



SUSTAINABLE  
**MOBILITY**

**MULTIMODAL STATION IN BOUINAN'S NEW TOWN**

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**"Innovate. Adapt. Sustain. The 3 pillars of  
eco-friendly mobility"**

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POPULAR DEMOCRATIC REPUBLIC OF ALGERIA  
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH  
UNIVERSITY OF SAAD DAHLEB BLIDA 01



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**"Choosing eco-friendly mobility isn't just about getting from A to B; it's about paving a sustainable path for future generations."**

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Institut of architecture and urbanisme  
Architecture and urbanism Master  
Option : envirement and technologie

MASTER 2 THESIS

**Theme: "Optimizing sustainable urban transportation with multimodal and intermodal networks at transit hubs"**

**Designing a multimodal station in Bouinane's new town.**

**Directed by :**

**-LADRAA MANELLE.**

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**Ender the direction of :**

**-DR. BENCHEKROUN Marwa.**

**-DR. BABA SLIMANE Nour El Houda.**

2023-2024

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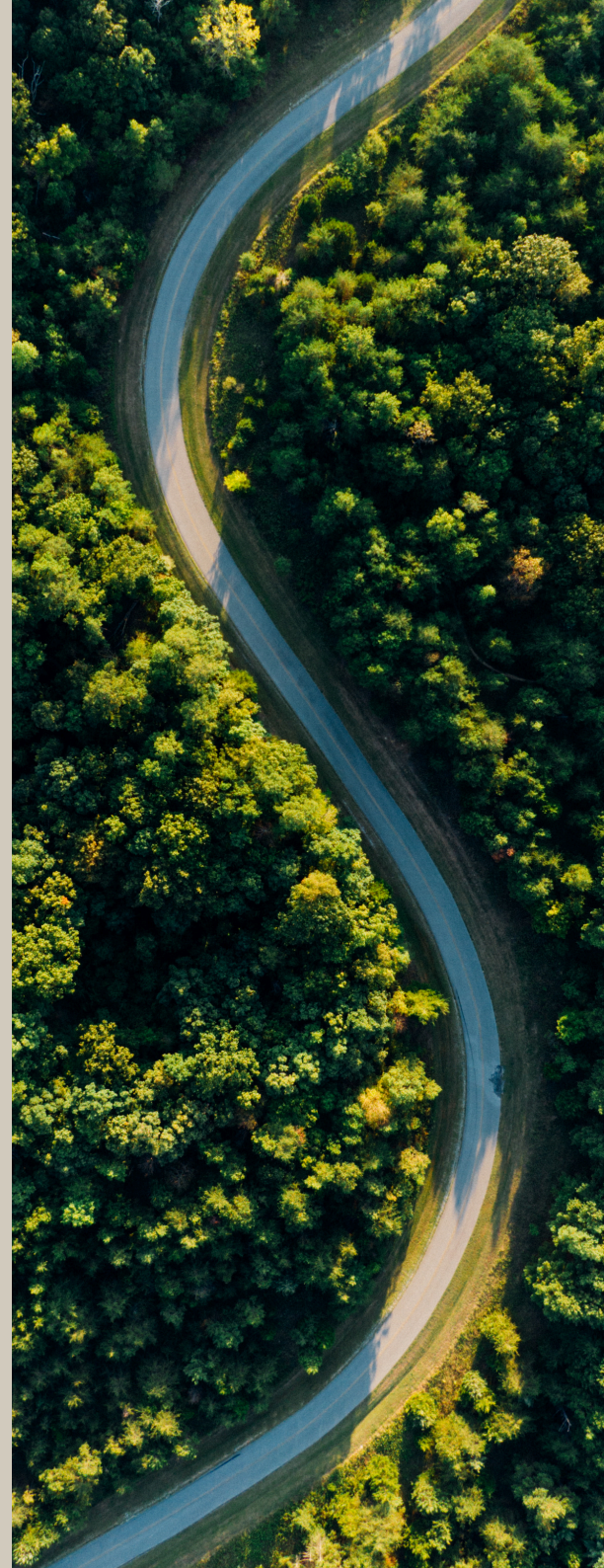
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# Remerciements

First and foremost, we thank ALLAH, for granting us the courage, strength, health, and perseverance to complete this modest work under the best conditions.

We express sincere gratitude to Dr. Baba Slimane Nour El Houda, We also thank Dr. Benchkroun Marwa and Dr. Kaoula Dalel for their consistent support, dedication, guidance, and encouragement throughout our project in architecture and urbanism. Their contributions have been invaluable to our work.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# Ecobuilt

Our workshop entitled **'ECOWBUILT'** presents itself as an educational experience in creating a project that respects its context, offering solutions to a variety of social and environmental issues, with a focus on sustainable development goals such as environmental preservation, functional efficiency, and social impact.



## TEAM PRESENTATION



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**our vision is to build a better  
place for the next  
generations**

## TEAM ECOBUILT



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# 01 | Introduction

## A new city for a new life

Our intervention site is located in the new city of Bouian, on an 18-hectare site situated in the most important axis of the city. The choice of intervention site is significant due to its position along the central axis of the new city, our goal being to create a multimodal transport hub to improve the social and environmental quality of life for residents facing challenges related to urban mobility, which have negative impacts on the environment.

By focusing on target 19 - avoiding forced displacement and improving low-impact environmental transport - as an obvious response, we aim to enhance the social and environmental fabric of the community in Bouian.



## 02 | Urban approach

### Bouinane, an ecological & modern city

Bouinane is one of the municipalities in the wilaya of Blida, at the foot of the Atlas Blidéen mountains, on the edge of the Metidja plain, between the 02 towns of Soumaa and Bougara, 25 km east of Blida and 35 km southwest of Algiers. This location is intended to accommodate the urban functions currently concentrated in Algiers.

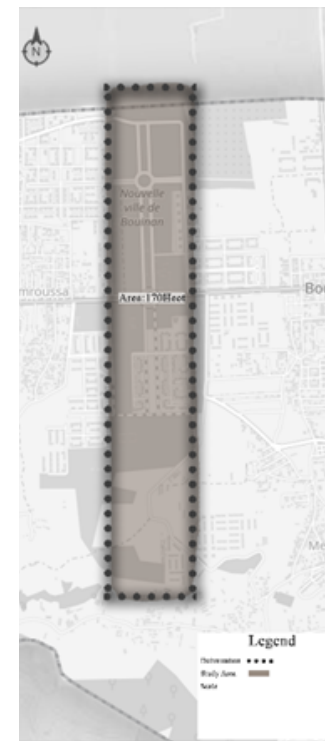
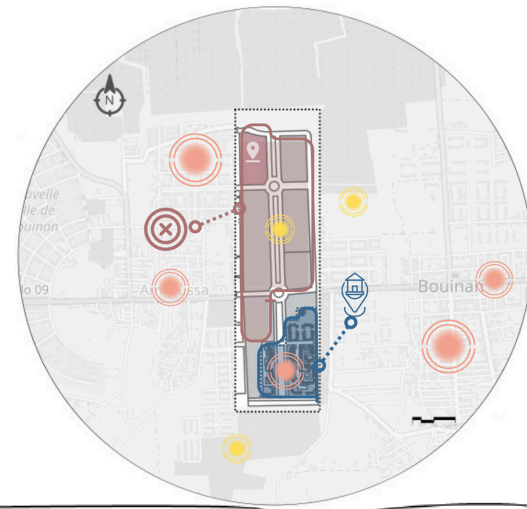
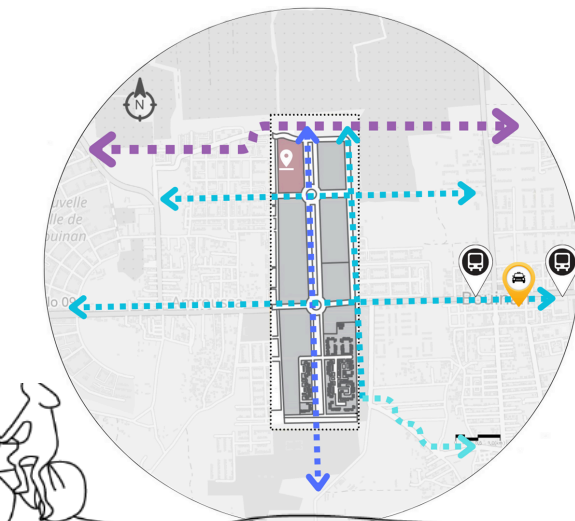
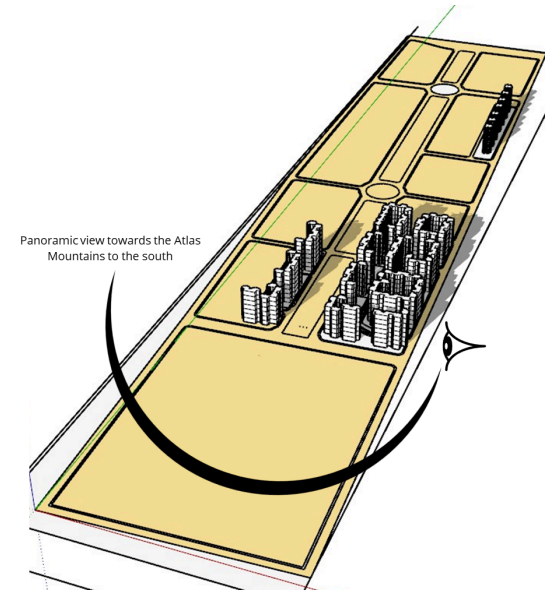




# STUDY AREA

ONLY RESIDENTIAL BUILDINGS ARE PRESENT ALONG THE MAIN AXIS

In the existing state of affairs in the city, there are only residential buildings along the main axis. According to the Urban Development and Planning Plan (PDAU), this land should host the following activities: administrative, educational, business and finance, healthcare, cultural, and residential.

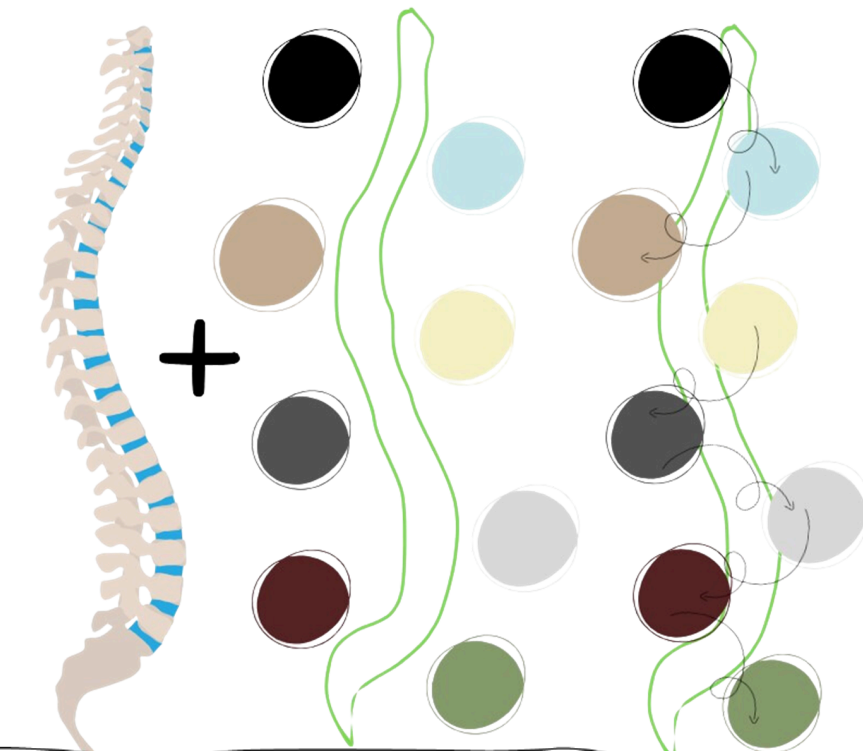


## TAKING ACTION

Our main action in this area is the Urban requalification of the main axis boulevard (the structuring axis of the new city)

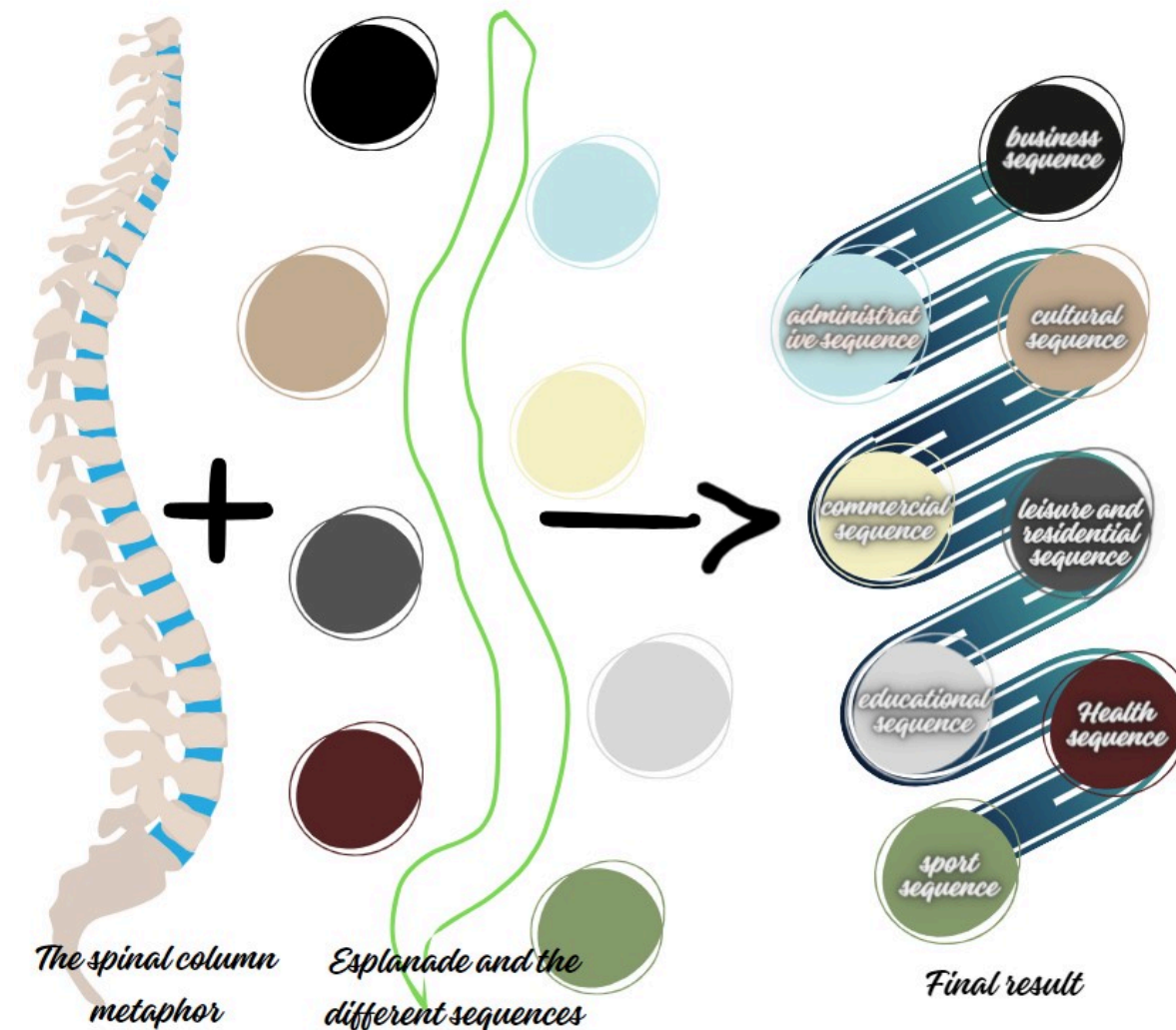
According to the urban analysis, we noticed that the structuring axis of the structuring equipment of the city reminds us of the spine. for this our main concept is inspired by the spine and its sequences which are articulated with each other with the integration of several concepts. see figure:

*Sequence concept with a metaphor*



*The spine column different sequences and nodes connected by Delineation and articulation*

according to the PDAU , the main functions that are planned are the following : *Summary diagram of the development principle*



Types	Content
Business sequence	<ul style="list-style-type: none"> <li>• National Institute for Vocational Training (INSEP)</li> <li>• Logistics and distribution center</li> <li>• High-tech industries</li> <li>• Mixed-use building</li> <li>• Vocational Training and Apprenticeship Centre (CFPA)</li> <li>• 250-bed hotel</li> <li>• 2 Vocational Training and Apprenticeship Centers (CFPA)</li> <li>• <b>Multimodal station</b></li> <li>• Finance and international business center</li> </ul>
Cultural sequence	<ul style="list-style-type: none"> <li>• Multimedia Centre</li> <li>• R&amp;D center</li> <li>• Cultural center</li> <li>• Exhibition hall</li> <li>• Weekly market</li> <li>• Mixed-use building</li> <li>• Conference center</li> <li>• Equipment proposed:               <ul style="list-style-type: none"> <li>o Meditech</li> <li>o Library</li> <li>o Multiplex</li> <li>o Islamic Cultural Centre</li> <li>o Radio bahdja</li> <li>o Youth center</li> <li>o Youth hostel</li> <li>o Exhibition gallery</li> <li>o Craft center</li> <li>o Integrated theatre</li> <li>o Open-air theatre</li> </ul> </li> </ul>
Leisure activities	<ul style="list-style-type: none"> <li>• Amusement park</li> <li>• Central Park</li> </ul>
Administrative sequence	<ul style="list-style-type: none"> <li>• 240-bed hospital</li> <li>• Fire station</li> <li>• PCA</li> <li>• Tribunal</li> <li>• Daira</li> <li>• 2 hotels (2 x 150) beds</li> <li>• Grand Mosque</li> <li>• 240-bed hospital</li> </ul>
Residential sequence	<ul style="list-style-type: none"> <li>• Medium density housing</li> <li>• Individual housing</li> <li>• High density housing</li> </ul>
Social protection sequence	<ul style="list-style-type: none"> <li>• Psycho-educational centre</li> <li>• Services for the disabled</li> <li>• Establishment for assisted children</li> <li>• civil protection</li> </ul>

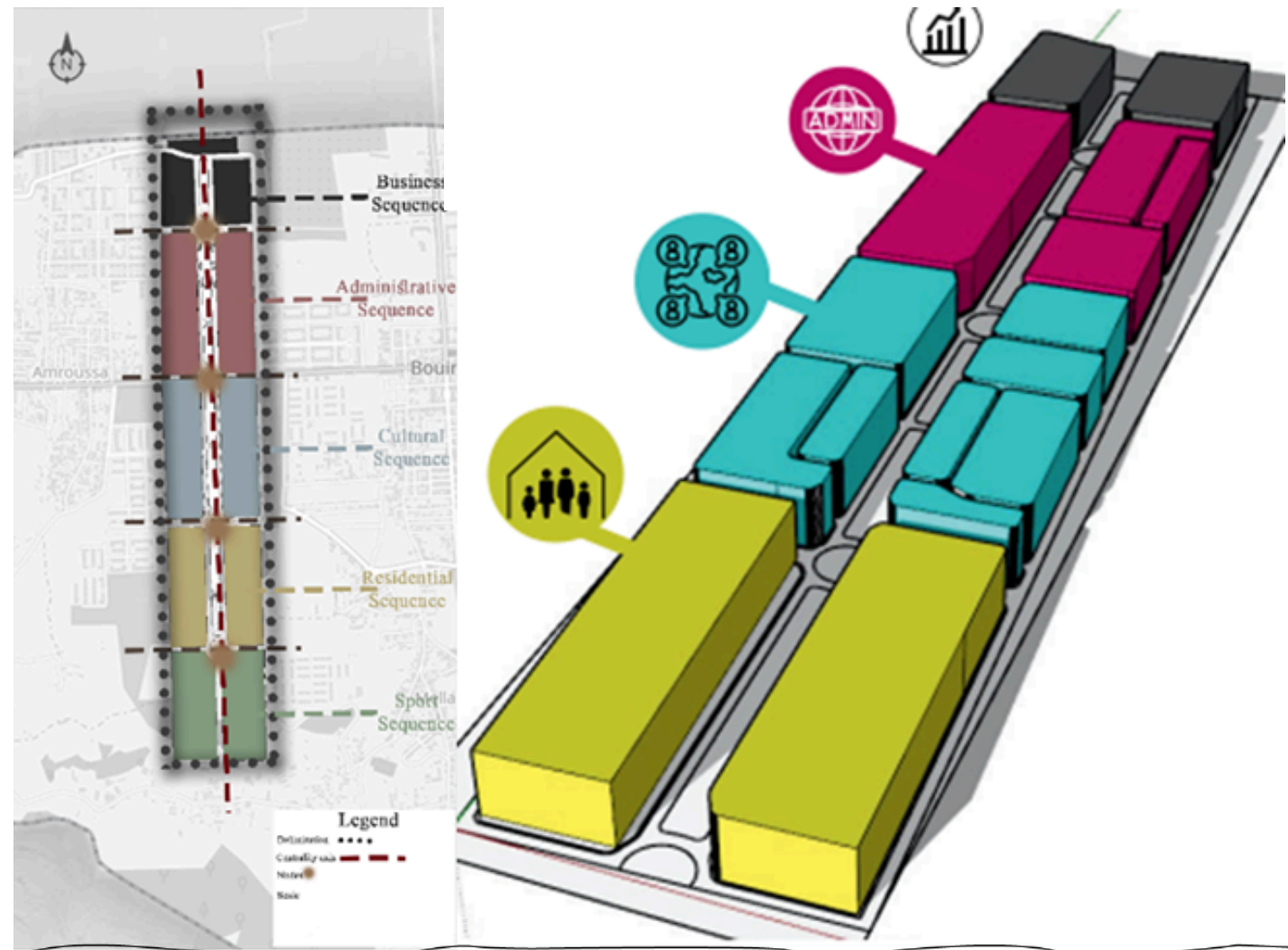
	<ul style="list-style-type: none"> <li>• Youth protection centre</li> <li>• security centre</li> <li>• Home for the elderly</li> </ul>
Health sequence	<ul style="list-style-type: none"> <li>• Hospital</li> <li>• Maternity ward and PMI 60 beds</li> <li>• Services for the disabled</li> <li>• Polyclinic</li> <li>• Pharmaceutical buildings</li> </ul>
Educational sequence	<ul style="list-style-type: none"> <li>• High School</li> <li>• International school</li> <li>• Creches</li> <li>• Cem</li> <li>• Primary school</li> <li>• Language school</li> </ul>
Sport sequence	<ul style="list-style-type: none"> <li>• Stadium</li> <li>• Semi-Olympic swimming pool</li> <li>• Wellness centre</li> <li>• Youth centre</li> <li>• Sports hall</li> <li>• Equestrian club</li> </ul>



# STUDY AREA

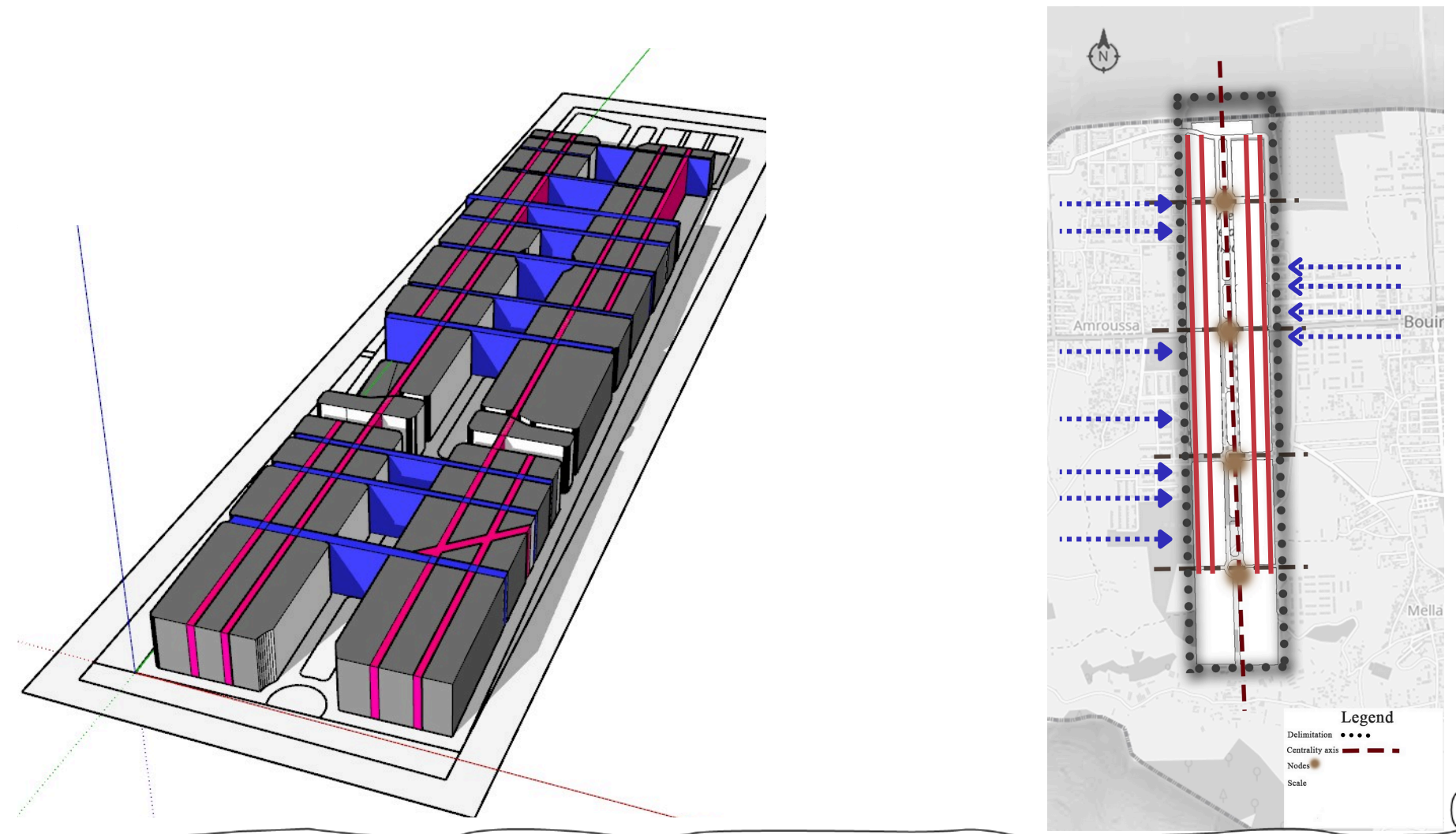
## 1 THE CITY'S BACKBONE

We divided the area into SAQUENCES by extending the existing road system.



## 2 ROAD EXTENSION

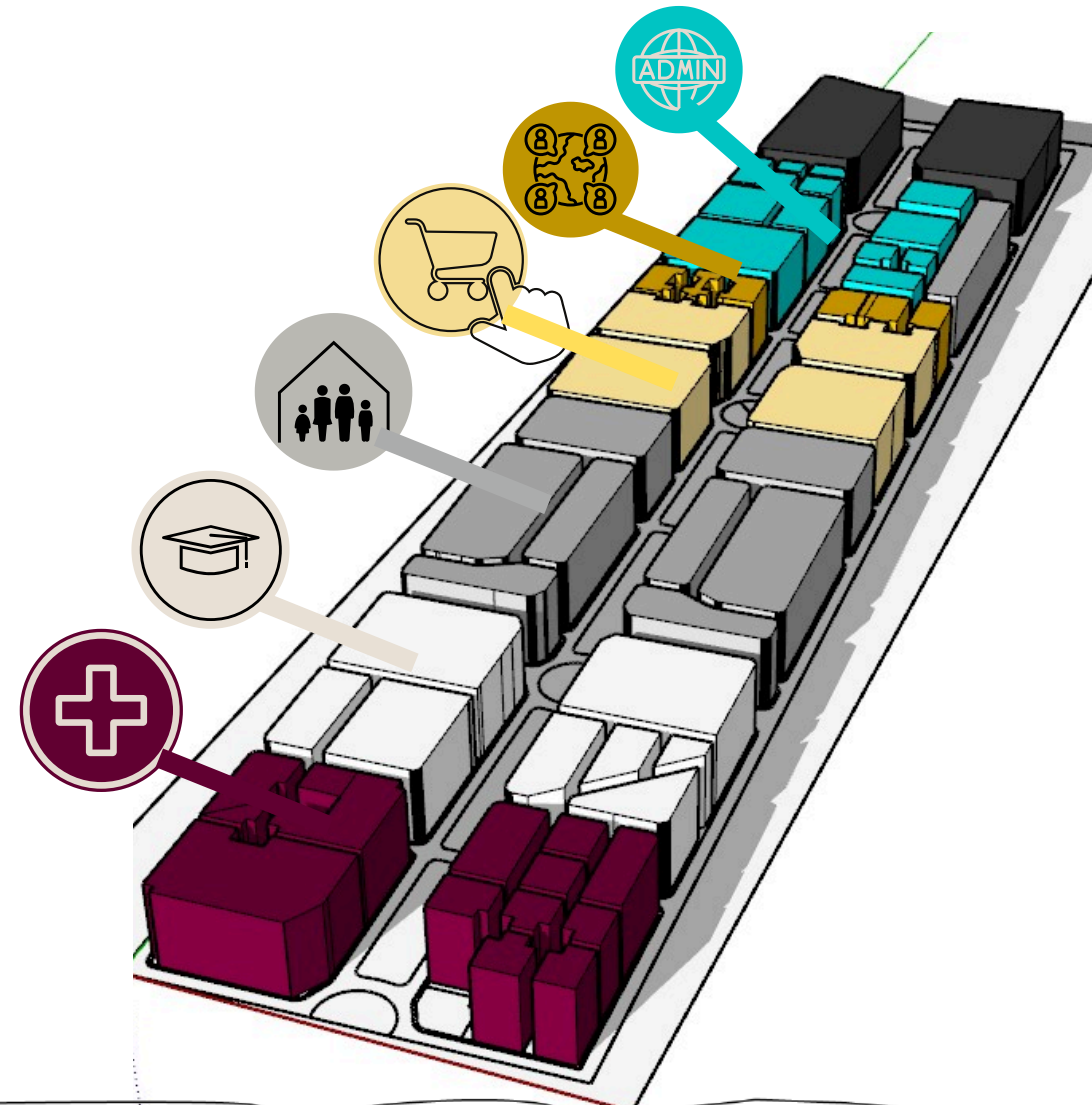
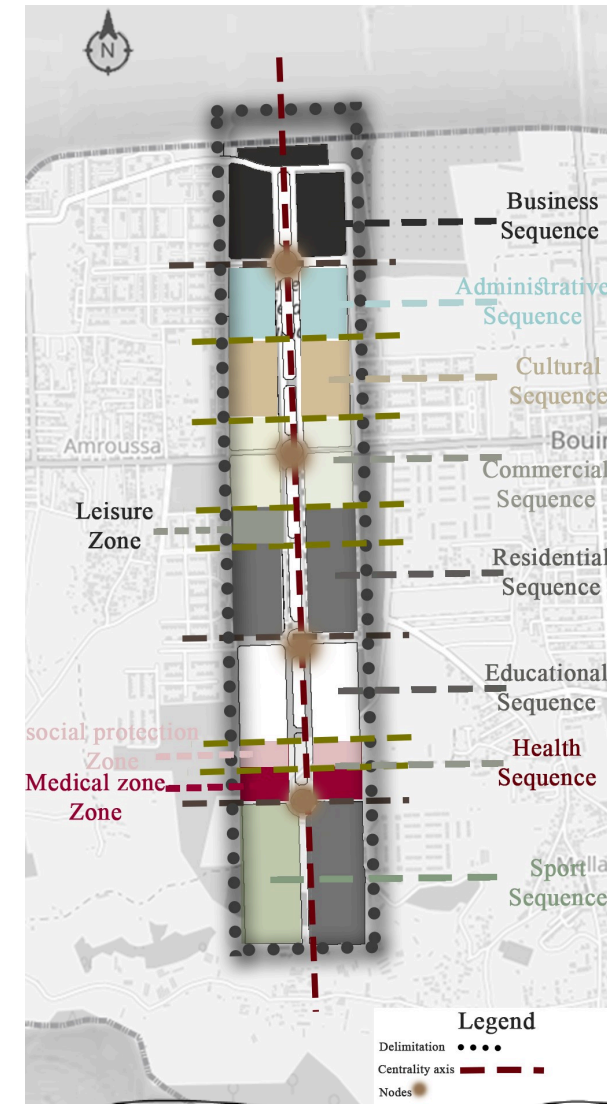
To maintain urban harmony and enhance spatial and visual continuity, we extend the existing road pattern.



# STUDY AREA

## 3

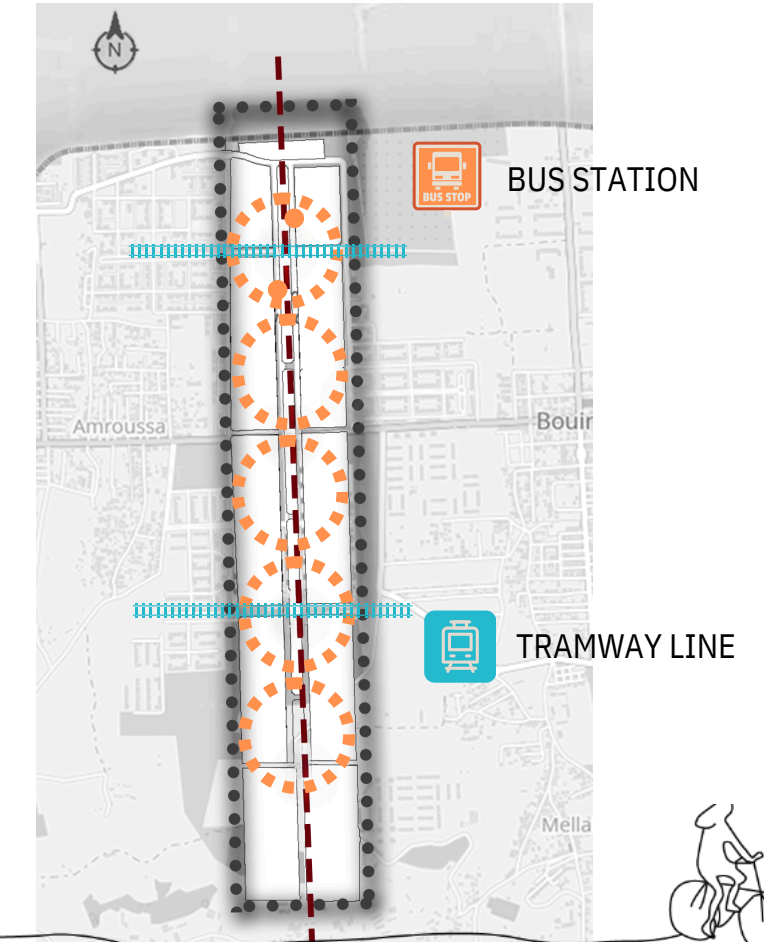
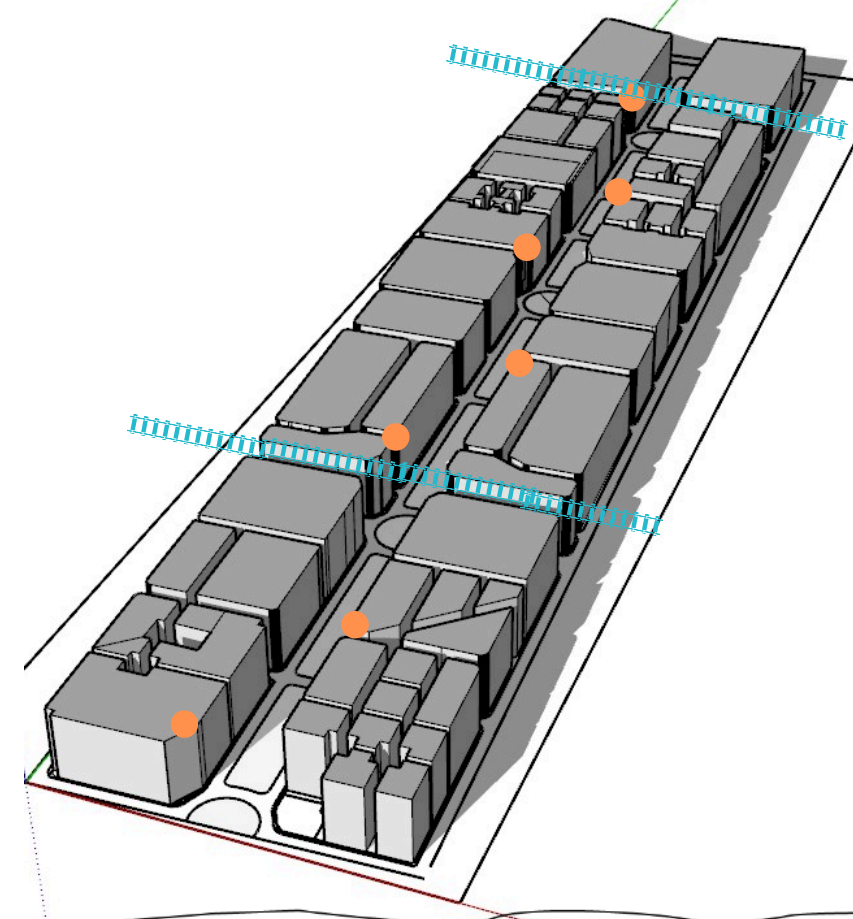
### DIVIDING THE MAIN SEQUENCES INTO ZONES



## 4

### MOBILITY

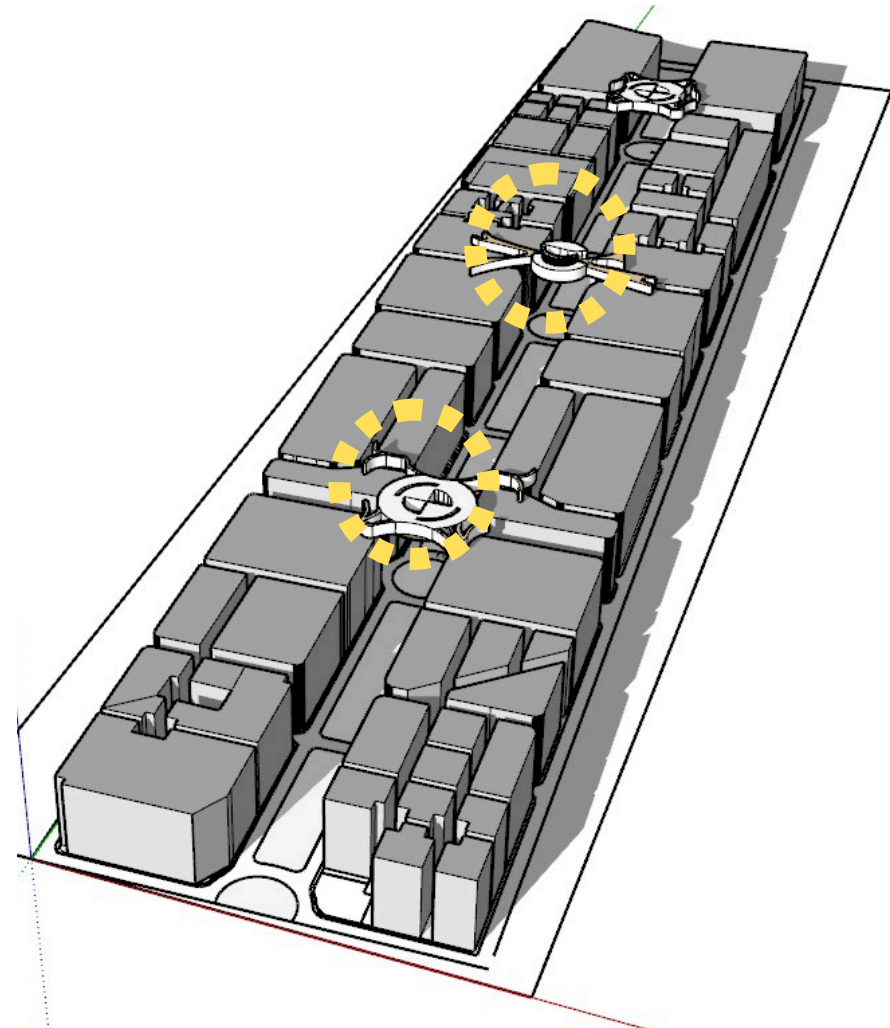
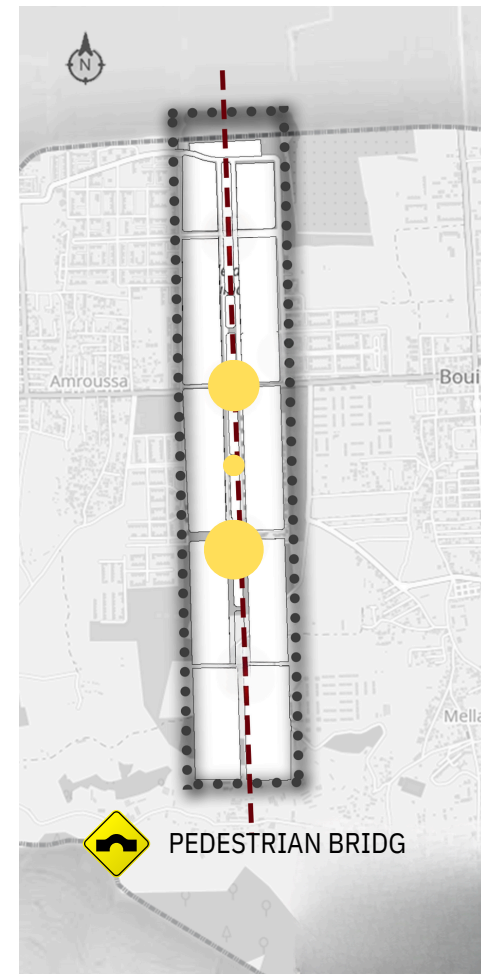
Redesigning the tramway line according to the study's propositions, adding bus stations by drawing circles with a diameter of 500 meters, and placing bus stations at each intersection. And we also planned the public restroom, the most underrated equipment in urban planning within each bus station.



# STUDY AREA

## 5 RECONNECTING THE ZONES

Proposing Pedestrian Bridges to Connect the Different Unit , And to encourage walkability and safety in the city



with the use of these concepts .....



SUSTAINABLE DEVELOPMENT CONCEPT



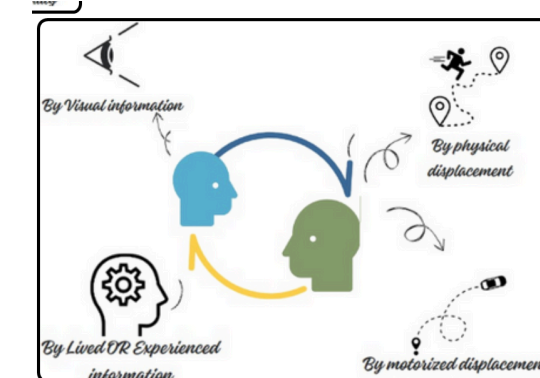
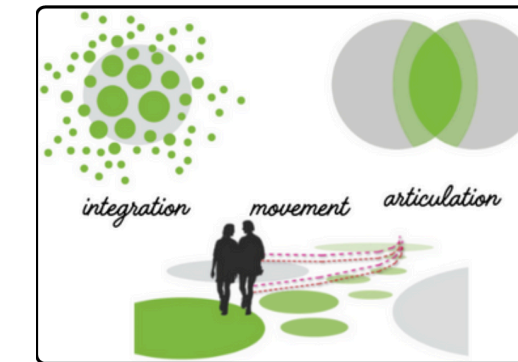
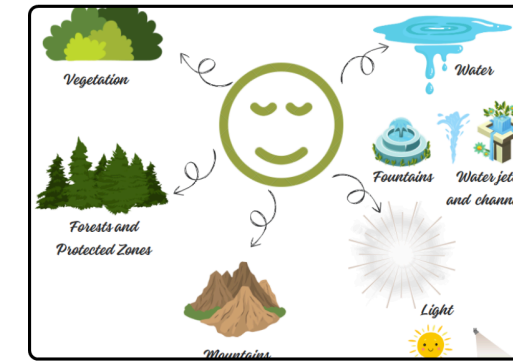
CONNECTION CONCEPT



CONNECTION CONCEPT



COMMUNICATION CONCEPT



# STUDY AREA Results



## URBAN INTERVENTION PLAN



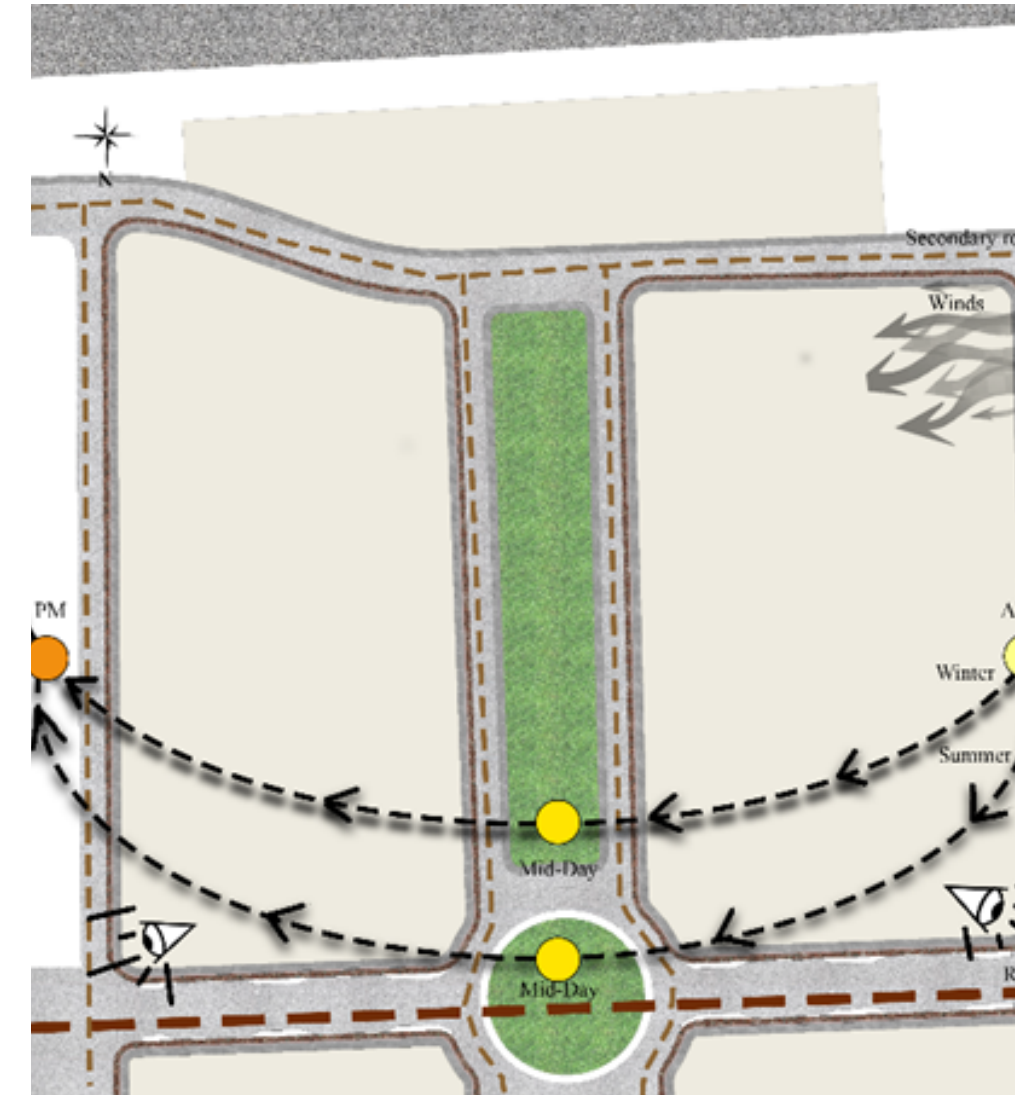
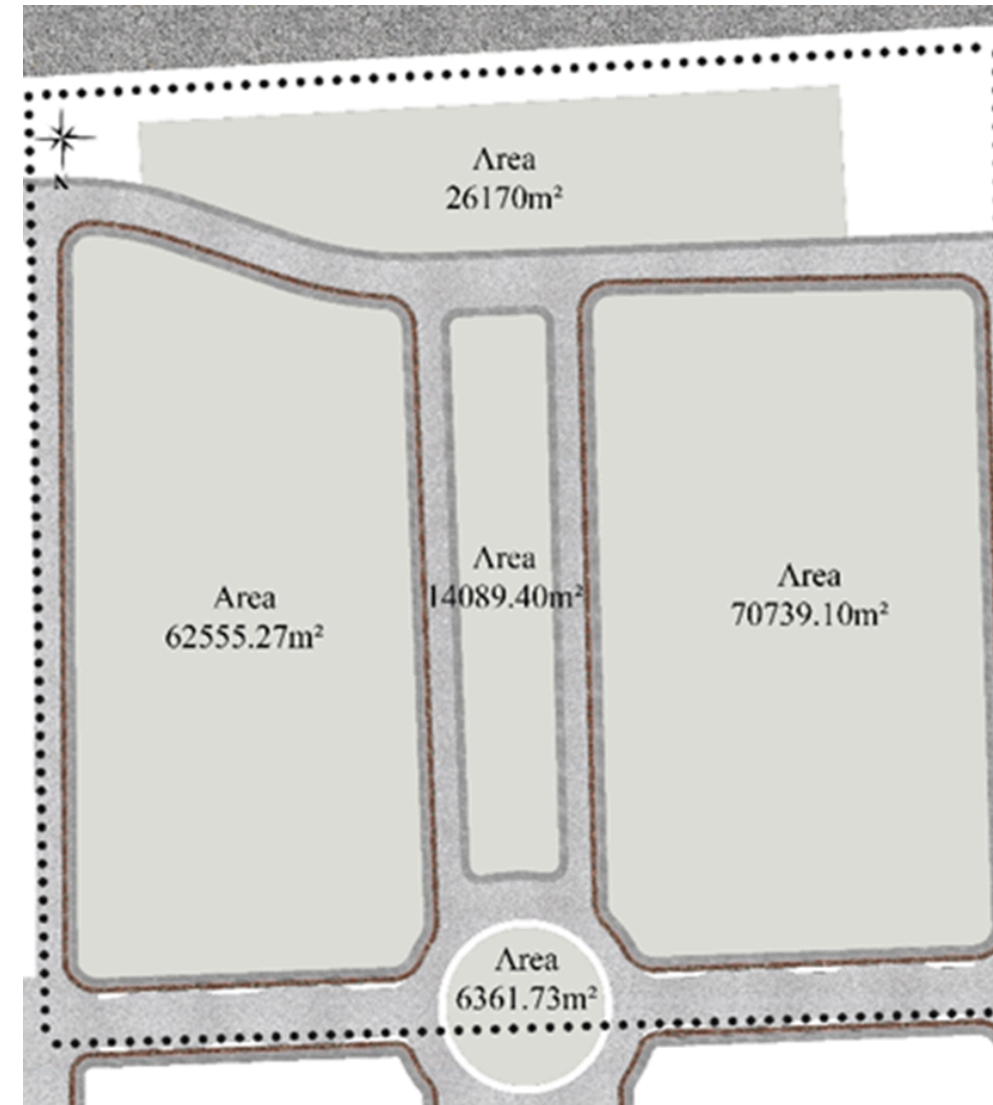
# 03 | INTERVENTION AREA



## INTERVENTION AREA

The concepts that we've used in the intervention area

Our intervention area is located in the north-west part of the structuring axis of the new town of Bouinen, it is made up of 5 plots as follows: Land "A", land "B", land "C", land "D" and land "E"



summary of the urban analysis:

- direction of sun
- wind direction
- accessibility
- streets: main secondary
- the railway and tramway railway
- potential views

# INTERVENTION AREA

The concepts that we've used in the intervention area

## Connect

- Connected City
- Urban Station Core
- Station as a Community
- Station for Everyone

## Grid

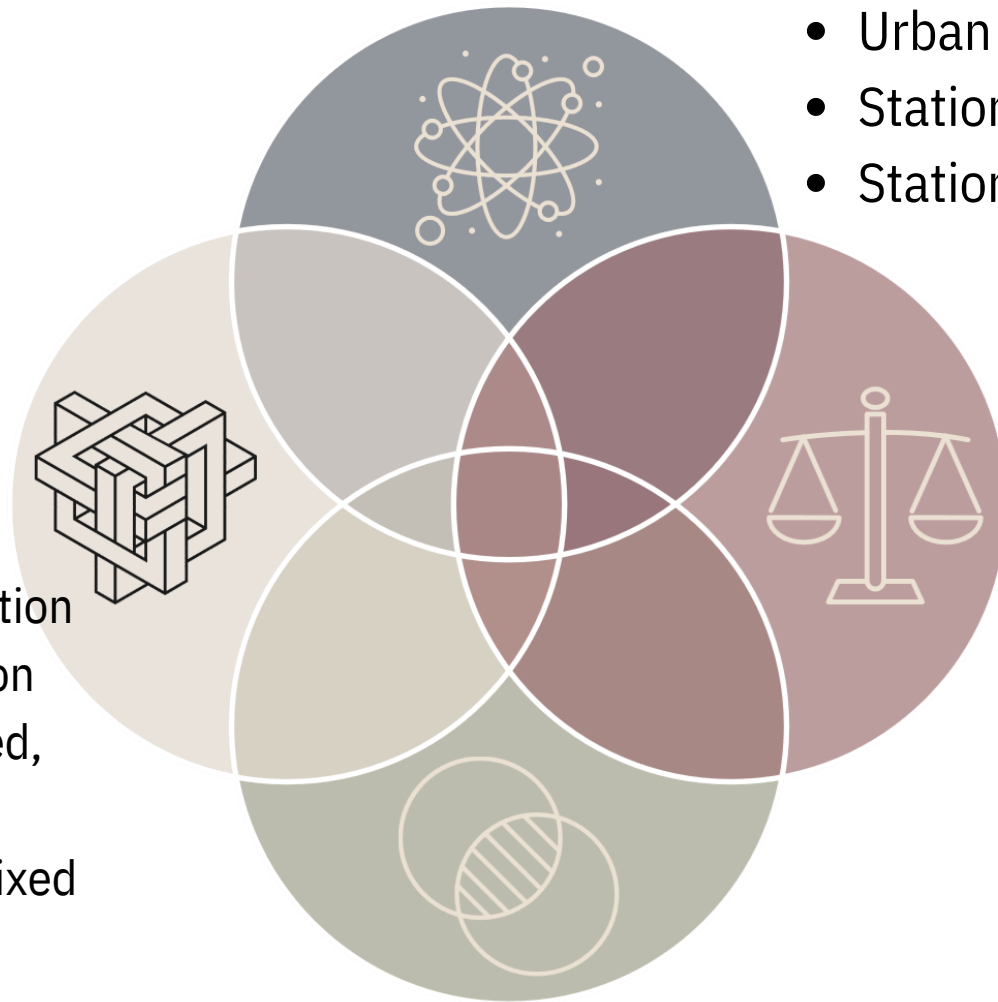


- Integration City-Station
- Hierarchy / Transition (Open, Semi-Covered, Covered)
- Multidimensional Mixed Use
- Multi-Layered City

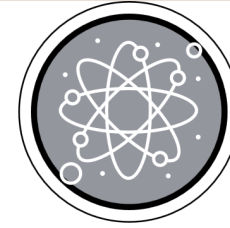
## Balance

- Back to Nature
- City and Environment
- A Respiring Space (Built and Unbuilt)

## Blend

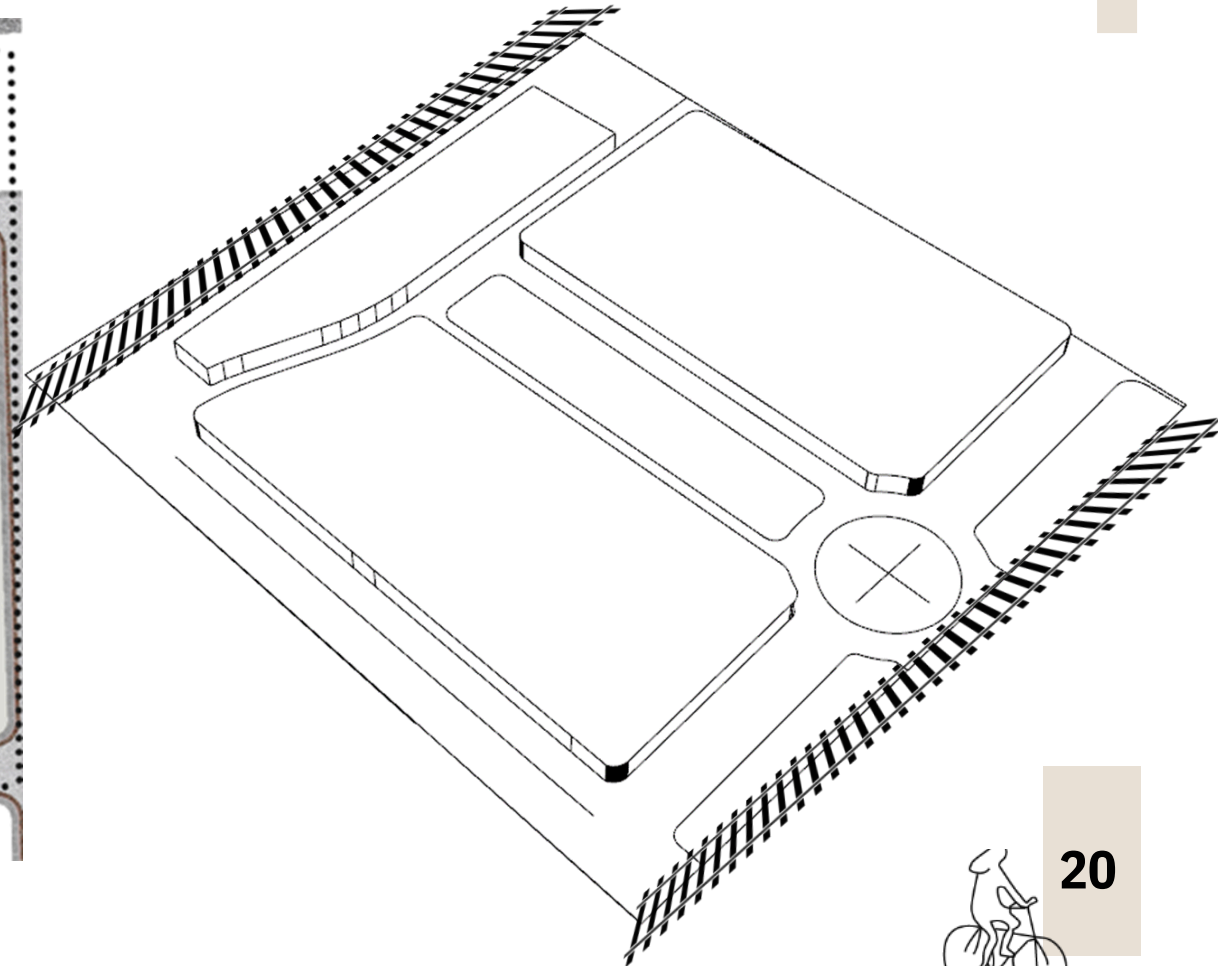
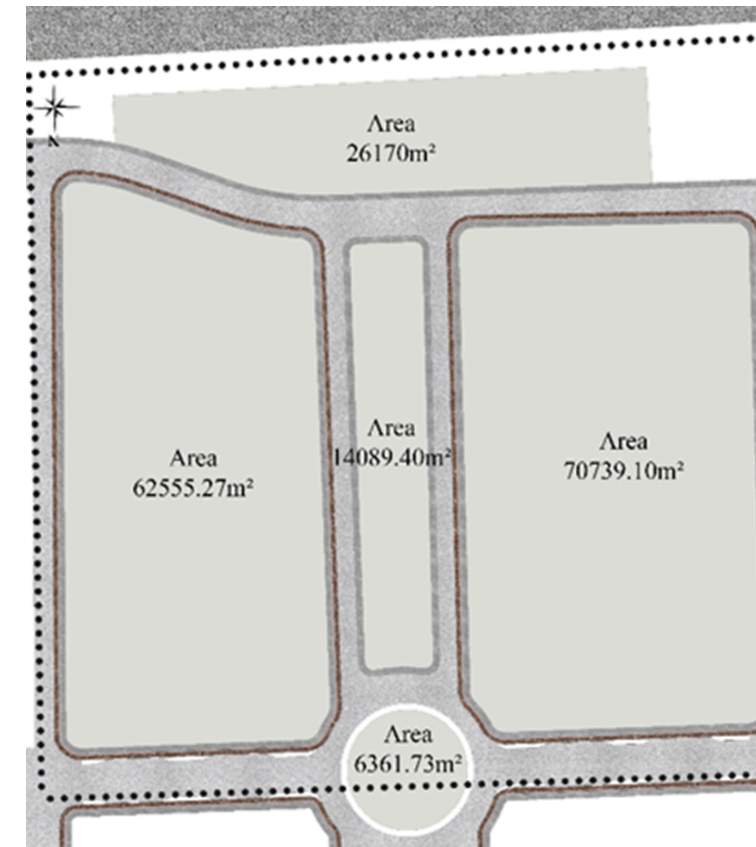


# 1



Connect

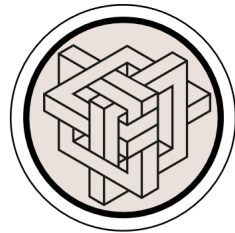
The decision to acquire the 18-hectare plot of land was informed by the strategic positioning of both the train track to the north and the tramway line to the south within the site.





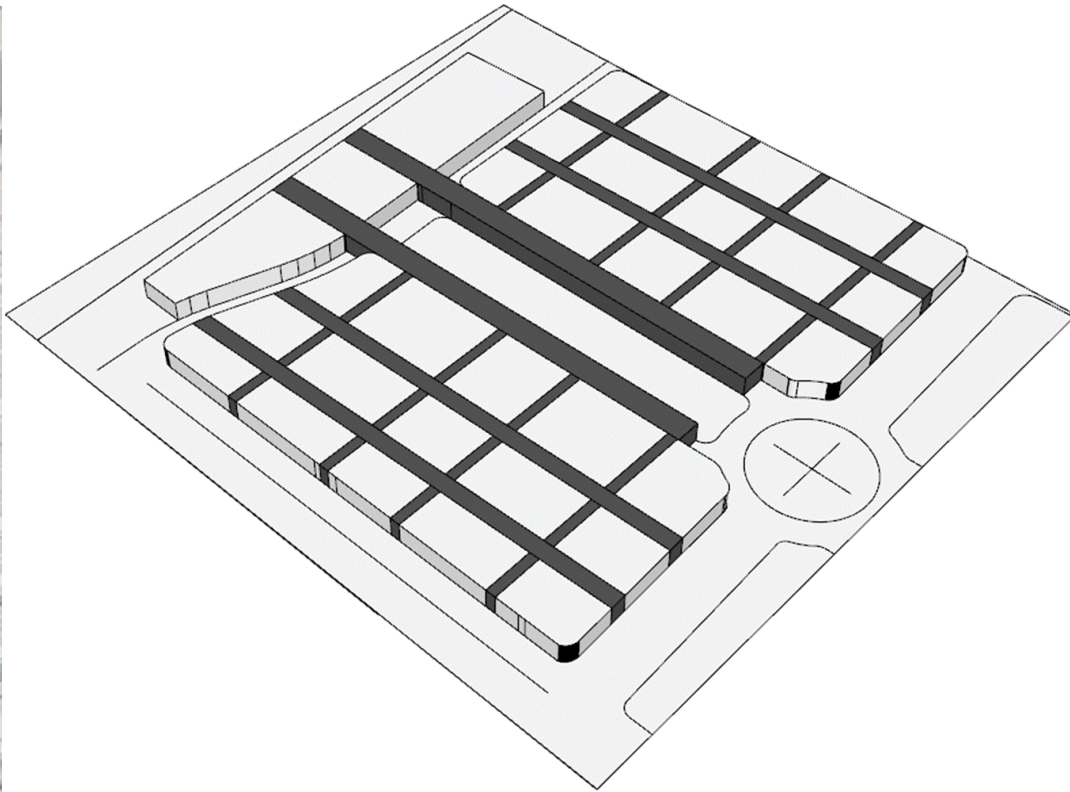
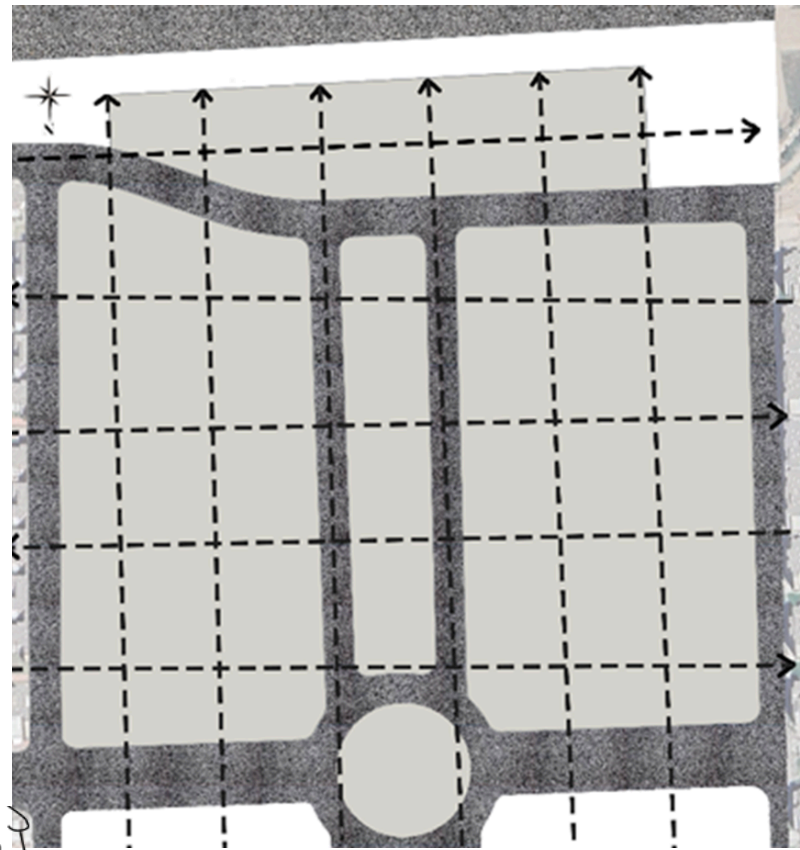
# INTERVENTION AREA

2



*Grid*

By extending the existing road lines to uphold continuity and spatial harmony, we have managed to create distinct blocks within the site.

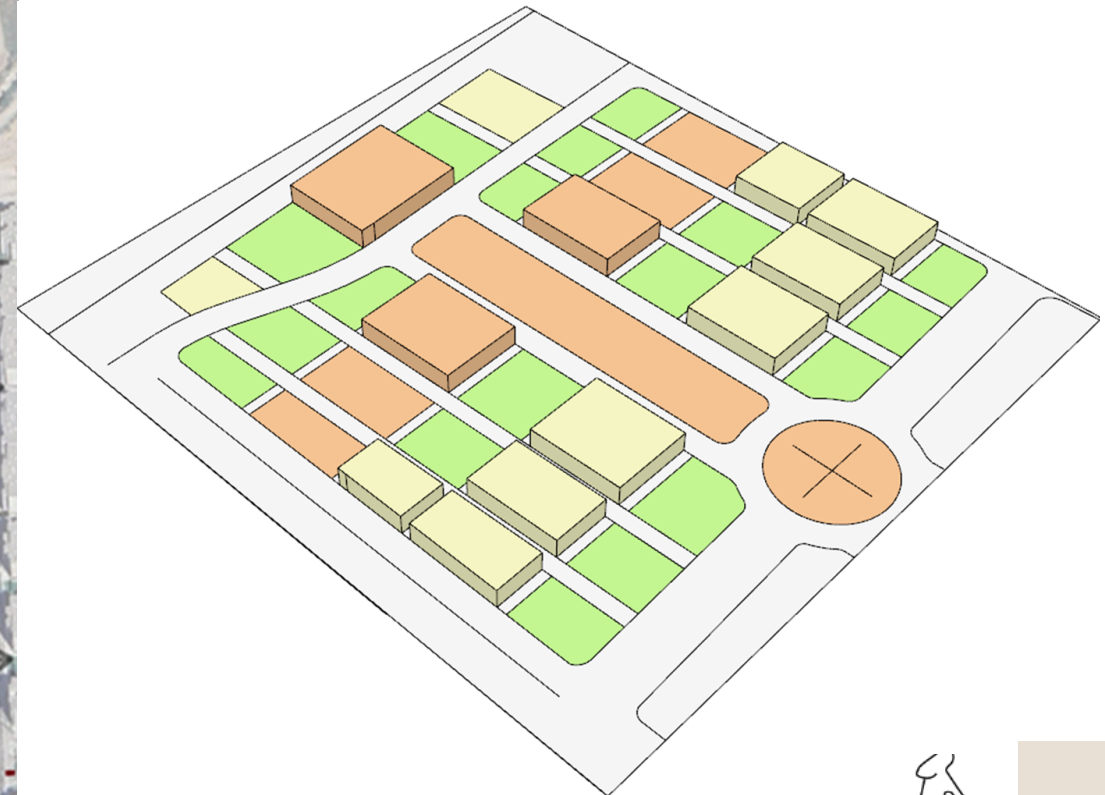
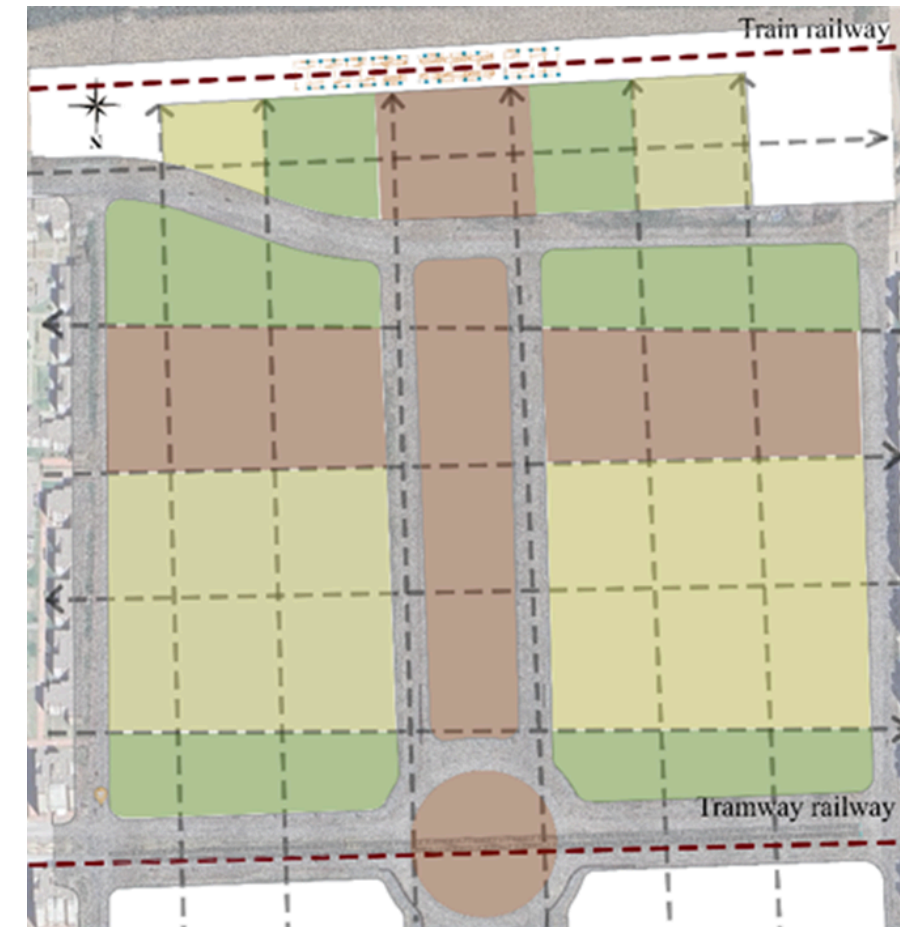


3

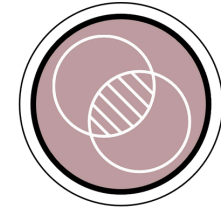


*Balance*

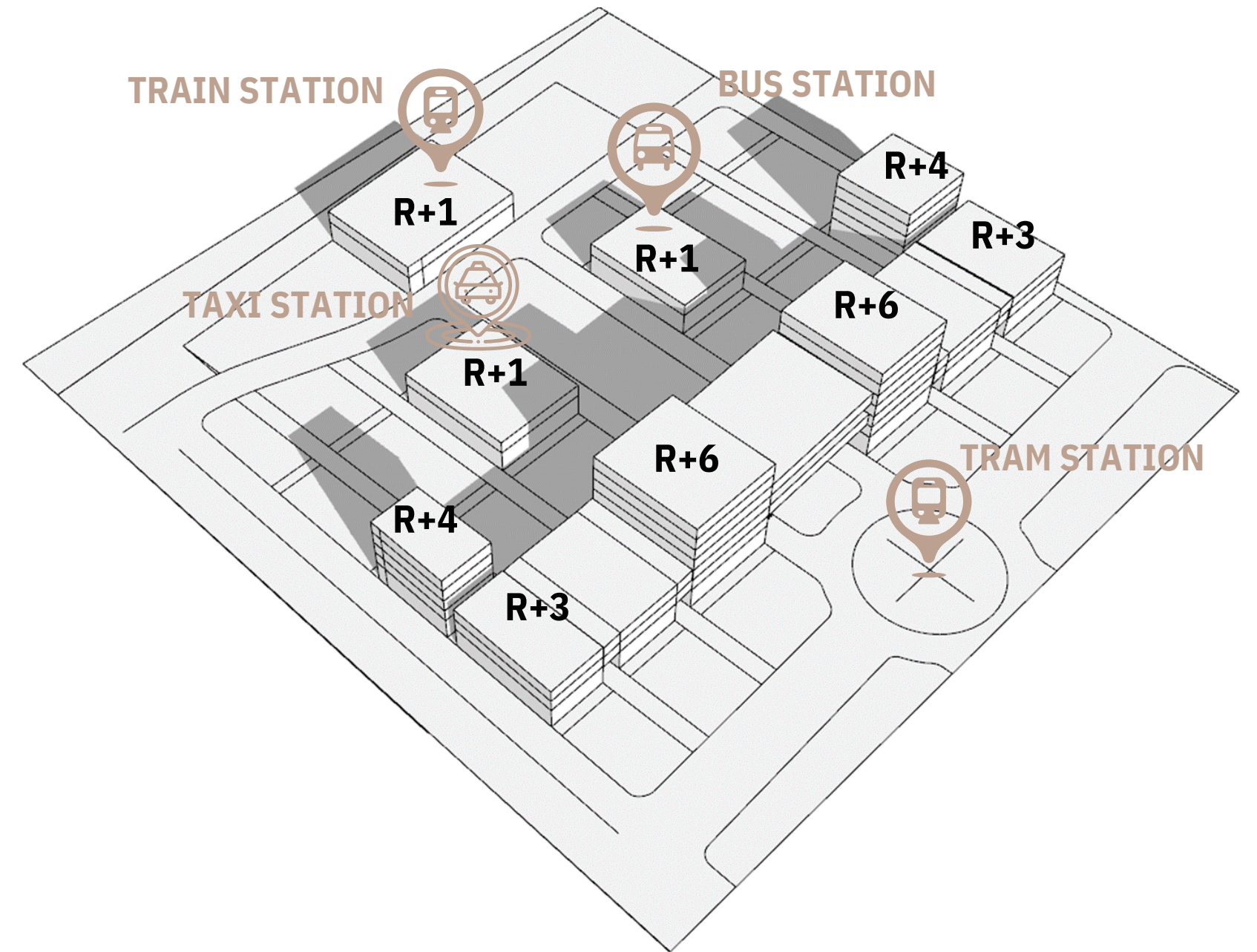
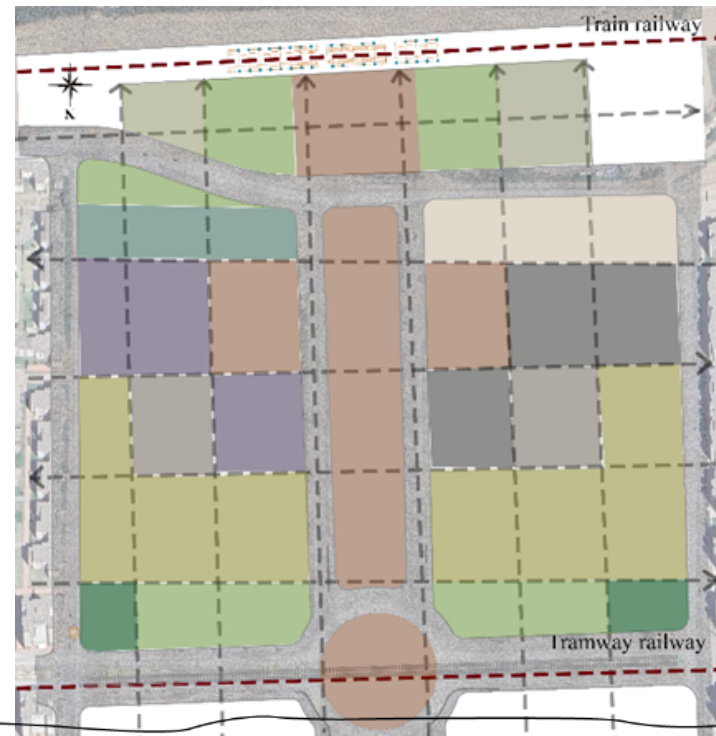
The concept of balance strives to equalize the built mass and the natural green space, ensuring their equitable distribution to create a harmonious area where both the city and the surroundings are conducive to breathing.



4

*Blend*

Our vision is to seamlessly integrate the station with the surrounding city, incorporating a variety of activities to create a multidimensional mixed-use environment. We are implementing a multi-layered design approach and maintaining continuity with existing city concepts.



# 04 | INTERVENTION SITE

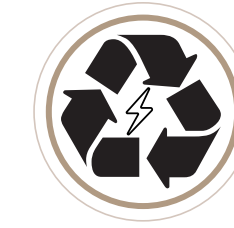
## INTERVENTION SITE



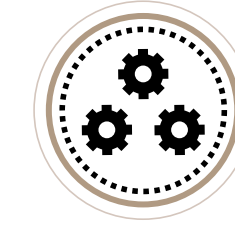
*Time*



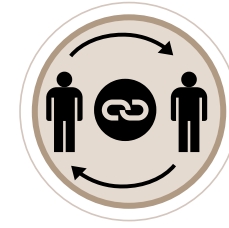
*Safety*



*Sustainability*



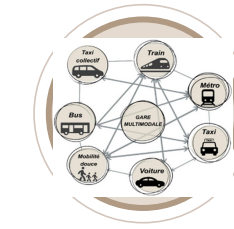
*Functionality*



*Social interaction*



*accessibility*



*Multimodality/intermodality*



*Public space*



*Students*



*Bikers*



*Families*



*Employees*



*Travellers*



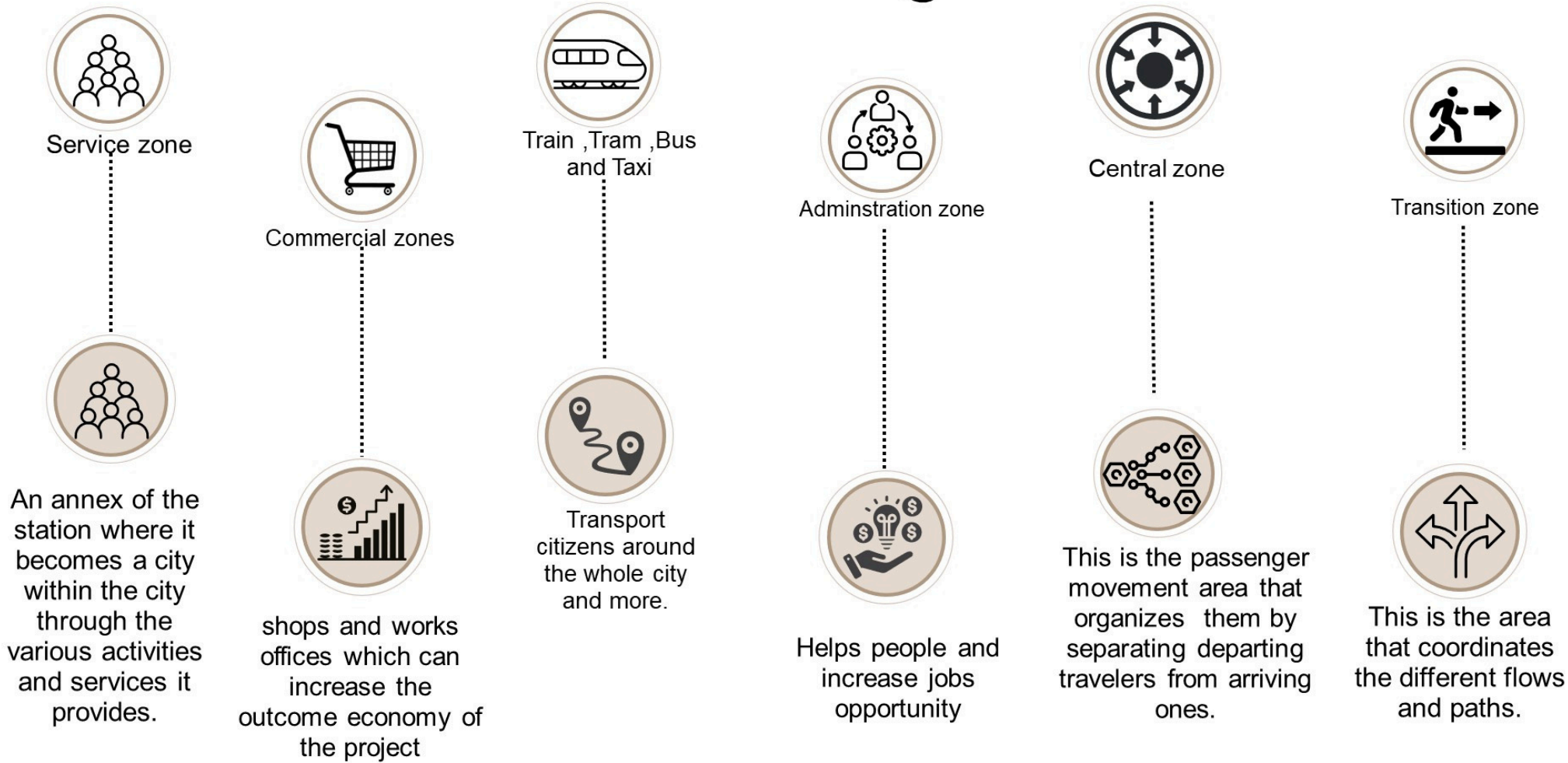
*Drivers*

*Keywords*

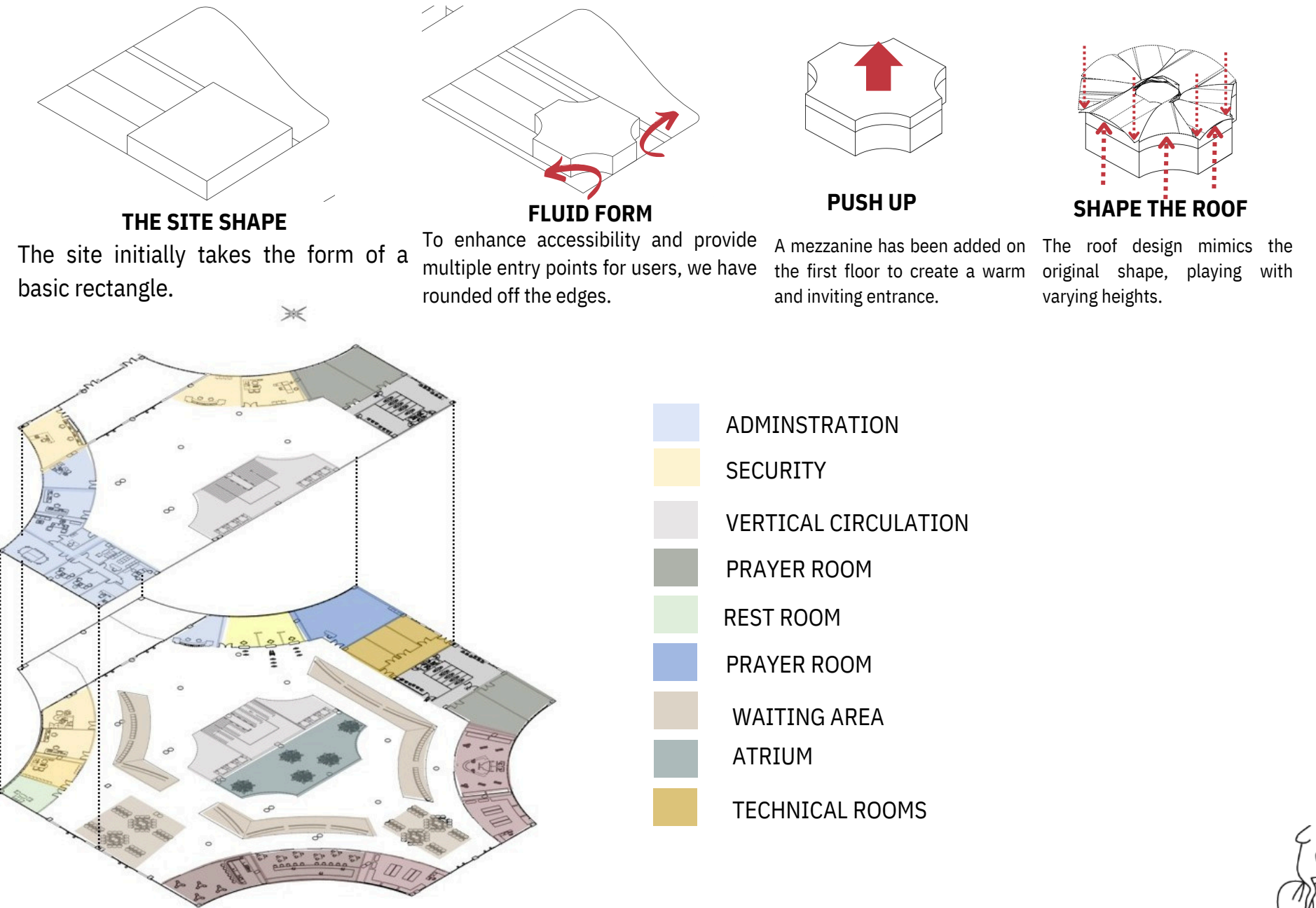
*Project Users*



## The multimodal exchange hub *Function*

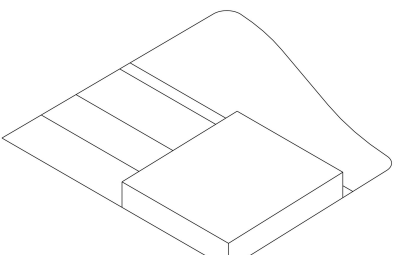


## BUS STATION GENESIS



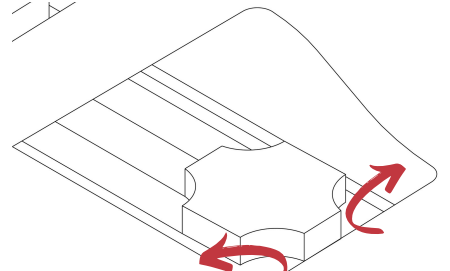
# INTERVENTION SITE

## TAXI STATION GENESIS



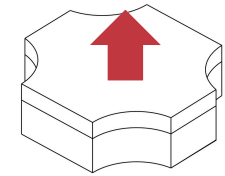
**THE SITE SHAPE**

The site initially takes the form of a basic rectangle.



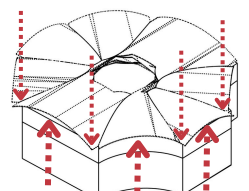
**FLUID FORM**

To enhance accessibility and provide multiple entry points for users, we have rounded off the edges.



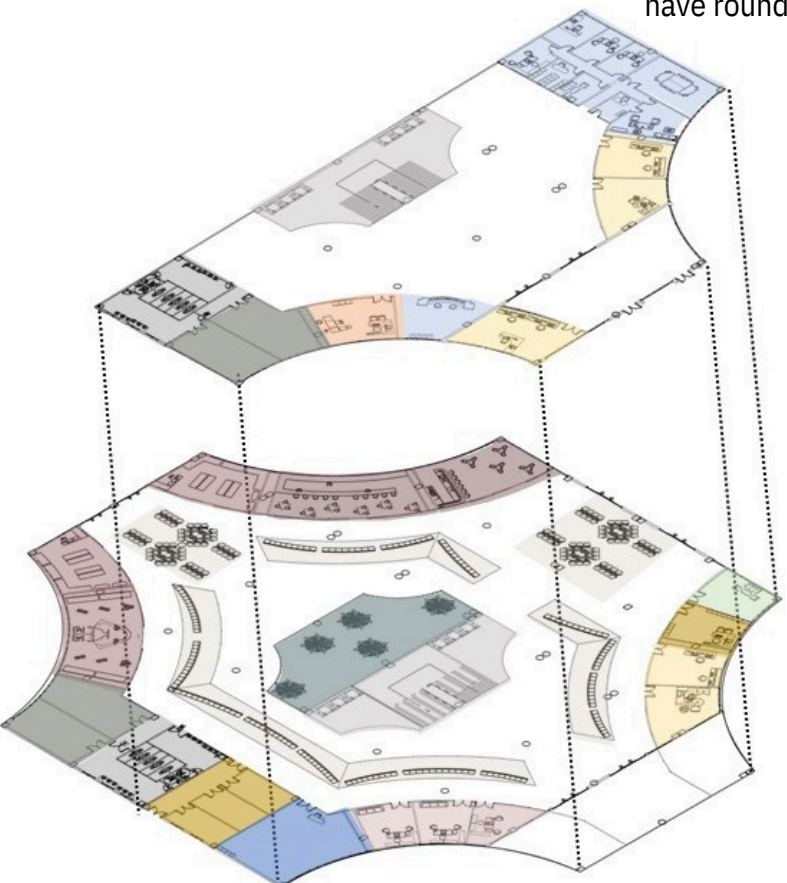
**PUSH UP**

A mezzanine has been added on the first floor to create a warm and inviting entrance.

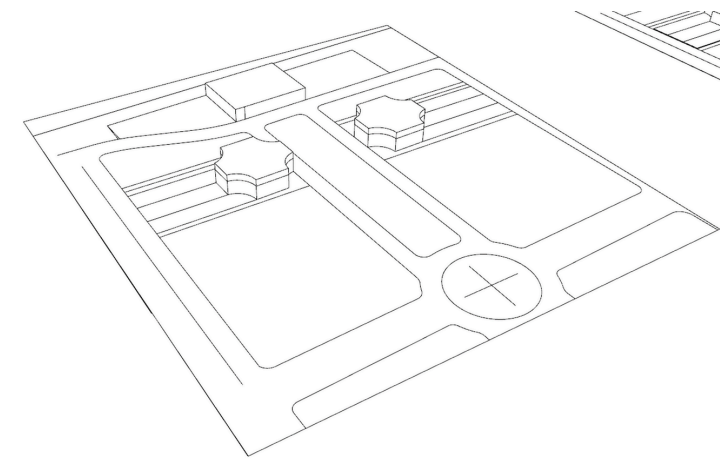


**SHAPE THE ROOF**

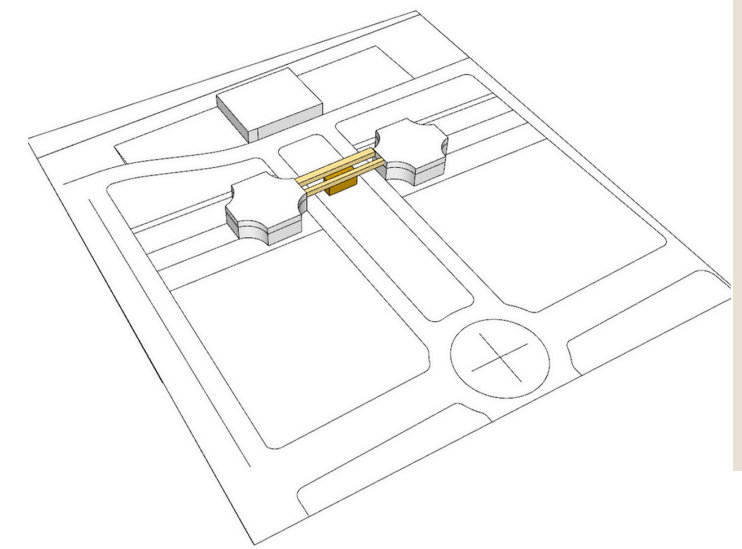
The roof design mimics the original shape, playing with varying heights.



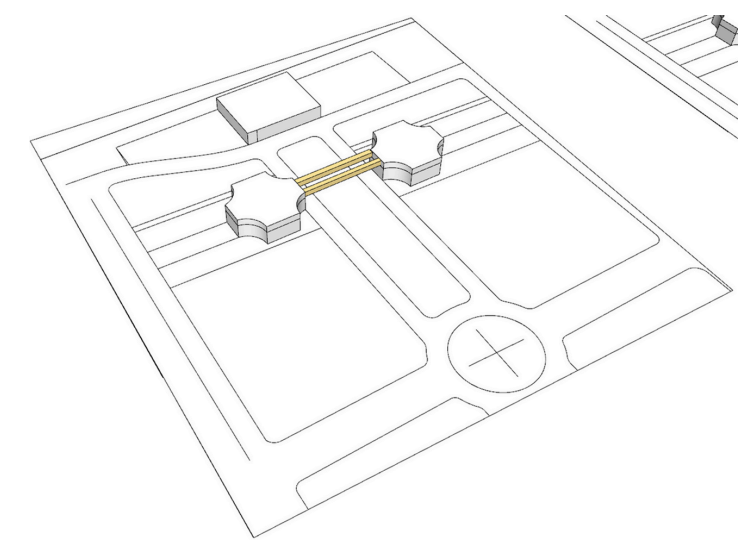
- ADMINISTRATION
- SECURITY
- VERTICAL CIRCULATION
- PRAYER ROOM
- REST ROOM
- PRAYER ROOM
- WAITING AREA
- ATRIUM
- TECHNICAL ROOMS



**having two station facing each other**



**--articulation : creating the restaurant as an articulation between the two buildings**

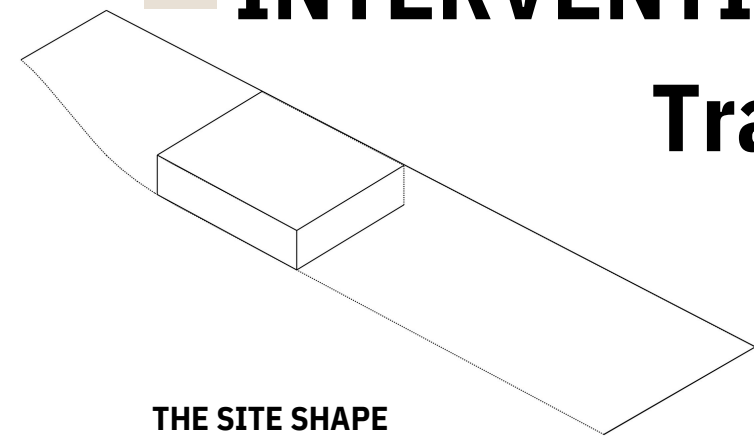


**-pedestrian bridg : creating the pedestrian bridge to maintain the connection between them ,**



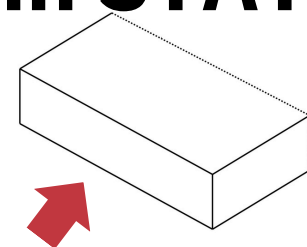
# 31 INTERVENTION SITE

## Train STATION GENESIS



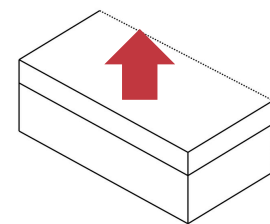
**THE SITE SHAPE**

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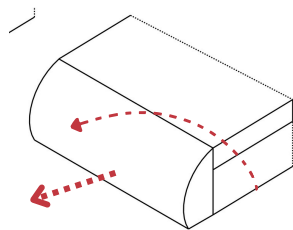
**PUSH THE SIDE**

To enhance accessibility and plan exterior activities for users like automatic vending machine



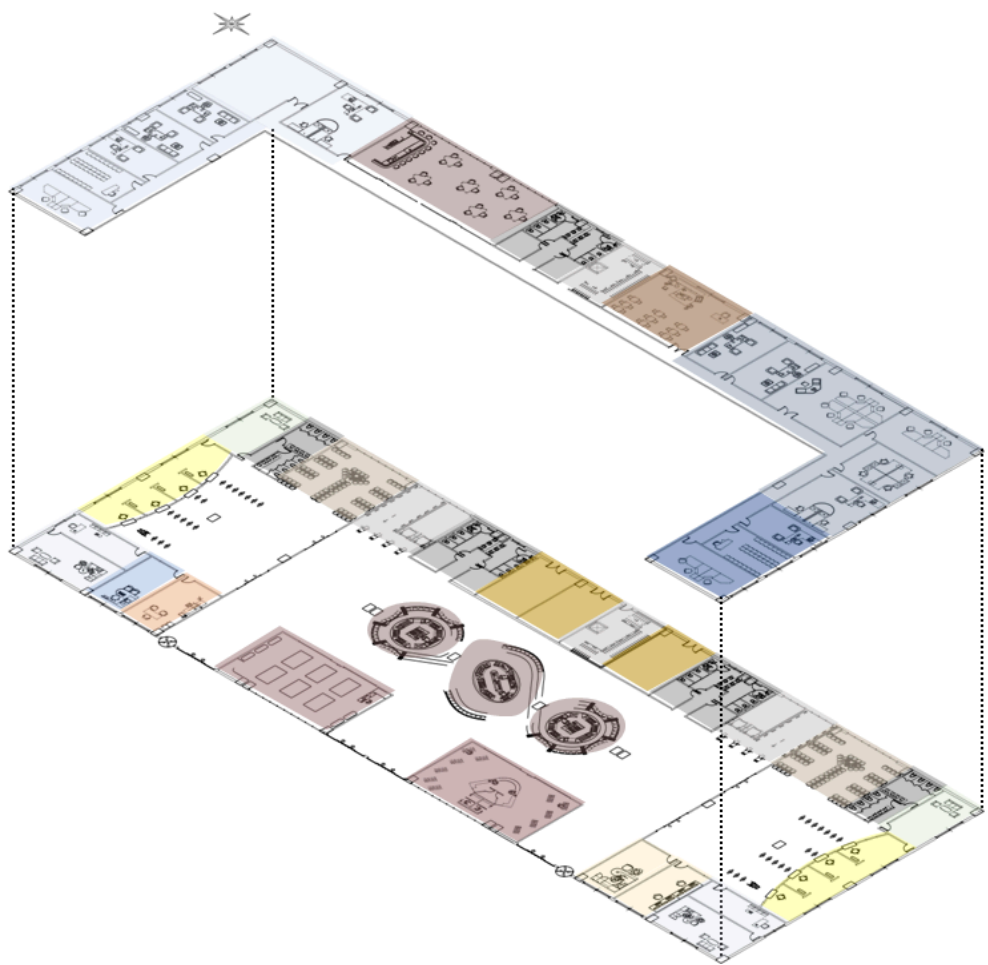
**PUSH UP**

A mezzanine has been added on the first floor to create a warm and inviting entrance.

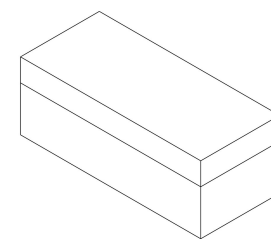


**SHAPE THE ROOF**

The roof design mimics the original shape, playing with varying heights.

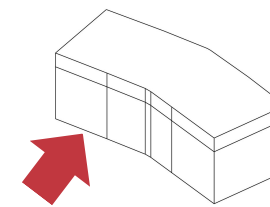


- ADMINISTRATION
- TICKET OFFICE
- VERTICAL CIRCULATION
- PRAYER ROOM
- REST ROOM
- WAITING AREA
- CONSOMATION
- TECHNICAL ROOMS



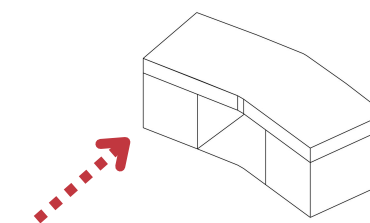
**PRIMARY FORM**

A subtle and understated form nestled underground



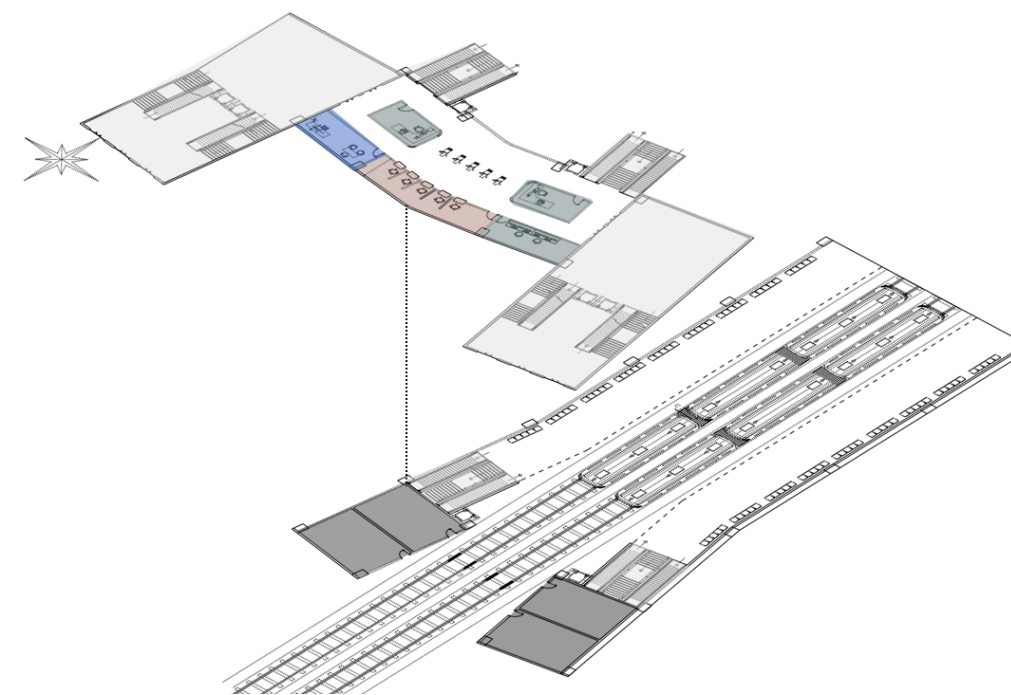
**Tramway MOTION**

The flowing movement of the Tramway getting through the building gradually taking on the shape akin to that of an arrow.



**TRAMWAY THROW THE BUILDING**

Maintaining the elevated platform as a seamless connection between the two elements, harmoniously uniting the masses.



- VERTICAL CIRCULATION
- EMERGENCY ROOM
- TICKET OFFICE
- SECURITY
- TECHNICAL ROOMS

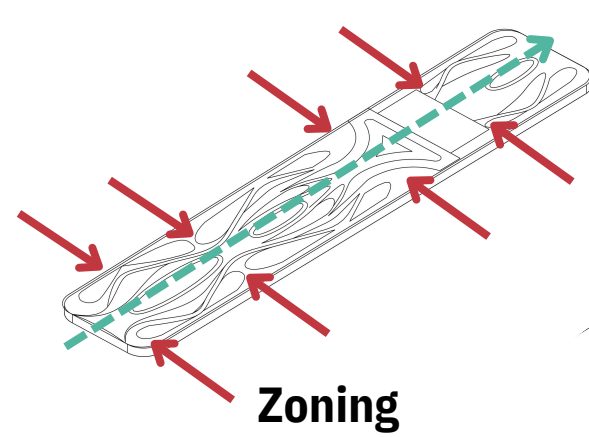


# INTERVENTION SITE

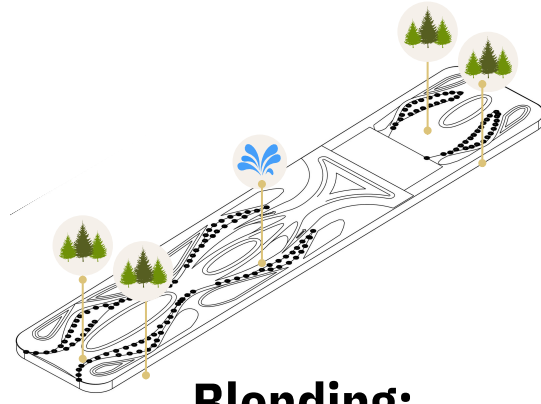


## Primary Shape of the Esplanade

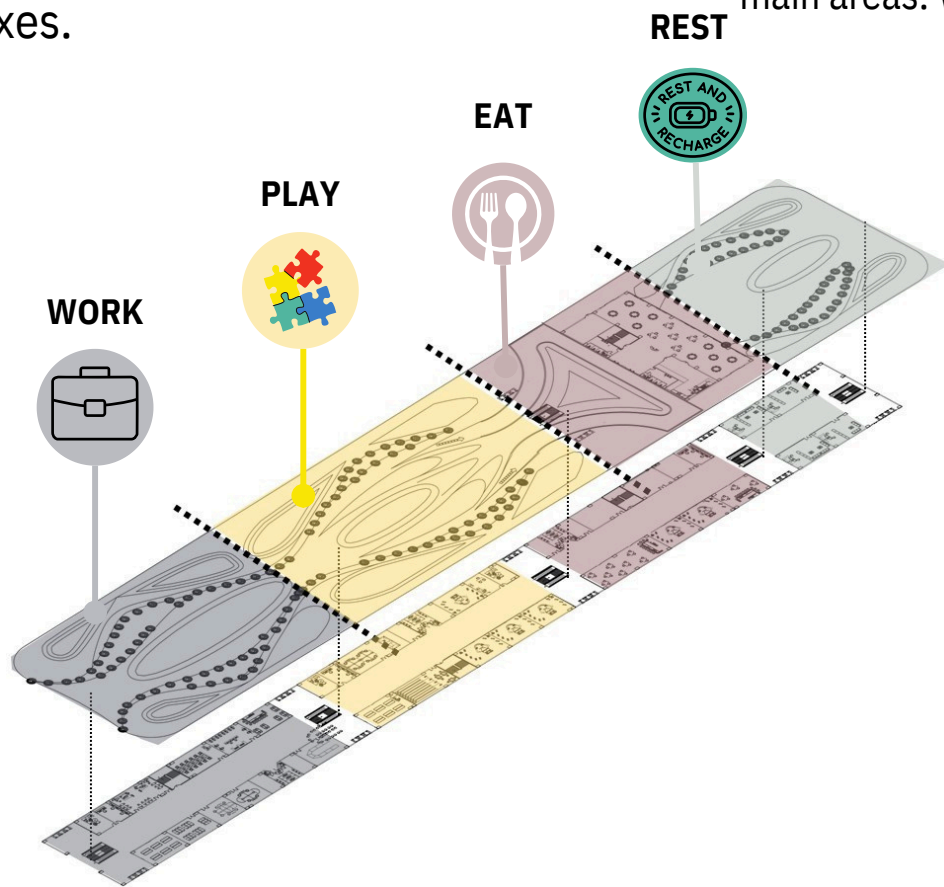
The design follows the main road axes.



By extending the existing roads, we created four main areas: Work, Play, Eat, and Rest.

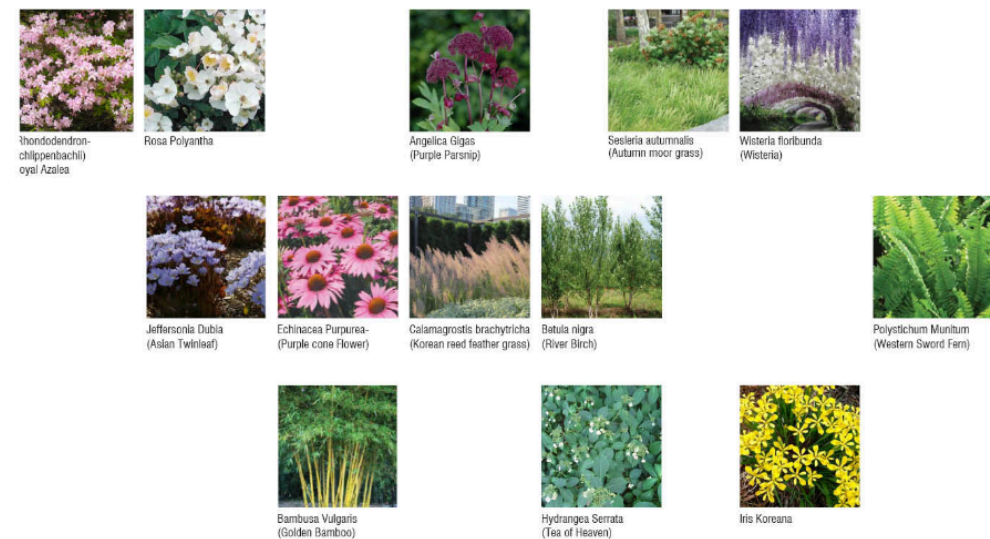


The zones are further divided into smaller activity areas, enhanced with green spaces and water fountains.



## INDIGENOUS PLANTS & SEASON OF FLORA

→ SPRING → SUMMER → AUTUMN → WINTER →



# STRUCTURE CONCEPTS

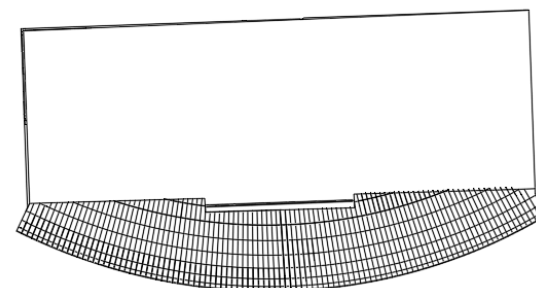
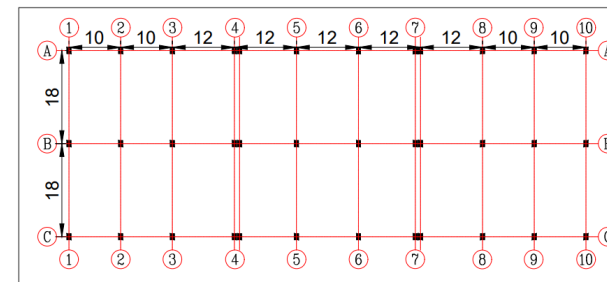
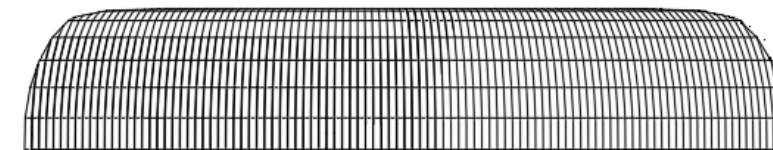
## Building system:

Our project is located in the new town of Bouinen, a city (RPA version 2003) classified in zone IIb. To ensure the stability of our project, we consulted a civil engineer who suggested using two constructive systems

## -for the railway station:

-Post-and-beam structure: A reinforced concrete post-and-beam framework. Rectangular columns (120x80cm<sup>2</sup>). Main beams (40x120 cm<sup>2</sup>) and secondary beams (40x100 cm<sup>2</sup>).

metallic structure: for the arched roof.



**-for the commercial tunnel:**

Post-and-beam structure: A reinforced concrete post-and-beam framework. Rectangular posts (120x80cm<sup>2</sup>). Main beams (40x120 cm<sup>2</sup>) and secondary beams (40x100 cm<sup>2</sup>) and the use of a 20cm-thick concrete veil.

**for the tramway station:**

Post-and-beam structure: A reinforced concrete post-and-beam framework. Rectangular posts (120x80cm<sup>2</sup>). Main beams (40x120 cm<sup>2</sup>) and secondary beams (40x100 cm<sup>2</sup>) and the use of a 20cm-thick concrete veil.

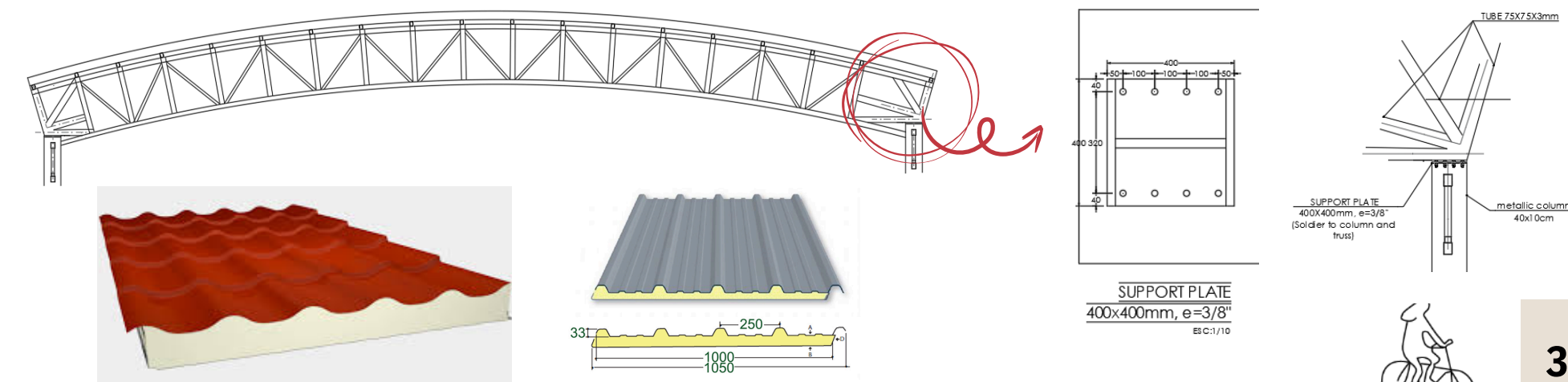
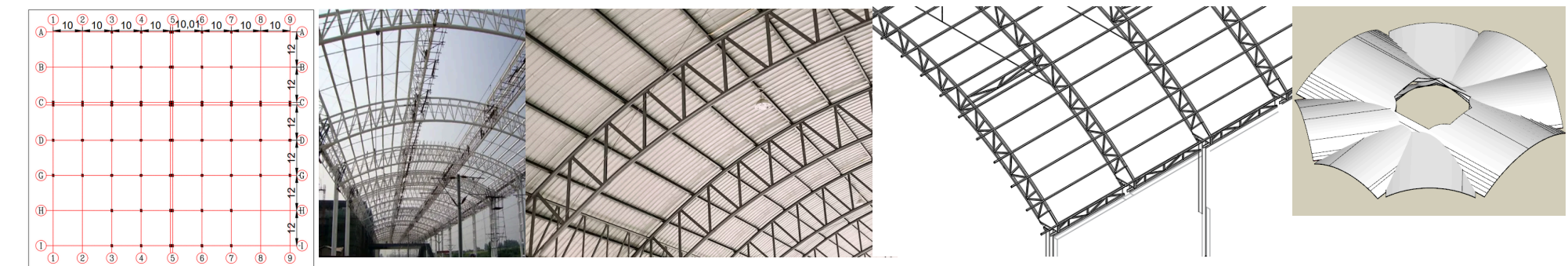
**Building materials**

We chose aerated concrete as the building material for the shell. Made from natural materials, it is both environmentally friendly and an excellent thermal insulator. It comes in blocks, tiles or panels, with thicknesses ranging from 5 to 30 mm. The material is very light and easy to install.

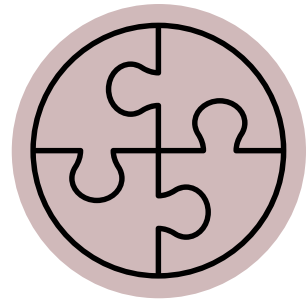
**-for the bus station**

Post-and-beam structure: A reinforced concrete post-and-beam framework. Rectangular posts (80x60cm<sup>2</sup>) and circular posts (80cm<sup>2</sup>). Main beams (40x90 cm<sup>2</sup>) and secondary beams (40x80 cm<sup>2</sup>).

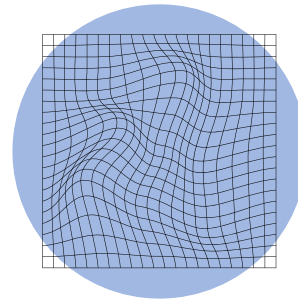
Metal structure: metal is a recyclable, reusable and, above all, lightweight material. We use a lattice system for the roof, which has a flowing and dynamic shape. with the use of sandwich panels



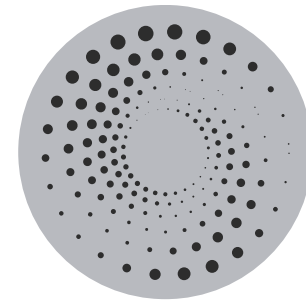


FACADES CONCEPTSFUSION

ery important element in facade design (visual transition from interior to exterior) (fusion between void and solid to achieve balance)

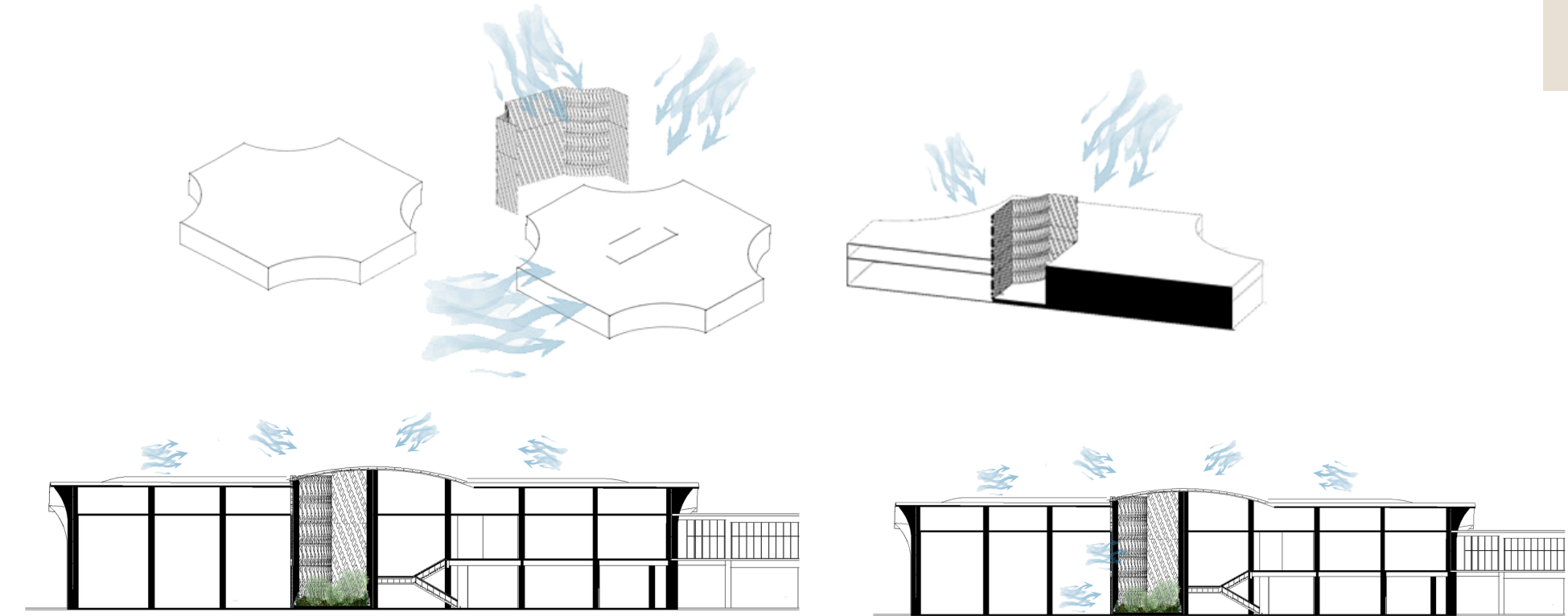
modenature

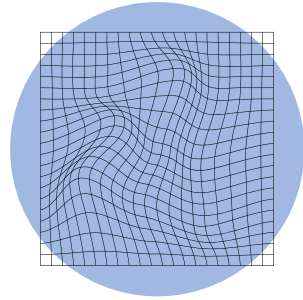
proportion of ornamental elements

fluidity.

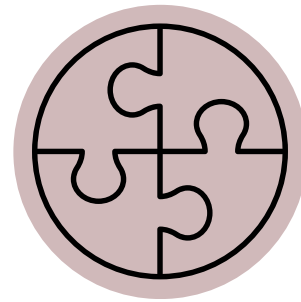
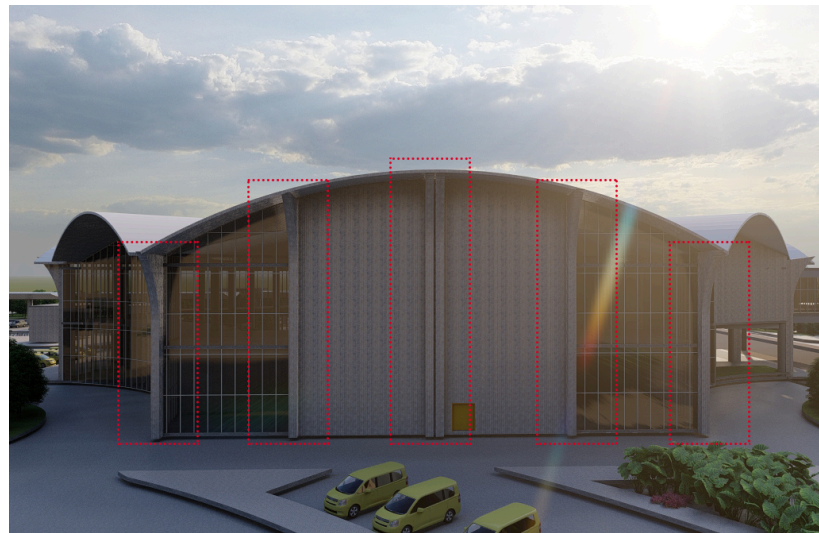
metaphor and fluid roof  
Incoming and outgoing flow

Passive strategies are utilized through the atrium to act as a natural ventilation system, enhancing thermal comfort. Additionally, the atrium serves as a pivotal element facilitating the penetration of natural light and integrates lush vegetation within the interior of the building.

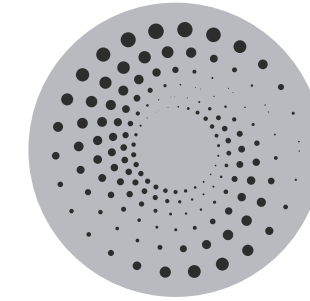
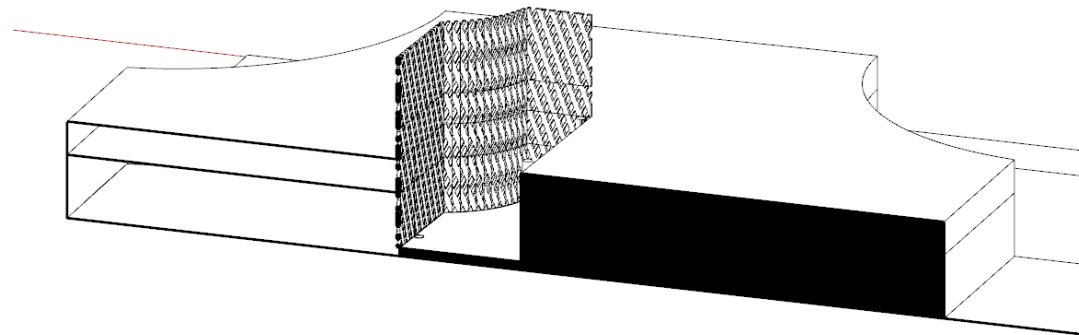


FACADES CONCEPTSmodenature

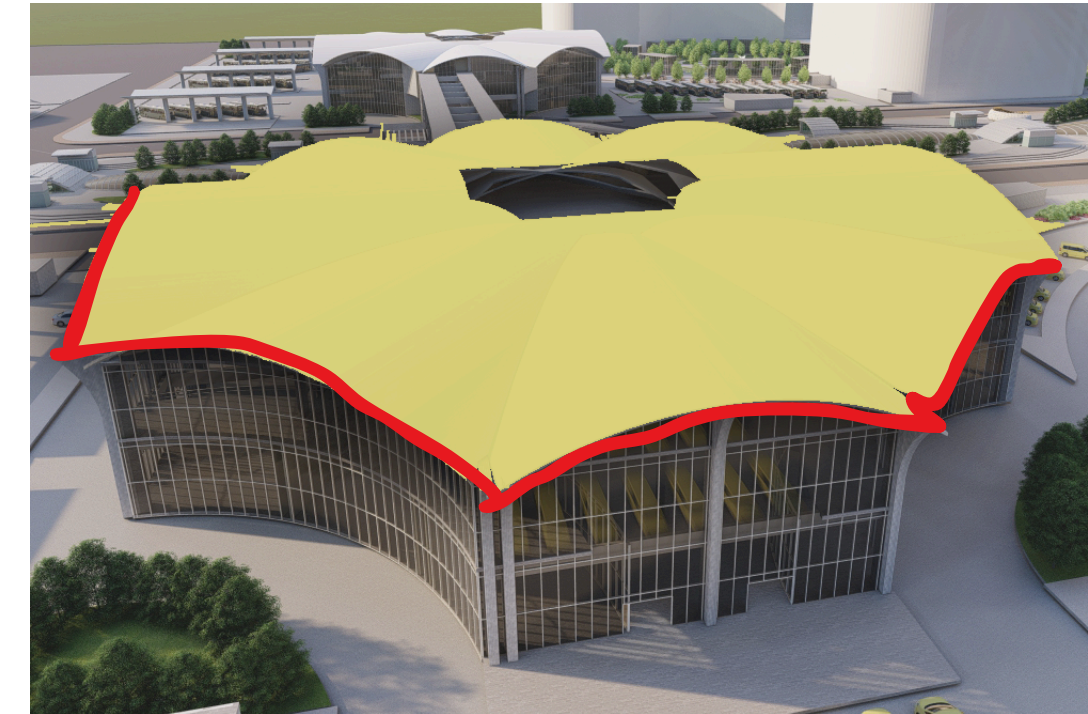
the facade expression follows the structure:  
we didn't hide the structure elements, instead  
we used them to express the facades

FUSION

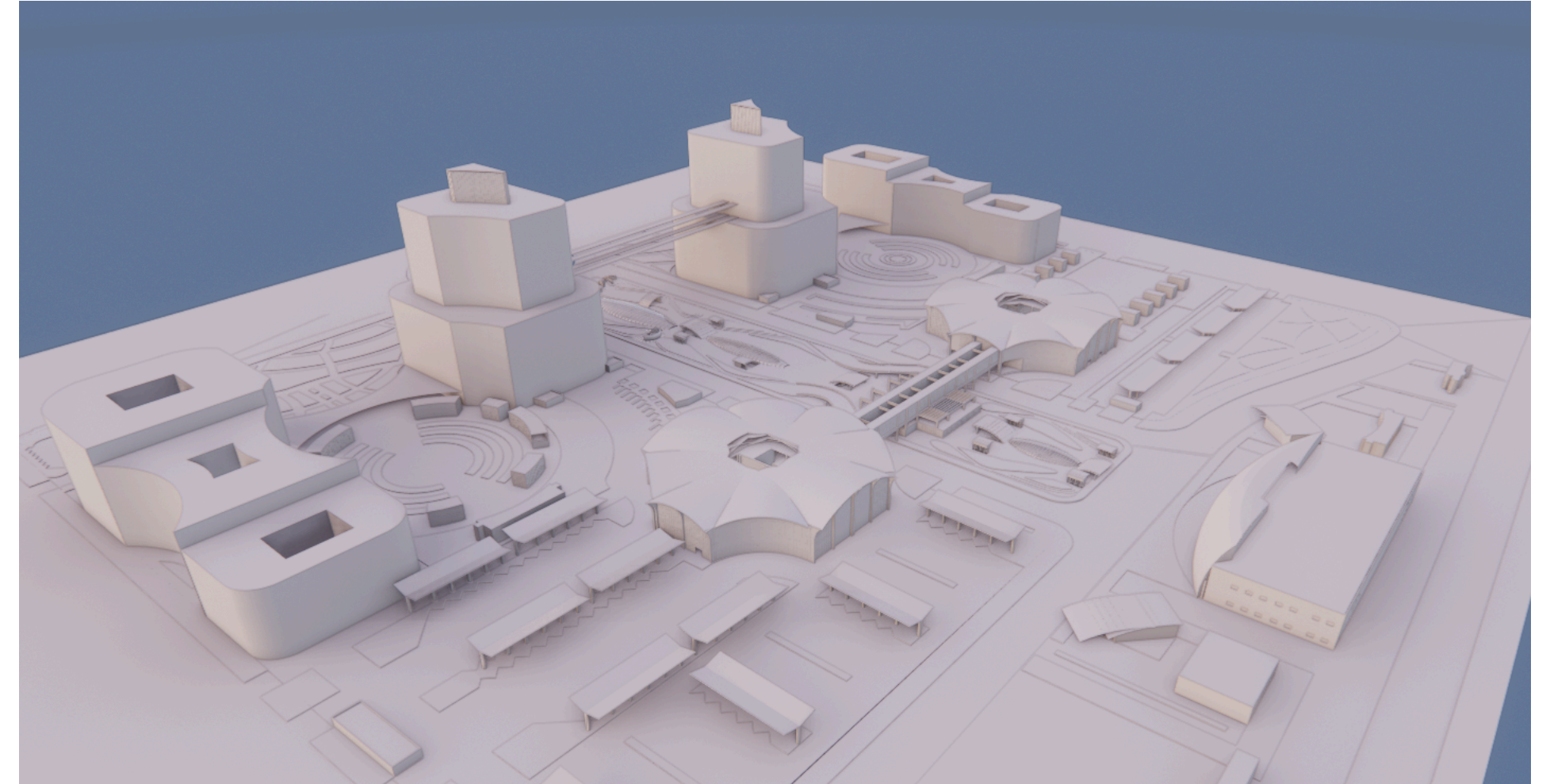
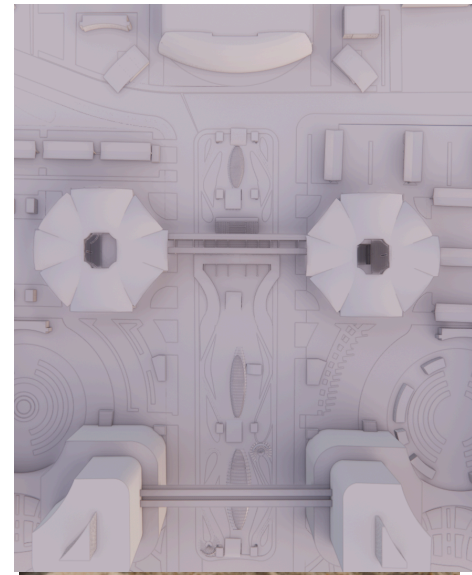
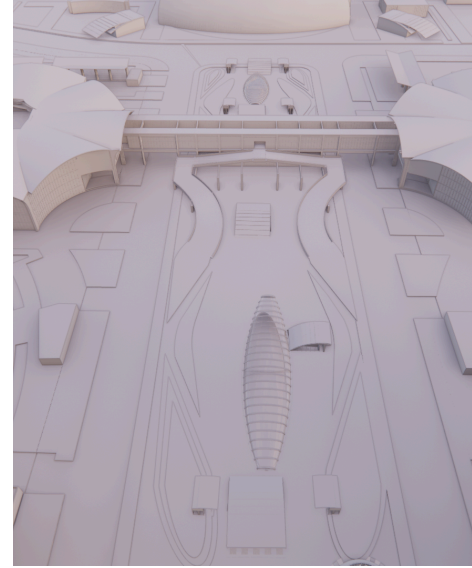
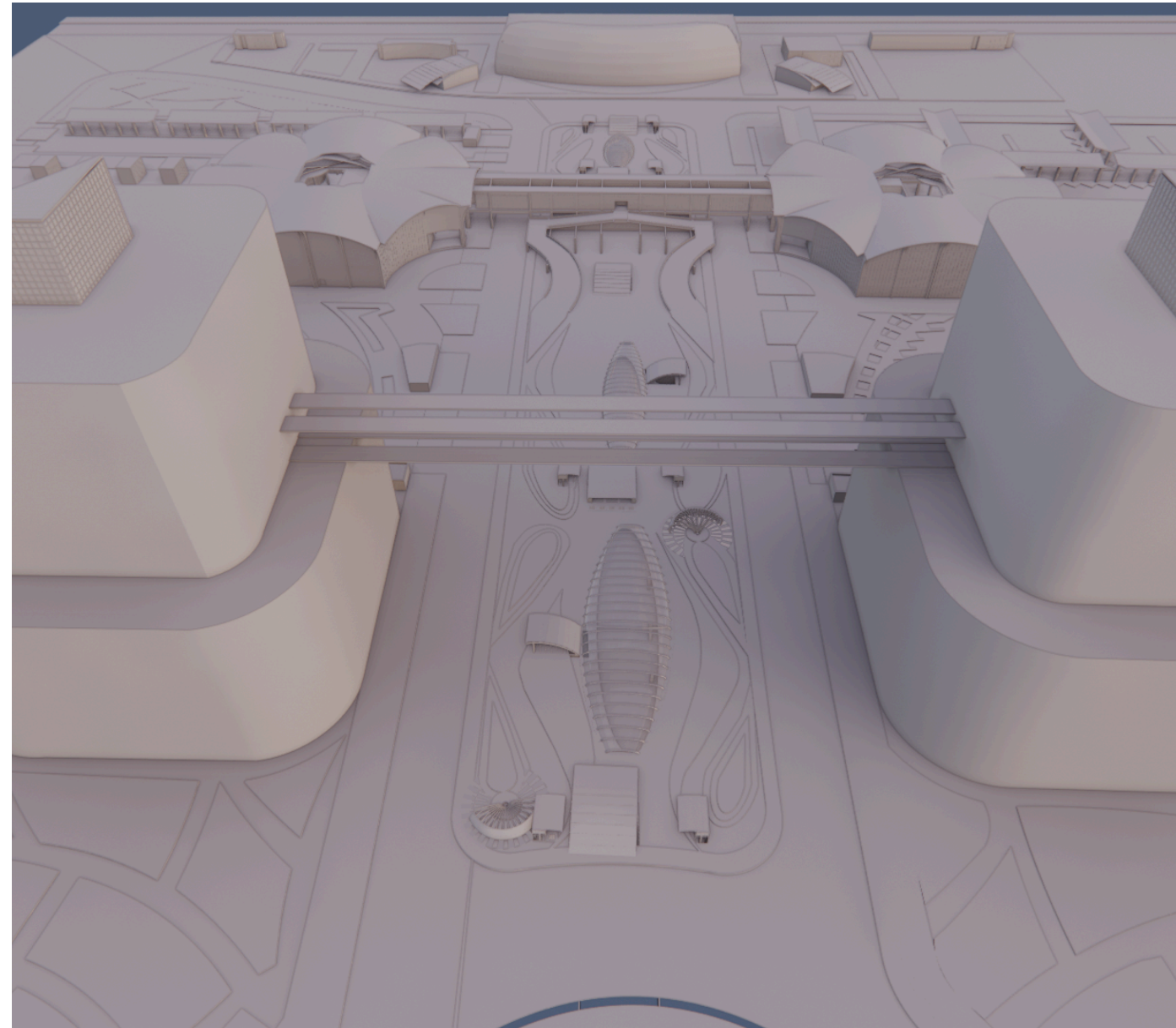
we used atrium as the important element  
of the project

fluidity

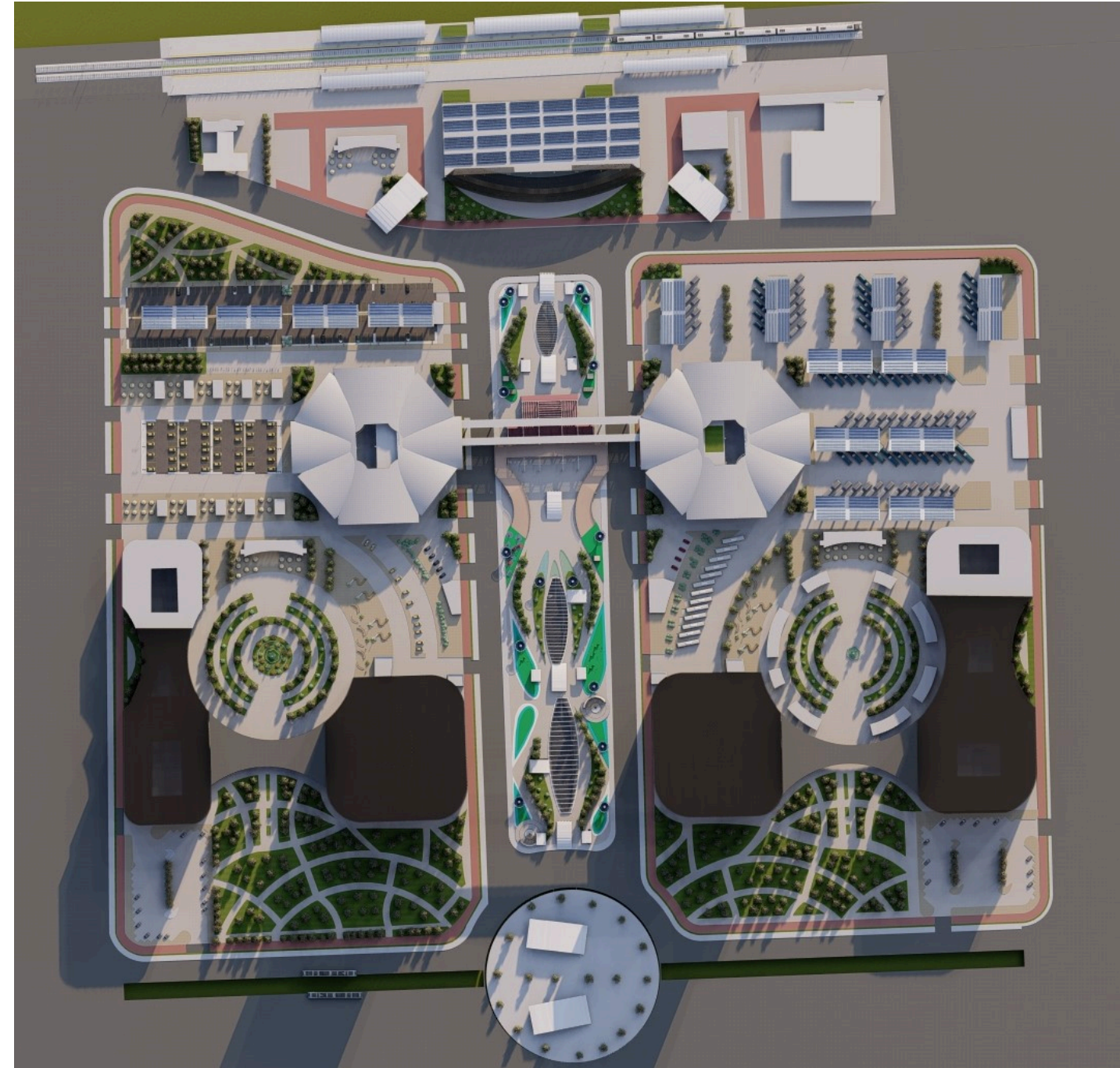
we used an Organic roof shape to make it more dynamic



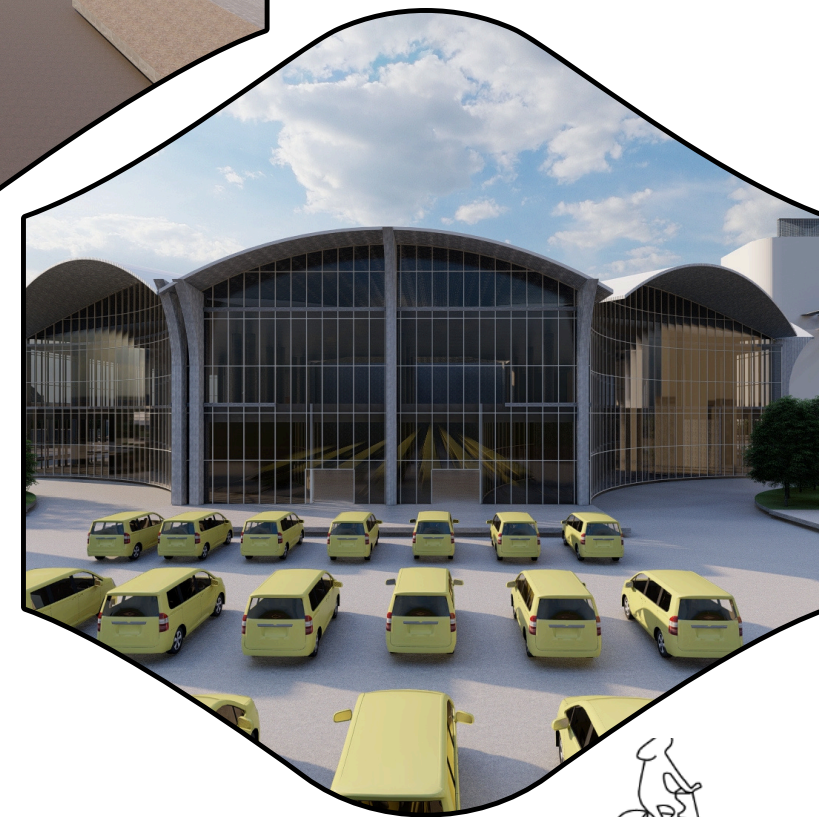
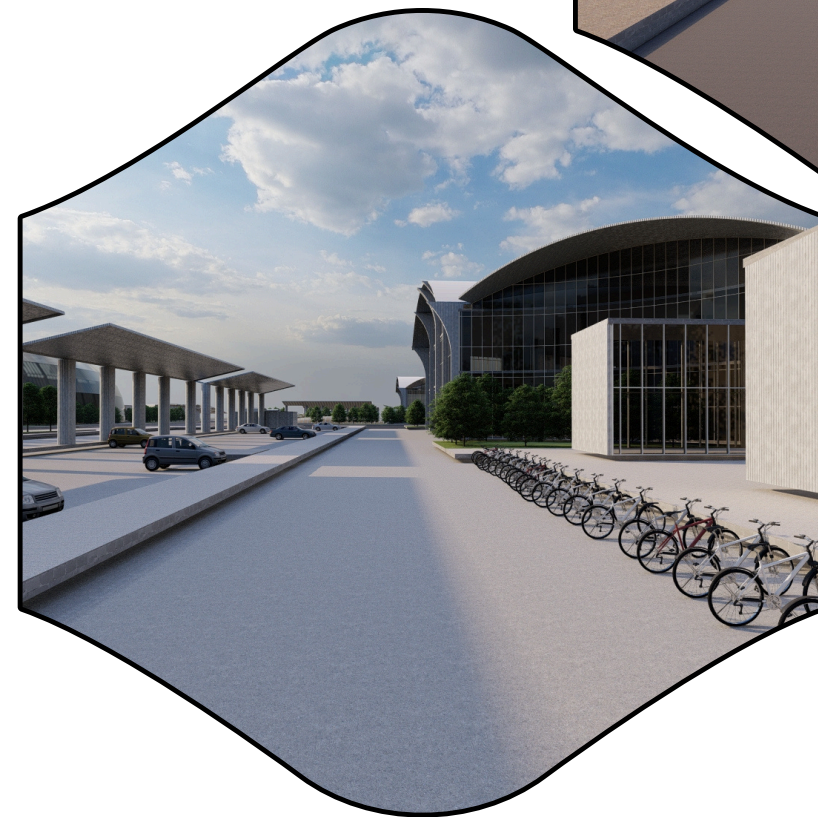
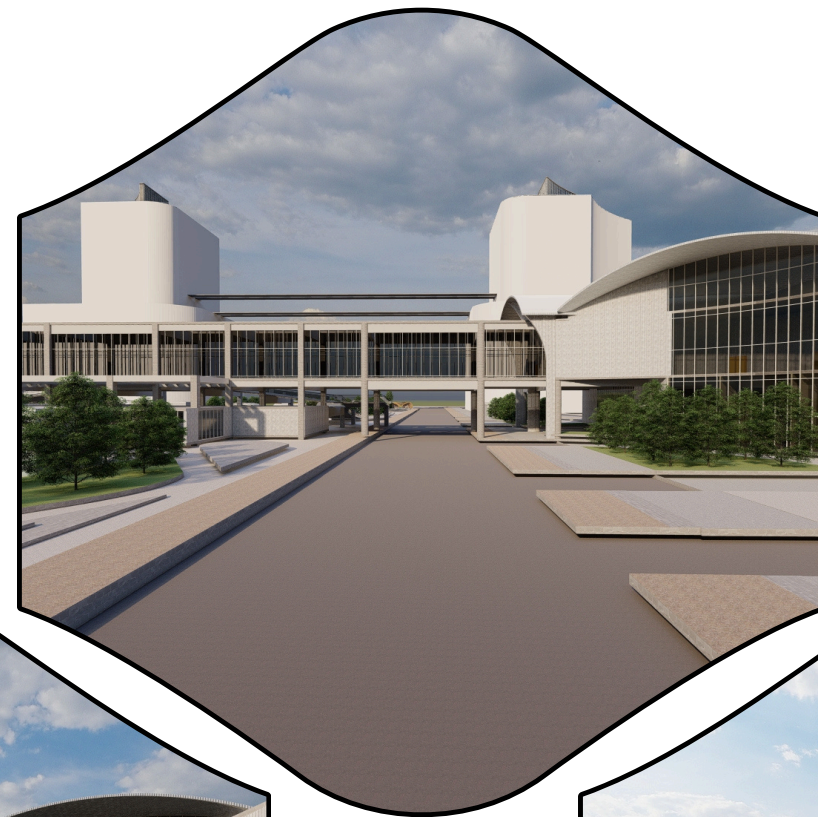
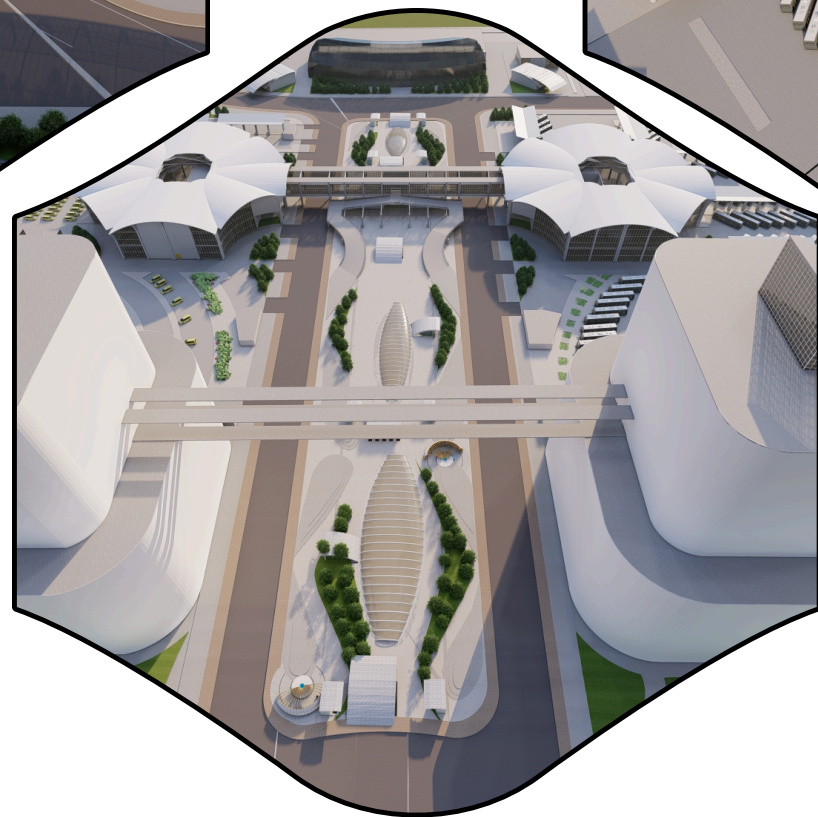
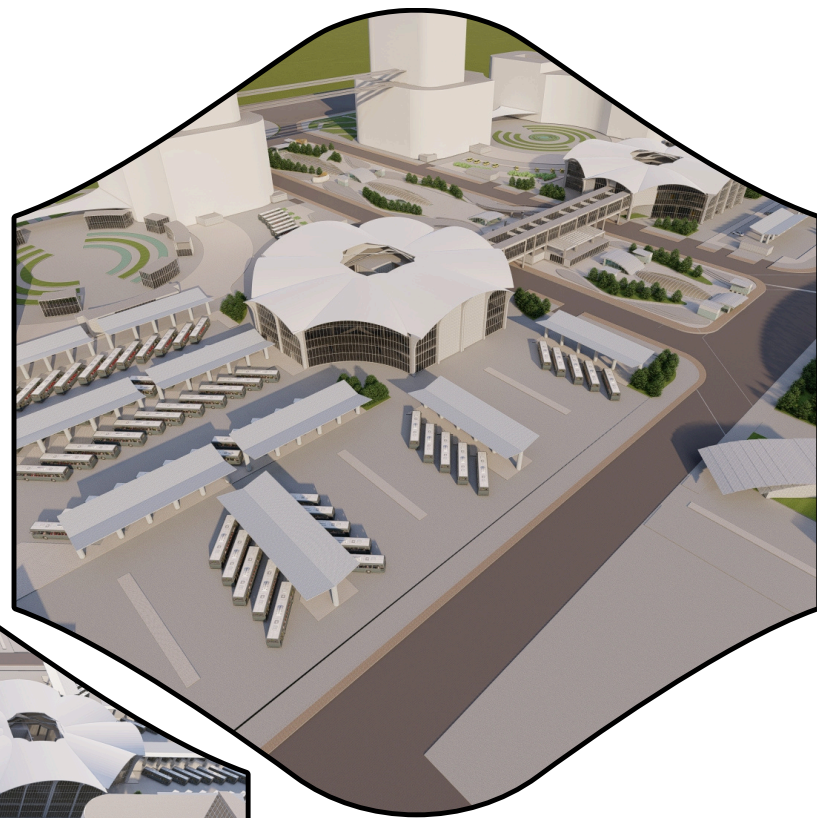
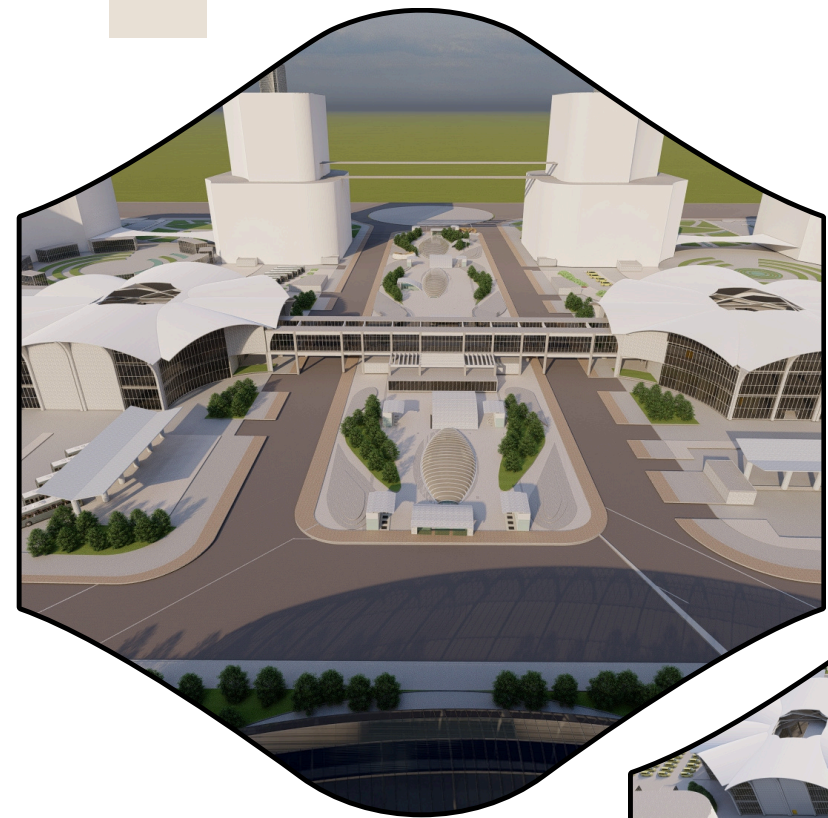
## MAQUETTE



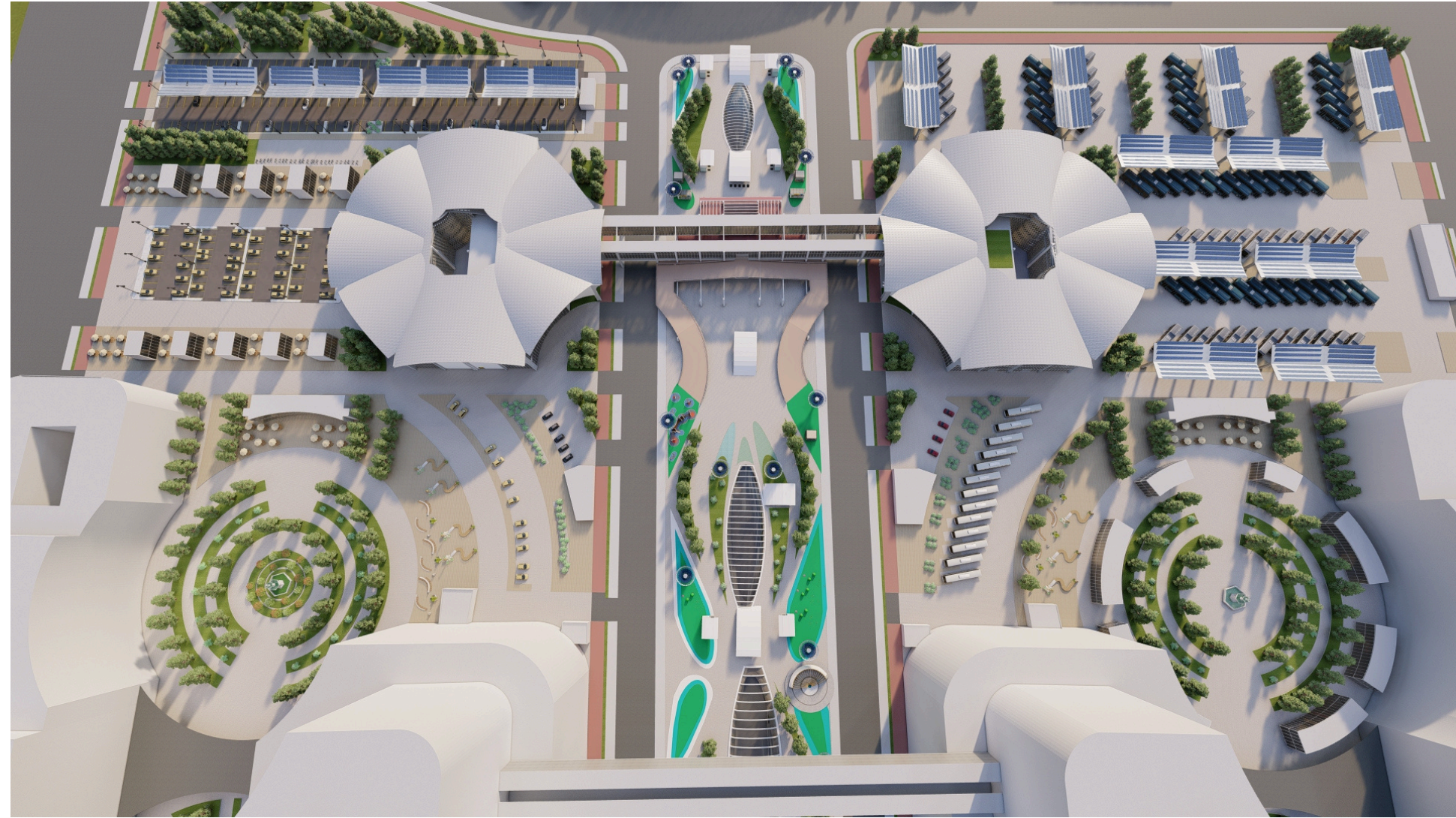
# INTERVENTION SITE

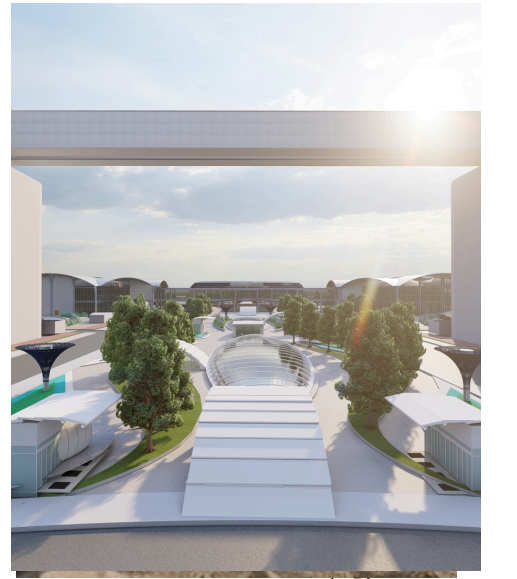
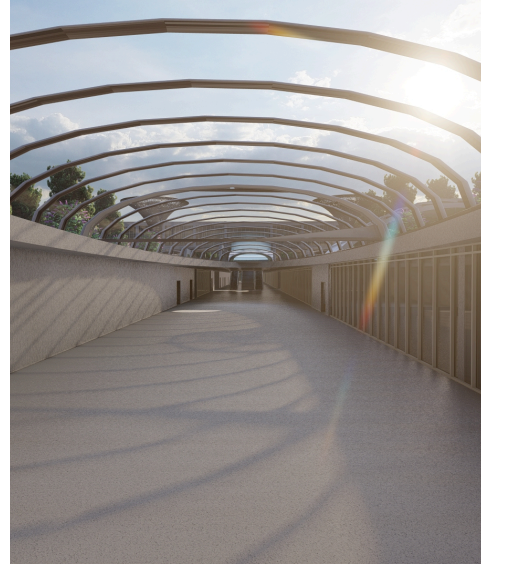
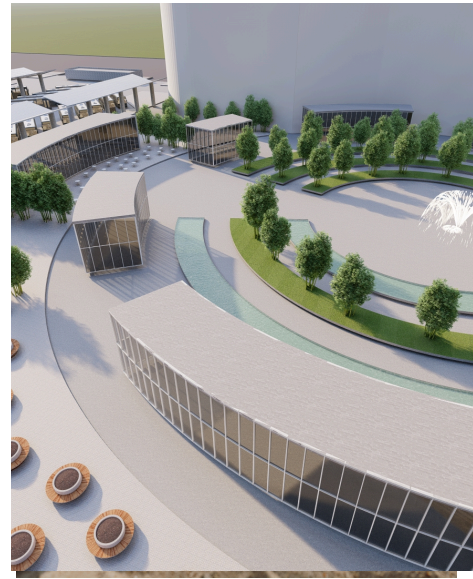
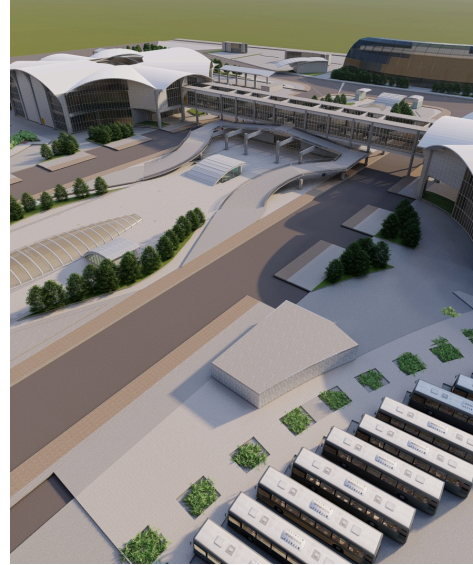
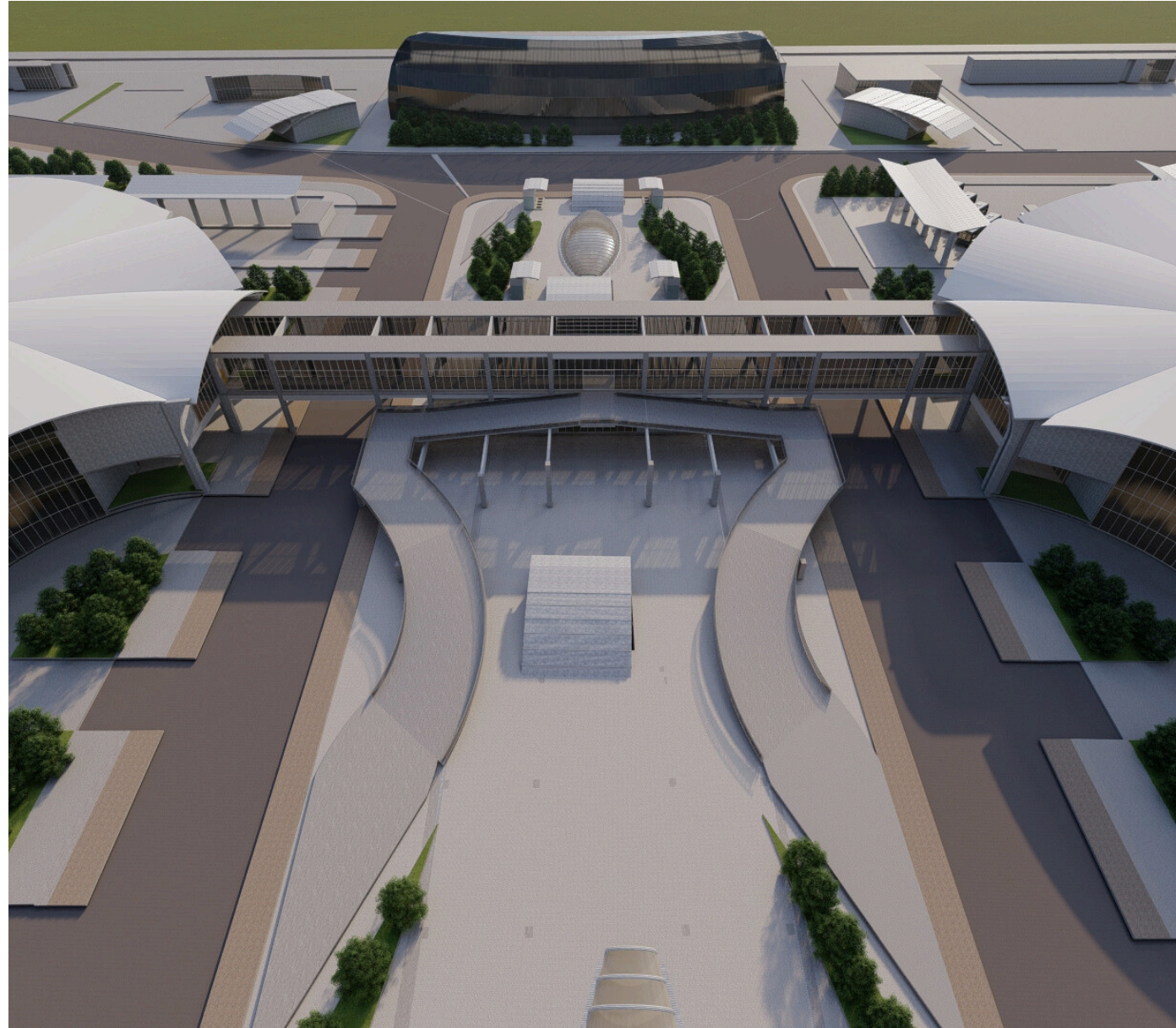


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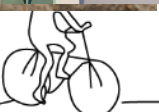
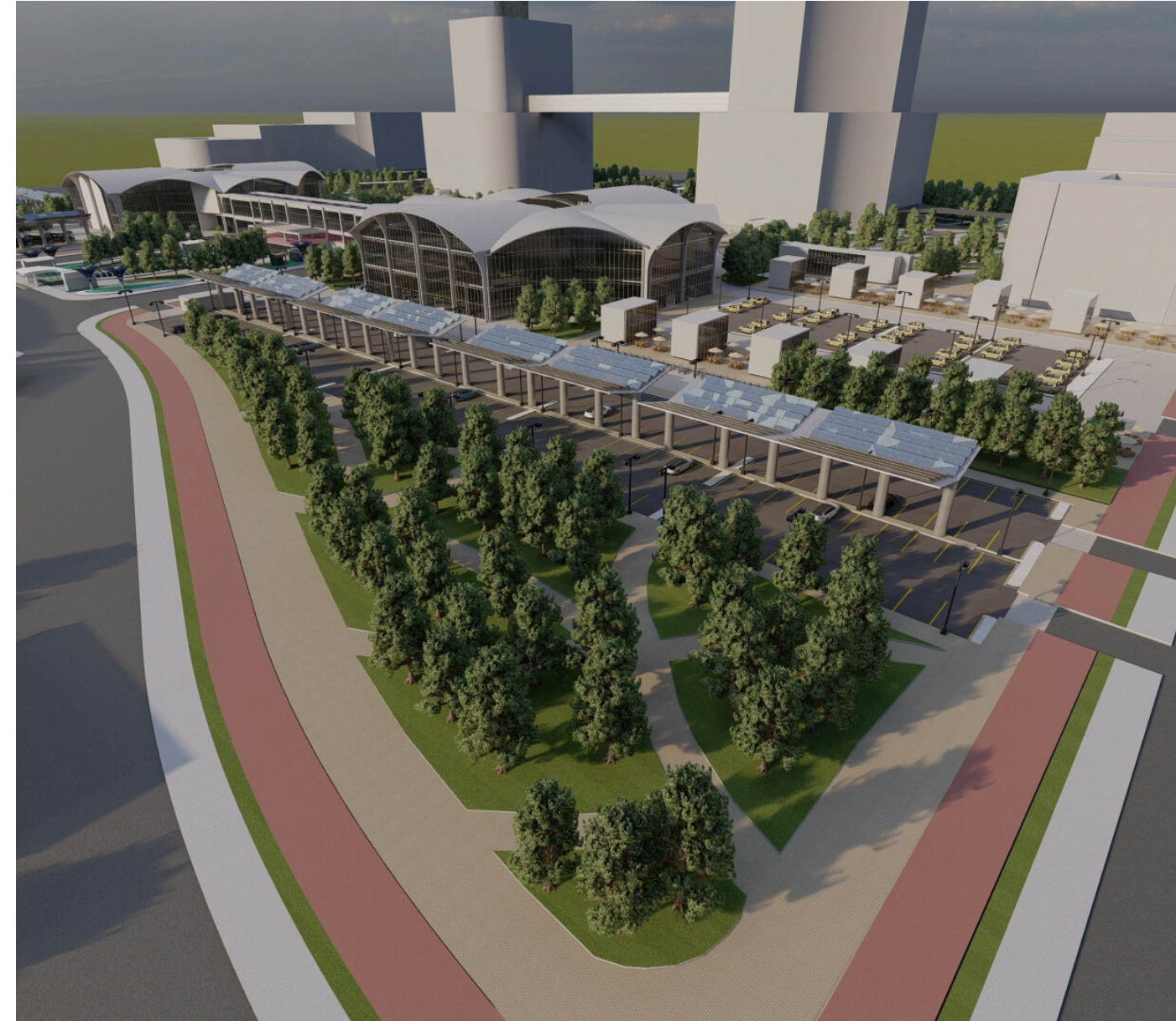
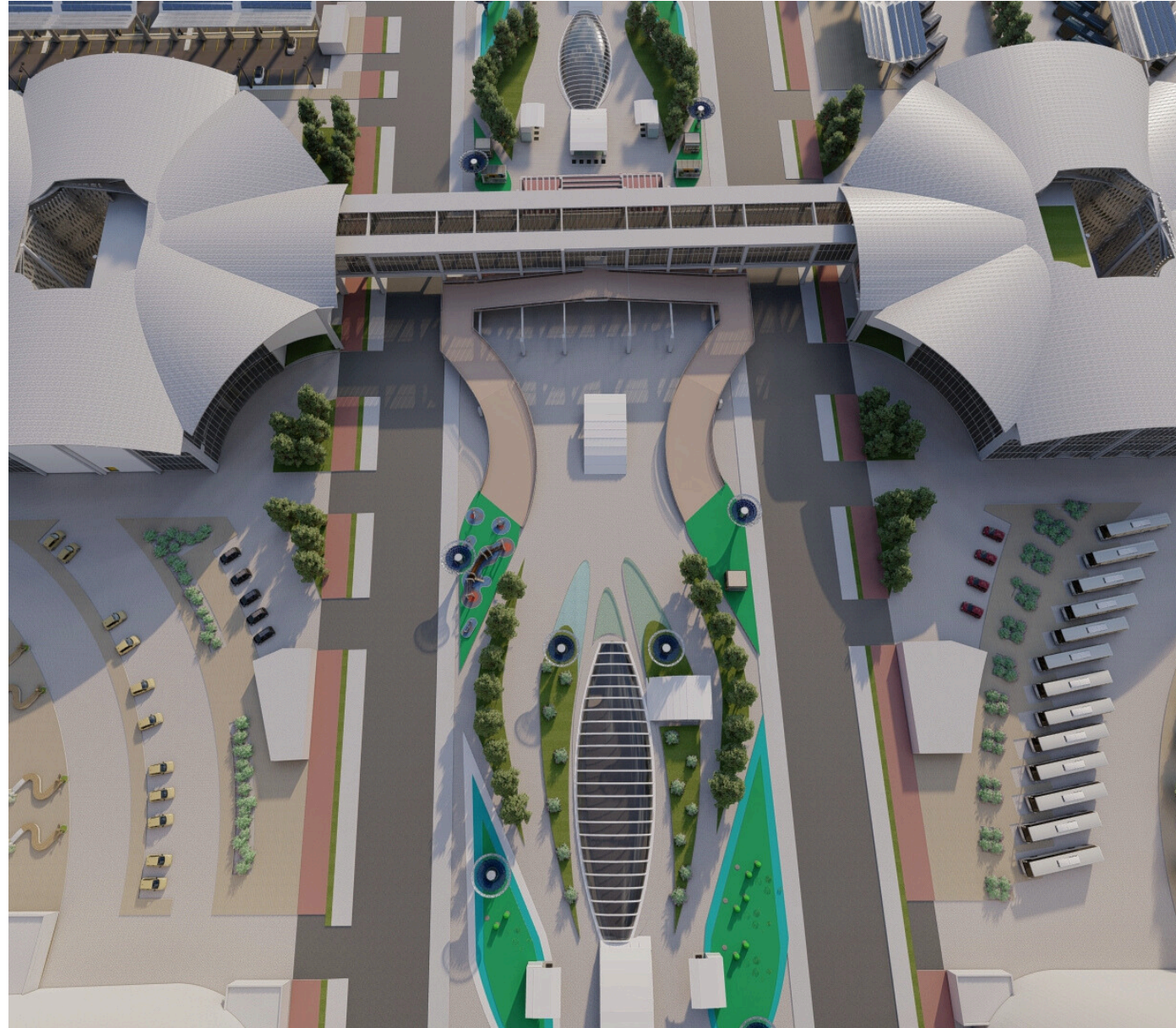


# INTERVENTION SITE



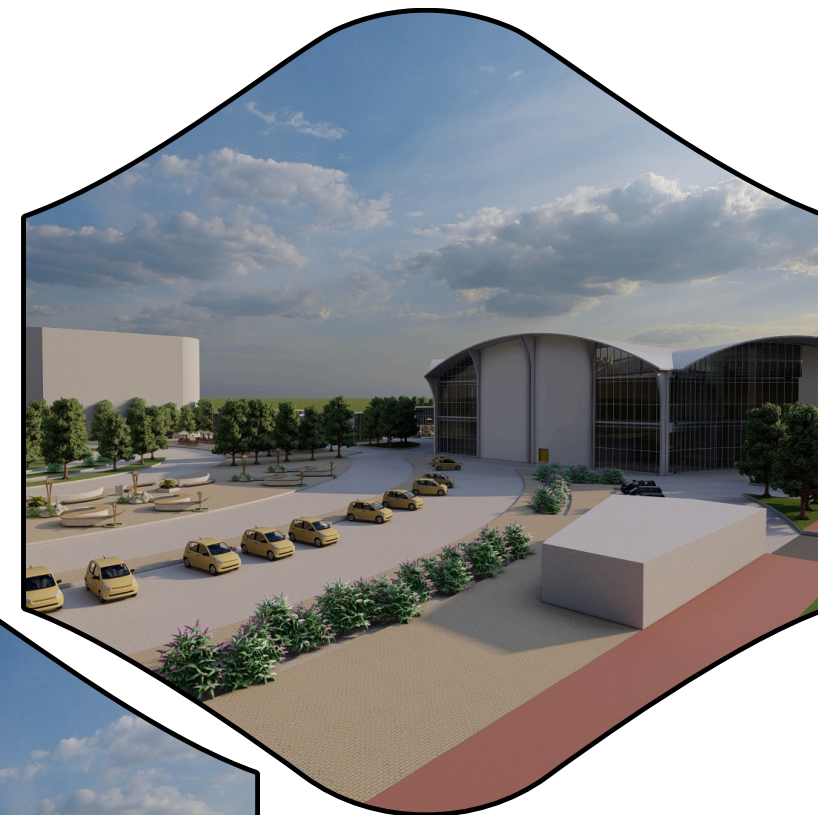
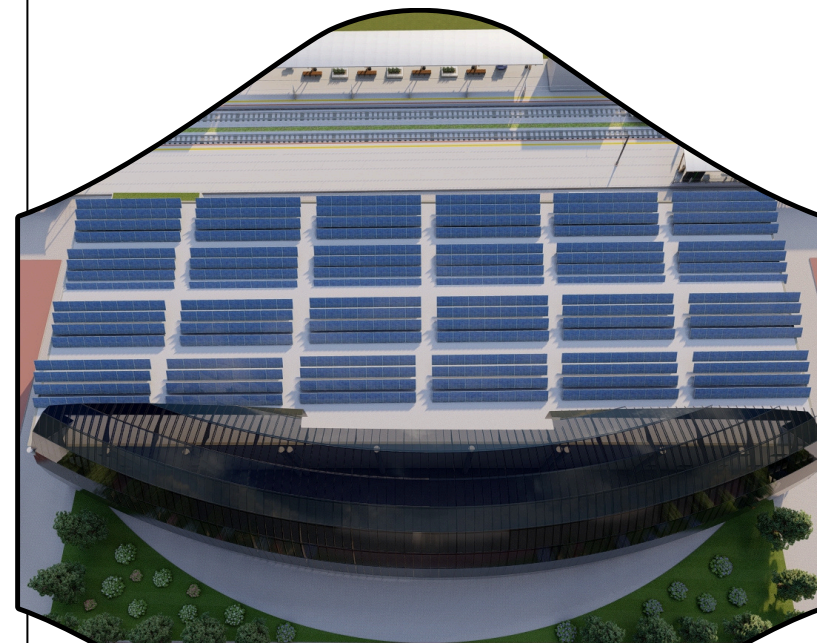
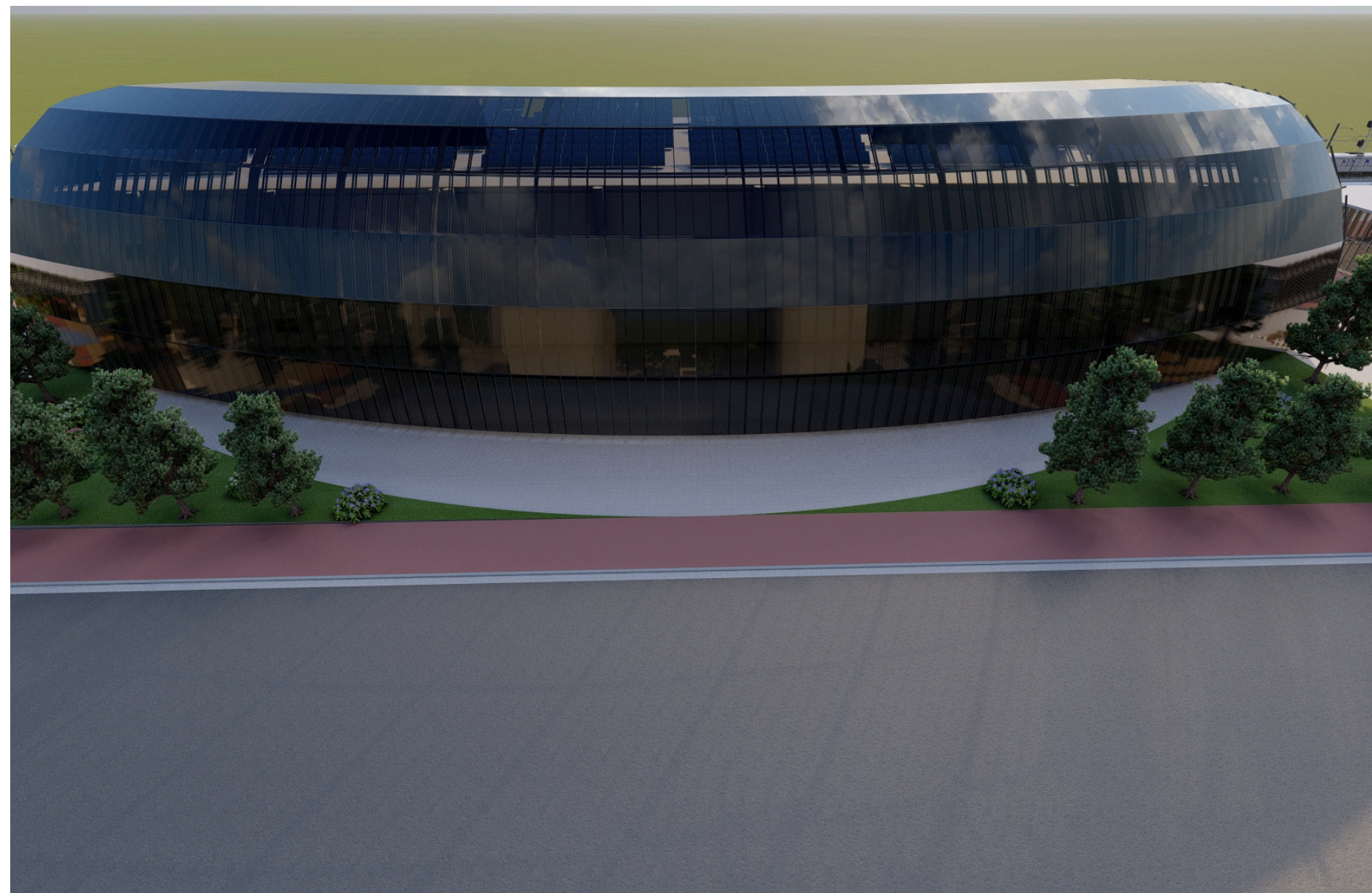


# INTERVENTION SITE





# INTERVENTION SITE



# SURFACE TABLE

program			
Train station			
Ground floor			
space	Surface	Space	surface
Waiting area	90 X 2 = 180 m <sup>2</sup>	Men's restroom	20 X 2 = 40 m <sup>2</sup>
	m <sup>2</sup>	Women's restroom	20 X 2=40m <sup>2</sup>
Lost objects room	m <sup>2</sup>	Women's Prayer Room	13 X 2= 26 m <sup>2</sup>
TICKET OFFICE	90 X 2= 180m <sup>2</sup>	Men's prayer room	13 X 2 = 26 m <sup>2</sup>
Police office	45 m <sup>2</sup>	Secrétaires' office	50 m <sup>2</sup>
Security	35 m <sup>2</sup>	Director's office	75 m <sup>2</sup>
Electrical technical room	53 m <sup>2</sup>	SECURITY AND SOUND SYSTEM	40 X 2=80 m <sup>2</sup>
Air conditioning technical room	53 m <sup>2</sup>	Kiosk	75 X 2 +100 =250m <sup>2</sup>
Heating technical room	60 m <sup>2</sup>		
Shop 01	138 m <sup>2</sup>		
Shop 02	138 m <sup>2</sup>		
Staff restrooms	40 X 2 = 80 m <sup>2</sup>		
First floor			
MEETING ROOM	100 m <sup>2</sup>	CENSUS OFFICE	53 m <sup>2</sup>
GENERAL RESOURCES OFFICE	40 m <sup>2</sup>	PROGRAMMING OFFICE	70 m <sup>2</sup>
MAIN CASH DESK	37 m <sup>2</sup>	Billings OFFICE	84 m <sup>2</sup>
ARCHIVES	40 m <sup>2</sup>	ARCHIVES	40 m <sup>2</sup>
ACCOUNTING OFFICE	35 m <sup>2</sup>	ACCOUNTING OFFICE	53 m <sup>2</sup>
BILLING OFFICE STATION MASTER'S OFFICE	84 m <sup>2</sup>	SMALL CHILDREN'S CARE	100 m <sup>2</sup>
ZONE CHIEF'S OFFICE	48 m <sup>2</sup>	CAFETERIA	190 m <sup>2</sup>
DATA PROCESSING	100 m <sup>2</sup>	Men's restroom	20 X 2 = 40 m <sup>2</sup>
TRANSMISSION OFFICE	60 m <sup>2</sup>	Women's restroom	20 X 2=40m <sup>2</sup>
STATION MASTER'S OFFICE	45 m <sup>2</sup>	Women's Prayer room	13 X 2= 26 m <sup>2</sup>

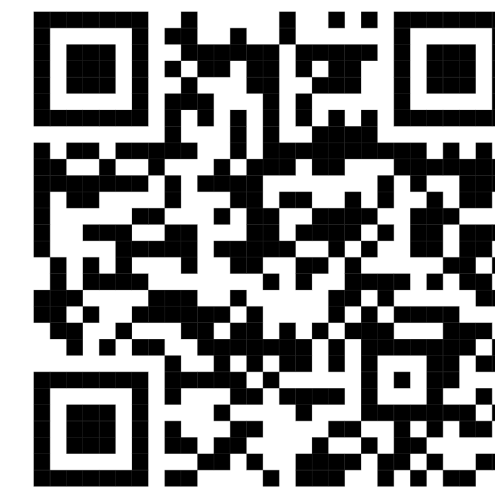
program			
Tramway station			
Ground floor			
space	Surface	Space	surface
TICKET CONTROL	20 m <sup>2</sup>	Electrical technical room	30 m <sup>2</sup>
CAMERA AND SOUND CONTROL	24 m <sup>2</sup>	Air conditioning technical room	32 m <sup>2</sup>
TICKET OFFICE	35 m <sup>2</sup>	Heating technical room	30 m <sup>2</sup>
EMERGENCY SERVICE	25 m <sup>2</sup>	GENERATOR	32 m <sup>2</sup>
POLICE OFFICE	20 m <sup>2</sup>		
Tunnel			
CAMERA AND SOUND CONTROL	30 X 4 = 120 m <sup>2</sup>	Small children care	130 m <sup>2</sup>
Insurence agency	44 m <sup>2</sup>	Reading room	100 m <sup>2</sup>
EMERGENCY SERVICE	30 m <sup>2</sup>	Book store	115 m <sup>2</sup>
POLICE OFFICE	32 X 3 = 96 m <sup>2</sup>	Coworking space	80 m <sup>2</sup>
Postal agency	40 m <sup>2</sup>	Multimedia room	124 m <sup>2</sup>
Banking agency	40 m <sup>2</sup>	Audiovisual room	100 m <sup>2</sup>
Travel agency	44 m <sup>2</sup>	Men's restroom	30 X 3 = 90 m <sup>2</sup>
Electrical technical room	35 m <sup>2</sup>	Women's restroom	30 X 3 = 90 m <sup>2</sup>
Air conditioning technical room	40 m <sup>2</sup>	Women's Prayer room	40 X 3 = 120 m <sup>2</sup>
Heating technical room	40m <sup>2</sup>	Men's prayer room	40 X 3 = 120 m <sup>2</sup>
GENERATOR	35 m <sup>2</sup>	Fast food	103 m <sup>2</sup>
Polyvalent space	105 m <sup>2</sup>	Bowling room	140 m <sup>2</sup>
Mini market	125 m <sup>2</sup>	Gaming room	160 m <sup>2</sup>
Cafeteria	220 m <sup>2</sup>	Boutiques	112 X 5 = 560 m <sup>2</sup>



# CONCLUSION

A transportation plan for Blida, focusing on Bouinan, is vital to improve economic, social, and environmental conditions. Sustainable transport solutions and bioclimatic architecture aim to reduce energy consumption and enhance occupant comfort. The study identified problems and proposed solutions, including a multimodal hub to reduce car usage and save resources. Key elements for sustainable transport design were discussed, emphasizing location, functional design, and formal organization. The research offers practical and theoretical recommendations for sustainable development, including energy-saving strategies like photovoltaic panels. Integration of insulation and passive and active energy strategies can enhance thermal comfort, presenting opportunities for future research in energy management and sustainable mobility.

**for mor details**



check the QR code

2023-2024