New Generics

Vol. 2

Investigations into
Pre-Fabricated Architecture

Blanchet / Sturt Studio

Winter, 2019

STUDIO TEAM

Shahryar Beyzavi

Mackenzie Bruce

Maxsim Drapey

Amlin Iqbal Eshita

Lovejeet Gehlot

Nicholas Hennessey

Zhipeng Liu

Marco Nieto

Jeffrey Richmond

Sydnee Rigsby

Cameron Williams

Austin Wiskur

STUDIO LEADERS

Clement Blanchet

Jono Bentley Sturt

GUEST CRITICS

Chloe Claire | Chief Technical Officer, VINCI Construction

Christophe Allaz | Manager of Products and Innovative Initiatives, VINCI Construction

Michelle Roelofs | Associate, Structural Engineering, ARUP

Christina Hansen | Principal, VolumeOne; Lecturer, Taubman College

Christian Unverzagt | Principal, M1/DTW; Professor of Practice, Taubman College

Yojairo Lomeli | Lecturer, Taubman College

Charlie Veneklase | Director of Design, Ovad

Sidney Migoski | Architect, Hamilton Anderson Associates

ABSTRACT

New Generics is a studio partnership between Taubman College and VINCI Construction, exploring the topic of pre-fabricated architecture. Over the winter term, 12 students worked with faculty Clement Blanchet and Jono Bentley Sturt in three distinct phases. First, a research document was compiled, analyzing the history, constraints, and opportunities within pre-fab. The studio then traveled to France to meet with VINCI representatives, learning from their work and expertise in construction.

Ultimately, the group produced four distinct interpretations along VINCI's working guidelines for pre-fabricated multi-family housing. Some of these proposals stick close to the guidelines, while others push back, reinterpreting the ultimate goals of these rules in new ways. All are focused on developing systems of architectural assembly which leverage economies of scale and controlled factory conditions that are able to reconcile themselves with the specificities of a particular site.

Thank you to everyone who supported our course and research in one way or another. Vinci construction, Taubman College, the wonderful designers who lent us their time and insight, the critics who provided valuable feedback and encouragement, and so many others. Thank you for your time, your support, and for opening your doors to an experience we will never forget.

Firminy Vert

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Introduction

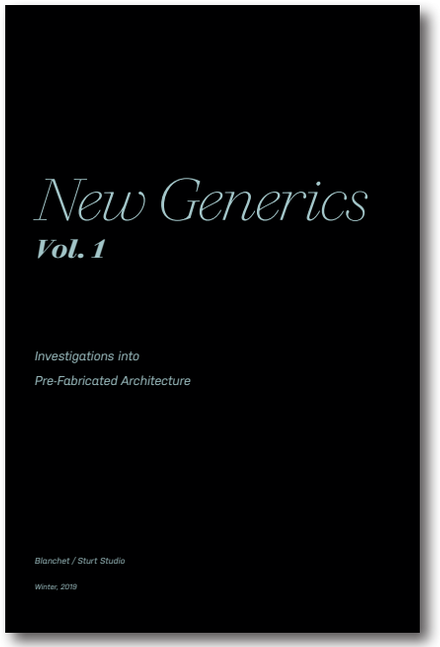
Relationship with Vinci - JBS
Summary of Vol. 1
Paris Trip

ABSTRACT
Pre-fabrication has long been sought-after as a means of leveraging economies of scale and a controlled factory environment against the challenges of producing the built environment. On a conventional construction site, variables of weather and climate, transportation of materials, and unavoidable nuances of site will often conspire to delay, confound, or otherwise problematize the act of construction. The production of buildings as component assemblies inside of a controlled factory environment has been championed by many over the past century as a means of achieving higher precision in constructed assemblies, faster and more predictable build times, all while lowering costs overall, providing quality environments to a broader segment of the socio-economic spectrum.

As a studio we took a stand against this status quo mentality and developed sophisticated, mass-customizable, scalable systems of spatial production.

VOLUME 1

In order to grasp the full scope of pre-fabrication in architecture, the studio assembled our research into a single document which worked to understand a wide range of precedents and strategies. This book collects our observations and reflections on the nature and scope of pre-fabricated architecture as it has been explored in the past, its current state of play, and its potential futures. A useful tool, the book became a companion that enhanced our understanding of the sites and architecture we visited during our travels to France. Divided into six chapters, they are as follows:



01 History of Pre-Fabricated Architecture
Documenting attempts to industrialize the production of architecture over the past century.

02 The Current State of Pre-Fabrication
Analyzing the various forms and degrees of efficiency of today's pre-fab.

03 Transportation + Logistics
Exploring the standards of assembly operations and phasing.

04 Current Building Industry Standards
Interrogating and understanding why pre-fab hasn't been able to become the norm.

05 The Future of Pre-Fabrication
Looking at the technological revolutions the industry is undergoing.

06 Matrices of Evaluation
Evaluating the information of the above chapters through a series of comparisons that act as a guide and means for developing our own designs.

Chapter 01

Chapter 02

Chapter 02

Chapter 03

Chapter 04

Chapter 05

Chapter 06

Chapter 06

01_Introduction

During our trip to France, we were fortunate enough to be able visit various sites with relevance to pre-fabricated and modular architecture, both old and new. The experiences directly influenced our own design decisions and investigations that immediately followed the trip.

La Defense Construction Site Visit

La Tourette

Centre Pompidou

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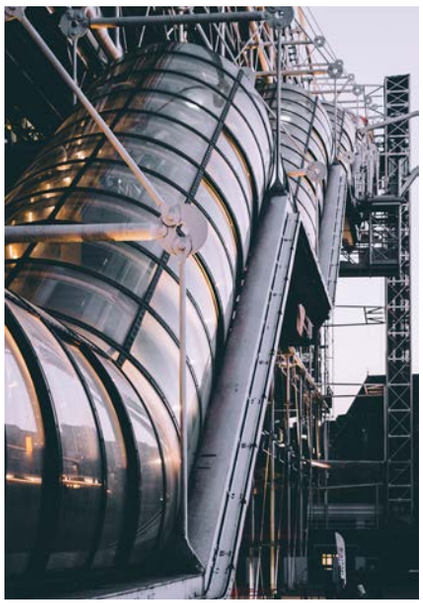

Centre Pompidou

La Tourette

La Tourette

La Tourette

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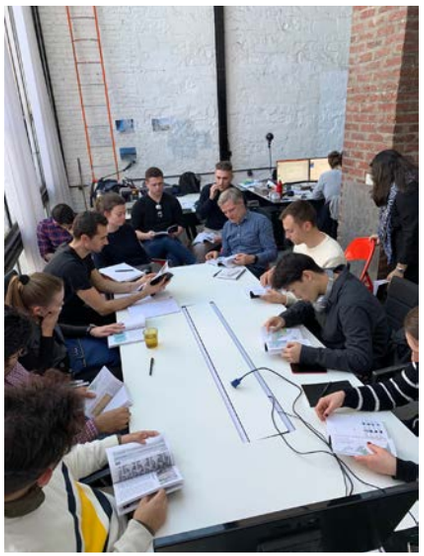


Clement Blanchet Architecture Office

La Defense

Clement Blanchet Architecture Office

02

Constraints

Rules - MN
Brief Analysis - JBS

ABSTRACT

The following diagrams represent the studio's understanding of some initial rules and guidelines provided by our partners in VINCI. Some are defined as Necessary, meaning they are seen as required for a pre-fab system to be most logistically and financially feasible. Forbidden items identify problem areas to be avoided, while the Free category specifies areas of maximum flexibility where design decisions can have greatest latitude and variability.

BUILDING/SITE

The following constraints pertain to the overall massing and placement of the building(s). These rules ensure minimal obstruction to the site that results in a cohesive building,

Fig. 1 - No more than 15% of non-regular modules.

Fig. 2 - Duplex for T4 or T5, limited to 10% per building.

Fig. 3 - 15m to 16m should be the depth of the building.

Fig. 4 - Creating T2 or T3 units with two views (garden/street) on ends of the buildings.

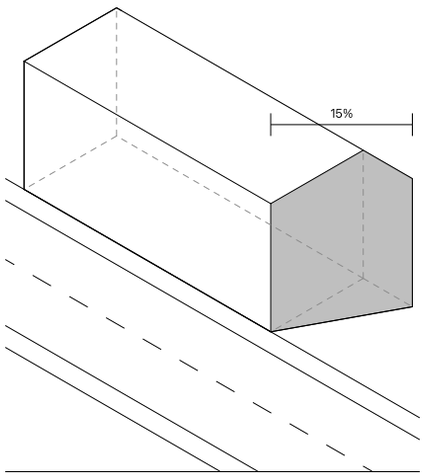


Fig. 1

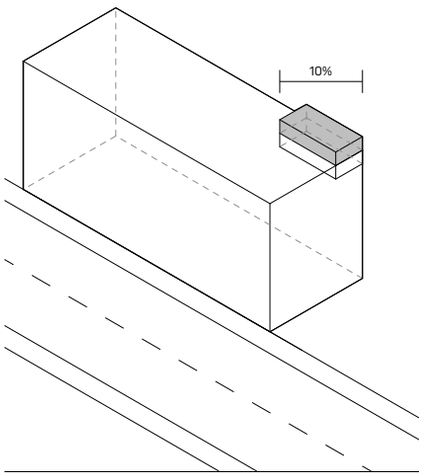


Fig. 2

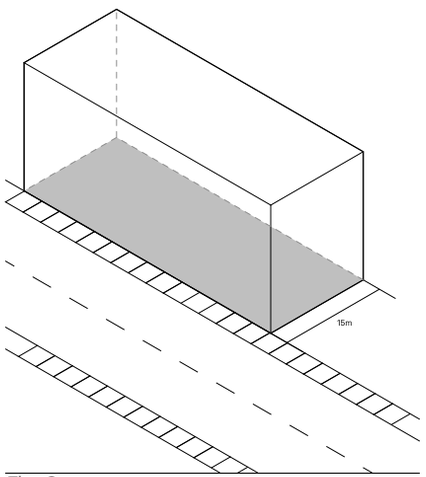


Fig. 3

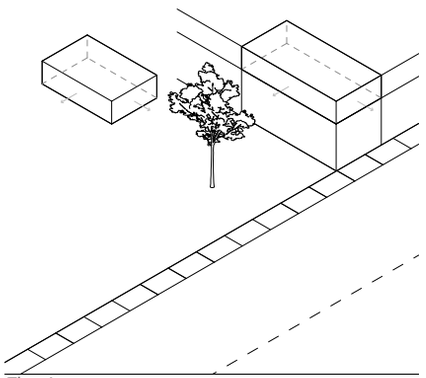


Fig. 4

FACADE

The following constraints explain the possibilities when it comes to designing the facade to unit relationship.

Fig. 5 - Any design for the facade.

Fig. 6 - No balconies over 8m².

Fig. 7 - Any shape for the balconies.

Fig. 8 - Must be able to fit a 4 seat table for a T2 balcony, 6 seat table for a T3 balcony, 8 seat table for a T4 balcony.

Fig. 9 - Balconies without user experience are not allowed.

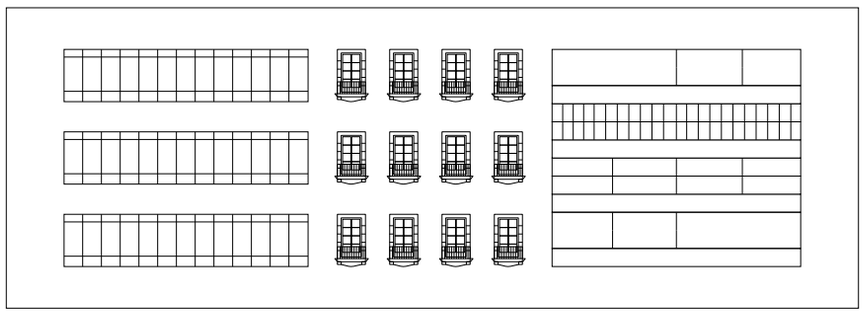


Fig. 5

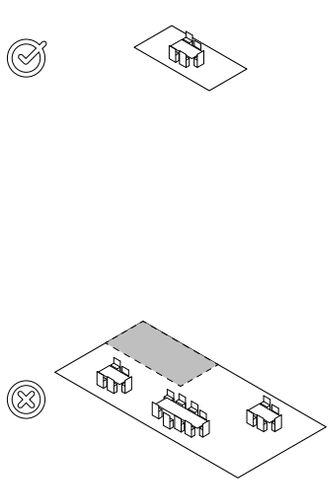


Fig. 6

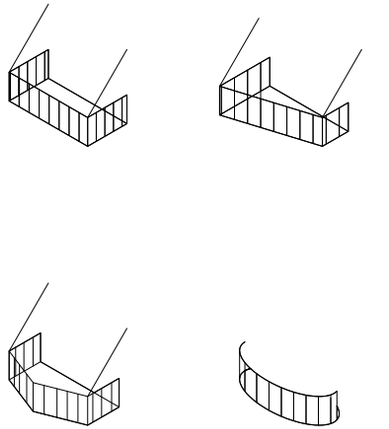


Fig. 7

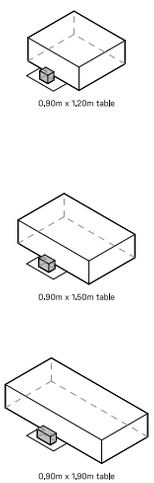


Fig. 8

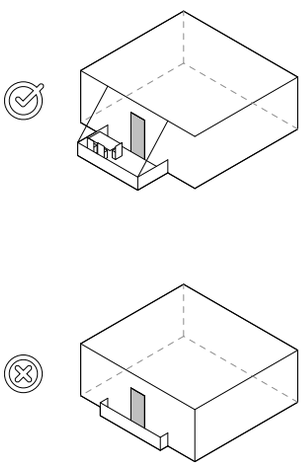


Fig. 9

PLAN

The following constraints focus on the overall floor plan of the building, aiming to maximize and provide as much as space as possible while still meeting codes and requirements.

Fig. 10 - Central corridor should measure 1.30m wide.

Fig. 11 - There should be a lift and stair for every 8 - 12 units per floor.

Fig. 12 - You are allowed to extend the length of the modules on the ends or corners of the buildings to avoid waste of space in corridors.

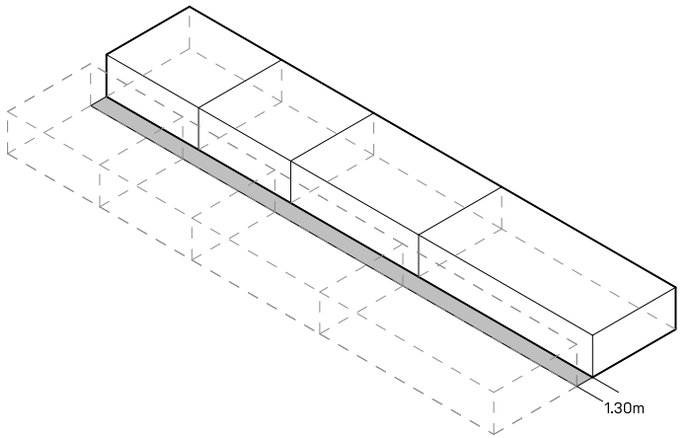


Fig. 10

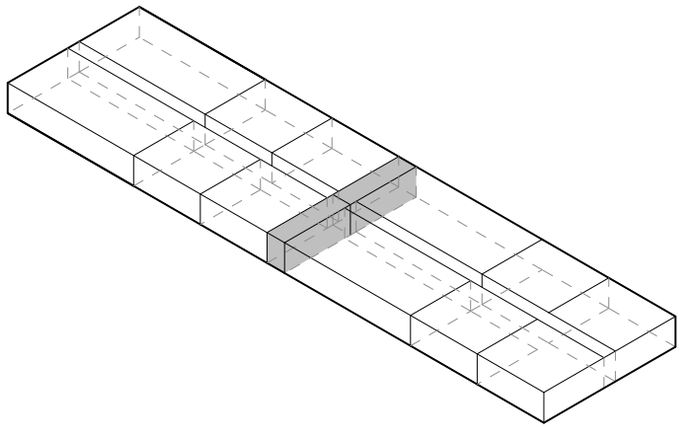


Fig. 11

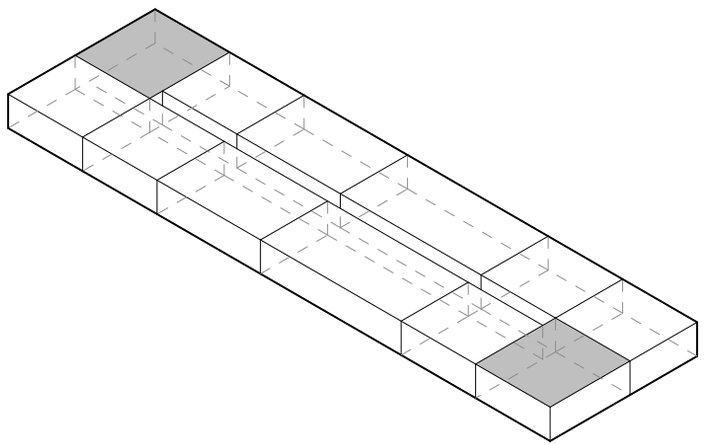


Fig. 12

UNIT

The following constraints focus on the several units and their modules, provided to us by Vinci Construction.

Fig. 13 - Bedroom windows: 1.20m w x 1.50m h or 0.90m w x 1.50m h (windows start at 0.90m height). Living room windows: 1.80m w x 2.10m h or 2.40m w x 2.10m h (T4) or 1.50m x 1.50m and 0.90m w x 2.10m h. For corners in living rooms, use the bedroom specifications.

Fig. 14 - 25% of total units should be T2, 50% should be T3, 25% should be T4. With these in place, the rest of the site should adapt with T1 up to 10%.

Fig. 15 - Bathrooms need to stack on top of bathrooms.

Fig. 16 - Stack T2 above T2, T3 above T3, etc. Adapt above the entrance hall/lobby.

Fig. 17 - The interior of the unit should have a 2.50m height, while the total unit height should be between 2.90m and 3m.

Fig. 18 - Windows can be located anywhere along the central strip.

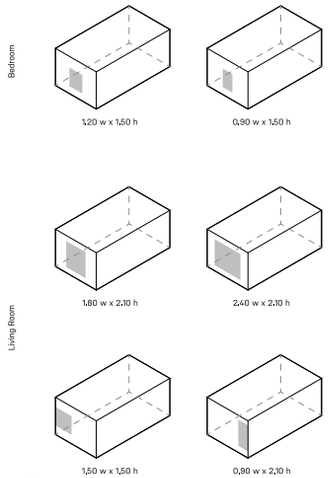


Fig. 13

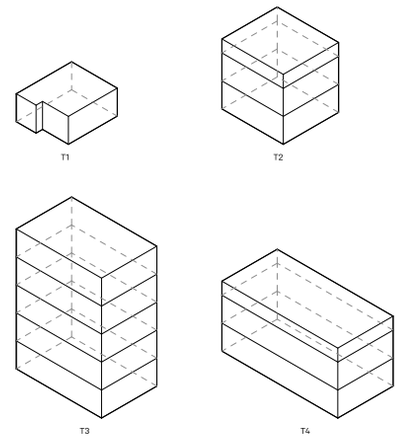


Fig. 14

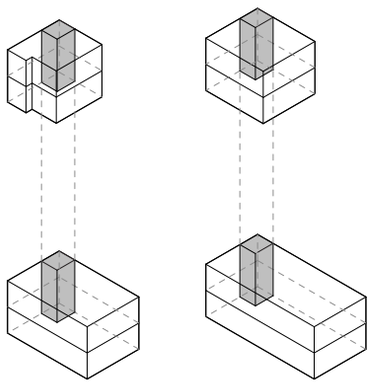


Fig. 15

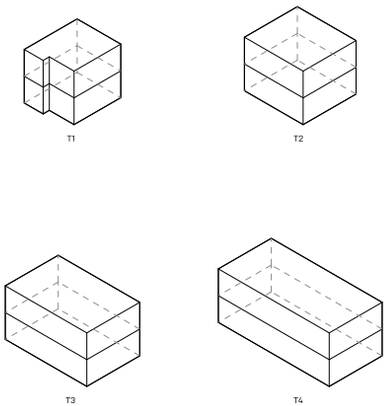


Fig. 16

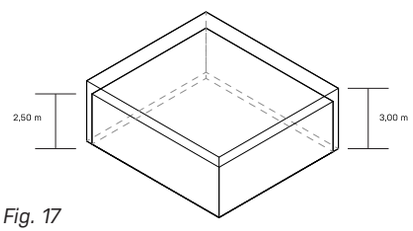


Fig. 17

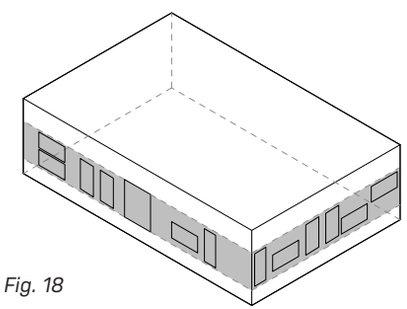


Fig. 18

TRANSPORTATION

The following constraint lays out the dimensions of a truck bed which the individual modules of each unit must fit on.

Fig. 19 - Max length: 14m.
Max width: 4m.
Max load: 10 tons per module.
Max height: 3m.

02_Constraints

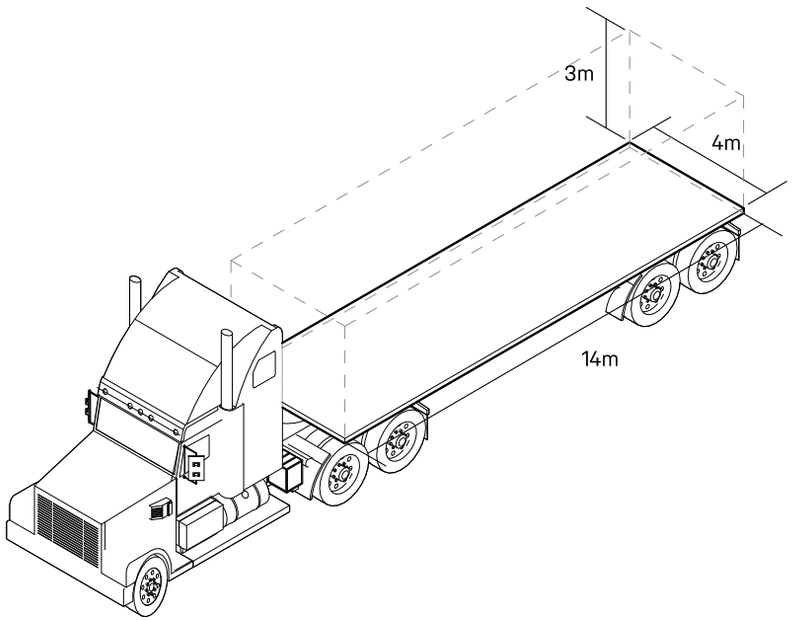


Fig. 19

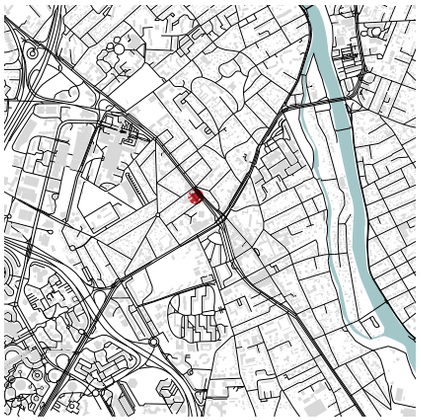
03

Test Site - Creteil

Creteil, Paris, France
Existing Documentation
Additional??

ABSTRACT

One of the inner ring suburbs of Paris, Créteil is an ideal location to test out systems of high-density pre-fabricated architecture. As cities continue to densify in coming years, it is these nearly-dense areas closest to major population centers that will likely see the brunt of development in new housing. The specific site chosen poses some interesting challenge for prefab systems as well, given the desired density of units on site and a fairly central location within Créteil itself.



Creteil, Paris, France

The chosen site is situated on a leafy street just North of the historic town center, and is bordered on either side by housing—a seven story building to its North and a two story building to the South.

Street angle looking North-West.

Street angle looking South-East.

Les Choux de Créteil

GÉRARD GRANDVAL, 1966-74

No stranger to ambitious architectural responses to the need for housing, Créteil is home to Le Choux de Créteil, a modular housing development designed and built in the early '70s.

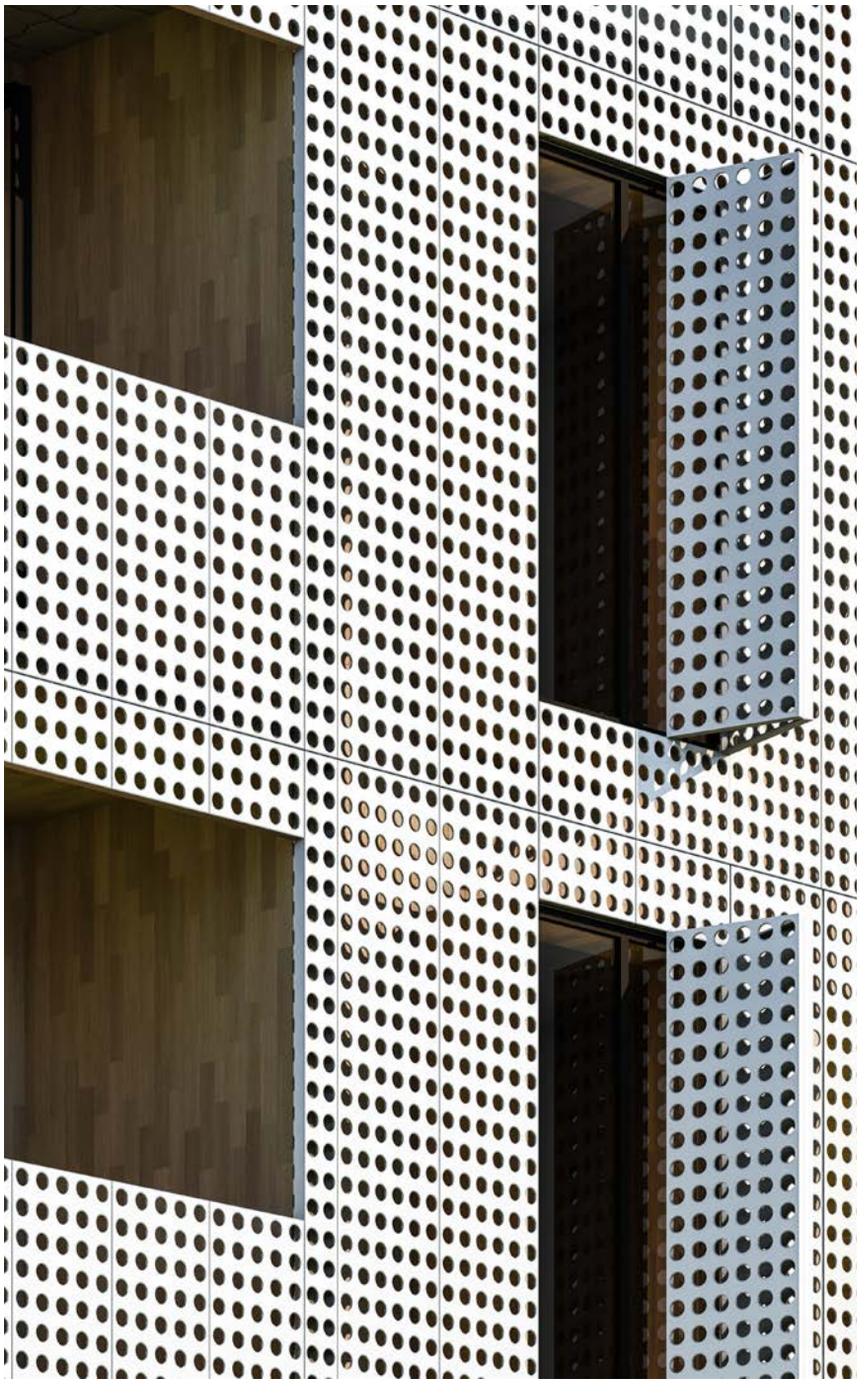
Créteil Town Hall

PIERRE DUFAU, 1974

After becoming the administrative center of Val de Marne in 1972, Créteil saw a fair amount of investment in infrastructure and displayed ambition through developments such as the massive new town hall.

Centre Ancien

Directly to the South of the chosen site, Créteil's medieval historic district is minuscule in comparison to the high density developments which surround it. Nevertheless, it provides a walkable core to the town.



04

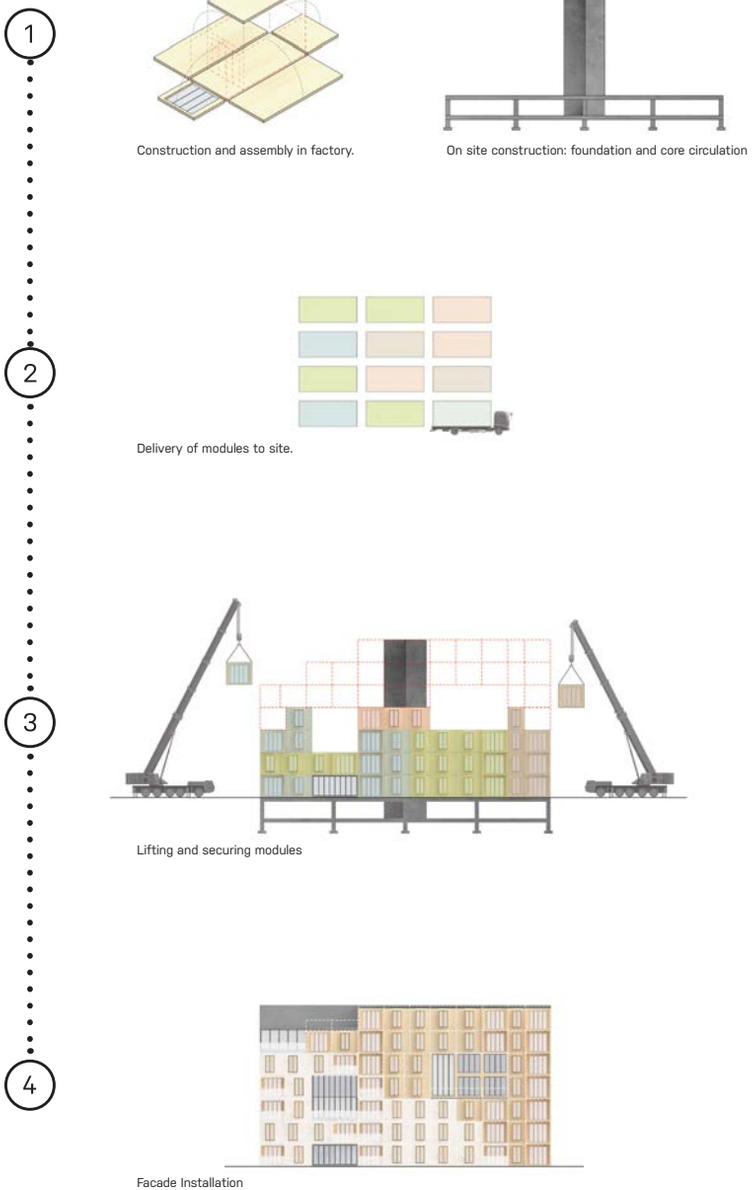
Vertical Neighborhood

Maksim Drapey
Zhipeng Liu
Cameron Williams

ABSTRACT

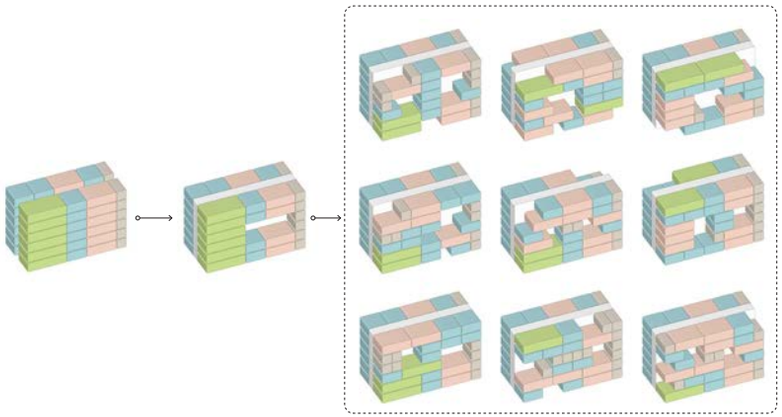
Urban life promises economic mobility, entertainment and social life unequaled in low density communities. Yet as the global population continues moving to cities in droves, many will also experience feelings of isolation. As people change jobs more and more frequently, they also move within or away from the city as their situations change. Technology offers the chance to make virtual connections in lieu of physical social interaction. High-density architecture reinforces social alienation through a lack of effective public space.

To restore the sense of community characteristic of small towns while also addressing demand for urban housing, we propose a high-density architecture that is efficient to build but also creates a neighborhood experience. Voids in the facade present a visual connection between the building and its neighborhood, while also offering residents spaces for casual interaction and mingling. By puncturing the urban street wall, Vertical Neighborhoods promote connections between residents and their neighborhood as well as among residents themselves.

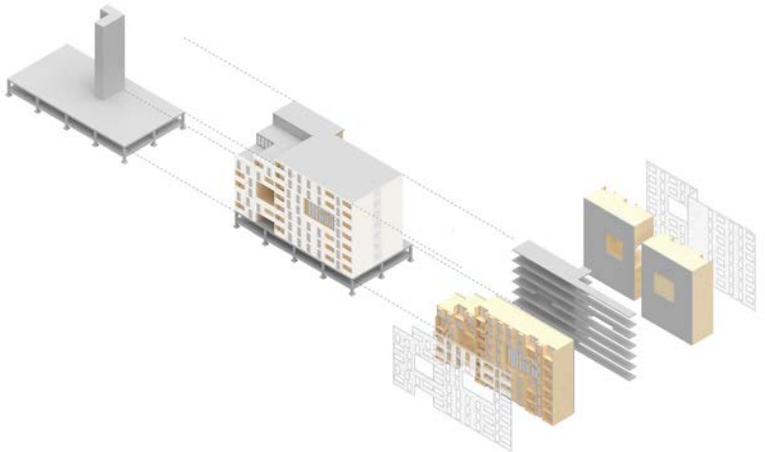


Phasing Diagram

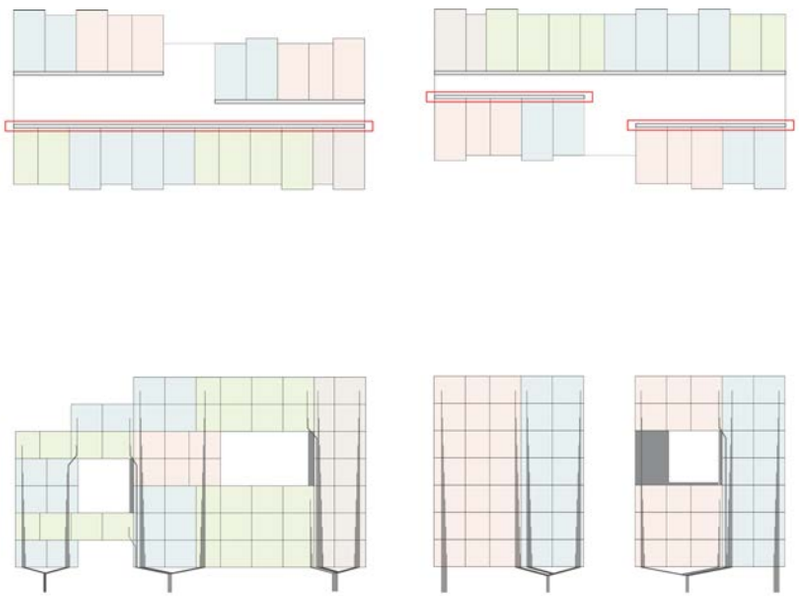
Site Axonometric



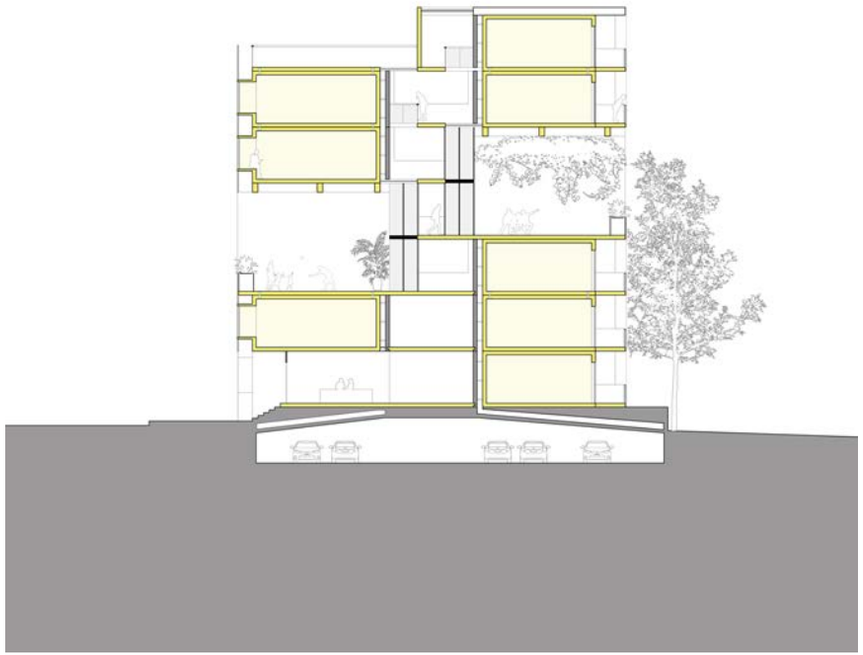
Customization



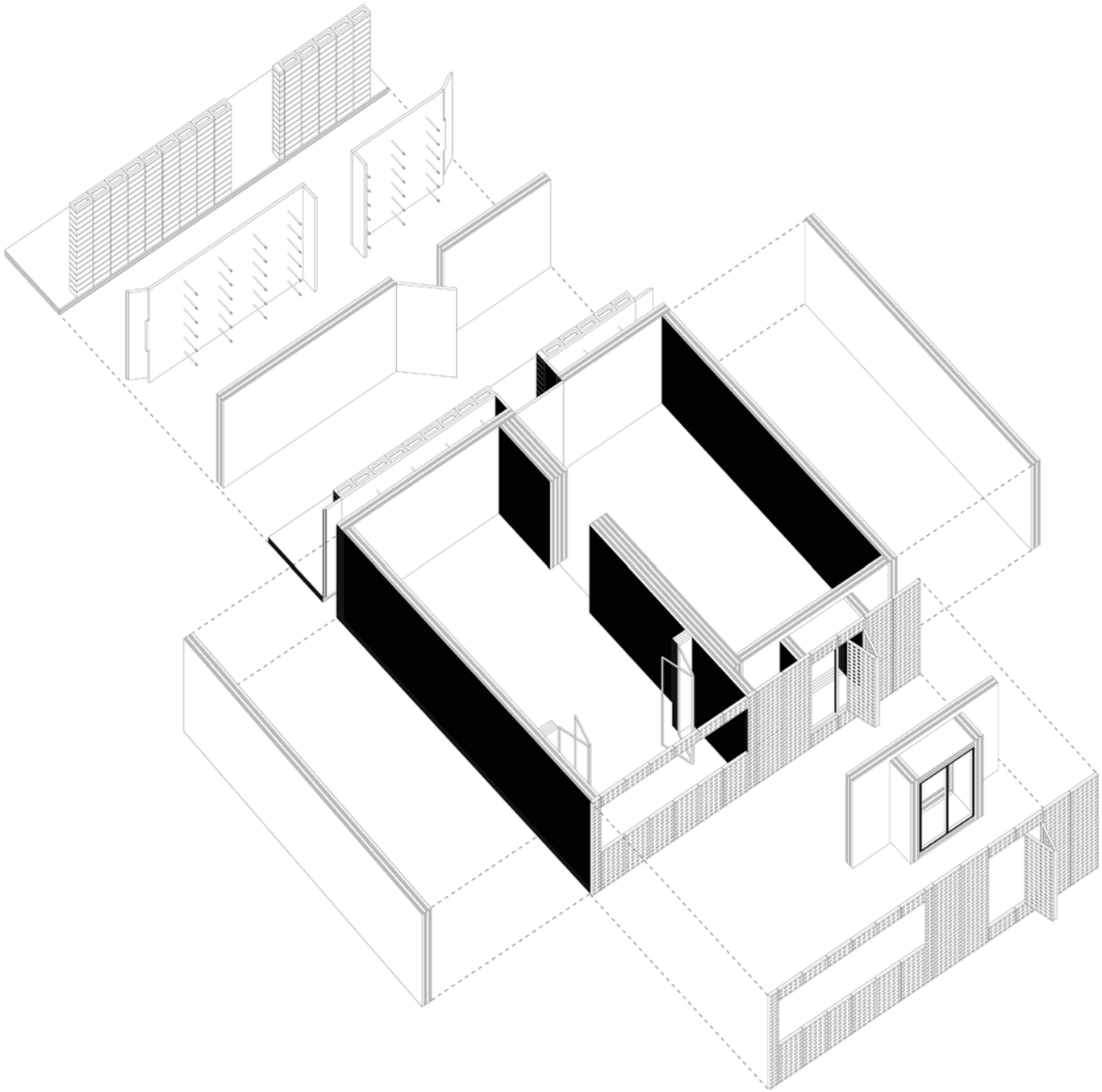
On-Site and Pre-Fab Components



Wetwall and Pipe Chase



Section



DESCRIPTION ABOUT THE ASSEMBLY

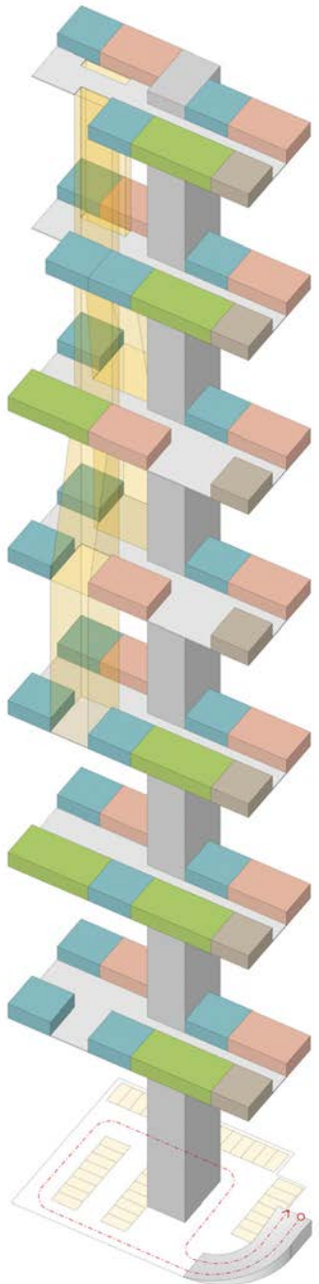
Parti Diagram

6th Floor

4th Floor

Ground Floor

DESCRIPTION ABOUT THE LIGHT WELL AND ITS INFLUENCE ON THE PLAN



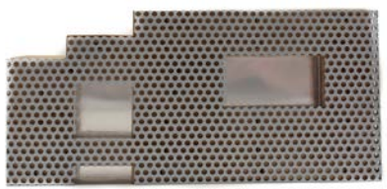
Unit Axonometric

04_Vertical Neighborhood

Hall Rendering

04_Vertical Neighborhood

(TOP) Street Perspective
(BOTTOM LEFT) Night Elevation
(BOTTOM RIGHT) Day Elevation



05

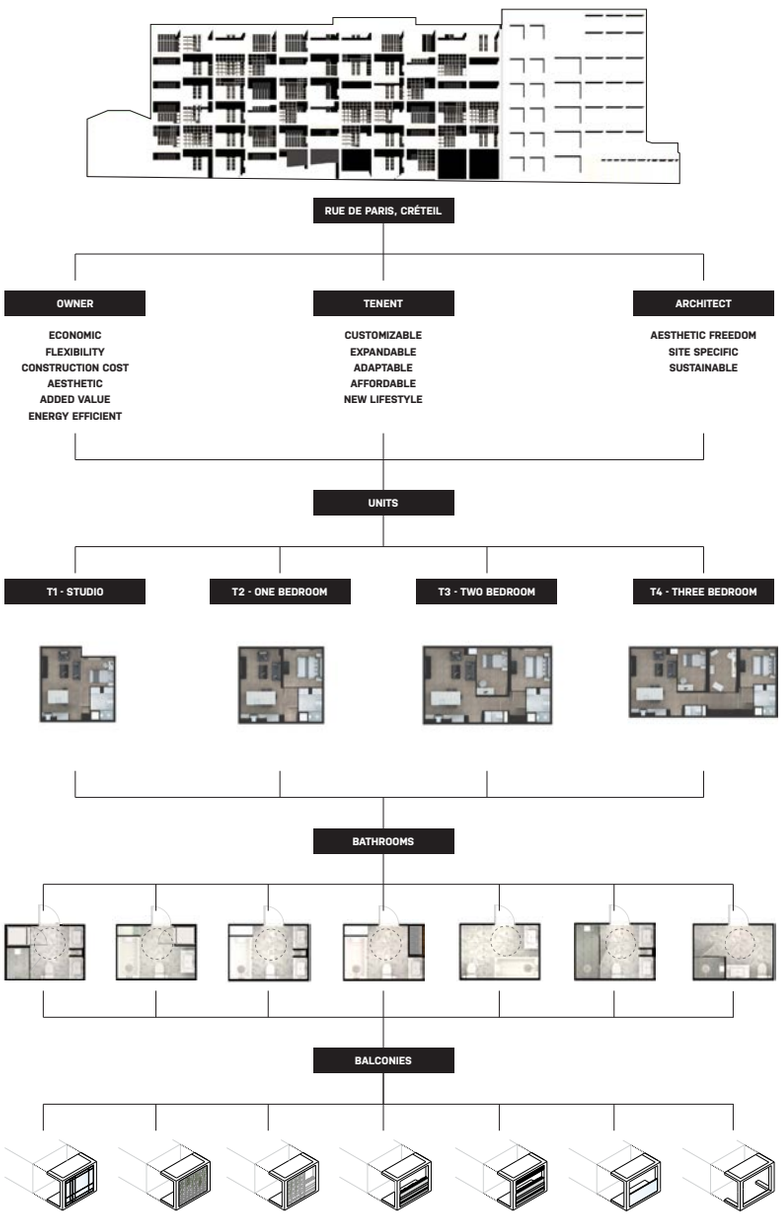
Plug & Play

Amlin Iqbal Eshita
Nicholas Hennessey
Sydnee Rigsby

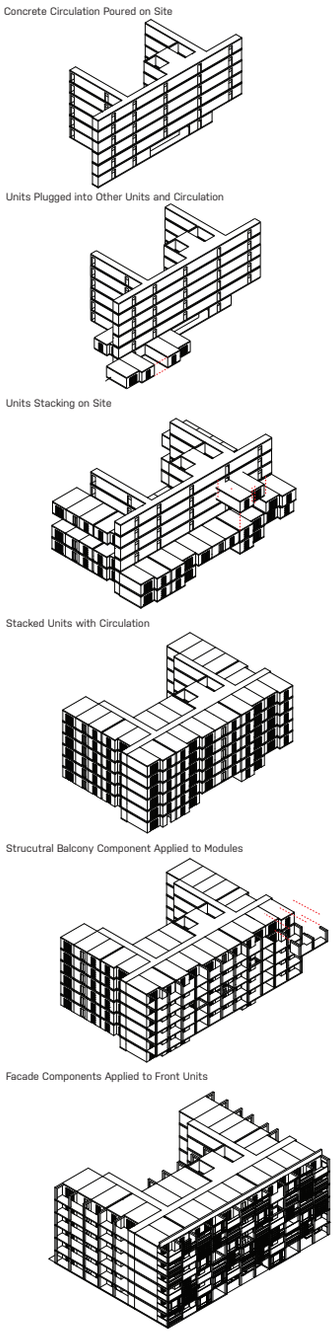
ABSTRACT

Faced with growing populations in the dense urban context of global cities, architecture is challenged to fulfil the need of housing which is affordable and customizable at various sites and scales. Plug and Play proposes a pre-fabricated modular building system which leverages economies of scale and the controlled factory environment to produce sophisticated, mass-customizable, scalable systems of spatial production. Through understanding of existing sell-able and marketable unit plans, Plug and Play's design incorporates them in order to maximize the number of sell-able units on site within the build-able volume through a method of stacking.

The systems intent is to have a catalogue of assemblies to be aggregated upon each built project, by incorporating the pre-existing facade components or allow customized site-specific facade components based on the budgetary needs of the project to hide the generic facade that other forms of modular architecture can create.



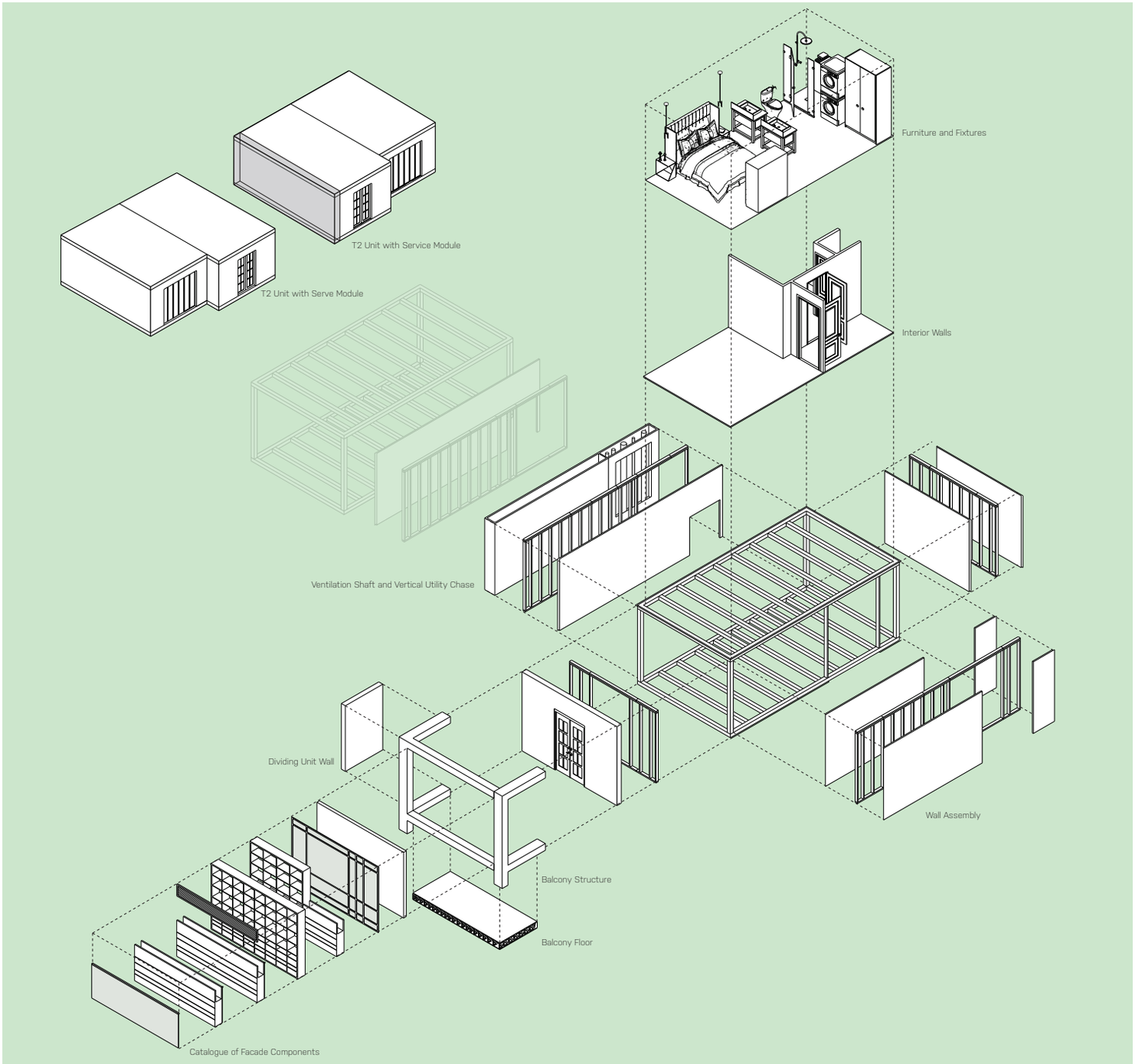
Component Relationships



Assembly Diagram

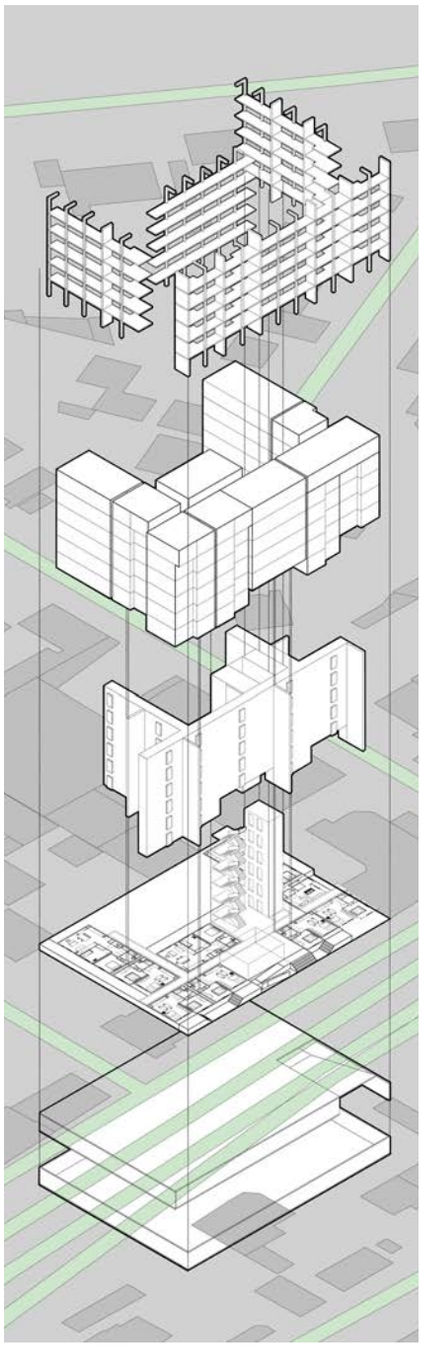
Advancing into the future, the design has the capability to be exchanged for a update of the facade to meet the needs of the ever-changing future within France and the globe. By removing the existing vertical utility chase from within the existing unit plans and placing it in between modules, called the service and the serve, the design allows for customization of bathroom layouts to meet the various needs of its residence, while adding an additional core for a natural ventilation system inspired by Le Corbusier's Unite d'Habitation in Marseille, France. This design proposal begins to define the architect's role within prefabricated construction by providing a free facade structural grid for site specific facade components to be designed and inserted. Doing so allows for each balcony and facade to be unique to each unit allowing residents to choose their desired indoor/outdoor relationships, but within the approved discretion of the architect.

05_Plug & Play

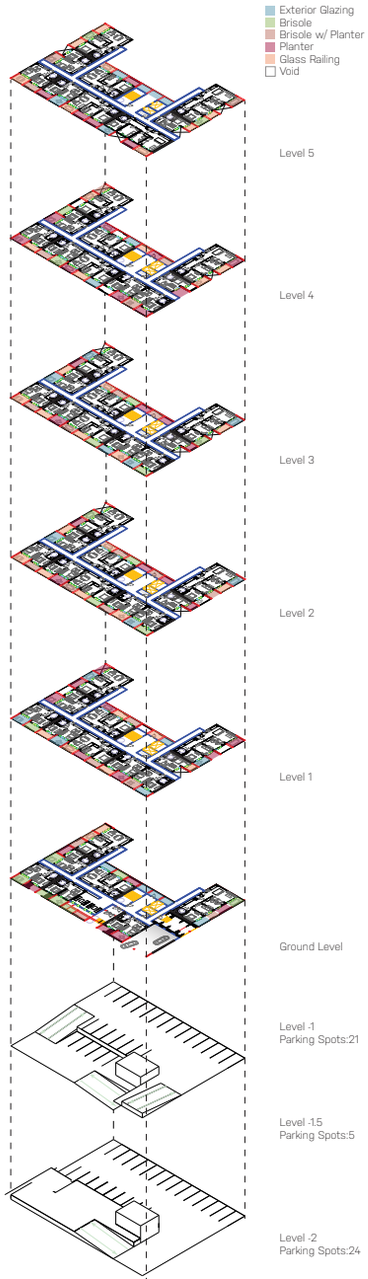


The design introduces an innovative unit/ balcony/facade relationship that allows for users to customize their own indoor/ outdoor relationships through a modest selection of facade choices provided by the architect, while maintaining the necessary relationship of a stacking vertical utility chase.

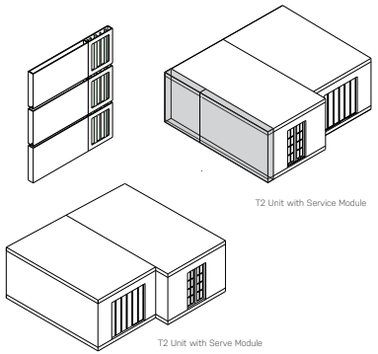
Pre-Fabricated Elements and Components of the Service Module



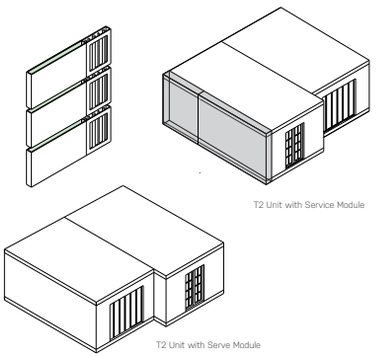
Exploded Axonometric



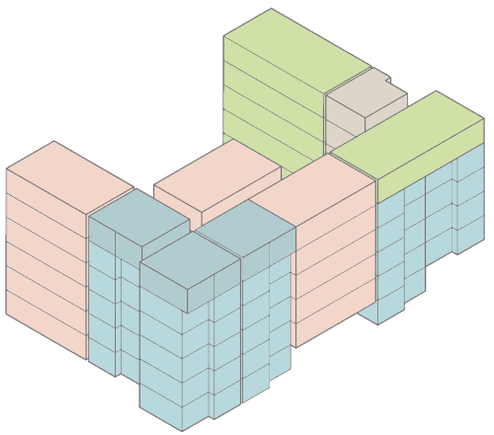
Balcony Relationship Plan



Vertical Utility Chase



Natural Ventilation



T1-Studio Apartment
5 Units

T2-One Bedroom Apartment
27 Units

T3-Two Bedroom Apartment
17 Units

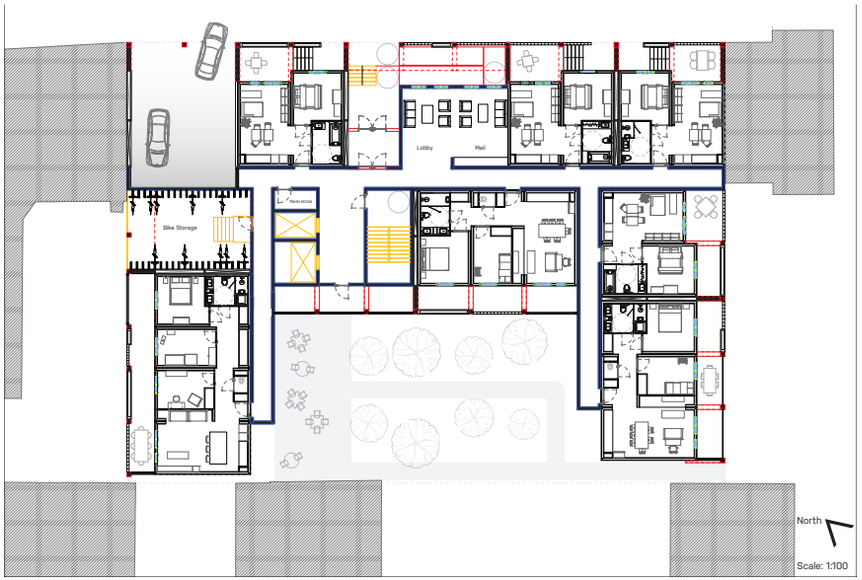
T4-Three Bedroom Apartment
7 Units

Total Units = 56 Units
Total Floors = 6 Floors

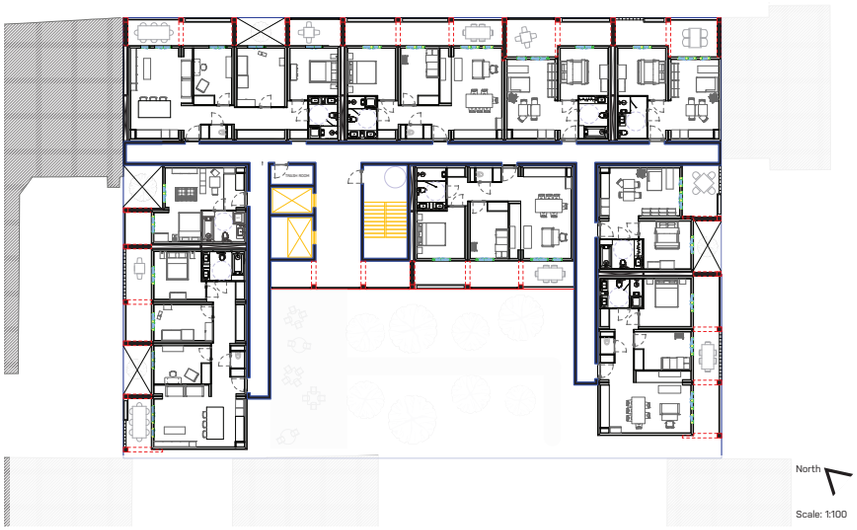
Permitted Floors = 7 Floors
Minimum Unit Number = 55 Units

If the desire is to maximize unit amount, within the buildable volume the design can add one floor of 10 units, equalling a total of **66 Units.**

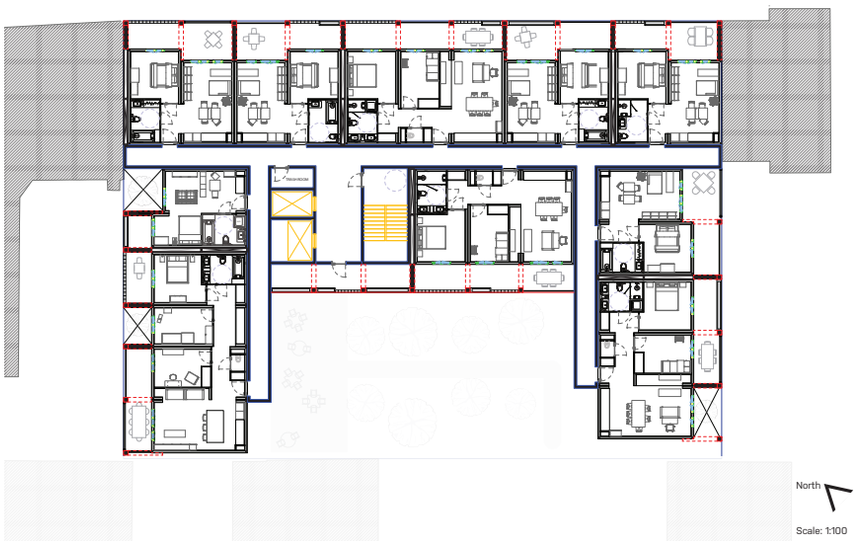
Unit Distribution



Ground Floor

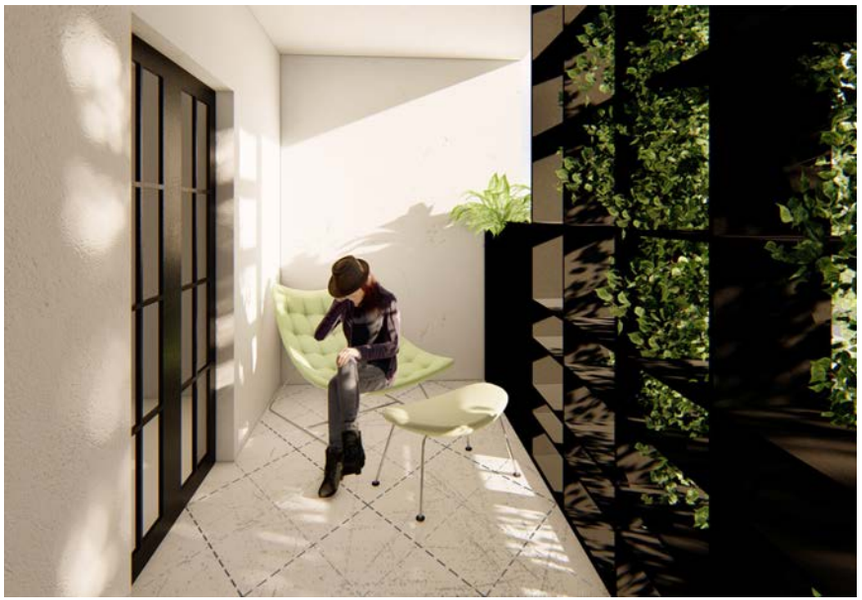


Attic Floor



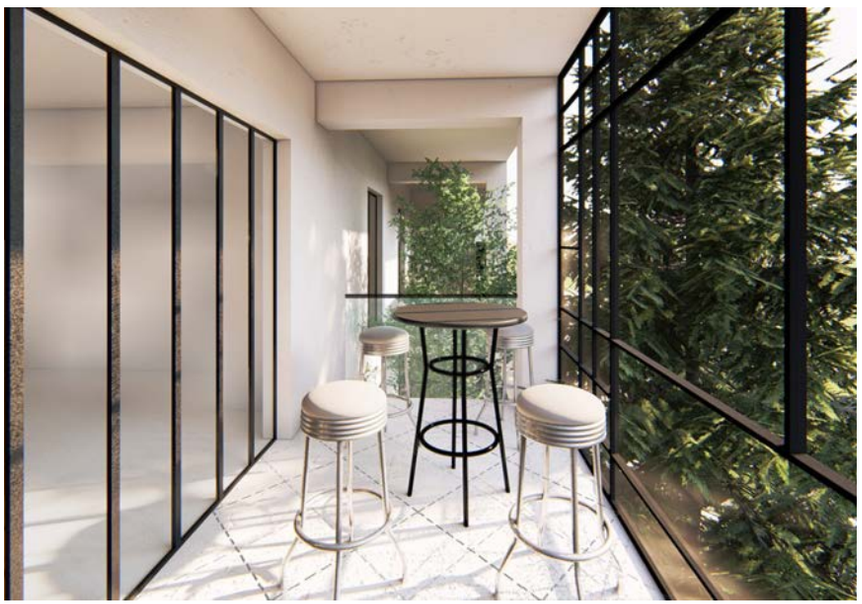
Floors 1 - 4

Section



Balcony 1

Balcony 2

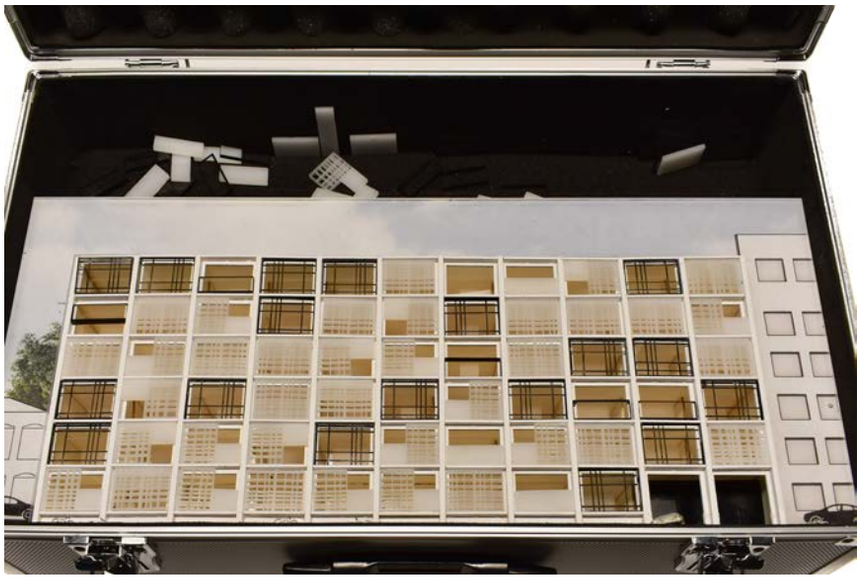


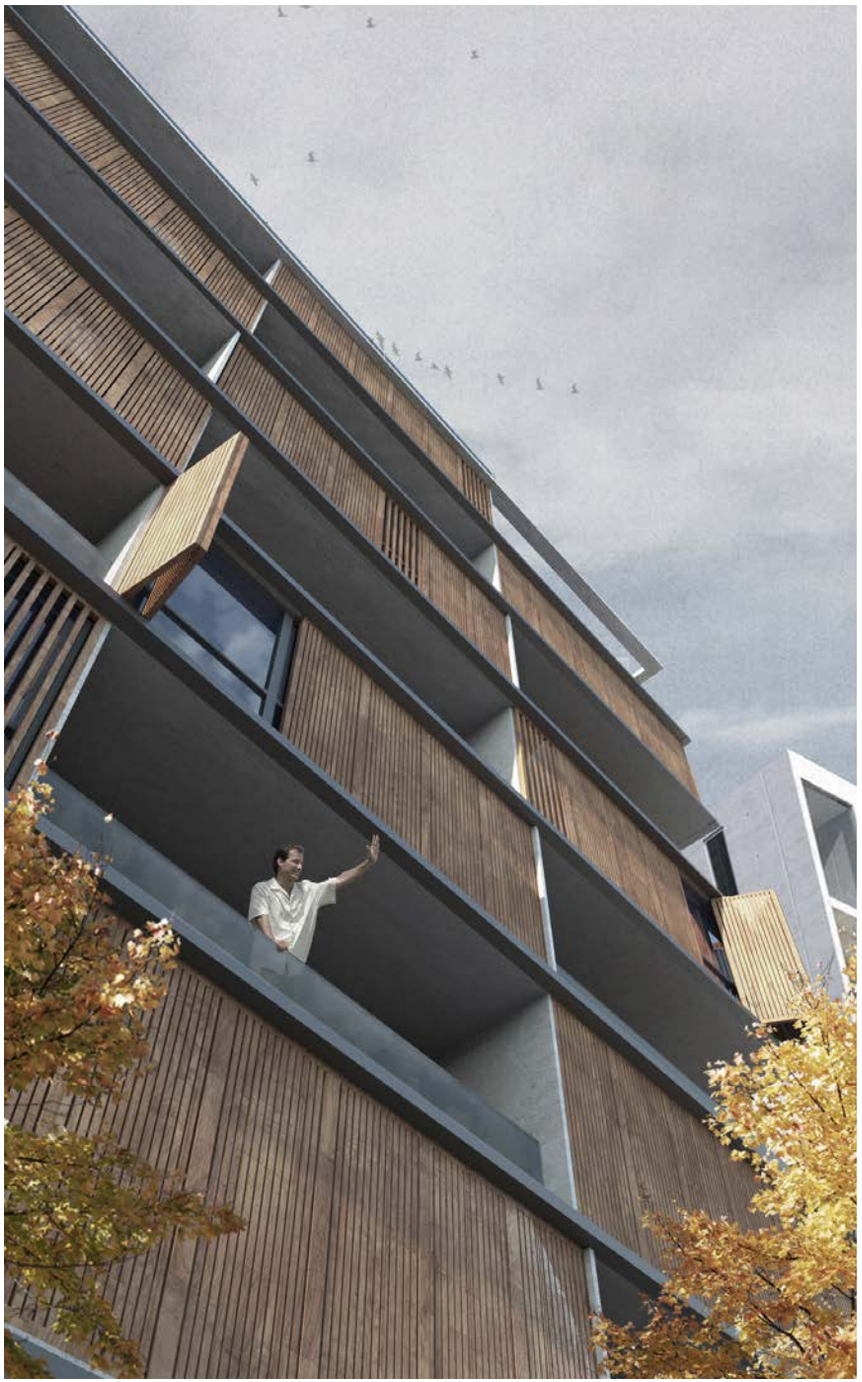
Balcony 3

Balcony 4

05_Plug & Play

(TOP) Street Perspective
(BOTTOM LEFT) Street Elevation
(BOTTOM RIGHT) Section





06

More with Less

Shahryar Beyzavi
Lovejeet Gehlot
Austin Wiskur

ABSTRACT

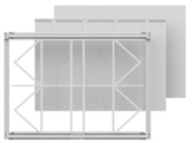
More with Less formulates a design to production strategy to provide affordable and sustainable housing solutions for residents. Achieving "more" by re-aligning the core wet walls on all units, allowing them to alternately stack units, creating more open space for the tenants, and a hassle-free process that cost "less" for the construction team, which could be repeated in other sites.

06_More with Less

DESCRIPTION ABOUT THE FACADE CONCEPT

Facade Perspective

Design



Manufacturing of Wall Component

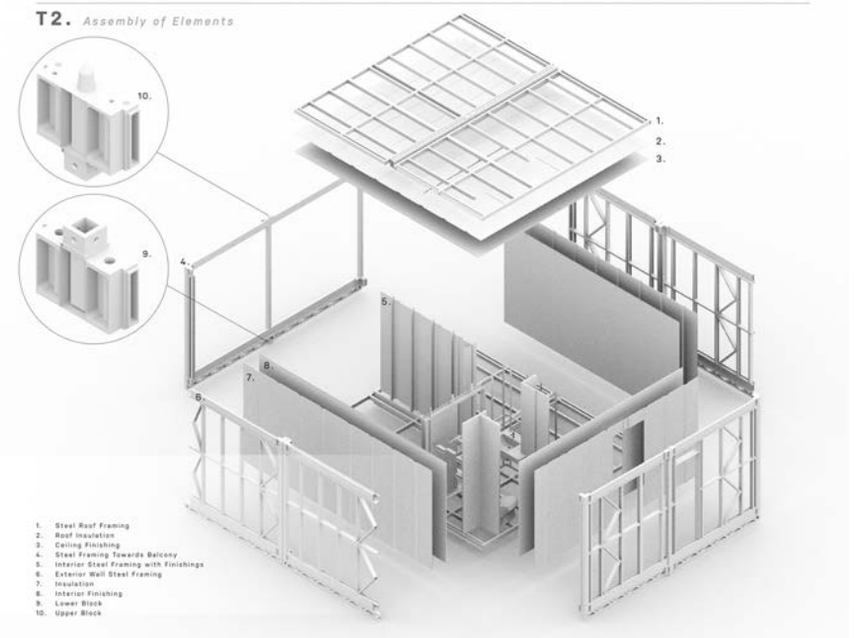
Transportation to Off-Site Assembly

Assembly

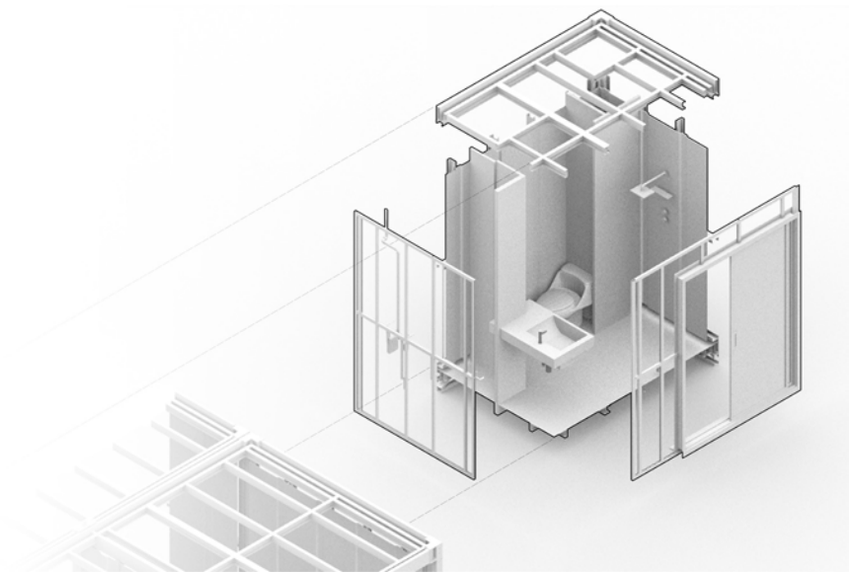
Transportation to Site

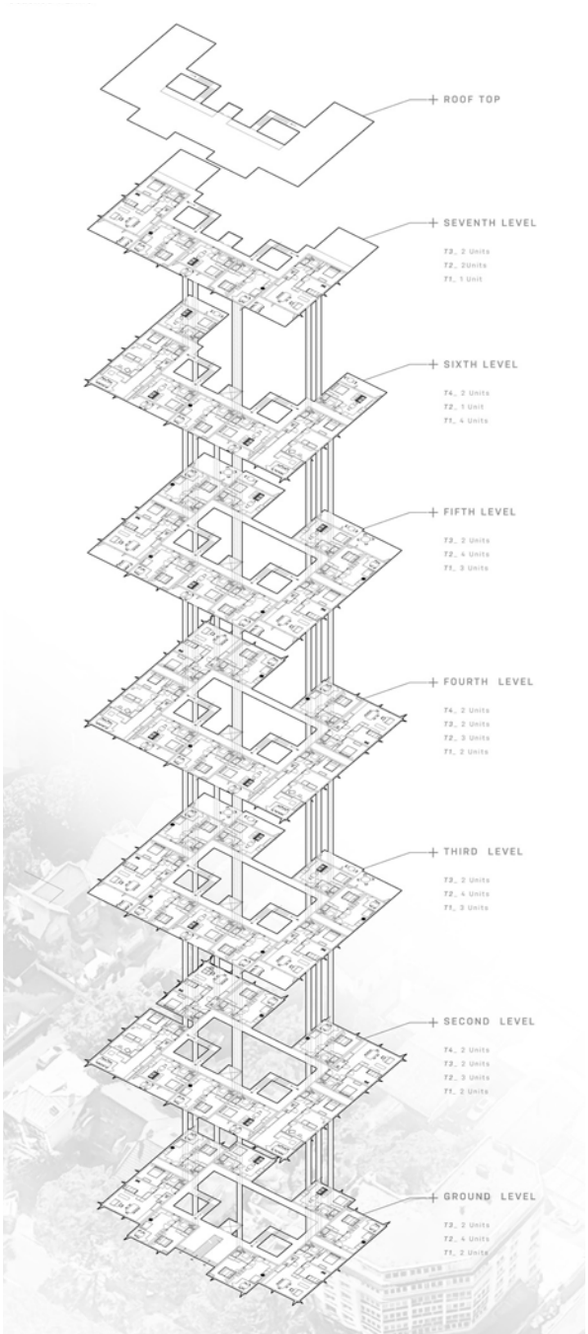
Assembly by Crane

Finished Building



Exploded Bathroom Diagram

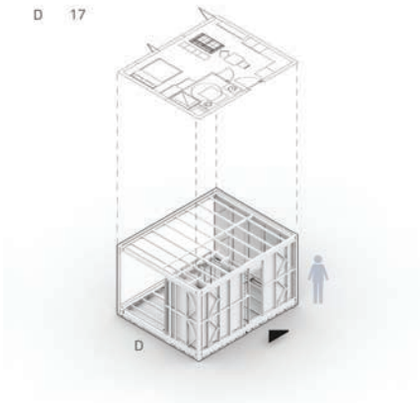




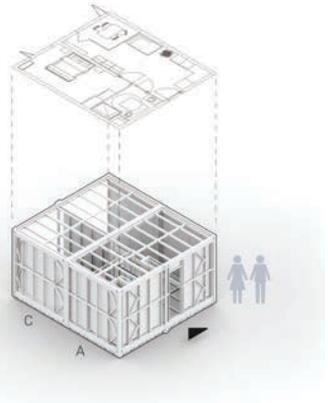
Stacked Floor Plans

A 49
B 24
C 39
D 17

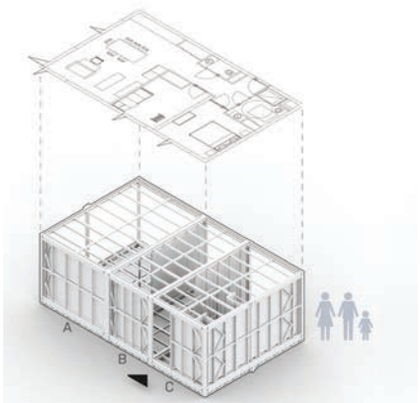
T1. 17 Units



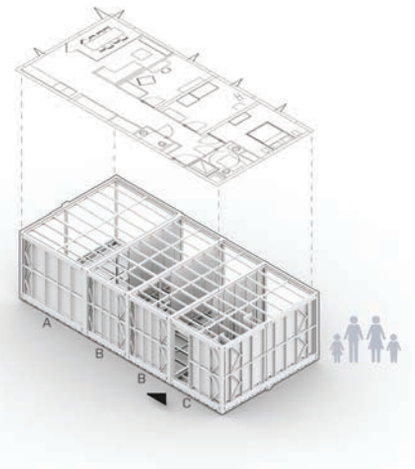
T2. 21 Units



T3. 12 Units



T4. 6 Units



06_More with Less

DESCRIPTION ABOUT THE ASSEMBLY

'Modular Block' Connection System

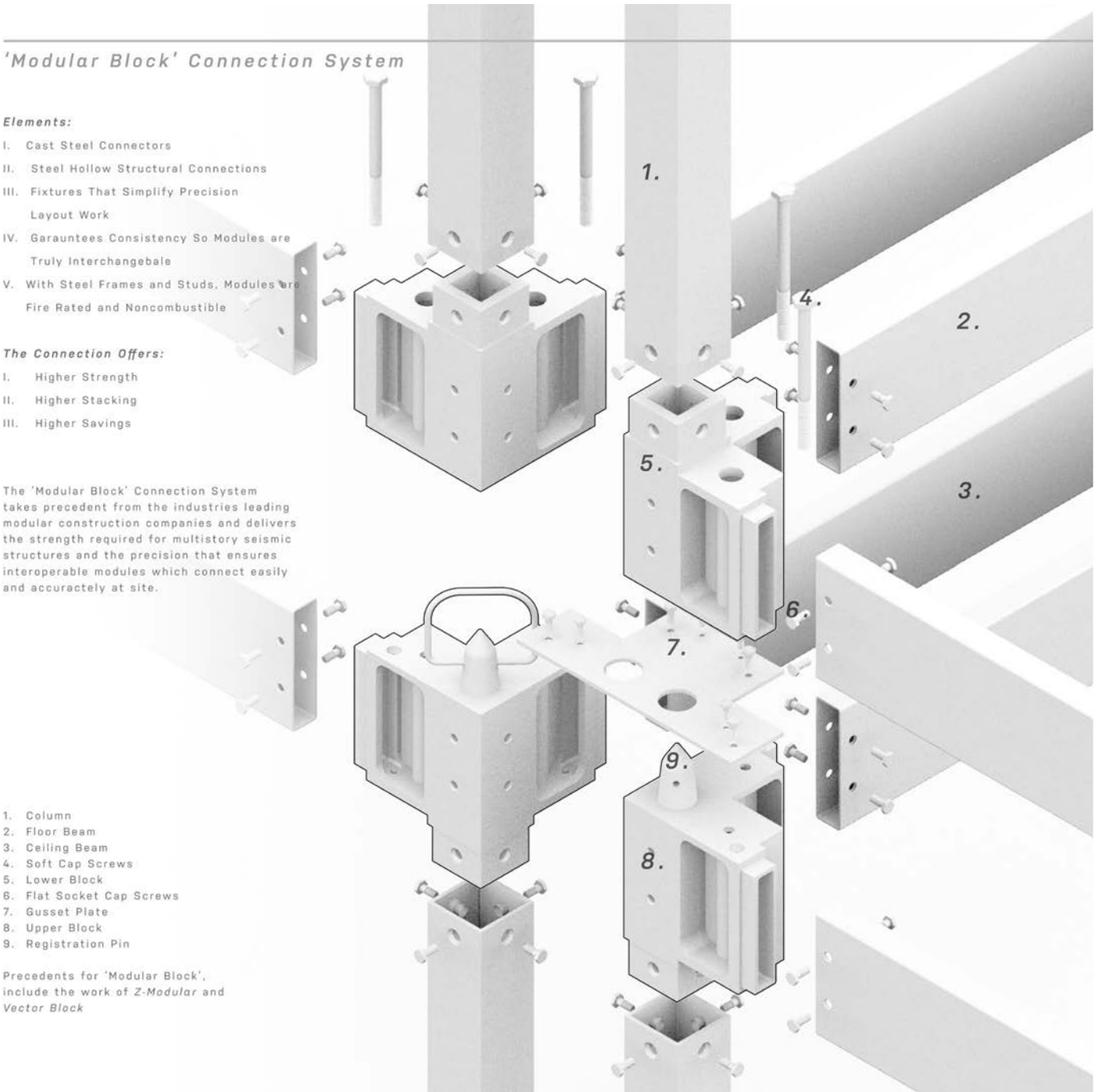
Elements:

I. Cast Steel Connectors
II. Steel Hollow Structural Connections
III. Fixtures That Simplify Precision Layout Work
IV. Garauntees Consistency So Modules are Truly Interchangebale
V. With Steel Frames and Studs, Modules are Fire Rated and Noncombustible

The Connection Offers:

I. Higher Strength
II. Higher Stacking
III. Higher Savings

The 'Modular Block' Connection System takes precedent from the industries leading modular construction companies and delivers the strength required for multistory seismic structures and the precision that ensures interoperable modules which connect easily and accuractely at site.

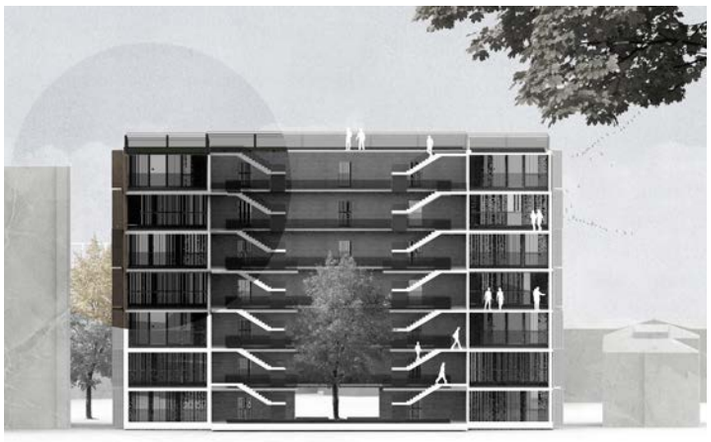


1. Column
2. Floor Beam
3. Ceiling Beam
4. Soft Cap Screws
5. Lower Block
6. Flat Socket Cap Screws
7. Gusset Plate
8. Upper Block
9. Registration Pin

Precedents for 'Modular Block', include the work of *Z-Modular* and *Vector Block*

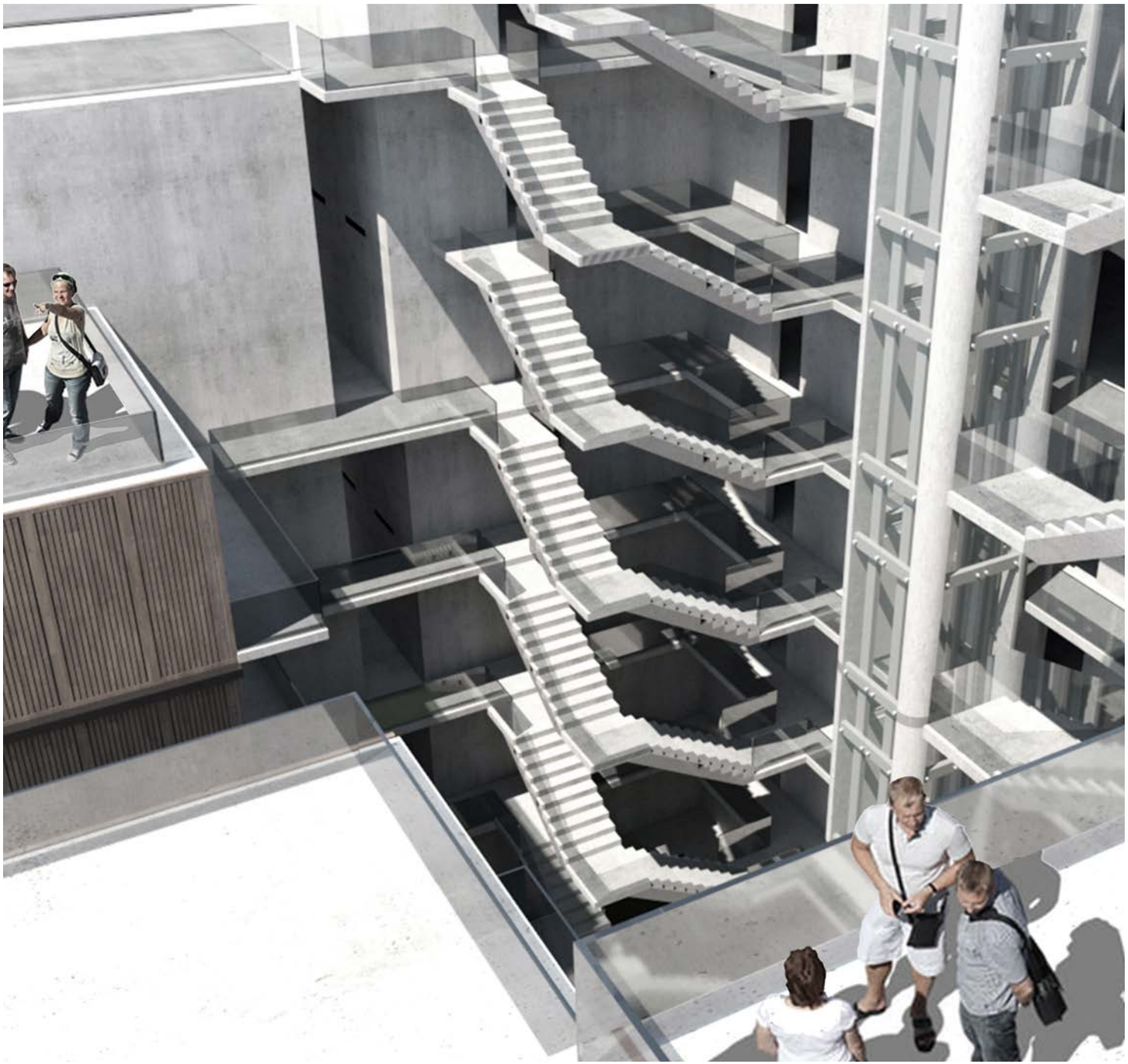
Connection Detail

06_More with Less

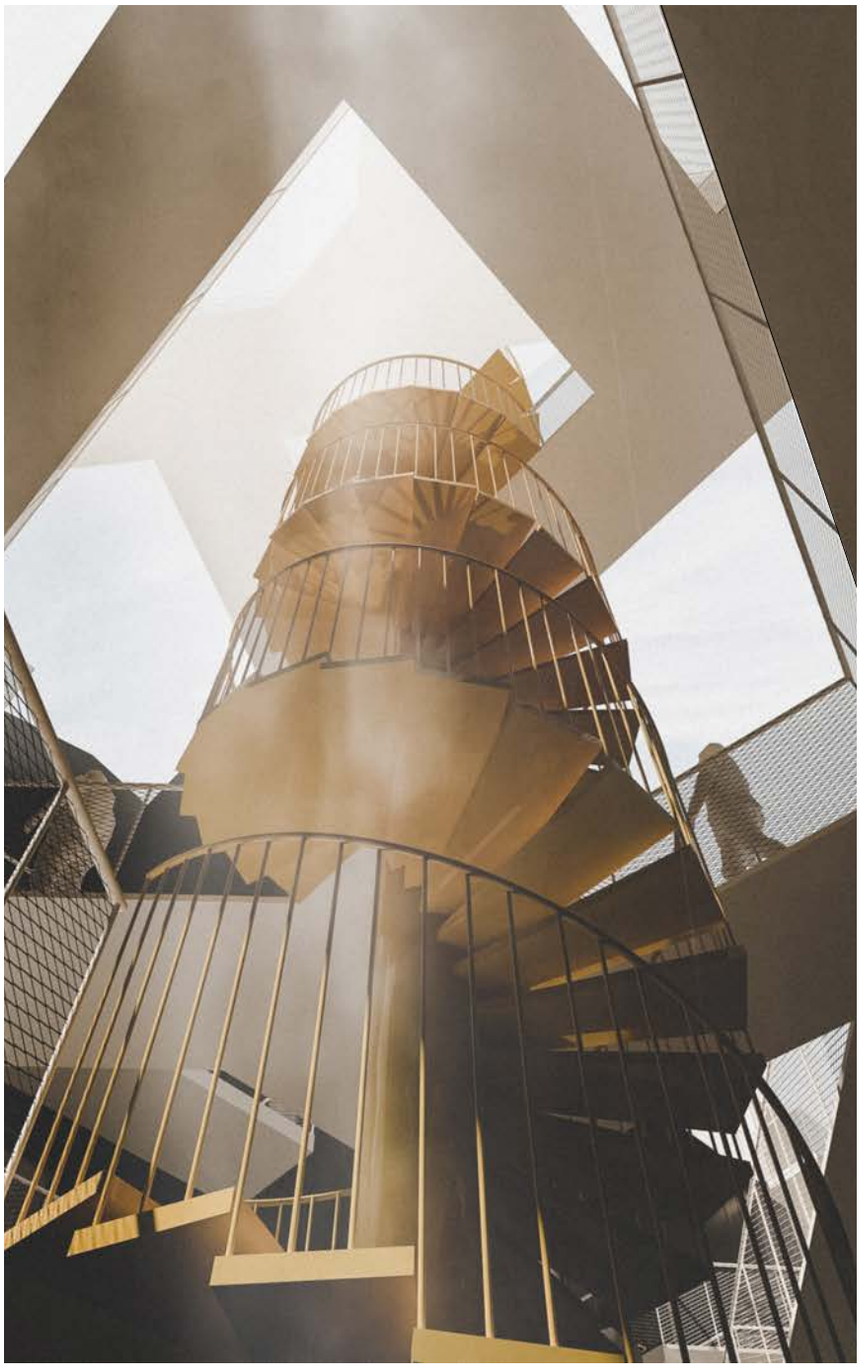


(TOP) Day and Night Elevation
(BOTTOM LEFT) Longitudinal Section
(BOTTOM RIGHT) Cross Section

06_More with Less



Interior Courtyard Perspective



07

Porous Panoramas

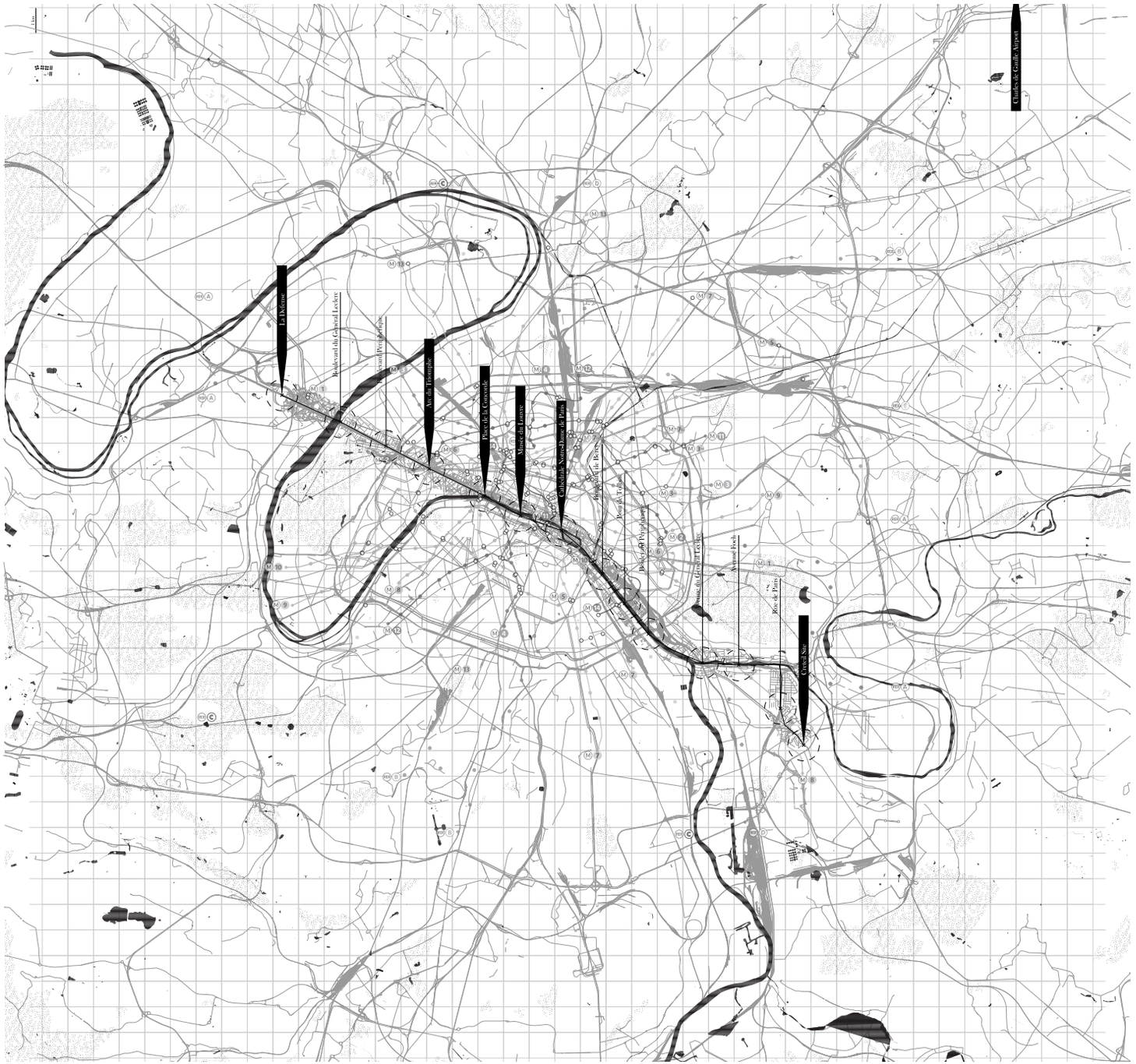
Mackenzie Bruce
Marco Nieto
Jeffrey Richmond

ABSTRACT

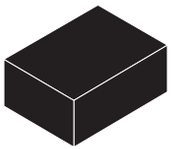
Porous Panoramas connects people through a scalable, mass-customizable pre-fabricated 'Fun Palace' that aims at visually and formally bridging the gap of social engagement and inactive relationships. The proposal utilizes both an environmentally conscious material selection that allows for non-destructive disassembly at the end of its life cycle, and the use of mechanical connections that let units and balconies aggregate with ease. The attention restoration theory also plays a large role in the way the building stimulates and offers a connection between the sensorial temporal qualities of architecture and its impact on wellbeing, by lending green space and visual/physical relationships to the outdoors whenever possible.

Altogether, our proposal provides a unique residential typology that offers a vast collection of socially active features and gestures that utilize and push the boundaries of off-site construction in a global context. Our proposal overcomes the stigma that architecture has an allegiance to the one-off, the custom-made, and temporality.

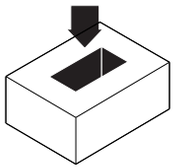
07_Porous Panoramas



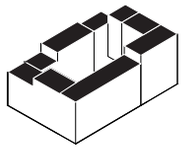
Mega map showing the various contextual and cultural relationships between several landmarks and sites in Paris



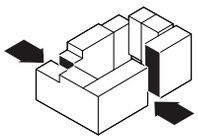
Extruded site



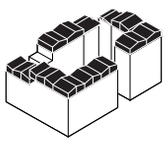
Center pushed down to create a courtyard



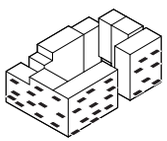
Roofs have been pushed or pulled to respect surrounding adjacencies



Access through the building is created by separating the masses

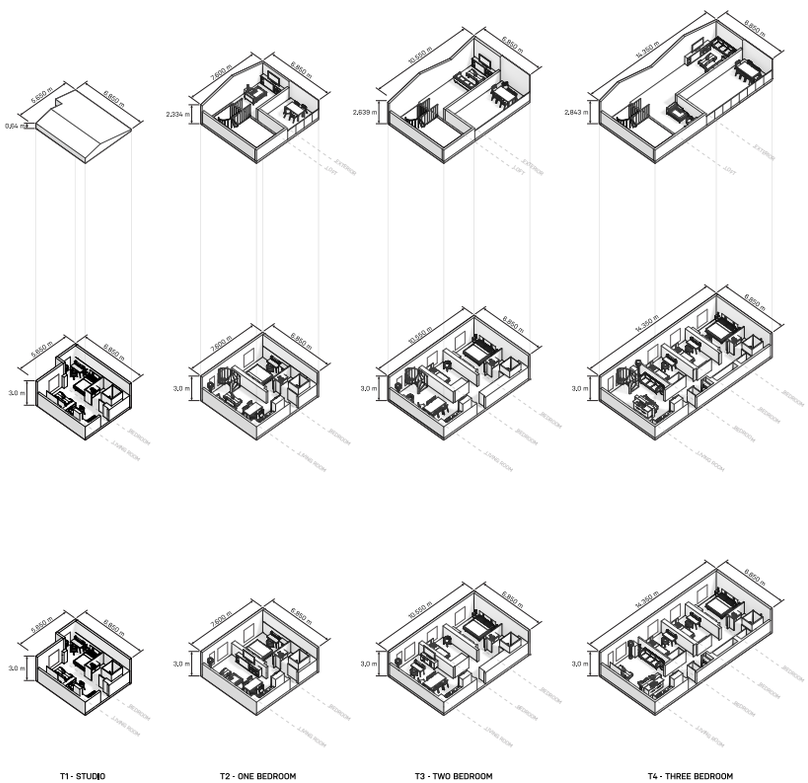


Gable roofs mimic the architectural language around the site

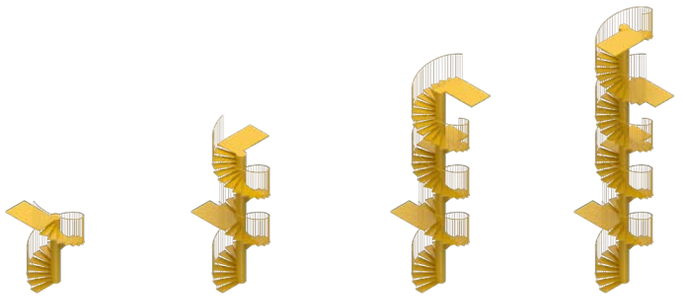


Several balconies create catered views and interactions

Alongside the standard units given to us by Vinci, our team developed duplex units on the highest floors that utilize vertical circulation. Spiral stairs are inserted inside the units which allows for the living room to move upstairs and become a loft directly adjacent to the provided outdoor space. An extension of the spiral stairs, two larger ones are placed in the courtyard which acts as the main circulation for users. Through a simple 90 degree rotation, the exterior stairs begin to create different scenarios for the corridors, or 'flying walkways', to spread out to the units, thus creating a layering effect that allows for a unique experience of shading and lighting to transcend onto the ground floor.



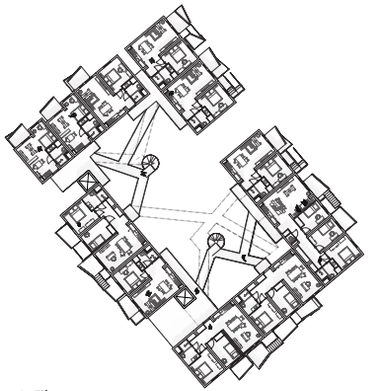
Isometric Units



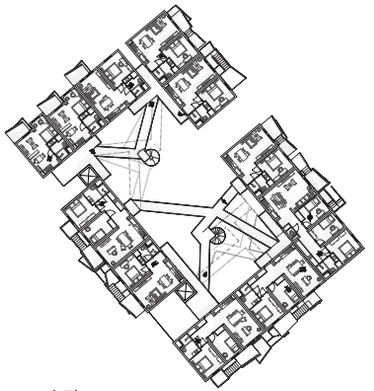
Street Entrance Perspective

The building mass is split and scaled accordingly to respect the adjacent structures to avoid intrusion. Specific features to Parasitic Porosity include a passage to a courtyard that allows the public to flow through, split balconies that allow for multi-level interaction between units on separate floors, gable roof gardens with interior views and a playful use of shading, and spiral stairs that connect the units on each level together through flying walkways.

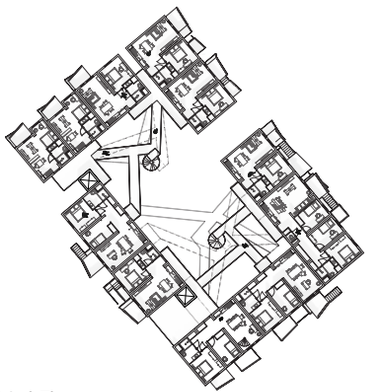
Ground Floor



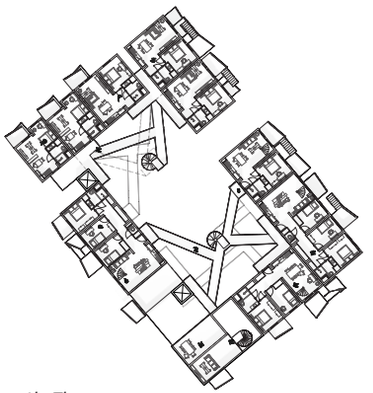
First Floor



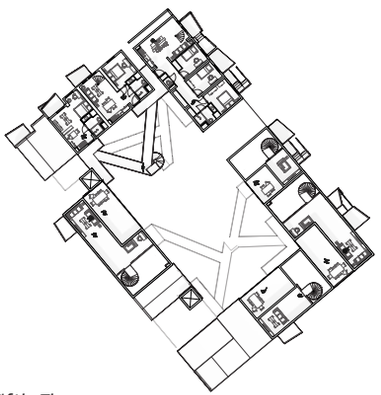
Second Floor



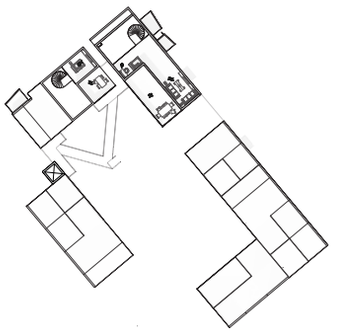
Third Floor



Fourth Floor

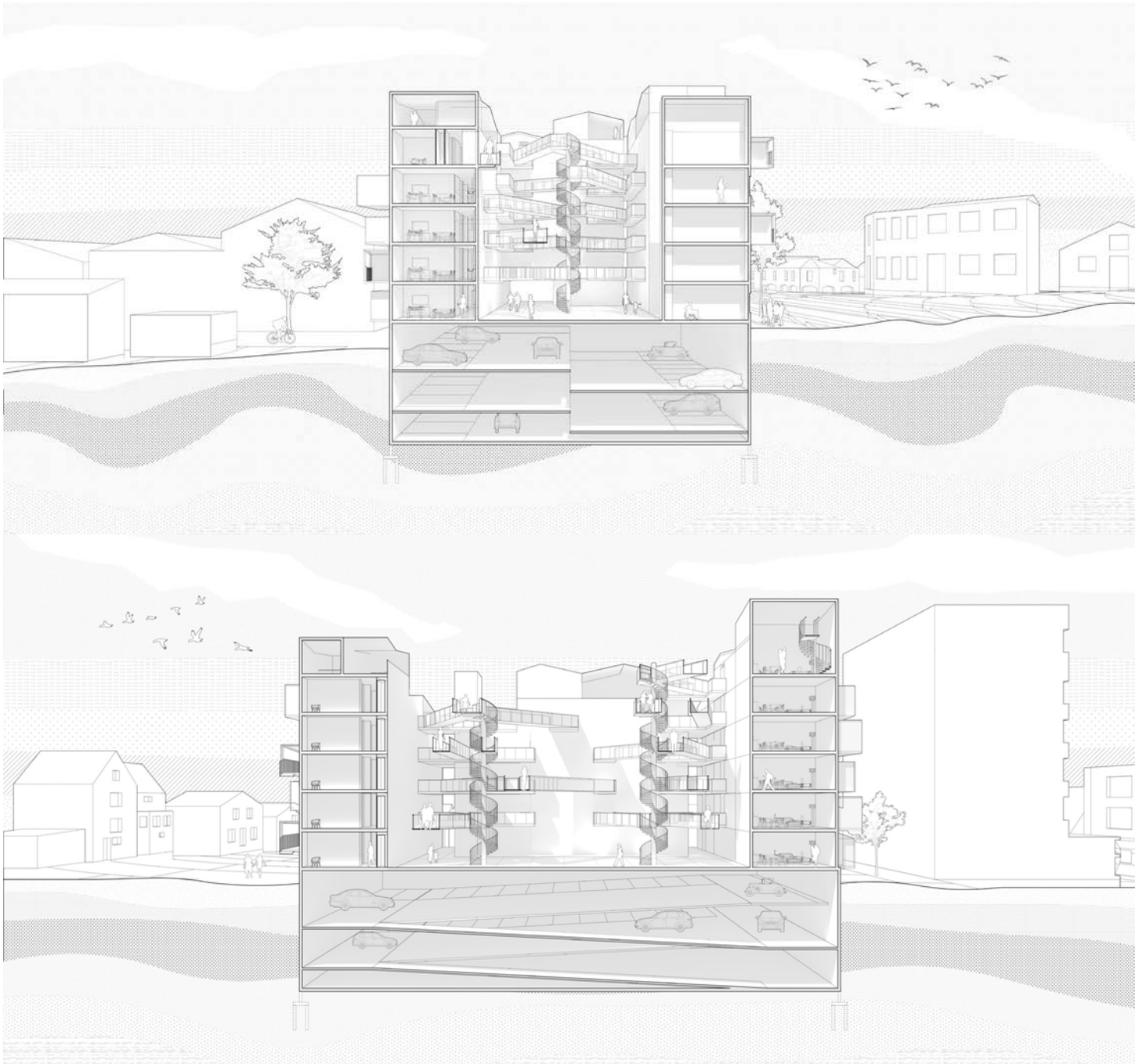


Fifth Floor



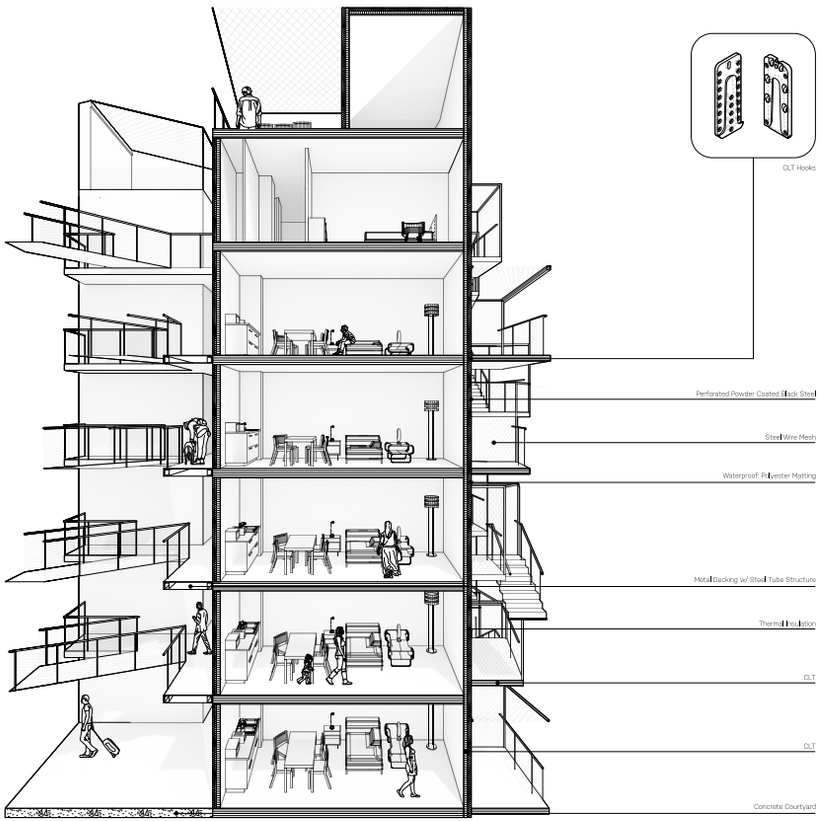
Sixth Floor

07_Porous Panoramas



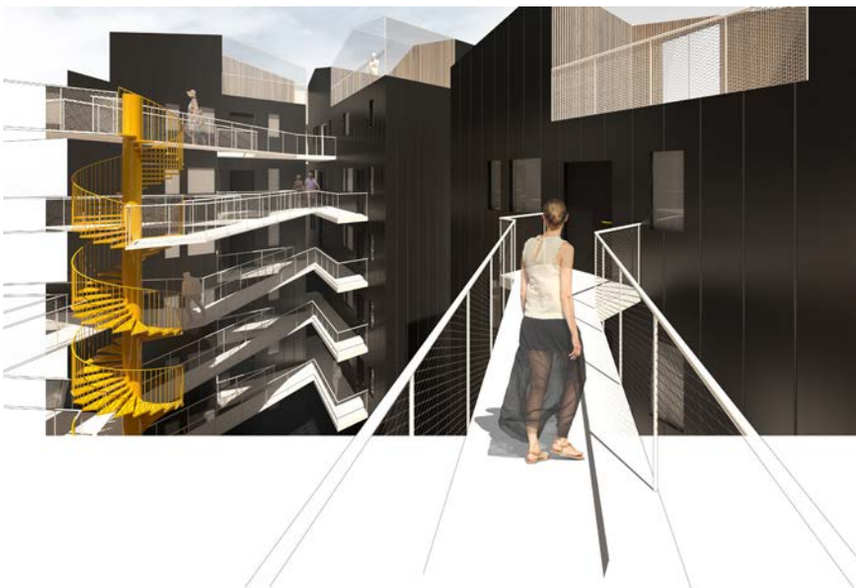
(TOP) West to East Section Perspective
(BOTTOM) South to North Section Perspective

Throughout the design process we put our focus on dictating the way the building stimulates and offers a connection between the material sensitivity of Europe as well as their affinity towards exterior space, by lending green space and visual/physical relationships to the outdoors whenever possible. Our proposal provides a unique residential typology that offers a vast collection of socially active features and gestures that utilize and push the boundaries of pre-fabrication in a global context, attempting to overcome the idea that pre-fab has restrictions and cannot be blended seamlessly into the architectural landscape.

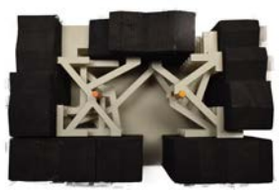


Detail Section Perspective

Attic Perspective



Flying Corridor Perspective



08

Comparative Matrices

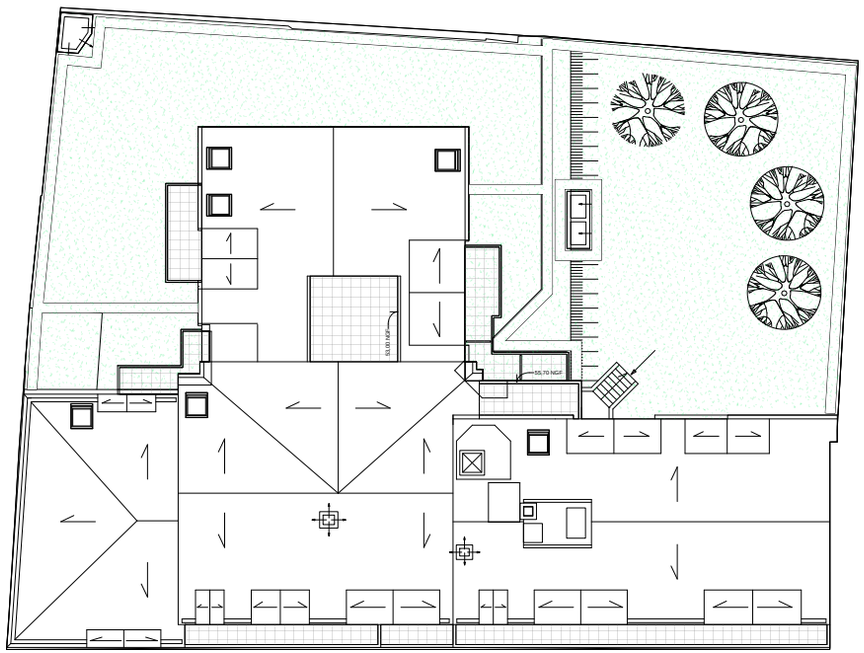
Prompt for next steps?
Endnotes?

ABSTRACT
Comparing the student projects with the building by Vinci that currently exists on the site, we are able to directly evaluate the potential pre-fabrication offers.

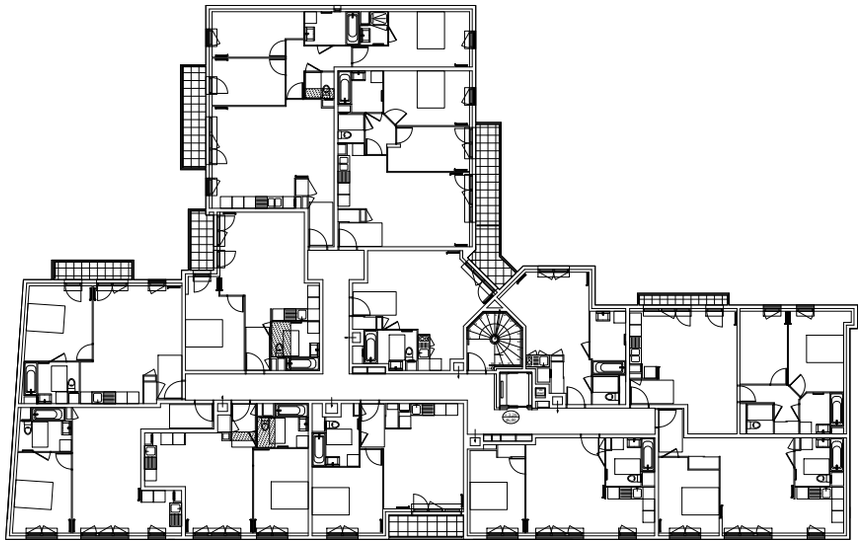
Students walked away from this course having dealt firsthand with the real world challenges of producing architecture for the world's increasingly populous urban centers, working alongside one of the largest global players in the construction industry.

Actual Building

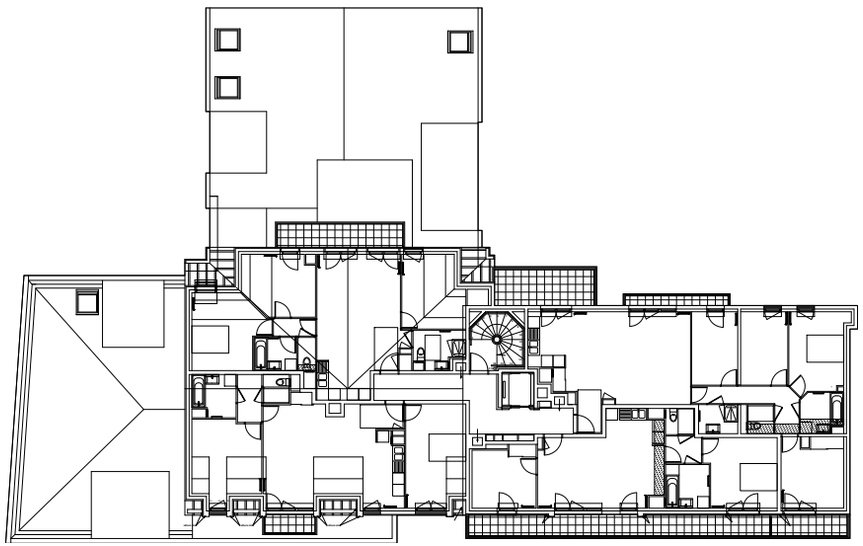
Using the existing structure built by Vinci Construction, we're able to directly compare our own studio proposals and see how pre-fabrication provides opportunities (or the lack there of) for growth and efficiency.



Site Plan



Second Floor

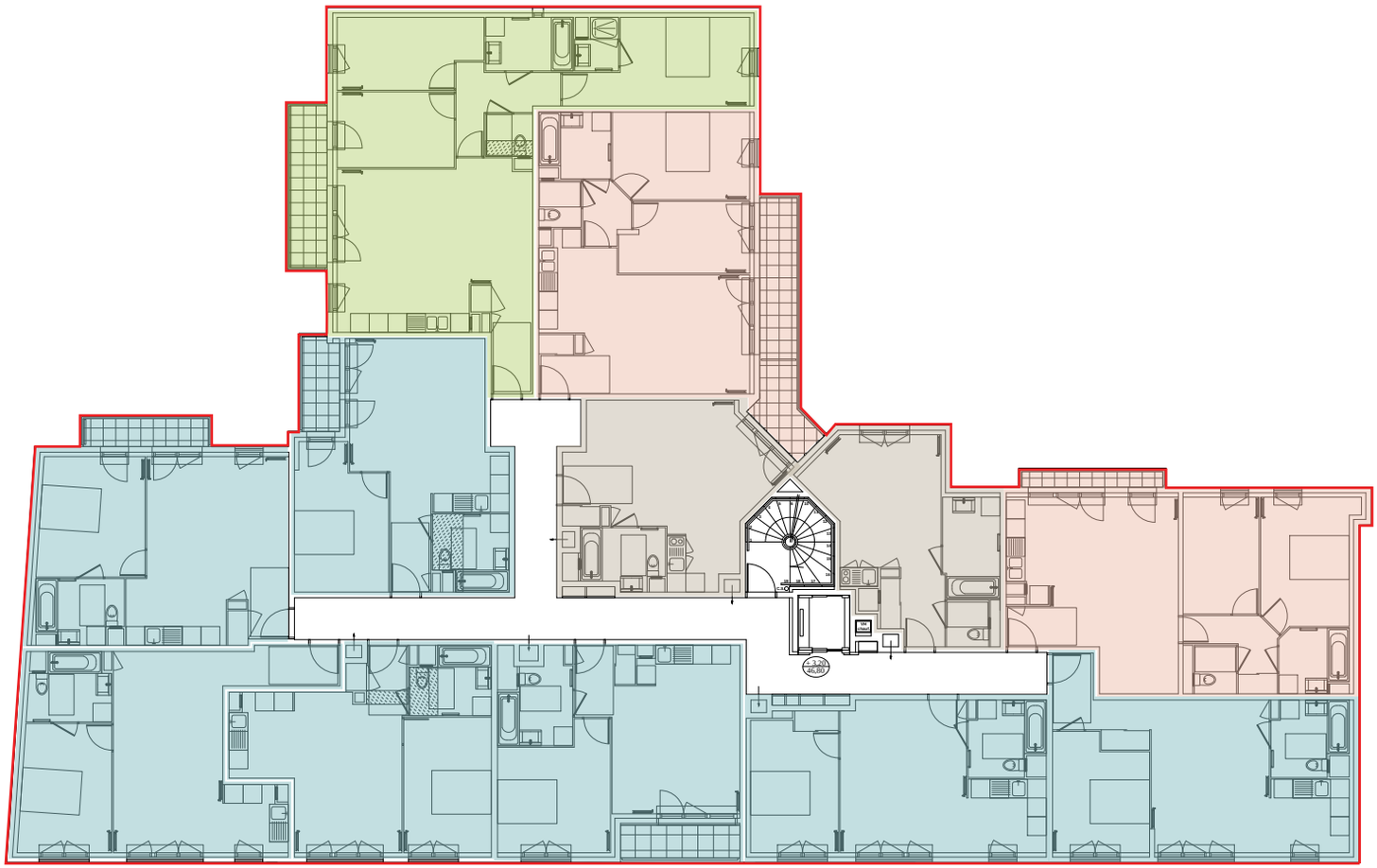


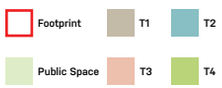
Fifth Floor

08_Comparitive Matrices

Vinci

	T1	T2	T3	T4	Footprint	Public Space
First Floor	2	3	3	1	0	0
Second Floor	2	7	2	1	0	0
Third Floor	2	7	3	0	0	0
Fourth Floor	1	6	1	1	0	0
Fifth Floor	1	2	2	2	0	0
Sixth Floor	0	0	2	1	0	0
TOTAL	8	25	13	6	0	0





Second Floor

Vertical Neighborhood

	T1	T2	T3	T4	Footprint	Public Space
First Floor	1	4	1	1	777.86 m^2	21.85 m^2
Second Floor	1	3	2	2	848.42 m^2	21.85 m^2
Third Floor	1	4	2	1	848.42 m^2	87.66 m^2
Fourth Floor	1	3	2	0	782.61 m^2	214.4 m^2
Fifth Floor	1	2	2	1	758.81 m^2	90.14 m^2
Sixth Floor	1	4	2	1	848.42 m^2	70.08 m^2
Seventh Floor	1	3	2	1	799.28 m^2	70.08 m^2
TOTAL (50 units)	7	23	13	7	5663.82 m^2	576.78 m^2

4th Floor

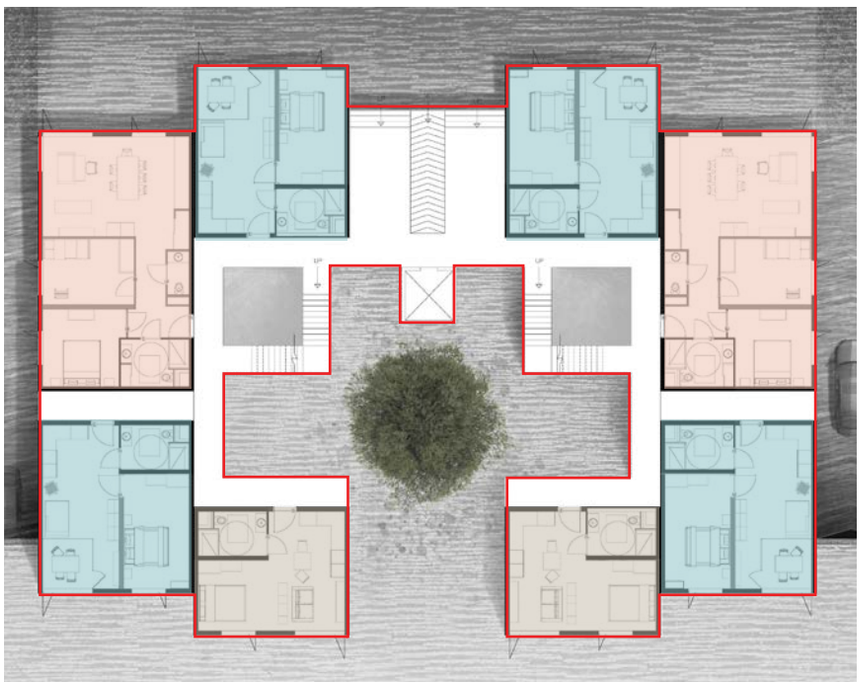
Plug and Play

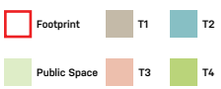
	T1	T2	T3	T4	Footprint	Public Space
First Floor	0	4	2	1	0	0
Second Floor	1	5	3	1	0	0
Third Floor	1	5	3	1	0	0
Fourth Floor	1	5	3	1	0	0
Fifth Floor	1	5	3	1	0	0
Sixth Floor	1	3	3	2	0	0
TOTAL (56 units)	5	27	17	7	0	0

Floors 1 - 4

More with Less

	T1	T2	T3	T4	Footprint	Public Space
First Floor	2	4	2	0	616.3 m^2	0
Second Floor	2	3	2	2	722.4 m^2	0
Third Floor	3	4	2	0	616.6 m^2	0
Fourth Floor	2	3	2	2	722.4 m^2	0
Fifth Floor	3	4	2	0	616.6 m^2	0
Sixth Floor	4	1	0	2	541.9 m^2	0
Seventh Floor	1	2	2	0	410.8 m^2	77.4 m^2
TOTAL (56 units)	17	21	12	6	2.908 m^2	461.05 m^2 (roof)





Site Plan

Porous Panoramas

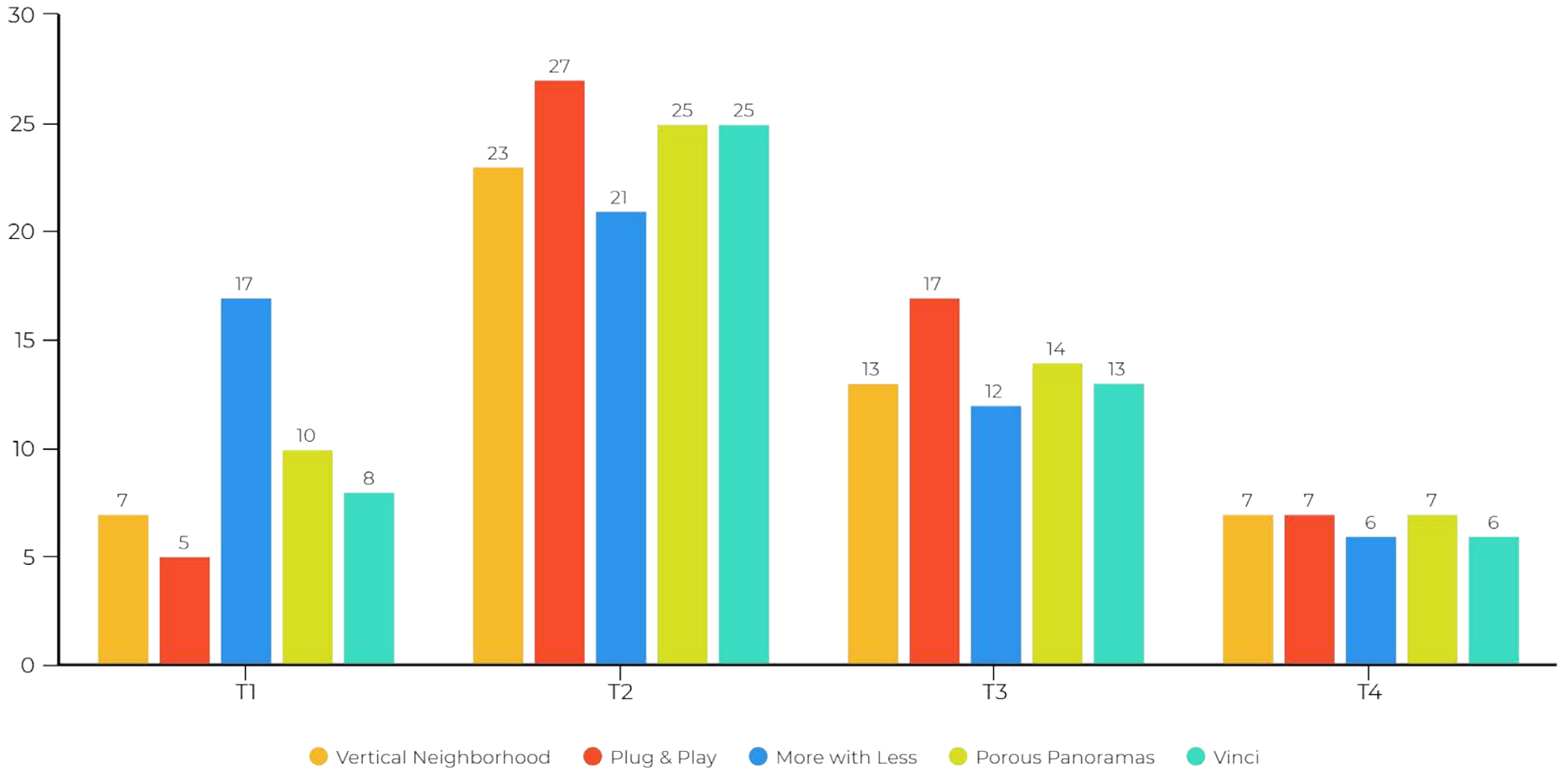
	T1	T2	T3	T4	Footprint	Public Space
First Floor	1	5	3	1	3912.9 m^2	401.7 m^2
Second Floor	2	5	3	1	4232.7 m^2	77.7 m^2
Third Floor	2	5	3	1	4196.5 m^2	60.8 m^2
Fourth Floor	2	5	3	1	3710.2 m^2	106.1 m^2
Fifth Floor	2	4	2	2	3447.9 m^2	59.1 m^2
Sixth Floor	1	1	0	1	902.3 m^2	9.5 m^2
TOTAL (56 units)	10	25	14	7	4160.4 m^2	714.9 m^2

Fourth Floor

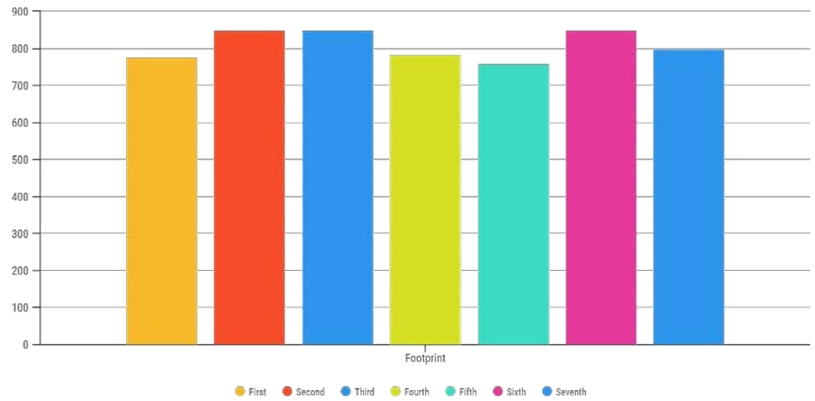
08_Comparitive Matrices

Units per Project

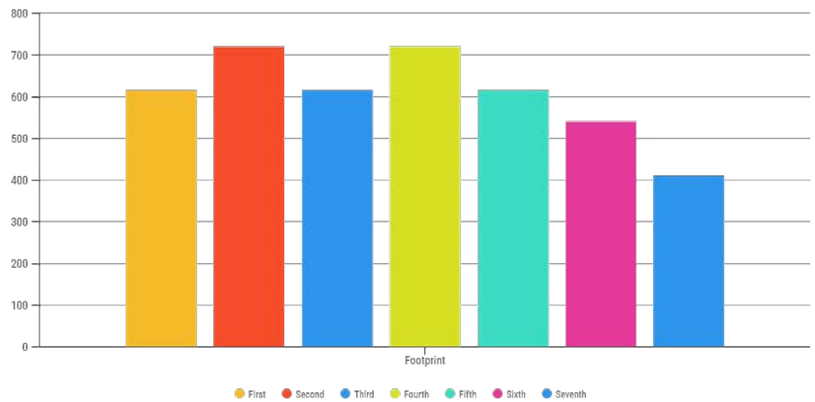
Although each project approaches the number of total units provided by Vinci in a different layout, there is a similar correlation between each building in terms of how many of each units there are.



Footprint per Floor

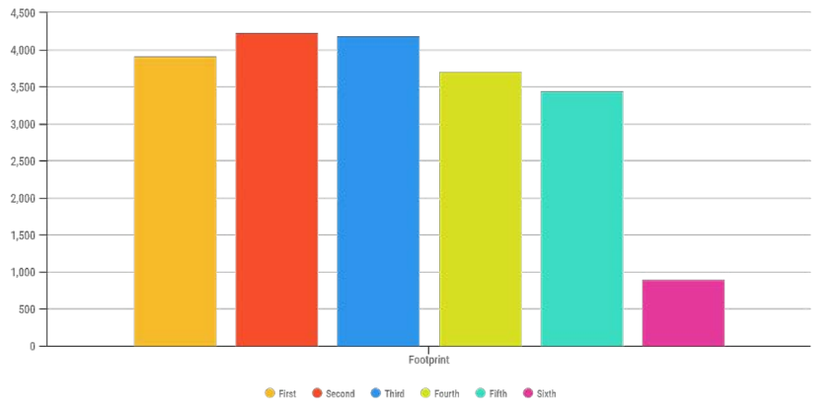


Vertical Neighborhood



More with Less

Plug & Play



Porous Panoramas