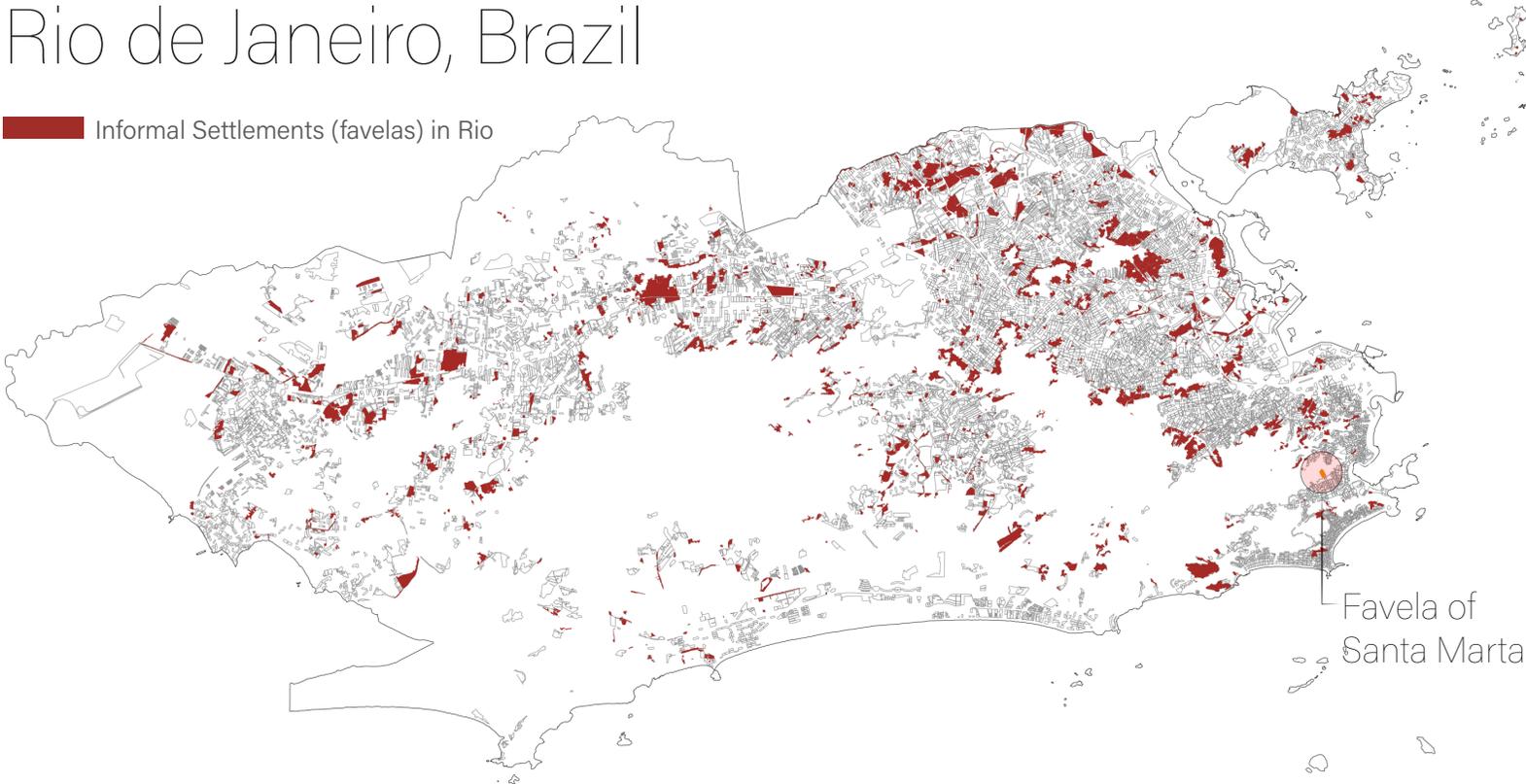
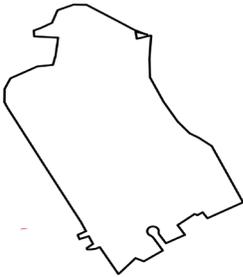


Rio de Janeiro, Brazil

Informal Settlements (favelas) in Rio



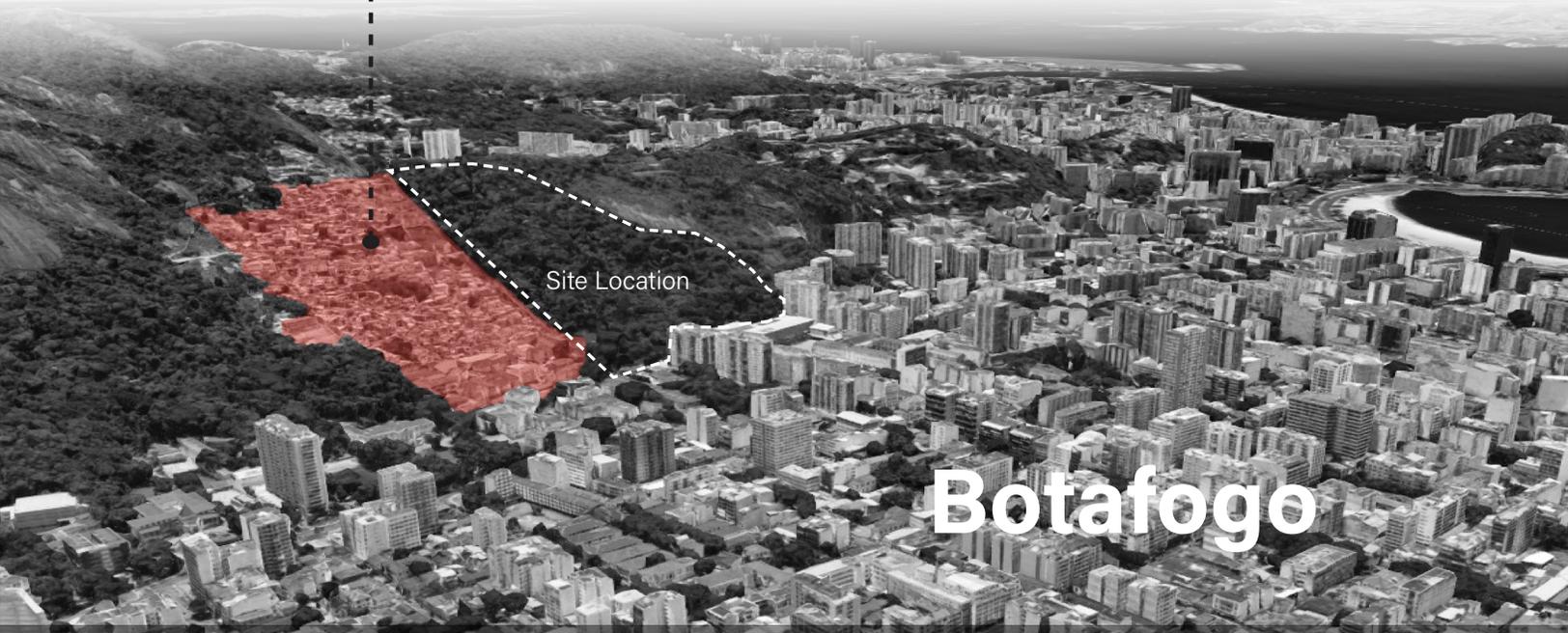
Favela Location



Area
76,000 sq. m



Buildings
1,072



Favelas are informal settlements, often located in areas less habitable for formal development to take place. In the case of Rio, 1.3 million people live in the over 900 favelas located in the steep rock outcrops of the city.

CHALLENGES IN SANTA MARTA

LACK OF SPACE

INFRASTRUCTURE

SANITATION

TENSION

Image sources: The Washington Post, La Gente, Fabio Telxeira, and Upsiste-Housing.com

GOALS

1

Provide equitable public space distribution through the entire favela.

2

Preserve and expand design strategies that facilitated construction for the residents.

3

Retain building density while improving quality of living.

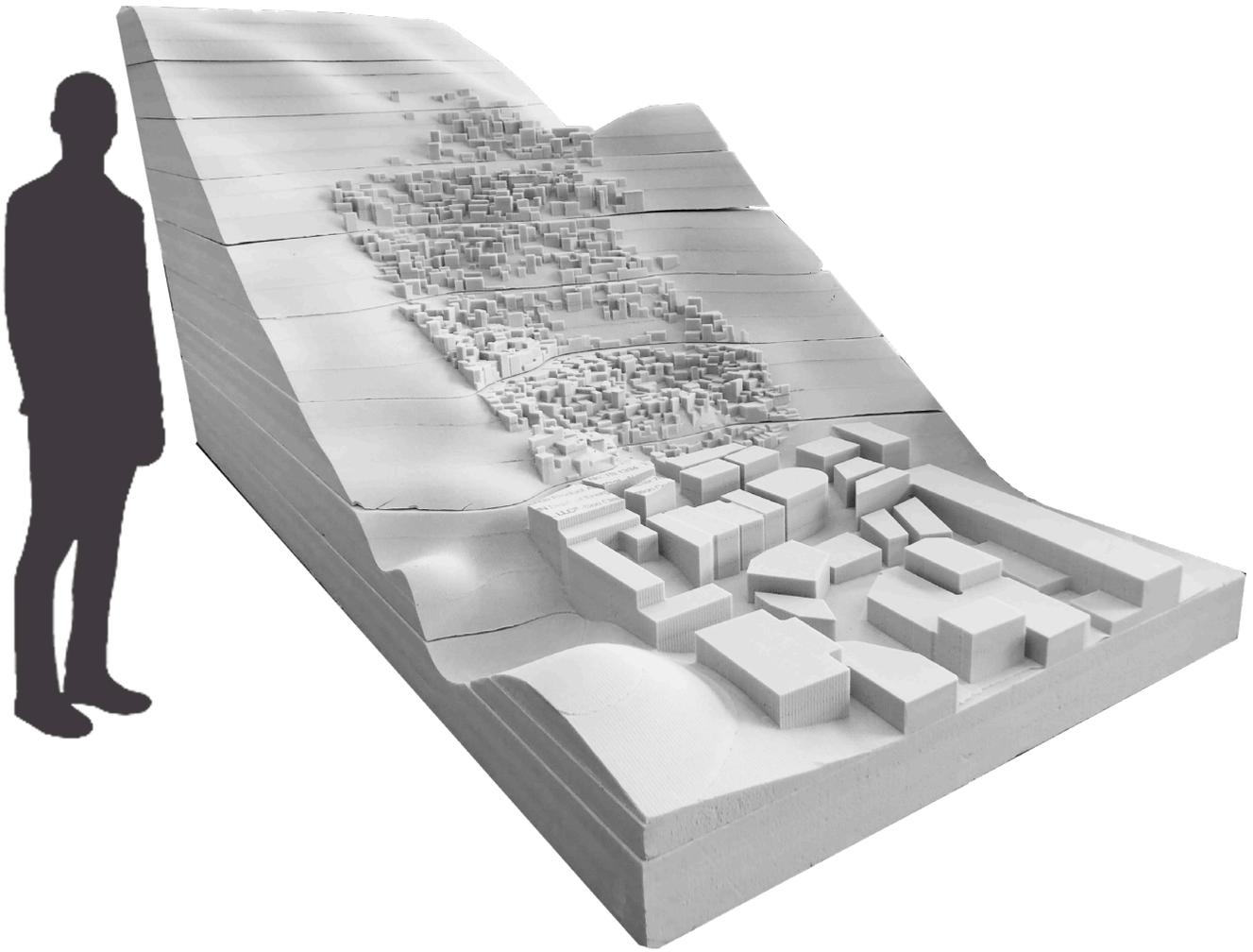
BUILDING NUMBERS



PEOPLE PER BUILDING

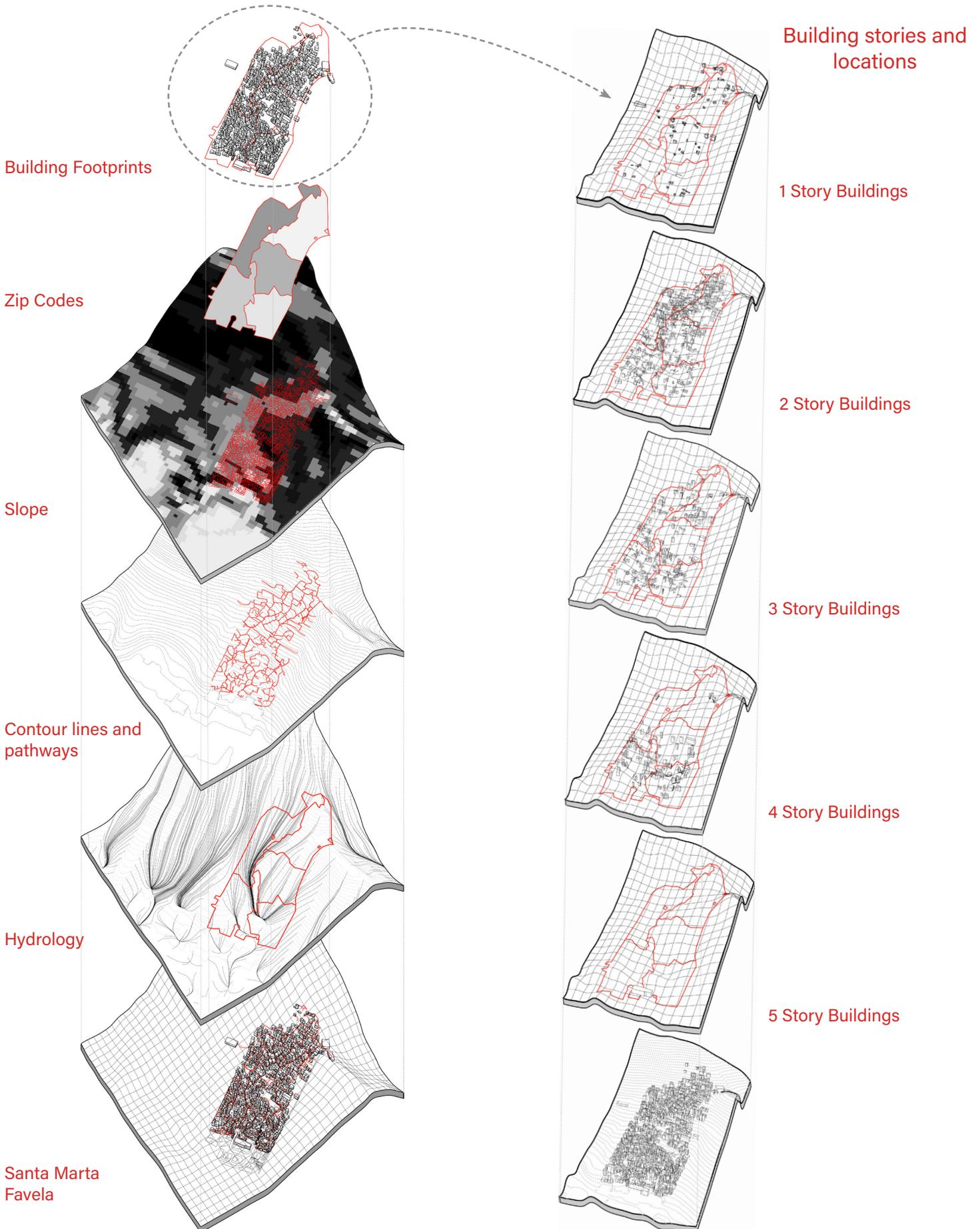
Information Source: Livia Minoja

Model and Site Analysis through VR Headsets



Architecture and Landscape Architecture Students utilizing virtual reality headsets to view a model of the existing Santa Marta favela, built with 360° photographs. Milled Model was created by students during analysis phase based on computer model of the existing favela.

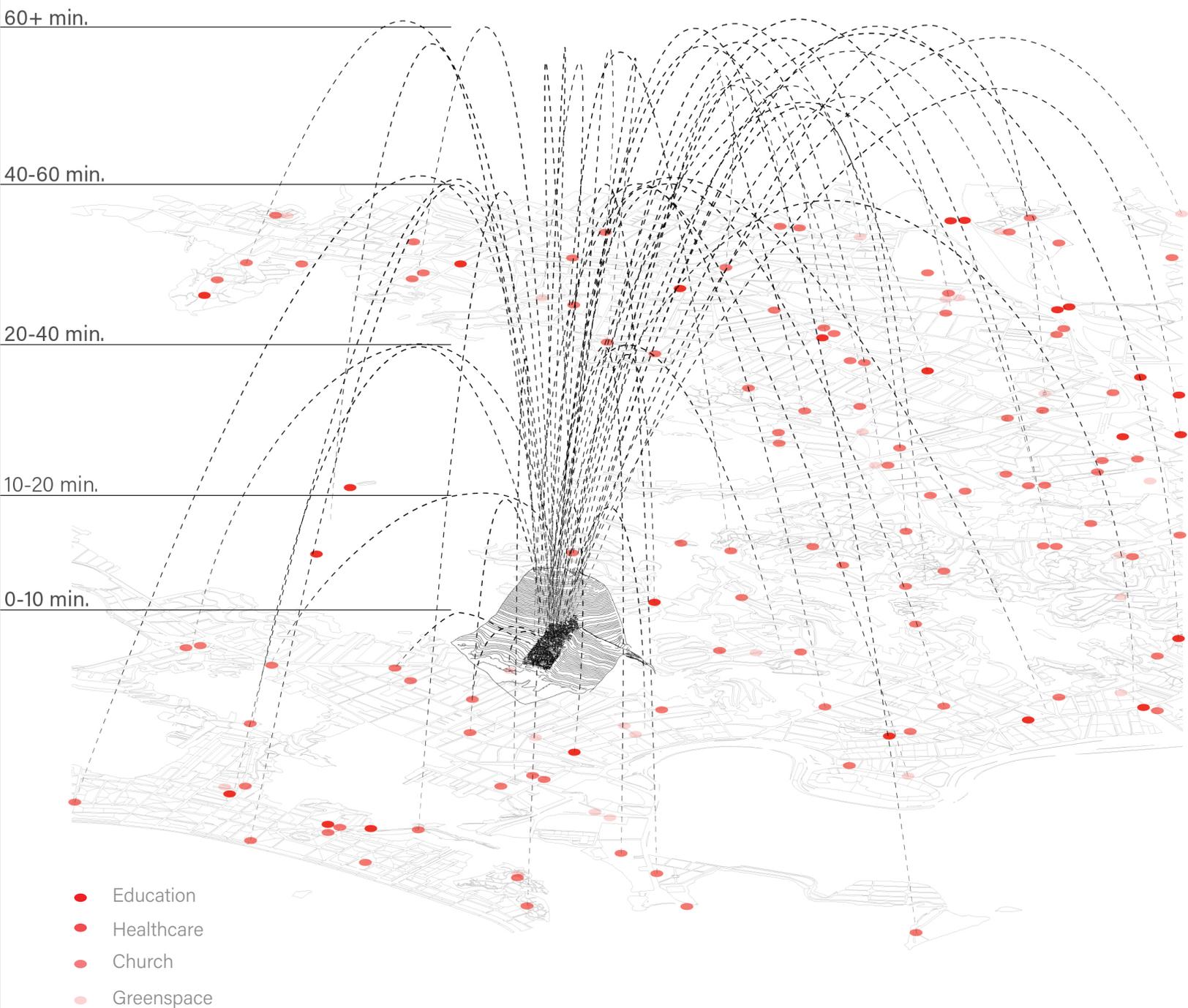
Relationship between Topography and Density



Part of the analysis was to find patterns between building density and ecological conditions. The project studied the location and density of buildings of different stories, to understand which topographic and hydrologic conditions are most favorable for which building types.

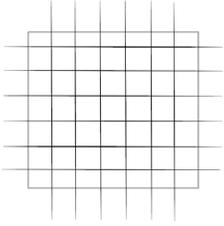
Analysing the Favela's Context

Distance between Santa Marta and basic services

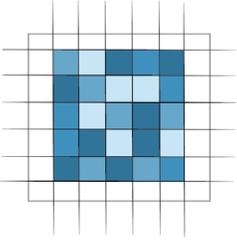


The team analysed the accessibility of different services outside of the favela, to determine which ones are most needed within a possible favela expansion.

Design Process:



Define Blocks

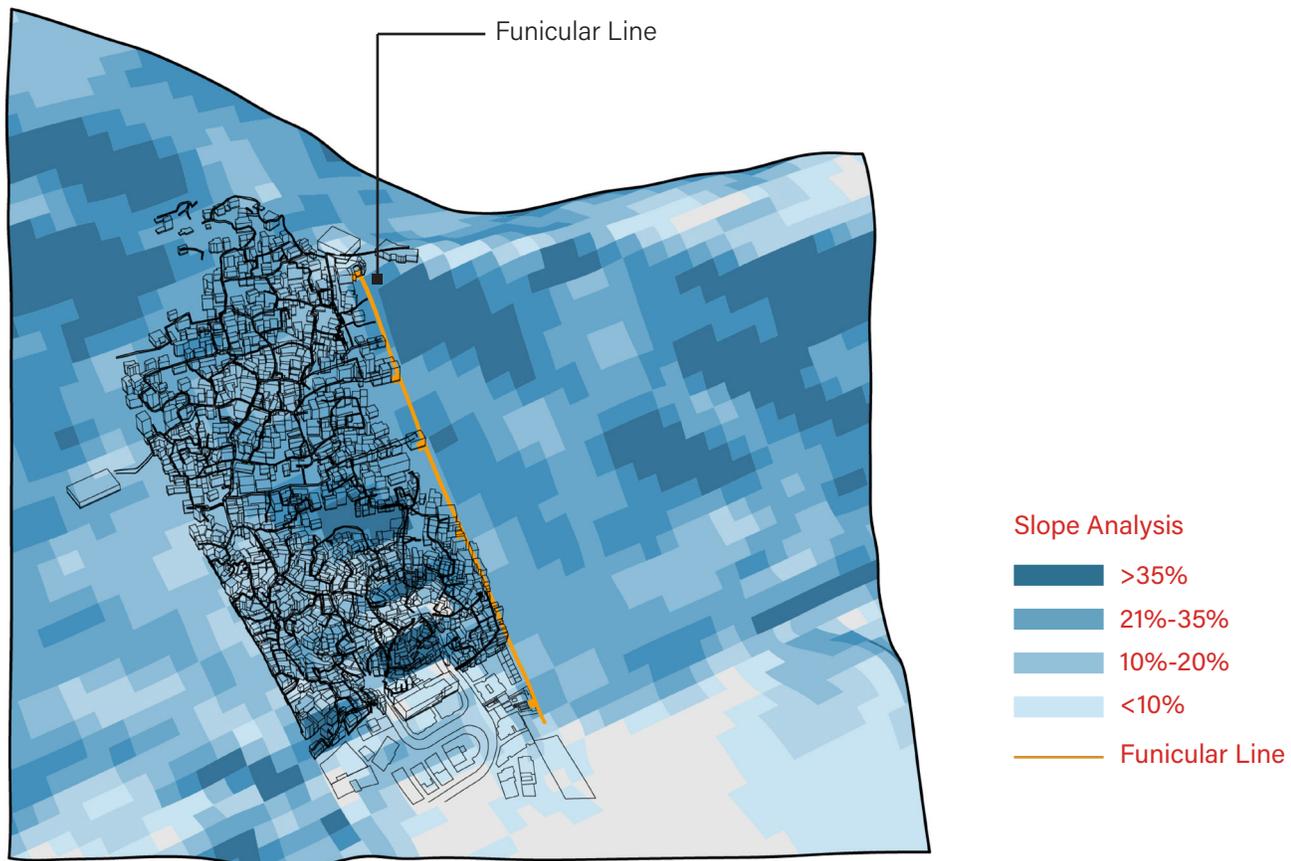


Choose Design Strategy for individual blocks based on Density/Slope Correlation

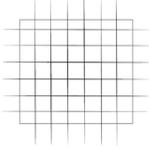


Define housing based on architecture rules for individual buildings.

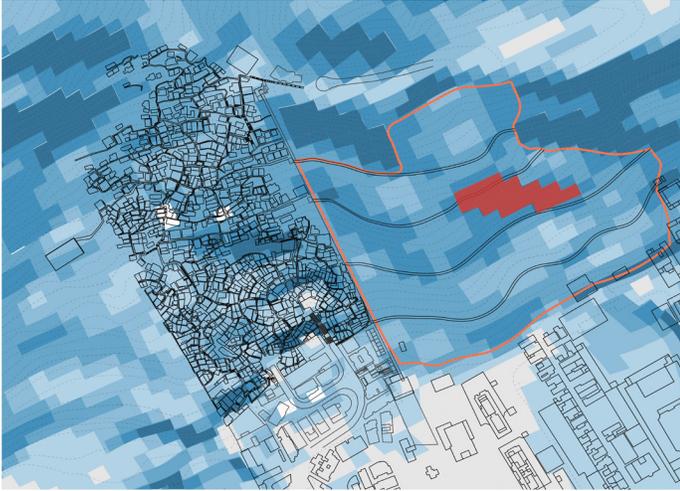
Density/Slope Correlation:



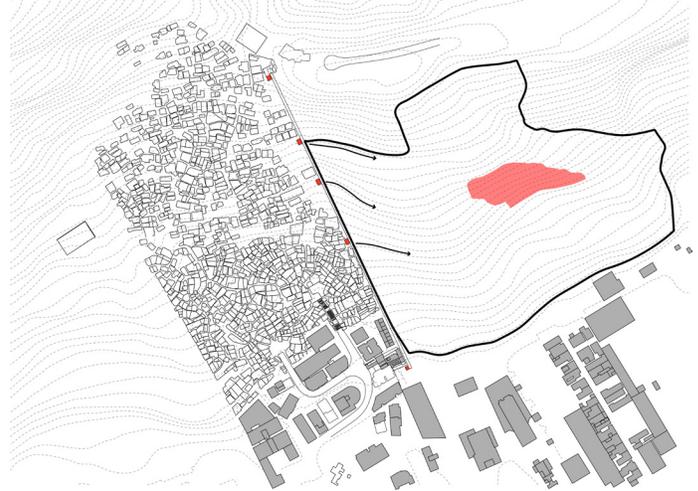
Density/Slope correlation dictates that areas with less than 10% slope have the highest building density (90%). Areas of 10%-20% slope have medium building density (75%), and areas with 21%-35% slope have low building density (50%).



Defining Blocks- Process



Define Site Boundary and exclude areas within site beyond the buildable slope found on Santa Marta (40%).



Define Connection points to existing favela (Funicular Stops).



Define Primary horizontal circulation paths (Rule: paths follow contour lines for easy construction).



Identify main hydrology lines as base for primary vertical circulation.

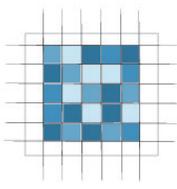


Identify areas of gentle slopes (8% or less) and connect them through vertical circulation.



Final Blocks formed.

The first step of the design was to define housing blocks through the delineation of horizontal and vertical circulation. These blocks are then assigned a design strategy based on their slope-located on the next page.



Choosing Design Strategy of Individual Blocks Based on Density/Slope Correlation.

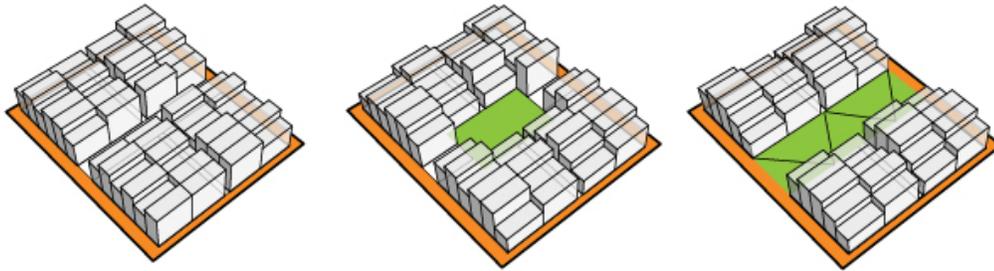
90% Density

75% Density

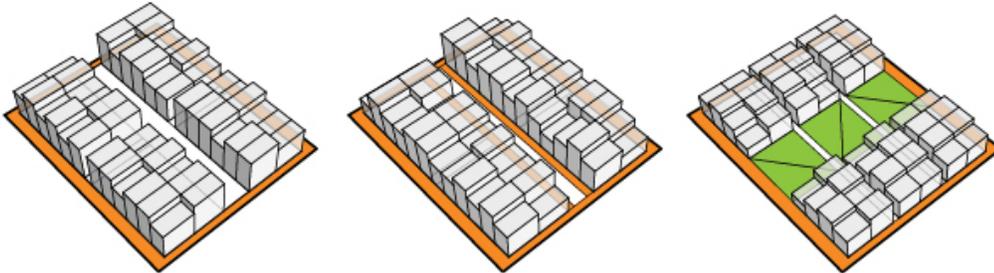
50% Density

PERSPECTIVE

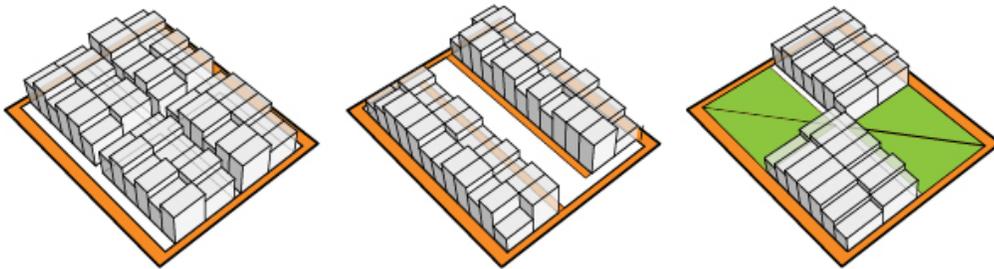
Multi-family residential



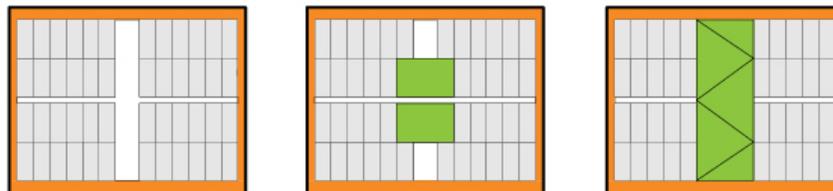
Single and Multi-family residential



Commercial buildings and stilt housing

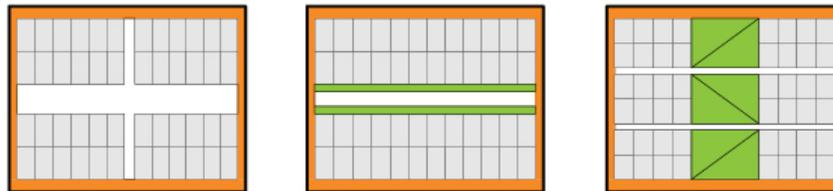


Multi-family residential



PLAN

Single and Multi-family residential



Commercial buildings and stilt housing



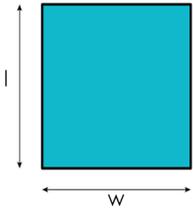
Areas with high density (10% slope or less) implement strategies for widening primary circulation and introducing green strips. Areas with low building density (20% slope or more) implement terracing systems for community gardening and easier navigation of the topography.



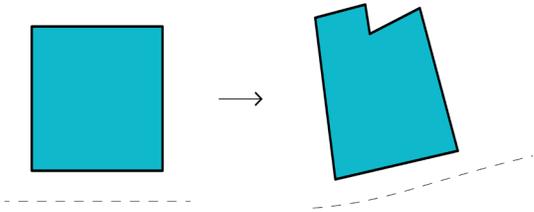
Define Housing Based on Architecture Rules for Individual Buildings.

Shape Grammar Rules:

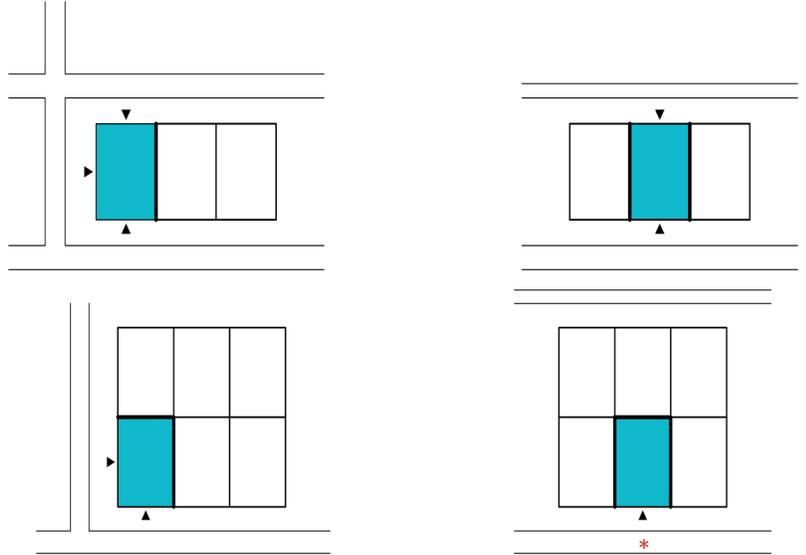
1 Plot Size will be adjusted to fit topographical conditions. Each plot should have minimum and maximum dimensions.



w=4.00m to 8.00m
l=4.00m to 8.00m



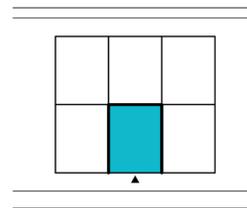
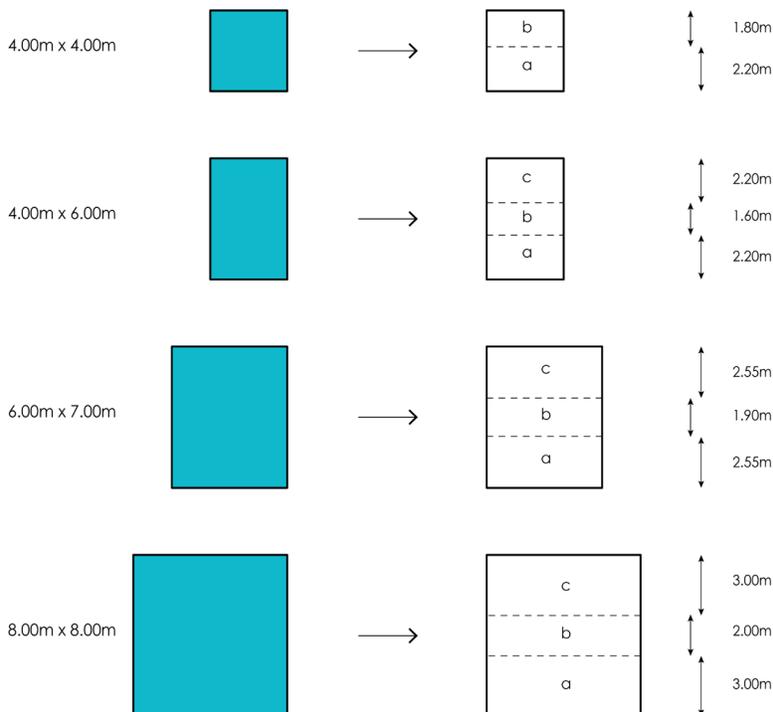
2 Each plot should have access to natural light and ventilation from at least two sides.



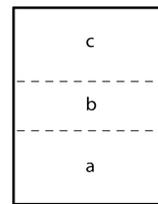
3 Each plot will be divided into 3 main spaces for program application.
a=2.20m-3.00m
b=1.60m-2.00m
c=2.20m-3.00m

4 If only one side of the plot has access to natural light, the placement of a courtyard is necessary

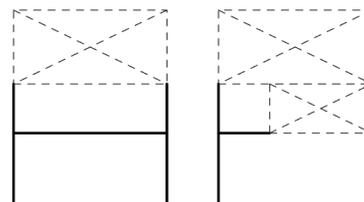
Plot size



If this condition happens, place a courtyard



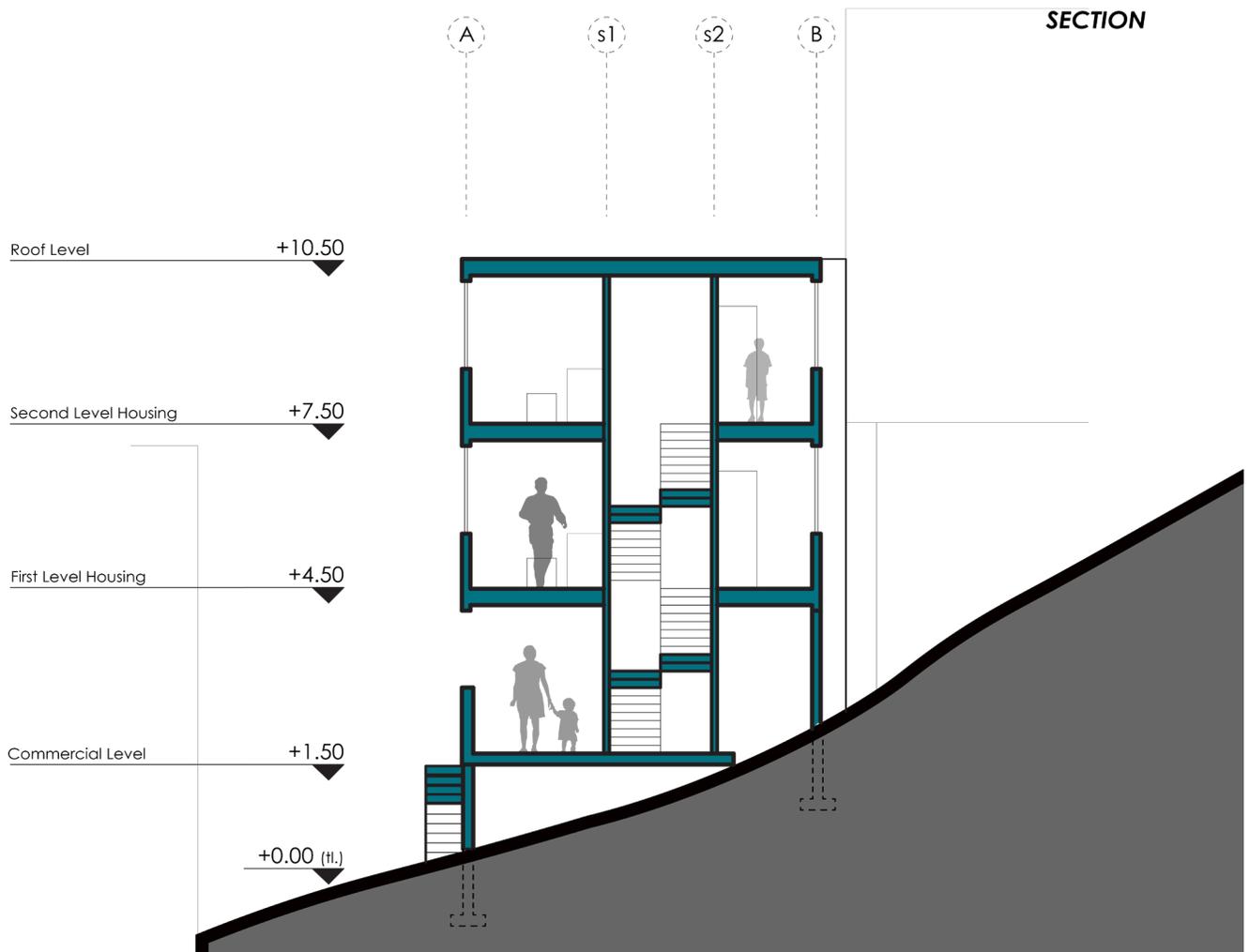
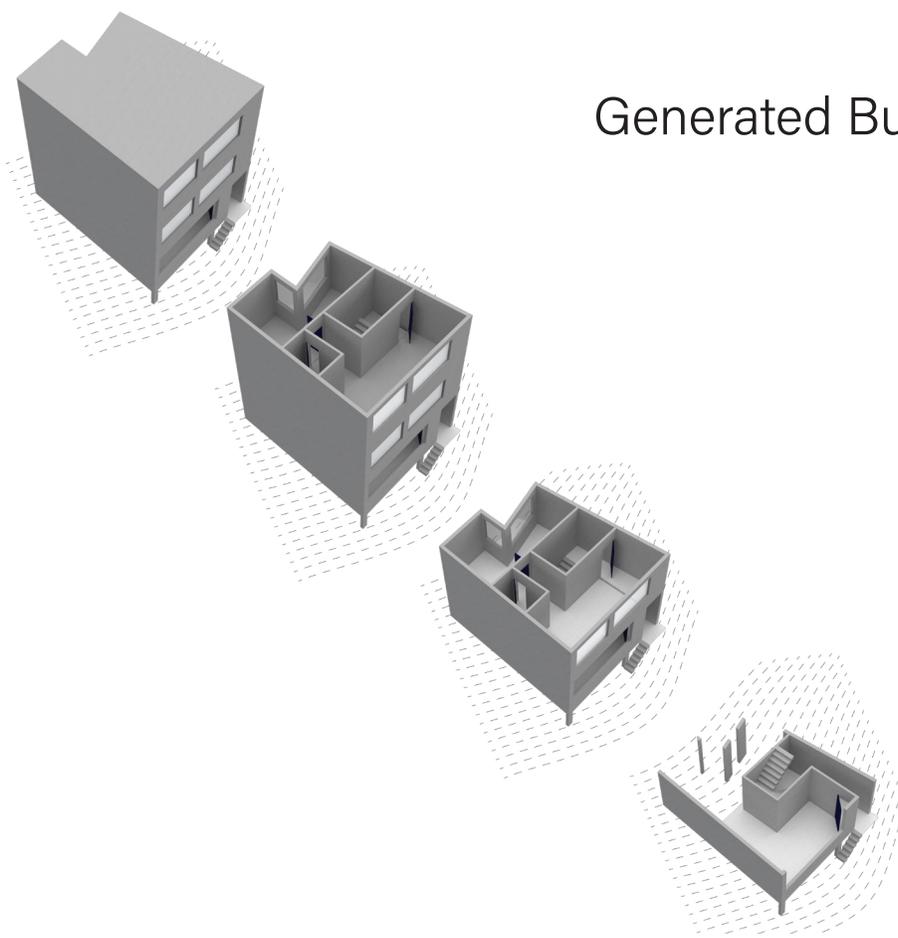
Place a courtyard in either section c and/or b



Areas to place a courtyard within plot

Rules regarding minimum space requirements and access to ventilation/natural light for each individual building. These rules are combined with the favela's existing shape grammar to preserve the organic character of the development, while establishing a standard for each house.

Generated Building Design Option



Example of a single building design following shape grammar rules.

Master Plan of the Generated Favela Expansion

1,072 buildings in 76,000 sq. m
in the original favela

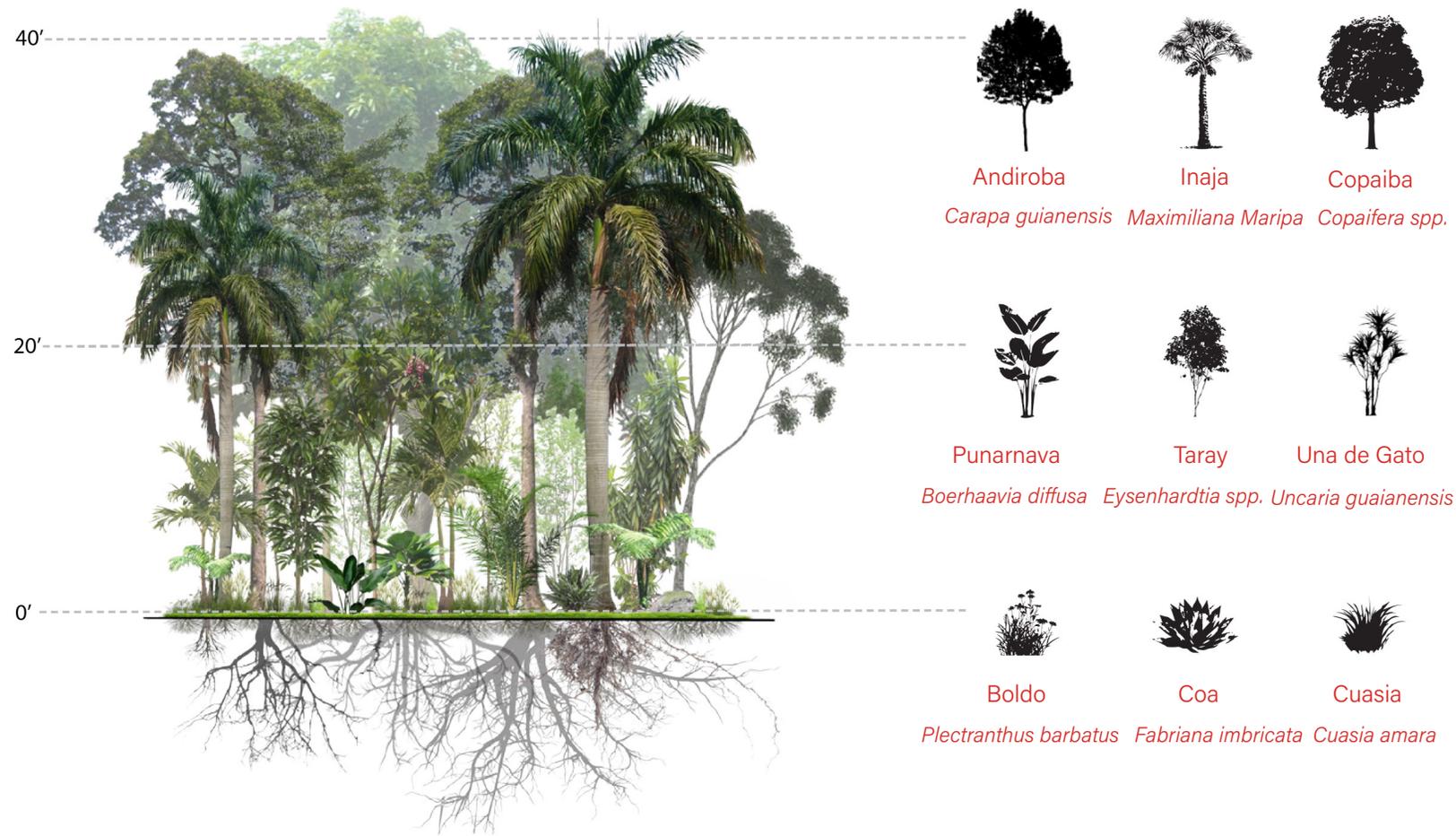
vs.

1,023 buildings in 55,000 sq. m
in the expansion



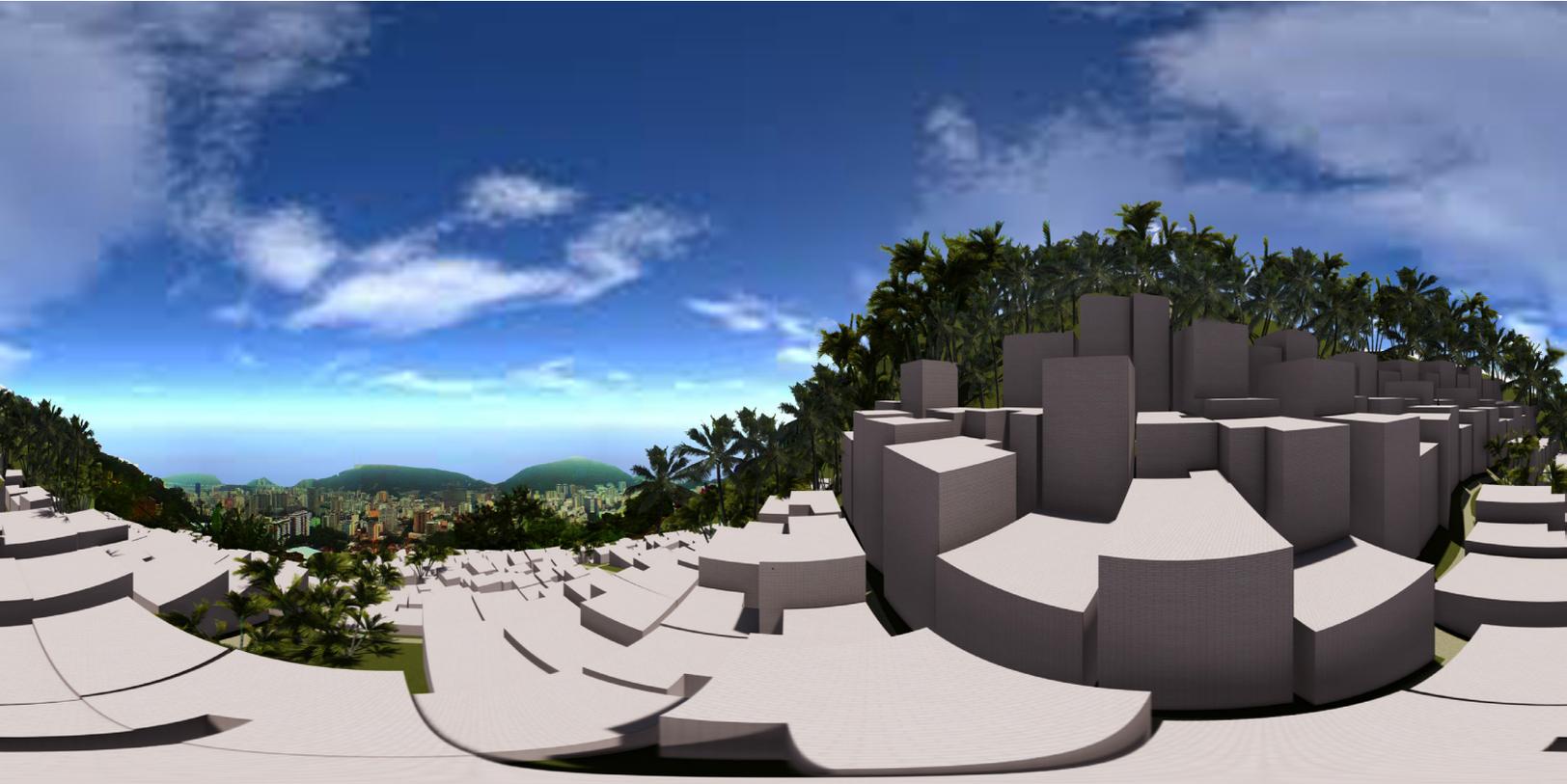
Master plan following the new housing density and public space designation rules. The new area achieves an almost equal amount of buildings in a comparatively smaller area, while providing more designated public spaces than the original favela.

Native Plants as a Livelihood



To address the lack of services close to the favela, part of the strategy was to maximize the services available on site. The team researched native plants with medicinal/food/construction material uses, to add community gardens as part of public spaces.

360° VR renderings



Team (faces blurred) presenting findings on University of Rio



Audience member viewing renderings on cardboard VR sets



Renderings of favela expansion design that can be viewed as 360° images through a virtual reality headset. The team presented their research, design strategy and final expansion design to professors and community members in the University of Rio de Janeiro.

Native Plants List

Research Source: "Frutíferas e Plantas Úteis na Vida Amazonica"

Local Name	Scientific Name
Andiroba	<i>Carapa guianensis</i>
Bacuri	<i>Platonia insignis</i>
Boldo	<i>Plectranthus barbatus</i>
Cancerina	<i>Semialarium mexicanum</i>
Caoba, mogno	<i>Swietenia macrophylla</i>
Chanca Piedra	<i>Phyllanthus niruri</i>
Coa	<i>Fabiana imbricata</i>
Copaiba	<i>Copaifera spp.</i>
Cuachalalate	<i>Amphipterygium adstringens</i>
Cuasia	<i>Quassia amara</i>
Curcuma	<i>Curcuma longa</i>
Doradilla	<i>Selaginella lepidophylla</i>
Ipê Roxo	<i>Tabebuia impetiginosa</i>
Manzanilla	<i>Matricaria chamomilla</i>
Pinguica	<i>Ehretia tinifolia</i>
Punarnava	<i>Boerhaavia diffusa</i>
Taray	<i>Eysenhardtia spp.</i>
Titica	<i>Heteropsis spp.</i>
Zarzaparrilla	<i>Smilax aristrolochiifolia</i>