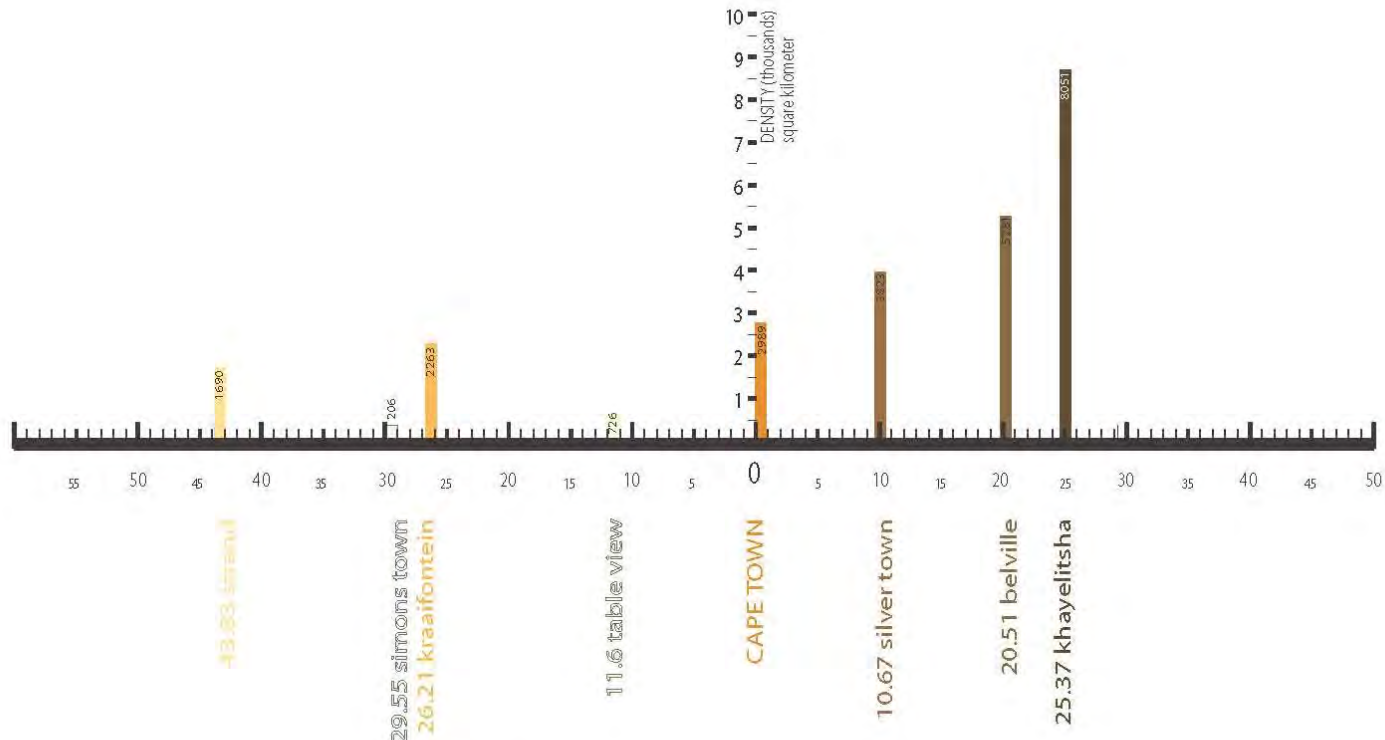
- New Investments Economic-Social
- New major private sector Investment (economic and social)
- Urban Sprawl
- Economic Backbone
- Possible Densification
- URP
- Urban Development Zones
- Major Settlement areas within the next 5 years
- Prepare for Settlement Growth + 6 years
- Prioritised Development Activity Routes



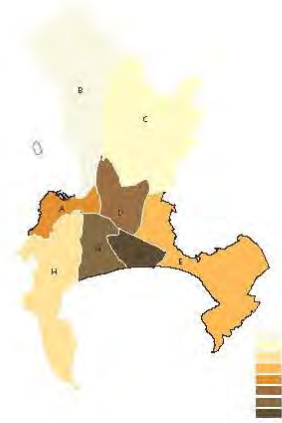
### MOVEMENT AND MOBILITY

- Urban Sprawl
- Public freight congestion
- Public Transport dependency
- Movement constrains
- Major radial structure
- Rail operating over capacity

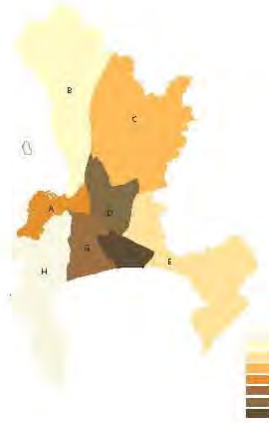




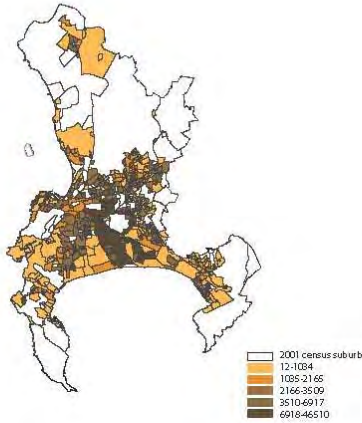
POPULATION IN THOUSANDS



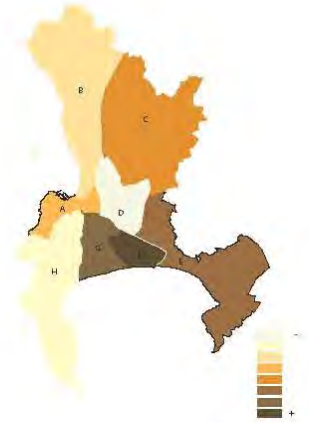
POPULATION DENSITY SQUARE KM (whole district)



POPULATION DENSITY SQUARE KM (district urban area only)

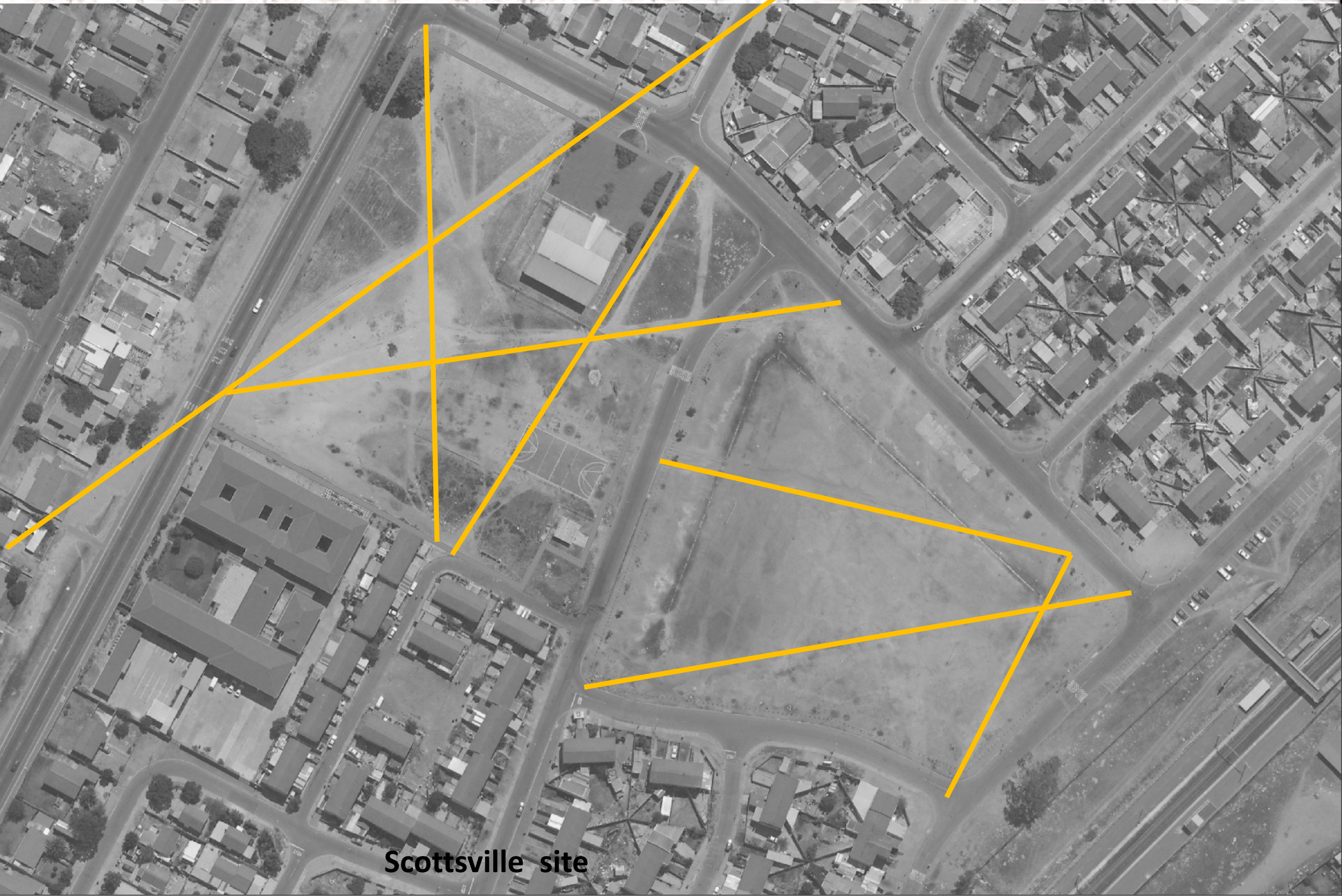


POPULATION DENSITY SQUARE KM (settlements)



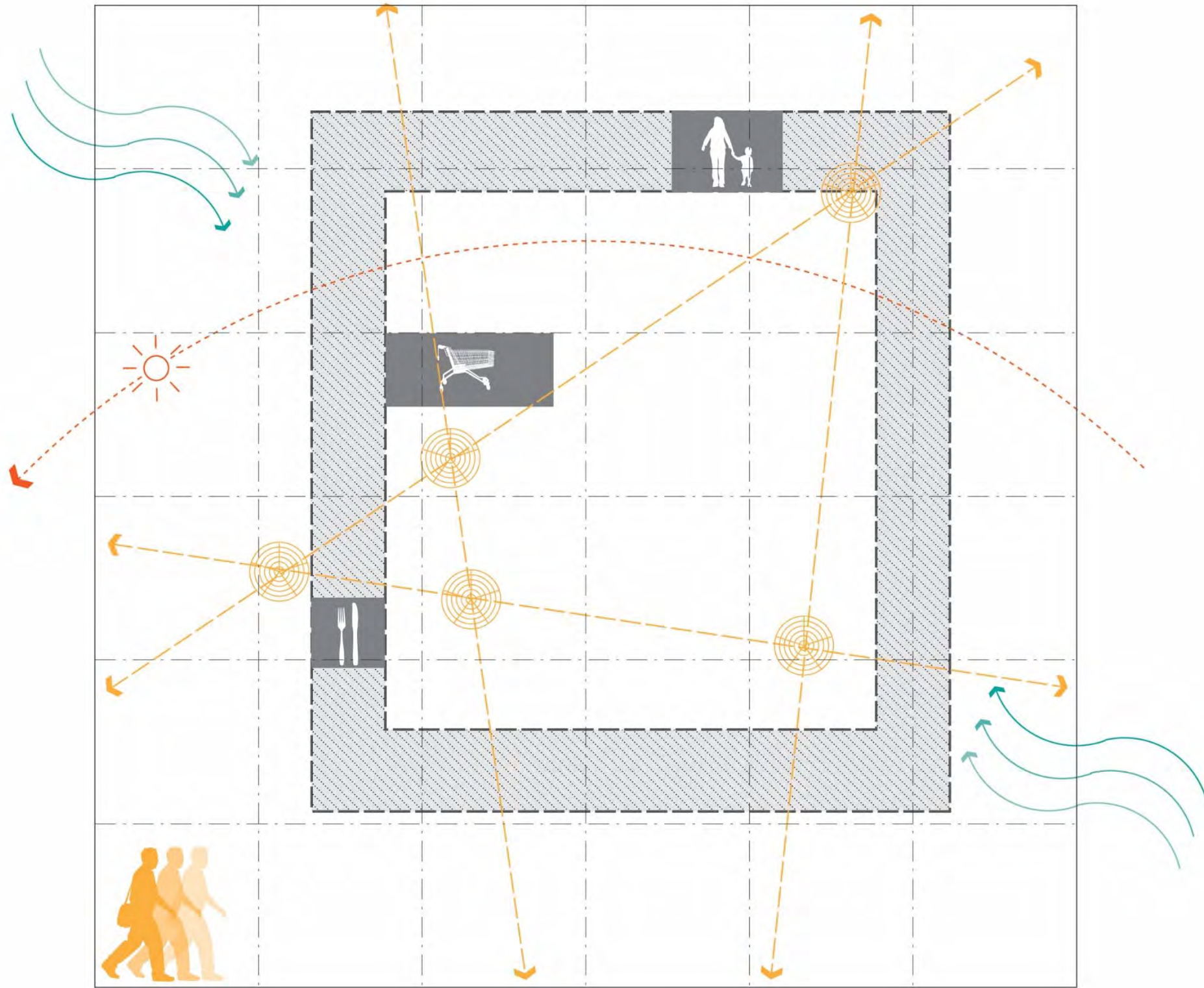
INFORMAL DWELLING SETTLEMENTS



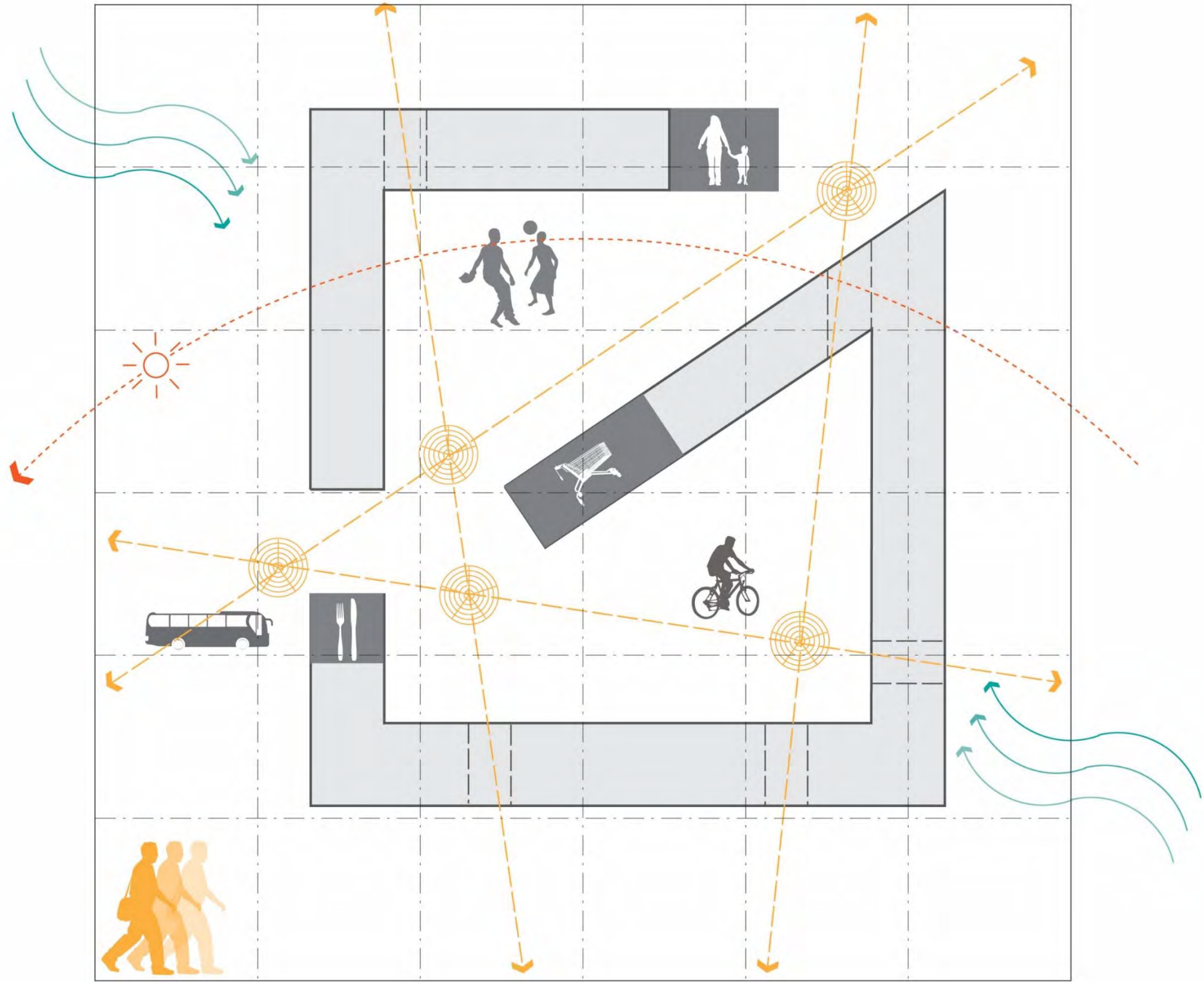


**Scottsville site**













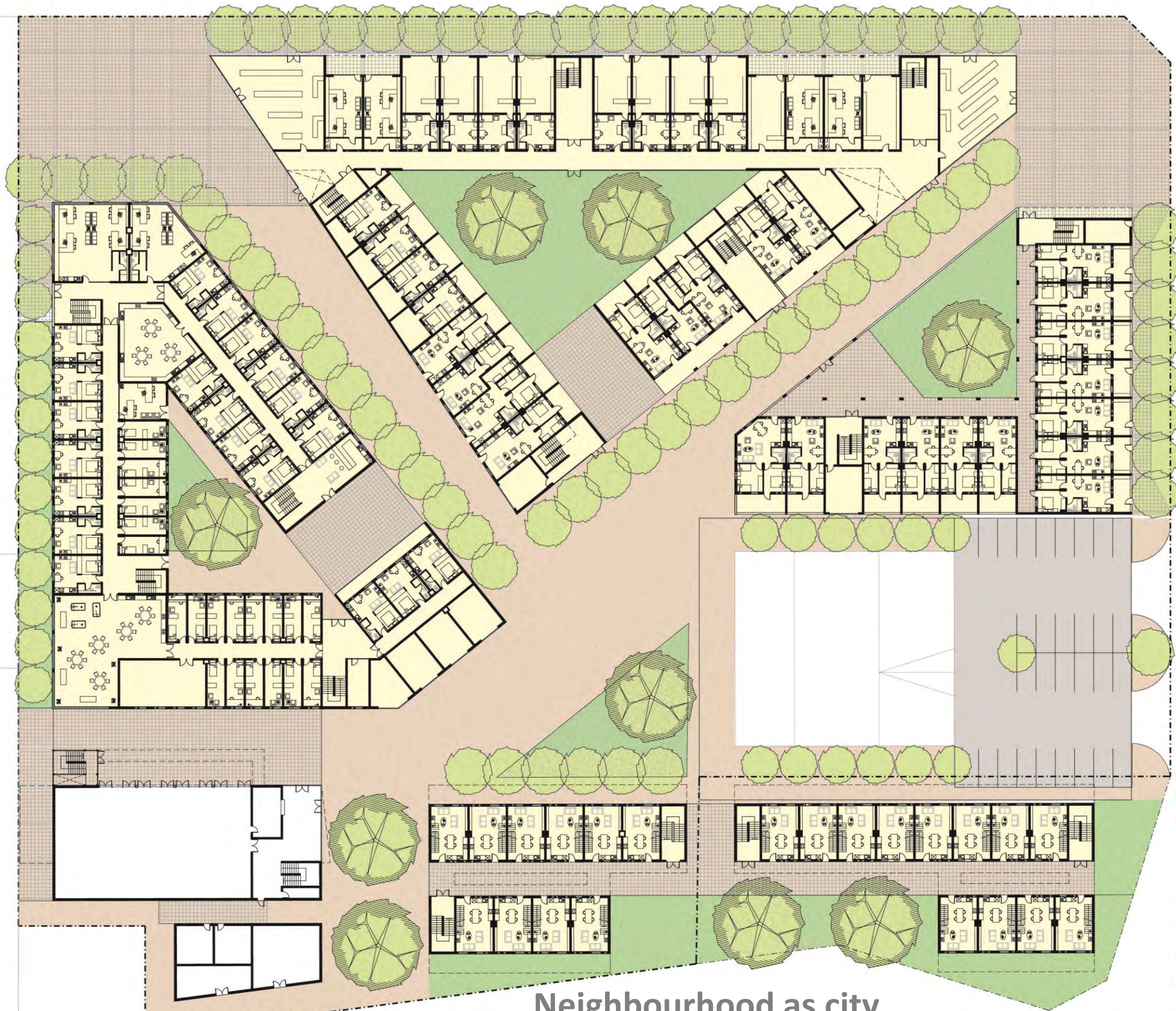










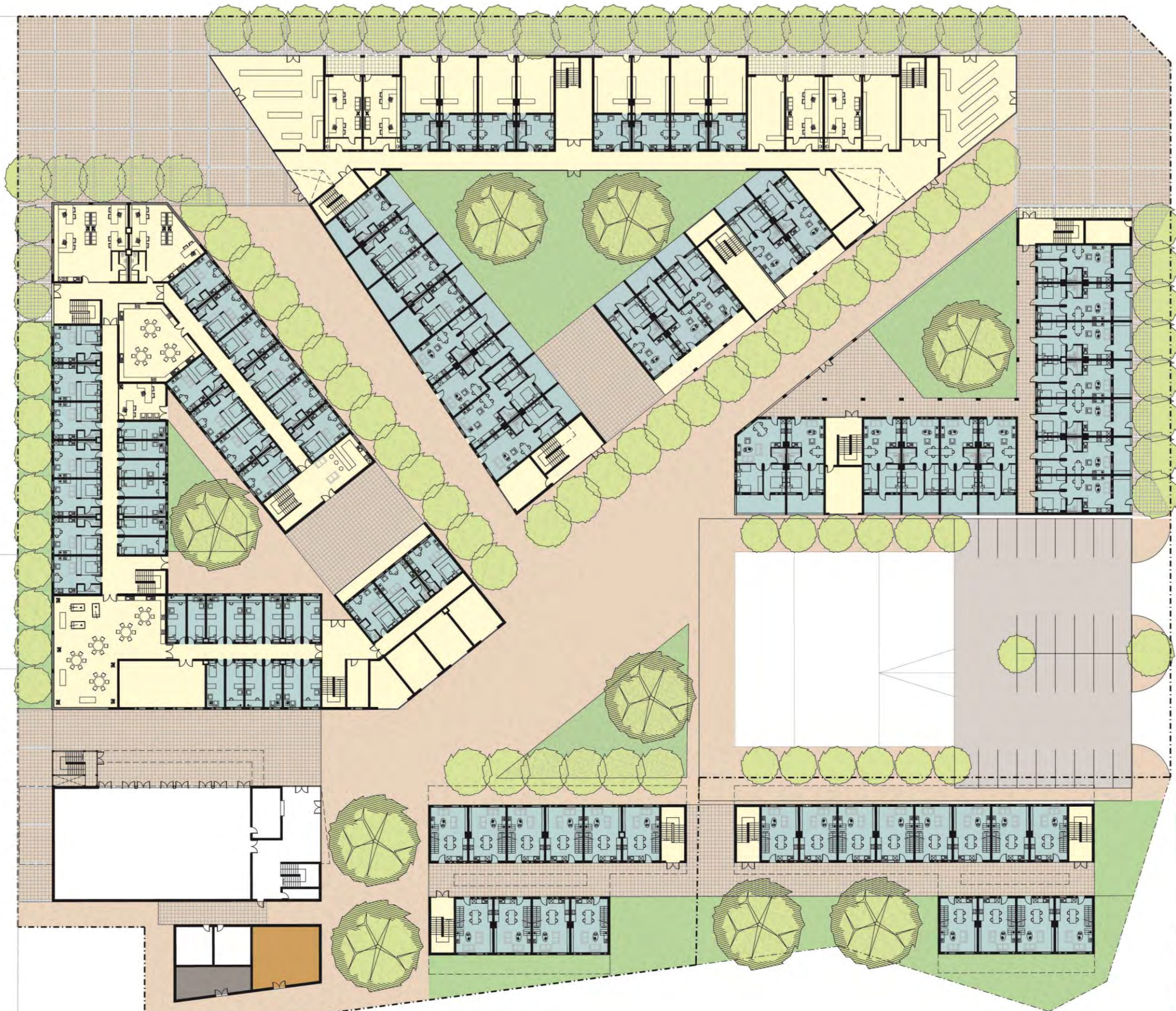


# Neighbourhood as city



- building blocks
- communal space
- communal kitchen
- residential unit
- commercial opportunity
- office
- circulation core
- ablution
- site development
- private courtyard
- public courtyard
- refuse yard
- garden maintenance





0

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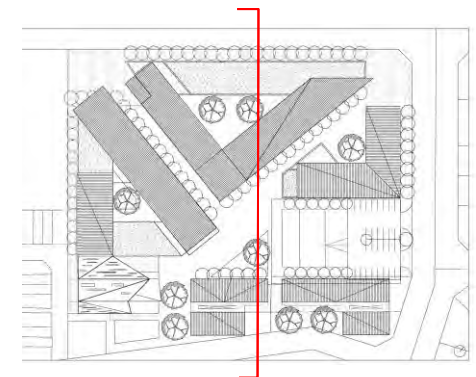
Livable city



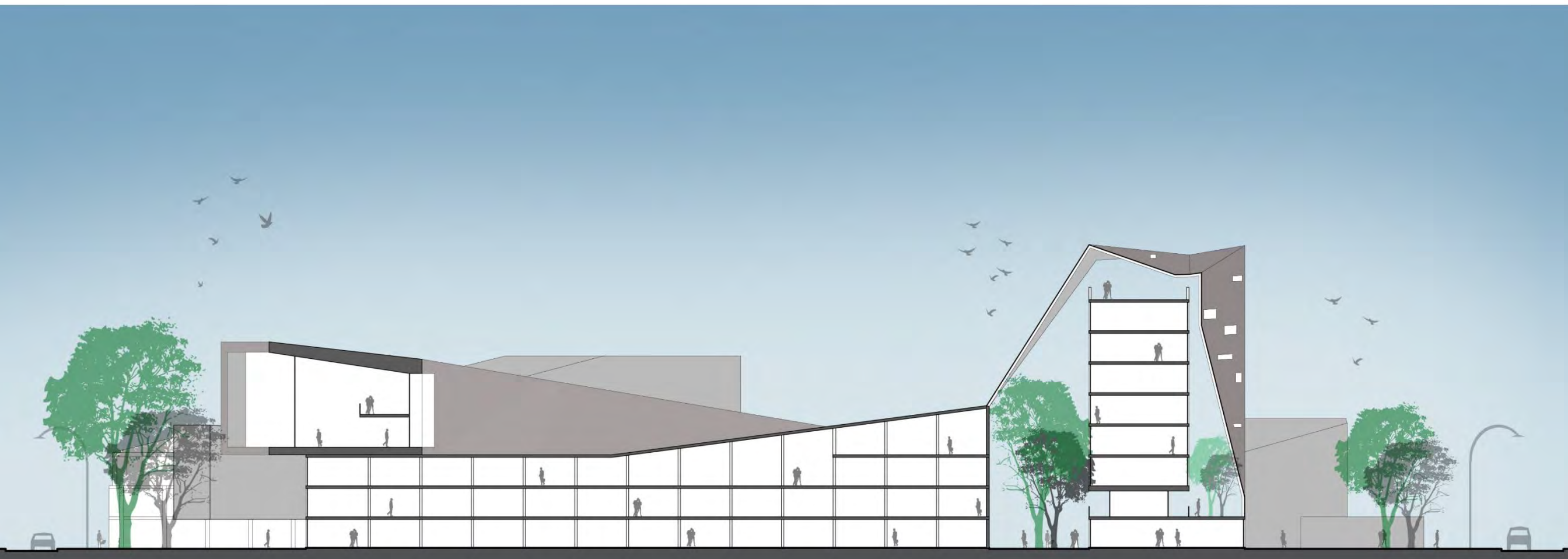
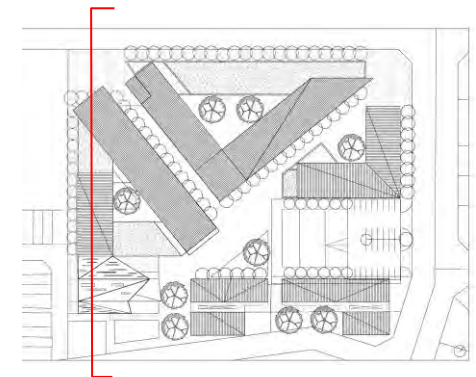


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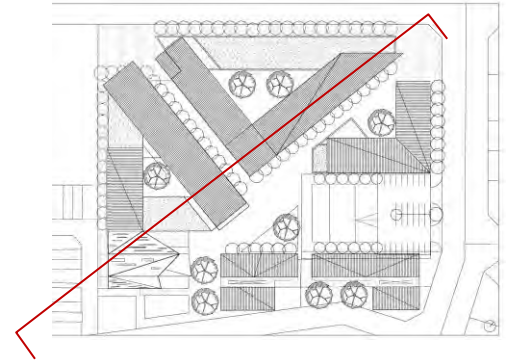












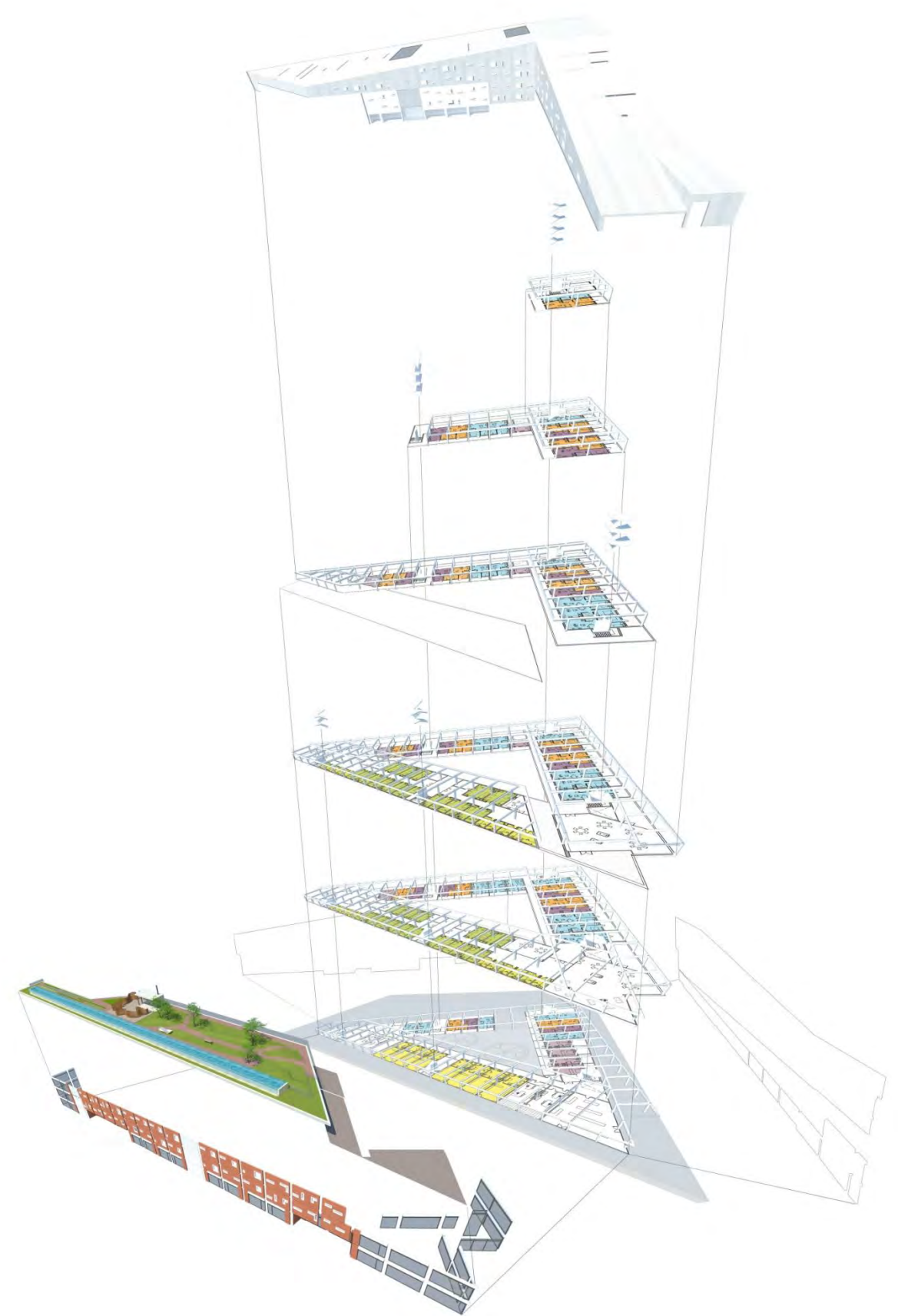
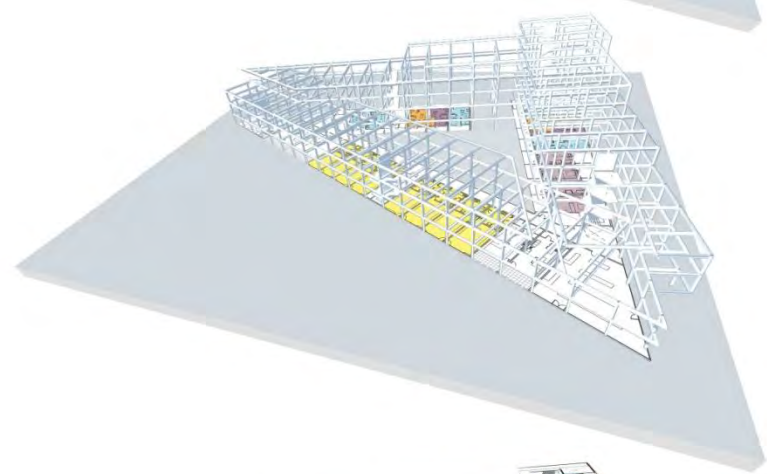
























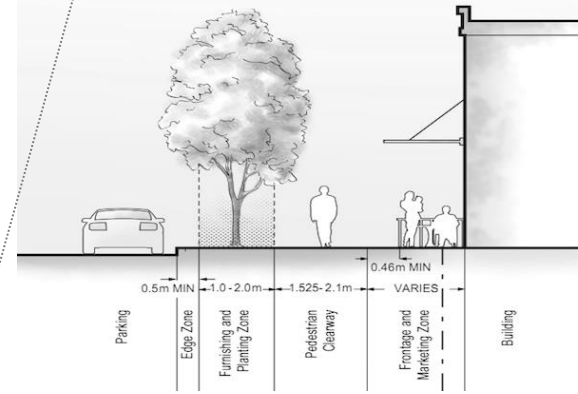
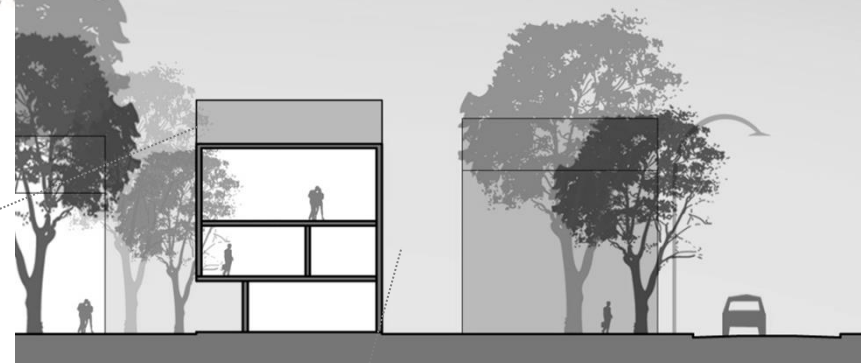












Stoep

Unit

Trade

Trade

Furniture

Pedestrian

Road









## Rwanda has challenges....

*Kigali should be an engine of growth and poverty reduction for Rwanda. But just 1,000 formal houses are built there each year, and most are too expensive for the majority low-income citizens. How can the government breathe life into the city's low income housing market? Robert Buckley and Sally Murray discuss.*

Rwanda is one of the least urbanised countries in Africa. However, considering the inability of many rural farms to cover subsistence needs, and rapid population growth, high urbanization rates are inevitable. The national economic plan (EDPRS II) recognizes that even in the presence of rural productivity gains, the country must create an additional **1.8 million off-farm jobs before 2020, and target the share of urban population to rise from 17% in 2012, to 35% by 2020.**

Rwanda's average annual household income is low (about \$400), and land and property prices in cities are expensive (especially in the capital, Kigali), however. How, in this context, can poor Rwandans finance urban housing to access urban jobs and services?

<https://blogs.lse.ac.uk/africaatlse/2015/06/25/delivering-low-income-housing-in-rwanda/>

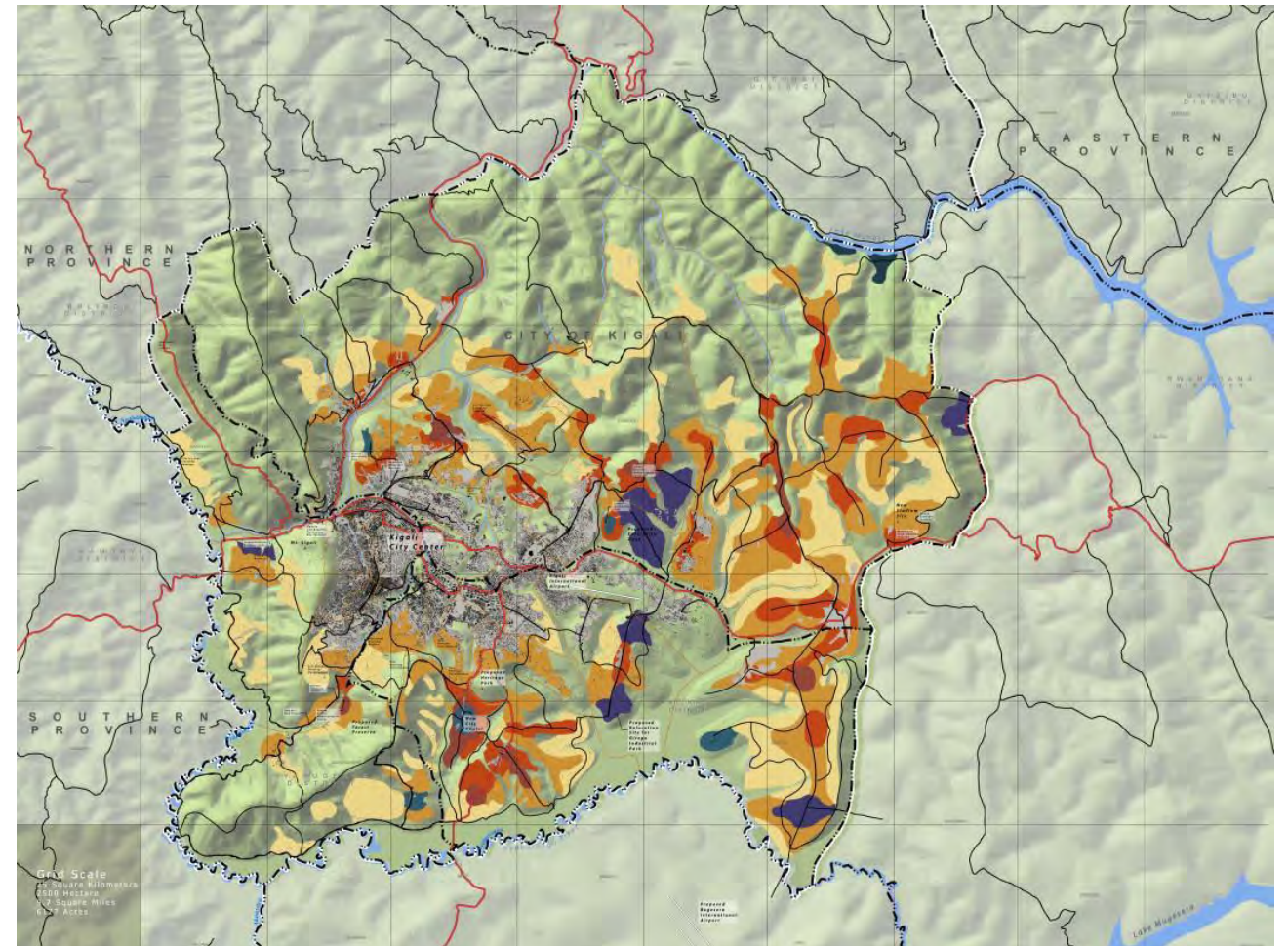


## Rwanda is addressing them....

“Kigali Master Plan will enhance **green growth**. Planners aspire to strike the fine balance between rapid development and protecting the city’s greenery, biodiversity and heritage. The Master Plan put in place various strategies to adapt to the realities of climate change, particularly rising global temperatures and rising sea levels. It will mitigate flood risks, improve drainage infrastructure and, where possible, integrate them with other developments to optimise land use.

This new concept has the population projection now at **3.8million, household size at 3.8, gross density at 5198 p/sqkm, and employment projection at 1.8m jobs**. This new updated Kigali Master Plan 2050 is an upgrade to the 2013 version and will lead the economic and social growth of Kigali for the next 30 years.

<https://masterplan2020.kigalicity.gov.rw/>







## ...driven by three key challenges

### Challenges

### Descriptions

### Quotes from stakeholders

1

#### Limited liquidity of households

- Close to 50% of households in Kigali rent the properties they reside in
- The average Rwandan households spends only about 25% of their monthly income on rent
- In 2018, the median household in the middle-income quartile could afford to rent a house worth a maximum of USD 11,306

*“Everyone wants to own a home, but it’s a long-term investment that requires them to a substantially financial outlay, but households already have other financial obligations which limits their capacity to take on further debt- Access to Finance Rwanda*

2

#### High cost of borrowing

- The median household could only afford to buy a property costing a maximum of USD 4,391 at a 17.3 % interest rate for 15 years
- Due to structuring gaps, banks charge high interest rates that render borrowing infeasible for the buyer
- There are less than 5,000 registered mortgages in Rwanda

*“When we started advertising our affordable housing project, we had long queues for sign ups until people found out that a 10% contribution was required and then the interest dropped significantly” – RSSB*

3

#### Limited availability of data to inform offering

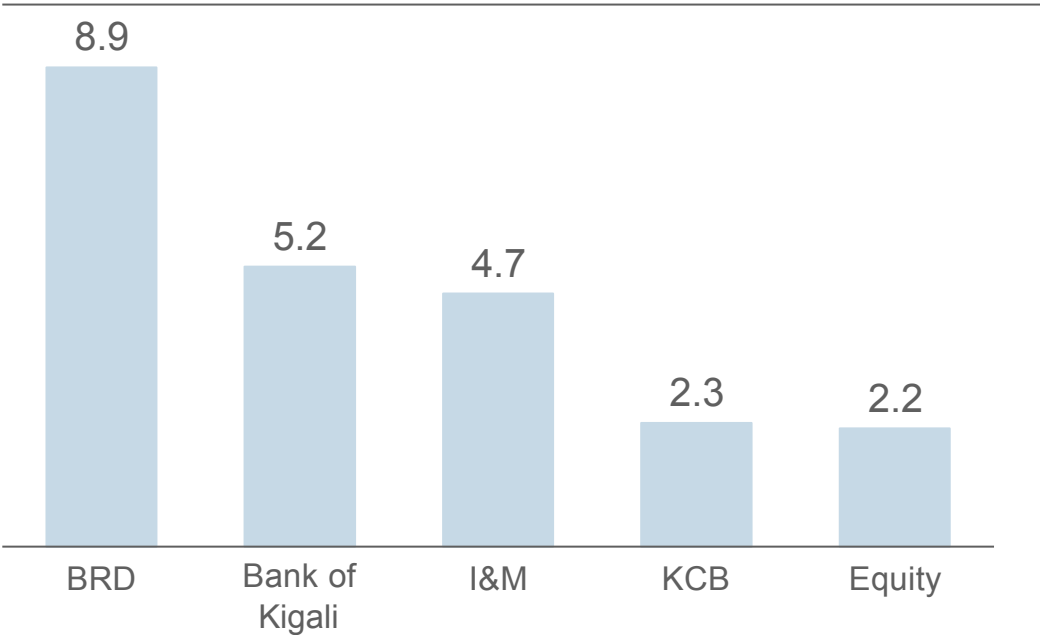
- There is limited data on housing demand and the mortgage market to inform lending from financial institutions
- The average price of an affordable house in an urban area has a value of roughly USD, 20,000 and only 4.29% of urban households can afford this house
- Due to limited data the housing market largely targets high-income households

*“Developers in the affordable housing space construct units on the assumption that they know the right price point, design, and location for the buyer without applying design thinking into their process, which usually results in low sales” – Bank of Kigali*

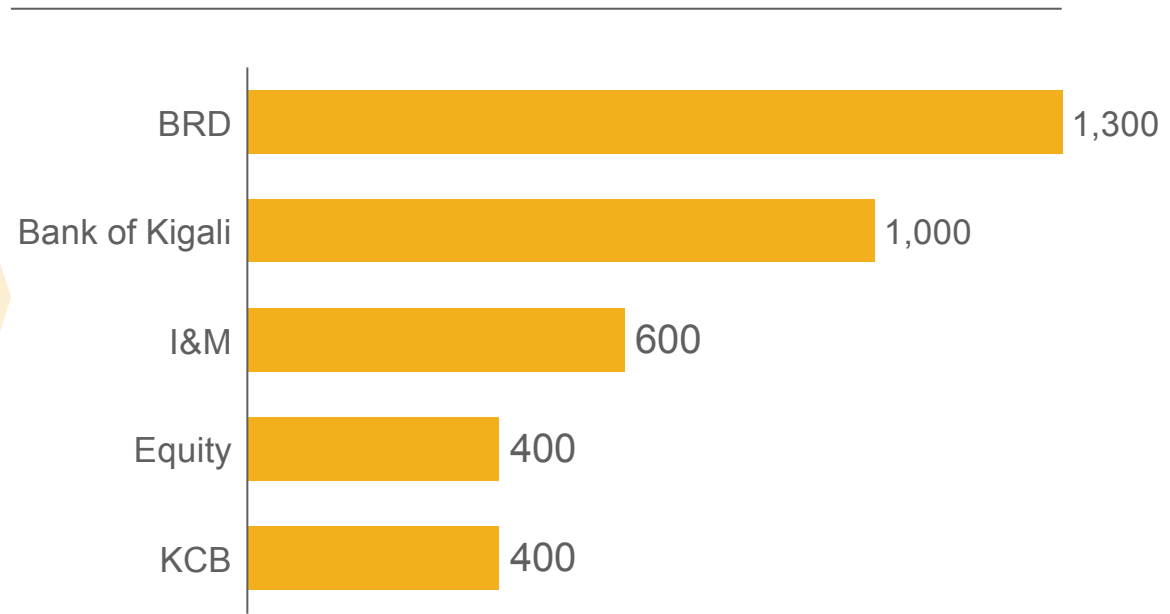


**Lending towards the affordable housing sector is limited and mostly targeted to higher income segments at high interest rates**

**Portfolio sizes affordable housing loans by local banks**  
(USD, millions, 2017)



**Number of affordable housing loans provided by local banks**  
(Number, 2017)



Loan components	Bank of Kigali	BRD	I&M	KCB	Equity
<b>Average Loan Size (USD)</b>	63,000	63,000	67,500	72,000	100,000
<b>Loan Term</b>	15 years	20 years	20 years	15 years	15 years
<b>Interest Rate</b>	18%	18 %	17.5%	18%	17.5%

Source: Landscape of Investment. Center for Affordable Housing Finance Africa. December 2017




## The mortgage market is still underdeveloped, which decreases the affordability of majority of Rwandan households to purchase homes

Challenges	Description	Implications on affordable housing
<p><b>1 Lack of sufficient mortgage liquidity facilities</b></p>	<ul style="list-style-type: none"> <li>Lack of secondary mortgage facilities such as mortgage backed securities or aggregators to provide housing liquidity has created a <b>refinancing gap for mortgages</b> and poses greater risk to primary lending institutions</li> </ul>	<ul style="list-style-type: none"> <li>There is a <b>73% long-term financing gap</b> to cover the current need for housing units in Rwanda</li> <li>Perceived <b>defaulting risks lead to higher interest rates averaging around 18 %</b></li> </ul>
<p><b>2 Expensive amortization schedule and high cost of borrowing</b></p>	<ul style="list-style-type: none"> <li>Total payment amortization schedules are the most common types of schedules utilized for mortgages in Rwanda</li> <li>High interest rates and significant down payments are prohibitive to borrowing, especially for low-income households</li> </ul>	<ul style="list-style-type: none"> <li>The cost of mortgages is <b>1.67 times higher</b> than if the even principal payments were adopted for a 20-year loan term at 16 % interest for instance</li> <li>Most mortgage lenders <b>require a loan contribution of at least 20%</b> which many Rwandan households cannot afford</li> </ul>
<p><b>3 Need for better targeting to low-middle income earners</b></p>	<ul style="list-style-type: none"> <li><b>69% of mortgages</b> are awarded to households earning between USD 310 and 620 ; 31 % are given to households earning above USD 620 monthly</li> <li>Limited mortgages awarded to households earning below USD 310</li> </ul>	<ul style="list-style-type: none"> <li>The current housing policy specifies that <b>affordable housing should be targeted to segments of the population earning less than USD 206</b></li> <li>The majority of the population is <b>largely excluded from the mortgage market</b> suggesting a mismatch between the current policy and its implementation</li> </ul>

*Albeit the challenges in the mortgage market, BRD is leading efforts provide below market interest rates of (11%-12%) for buyers targeting affordable housing*





## Affordable construction material, flexible payments, and consumer-centric design are all among successful affordable housing projects

Country  
context

### Innovative mechanism

### Description

### Case Studies

#### 1 Affordable Construction Materials

- Utilizing innovative construction materials such as autoclaved concrete masonry, or materials sourced through contracted local suppliers can decrease costs
- Forming strategic partnerships with government can also unlock opportunities to decrease costs such as the provision of cheaper land and lower taxes

- KARIBU Homes, an affordable housing project in Kenya used a load bearing wall reducing costs
- In Mozambique, the Casa Real project built houses with a built-up foundation and slabs for incremental expansion
- Casa Real conducted a supplier survey to understand costs associated with procuring local building materials and partnered with the municipalities to contract suppliers

#### 2 Flexible Payments and Financing

- Designing payment mechanisms that can accommodate different financial abilities of end-users such as allowing users to pay in phases or renting to buy can expand access to financing for low and middle-income families
- Cross subsidizing housing units can allow developers to vary prices according to the ability to pay

- Casa Real in Mozambique allowed end users to pay through cash payments, mortgage financing, pay as you go or pay as we build, and rent to buy for three years.
- In pay as we build, the client pays for the house in phases such as foundation, superstructure, roofing and finishes
- KARIBU Homes were designed such that higher profits from higher priced units, would subsidize the lower priced units

#### 3 Customer-oriented Design

- Conducting market surveys to gauge customer preferences and incorporating them in the final design can decrease the mismatch between the demand and supply of affordable housing

- KARIBU conducted research to gauge key attributes to include in the apartments. Some of the needs included low density buildings, security, incremental building and variety
- Prior to construction, Casa Real did a market survey to gauge customer willingness to pay and house amenities preferences

*Across the affordable housing projects that have succeeded, developers increased the uptake of their units by proposing attractive and affordable end-user designs and financial products*



## Majority of projects in the sector have struggled to take shape due to supply-side constraints such as cost overruns

Country context

### Overview

High construction costs are the main barriers to the success of affordable housing projects in Rwanda. Despite these challenges, some projects have managed to achieve certain successes in providing low cost housing and using innovative construction materials such as aerated autoclave concrete. To achieve a high level of success in affordable housing development, investors need to ensure more comprehensive planning including targeted marketing strategies to increase uptake, and affordable construction and financing schedules.

#	Project Name	Funders	Description	Number of Units	Project insights
1	<b>Ndera Housing Project</b>	Development Bank of Rwanda (BRD) and Palmeraie Development Group	The aim of the project is to develop 1759 housing units in the first phase, with the cheapest property under the project valued at USD 31,000. The project will feature moderately-sized two- and three-bedroom apartment blocks.	The project aims to build a total of 5000 units	<ul style="list-style-type: none"> <li>100% booked but the construction is not yet complete</li> <li>Drivers for demand include affordable pricing and low mortgage rates and down-payments</li> </ul>
2	<b>Abadahigwa Ku Ntego Ltd. Project</b>	BRD and Abadahigwa Ku Ntego Ltd.	The project was initiated by army veterans in 2014 and initiated 32 housing units costing USD 20,000 each. The project is located in Kabuga in the Gasabo district.	Future phases will aim to build, 30 and 40 units successively	<ul style="list-style-type: none"> <li>90% completion rates out of 56 units proposed for delivery</li> <li>Among the most affordable planned housing developments</li> </ul>
3	<b>Rugarama Park Estate</b>	Shelter Afrique and BRD	Shelter Afrique and the BRD initiated the development of 2,000 affordable housing units in Nyamirambo Sector, Nyarugenge District at an estimated cost of cost USD 131 million in 2019	The project aims to build about 2,800 affordable houses on a 42-hectares piece of land. The expected cost of one unit will be around USD 16,000 and the most expensive unit around USD 35,000	<ul style="list-style-type: none"> <li>Used the aerated autoclaved concrete masonry to decrease construction costs</li> <li>Cheapest units are advertised at USD 12,400 with a 10% down-payment, but sales are still low</li> <li>Cost over-runs that are likely to increase the price of housing units</li> </ul>
4	<b>Batsinda II Affordable Housing Project</b>	Rwanda Social Security Board (RSSB)	Low cost homes at Batsinda II located in Kinyinya sector in Gasabo district are expected to cost on average USD 27,000. RSSB will help connect buyers to sources of finance.	600 units are currently in construction and will be built by the contractor Horizon	<ul style="list-style-type: none"> <li>Stalled due to cost-overruns which has substantially increased the final price of the units for buyers</li> <li>Prices will now range from USD 55,000-65,000</li> </ul>

Level of success in sales and completion rate

Medium

Low



## There are a few ecosystem-wide challenges that limit the feasibility of affordable housing developments in Rwanda

Country context

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#### Limited availability of data to inform offering

- There is limited data on housing demand and the mortgage market to inform lending from financial institutions
- The average price of an affordable house in an urban area has a value of roughly USD, 20,000 and only 4.29% of urban households can afford this house
- Due to limited data the housing market largely targets high-income households

*“Developers in the affordable housing space construct units on the assumption that they know the right price point, design, and location for the buyer without applying design thinking into their process, which usually results in low sales” – Bank of Kigali*





# The National Housing Policy outlines three main strategic activities to enable the affordable housing sector to scale

## National Housing Policy Provisions

## Description

**1**  
**Support framework for affordable housing developments**

The government will financially support affordable housing development projects that can be accessed by low income households, use local resources and create a well-planned livable environment by:

- Financing 100% of service infrastructure within the housing neighborhood
- Financing construction materials
- Advancing finance and implementing service for infrastructure within the neighborhood
- Providing tax incentives for investment in affordable housing

**2**  
**Mitigating risks for developers and buyers**

The government will enable investment risk mitigation through

- Assisting in the identification of committed buyers for ownership or renting through district governments
- Identifying new owners in case the developer or buyer fails to finance the project

**3**  
**Incentives for affordable housing developers and producers of affordable materials**

The following incentives will be provided for developers in the affordable housing sector:

- Reducing corporate income tax for investment in affordable housing
- Depreciating assets for registered investors
- Making housing data available to developers
- Offering official documents, forms and title deeds in international languages





## For an affordable project to work in Rwanda, houses need to have more room to suit family needs at lower costs

Our  
Under-  
standing

1

### Update the design



- **Certain features should be adjusted to fit within the preferences of Rwandans** wanting to buy a new home
- This includes **more rooms to suit families needs**
- These homes can either be in **an apartment style home or standalone**
- Key additional features included **increasing the size of the kitchen and outside space such as a balcony or small garden** as well as **adding a bathroom to the master bedroom.etc**

2

### Reduce the cost



- The **current low-cost option would need to be at a lower price** if it were the style and size were to be maintained
- People are **willing to pay up to \$15k for certain features** – such as additional rooms and being close to a tarred row
- The **additional features that were not highlighted and could be removed to reduce cost**
- **Lower costs of construction material** will need to be acquired to reduce the cost of the build

*The desire and willingness to buy a quality home is evident in Rwanda, but either cost needs to be reduced or the style needs to be adjusted to suit market needs*