



CONTENT

Idea

Architectural

Technical

CONTENT

Saint-Denis

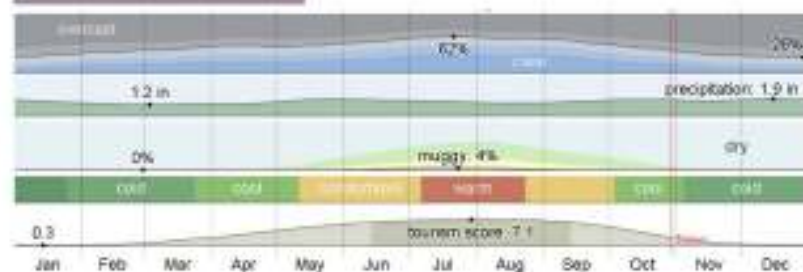
- Saint-Denis, as a medieval city and industrial area where the working class plays an important role.
- Saint-Denis has undergone drastic changes to keep up with the times.
- The city has changed in an unprecedented way over the past 30 years.
- As an example of population growth, more than 109.000 people live in Saint-Denis.
- The city embraces new people with its urbanization policies, construction policies, and constantly evolving living standards and dynamic structure.

"In Saint-Denis, the summers are short, warm, and partly cloudy and the winters are long, very cold, windy, and mostly cloudy. Over the course of the year, the temperature typically varies from 35°F to 78°F and is rarely below 24°F or above 88°F. The predominant average hourly wind direction in Saint-Denis varies throughout the year."

Population Growth

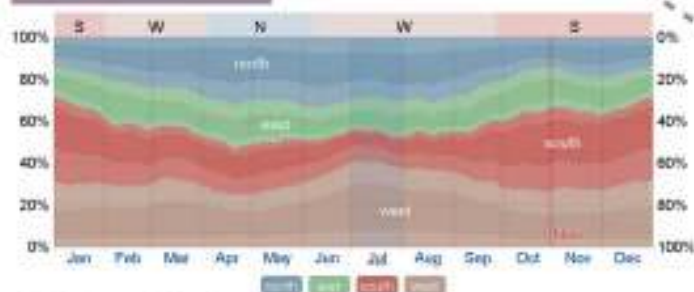


CLIMATE SUMMARY



Data Source: <https://weatherspark.com/>

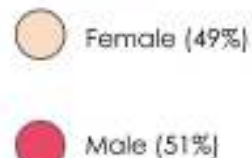
WIND DIRECTION



Data Source: <https://weatherspark.com/>

Election 2017

GENDER



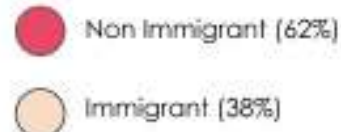
NATIONALITY



AGE DISTRIBUTION



IMMIGRATION



Data Source: <https://www.citypopulation.de/>

User Profile



"Bonnie is loved and known to everyone around her. Her biggest hobby is making orange jams. While sharing her jams with people certain times of the year, she enjoys both generating income and interacting with the people she lives with."



"Pierre works very close to the city park. Being in the city park and listening to the silence whenever he has time is a very good source of motivation for him and increases his concentration."



"Paul and Philip are two peers, enjoy researching and working together. The public library is an indispensable environment for them. In this library, which carries traces of the change of the region, they have the opportunity to find everything they are looking for."



"Carlotta is a teacher who loves her profession. She lives alone. Seeing a new face every time she steps out of the house and spending time in the community gardens is great for her."



"Patrick and Carol have been living together for a long time. Carol is delighted to be able to spend time with Paul in the city park and to be able to reach the riverside without any problems whenever she wants."



"They are a new generation of young people from different cultures or countries. They are quite happy that public spaces belong to themselves and indeed to everyone, not to private groups. They are together with all their differences."



"Allison and Adele are two young students, study at the same school. They want to share an apartment with other students, as their economic situation is not enough to rent an apartment alone and they want to spend their time in a more social way."



"Anne is 9 years old. She has a lot more to learn and a long way to go. Her school will play an important role in growing up as a physical, social and conscious individual."



"Antonie is a fan of modern dance. They even have a small dance group. In their spare time, they need open spaces where they can practice for their performances together, work long hours or rent a studio that they can be comfortable inside."



"Henri is a young man and together with his dog Pablo for years. They are both very sociable and like to be outside whenever they find time. Pablo is a water lover. Spending time by the river is very good for him."



"Fabien is a well-known street performer who released an album for himself. He likes to be in open spaces with his guitar in the spring season and make others happy and relaxed with the sound of his music."



"Oliver is a young father, raised with a sense of history. Caring and knowledgeable about all the historical sites around. He does his best to make his child grows up with the same consciousness and teaches him all he knows."

Design Ideas

- Creating public spaces that will allow the sharing of expenses within the specified limited area.
- Preserving the habitual lifestyle by infiltrating terraces and living spaces into the garden.
- Landscaping for noise reduction starting from the railway.
- Providing job opportunities in the site.
- Positioning according to the sun.
- Raising awareness of sustainability in schools as well: "Orchards and Recycling Workshops".
- Creating hard floors in green areas and forming places suitable for different activities.
- Designing the spaces in a way that encourages social cohesion.
- Separating houses with more rooms for common living and student accommodation, too.
- Ensuring spatial permeability: "Transition from private to public".
- Designing urban furniture that can be easily accessed and used in every part of the site.
- Opening the ground floors to contribute to the economy: "Living Street".
- Creating public gardens for everyone to cultivate and collect: "Community Gardens".
- Protection of historical heritage and making them fully public.
- Utilizing the roof surfaces with a strategy that will instill energy-efficient and social sustainability awareness.
- Aiming to create an atmosphere intertwined with nature for visual comfort and its reflections on the facade.



CLOSE SOCIETY

It represents leaving the word "Individual" and being a part of a whole. In a cohesive society, individuals manage to be a whole, despite all their differences, instead of coming together for the same purposes. Places aim to exist for "everyone".



HISTORICAL AWARENESS

Repositories have been made a part of "education", which is the most powerful tool to transfer awareness of history from one generation to other, and reserved for the public library. Maison Coignet has been turned into an iconic place and publicized as an important part of the river section.



SUSTAINABILITY

In the implementation of sustainability principles, rather than just thinking and restricting structurally, things to be done in the social context were taken into consideration in order to transfer environmental awareness from generation to generation, and various places were created that instill this consciousness.



PUBLIC BENEFIT

It is aimed that the possibilities in housing solutions reach the highest level for the public benefit. While the ground floors were kept away from being privatized for certain groups, it was aimed to meet the needs of the people living in the region, to make economic contributions to their surroundings and to each other and to provide job opportunities.

Site Plan

The old factory's parking lot and foundations can be used to prevent re-paving.



pier for enjoying the river



Maison Coignet, as a statue garden



bicycle roads



historical depots as library and workshop areas



bazaar for social and economical purposes

P

underground parking area



trees as noise barrier



Site Context - Connections

- Shared Streets
- Vehicles
- Bicycle Roads
- Pedestrian Paths

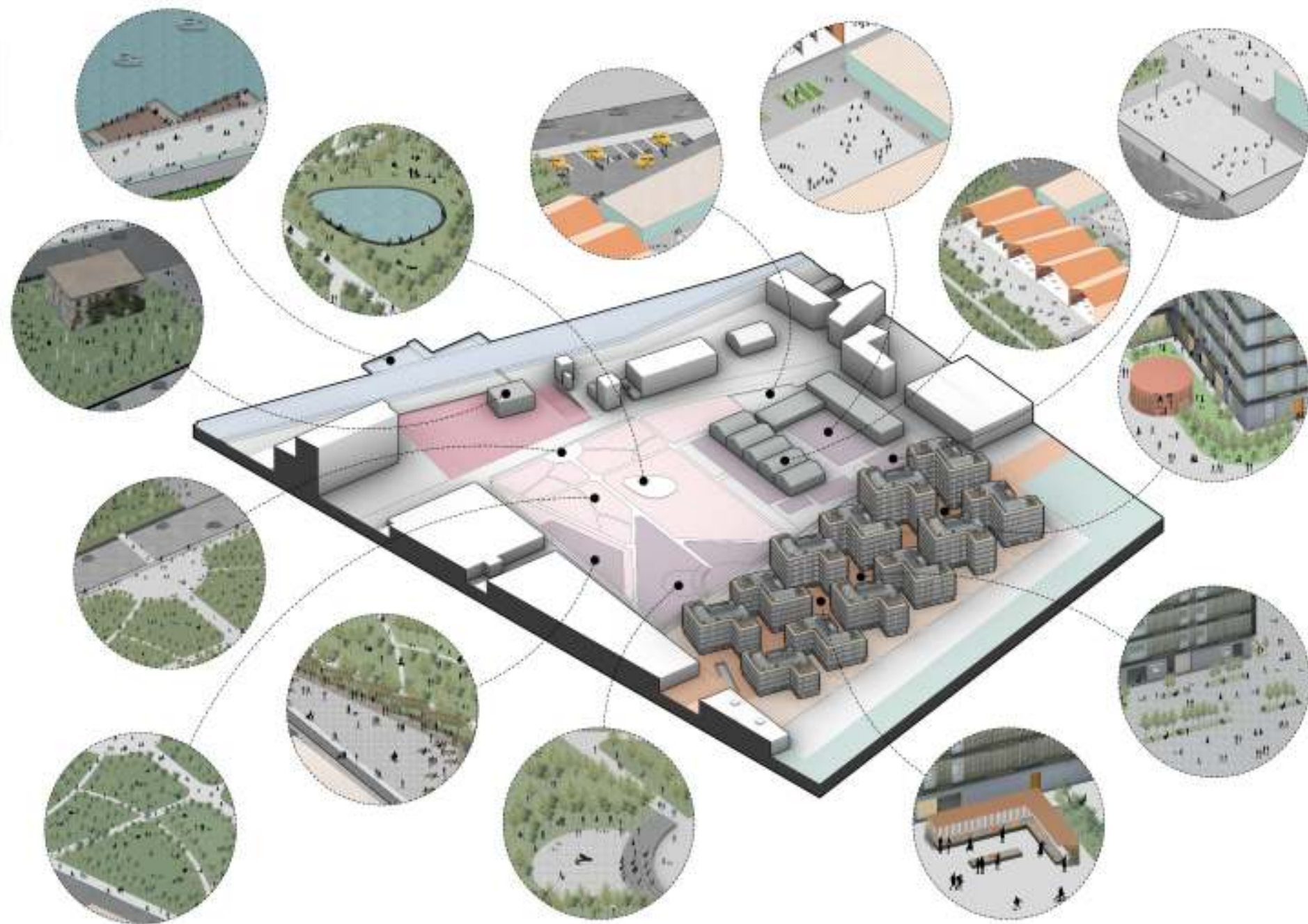
Axes/elements determined in the future projects for the site

Urban Scale Context - Connections



Site Design

#RIVERSIDE
#POND
#PARKING LOT
#ICON
#MAIN SQUARE
#ACOUSTIC BARRIER
#FAIR
#SCHOOLYARD
#PERGOLAS
#BAZAAR
#GREEN PARK
#SHARED STREET
#ACTIVITY SQUARE
#STATUE GARDEN
#PIER
#COMMUNITY GARDEN
#RELAXATION
#BUFFER ZONE
#SPORT COURTS
#COMMUNAL SPACES
#WORKSHOP SPACES
#ATTRACTION POINT
#BICYCLE ROAD
#PUBLIC LIBRARY



Site Design

Classification and acoustic impact on project: **existing environmental factors**

-  Mobility on the canal / Distance: >100m
-  Road II / Category: 3 / Distance <100m
-  Road I / Category: 3 / Distance: <100m
-  Railway / Category 1 / Distance <300m

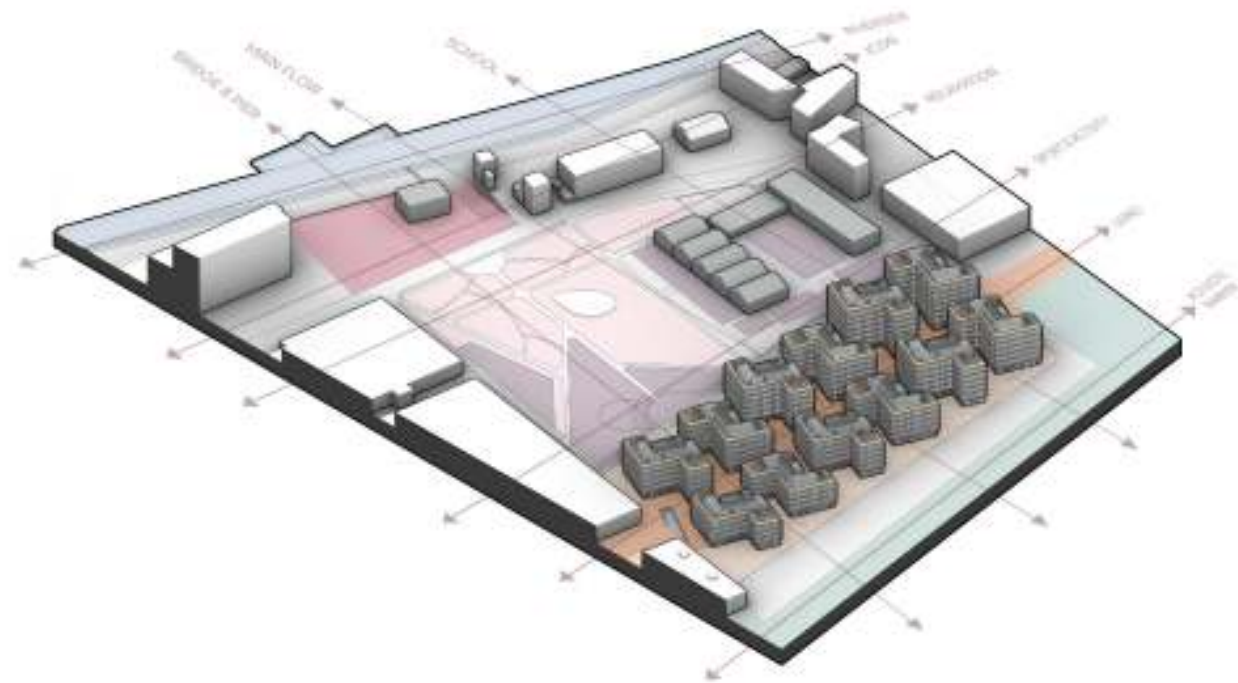


The project is located outside the Paris airports.

While designing the project area, a **grid logic** was used to connect the north-south and east-west. An **acoustic barrier** is formed as the first line in order to protect the site against the noise on the train track,

and the living spaces are hidden behind it. A **vivacious path** with social areas both sides was designed between the apartment blocks

in the form of a line and the **living area** is separated from other areas by a double lane road. The sports, activity and relaxation areas, which were originally designed on a line, later spread to the project site. In this way, more **fluid transitions** between spaces have been achieved. The riverside follows the icon line which include an important **historical building**. The general pedestrian flow crosses these lines and it is supported by a route on which a bridge and pier are found. At the same time, another line has been designed for communal spaces proper for **students' activities**.



Riverside

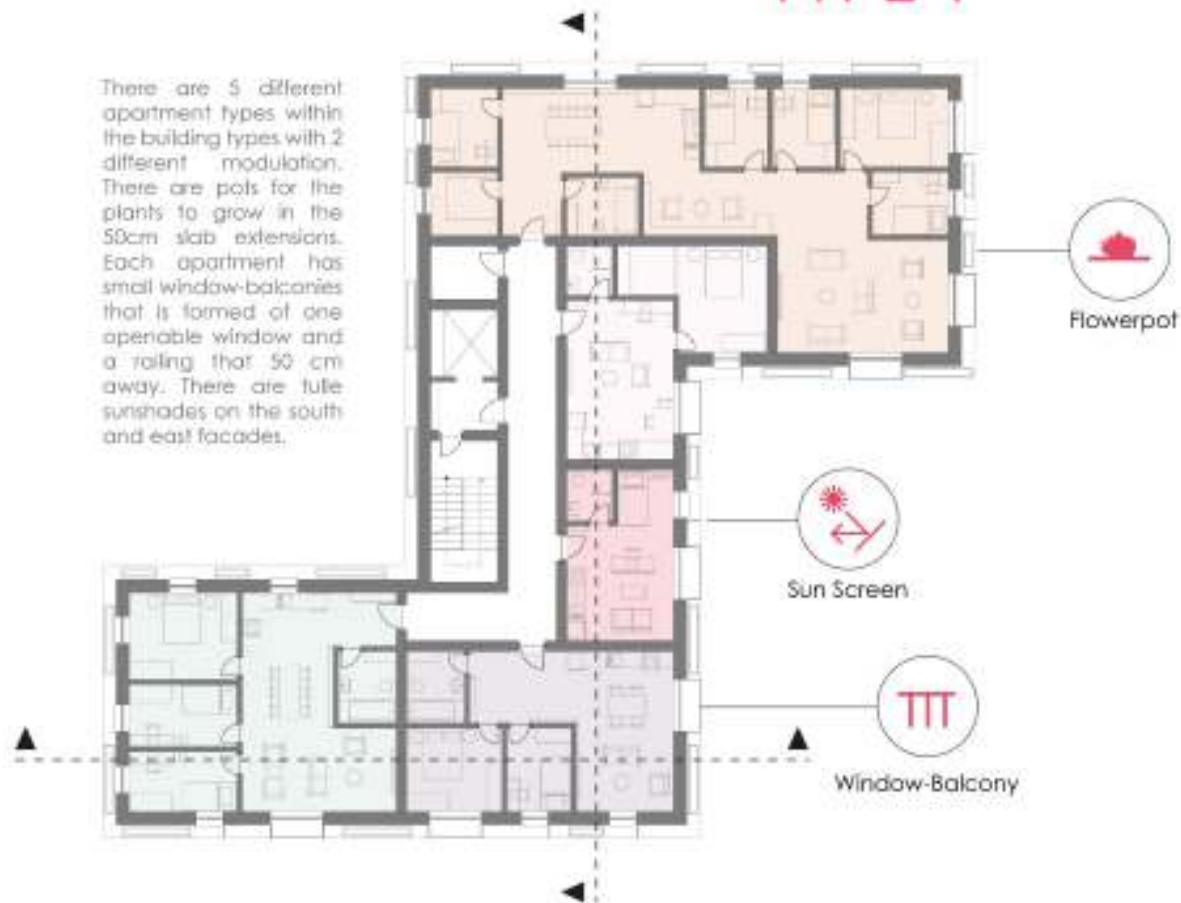
- A sunny day at last! I feel like I'm ready for a long walk by the river. And Betty was right! Maison Coignet, which has been renovated and transformed into a sculpture garden, looks really beautiful.



Building Typologies

TYPE 1

There are 5 different apartment types within the building types with 2 different modulation. There are pots for the plants to grow in the 50cm slab extensions. Each apartment has small window-balconies that is formed of one operable window and a railing that 50 cm away. There are full sunshades on the south and east facades.



Z-shaped buildings are settled in the plan at 21-degree angles from the north to benefit more from the sun and cut the wind with its corner.

TYPE 2

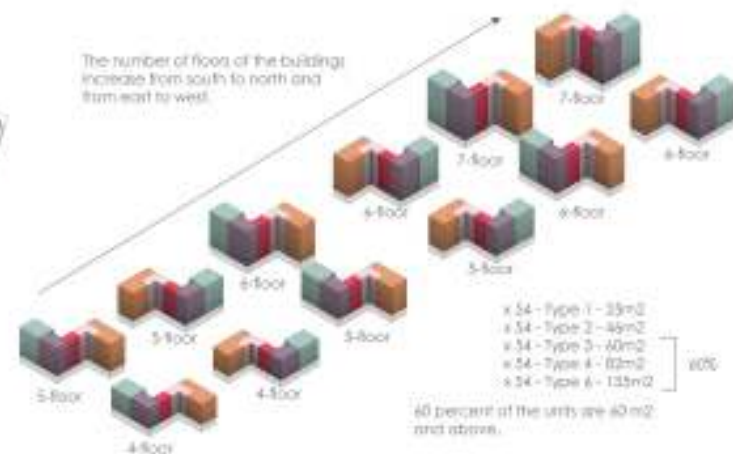


The apartments are connected by a single corridor. There are fire-protected cores in every building. On the north and west facades, the floor extensions unite with a structure in which ivy can wrap. Thanks to the rotation of the building, the units benefit from the sun, while a different settlement is created.



Apartment Typologies

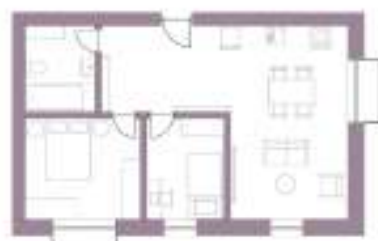
Considering the possible user's demands, 5 different apartment types with different sizes have been designed. The living spaces of all apartments are rotated to the south and east to benefit from the sun maximum. The largest apartment can be reserved for both large families and students who cannot afford to rent an apartment alone.



25m²
Type 1



46m²
Type 2



60m²
Type 3



82m²
Type 4



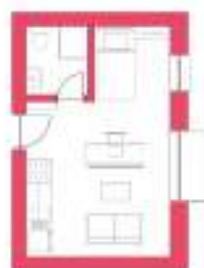
135m²
Type 6



Unit Typologies

There is a cradle in every bedroom with a double bed. Cradle size is determined as 162cm x 66cm.
The window-balconies were formed in the east and south directions by 50 cm widening of the floor.
While designing the units, the minimum dimensions given were taken into account.

TYPE 1
25 m²



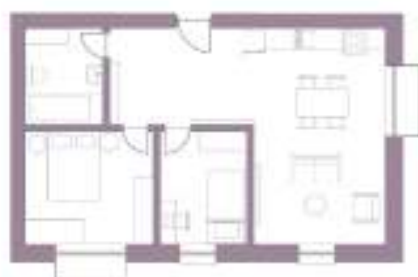
Units	m ²
Studio	21.6 m ²
Bathroom	3.2 m ²

TYPE 2
46 m²



Units	m ²
Living	23.8 m ²
Bedroom	17.4 m ²
Bathroom	3.2 m ²

TYPE 3
60 m²



Units	m ²
Living	32.5 m ²
Bedroom 1	12 m ²
Bedroom 2	9 m ²
Bathroom	5.7 m ²

TYPE 4
82 m²



Units	m ²
Living	40 m ²
Bedroom 1	13.1 m ²
Bedroom 2	9.3 m ²
Bedroom 3	9.1 m ²
Bathroom	5.7 m ²

TYPE 6
135 m²



Units	m ²
Living	72 m ²
Bedroom 1	12 m ²
Bedroom 2	9 m ²
Bedroom 3	9 m ²
Bedroom 4	9 m ²
Bedroom 5	9 m ²
Storage	5.8 m ²
Bathroom	5.7 m ²

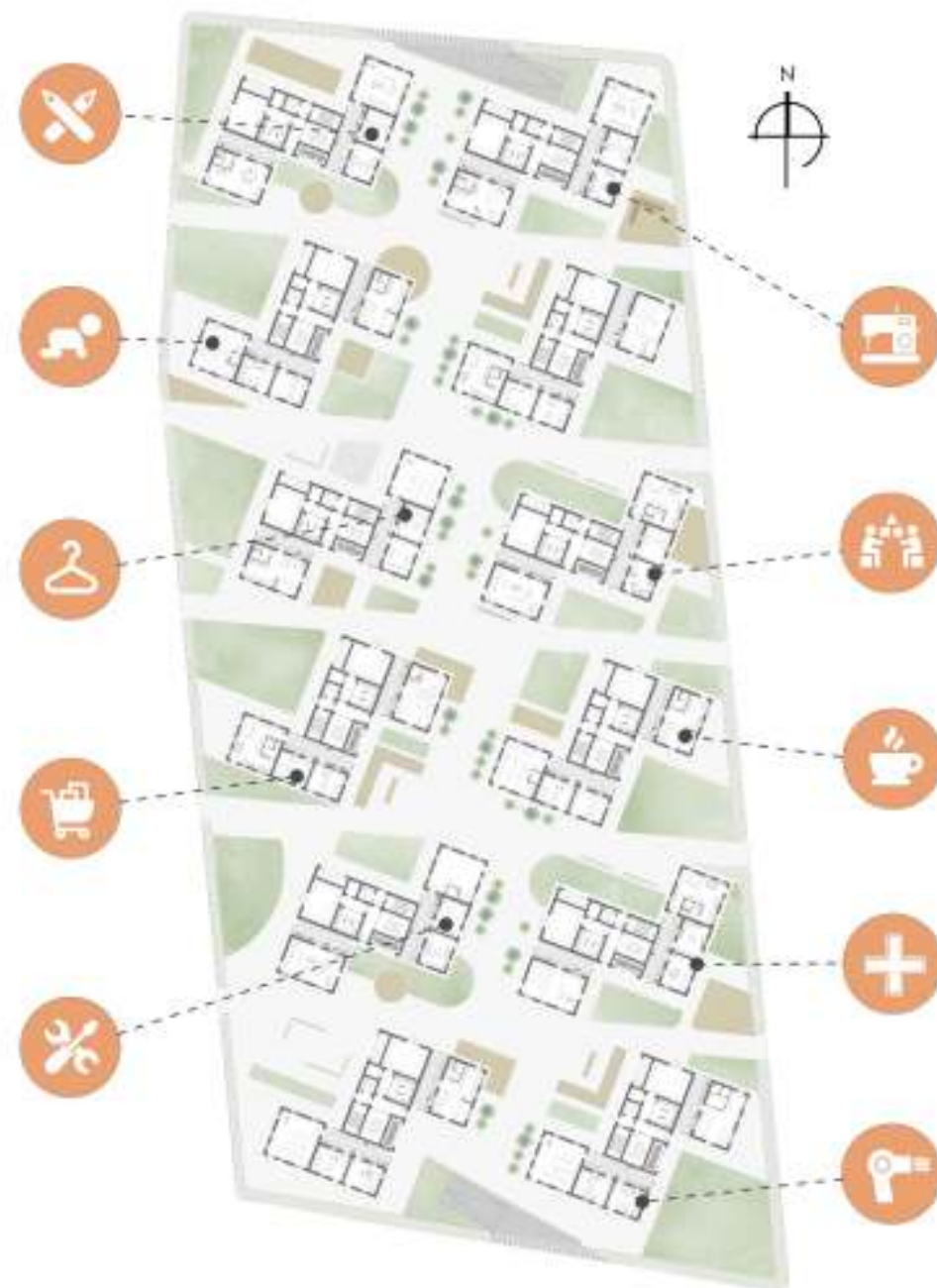


Ground Floor Typologies



Units	m2
Laundry	18 m2
Storage	39 m2
Recycling	8.8 m2
Multipurpose	20.1 m2
Bicycle Park	10.6 m2
Technical	5 m2
Type A	63.1 m2
Type B	27.6 m2
Type C	27.6 m2
Type D	62.3 m2

Space	Number	Units
Children Care	2	A - D
Coiffeur	2	B - C
Cafe	12	A - B - C - D
Shop	8	A - B - C - D
Boutique	10	A - B - C - D
Workshop	8	A - B - C - D
Tailor	1	C
Reparer	1	B
Doctor	2	C
Pharmacy	1	A



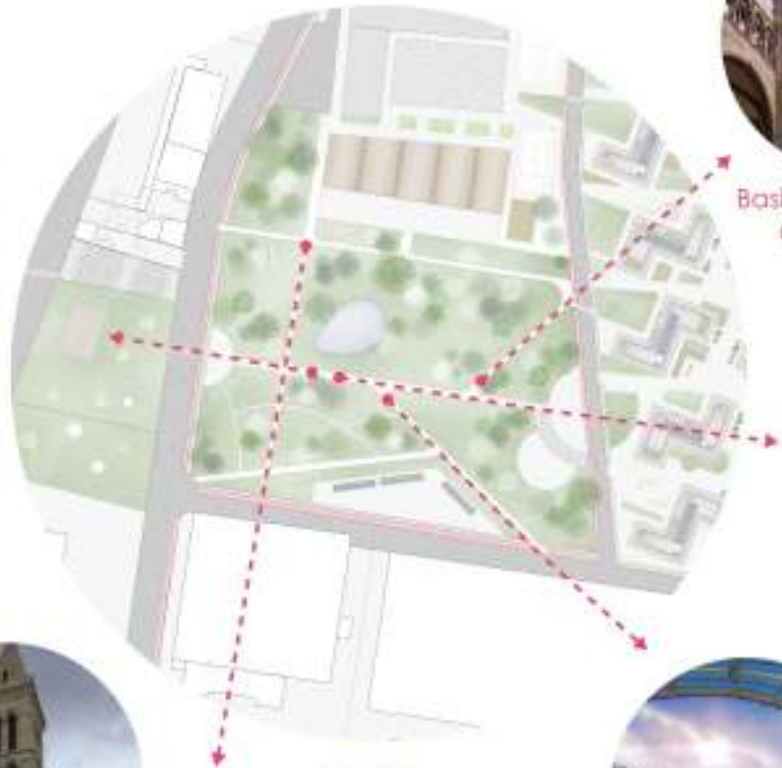
Living Street



Park



Maison Colnet



Basilique Cathédrale
de Saint-Denis



Musée d'art et
d'histoire



Église Notre-Dame
du Rosaire



Porte Saint-Denis



Stade de France



While designing the paths in the park, **significant attraction points** in the city were referenced. The lines followed by the paths reach a couple of **landmarks** and they are supported with **signs** inside the park which shows the directions of important buildings. The purpose of these paths designed as a concept is to provide **touristic information** and to **draw attention** to important points of Saint-Denis.

Park

- I love this place. I both know the people I buy the products from and I can find the freshness of everything. Moreover, there are lots of handcrafted items!



- It is very nice that the vehicles do not stop in the area we live in and everyone tries to use bicycles as much as possible. Moreover, all kinds of opportunities are provided for this.

School

- I have no other classes today. But I guess I'll hang around the school. Hey, Andrea! Let's go get some cookies from Aunt Bonnie! ... Excuse me, I have to go now... Andrea, wait!



Historical Buildings



as part of the school complex:



Ateliers for students / Productive Spaces to increase Social Interaction

as part of the public place



Public Library



provided possibility to people discover that historical place as heritage



Maison Coignet as a statue garden

as part of the public place



Open to public visits and sightseeing tours

Facades

- South/East facade combination is focuses on the advantages of sun light and fresh air possibilities.
- Openable large windows are supported by added rectangular windows. To avoid heat loses, that type is divided into three parts; two fixed windows on the top and the bottom parts, one openable window in the middle.
- North/East facade proposal designed as supportive function on the North side for visual comfort. It is aimed to be continuation of urban park by going green on the West side, too. (They cover the vertical circulation areas from outside)



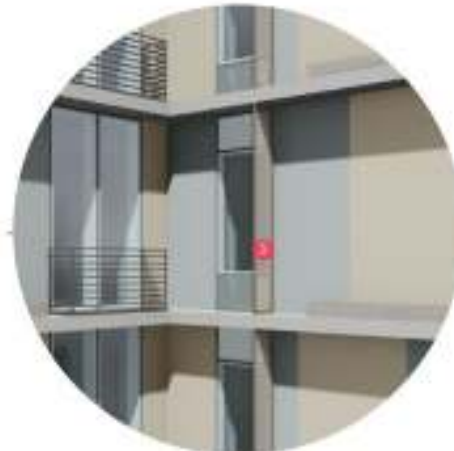
SOUTH / EAST FACADE COMBINATION



1- Fixed Window / 2- Openable Window / 3- Fixed Window



4- Larger Window Orientation for Sun Light



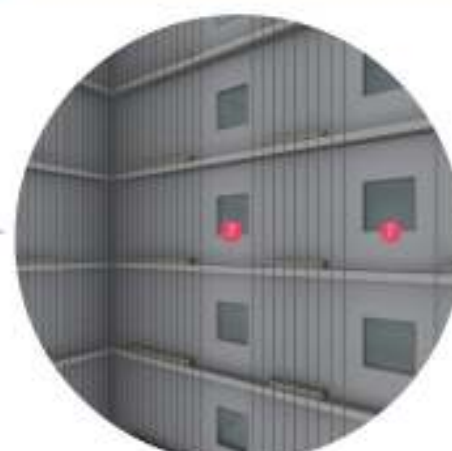
5- Sun Screen & Protection



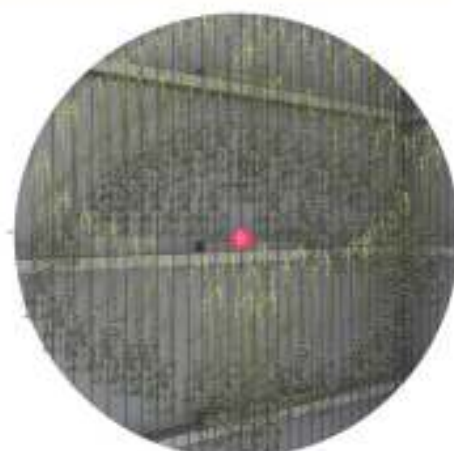
NORTH / WEST COMBINATION



6- Green Facade Application



7- Smaller Windows to avoid heat loses



5- Growth Areas for plants

Section

- Roof surfaces are considered as linkage between open places to close wintergarden.
- Open social place is followed by wooden deck to the roof garden, semi-open space aims to give welcome feeling.
- Ground Floor for various public uses; Childcare, Coiffeur, Grocery etc.
- Ground Levels are supported by greenery areas to give users possibility of outdoor activities.
- West Elevation as considered as visual continuation of urban park.
- View possibilities are provided to the public greenery from different sides of the flats.

Details will be presented in the following pages.



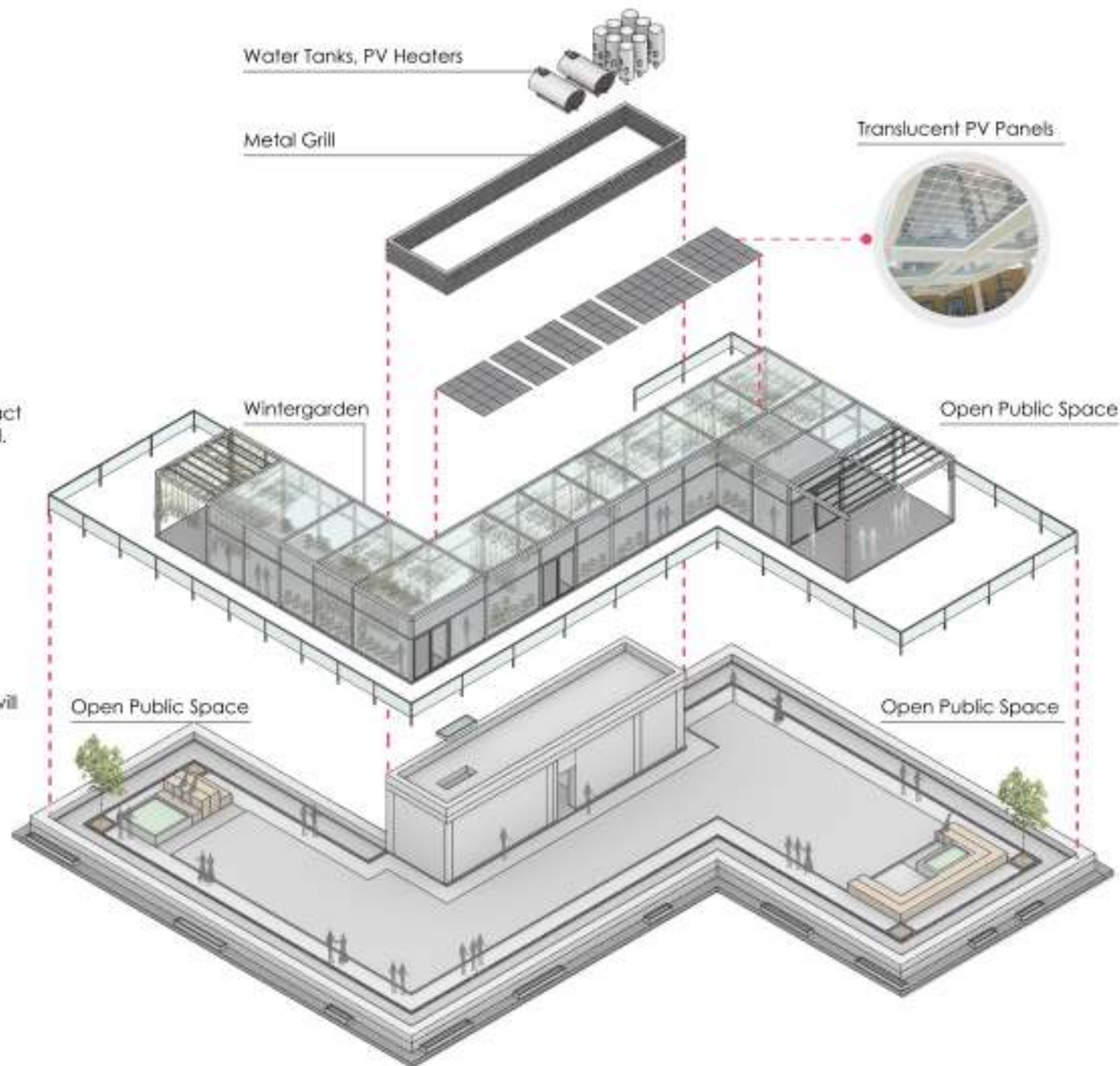


Roof

- The roof design is based on sustainable, social and technical needs.

FUNCTIONS

- When outdoor activities are not possible in poor weather conditions, individuals within the apartment are offered social sharing and interaction opportunities in the Winter Garden on the roof.
- Wintergarden starts with welcome wooden decks which can be considered as open public space especially in good weather. Individuals may encounter, interact and connect randomly and suddenly in these places. Neighborliness is supported.
- As they are responsible for the maintenance and production in Winter Gardens, it is aimed to develop social sustainability awareness.
- To avoid summer overheating, parts of the side glazing are sliding to promote ventilation.
- Wintergardens for energy efficiency and social interaction place.
- The conservatory volume of the roof for winter is used for solar ventilation pre-heating.
- During winter which is most of the year (when heating is needed), wintergarden will take air which is warmed by sun, that air will be used in main ventilation system.
- Top roof is surrounded with a metal screen for both visual comfort and security.
- The heart of the heating system is a boiler at the basement, which can receive heat contributions from various sources. We propose a water-water heat pump supported by solar water panels on the roof.
- As the river is nearby, we presume that the water table is not deep and easy to access through short boreholes for the heat pump. This option seems more feasible than pipes going all the way to the river.
- The glasses are fixed and the u-value is chosen as 0.6 to avoid over heat losses.



Roof

- Hello! I go to the public library, then attend the pottery workshop held downstairs in our apartment. Do you want to come?



- It's nice to have a place where we can escape when the weather is cold! Brrr!

Fire Safety

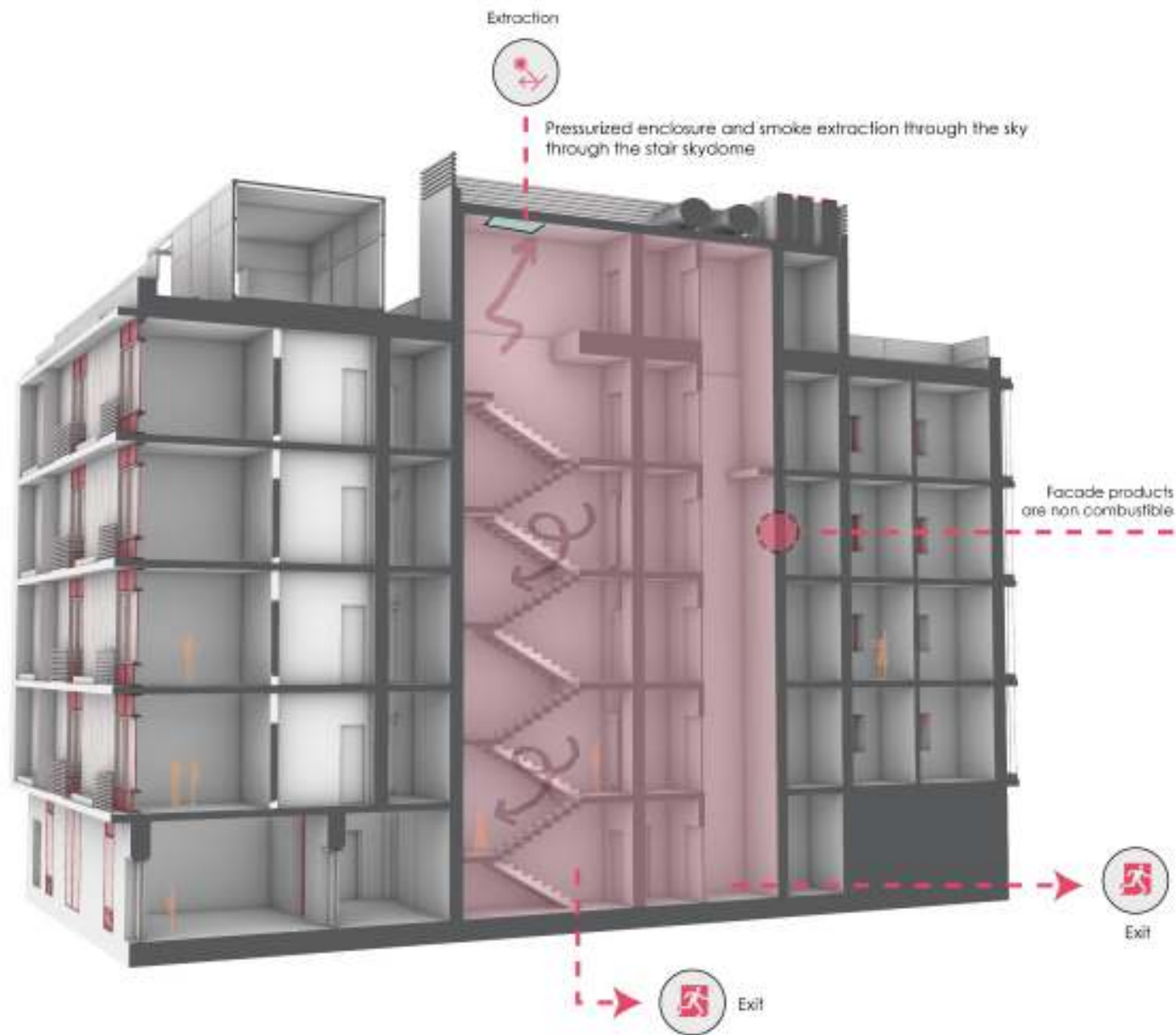
FIRE ESCAPE ROUTES



■ Fire Emergency Exits

■ Fire Truck Entry Circulation

- Fire safety strategy based on the set of practices intended to reduce the destruction caused by fire.
- Non combustible facade products provide a protection in case of emergency.
- Exit passages and doors are provided to escape directly to outdoor spaces.
- Fire engines can be intervened on two facades in buildings to respond to the fire by using the internal transport routes. (at least 4m width)
- Extraction on top of the roof is arranged. In this way, pressurized enclosure and smoke extraction through the sky and sky through the stair skydome.



Rear Ventilated Facade System

"As multi-purpose walls with multiple protective functions"

FUNCTIONS

- Multi-purpose walls with different layers.
- Flexibility to design for different energy requirements.
- Flexibility to individually measured insulation materials of any desired thickness.
- Avoiding thermal bridges by not having interruptions caused by floor slabs.
- Due to the structure, the vapour diffusion resistance decreases from internal to external walls.
- Contribution to healthy and comfortable indoor climate.
- Highest possible heat retention values for the structure, while it compensates high temperatures in the summer from within, result is the reduction in the heating / cooling needs for building.

ACOUSTIC INSULATION

- Positive effects on the sound insulation properties of the external wall.
- Thickness of the insulation may help to reduce sound. (up to 14 dB)

ENVIRONMENTAL PROTECTION

- Resistancy to driving rain.
- Possibility of removed moisture through the ventilated space between insulation material and cladding.
- Rain protection: the ventilation gap functions as a pressure compensation room, driving rain is drained over the back of the cladding.
- Protecting the thermal insulation from wetness.

Details

Roof 1

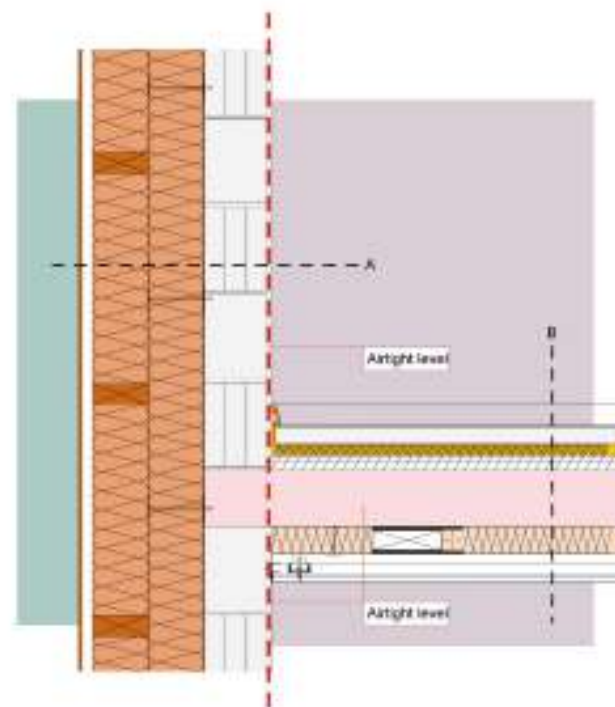
Build-up B in cm

- 8,0 Pebbles
- 0,8 Double layer roof and sealing sheeting, banded or scorched
- 16,0 ISOVER Export EPS 200/035 GD
- 16,0 ISOVER Export EPS 200/035 FD
- Vapour retarder
- Leveling layer, bitumen perforated glass-mat sheeting
- 20,0 Preliminary coat, bonding course
- 1,5 Interior plaster

U-Value (cut B) - 0.11 W/m2K

ISOVER Export EPS 200/035 FD
Vapour Retarder /
Leveling Layer /
Bitumen perforated glass-mat sheeting /
Preliminary coat bonding course

ISOVER Akustic EP 3
The high-density stone wool screed
insulation board



ISOVER Kontur FSP 1-032 Easy Fix
Moisture Protection /
Energy Saving Thermal Insulation through
thermal conductivity layer 032 /
Sound Protection /
Fire Protection

Exterior Wall & Slab 2

Build-up A in cm

- 1,5 Interior plaster
- 17,5 Lime-sandstone KSR 6 DF (175)
- 16,0 ISOVER Kontur FSP 1-032 Easy Fix (wood vertical 6/16 e=60cm)
- 16,0 ISOVER Kontur FSP 1-032 Easy Fix (wood horizontal 6/16 e=120cm)
- 3,0 Rear ventilation
- 1,0 Exterior Cladding

U-Value (cut A) - 0.11 W/m2K

Build-up B in cm

- 5,0 Floor covering
- Screed
- Separating layer
- 3,0 ISOVER Akustic EP 3
- 4,0 ISOVER Export EPS 100/035 as compensation for height of tube
- 16,0 Reinforced concrete ceiling
- 8,0 Installation level with ISOVER Akustik TP 1
- 2,7 Rigips ceiling profile CD 60/27 as basic profile
- 2,7 Rigips ceiling profile CD 60/27 as supporting profile
- 2,5 Rigips Rigidur H double layer, 2 layers

Details

Triple Glazed Window

The u-value is selected as low as possible reduce heat loss.

U-Value (cut A) - 0.7 W/m²K

3

U-Value (cut A) - 0.6 W/m²K

5

< 0.80 W (m²K)

g value = 0.5 (total solar energy permeability 50 %)

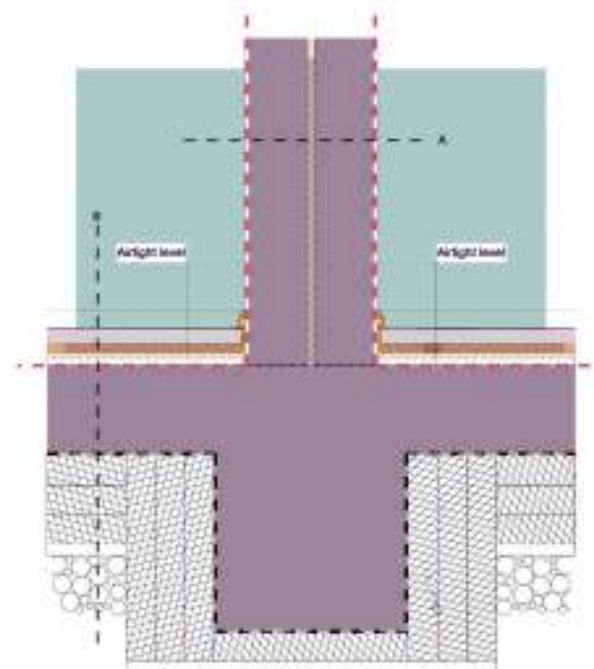
low-e property advantages

Building indoor energy conservation is ensured, energy consumption is reduced and energy saving is achieved.

Prevents the formation of cold/hot areas in the parts of the building near the window. Therefore, by keeping temperature values at the same levels in almost every area of the building, the space usage capacity is increased.



ISOVER Akustic EP 3 040
Sound insulation board



ISOVER Akustic HWP2 smartpack
Light and large sized /
Easy and quick to install /
Sound insulation

Partition Wall & Ground Slab

4

Build-up A in cm

- 1.5 Innenputz
- 20.0 Betonwand
- 2.0 ISOVER Akustic HWP2 smartpack
- 20.0 Betonwand
- 1.5 Innenputz

Build-up B in cm

- 5.0 Floor covering
- Screed
- Vapour retarder and separating layer
- 3.0 ISOVER Akustic EP 3 040
- 4.0 ISOVER Export EPS 100/035 as compensation for height of tube
- 0.5 Sealing against moisture
- 30.0 Concrete foundation slab
- Separating layers
- 10.0 Styrodur CS
- 10.0 Styrodur CS
- 10.0 Styrodur CS
- Granular subbase

U-Value (cut B) - 0.10 W/m²K

Details

Calculations by product managers of Saint-Gobain.

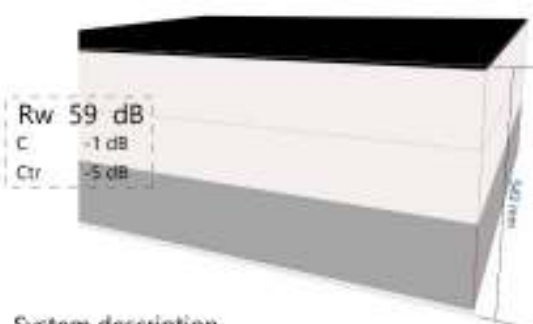


Sound Insulation Prediction (v9.0.23) ROOF

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within $R_w \pm 3$ dB
- Key No. 6305
Job Name:
Job No.:
Date: 25.01.2021
File Name:

Initials: J0134568

+ 2 x 100 mm Isover EPS 100
+ 1 x 200 mm Concrete



Rw 59 dB
C -1 dB
Ctr -5 dB

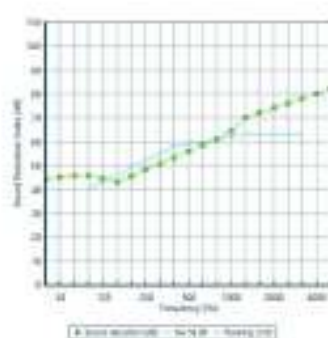
System description

Panel 1 : 1 x 8 mm Masse bitume viscoélastique
+ 1 x 0.4 mm PE Folic
+ 1 x 15 mm Gypsum plaster on lath

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 510 kg/m²

freq (Hz)	R _{dB}	R _{dB}
50	44	45
63	45	45
80	46	46
100	46	46
125	45	44
160	43	43
200	48	48
250	48	48
315	51	51
400	53	53
500	56	55
630	58	58
800	61	61
1000	64	64
1250	73	73
1600	72	74
2000	74	74
2500	76	76
3150	78	78
4000	80	80
5000	82	82



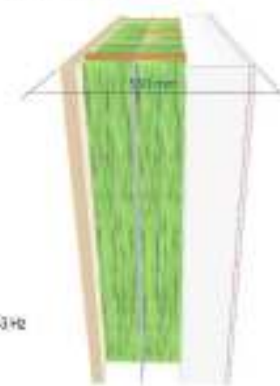
Sound Insulation Prediction (v9.0.23) EXTERIOR WALL

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within $R_w \pm 3$ dB
- Key No. 6305
Job Name:
Job No.:
Date: 25.01.2021
File Name:

Initials: J0134568

Rw 68 dB
C -1 dB
Ctr -5 dB

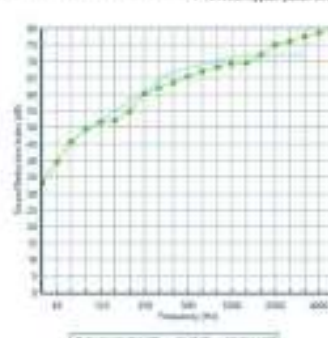
Mass-air mass resonant frequency = 47 Hz, 363 Hz
Panel Size = 2.7 m x 4.0 m
Partition surface mass = 344 kg/m²



System description

Panel 1 : 1 x 10 mm Gypsum Plaster
+ 1 x 0.4 mm PE Folic
+ 1 x 15 mm Gypsum plaster on lath
Panel 2 : 1 x 0.4 mm PE Folic
+ 1 x 15 mm Gypsum plaster on lath
Panel 3 : 1 x 10 mm Gypsum Plaster
+ 1 x 0.4 mm PE Folic
+ 1 x 15 mm Gypsum plaster on lath

freq (Hz)	R _{dB}	R _{dB}
50	44	45
63	45	45
80	46	46
100	46	46
125	45	44
160	43	43
200	48	48
250	48	48
315	51	51
400	53	53
500	56	55
630	58	58
800	61	61
1000	64	64
1250	73	73
1600	72	74
2000	74	74
2500	76	76
3150	78	78
4000	80	80
5000	82	82



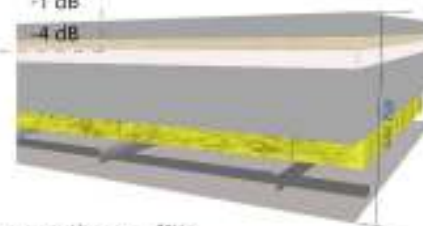
Sound Insulation Prediction (v9.0.23) SLAB/CEILING

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within $R_w \pm 3$ dB
- Key No. 6305
Job Name:
Job No.:
Date: 25.01.2021
File Name:

Initials: J0134568

Rw 74 dB
C -1 dB
Ctr -4 dB

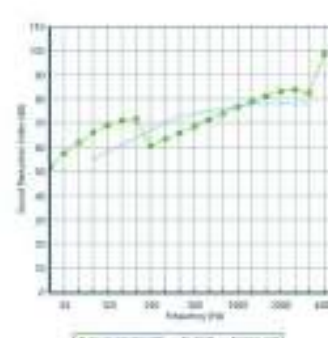
Mass-air mass resonant frequency = 24 Hz
Panel Size = 2.7 m x 4.0 m
Partition surface mass = 535 kg/m²



System description

Panel 1 : 1 x 10 mm Concrete
+ 1 x 25.3 mm Isover T-P
+ 1 x 10 mm Concrete
Panel 2 : 1 x 10 mm Concrete
+ 1 x 25.3 mm Isover T-P
+ 1 x 10 mm Concrete

freq (Hz)	R _{dB}	R _{dB}
50	52	52
63	58	58
80	62	62
100	66	66
125	68	68
160	71	71
200	72	72
250	61	61
315	63	63
400	66	66
500	68	68
630	71	71
800	74	74
1000	77	77
1250	79	79
1600	81	81
2000	83	83
2500	84	84
3150	82	82
4000	86	86
5000	88	88



Sound Insulation Prediction (v9.0.23) PARTITION WALL

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within $R_w \pm 3$ dB
- Key No. 6305
Job Name:
Job No.:
Date: 25.01.2021
File Name:

Initials: J0134568

+ 1 x 20 mm Isover T-P (Cory)

Rw 65 dB
C -1 dB
Ctr -5 dB

System description

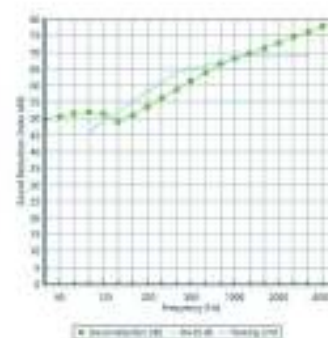
Panel 1 : 1 x 200 mm Concrete
+ 1 x 200 mm Concrete

Panel Size = 2.7 m x 4.0 m

Partition surface mass = 344 kg/m²



freq (Hz)	R _{dB}	R _{dB}
50	50	50
63	51	51
80	51	51
100	52	52
125	51	51
160	49	49
200	51	51
250	54	54
315	56	56
400	58	58
500	61	61
630	64	64
800	67	67
1000	68	68
1250	70	70
1600	71	71
2000	73	73
2500	75	75
3150	76	76
4000	78	78
5000	80	80



Building Performance Calculations

Program used for calculation: Grasshopper - Honeybee

Project Data:

Climate Zone: Saint Denis
Construction: New Building
Building Type: Residential
Usage: For Living
Design Temperature: 20°C

Area Input:

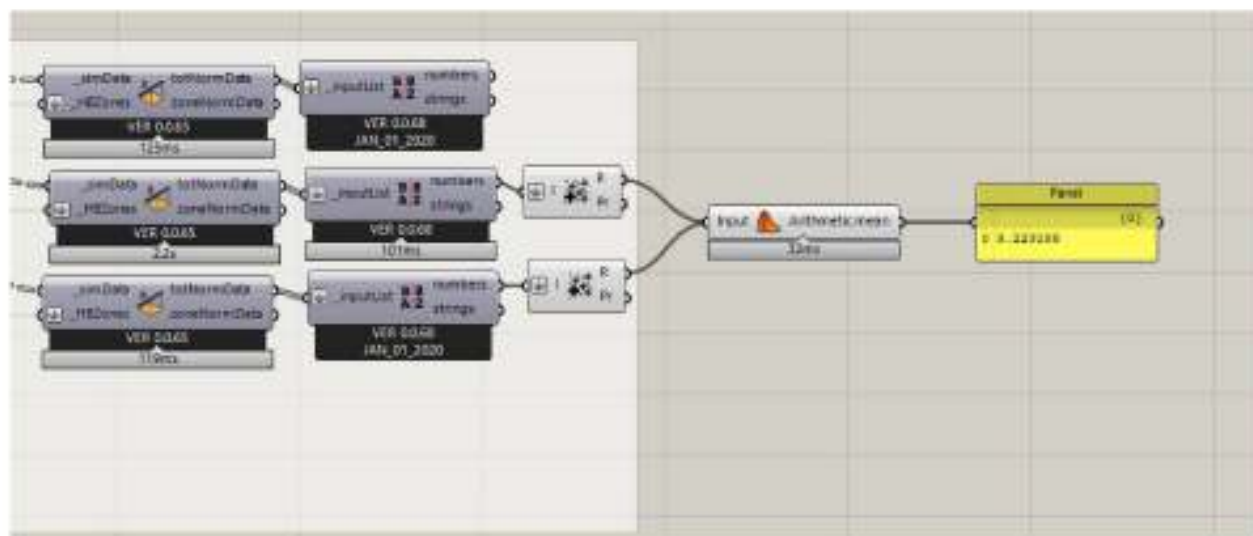
Total Building Area: 2689.57
Net Conditioned Building Area: 1916.59
Unconditioned Building Area: 772.98

U-Values:

Warm Roof with Pebbles: U-Value: 0.11 W/(m2K)
Exterior Wall: U-Value: 0.11 W/(m2K)
Partition Wall: U-Value: 0.11 W/(m2K)
Ground Slab: U-Value: 0.08 W/(m2K)
Triple Glazed Windows: 0.70 W/ (m2K)
Roof Windows: 0.60 W/ (m2K)
Doors: 0.80 W/ (m2K)

Air Quality:

Airtightness Rate: 0.60
Thermal Bridge Free: Yes



Results:

Annual Heating Demand: 10.93 kWh/(m2a)
Annual Cooling Demand: 7.51 kWh/(m2a)

Average Value: 9.22 kWh/(m2a)



THANK YOU