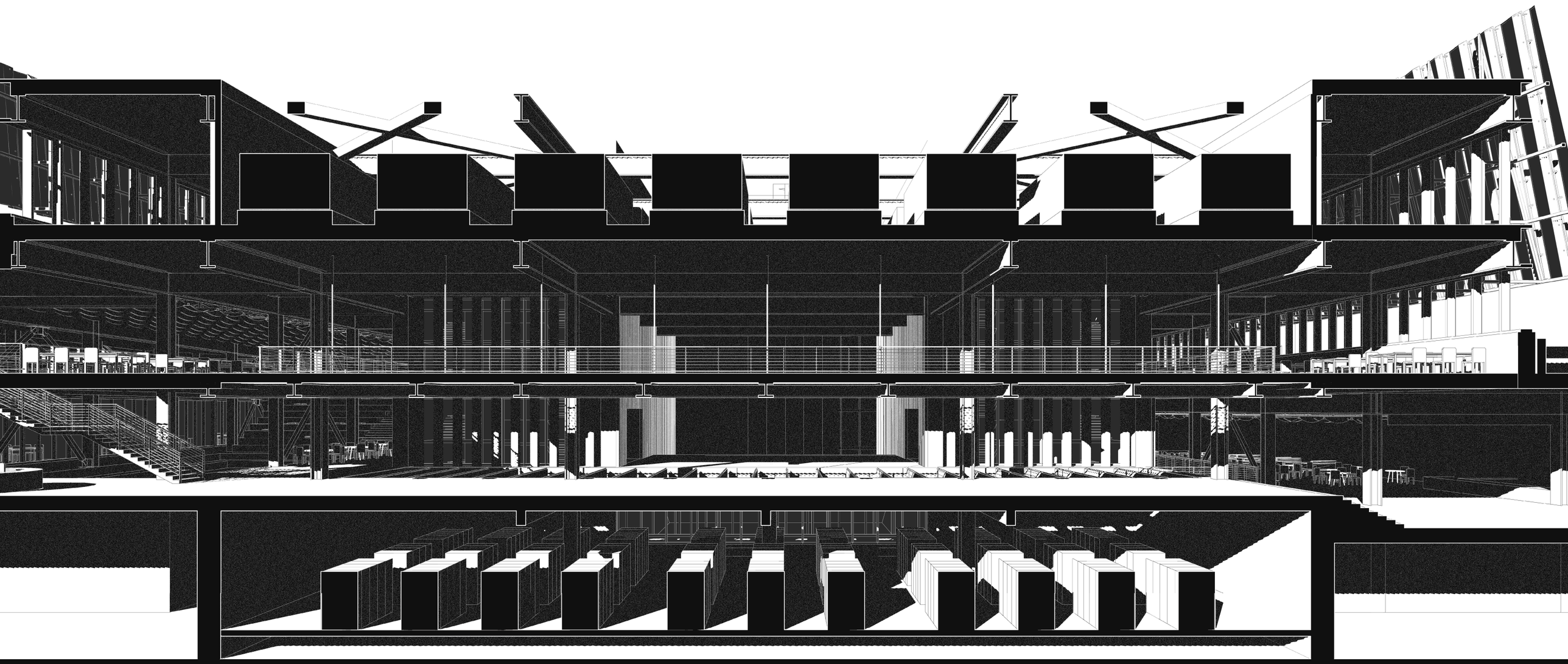
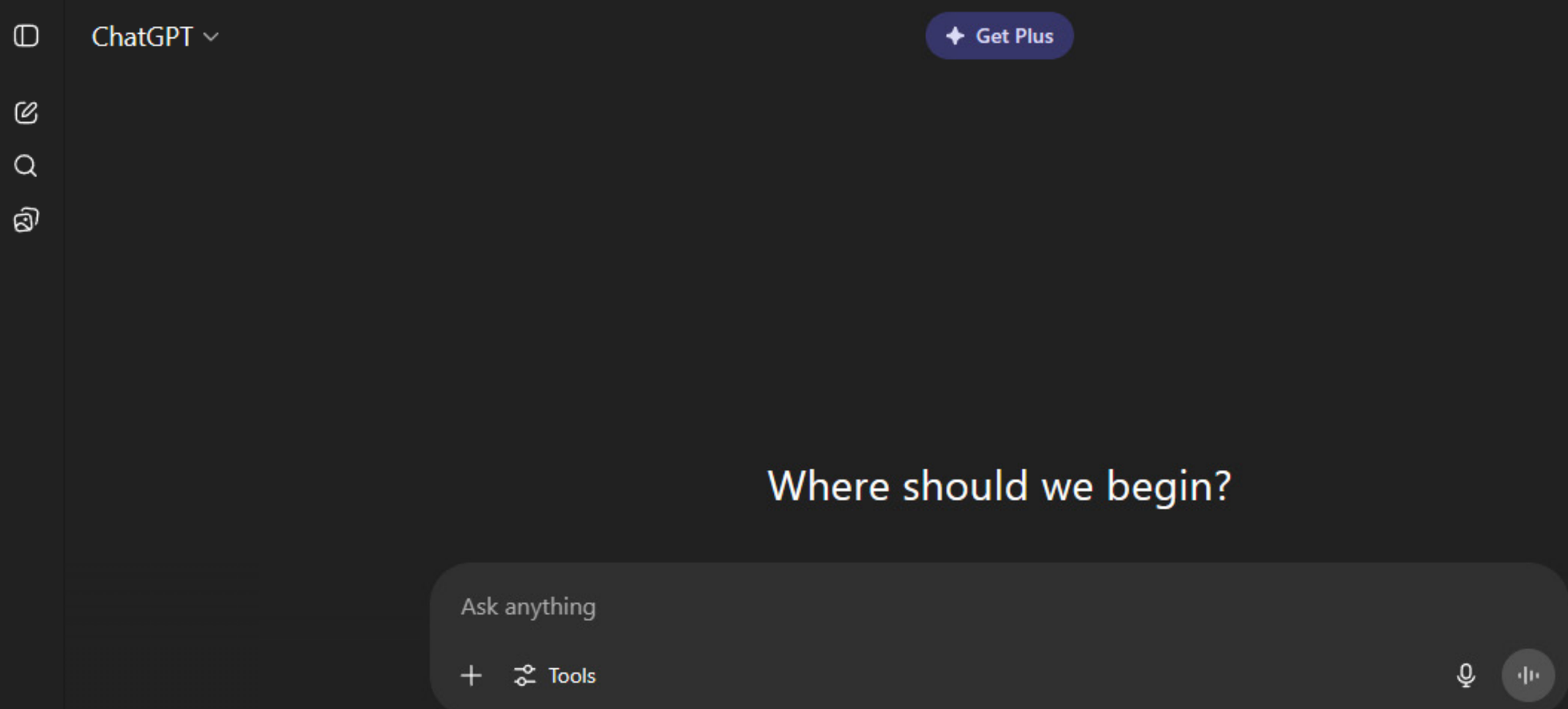
P5 Presentation
2/7/2025



BEYOND THE BLACK BOXES

Cultivating Commons from Madrid's Digital Shadows

Tsz Kwan Kelvin Chan
Architectural Design Crossovers
MSc Graduation Studio: Heterogeneous City - Madrid



Fascination

Do you know how much energy is consumed for each word you ask ChatGPT?

Saying 'Please' and 'Thank You' to ChatGPT Costs OpenAI 'Tens of Millions of Dollars'

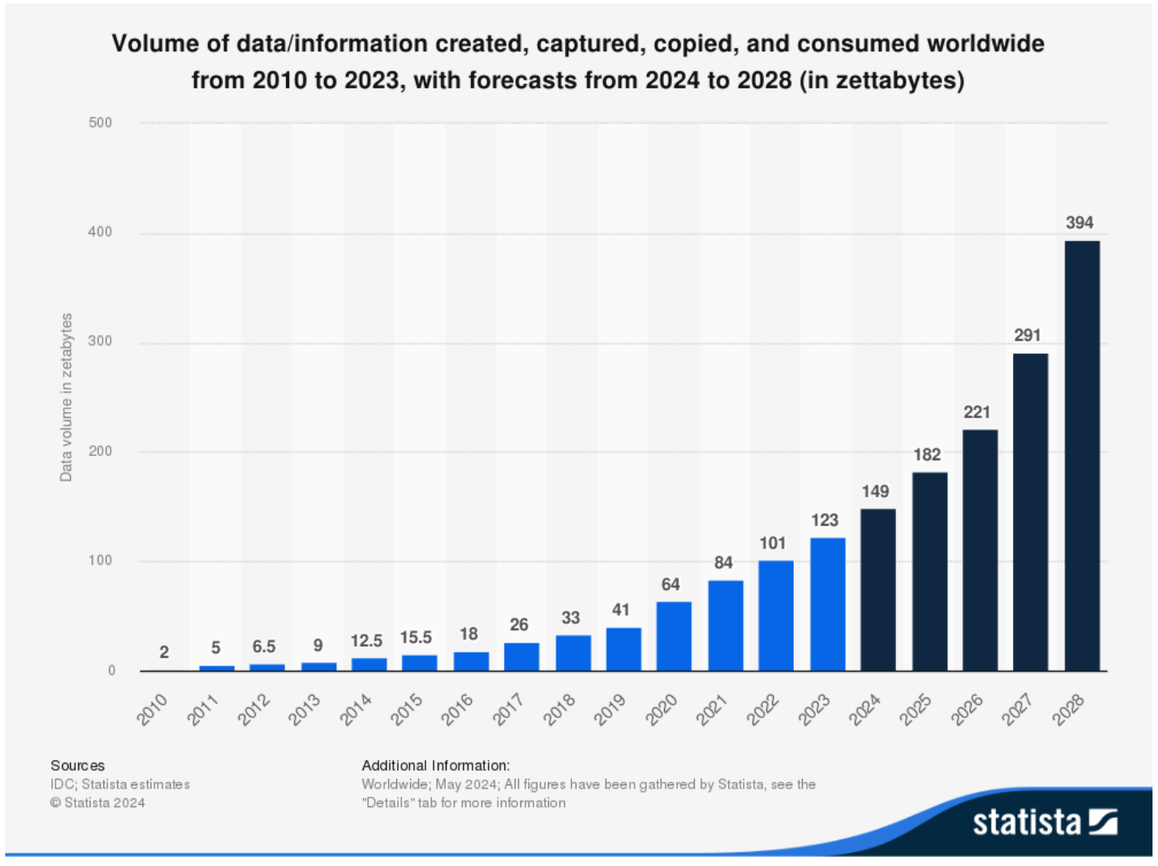
It's more environmentally friendly (and cost-efficient) to skip the niceties.

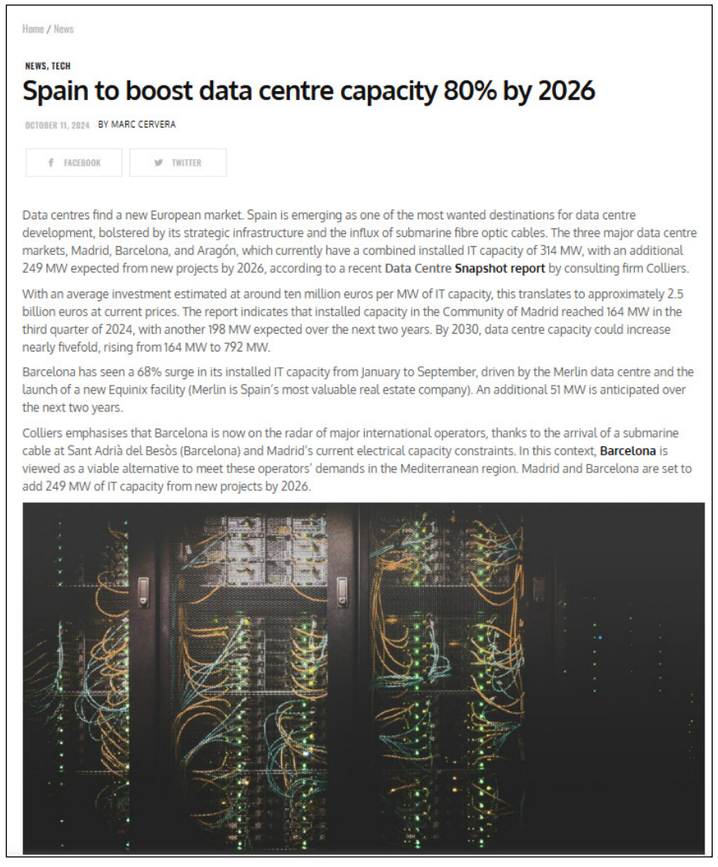
BY SHERIN SHIBU EDITED BY MELISSA MALAMUT APR 21, 2025

Share

Key Takeaways

- OpenAI CEO Sam Altman says that the company spends tens of millions of dollars on electricity costs because people say “please” and “thank you” to ChatGPT.
- Most people who use AI in the U.S. report being polite to it.
- Sending a query through ChatGPT requires 10 times more energy than running a standard Google search.





Home / News

NEWS, TECH

Spain to boost data centre capacity 80% by 2026

OCTOBER 11, 2024 BY MARC CERVERA

FACEBOOK TWITTER

Data centres find a new European market. Spain is emerging as one of the most wanted destinations for data centre development, bolstered by its strategic infrastructure and the influx of submarine fibre optic cables. The three major data centre markets, Madrid, Barcelona, and Aragón, which currently have a combined installed IT capacity of 314 MW, with an additional 249 MW expected from new projects by 2026, according to a recent **Data Centre Snapshot report** by consulting firm Colliers.

With an average investment estimated at around ten million euros per MW of IT capacity, this translates to approximately 2.5 billion euros at current prices. The report indicates that installed capacity in the Community of Madrid reached 164 MW in the third quarter of 2024, with another 198 MW expected over the next two years. By 2030, data centre capacity could increase nearly fivefold, rising from 164 MW to 792 MW.

Barcelona has seen a 68% surge in its installed IT capacity from January to September, driven by the Merlin data centre and the launch of a new Equinix facility (Merlin is Spain's most valuable real estate company). An additional 51 MW is anticipated over the next two years.

Colliers emphasises that Barcelona is now on the radar of major international operators, thanks to the arrival of a submarine cable at Sant Adrià del Besòs (Barcelona) and Madrid's current electrical capacity constraints. In this context, **Barcelona** is viewed as a viable alternative to meet these operators' demands in the Mediterranean region. Madrid and Barcelona are set to add 249 MW of IT capacity from new projects by 2026.

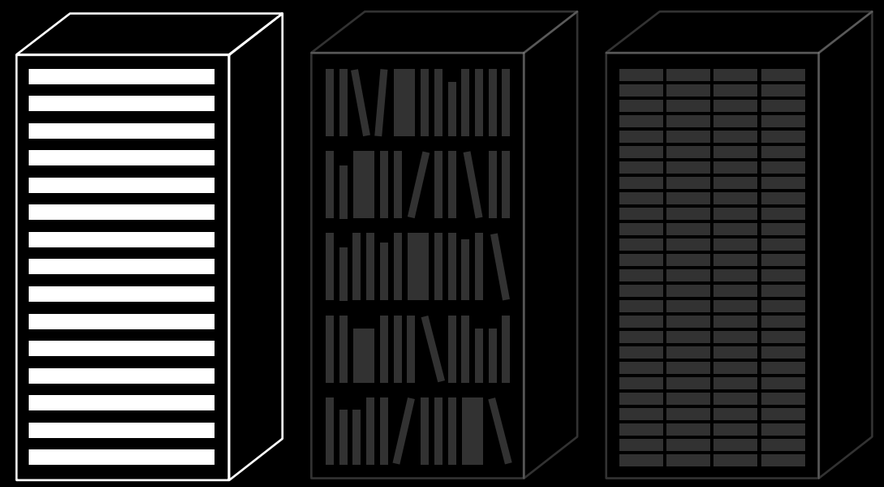
FASCINATION

Data center demands are growing exponentially.

ARCHITECTURAL DESIGN CROSSOVER

Research

The Three hidden Boxes



Data Center

Subestación de La Mudarra (Wind Farm)

SSubestación eléctrica de Grijota (Wind Farm)

Parque Eólico de Maranchón (Wind)
208 MW

El Pardo Reservoir

Polígono Industrial Valportillo

13889.1m

System of Data Center

Data Center
- Data Center
- Industrial Zone

Water Related
- Reservoir
- Water
- Green Park (Pond Harvesting System)
- Forest
- Waterway

Rainwater Storage
- 36 Rainwater Tanks

Power Related
- Electrical Substation
- Above Head Power Line
- Underground Power Line

Building
- Buildings
- Distance

7657m

Plaza de Colon

Plaza Mayor

Polígono Industrial Julián Camarillo

Central Nuclear de Trillo (Nuclear)
1003 MW

Central hidroeléctrica de Azután (Hydroelectric)
200 MW

Aceca Power Plant (Combustion)
759 MW

Planta Solar Fotovoltaica Solaria-Añover I (Photovoltaic) 759 MW

Parque Eólico La Plata(Wind)
21.25 MW


MERLIN | edged

“We are constructing an architecture without people. This is not a ‘posthuman’ condition… they are more accurately extra-human in that they are outside us, totally indifferent to us, where we are no longer part of the equation at all.”

Young, 2019.

City's Periphery



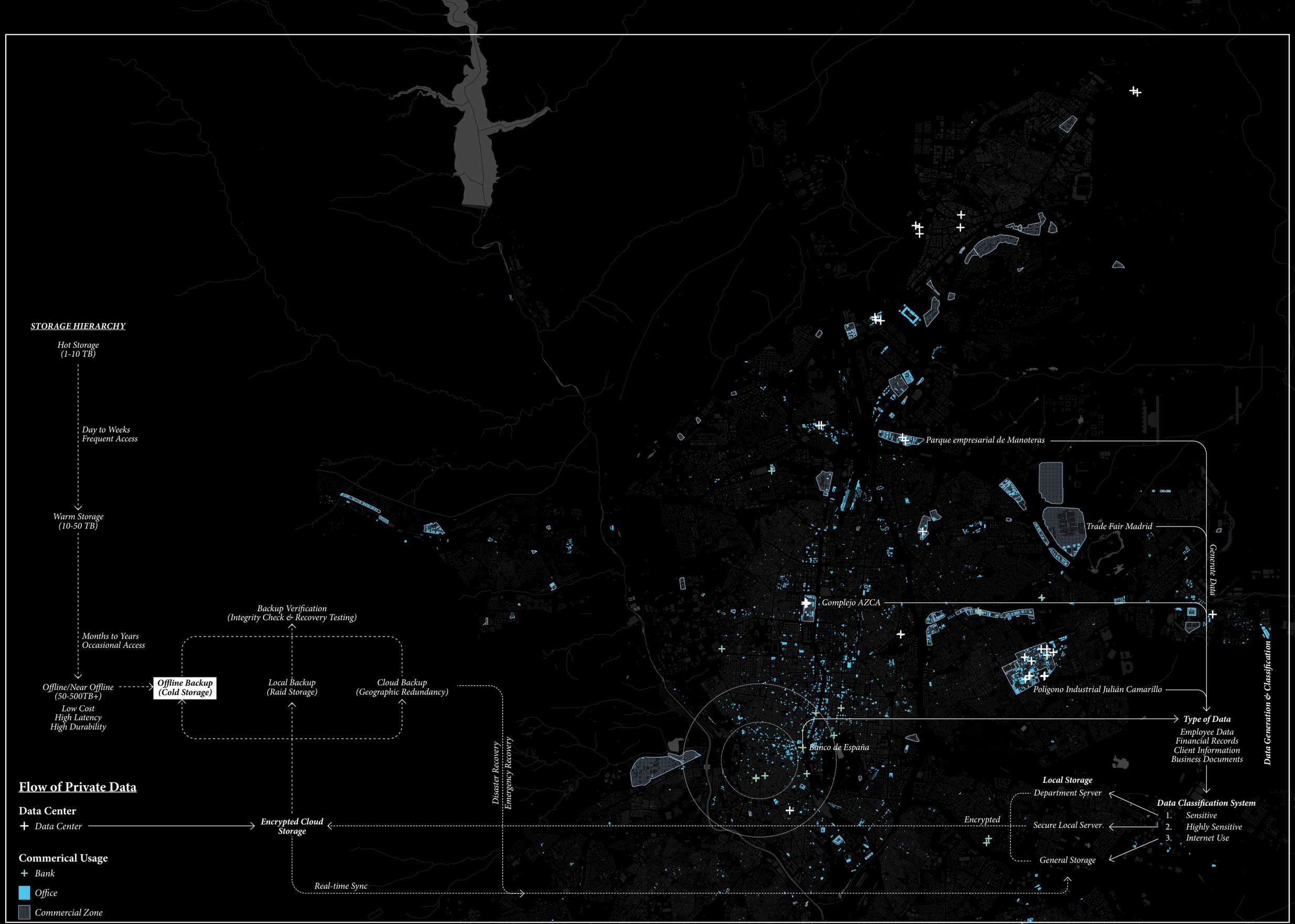
Digital Infrastructure

What's the connection between them?

City's Center



Citizens


STORAGE HIERARCHY
Hot Storage
(1-10 TB)
Day to Weeks
Frequent Access
Warm Storage
(10-50 TB)
Months to Years
Occasional Access
Offline/Near Offline
(50-500TB+)
Low Cost
High Latency
High Durability
Offline Backup
(Cold Storage)
Backup Verification
(Integrity Check & Recovery Testing)
Local Backup
(Raid Storage)
Cloud Backup
(Geographic Redundancy)
Disaster Recovery
Emergency Recovery
Flow of Private Data
Data Center
Data Center
Encrypted Cloud
Storage
Commerical Usage
Bank
Office
Commercial Zone
Real-time Sync
Parque empresarial de Manoteras
Trade Fair Madrid
Generate Data
Complejo AZCA
Polígono Industrial Julián Camarillo
Banco de España
Type of Data
Employee Data
Financial Records
Client Information
Business Documents
Data Generation & Classification
Local Storage
Department Server
Encrypted
Secure Local Server.
General Storage
Data Classification System
1. Sensitive
2. Highly Sensitive
3. Internet Use

Offsite Backup

Emergency & Disaster Recovery

Digital Presearvation

Metadata Mangement

Post-Processing

Quality Control

Scanning/Photography

Equipment Setup & Calibration

Pre-Digitization Prep

Selection for Digitization

DIGITALIZATION PROCESS

Autonomous University of Madrid

Public Access Interface

1. Academic Research
2. Government Agencies
3. Legal Professionals
4. Genealogists
5. Cultural Institutions

Universidad Politécnica de Madrid

Archivo Histórico Nacional

Archivo General de Palacio

Archivo Regional de la Comunidad de Madrid

Storage in Climate-Controlled Environment

Physical Organization

Conservation Treatment

Good Condition

Conservation Check

Initial Assessment

Receive Materials

PHYSICAL ARCHIVE MANAGEMENT

Flow of Pulic Data

5 km Radius

Traditional Repository

Public Library (Public)

Musuem (Semi-Public)

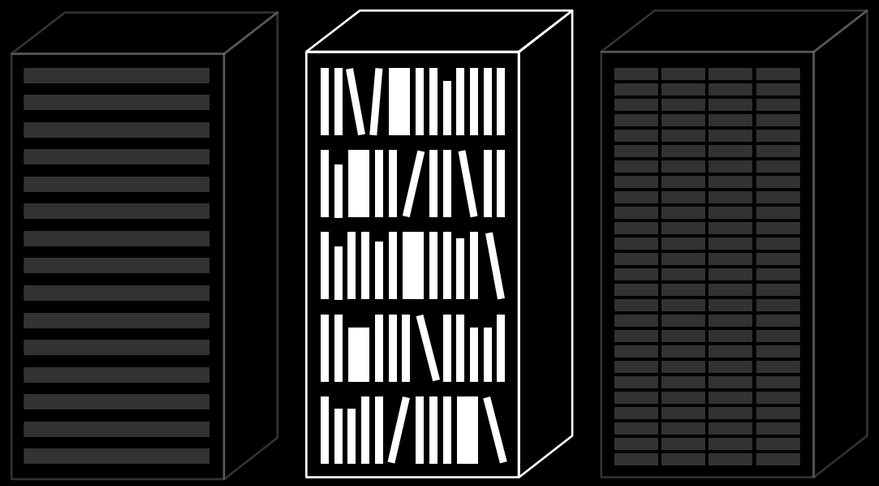
Archive (Semi-Private)

Digital Storage

Data Center

Knowledge Production

University



City Archive


Madrid se bebe
VIAJE
CON NOSOTROS



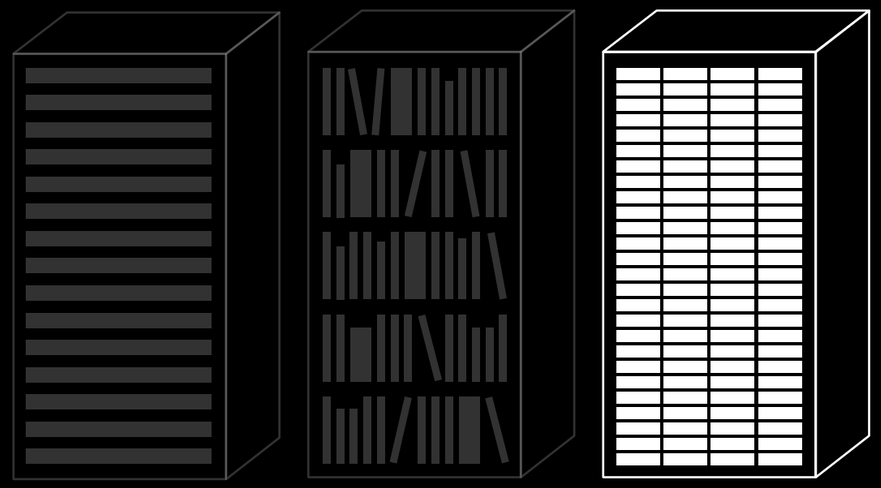

VIAJE
CON NOSOTROS
Salón de actos
Sala de exposiciones


SALIDAS

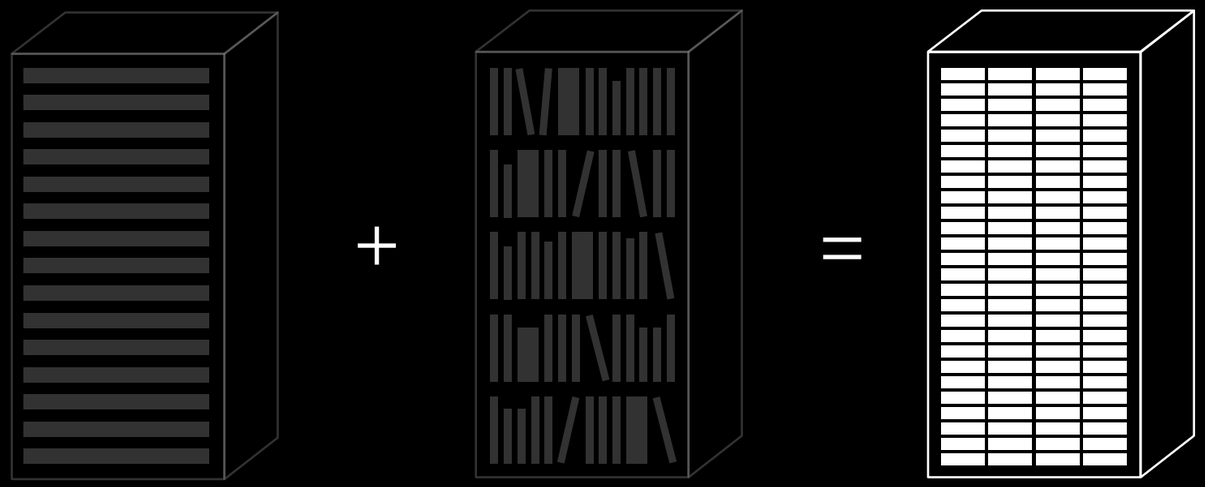
"...Maurice Halbwachs' On Collective Memory, where he described all those things handed down by tradition – languages, rituals, myths, songs, monuments, institutions – as the material frameworks through which collective memory and collective self-images assert themselves."

Ina Blom's "Rethinking Social Memory"

How do we open up those closed stack archive?



Digital Archive



Digital Archive / Library

Español | English

BIBLIOTECA DIGITAL

EL PORTAL DEL LECTOR

Home | Search | Collections | Serials | Libraries | Users | Full text search

You are: Home



- **Collective Catalogue of Bibliographic Heritage of Madrid**
- **Archives and documentary holdings in the Regional Library**
- Regional Library Treasures
- Virtual Exhibitions
- **PublicaMadrid**

The Digital Library of Madrid offers a rich collection of unique works, which make up the bibliographic heritage of the Community of Madrid, for the knowledge and enjoyment of everyone.

In this space there are digitized manuscripts, printed matter, periodical publications, maps, posters, drawings and the most diverse bibliographic collections. The majority are royalty-free works with a broad chronology, from the 15th century to the 20th century, on the most diverse topics, including classical literature, scientific literature, travel books, music, etc. and with special dedication to Madrid themes.

It brings together bibliographic resources / collections kept in heritage libraries such as the Regional Library of Madrid, and from historical institutions of the Community of Madrid such as the Royal Spanish Academy, the Lázaro Galdiano Foundation, the Royal Academy of History, the Spanish University Foundation or the Institute Cardinal Cisneros. It also offers access to the search in the Collective Catalogue of Bibliographic Heritage of Madrid, in which more than 70 libraries of different institutions in Madrid integrate their heritage collections.

The Digital Library provides easy and unrestricted Access to curious, rare, delicate and valuable pieces through the online consultation or downloading of these materials.

It allows you to search by title, author, phrase in quotes or explore outstanding collections, works in different formats and themes, with special attention to those whose content or origin is from Madrid.

Applications developers to have an artificial intelligence system that is expert in understanding and writing the Spanish language

28 July 2021

The model has been created at the Barcelona Supercomputing Center (BSC) and has been trained on the MareNostrum supercomputer with data files from the Biblioteca Nacional de España (BNE).



The project has been financed with funds from the Language Technologies Plan of the Ministry of Economic Affairs and Digital Agenda and the Future Computing Center, an initiative of the BSC and IBM.

MarIA, which is the name of the system, is available at no cost so that any developer, company or entity can use it at no cost. Its possible applications range from language correctors or predictors, to automatic summarization applications, chatbots, smart searches, translation engines and automatic subtitling, among others. These are the WARC resulting from the tracking and archiving of the Spanish website, which the BNE keeps, by virtue of the legal deposit law, as documentary heritage. The BSC has been able to use them to train the system thanks to the participation of both institutions in the Language Technologies Plan.

“with digital technologies, nothing
is stored but code: the mere potential for generating an image of a certain material composite again and again by means of numerical constellations”

Ina Blom, “Rethinking Social Memory”

Stable Stored objects



DE-ARCHIVING

&

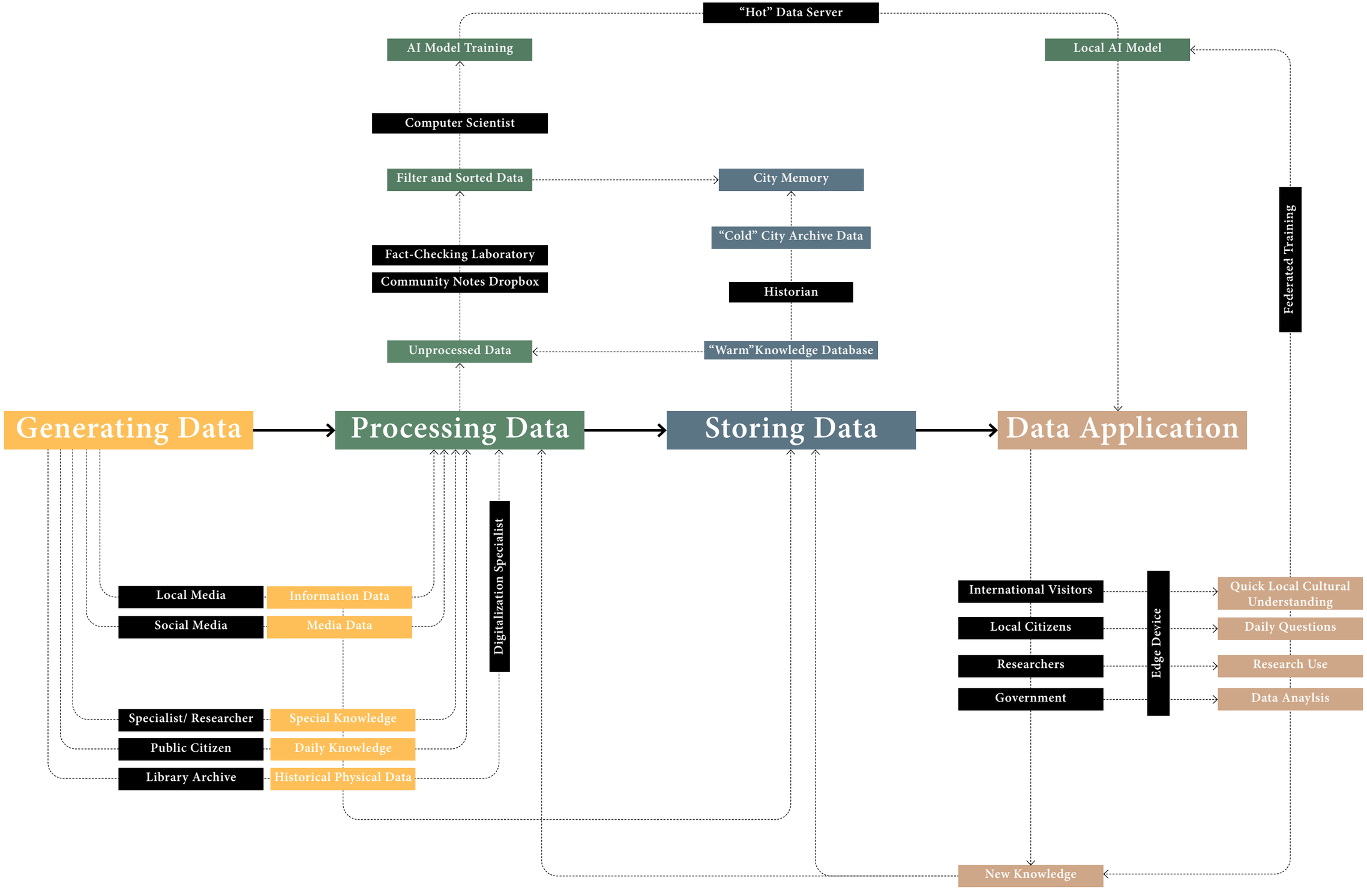
RE-ARCHIVING



New form of Knowledge, Memories, or even Culture

“The archive, which is ‘traditionally that which arrests time, which stops all motion, [instead] is set in motion in the age of digitization”

David Berry’s “Post-Archival Constellation”



FLOW OF DATA

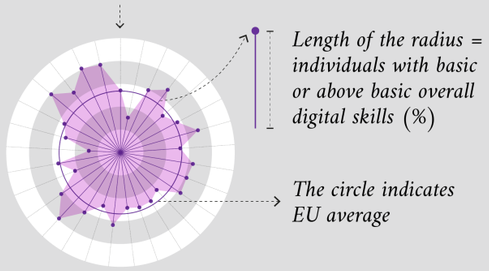
Digitalization required different digital skills.

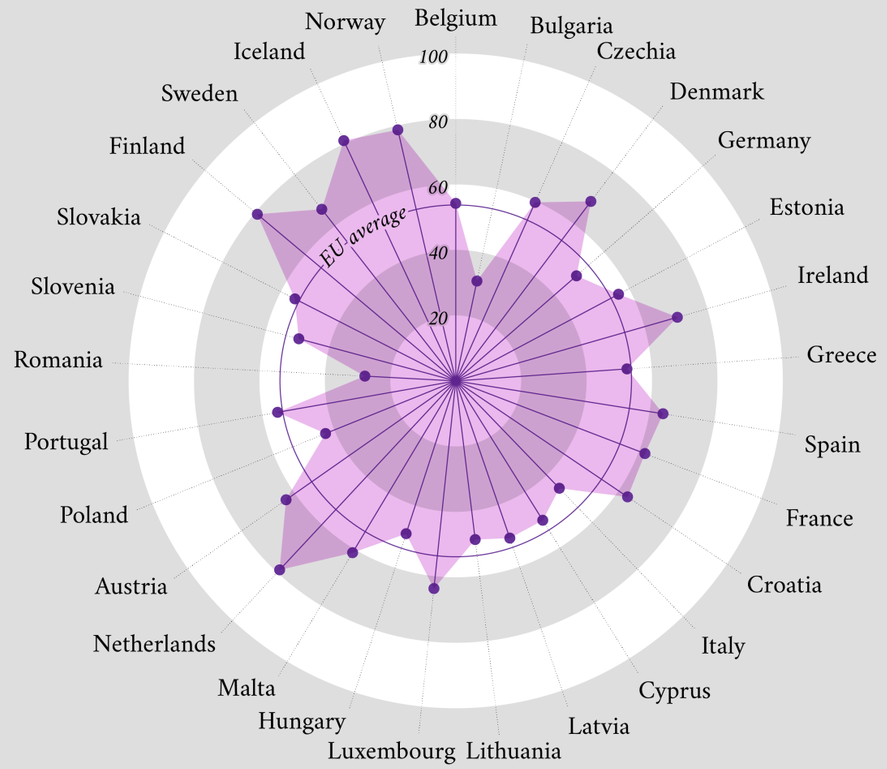
ARCHITECTURAL DESIGN CROSSOVER

INDIVIDUALS WITH BASIC OR ABOVE BASIC OVERALL DIGITAL SKILLS BY COUNTRY, 2021

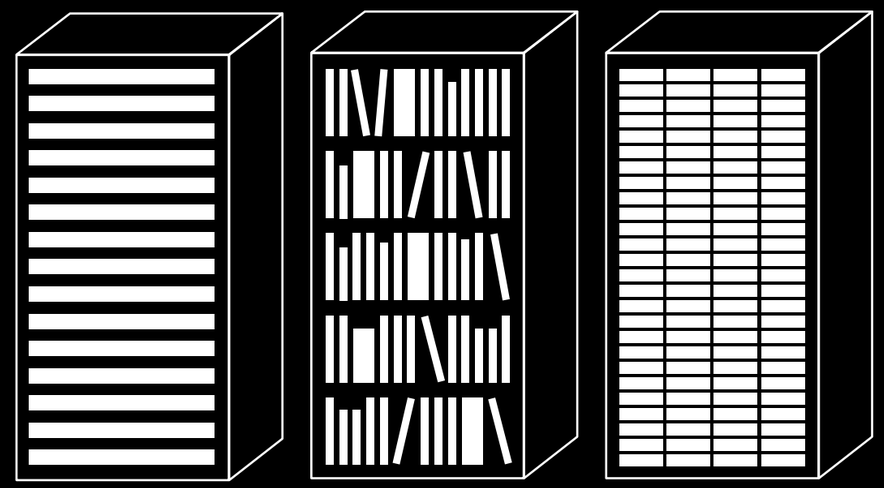
LEGEND

Each radius is a country





Source: Eurostat.

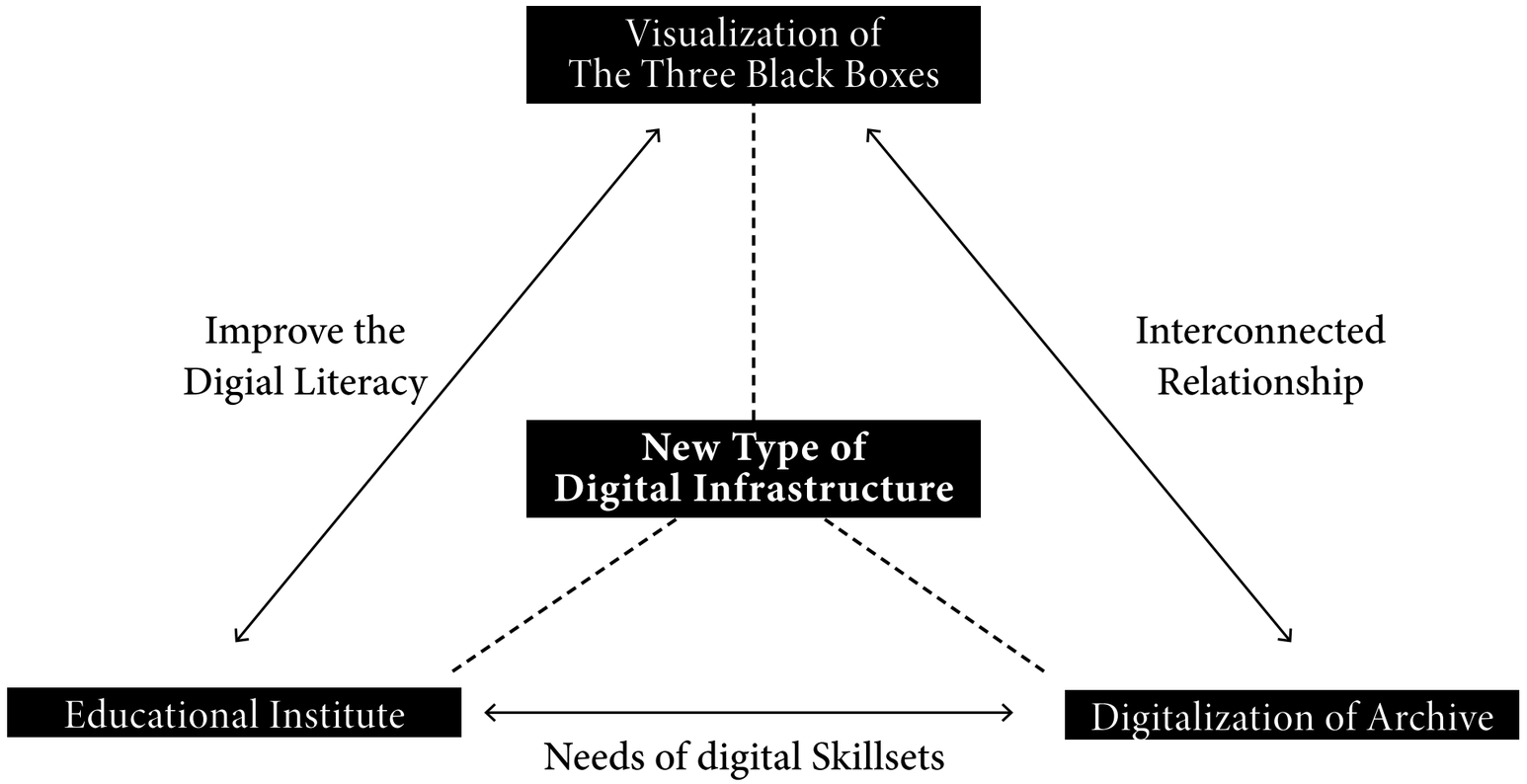


Data Center *City Archive* *Digital Archive*

*What if Madrid's **archive** were reimagined to **incorporate digital infrastructure** and **promote public digital literacy**?*



1. WHAT IF knowledge centers like libraries integrated transparent data processing facilities to transform from information repositories to digital literacy classrooms?
2. HOW can existing civic venues adapt their spatial organization to reveal digital processes that citizens interact with daily?
3. WHICH architectural elements in community centers could be redesigned to demonstrate data flows and enhance visitor digital literacy?
4. WHERE should digital literacy interventions be positioned within cultural institutions to maximize public engagement and learning?
5. HOW might the thermal and energy systems of public buildings be revealed to educate citizens about the material reality of digital infrastructure?

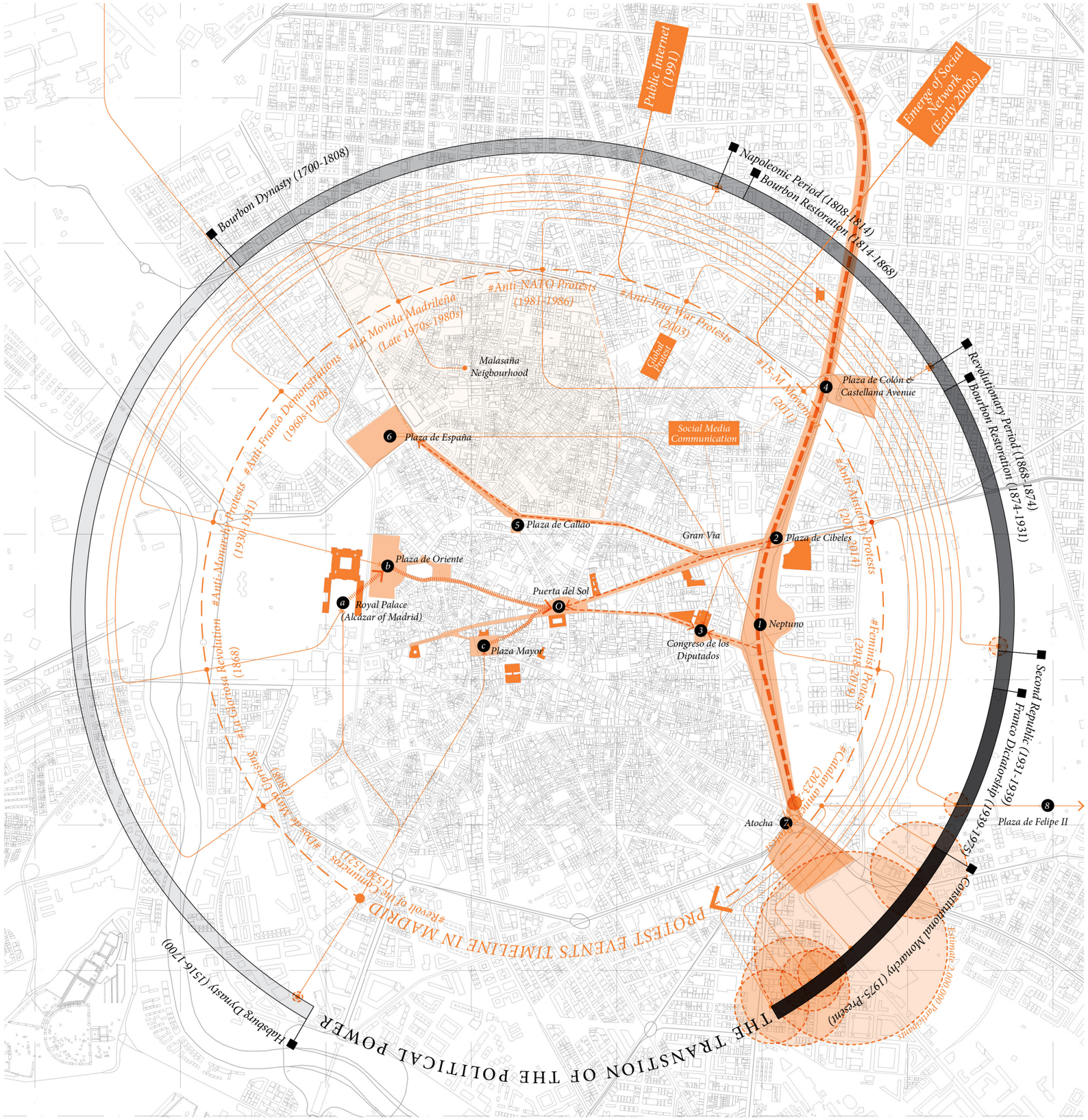

Visualization of
The Three Black Boxes
Improve the
Digial Literacy
Interconnected
Relationship
New Type of
Digital Infrastructure
Educational Institute
Digitalization of Archive
Needs of digital Skillsets

“Archives are never neutral. They are dynamic spaces of knowledge and power, never passive, always active.”

Eivind Røssaak’s chapter on “FileLife”

Site Investigation

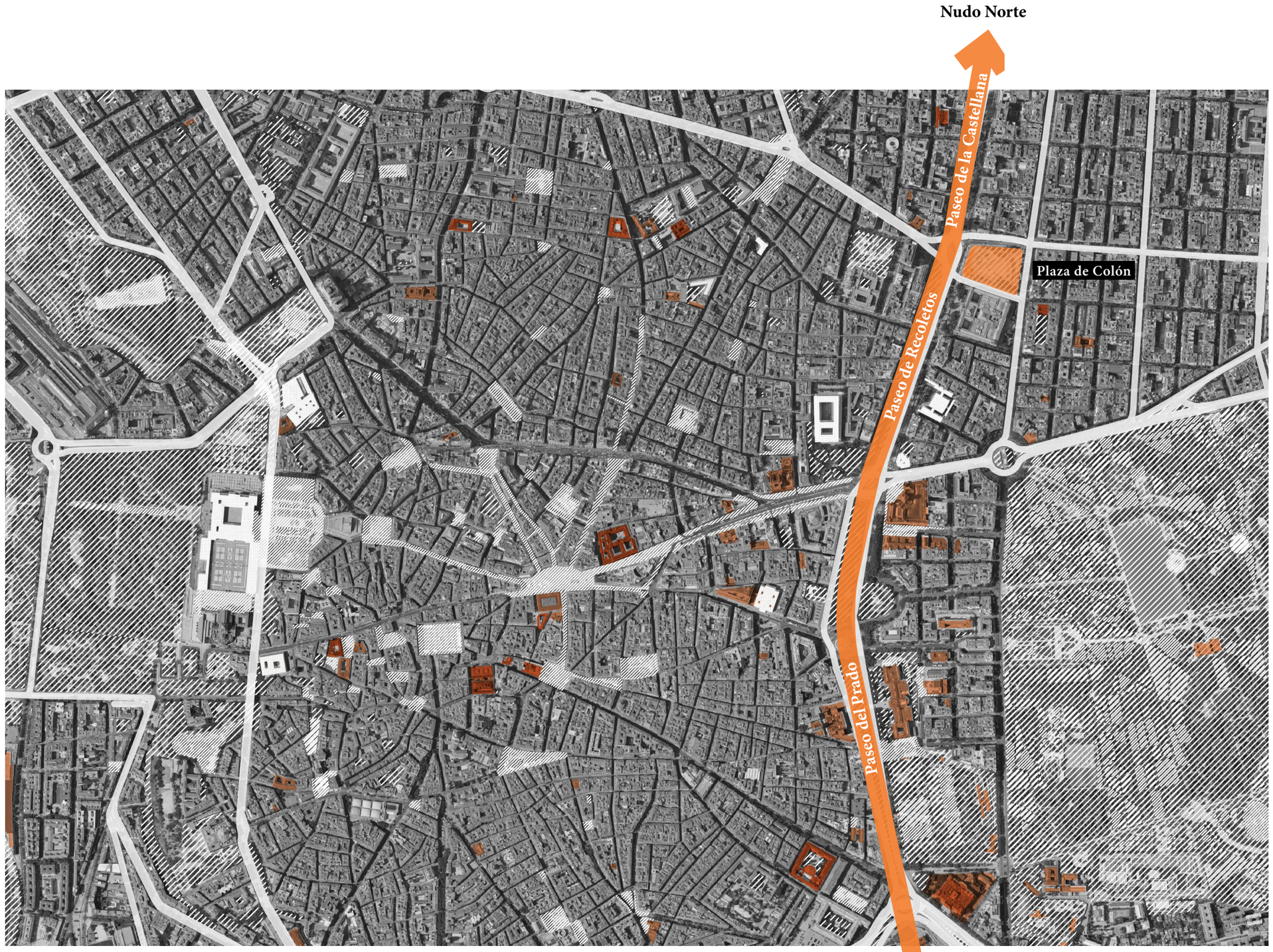
1. *Polígono Industrial de Alcobendas*
2. *Polígono Industrial Julián Camarillo*
3. *Royal Palace of Madrid*
4. *Parque de El Retiro*
5. *Parque Norte-Carmen Tagle*
6. *Parque Enrique Tierno Galván*



HISTORICAL MAPPING

Mapping of Demostration Sites

ARCHITECTURAL DESIGN CROSSOVER


Nudo Norte
Paseo de la Castellana
Plaza de Colón
Paseo de Recoletos
Paseo del Prado



Overall image of the Site



Royal Mint, 1861
https://www.enumismatic.com/mints-history/madrid/es/la-ceca-de-madrid

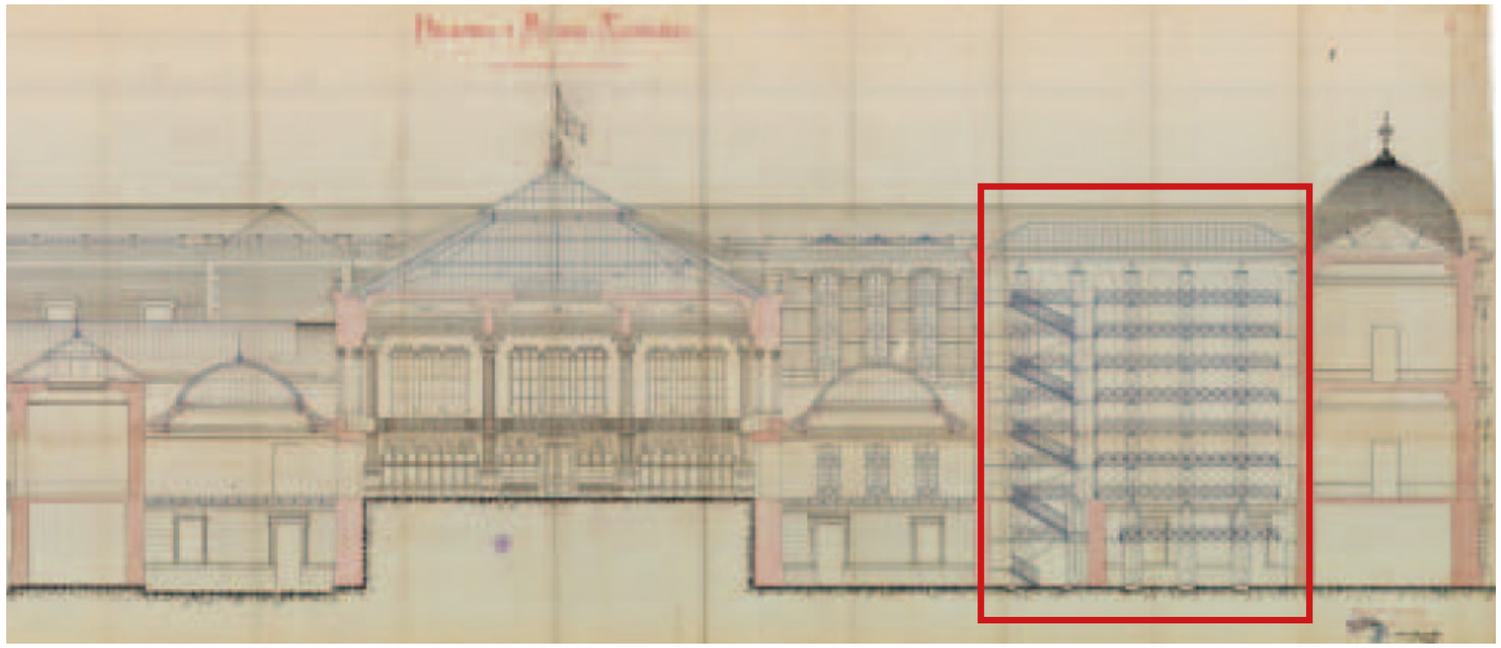




HISTORICAL ANALYSIS

Biblioteca Nacional de España, 1711 & National Archaeological Museum, 1962

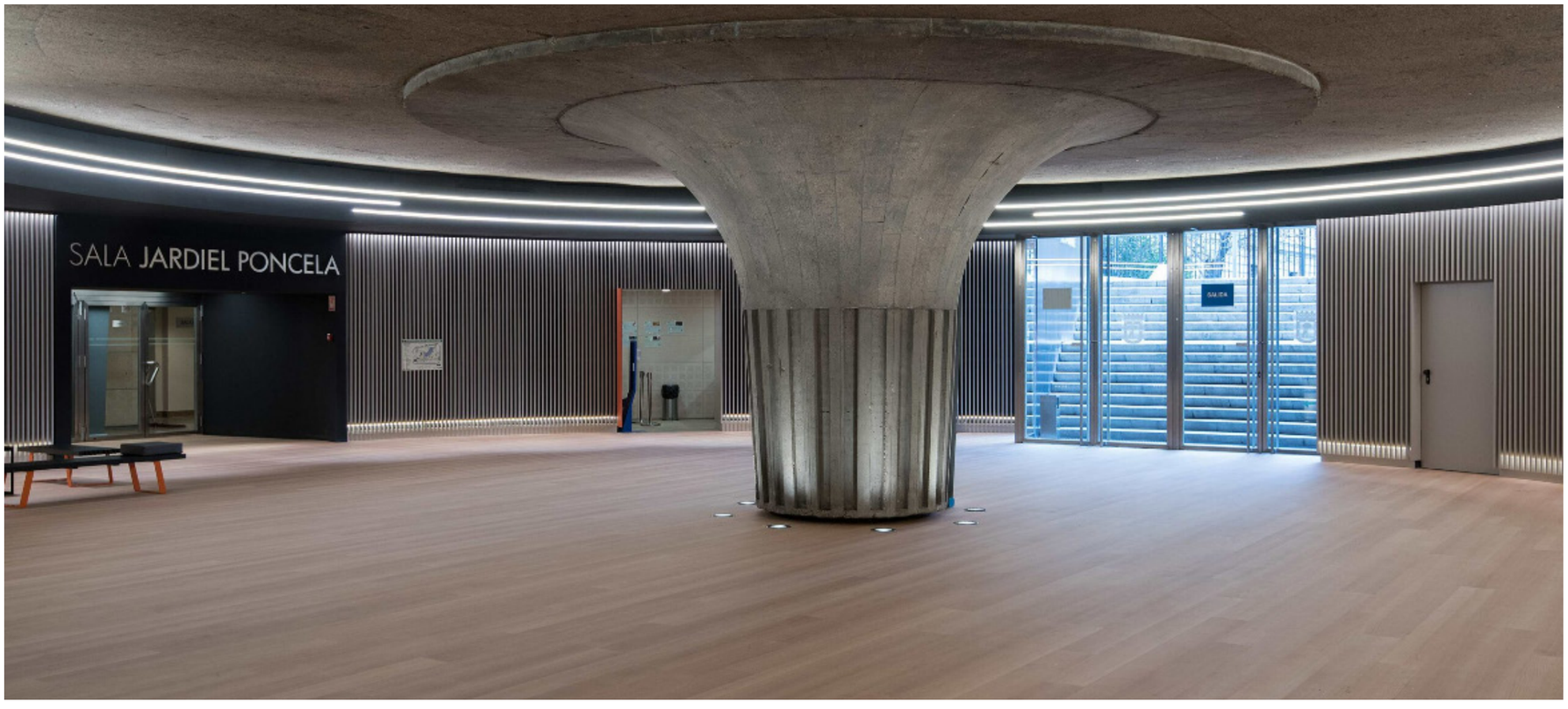
ARCHITECTURAL DESIGN CROSSOVER









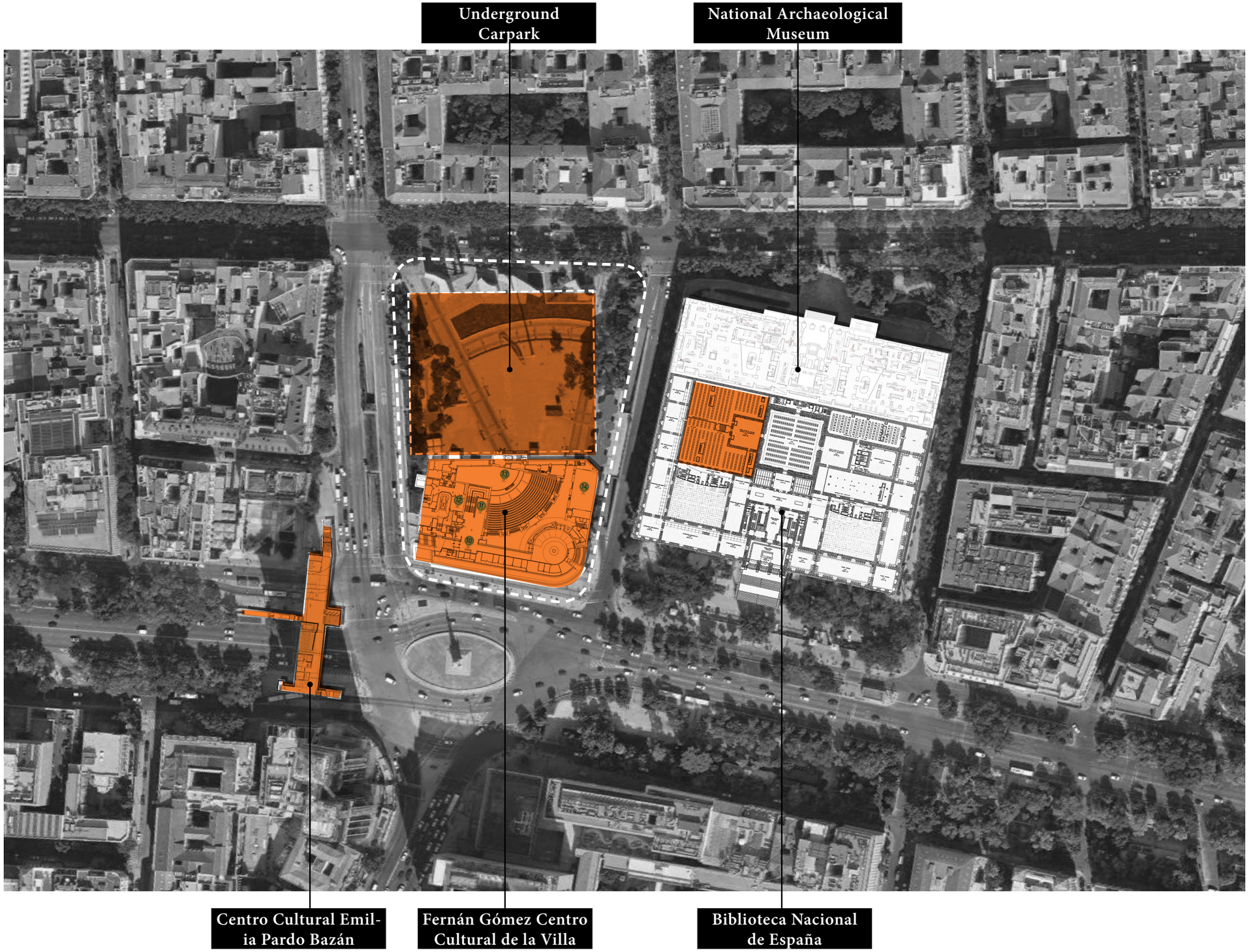


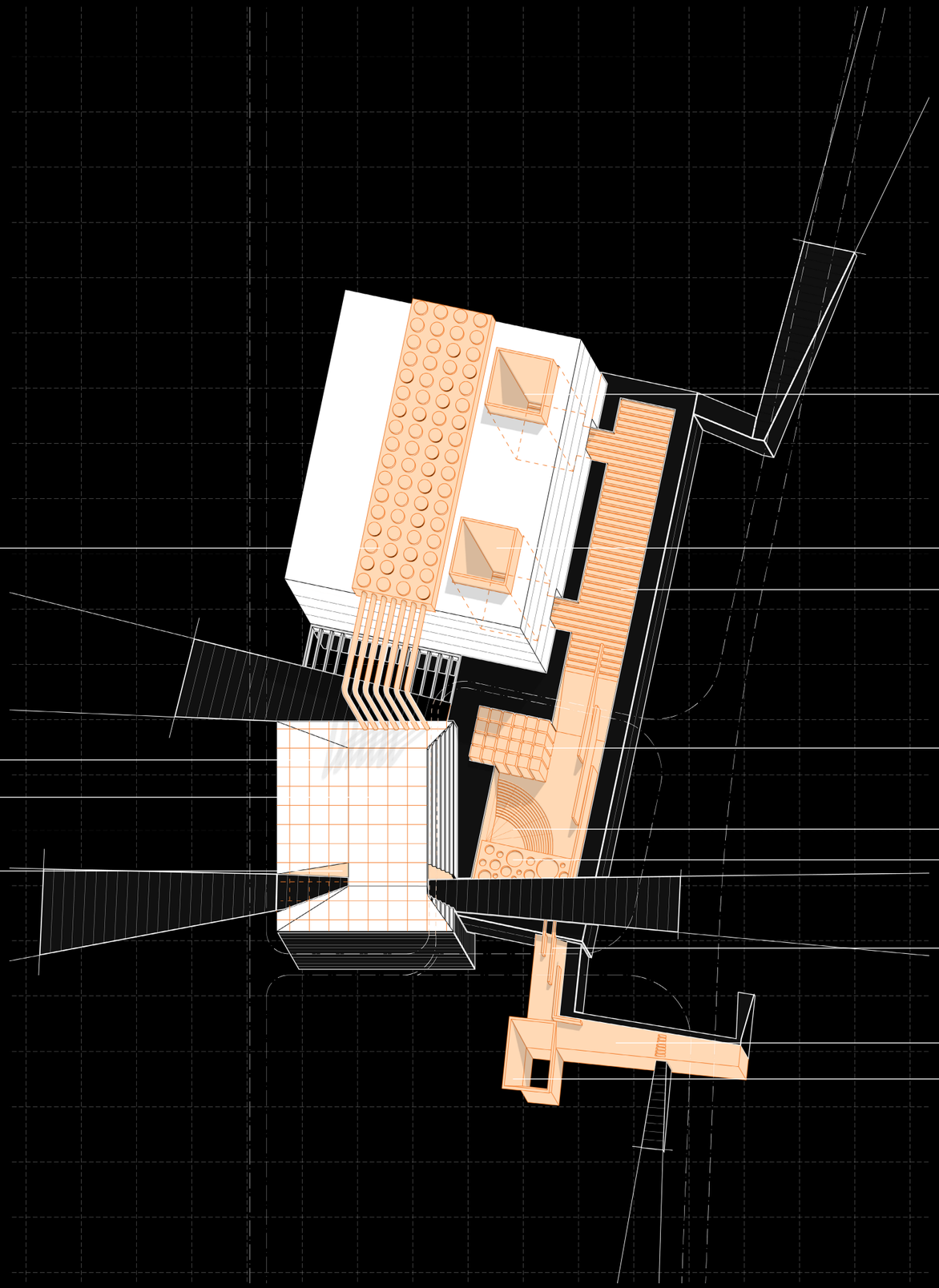
Fernán Gómez Centro Cultural de la Villa, 1970

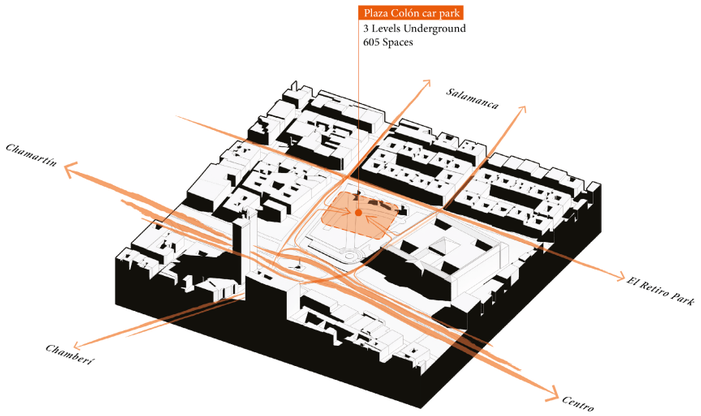




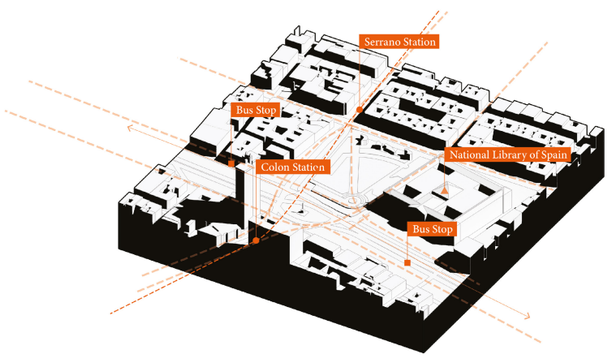
Centro Cultural Emilia Pardo Bazán, 2022


Underground Carpark
National Archaeological Museum
Centro Cultural Emilia Pardo Bazán
Fernán Gómez Centro Cultural de la Villa
Biblioteca Nacional de España


Greenery Couryard (Greenhouse)
Data Center
Bookstore & Cafe
Open frontyard
Public Plaza
Data Center
Discussion Room
Theater for Speeches
Mediation Suites
Windows to Look into the Data Center
Inforamtion Display Wall
Classroom
Media Literacy Center with a welcoming entry

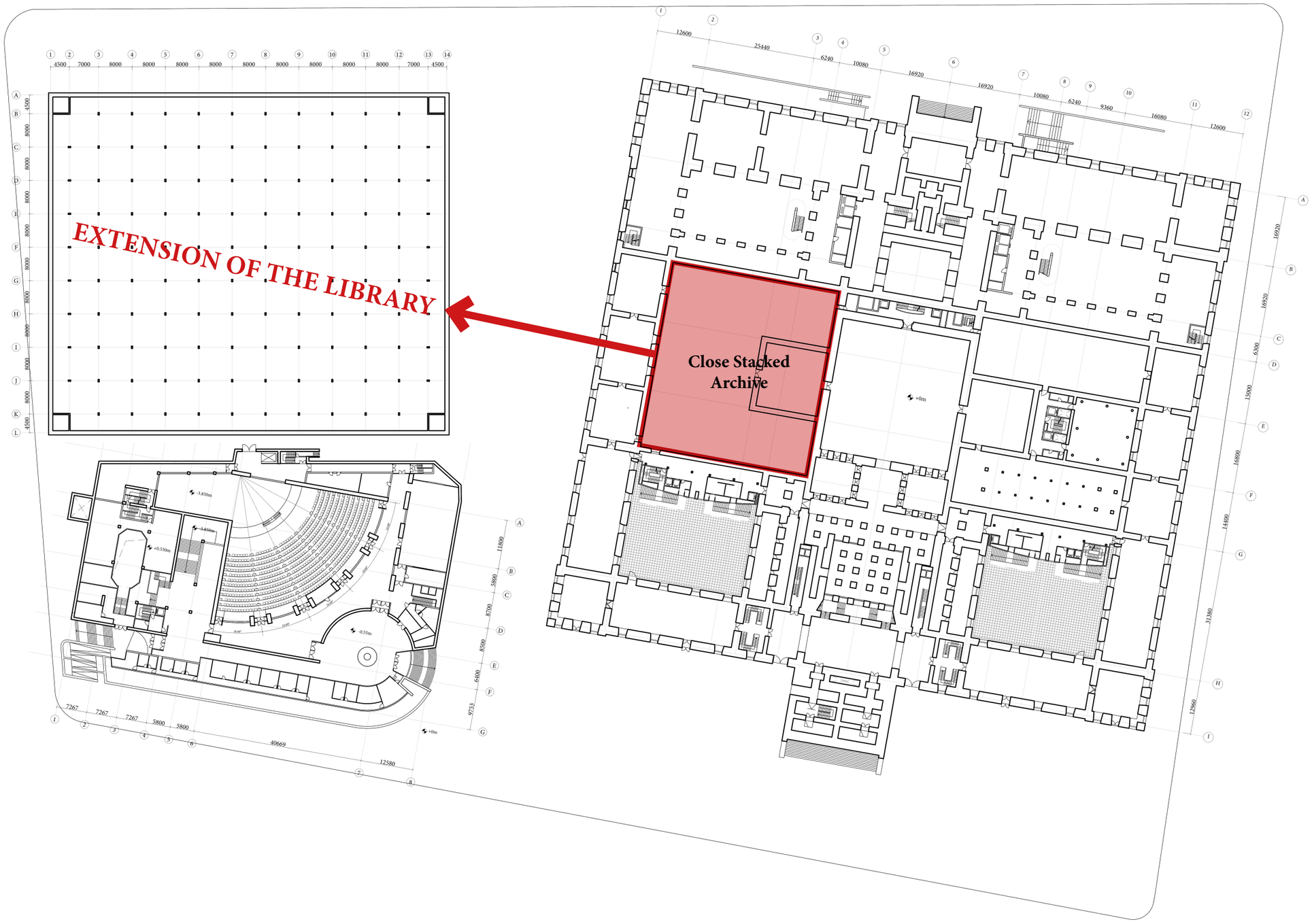


Traffic access to the Site



Pedestrian access to the Site



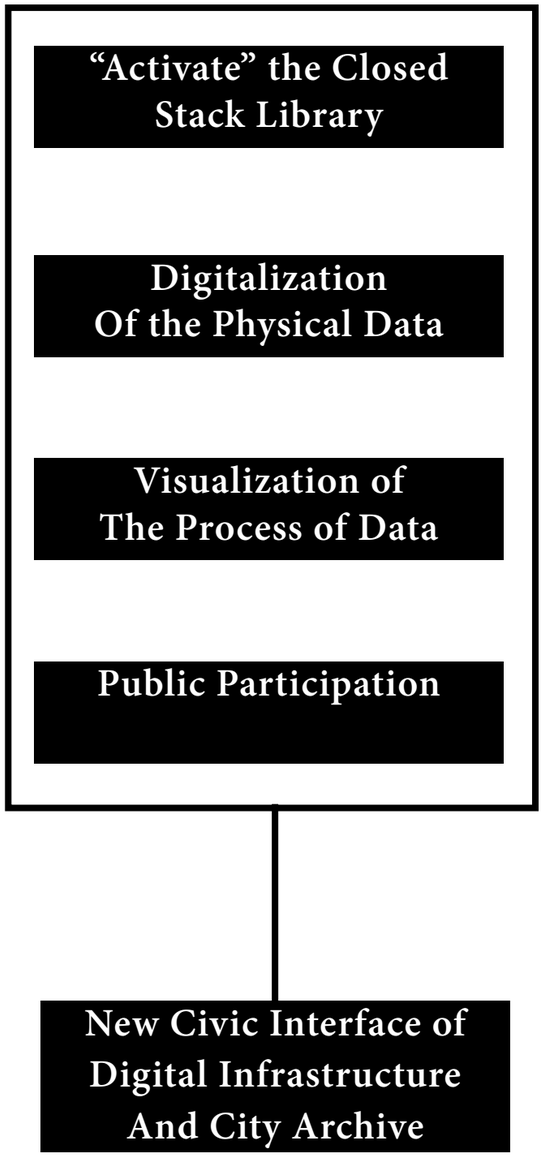

EXTENSION OF THE LIBRARY
Close Stacked Archive

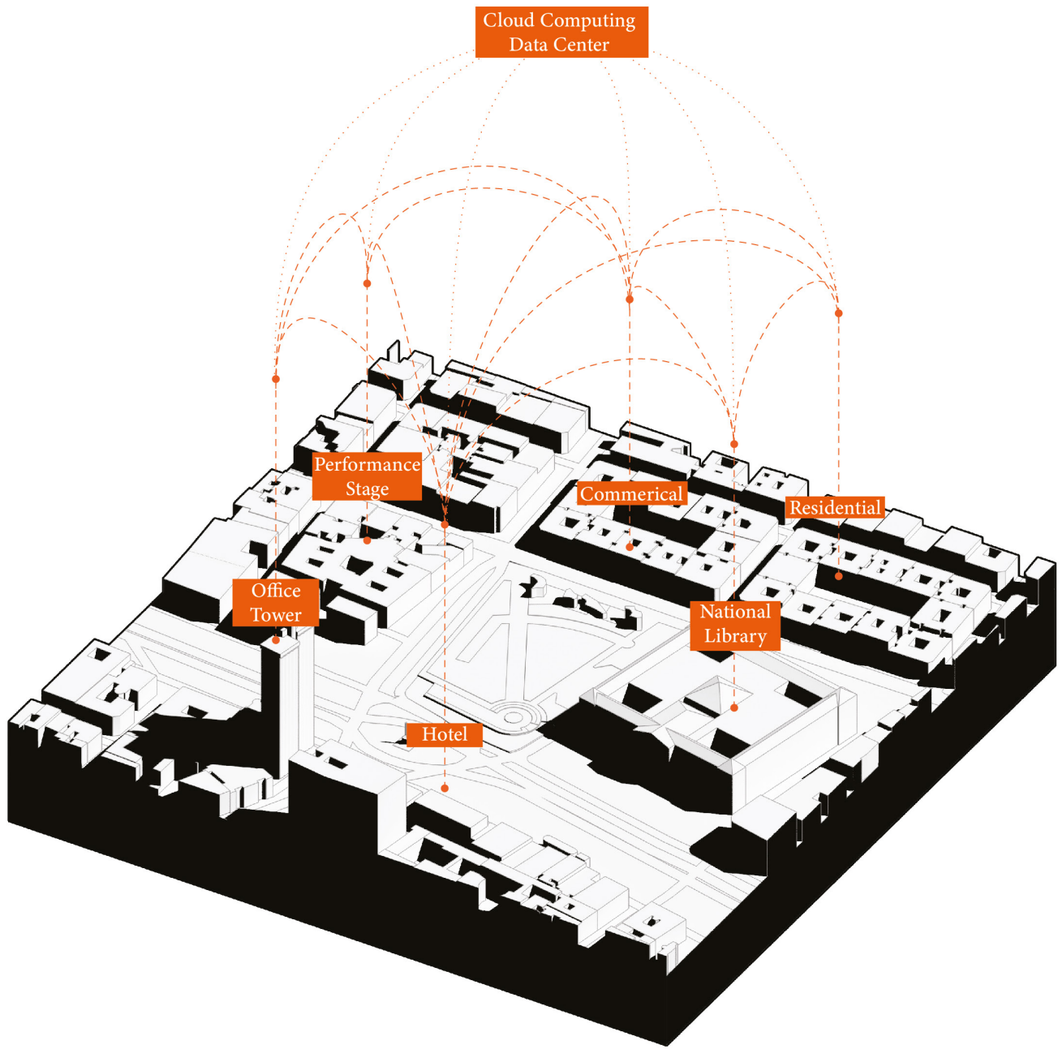
Activate the Closed Stack Library

Digitalize the Physical Data

Visualize the Process of Data

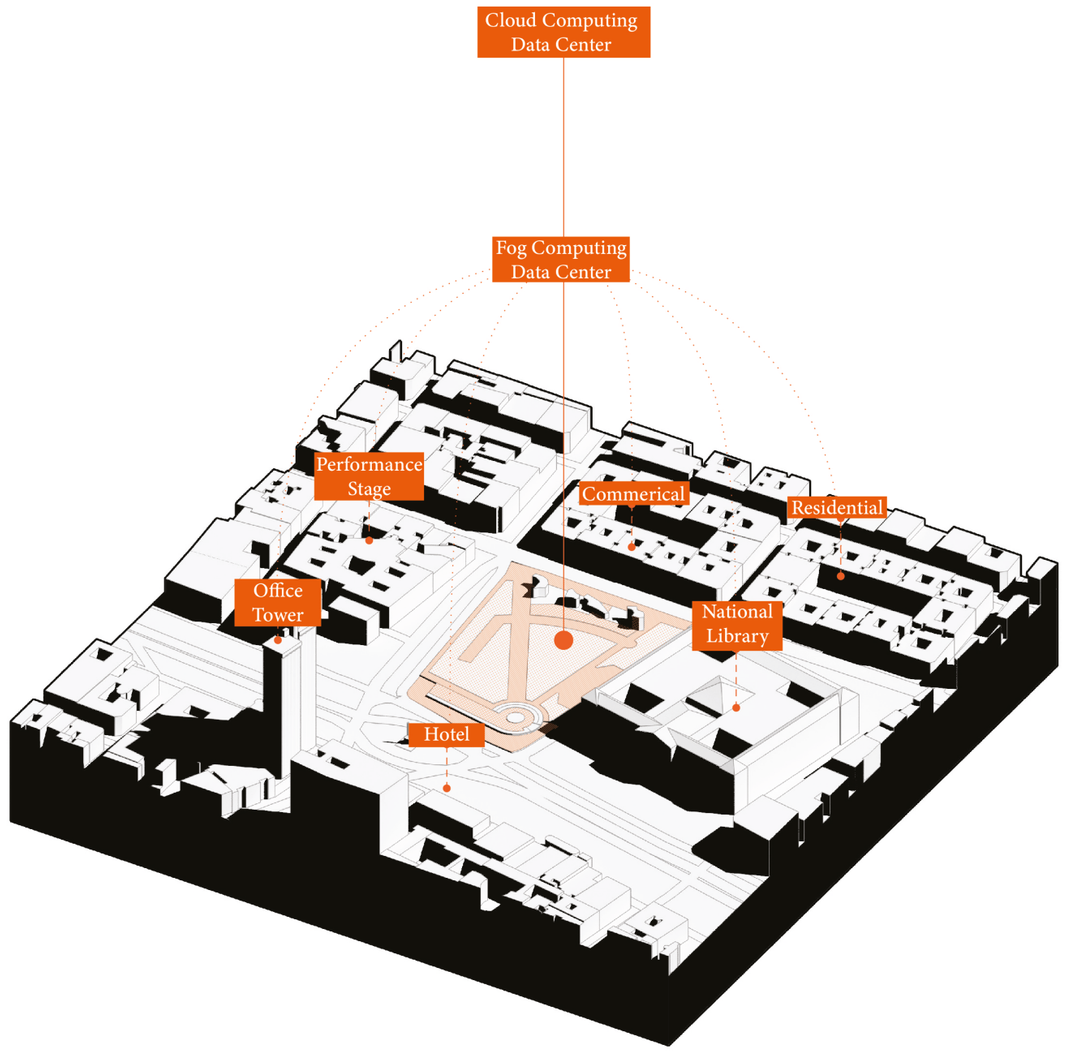
Public Participation


“Activate” the Closed
Stack Library
Digitalization
Of the Physical Data
Visualization of
The Process of Data
Public Participation
New Civic Interface of
Digital Infrastructure
And City Archive



Current State:

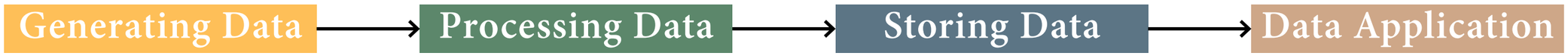
Centralized cloud computing data center
manage by private service provider

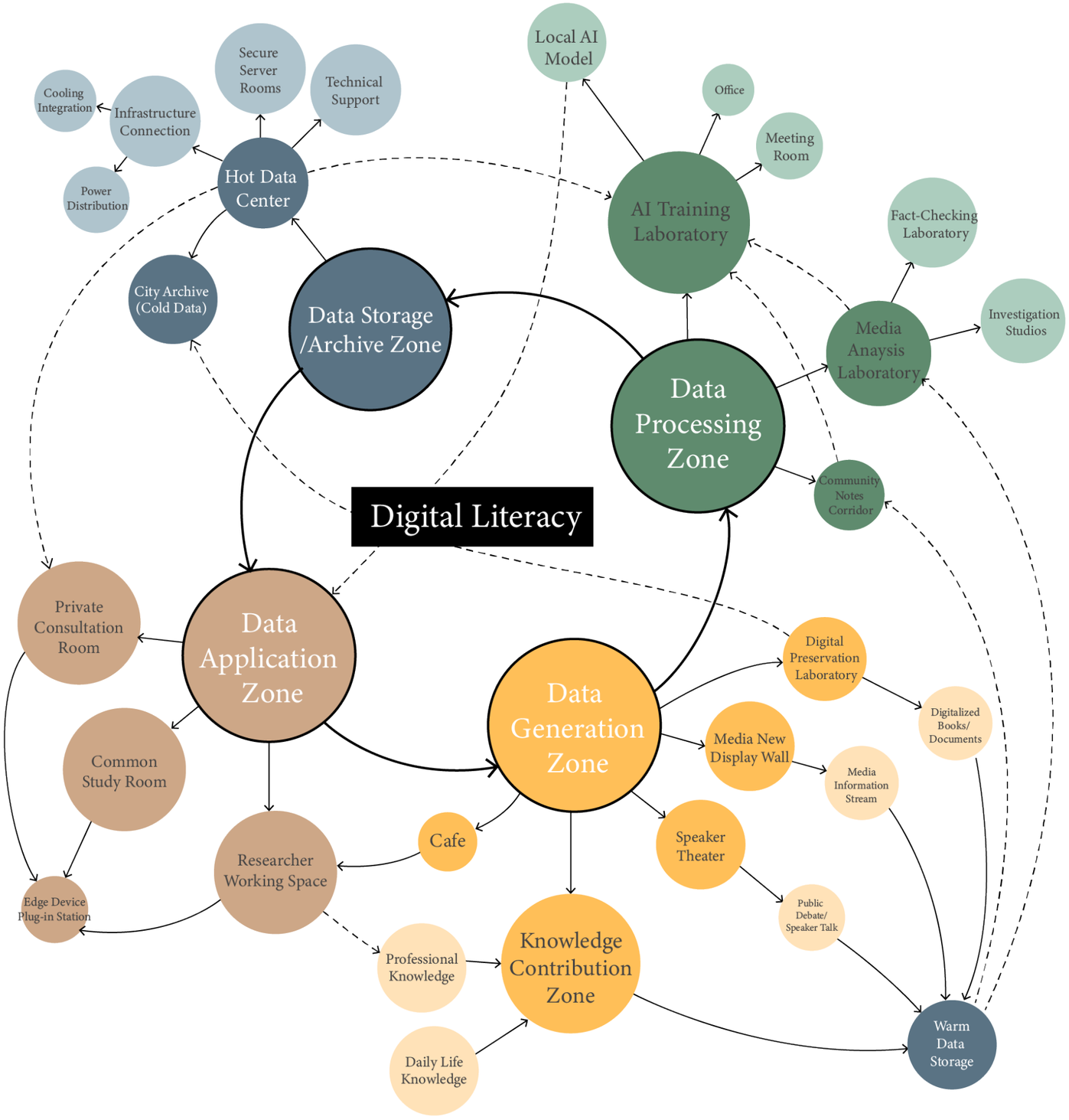


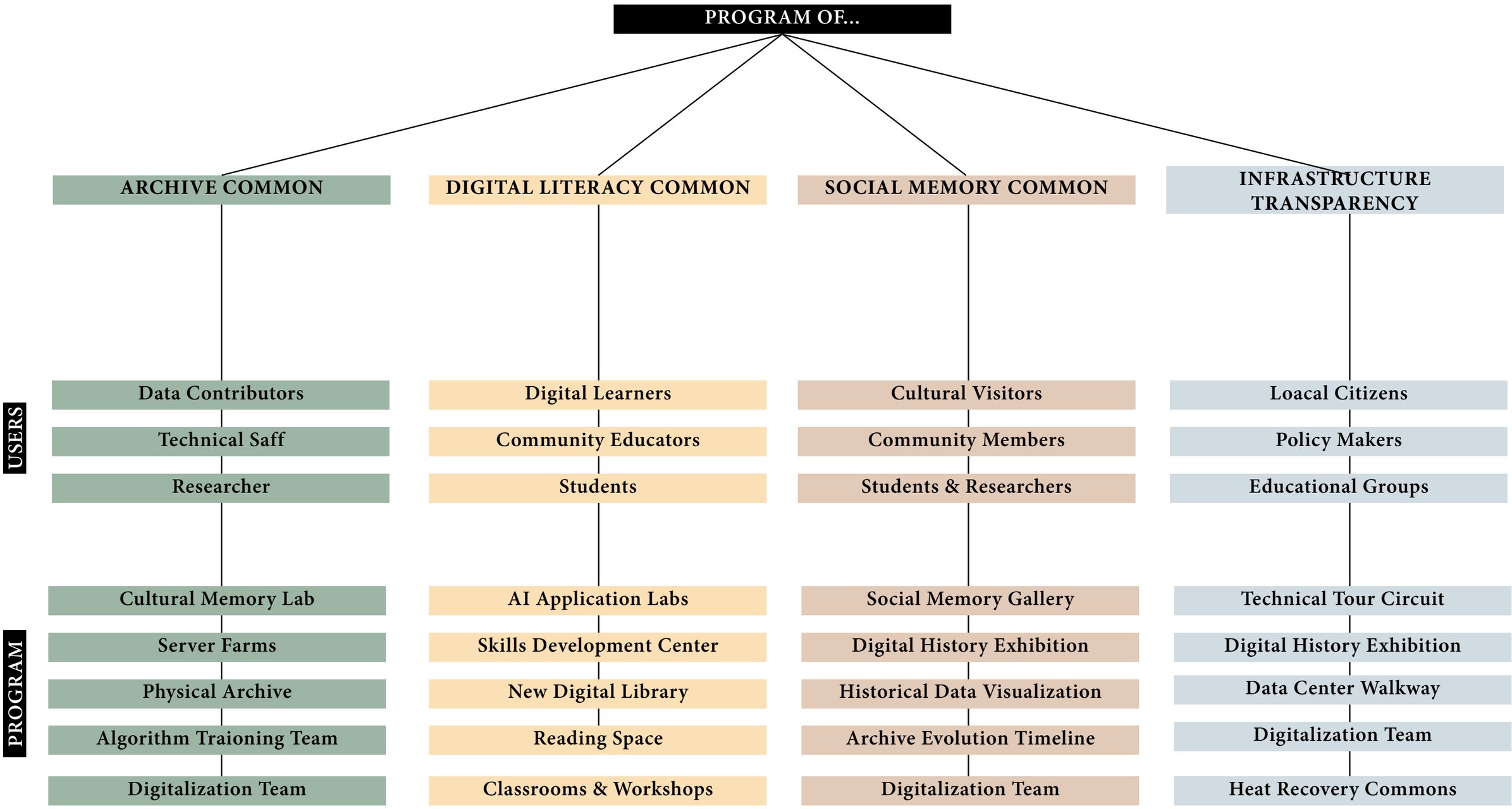
Proposed Framework:

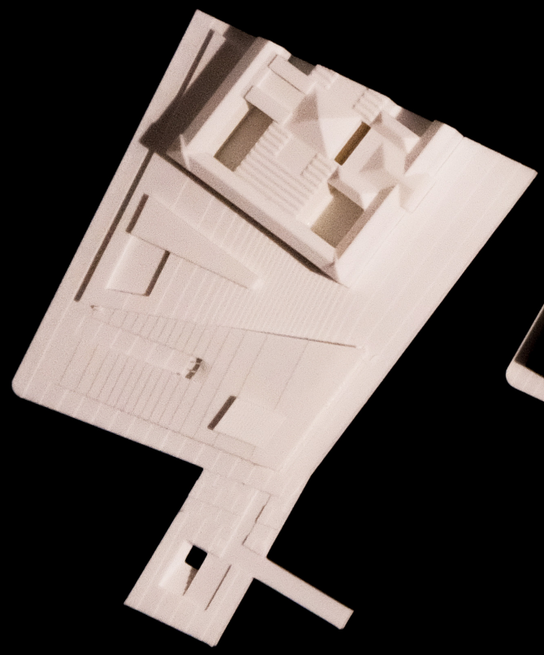
Cloud-Fog-Edge framework

De-centralized data computing that improve
privacy of user data

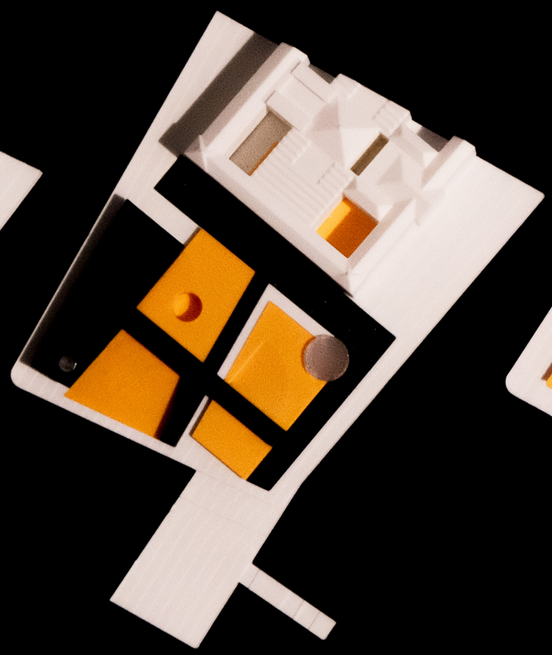

Generating Data
Processing Data
Storing Data
Data Application


Local AI Model
Office
Meeting Room
Secure Server Rooms
Technical Support
Cooling Integration
Infrastructure Connection
Power Distribution
Hot Data Center
AI Training Laboratory
Fact-Checking Laboratory
City Archive (Cold Data)
Data Storage /Archive Zone
Media Anaysis Laboratory
Investigation Studios
Data Processing Zone
Community Notes Corridor
Digital Literacy
Private Consultation Room
Data Application Zone
Digital Preservation Laboratory
Digitalized Books/ Documents
Data Generation Zone
Media New Display Wall
Media Information Stream
Common Study Room
Cafe
Speaker Theater
Researcher Working Space
Edge Device Plug-in Station
Public Debate/ Speaker Talk
Professional Knowledge
Knowledge Contribution Zone
Warm Data Storage
Daily Life Knowledge


PROGRAM OF...
ARCHIVE COMMON
DIGITAL LITERACY COMMON
SOCIAL MEMORY COMMON
INFRASTRUCTURE TRANSPARENCY
USERS
Data Contributors
Digital Learners
Cultural Visitors
Loacal Citizens
Technical Saff
Community Educators
Community Members
Policy Makers
Researcher
Students
Students & Researchers
Educational Groups
PROGRAM
Cultural Memory Lab
AI Application Labs
Social Memory Gallery
Technical Tour Circuit
Server Farms
Skills Development Center
Digital History Exhibition
Digital History Exhibition
Physical Archive
New Digital Library
Historical Data Visualization
Data Center Walkway
Algorithm Traioning Team
Reading Space
Archive Evolution Timeline
Digitalization Team
Digitalization Team
Classrooms & Workshops
Digitalization Team
Heat Recovery Commons



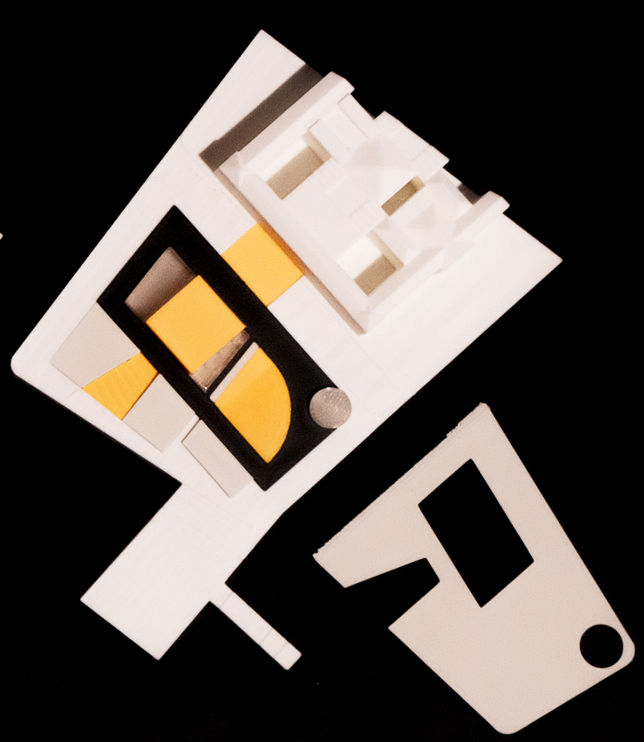
Form Finding



Machine & Human Space



Old & New Infrastructure

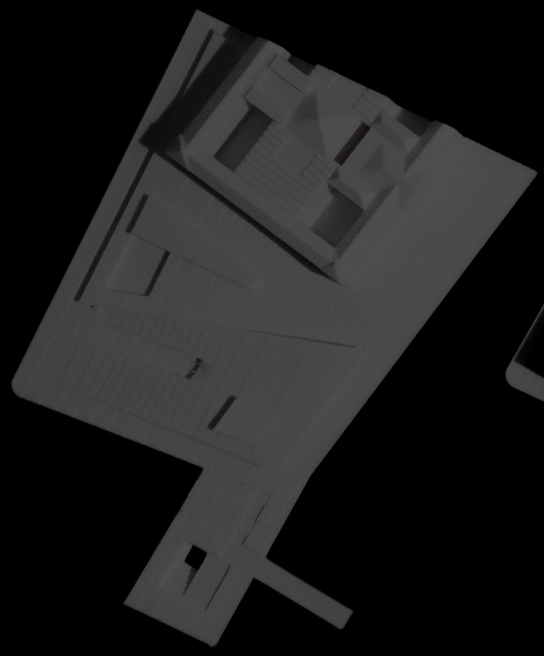


Learning & Processing

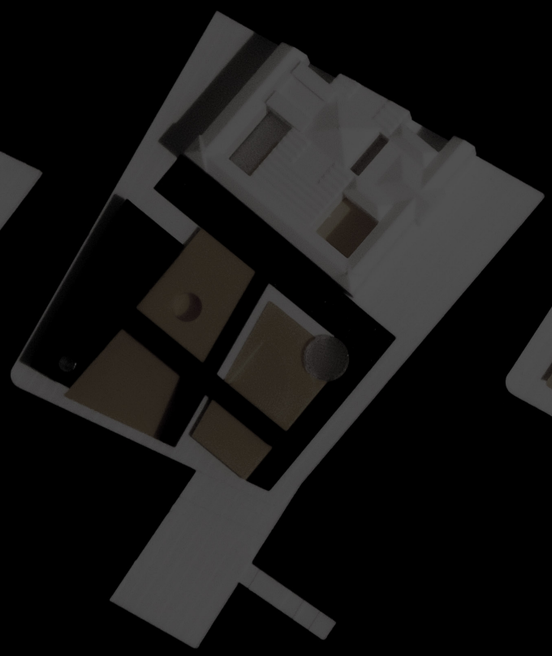
MASSING STUDY

How should the various programs intersect?

ARCHITECTURAL DESIGN CROSSOVER



Landscape Transformation



Machine & Human Space



Old & New Infrastructure



Learning & Processing

MASSING STUDY

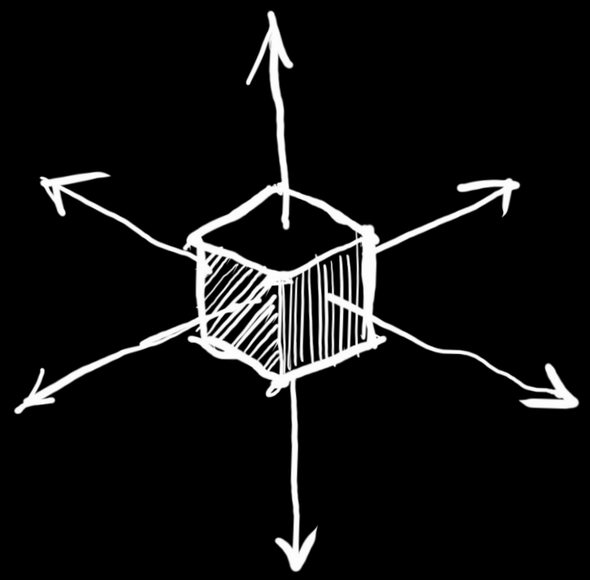
How should the various programs intersect?

ARCHITECTURAL DESIGN CROSSOVER

Concept

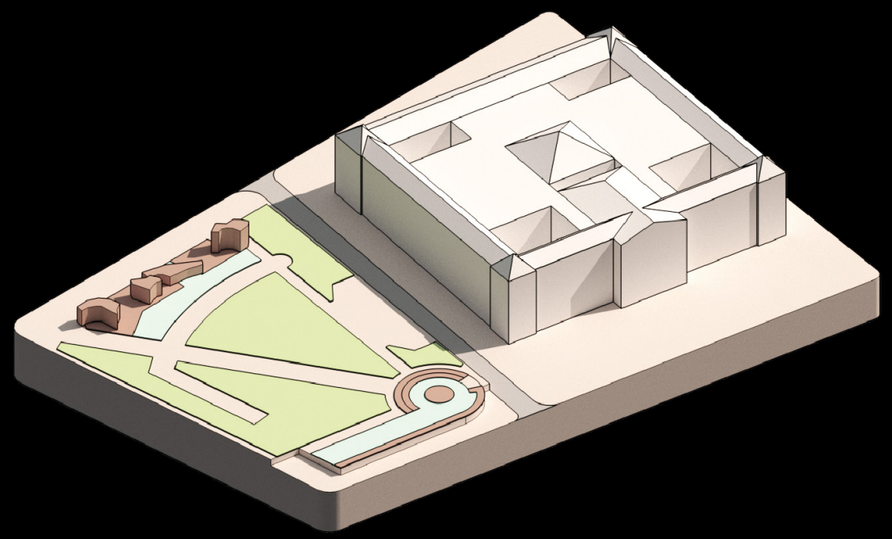


The new interface of a black box



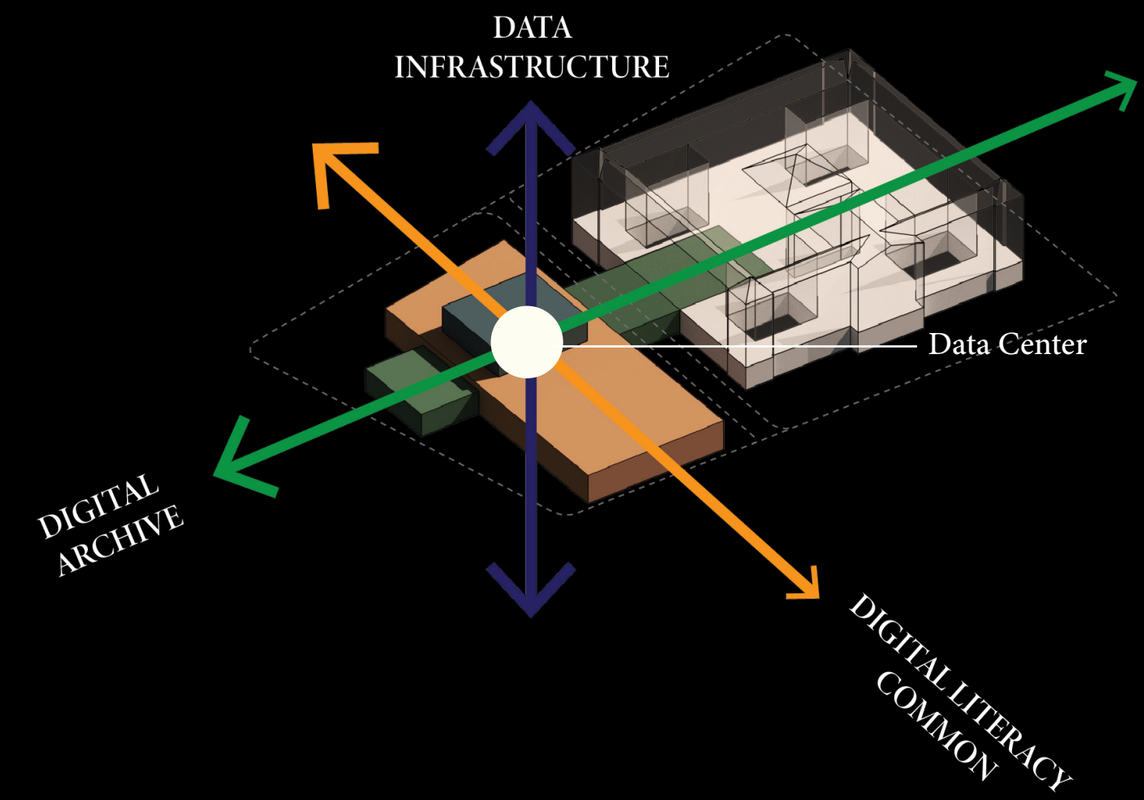
CONCEPT

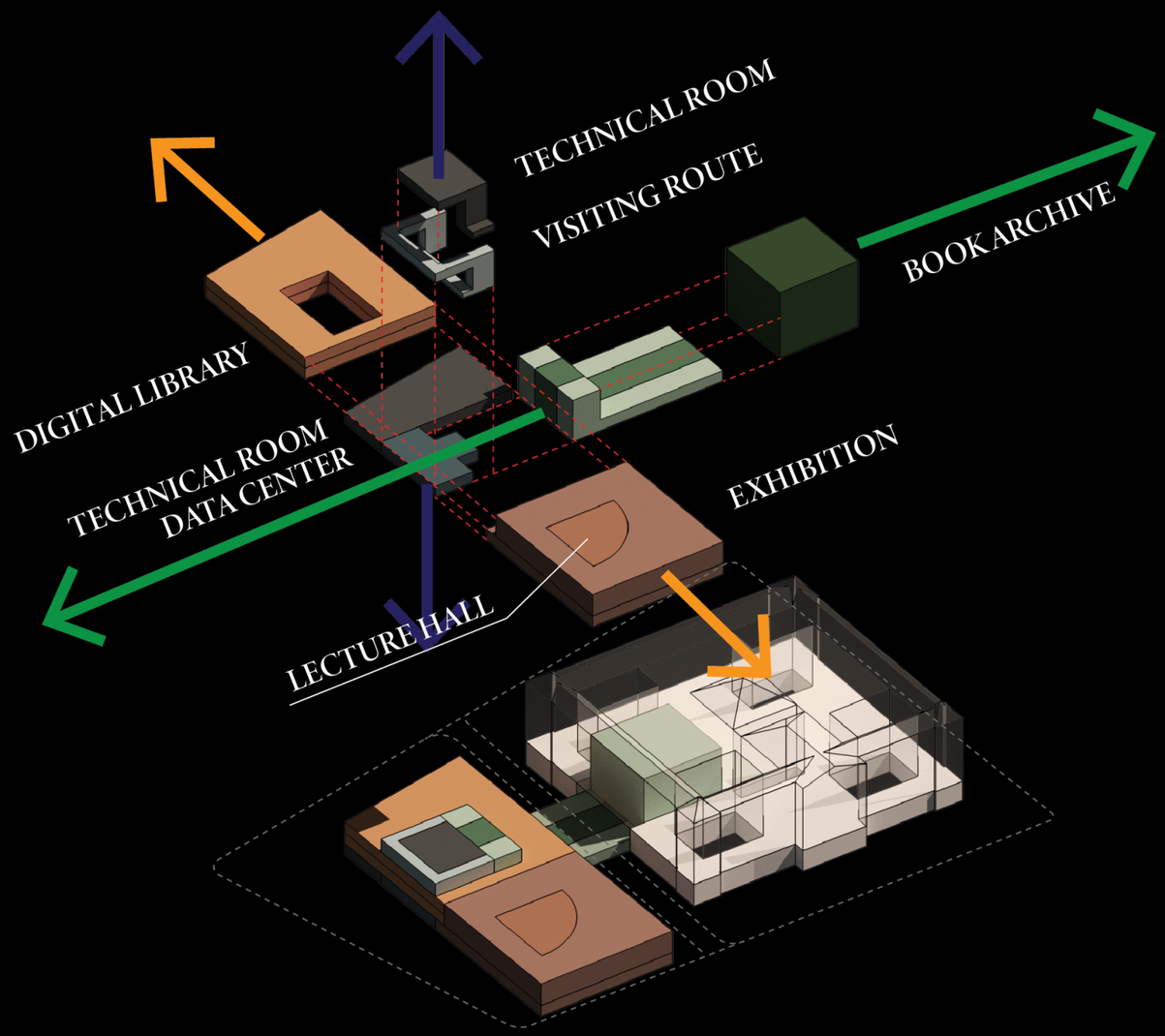
Black box as the intersection point in different direction.

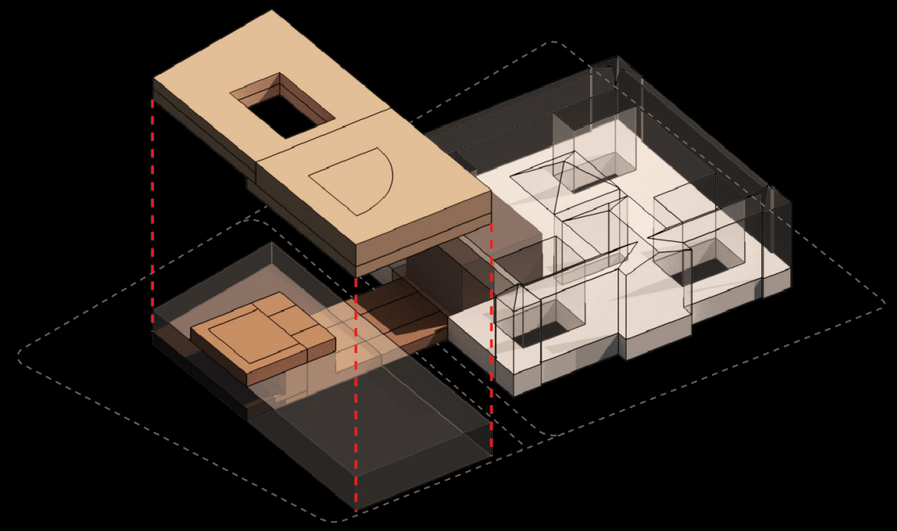


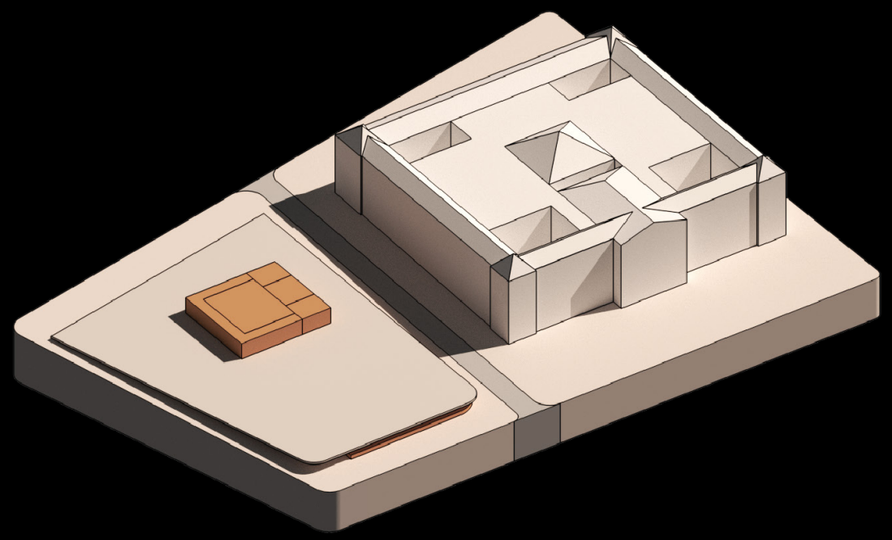
MASSING DEVELOPMENT

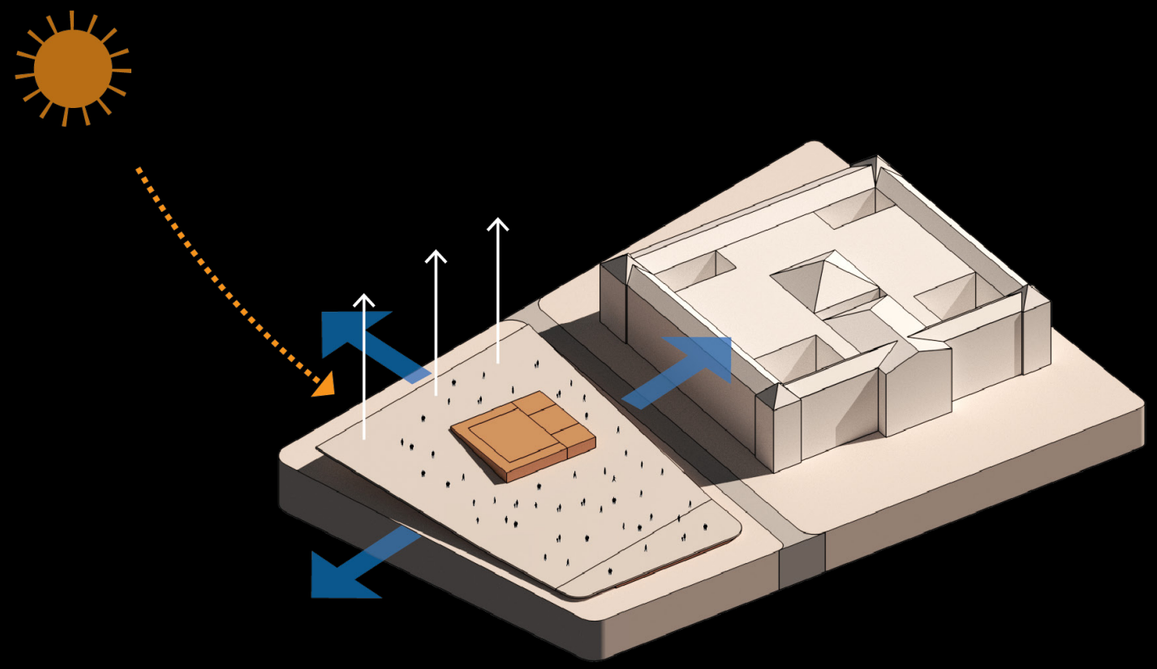
1. Existing Site


DATA
INFRASTRUCTURE
Data Center
DIGITAL
ARCHIVE
DIGITAL LITERACY
COMMON


TECHNICAL ROOM
VISITING ROUTE
BOOK ARCHIVE
DIGITAL LIBRARY
TECHNICAL ROOM
DATA CENTER
EXHIBITION
LECTURE HALL



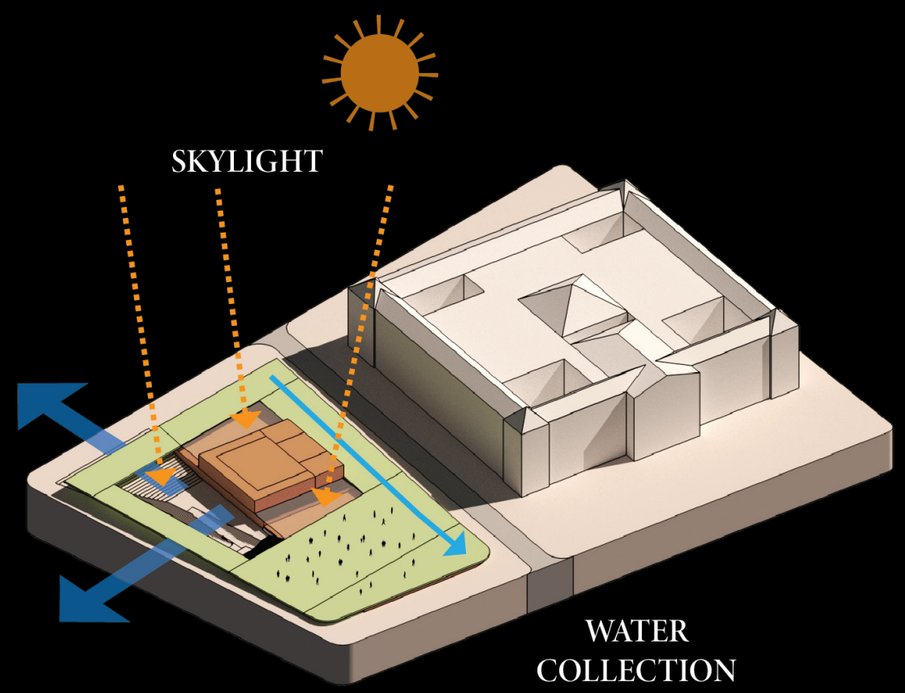


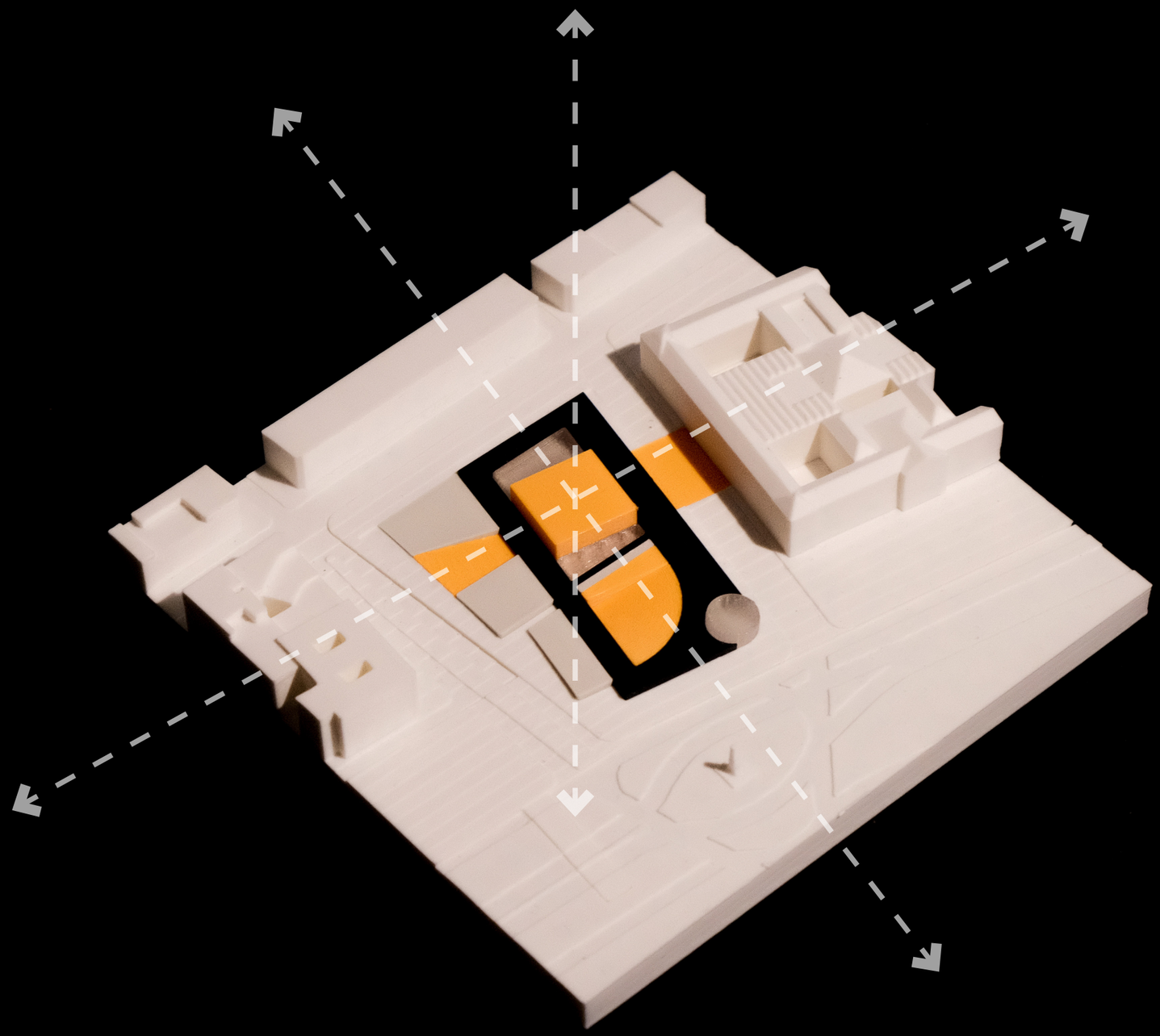


MASSING DEVELOPMENT

6. Lifting Up the deck to open up the underground space

ARCHITECTURAL DESIGN CROSSOVER


SKYLIGHT
WATER
COLLECTION



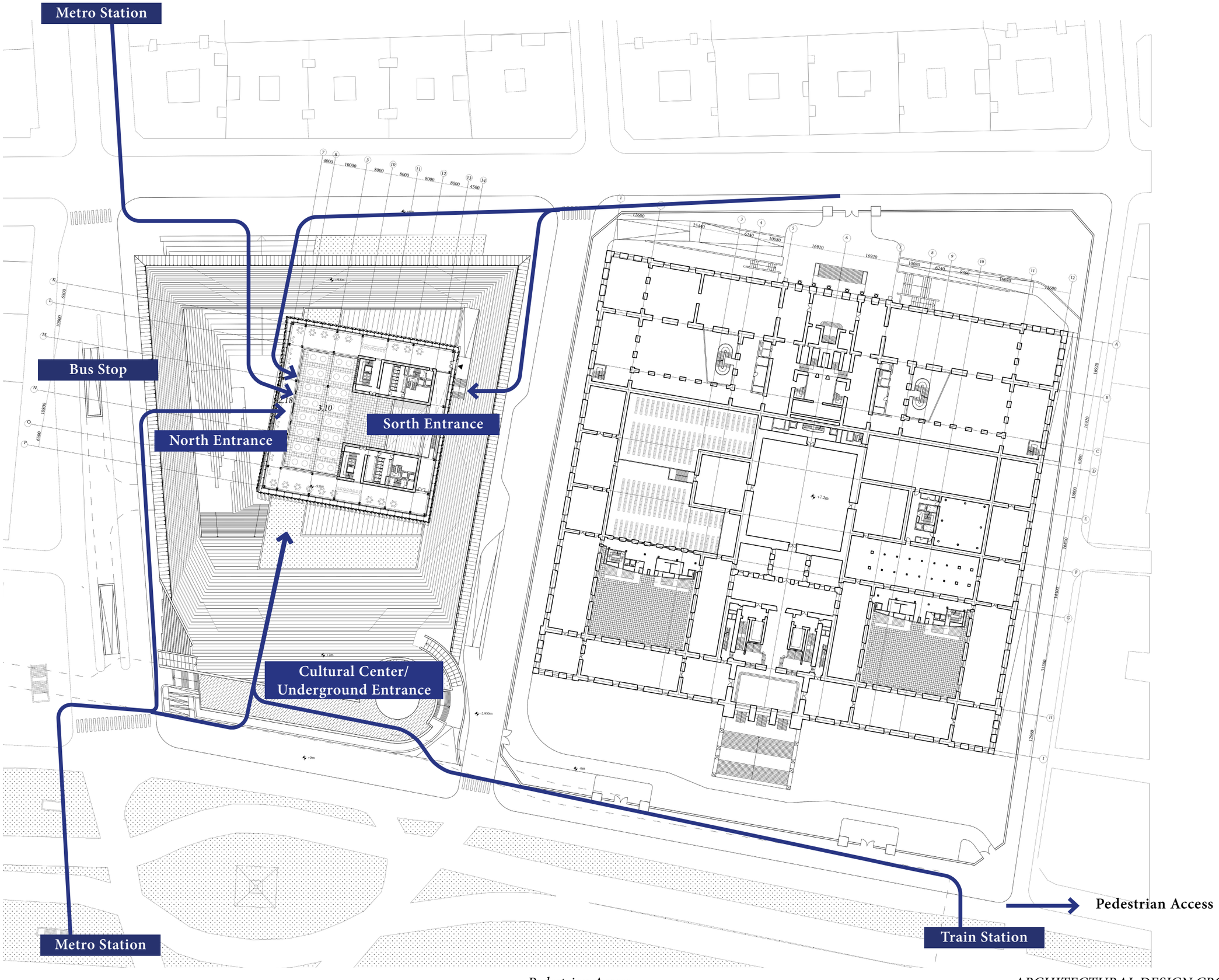
MASSING MODEL

The Three Axis

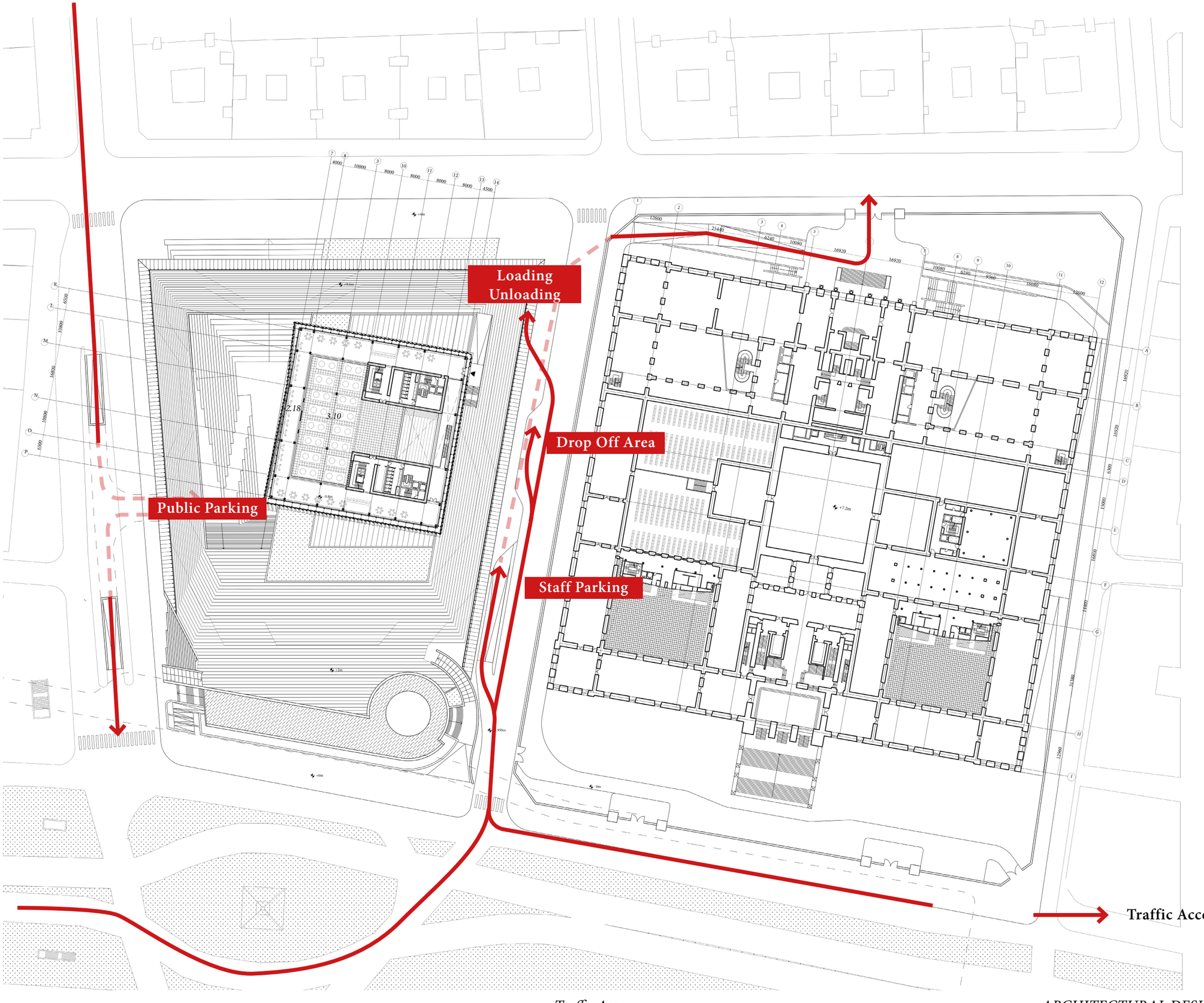
ARCHITECTURAL DESIGN CROSSOVER



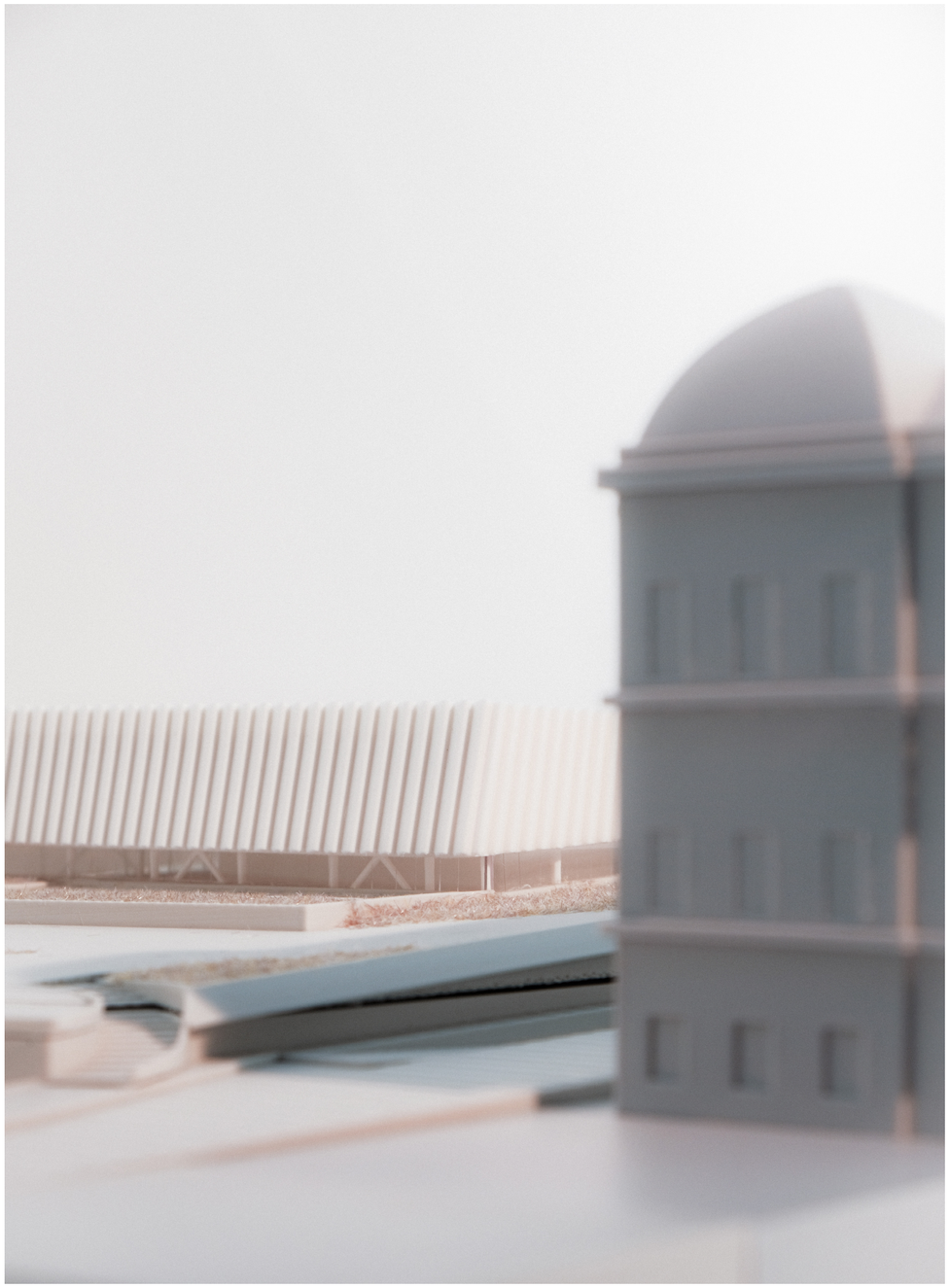
Design Implementation

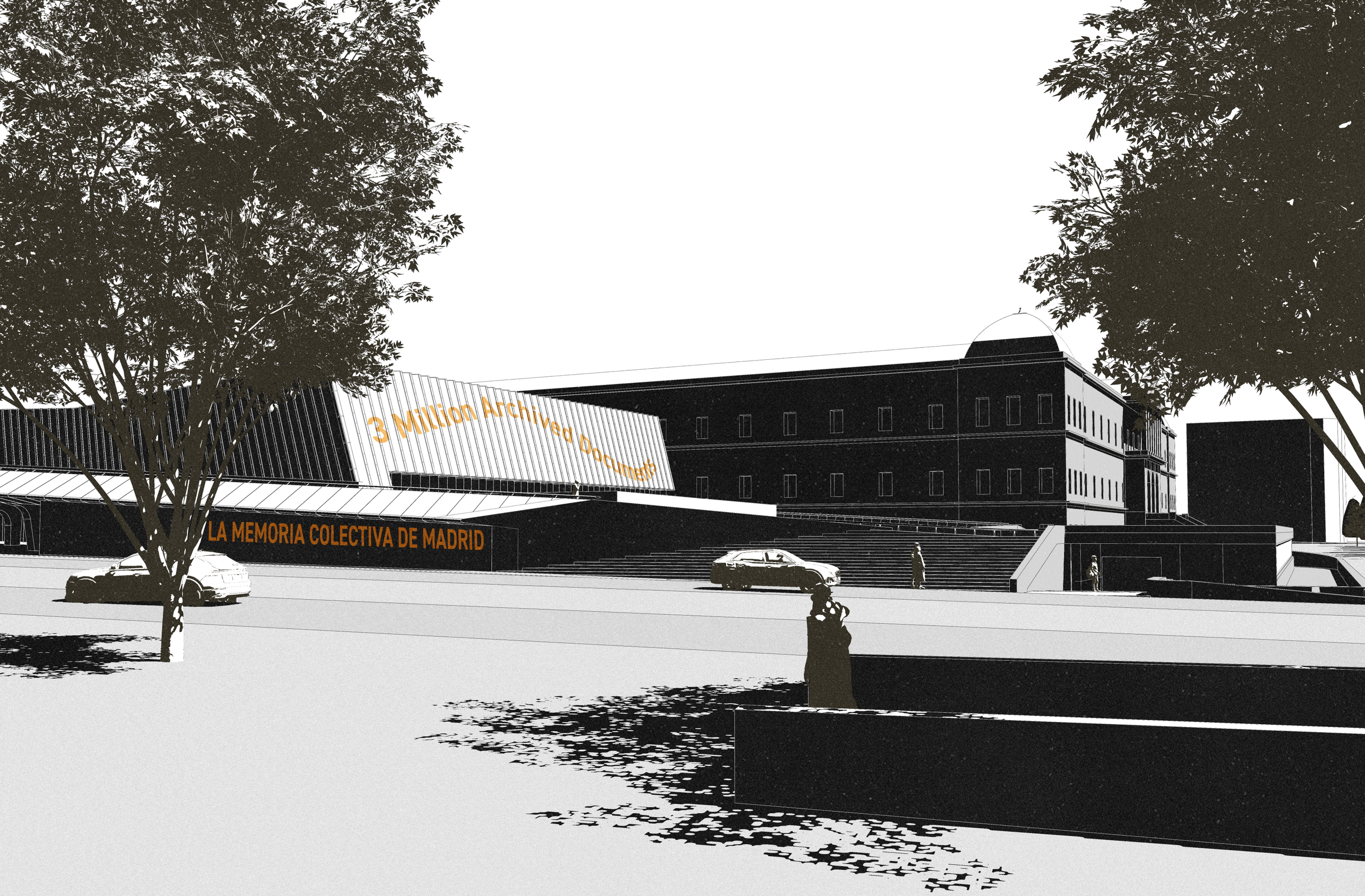


ACCESSIBILITY *Pedestrian Access* *ARCHITECTURAL DESIGN CROSSOVER*



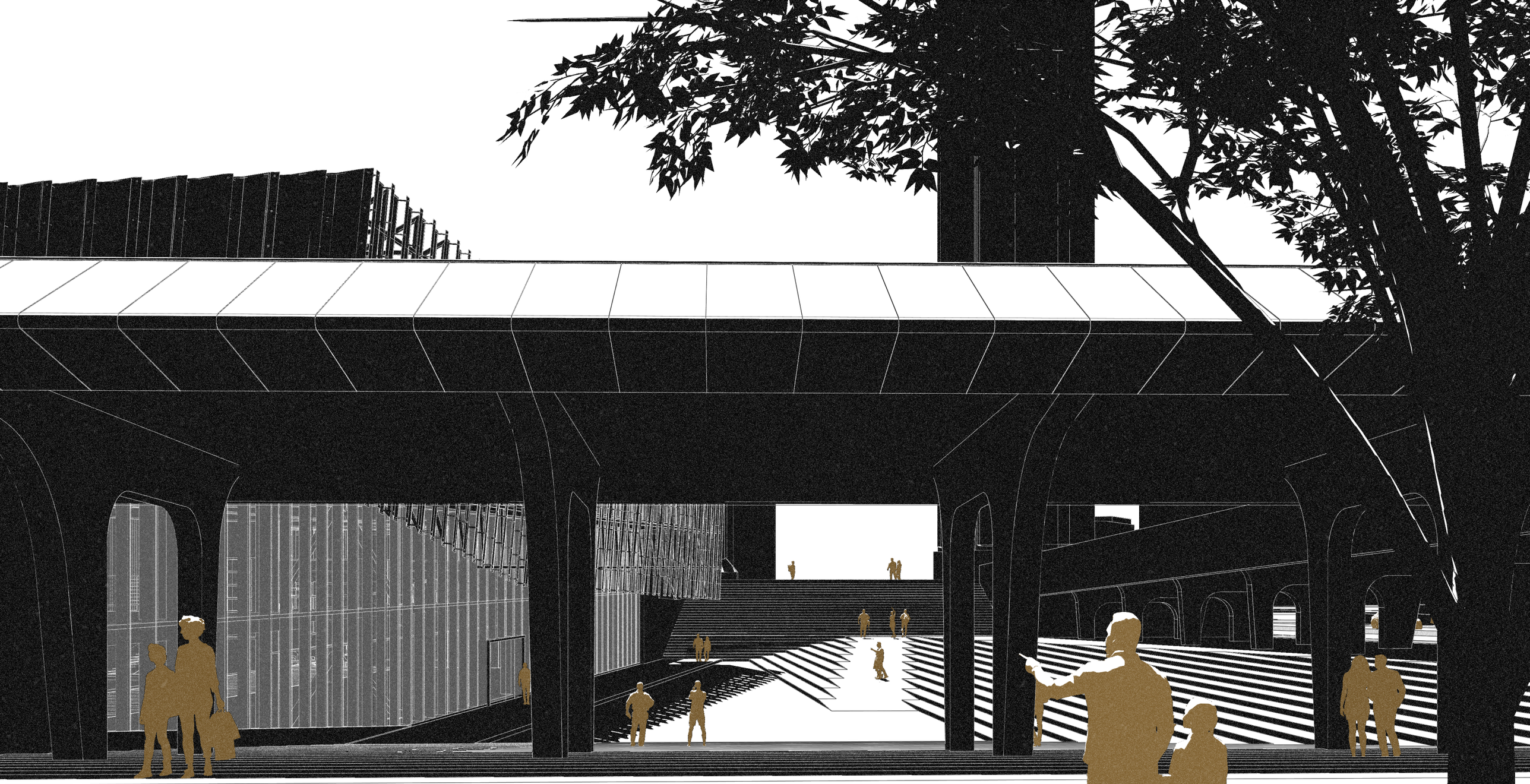
ACCESSIBILITY *Traffic Access* *ARCHITECTURAL DESIGN CROSSOVER*

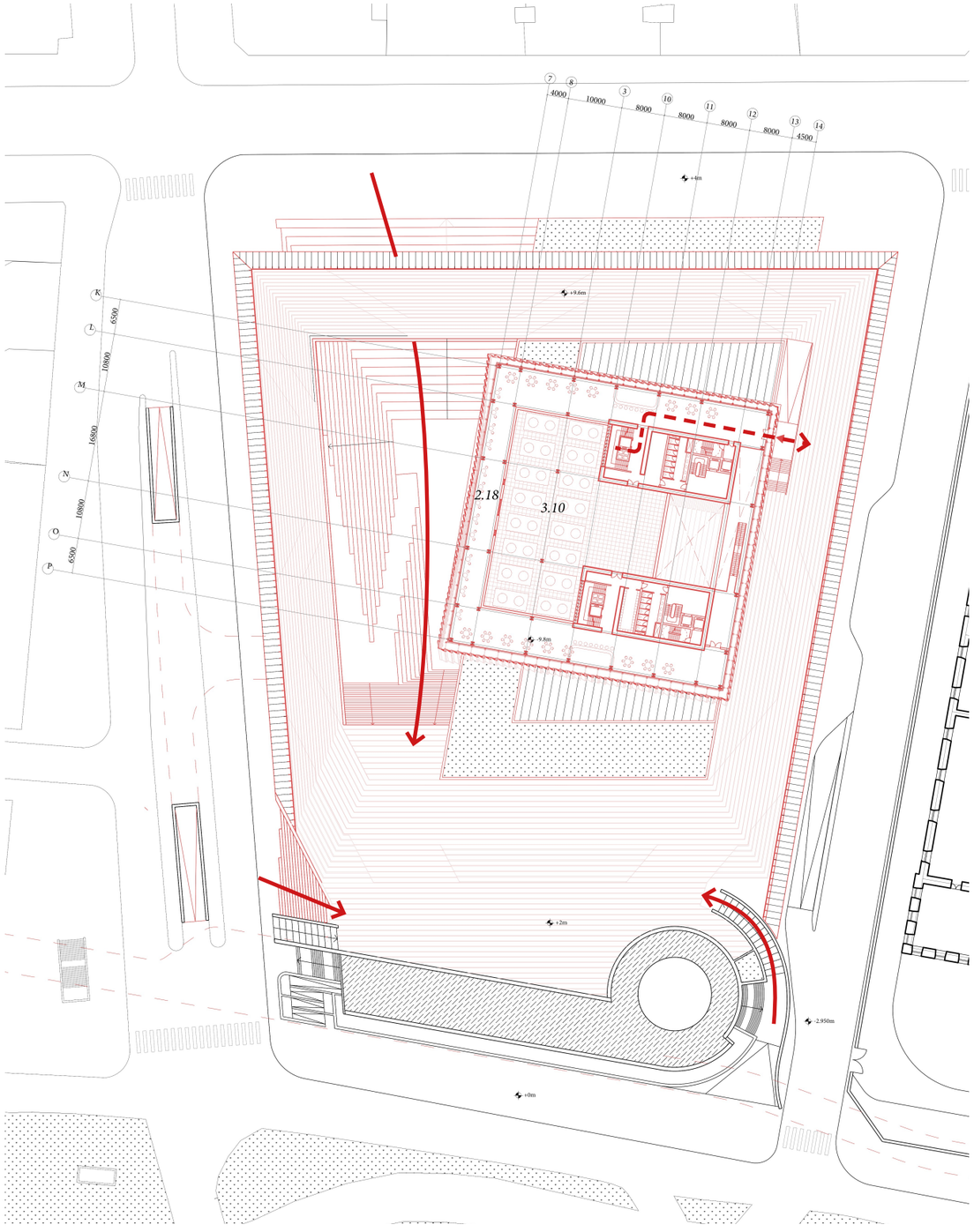


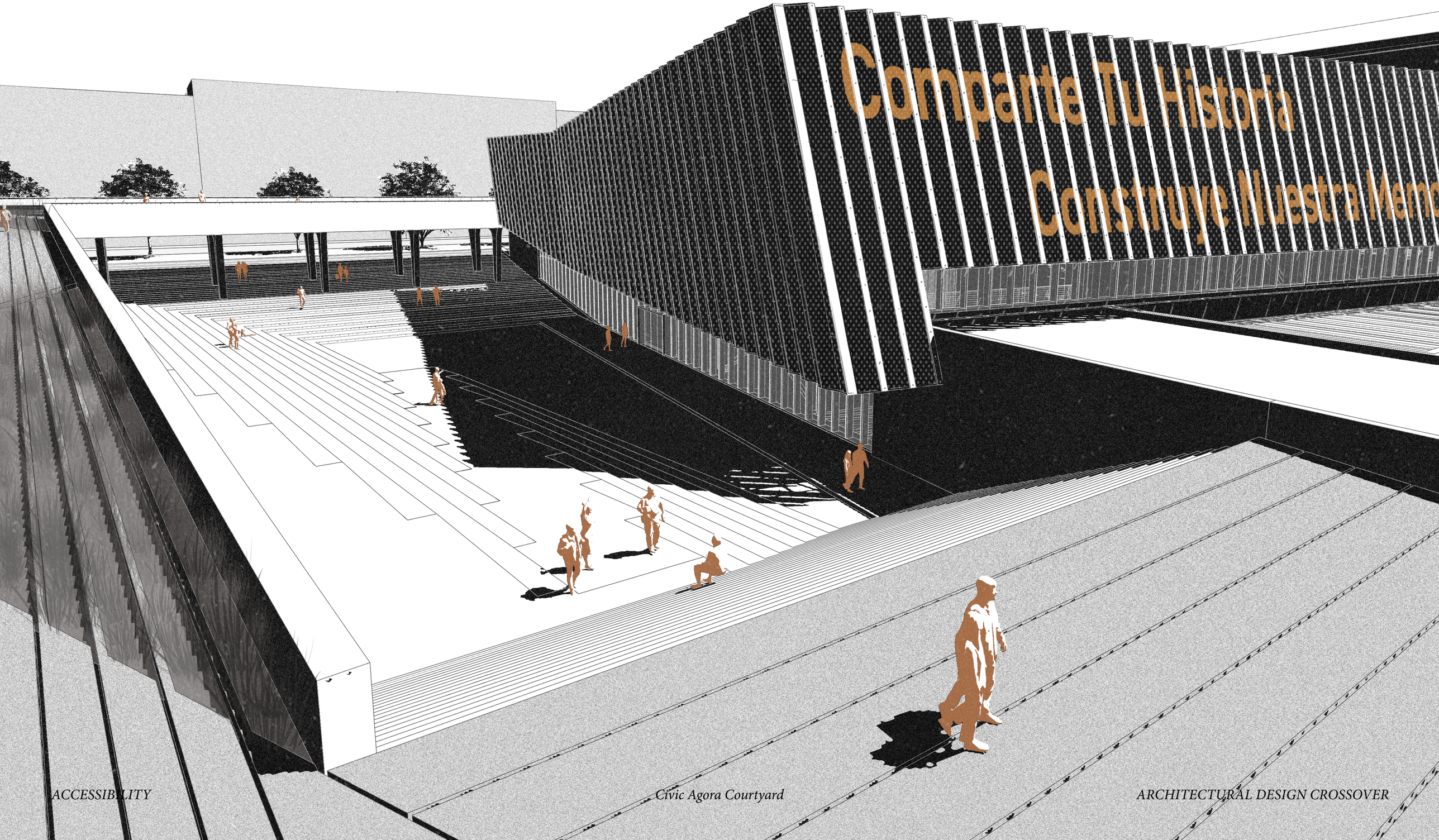


ACCESSIBILITY *North-West Side* *ARCHITECTURAL DESIGN CROSSOVER*





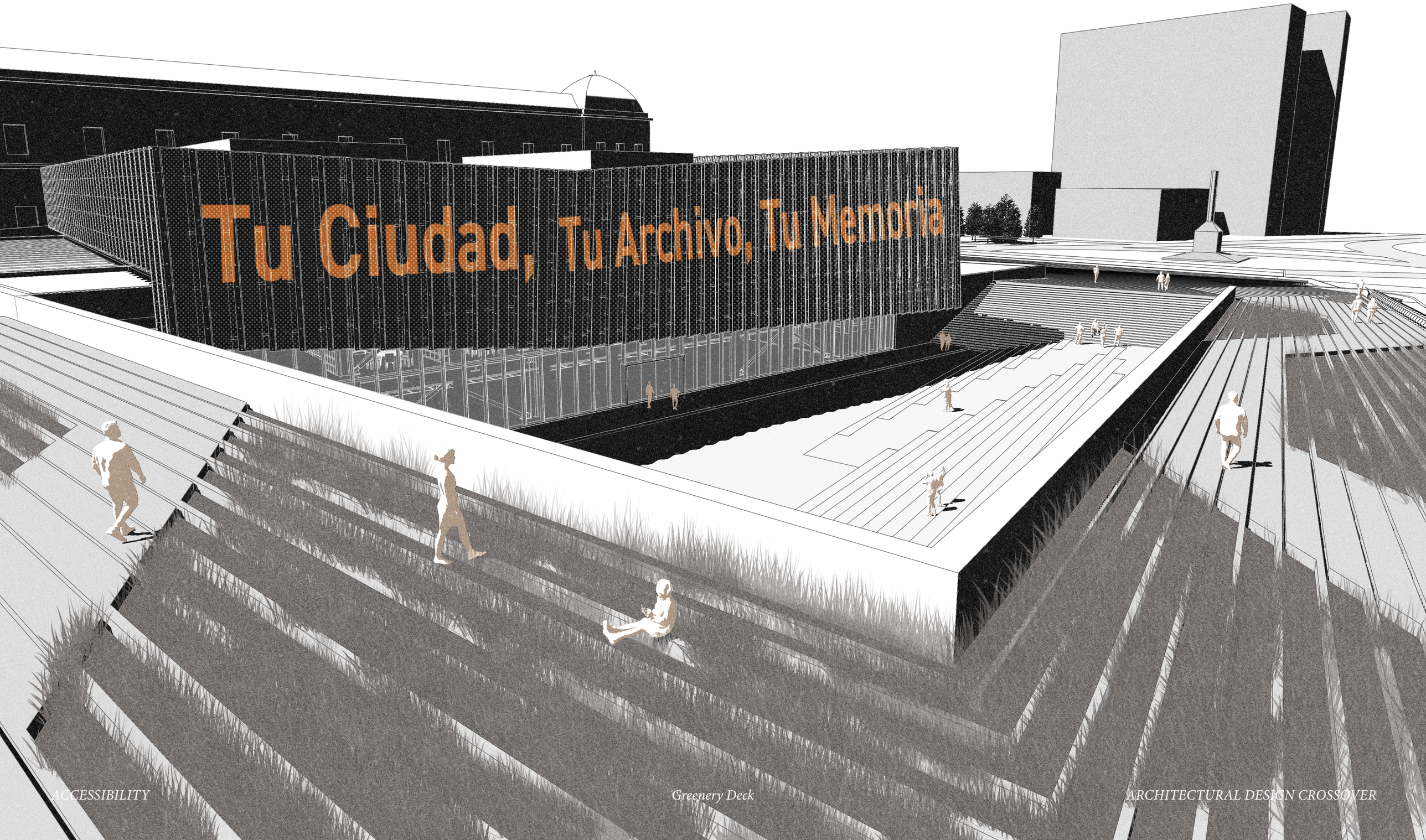

7
8
3
10
11
12
13
14
4000
10000
8000
8000
8000
8000
4500
K
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M
N
O
P
6500
10800
16800
10800
6500
+4m
+9.6m
2.18
3.10
-9.8m
+2m
2.950m
+0m

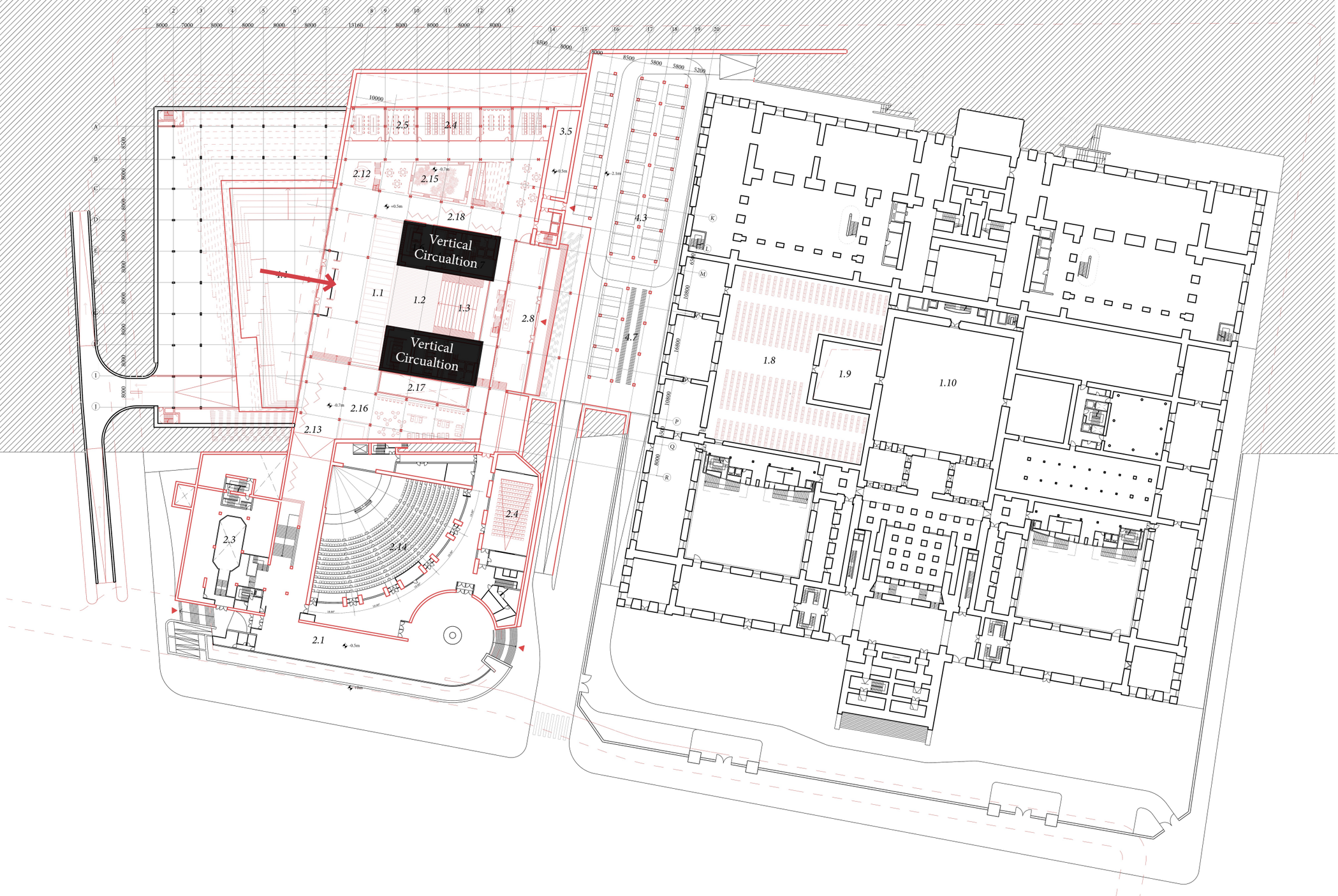


ACCESSIBILITY

Civic Agora Courtyard

ARCHITECTURAL DESIGN CROSSOVER


Tu Ciudad, Tu Archivo, Tu Memoria



City Digital Archive
1.1 Infrastructure Viewing Well
1.2 Library Reception
1.3 Speaker Theater
1.4 Clockroom
1.5 Toilet
1.6 Circulation Core
1.7 Staff Office Lobby
1.8 Book Archive
1.9 Archive Consultation Room
1.10 Reading Room
1.11 Close Stack Bookshelf Delivery Room
1.12 Social Memory Gallery
1.13 Community Storytelling Studio
1.14 Digital Heritage Workshop
1.15 Data Processing Office
1.16 Data Archiving Office

Civic Technology Hub & Social Memory Gallery
2.1. Reception
2.2 Digital Infrastructure's Viewing Deck
2.3 Restaurant
2.4 Classrooom
2.5 Computer Lab
2.6 Quiet Working Station
2.7 Educational Curator Office
2.8 Group Visitor Reception
2.9 Library Stack
2.10 Common Working/Reading Area
2.11 Meeting Room
2.12 Information Desk
2.13 Exhibition
2.14 Theatre / Lecture Hall
2.15 Green Atrium
2.16 Cafe
2.17 Information Dashboard Wall
2.18 Rooftop Bar & Teahouse

Transparent Infrastructure Core
3.1 Supercomputer Room (Hot Data)
3.2 Tape Digital Archive (Cold Data)
3.3 Heat Exchange Room
3.4 Liquid Cooling System
3.5 Service Core
3.6 Loading/Unloading Bay
3.7 Diesal Gernerator Room
3.8 Water Storage Tank & Pump Room
3.9 Transformer Room
3.10 Network Operations Center
3.11 Storage Room
3.12 Cooling Tower
3.13 Service Corridor

OTHER
4.1 Civic Agora Courtyard
4.2 Public Car Parking
4.3 Staff Car Parking
4.4 Pedestrian Tunnel
4.5 Pedestrian Deck
4.6 Visitor Drop Off Area
4.7 Bike Rack

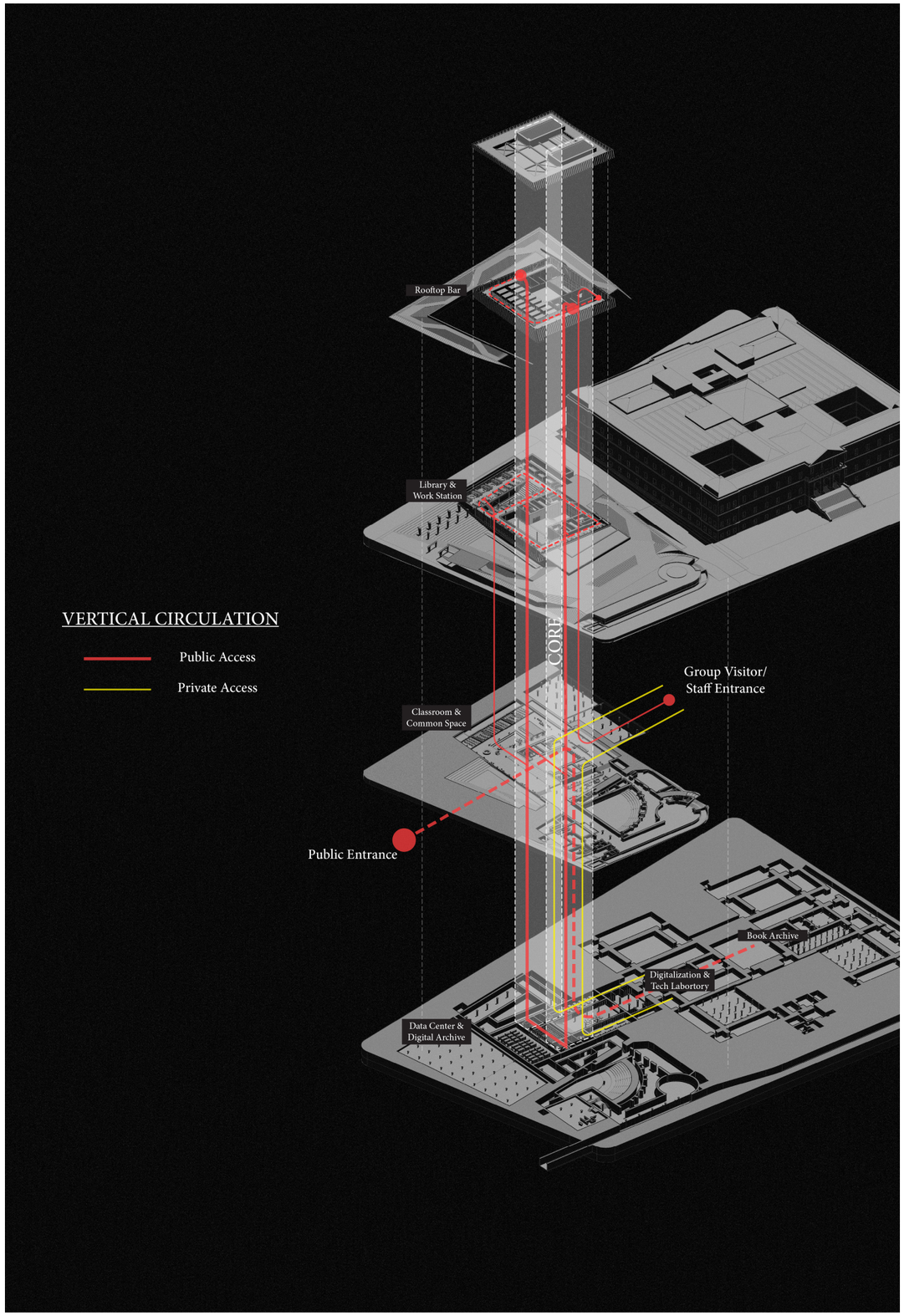
Ground Floor +1.5m 1:500

0 10 20 30 50

CIRCULATION

Ground Floor Plan

ARCHITECTURAL DESIGN CROSSOVER


VERTICAL CIRCULATION
Public Access
Private Access
Rooftop Bar
Library &
Work Station
CORE
Group Visitor/
Staff Entrance
Classroom &
Common Space
Public Entrance
Book Archive
Digitalization &
Tech Labortory
Data Center &
Digital Archive



City Digital Archive

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Civic Technology Hub & Social Memory Gallery

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Transparent Infrastructure Core

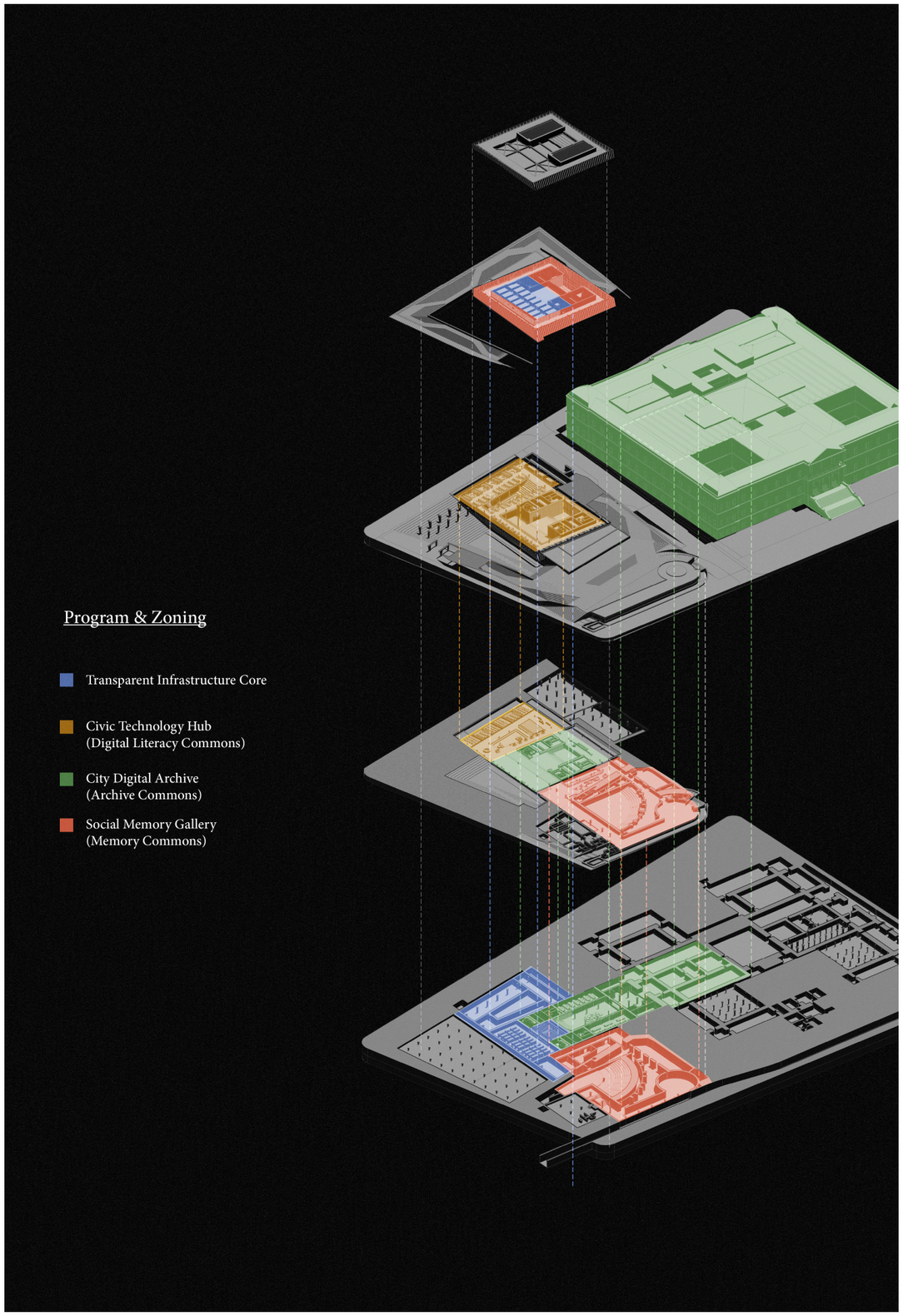
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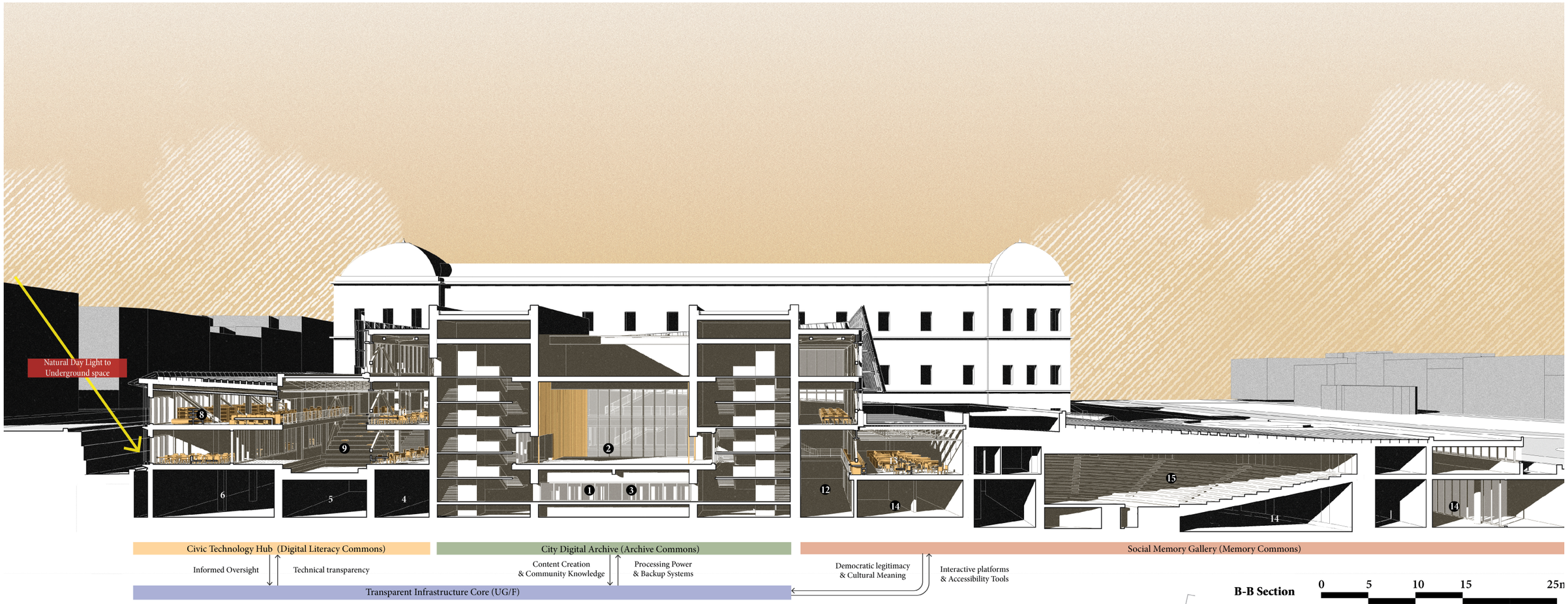
OTHER

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4.3 Staff Car Parking
4.4 Pedestrian Tunnel
4.5 Pedestrian Deck
4.6 Visitor Drop Off Area
4.7 Bike Rack

Ground Floor +1.5m 1:500

0 10 20 30 50


Program & Zoning
Transparent Infrastructure Core
Civic Technology Hub
(Digital Literacy Commons)
City Digital Archive
(Archive Commons)
Social Memory Gallery
(Memory Commons)



B-B Section 0 5 10 15 25m

1. Back of House Visiting Route
2. Reception Space
3. Cold Digital Archive
4. Back of House
5. Water Tank Storage
6. Diesal Backup Power Room
7. Classroom & Workshop
8. Digital Library & Reading Room
9. Green Atrium
10. Quiet Study Space
11. Exhibition Gallery
12. Information Dashboard Wall
13. Cafe
14. Exhibition
15. Theatre/ Lecture Hall

City Digital Archive (Archive Commons)

Archive Commons + Transparent Infrastructure Core

- Direct digital pipeline from water cooling to server storage
- Real-time backup systems visible through glass partitions
- Shared cooling systems serving both digitization equipment and servers
- Quality control stations monitoring digital file integrity

Book Digitization → AI Training Flow

Historical document/ Books (Library Archive)

↓

Digital Scanning

↓

Server Storage

↓

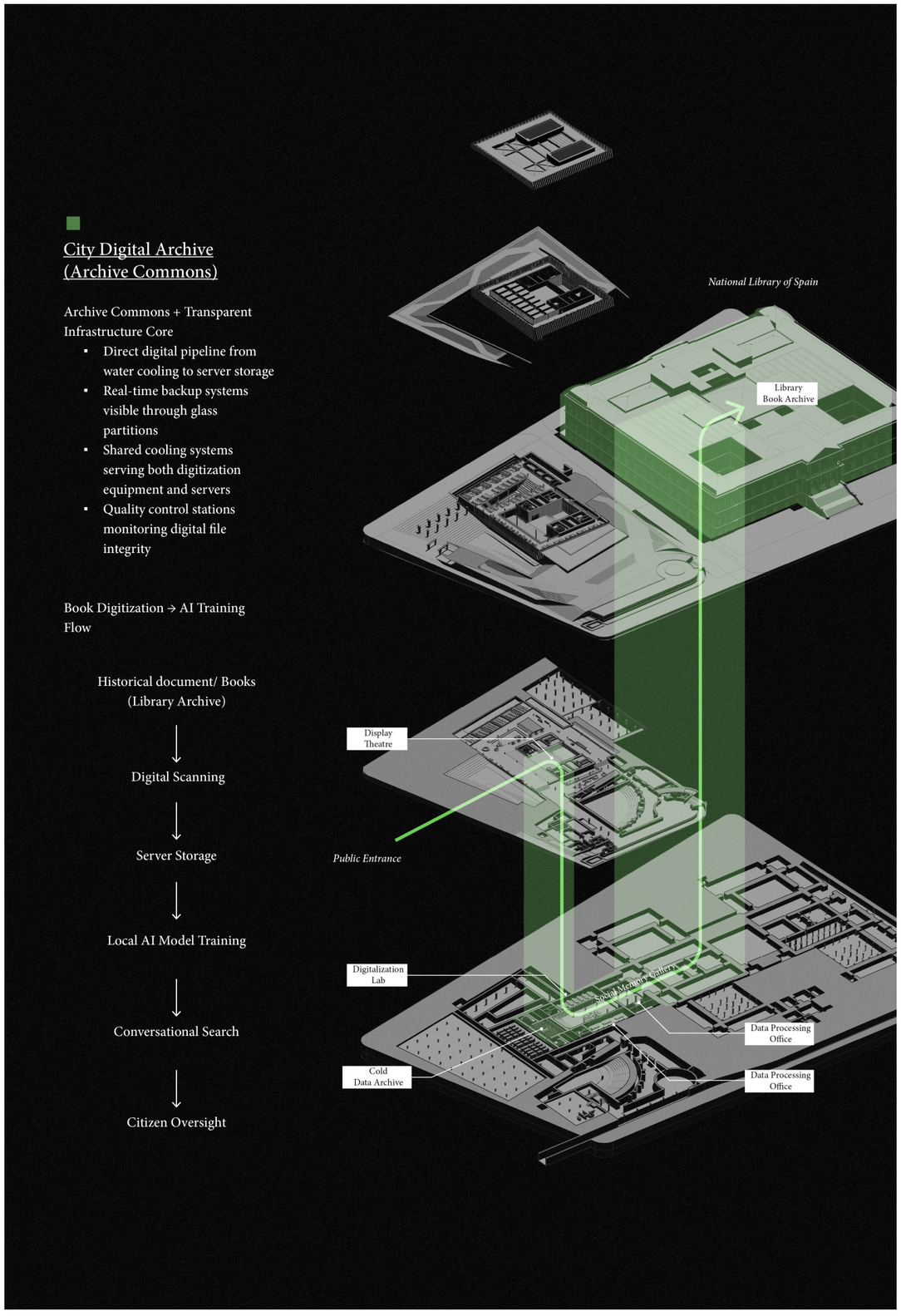
Local AI Model Training

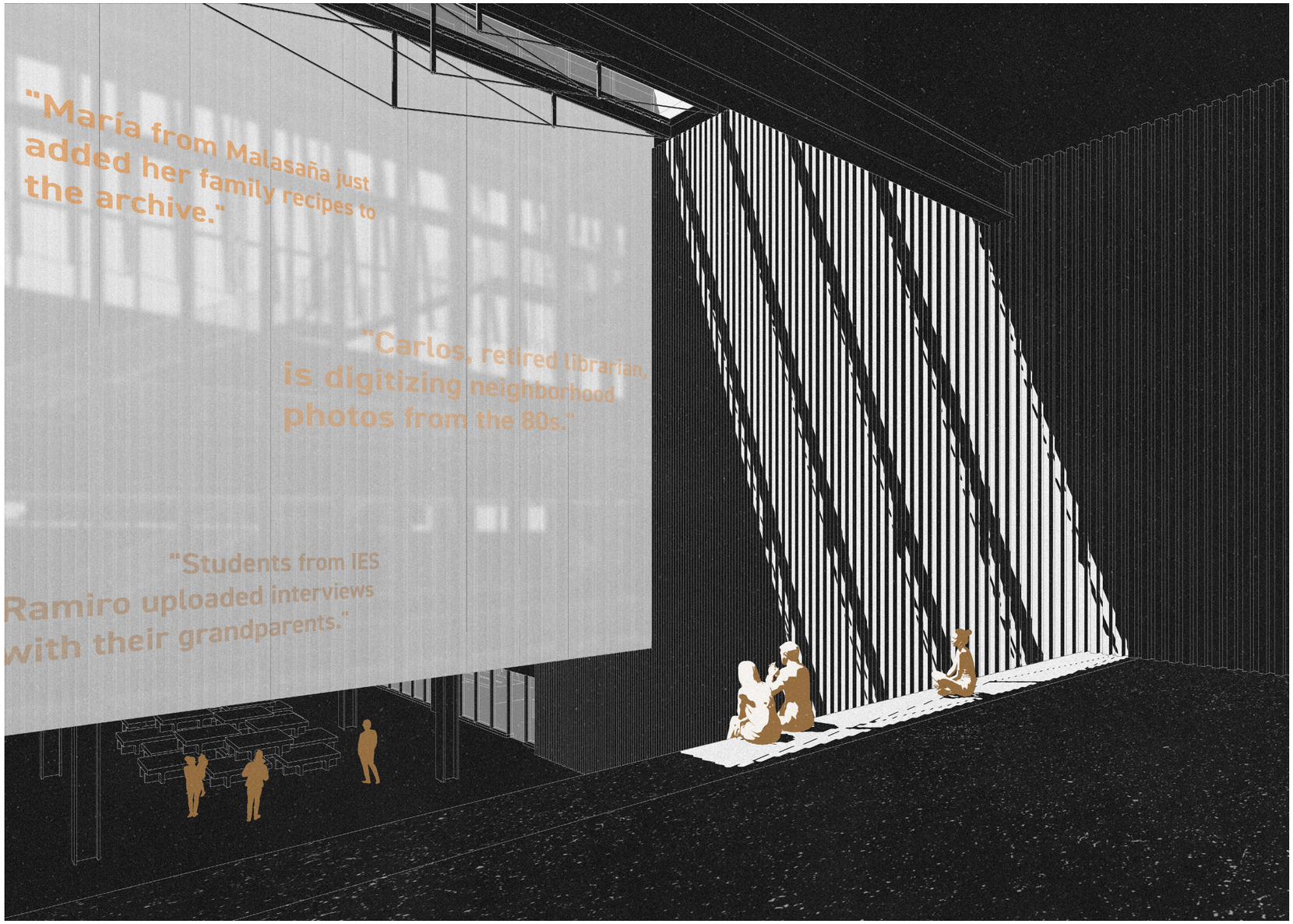
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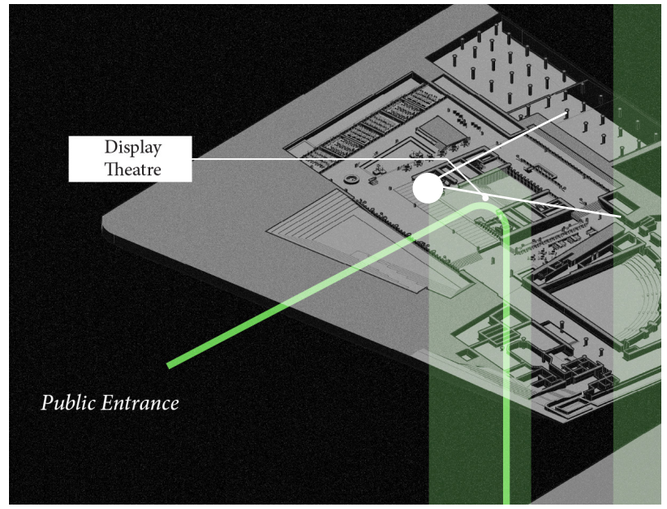
Conversational Search

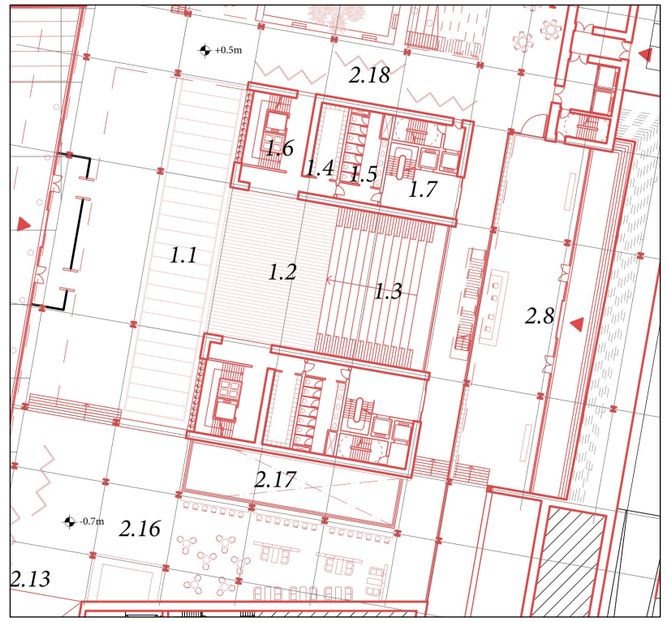
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Citizen Oversight

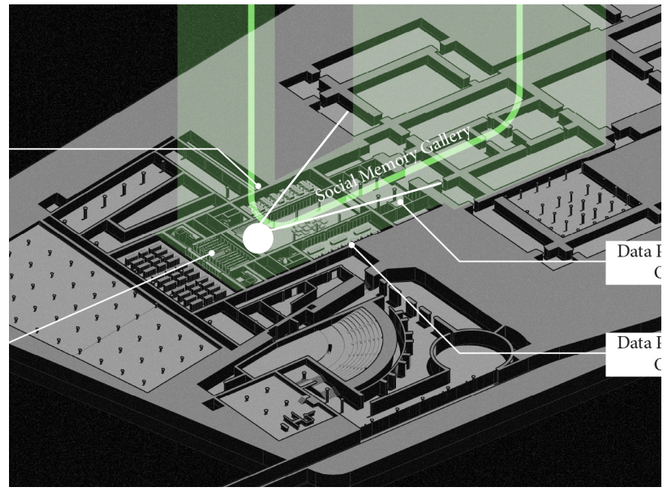


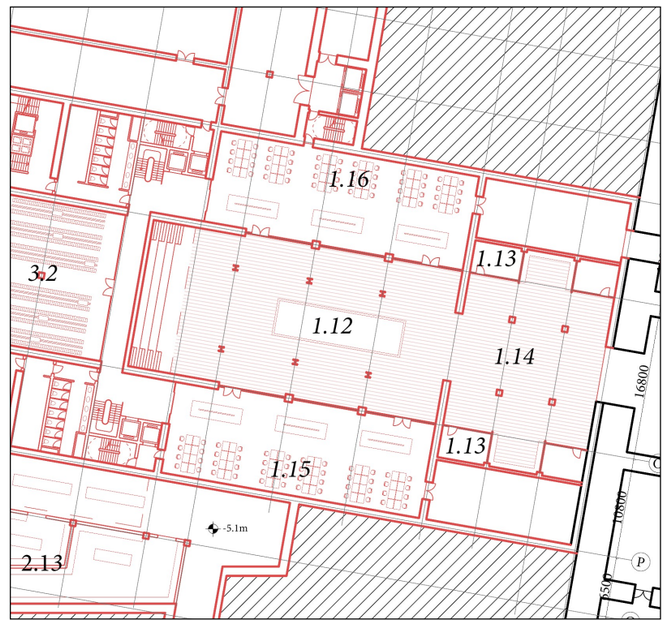

"María from Malasaña just added her family recipes to the archive."
"Carlos, retired librarian, is digitizing neighborhood photos from the 80s."
"Students from IES Ramiro uploaded interviews with their grandparents."

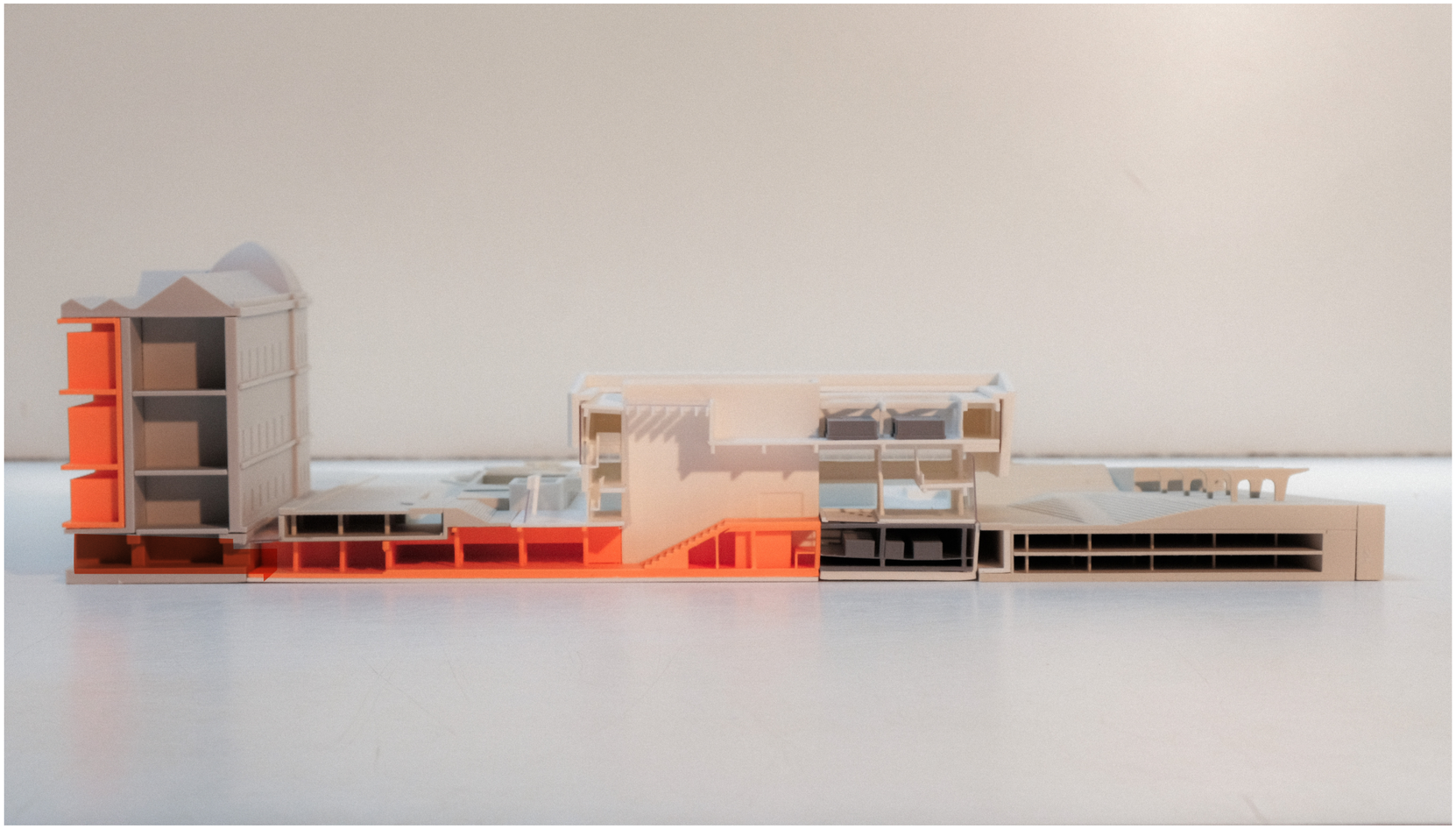

Display Theatre
Public Entrance


+0.5m
2.18
1.6
1.4
1.5
1.7
1.1
1.2
1.3
2.8
2.17
-0.7m
2.16
2.13

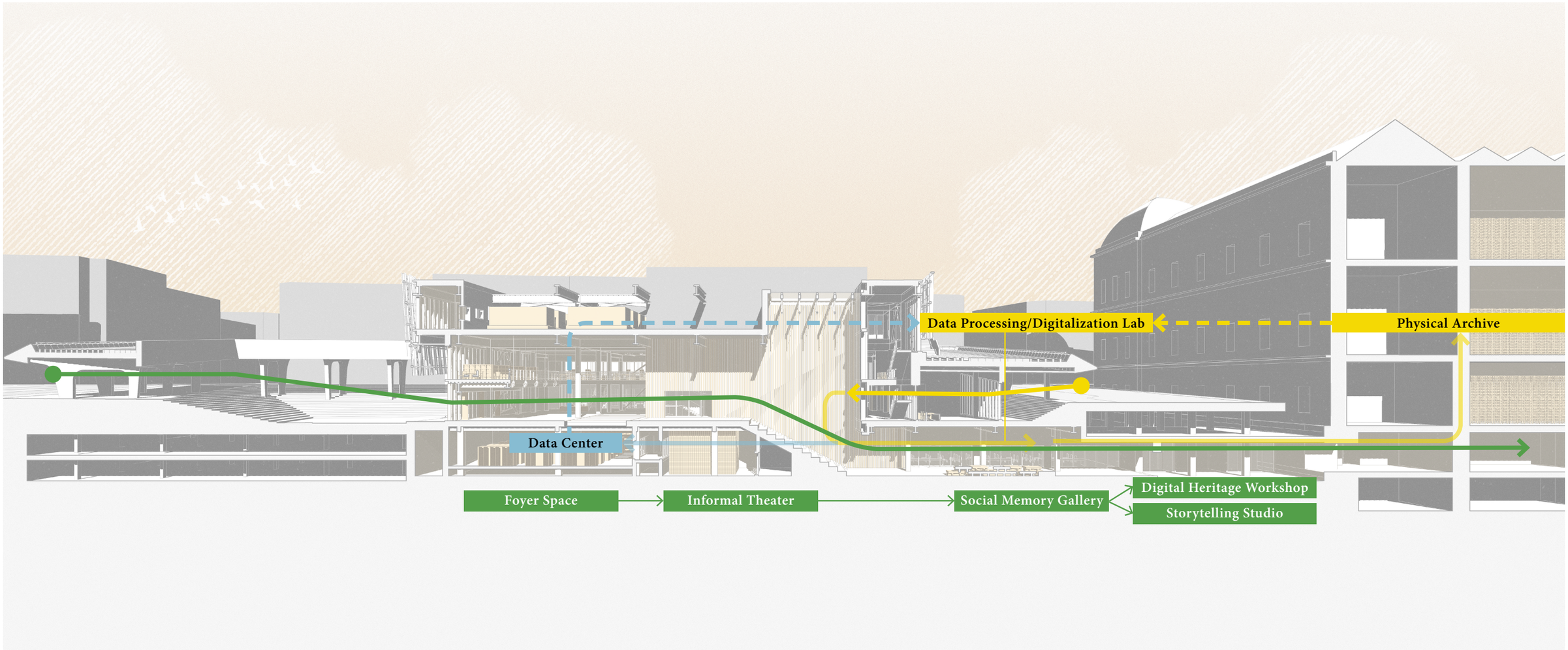

LABORATORIO DE
DIGITALIZACIÓN
APORTA
TUS CONOCIMIENTOS!
LABORATORIO DE
PROCESAMIENTO DE DATOS


Social Memory Gallery
Data P
C
Data P
C


1.16
1.13
3.2
1.12
1.14
16800
1.13
1.15
-5.1m
16800
2.13
850
P






Data Processing/Digitalization Lab
Physical Archive
Data Center
Foyer Space
Informal Theater
Social Memory Gallery
Digital Heritage Workshop
Storytelling Studio

Civic Technology Hub (Digital Literacy Commons)

Civic Tech Hub + Data Center:

- Glass viewing corridors allowing students to observe server operations during classes
- Real-time infrastructure dashboards integrated into learning stations
- Exposed MEP systems
- Interactive displays showing data flow and energy consumption

- AI-Mediated Knowledge Integration Flow:

Personal Story/Knowledge

↓

AI Training Workshop

↓

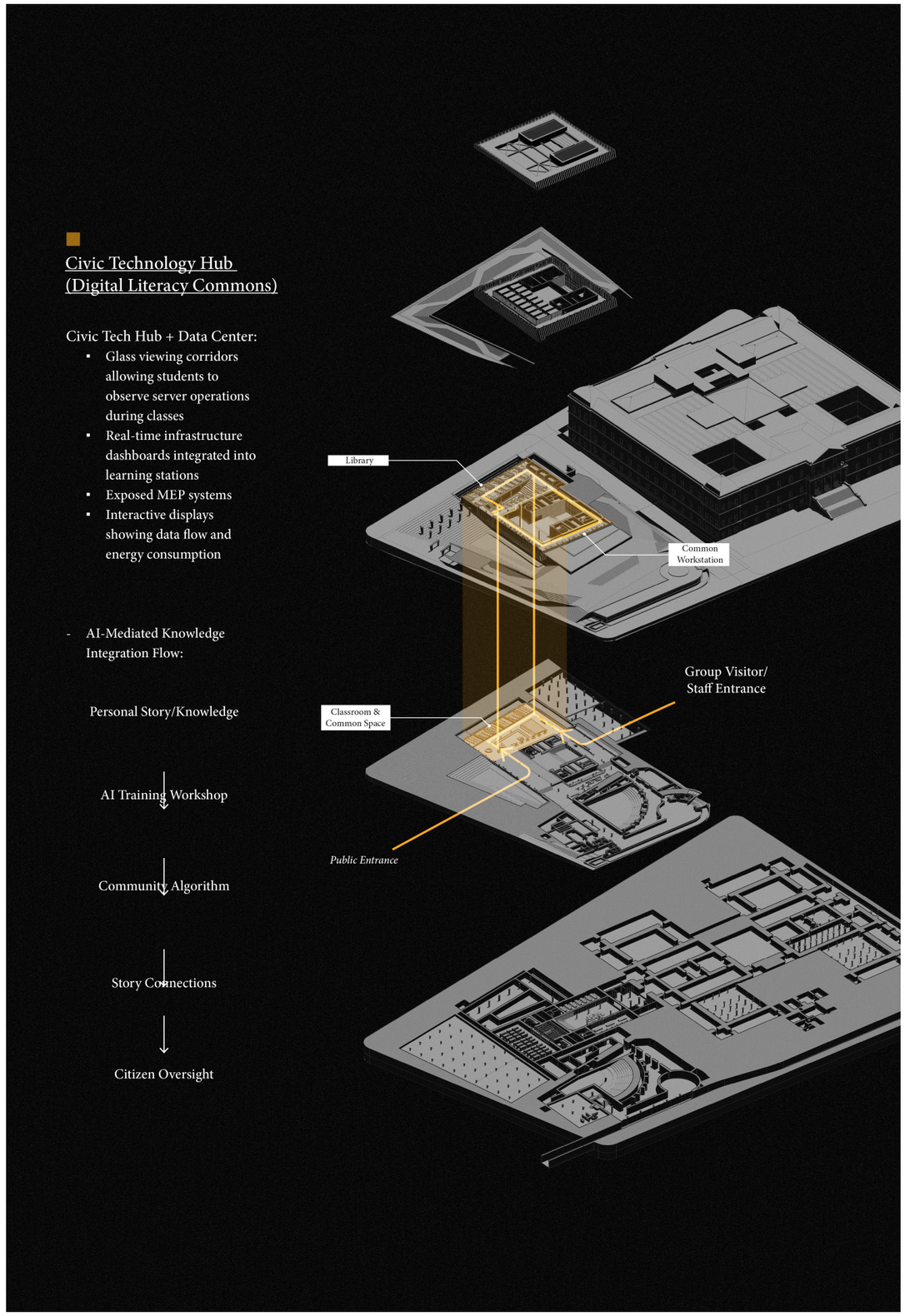
Community Algorithm

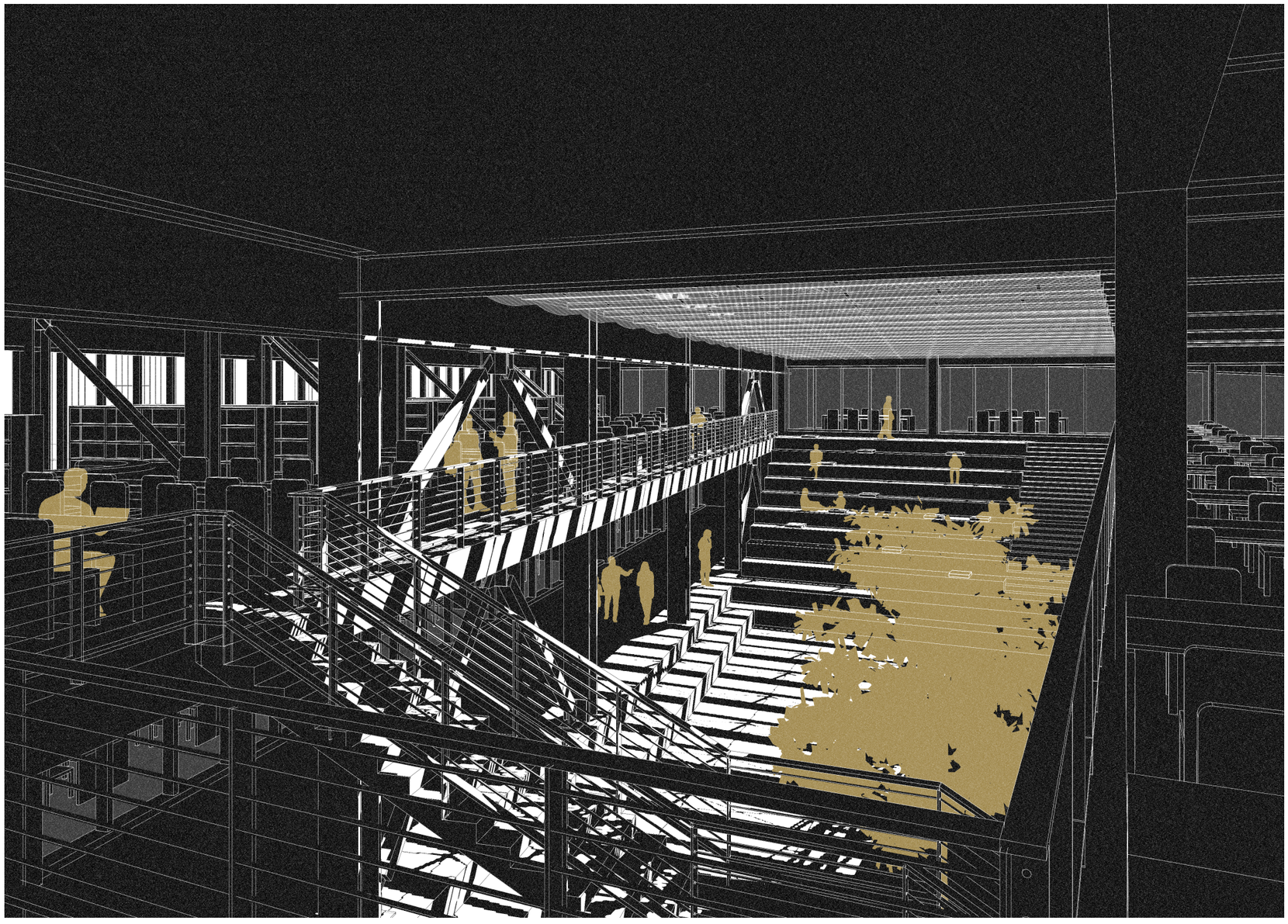
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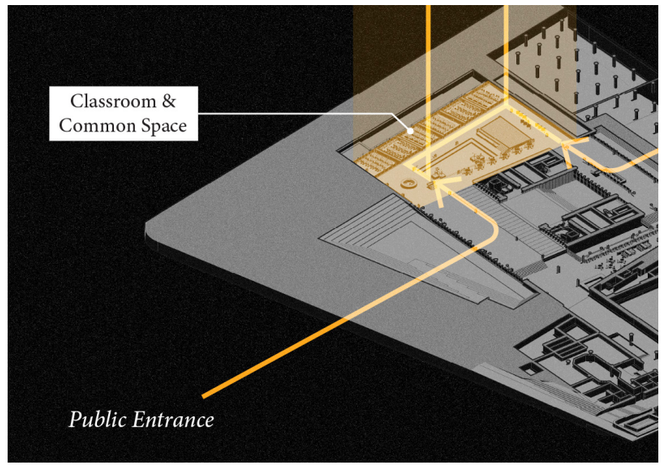
Story Connections

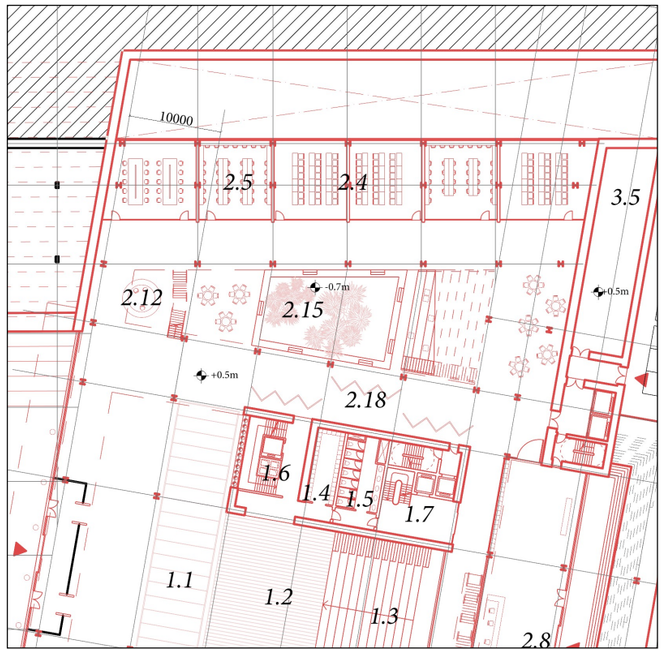
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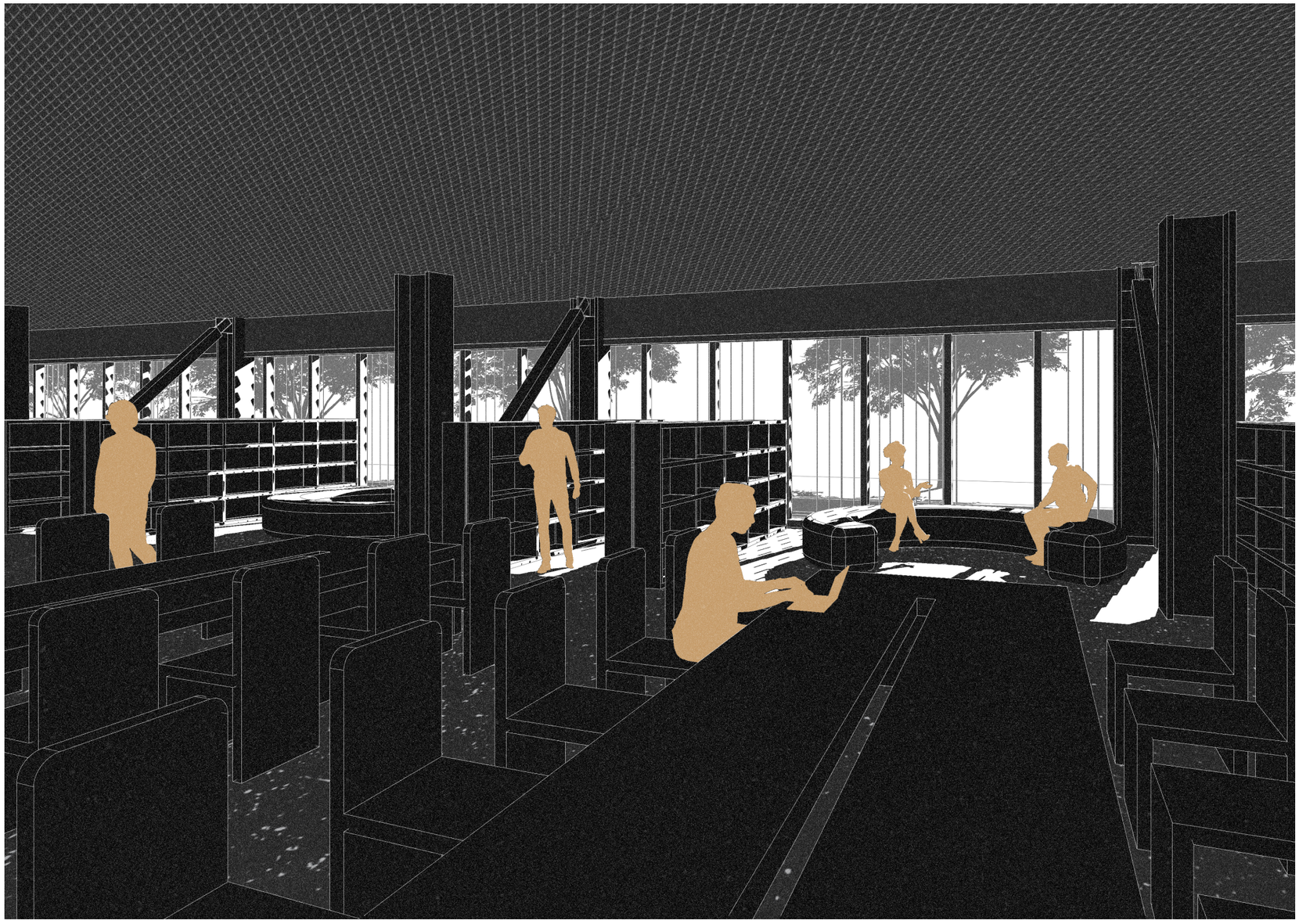
Citizen Oversight

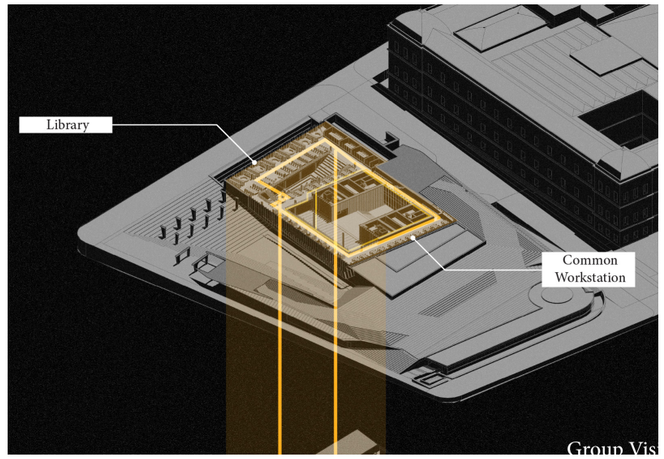


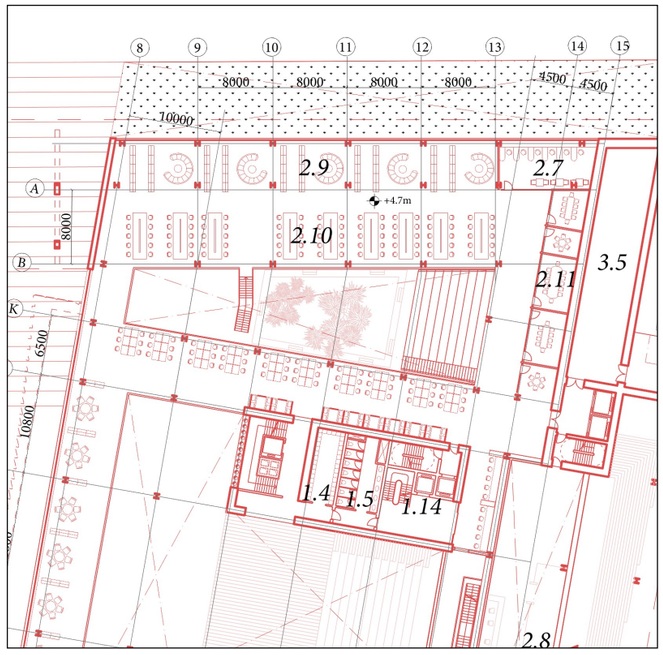


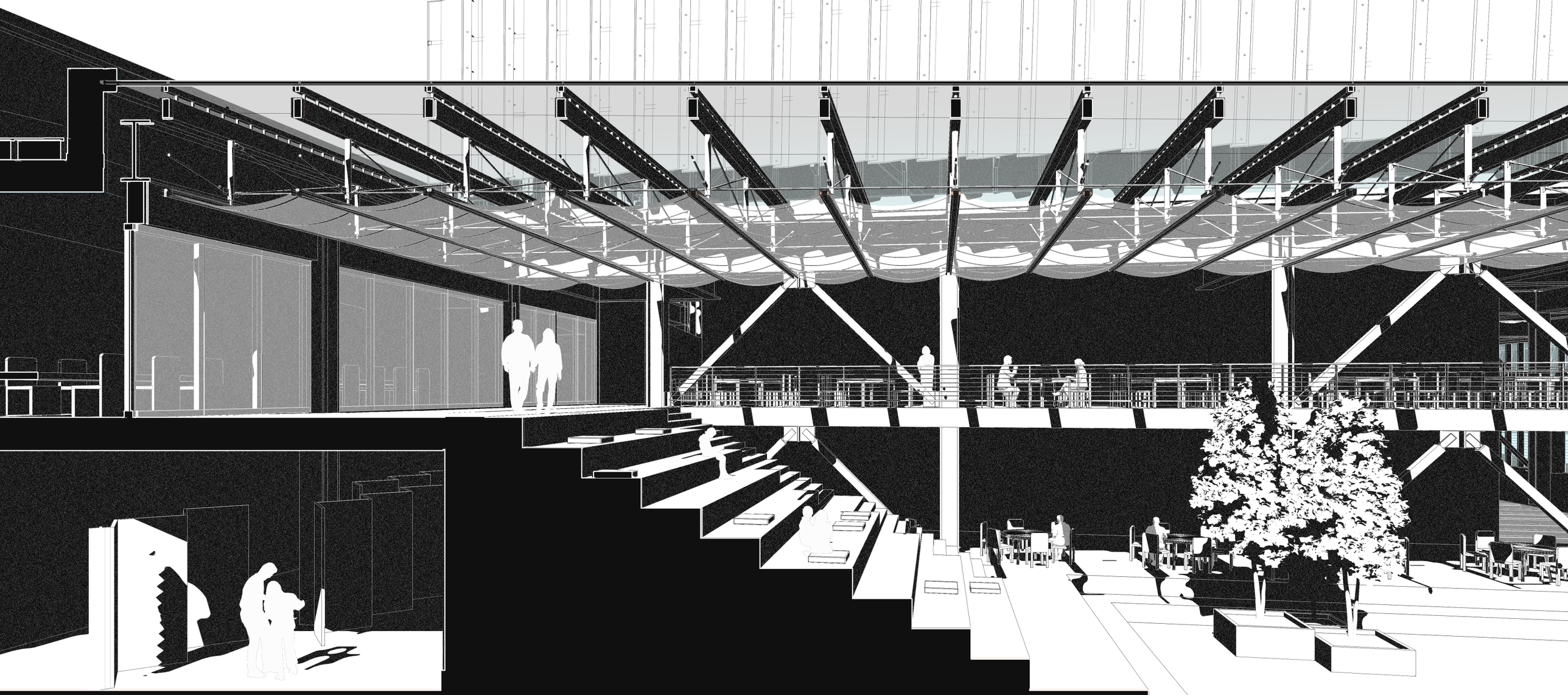

Classroom &
Common Space
Public Entrance


10000
2.5
2.4
3.5
2.12
2.15
-0.7m
-0.5m
+0.5m
2.18
1.6
1.4
1.5
1.7
1.1
1.2
1.3
2.8




Library
Common
Workstation
Group Vis


8
9
10
11
12
13
14
15
8000
8000
8000
8000
4500
4500
10000
2.9
2.7
+4.7m
A
8000
2.10
B
2.11
3.5
K
6500
10800
1.4
1.5
1.14
2.8



PROGRAMS

Common Atrium

ARCHITECTURAL DESIGN CROSSOVER

Social Memory Gallery (Memory Commons)

Social Memory Commons + Archive Commons

- Community story recording stations feeding into archive database
- Collaborative cataloging workspaces where citizens help tag historical materials
- Exhibition prep areas where archived materials become public displays
- Research consultation desks connecting personal stories to historical context

Community Contribution Flow:

Personal Story /Knowledge Contribution

↓

Review & Tag

↓

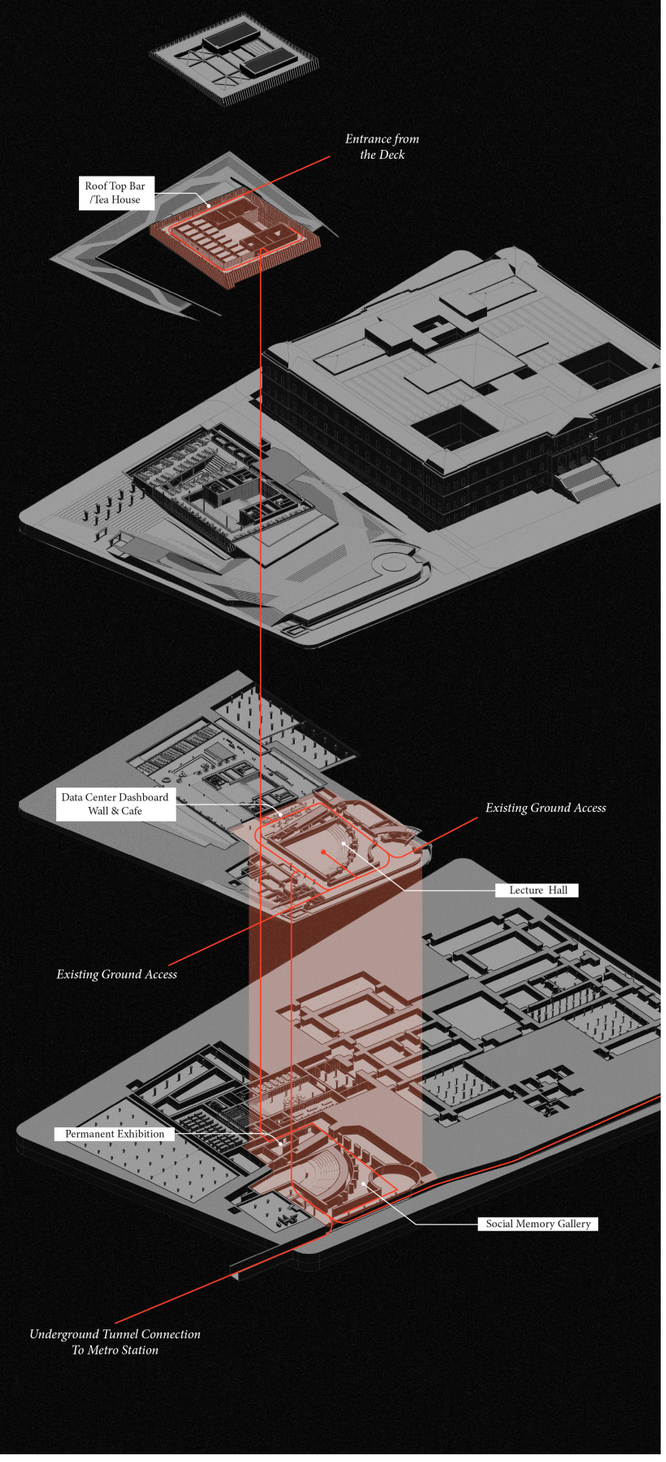
Digital Storage

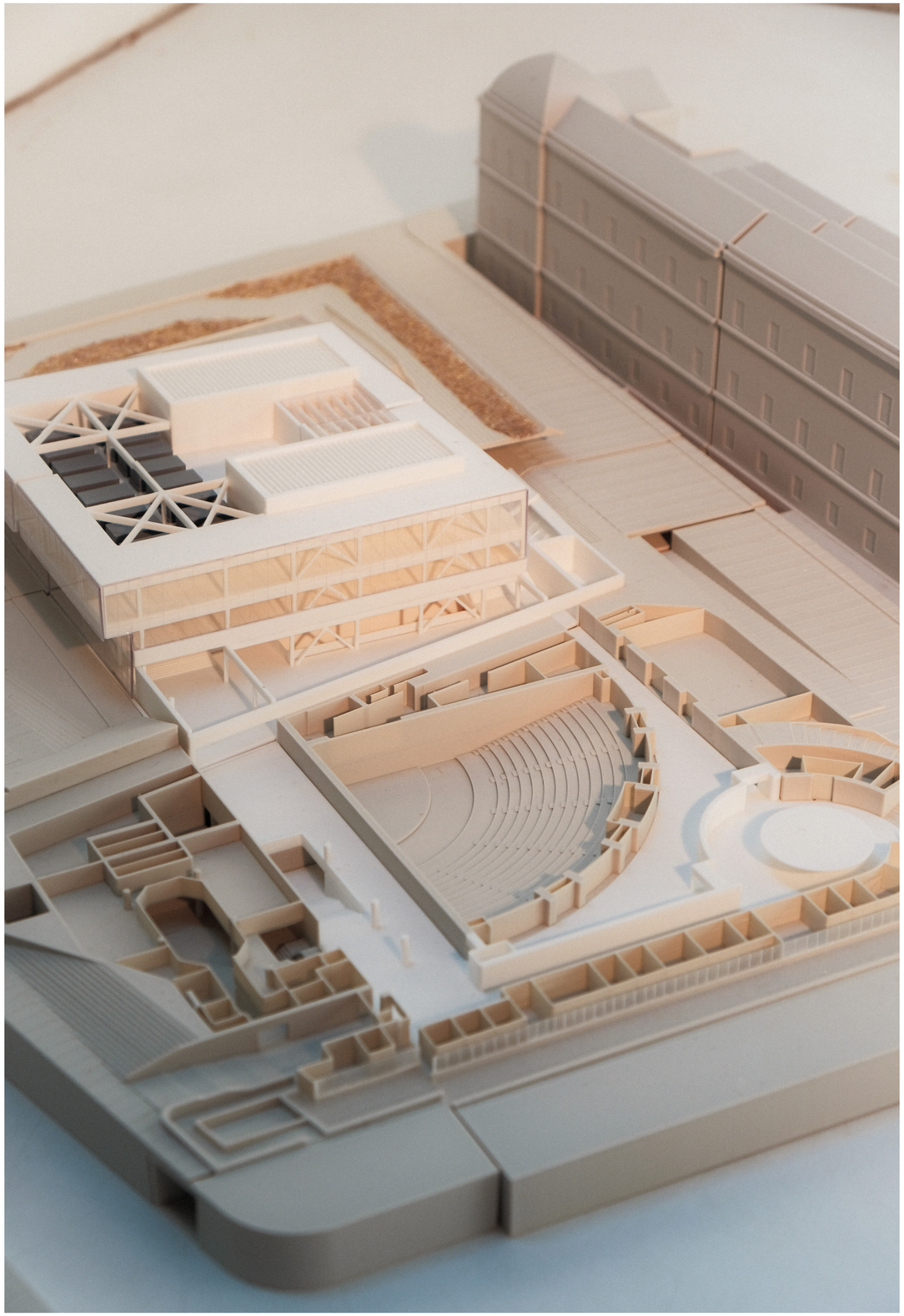
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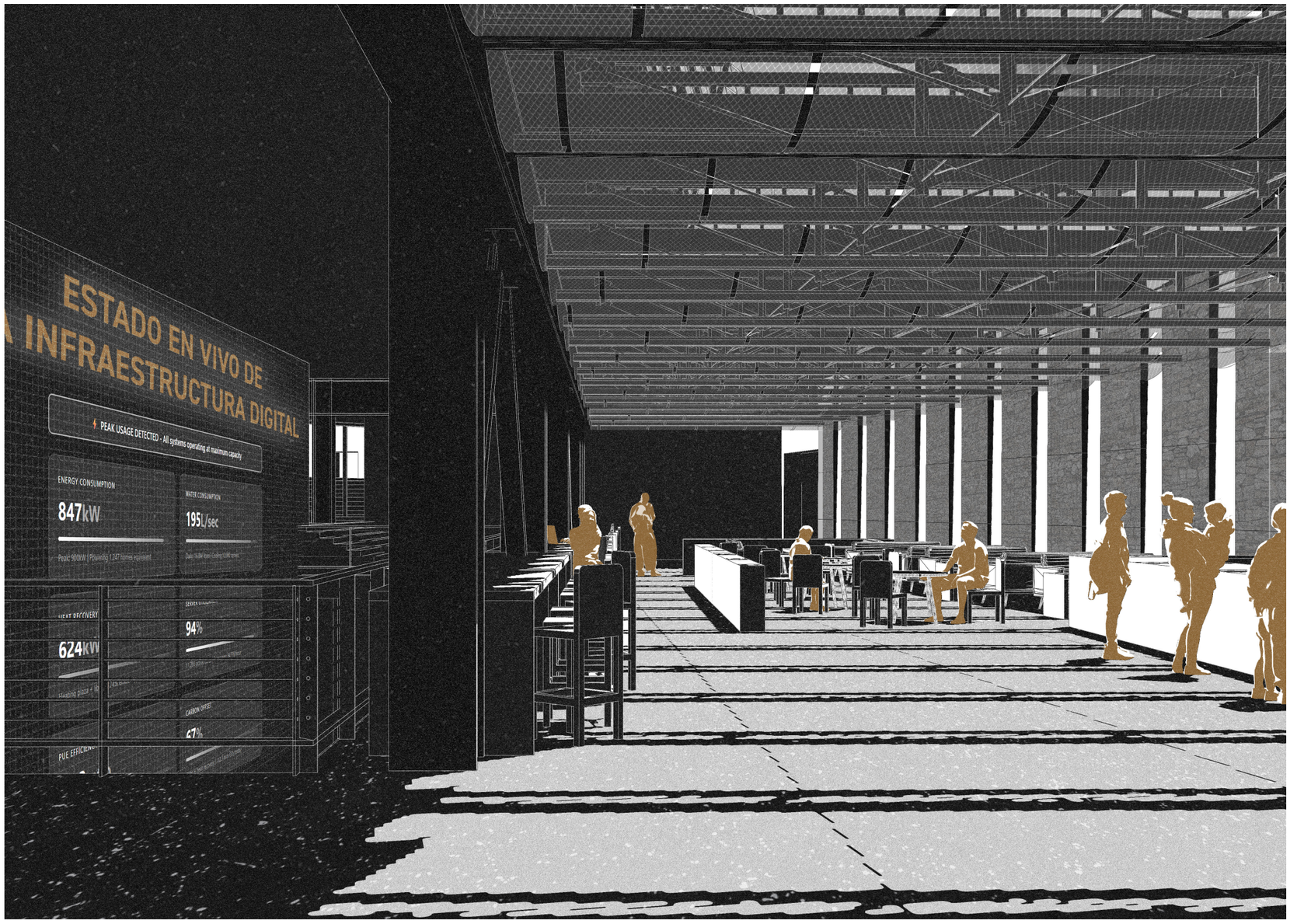
Public Exhibition

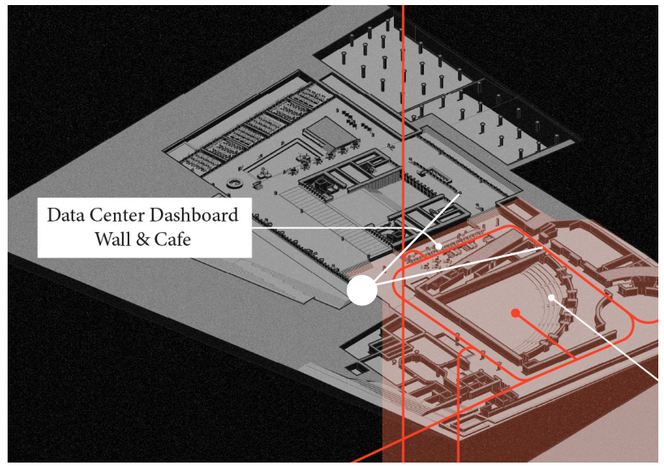
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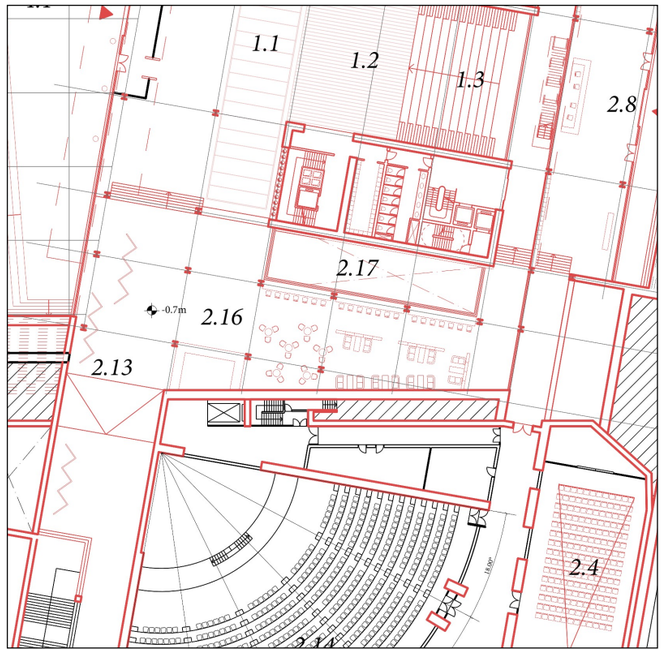
Community Social Memory

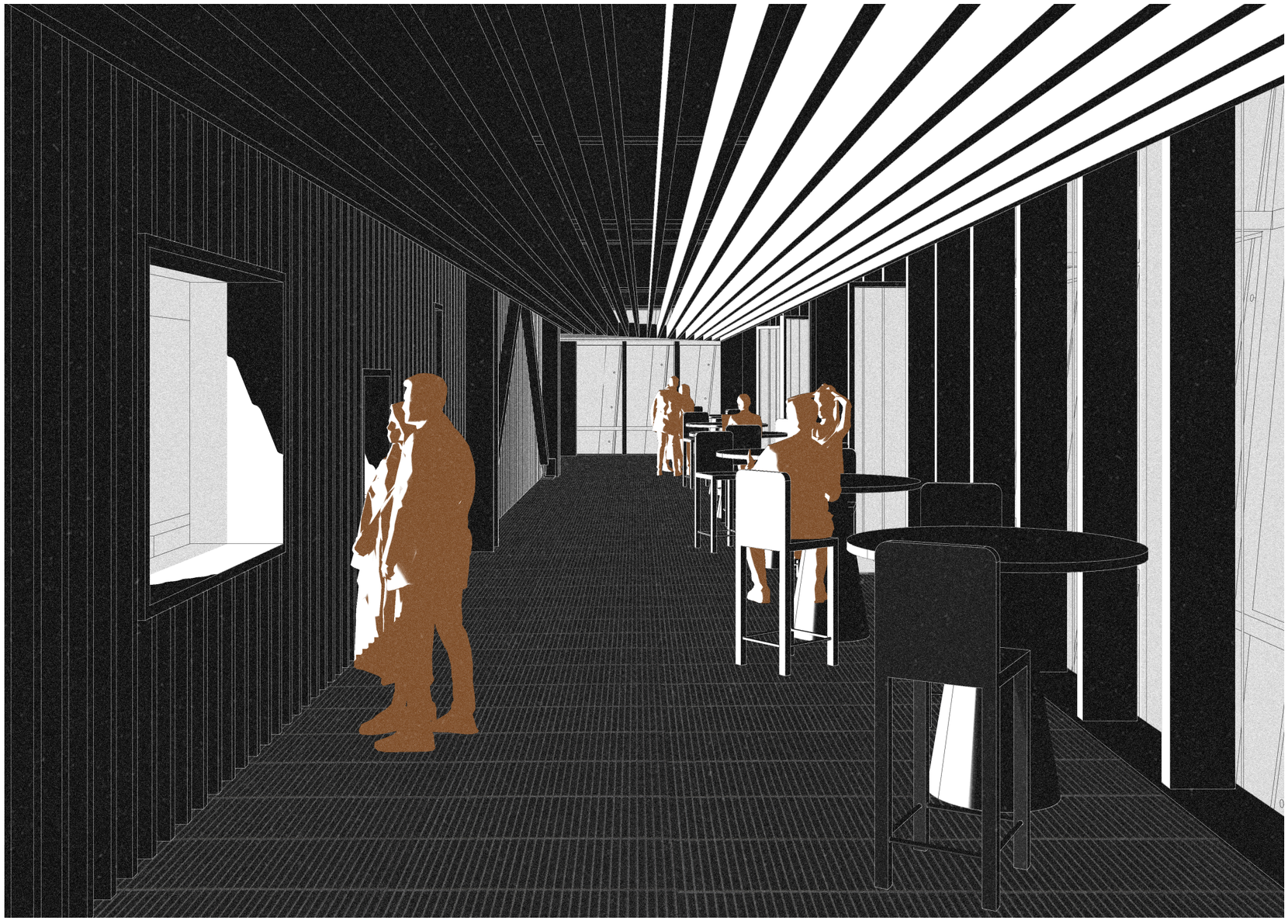


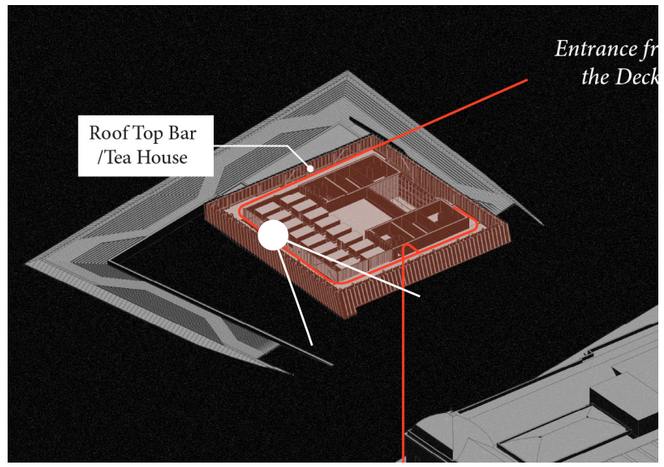


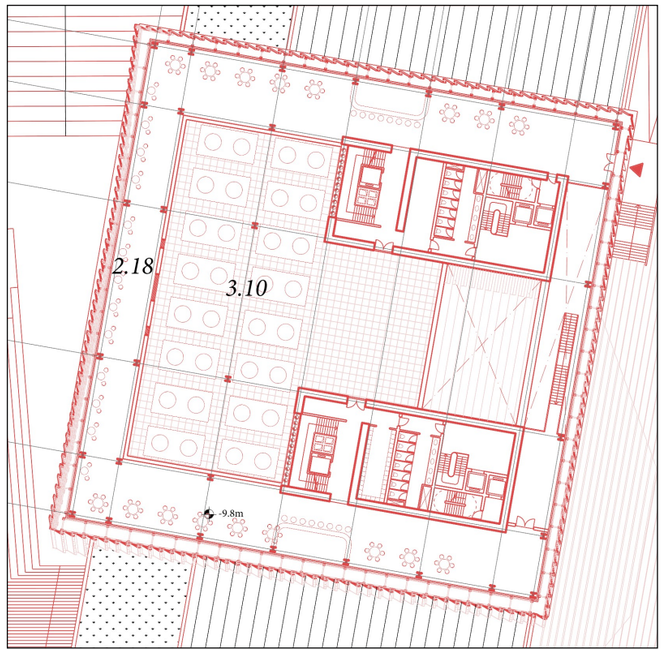

ESTADO EN VIVO DE
INFRAESTRUCTURA DIGITAL
PEAK USAGE DETECTED - All systems operating at maximum capacity
ENERGY CONSUMPTION
847kW
WATER CONSUMPTION
195L/sec
624kW
94%
47%


Data Center Dashboard
Wall & Cafe


1.1
1.2
1.3
2.8
2.17
-0.7m
2.16
2.13
2.4




Entrance fr
the Deck
Roof Top Bar
/Tea House


2.18
3.10
-9.8m

Transparent Infrastructure Core

Civic Tech Hub + Data Center:

- Glass viewing corridors allowing students to observe server operations during classes
- Real-time infrastructure dashboards integrated into learning stations
- Exposed MEP systems
- Interactive displays showing data flow and energy consumption

- Learning-by-Observing Flow:

Digital Theory
from Classes (Abstract Concept)

↓

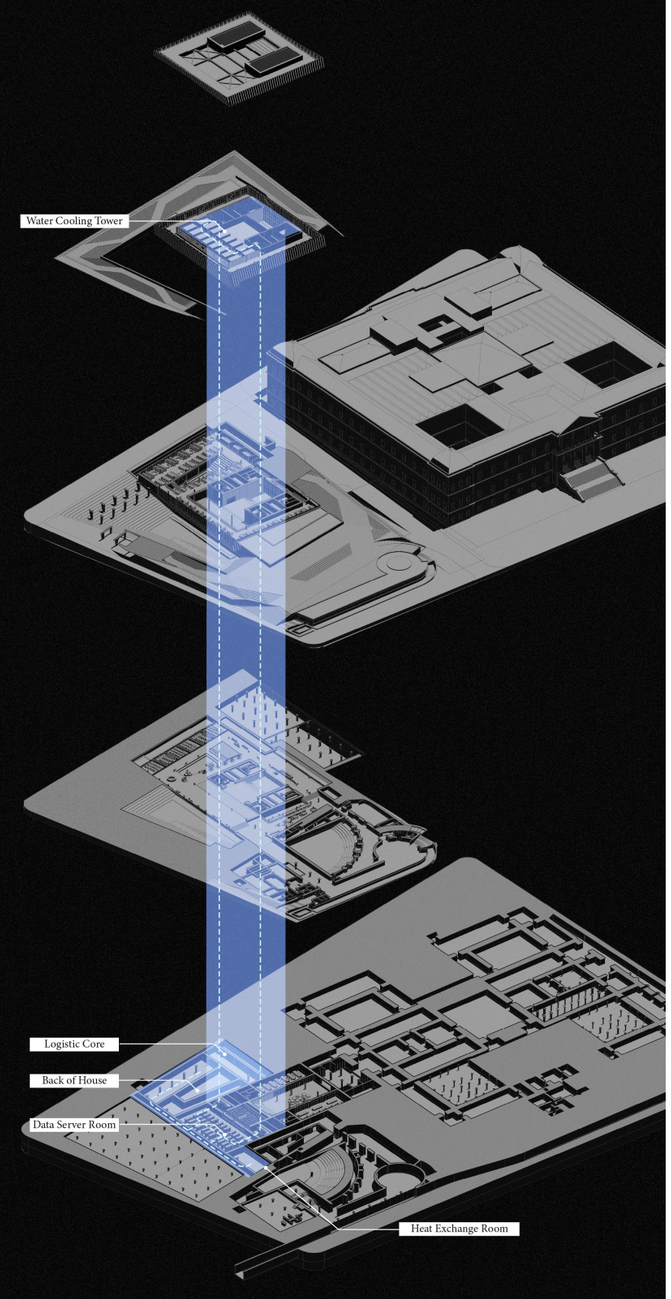
Live Observation
of Server Operation
(Physical Reality)

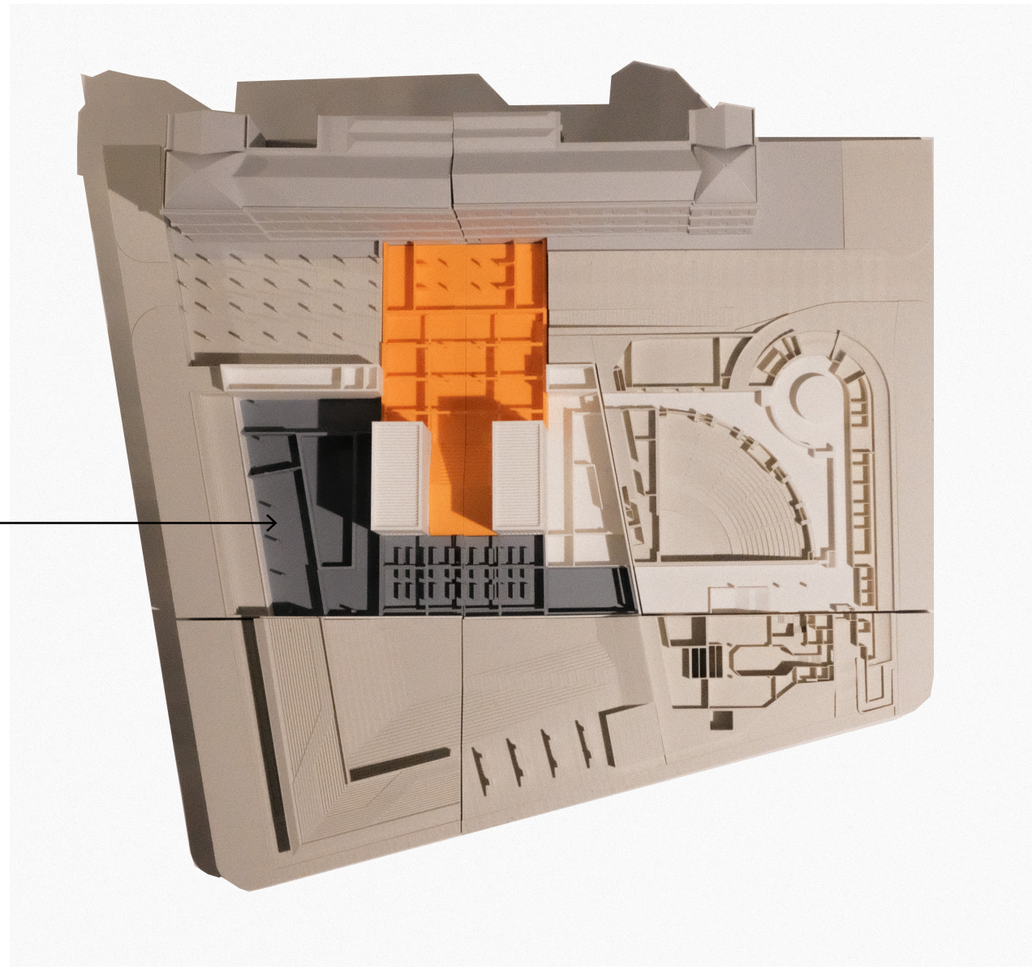
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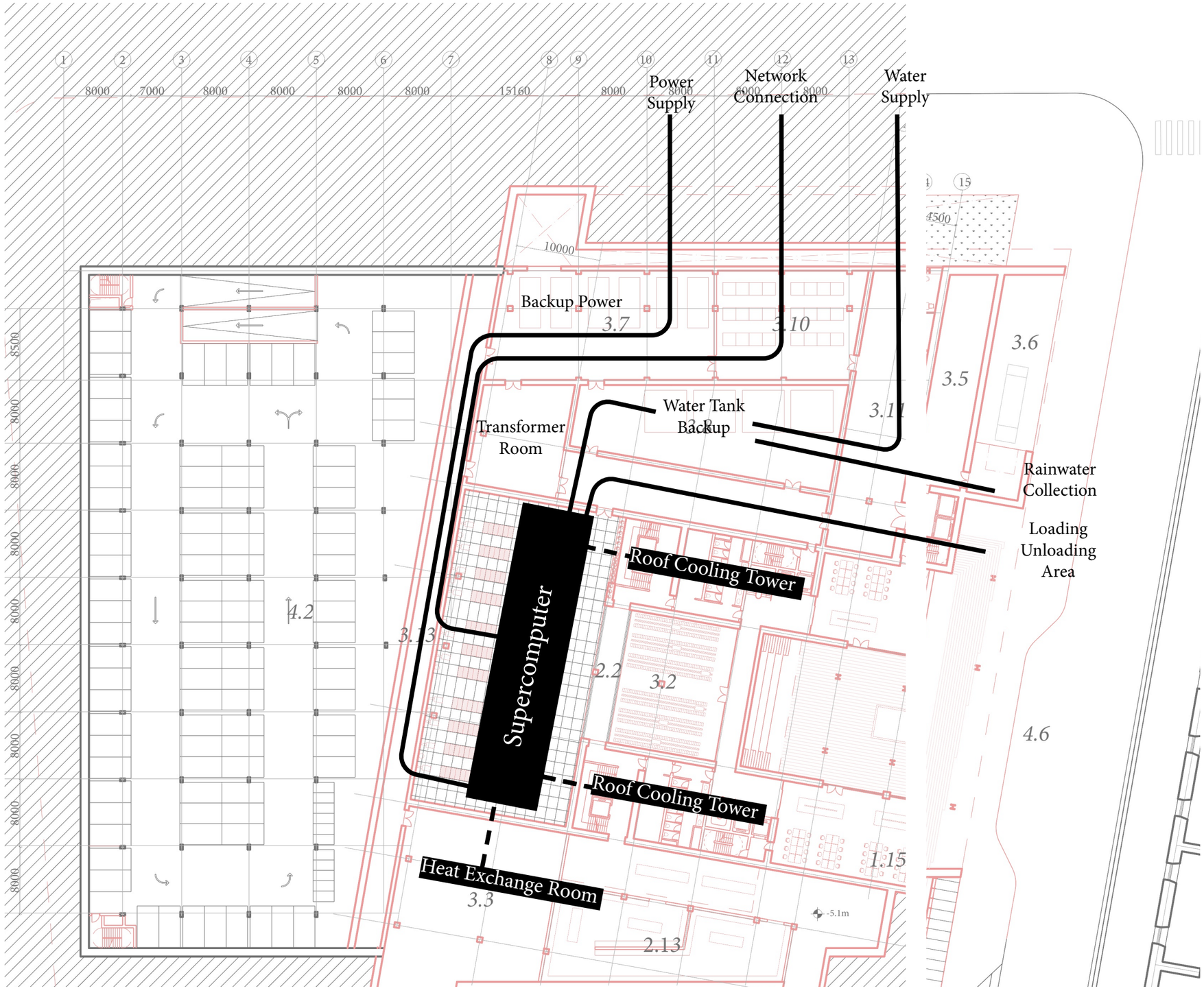
Real Understanding
(Informed Citizenship)

↓

Other
Practical Application

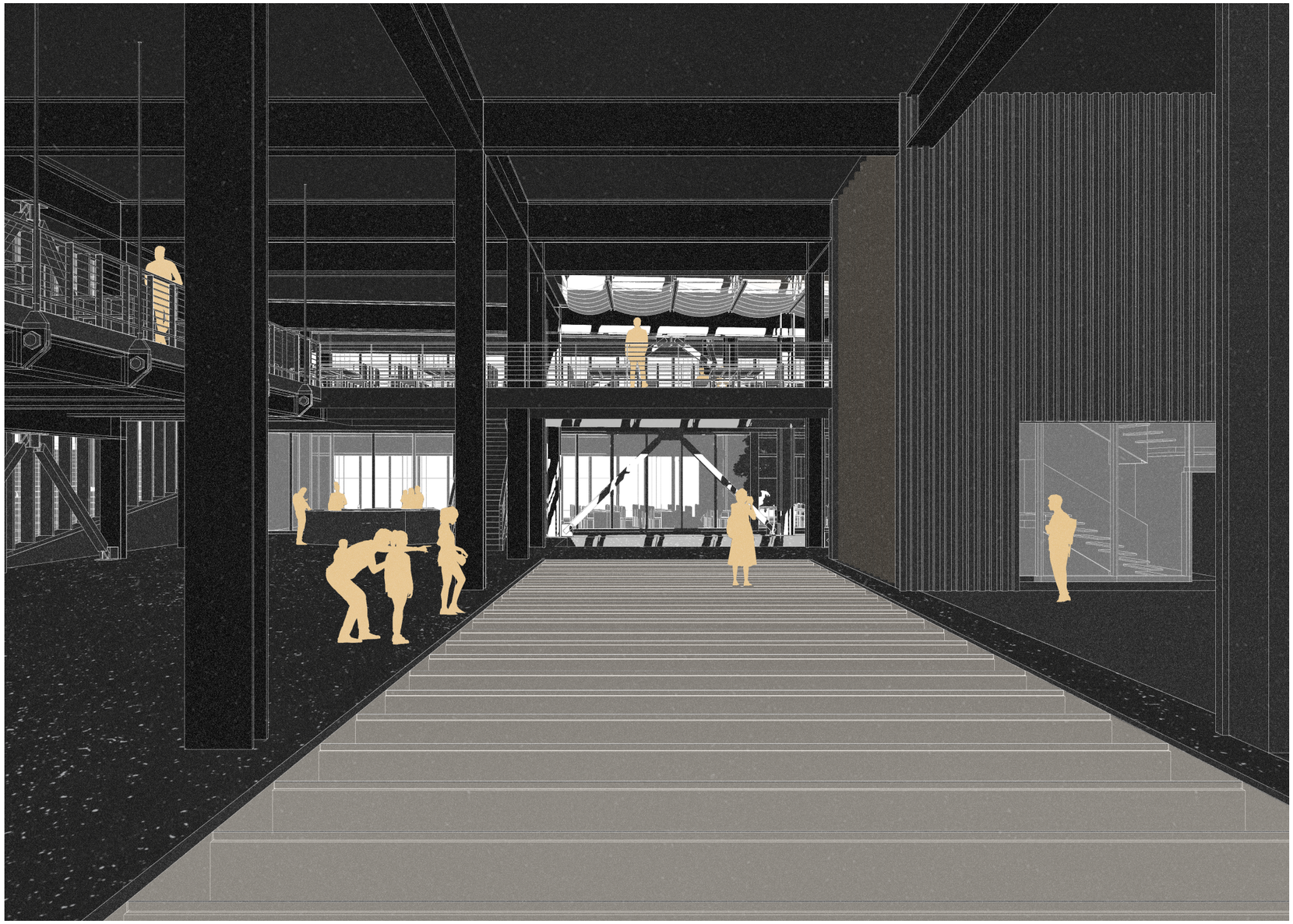


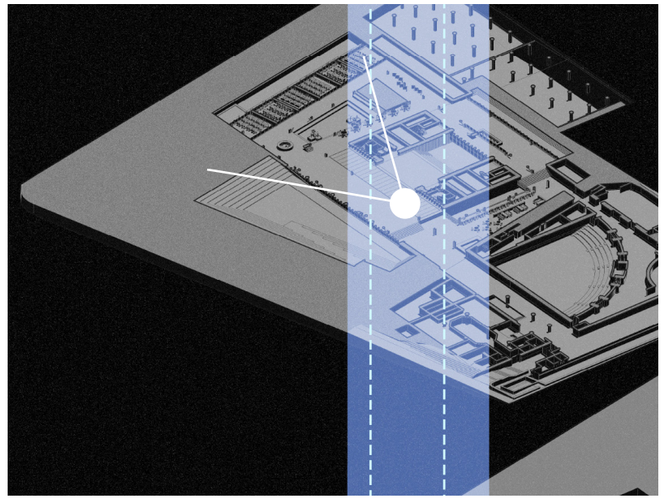

Power,
Water Supply
from the city

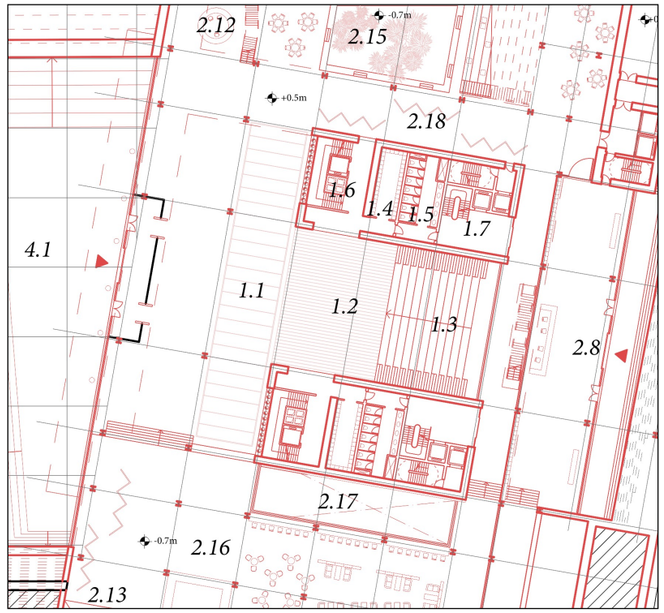


Transparent Infrastructure Core

3.1 Supercomputer Room (Hot Data)
3.2 Tape Digital Archive (Cold Data)
3.3 Heat Exchange Room
3.4 Liquid Cooling System
3.5 Service Core
3.6 Loading/Unloading Bay
3.7 Diesal Gernerator Room
3.8 Water Storage Tank & Pump Room
3.9 Transformer Room
3.10 Network Operations Center
3.11 Storage Room
3.12 Cooling Tower
3.13 Service Corridor



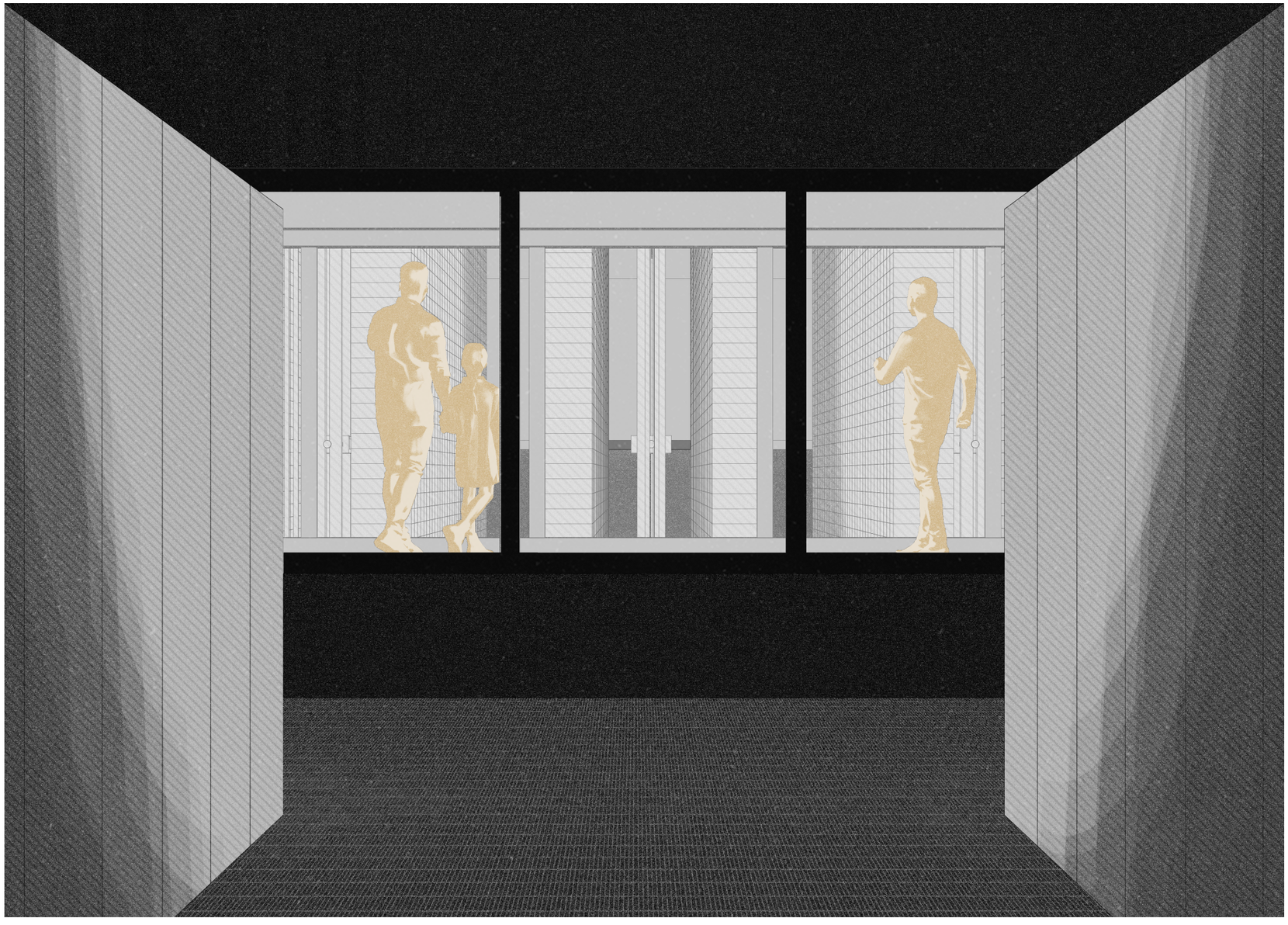


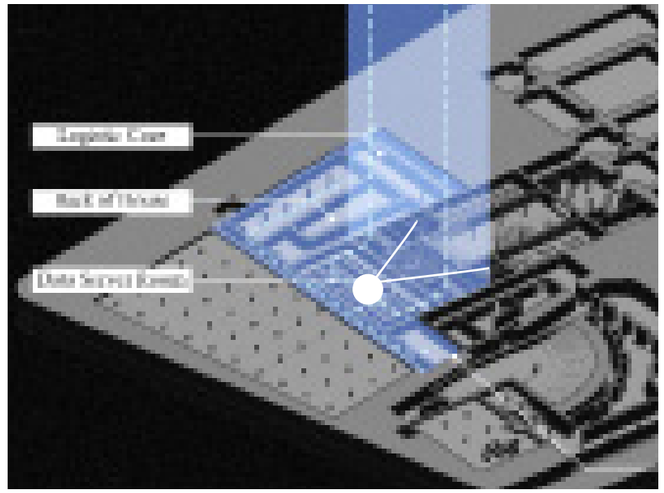


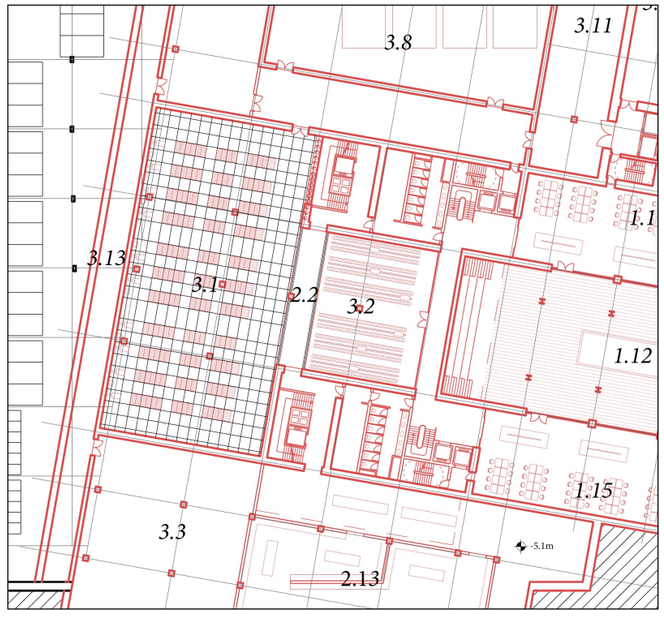
PROGRAMS

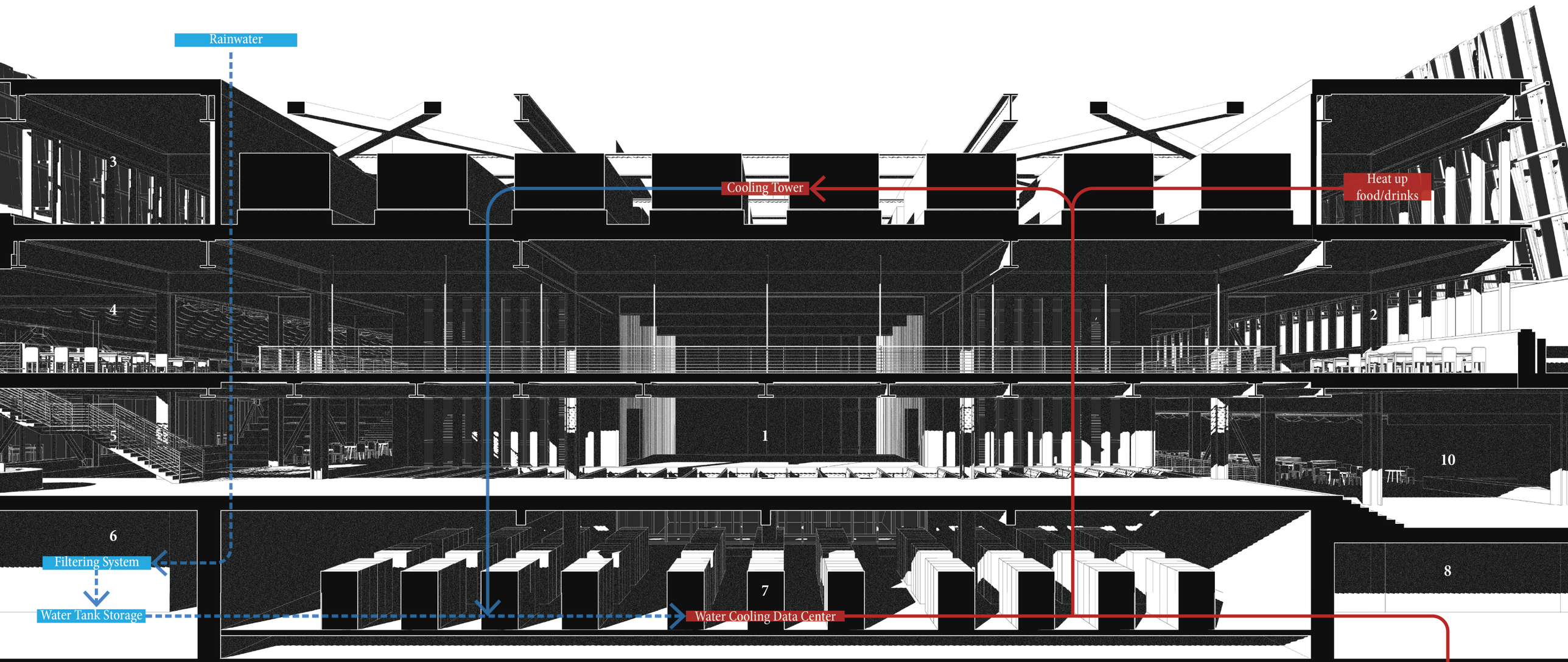
Observational glass floor

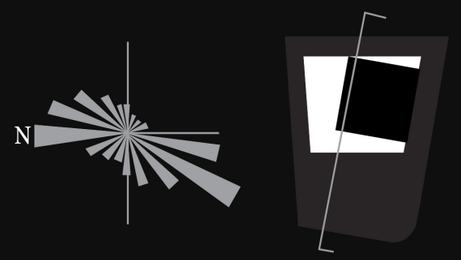
ARCHITECTURAL DESIGN CROSSOVER




Longitudinal Section
Roof Plan
Ground Surface Elevation

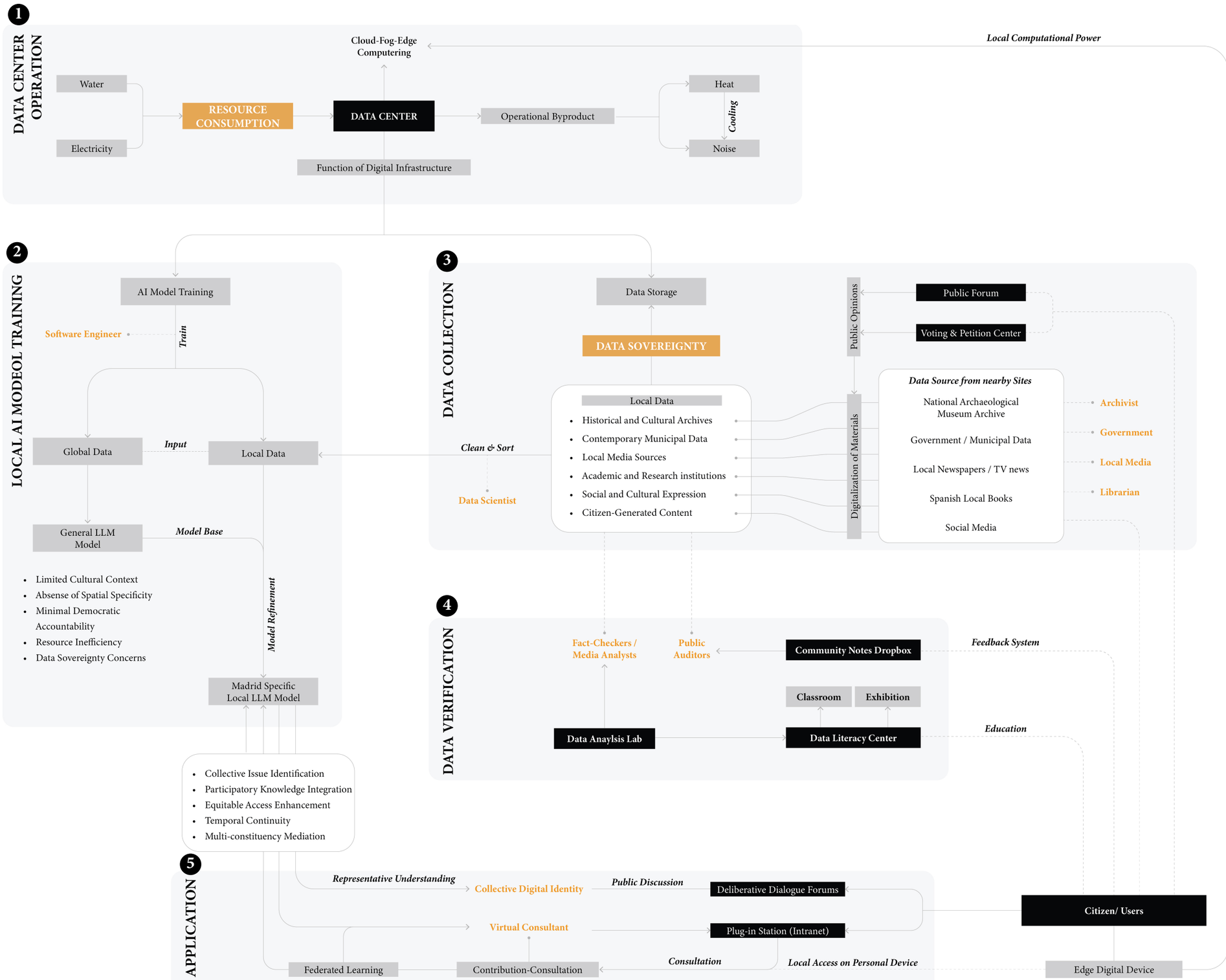

3.8
3.11
1.1
3.13
3.1
2.2
3.2
1.12
1.15
3.3
-5.1m
2.13





B-B Section

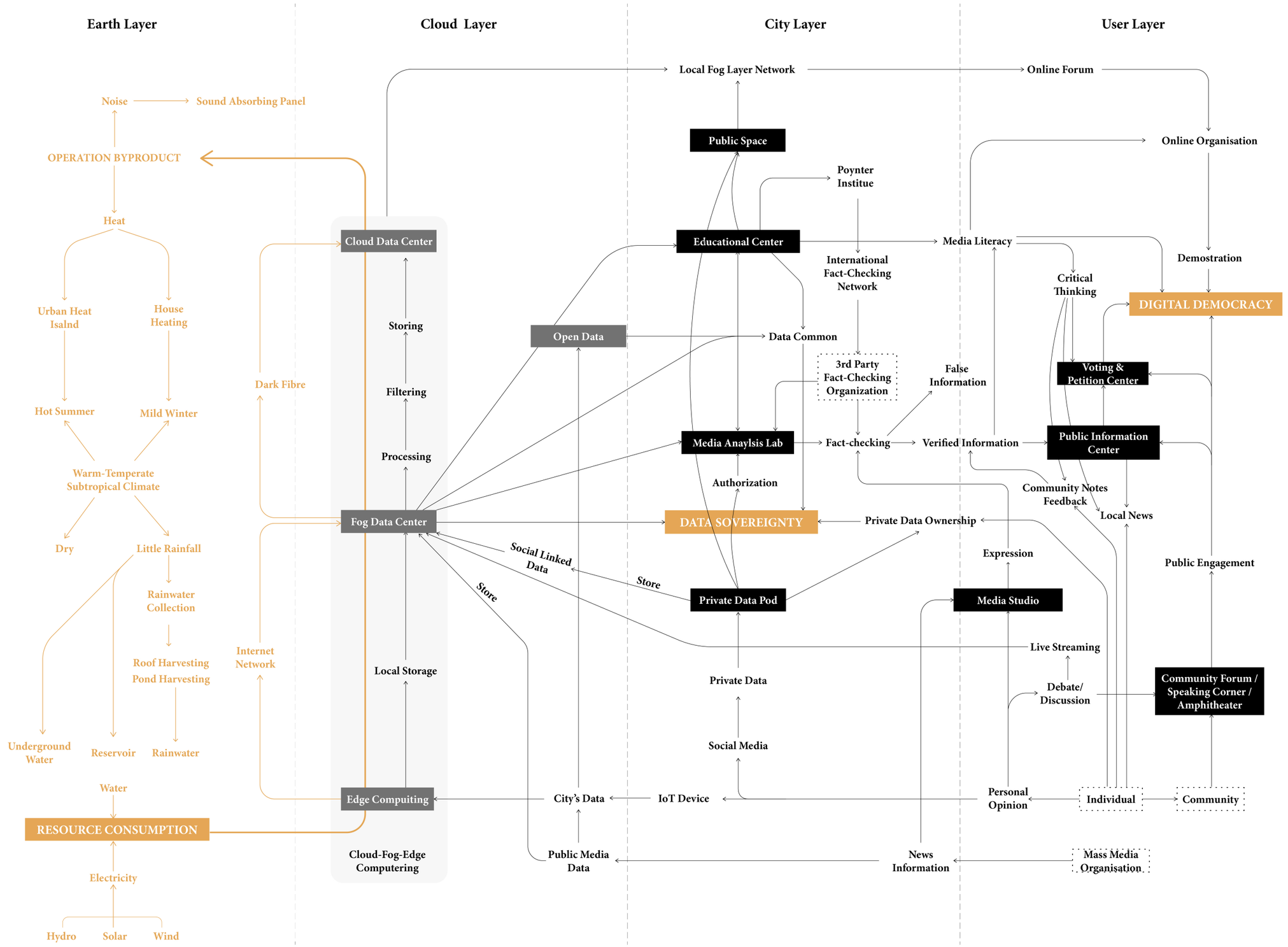
1. Reception Space
2. Quiet Working Station
3. Rooftop Bar & Teahouse
4. Digital Library
5. Classroom and Workshop
6. Technical Rooms (Power and water supply)
7. Data Cemter
8. Heat Exchange Room
9. Pedestrian Deck



ACTOR NETWORK DIAGRAM

Turn The flow of Data into architectural space sequences

ARCHITECTURAL DESIGN CROSSOVER



ACTOR NETWORK DIAGRAM

Entanglement of Systems give the complexity of the civic architecture.

ARCHITECTURAL DESIGN CROSSOVER

Building Technology

Transforming Concepts into Reality

Underground Architecture

Conflict between New & Old

Climate Response

Sustainability

Provide major lateral support

Allow flexibility in the future transfor-
mation of space

8m x 8m structural grid

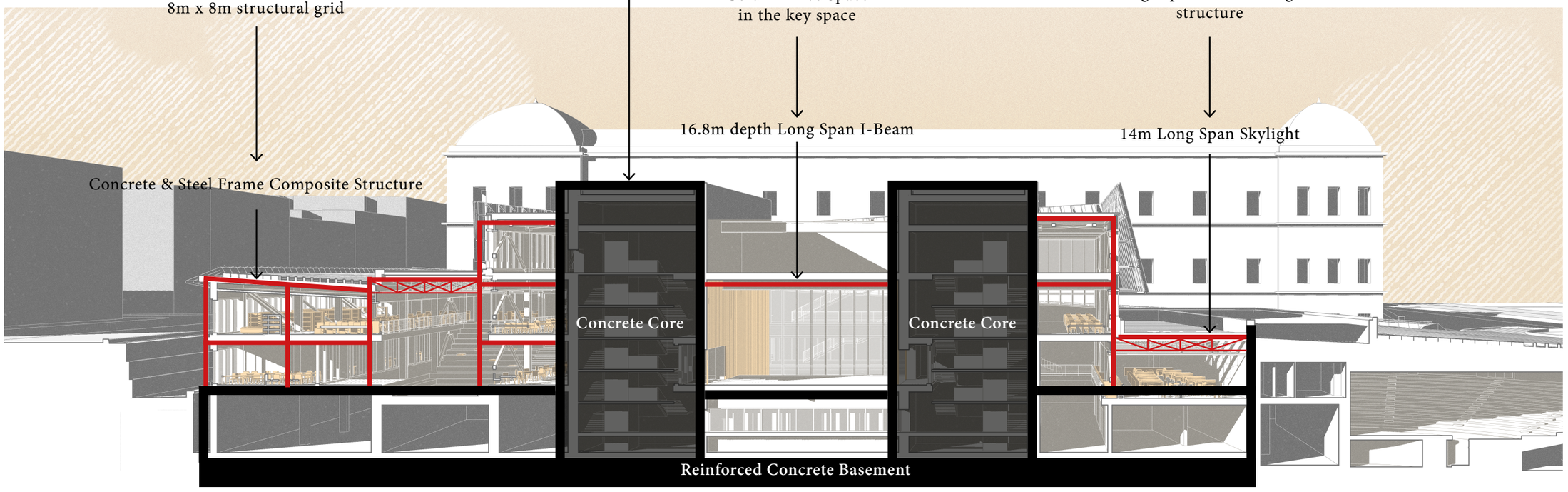
Concrete & Steel Frame Composite Structure

Column Free Space
in the key space

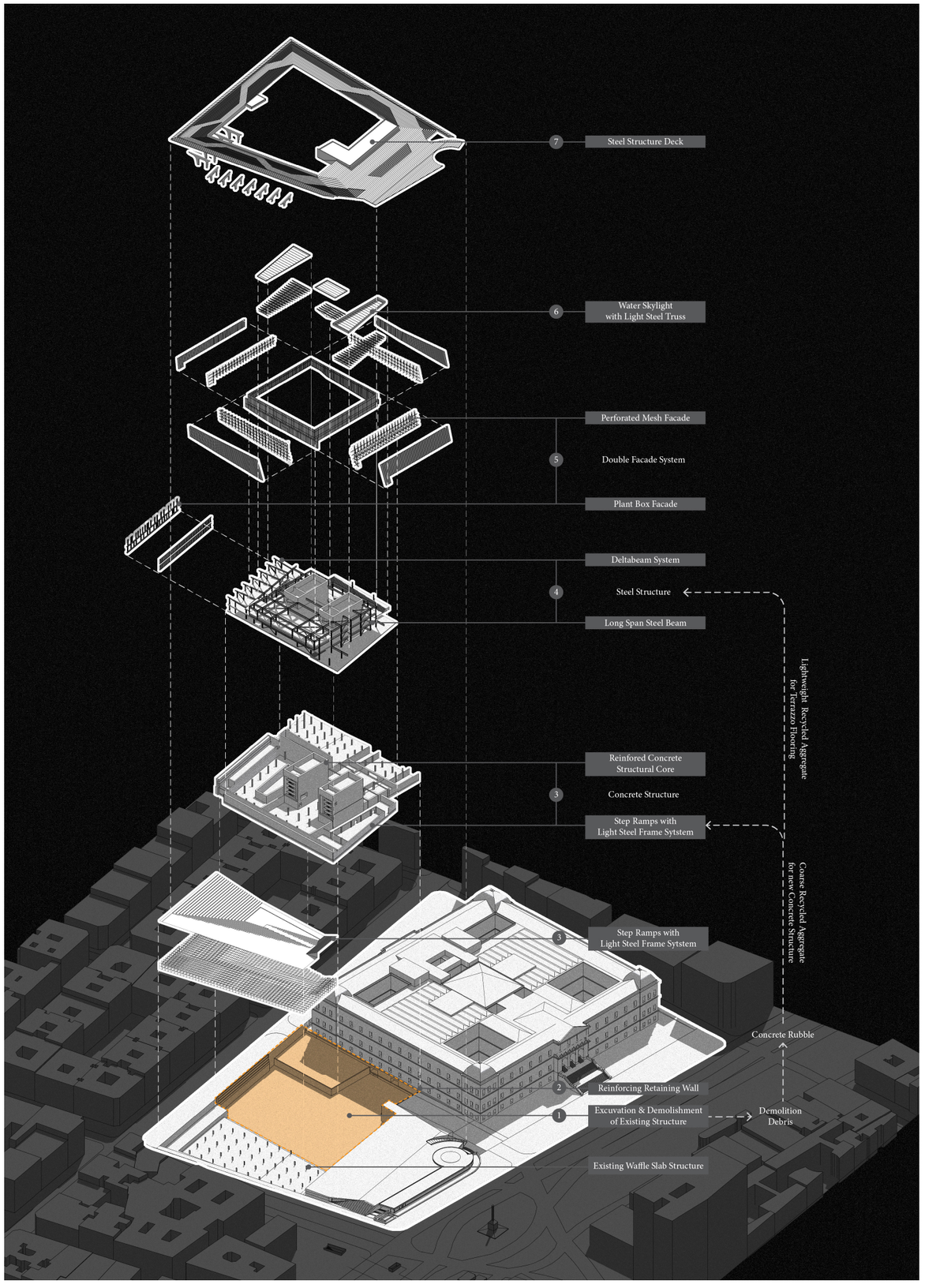
16.8m depth Long Span I-Beam

Lighter steel Truss that allowing
more light penetrate through the
structure

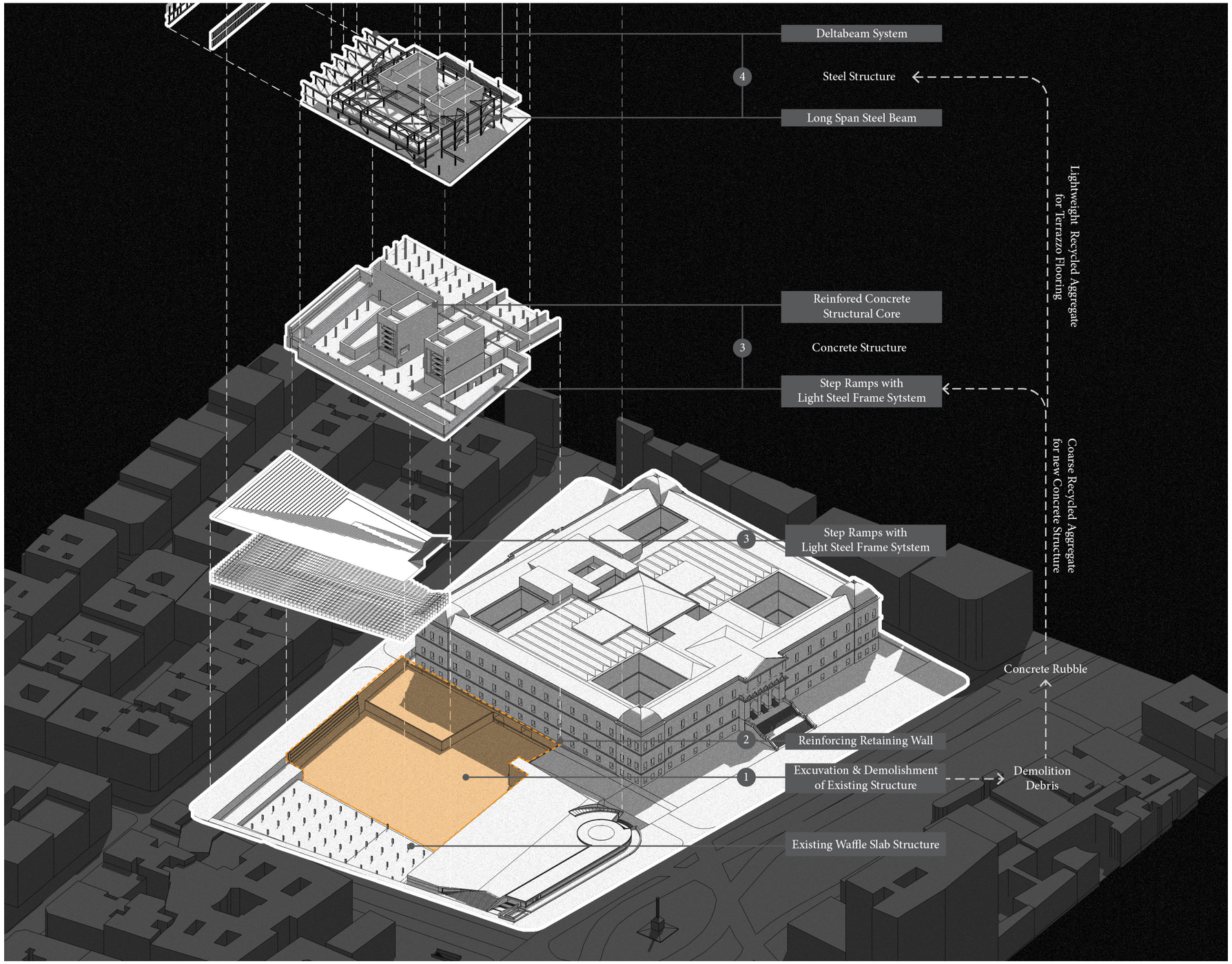
14m Long Span Skylight

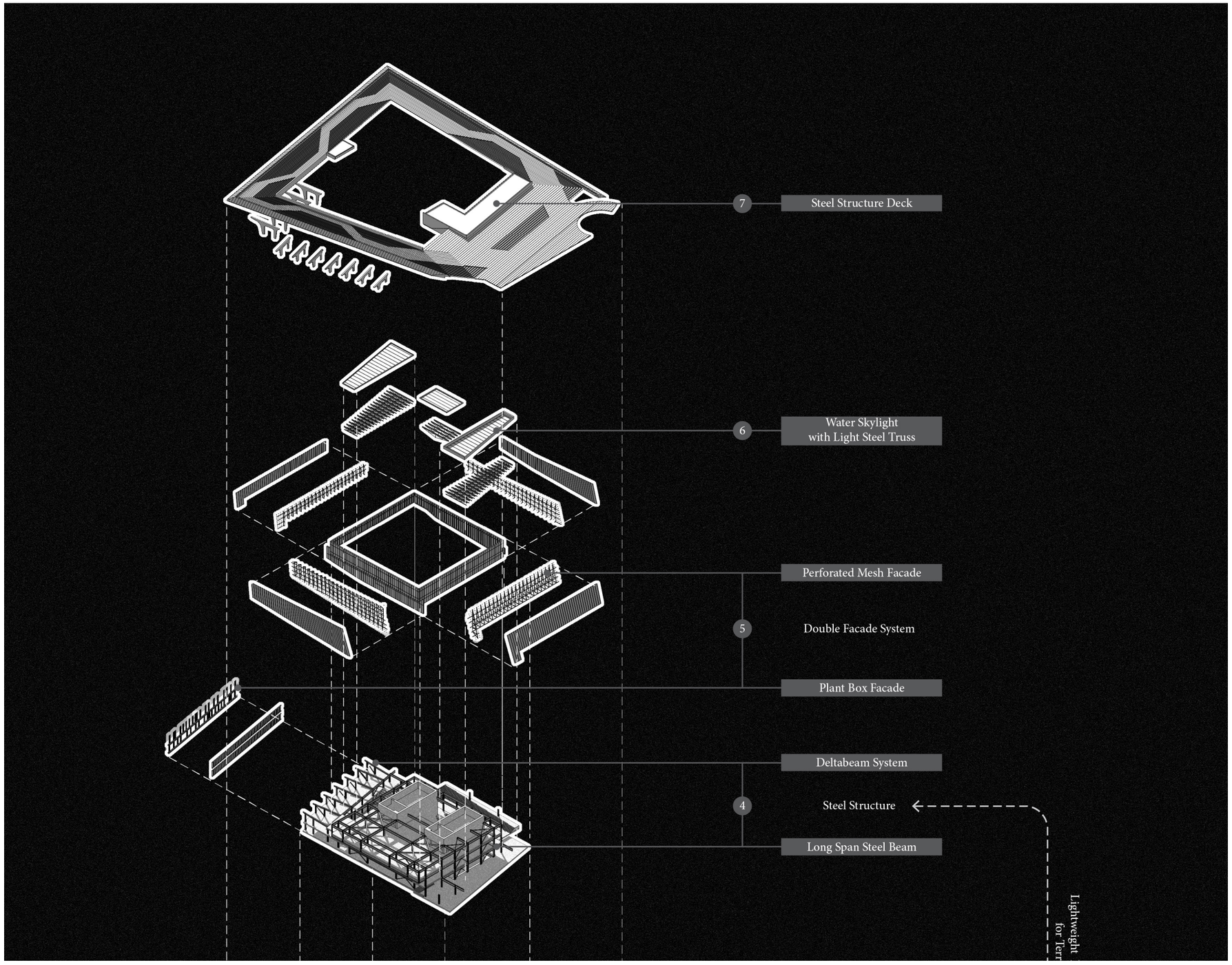


Basement Level are usually humid and cold due to the
lack of proper ventilation and insulation



Construction Phase (From bottom to the top)


Deltabeam System
4
Steel Structure
Long Span Steel Beam
Lightweight Recycled Aggregate
for Terrazzo Flooring
Reinfored Concrete
Structural Core
3
Concrete Structure
Step Ramps with
Light Steel Frame Sytstem
Coarse Recycled Aggregate
for new Concrete Structure
3
Step Ramps with
Light Steel Frame Sytstem
Concrete Rubble
2
Reinforcing Retaining Wall
1
Excuvation & Demolishment
of Existing Structure
Demolition
Debris
Existing Waffle Slab Structure

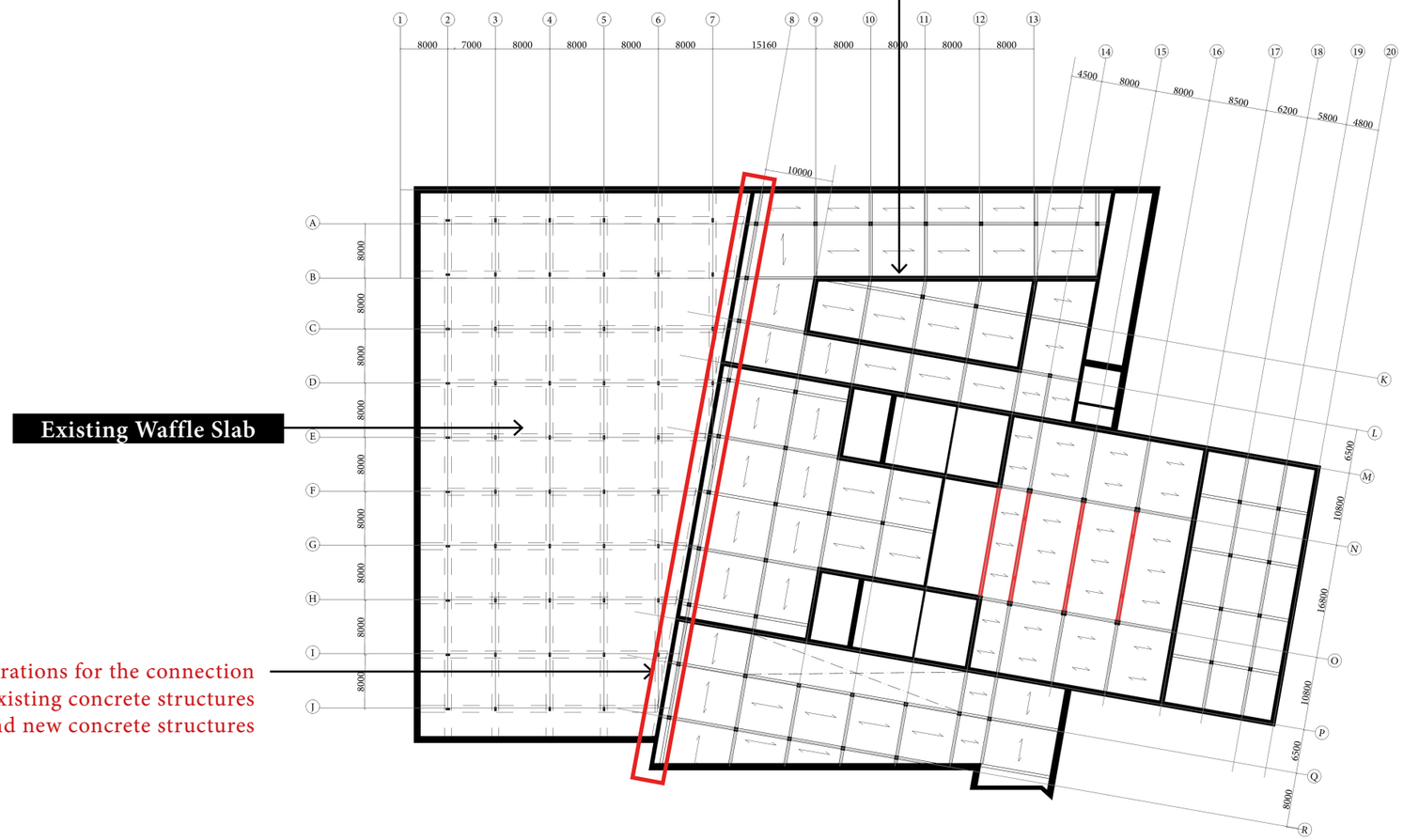

7
Steel Structure Deck
6
Water Skylight
with Light Steel Truss
Perforated Mesh Facade
5
Double Facade System
Plant Box Facade
Deltabeam System
4
Steel Structure
Long Span Steel Beam
Lightweight
for Terr

Reinforcement of existing foundations

New Structural Grid

Existing Waffle Slab

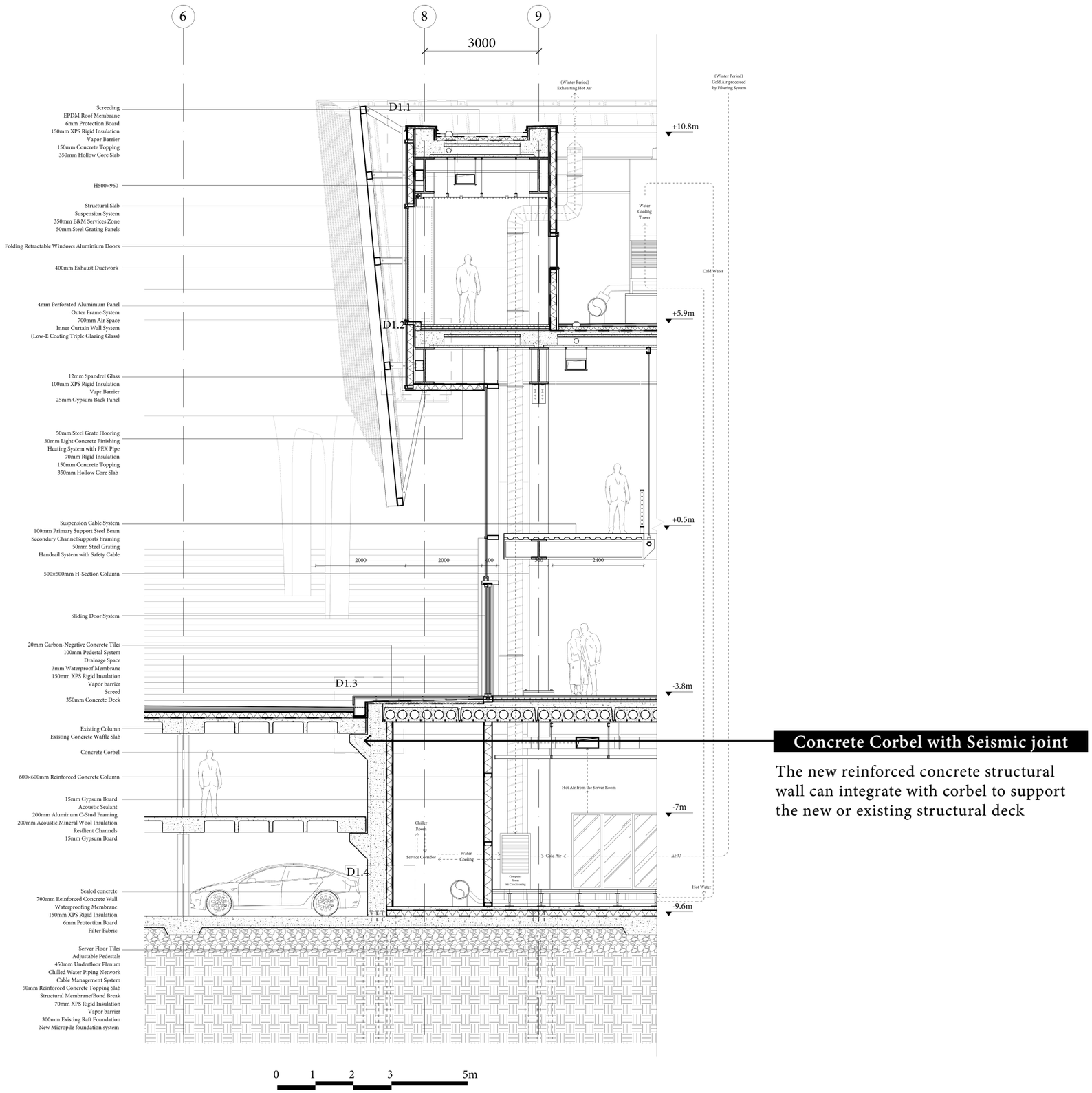
Considerations for the connection between existing concrete structures and new concrete structures



Ground Floor G/F Structural Plan

0 10 20 30 50

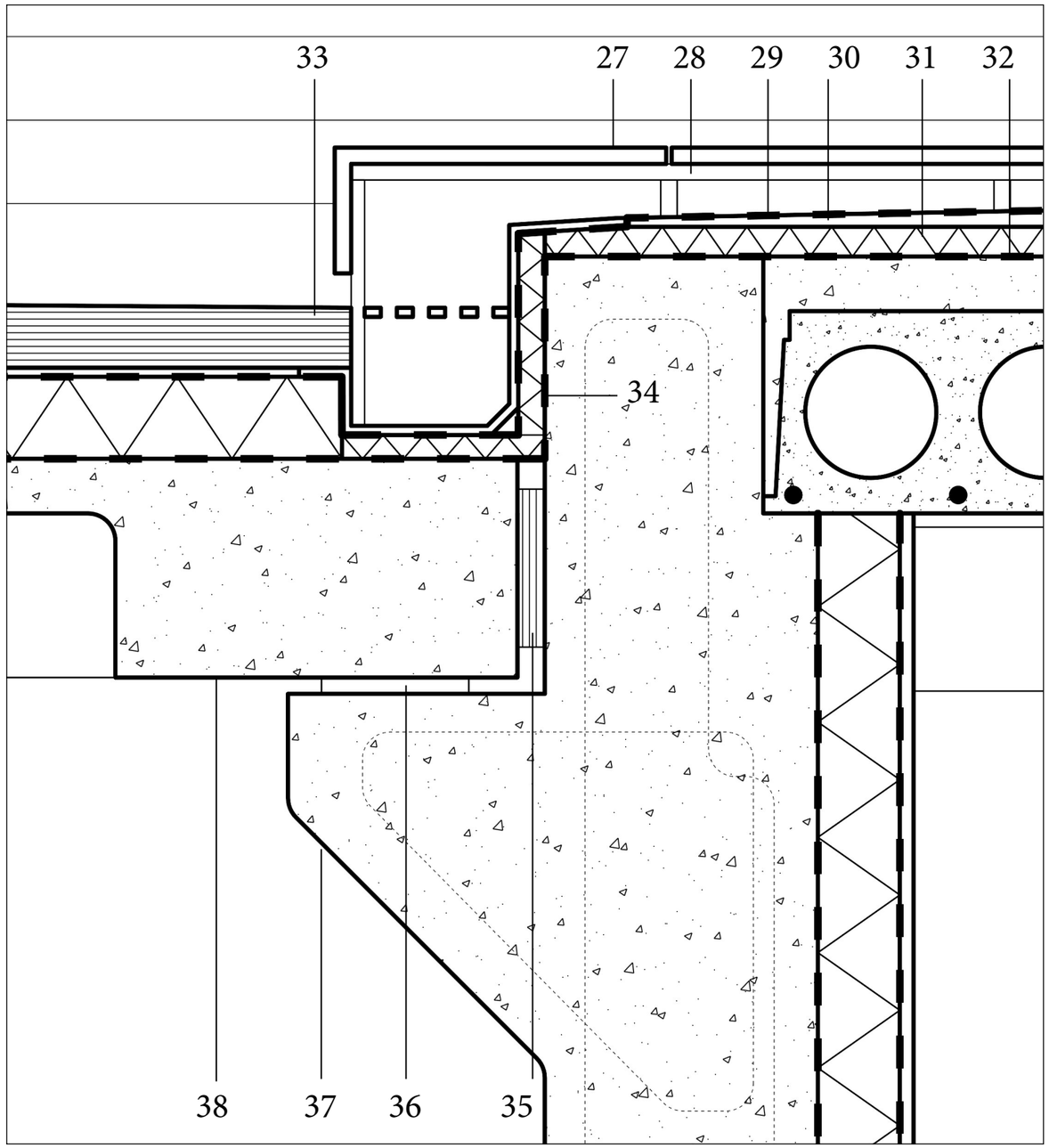
- *DELTABEAM Green System*
- *Long Span I-Beam*
- *Long Span Truss System*
- *Steel Frame System*
- *Concrete Beam*
- *Concrete Structural Wall/Column*
- *Existing Waffle Slab System*
- *Concrete Hollow Core Slab Direction*



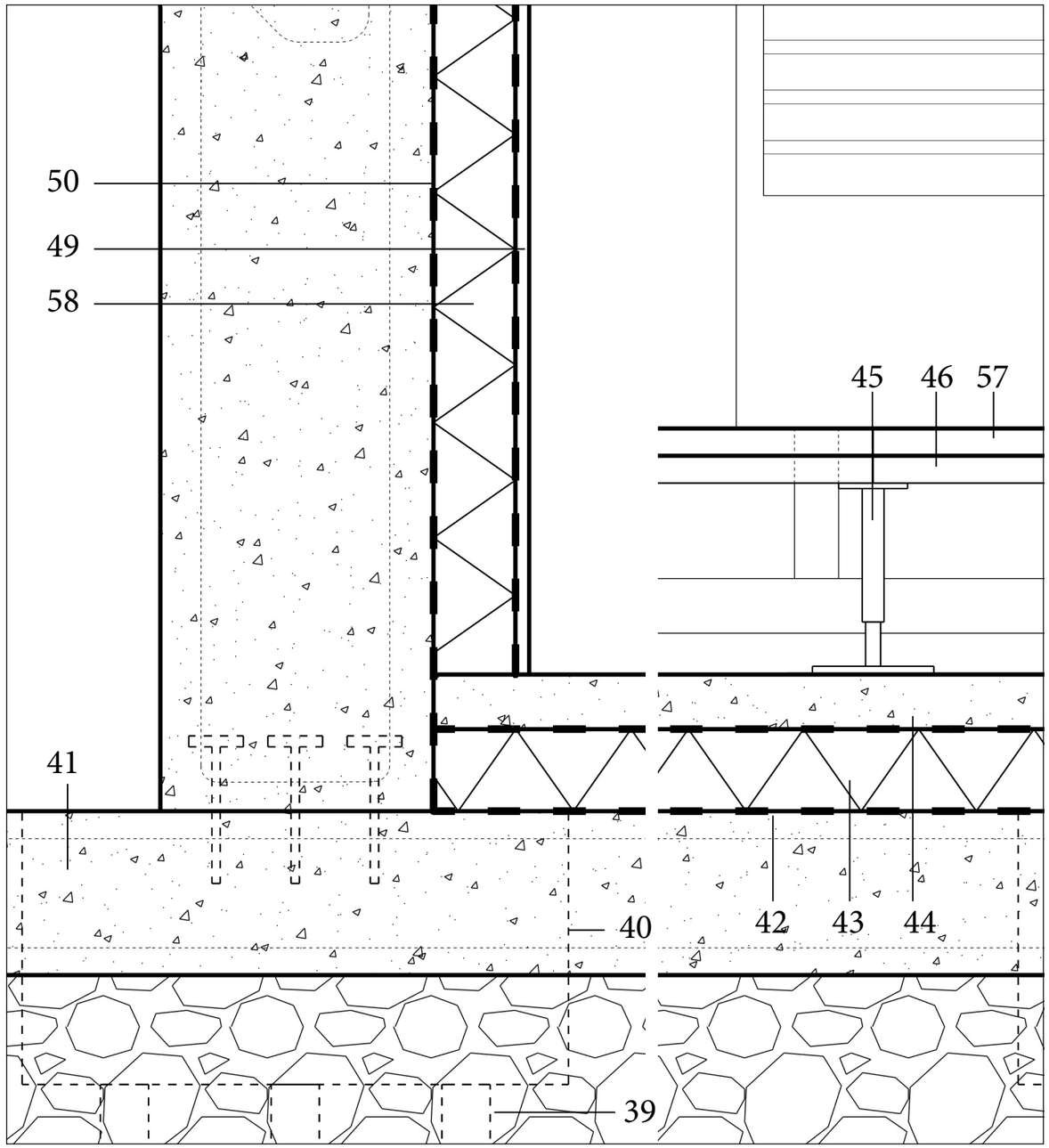
Concrete Corbel with Seismic joint

The new reinforced concrete structural wall can integrate with corbel to support the new or existing structural deck

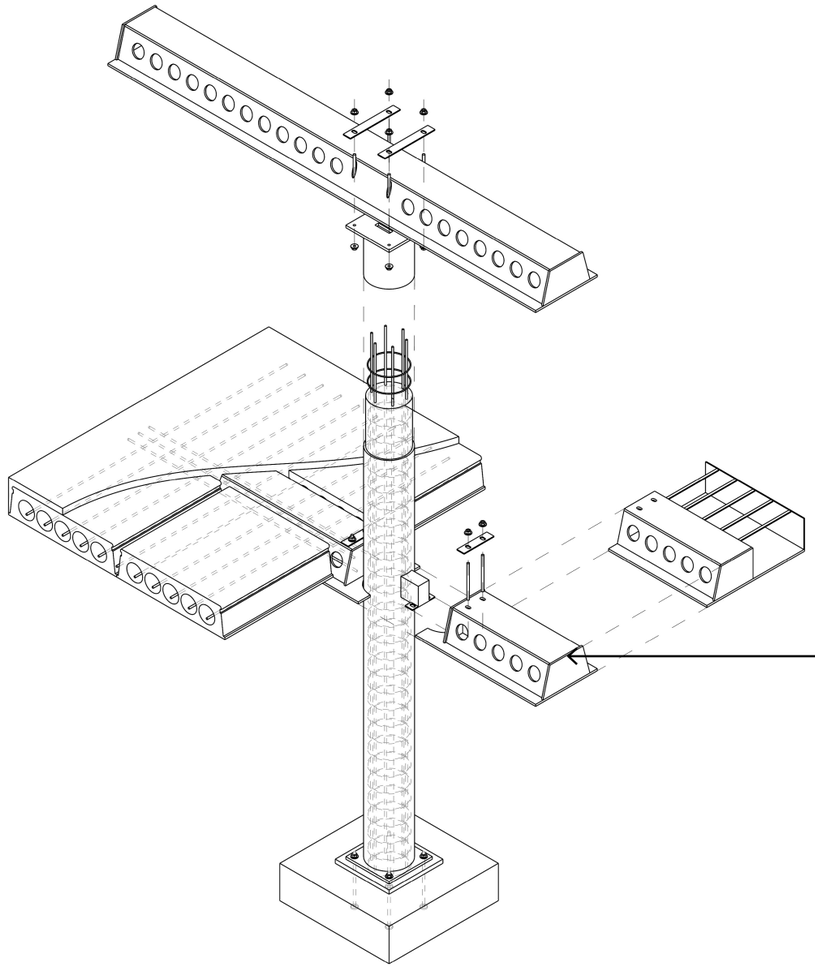
Roof To Foundation Section 1:50



27. 50mm Concrete pavers
28. Adjustable Pedestals
29. Drainage Mat
30. 25mm Additional fall screed
31. 100mm rigid insulation
32. Protection board over Waterproofing membrane
33. Exterior concrete finishing topping with 25mm Additional fall screed
34. Water Drianage
35. 25-50mm Seismic joint with flexible sealant
36. Bearing Pad
37. Concrete Corbel
38. 400mm Existing Waffle Slab



39. Micropile foundation system (new)
40. 500mm Concrete grade foundation
41. Existing concrete floor slab (retained)
42. Vapor barrier membrane
43. 150mm XPS rigid insulation boards
44. 150mm Concrete topping
45. Adjustable steel pedestals (150-600mm height)
46. Steel grid framework system
47. 600x600mm Anti-static raised floor panels
48. 150mm Wall insulation
49. 25mm Protection board on wall
50. Weather barrier/vapor control layer



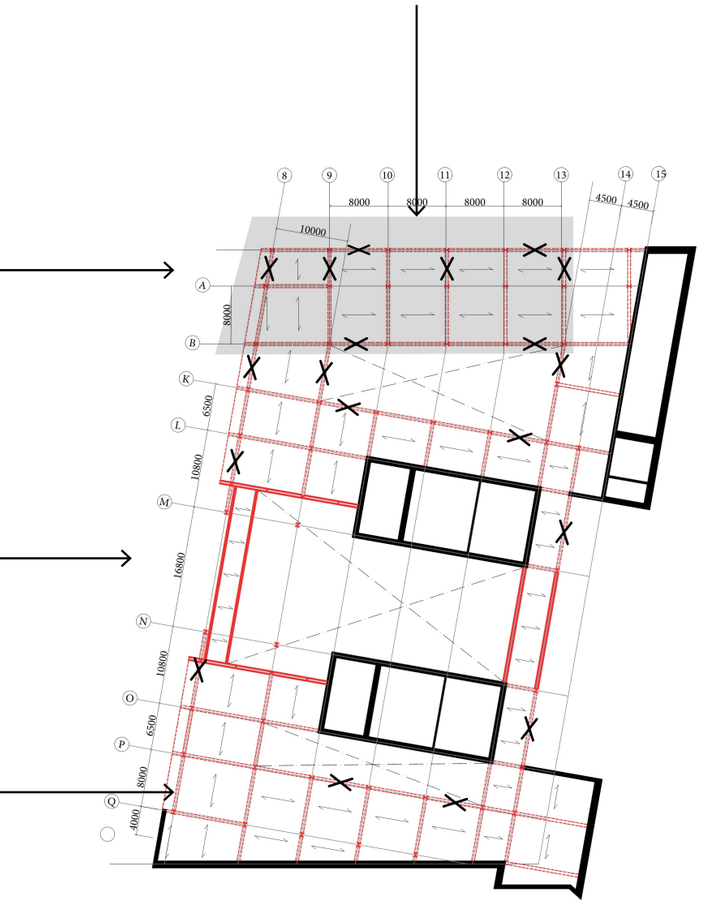
Structural Bracing

Suspended Catwalk

Deltabeam System

The system also allow CLT deck, however, the 8x8m structural grid is not efficient for clt deck. pretensioned Hollow core slab can allow span even 20m long span slab.

The structure is located far away from retaining walls or concrete cores that have weak structural integrity.



First Floor 1/F Structural Plan

0 10 20 30 50 100m

DELTABEAM Green System
Long Span I-Beam
Long Span Truss System
Steel Frame System
Concrete Beam
Concrete Structural Wall/Column
Existing Waffle Slab System
Concrete Hollow Core Slab Direction

Pedestrian Walkway Steel Structure

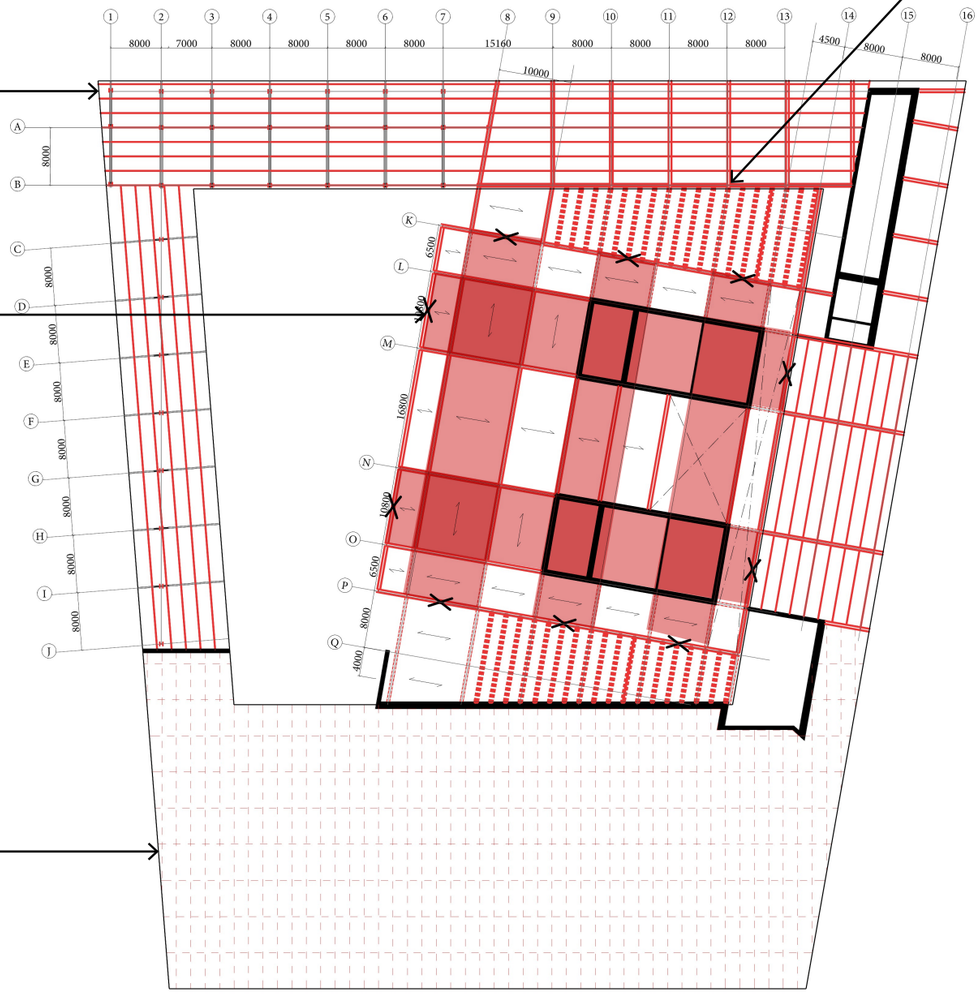
The columns need to sit on top of the structural grid below.

Structural Bracing

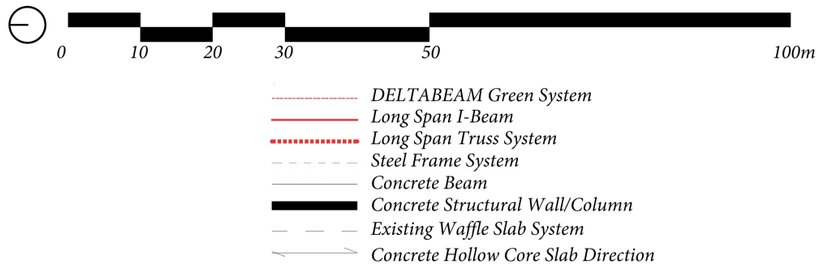
Work together with the concrete core to provide lateral support of the front facade.

Light Steel Frame System

Raise Floor System to create the in-clining landscape

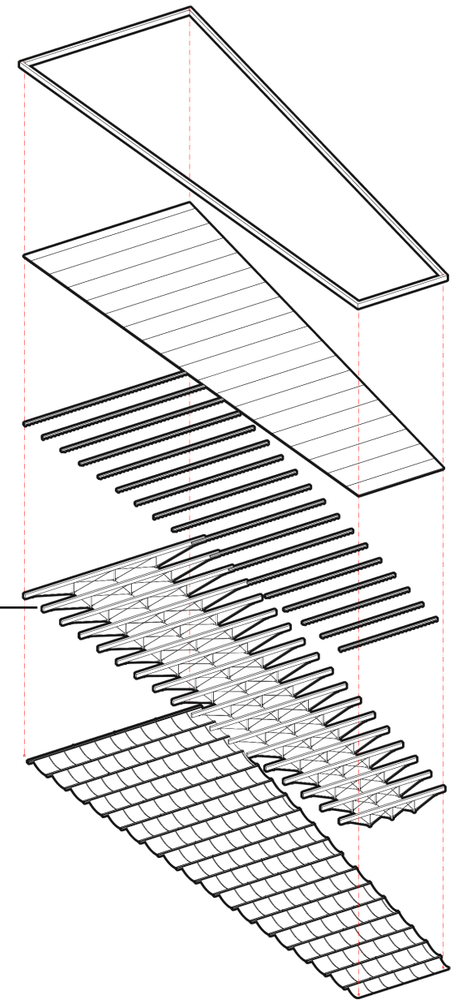


Second Floor 2/F & Roofscape Structural Plan



Long Span Truss

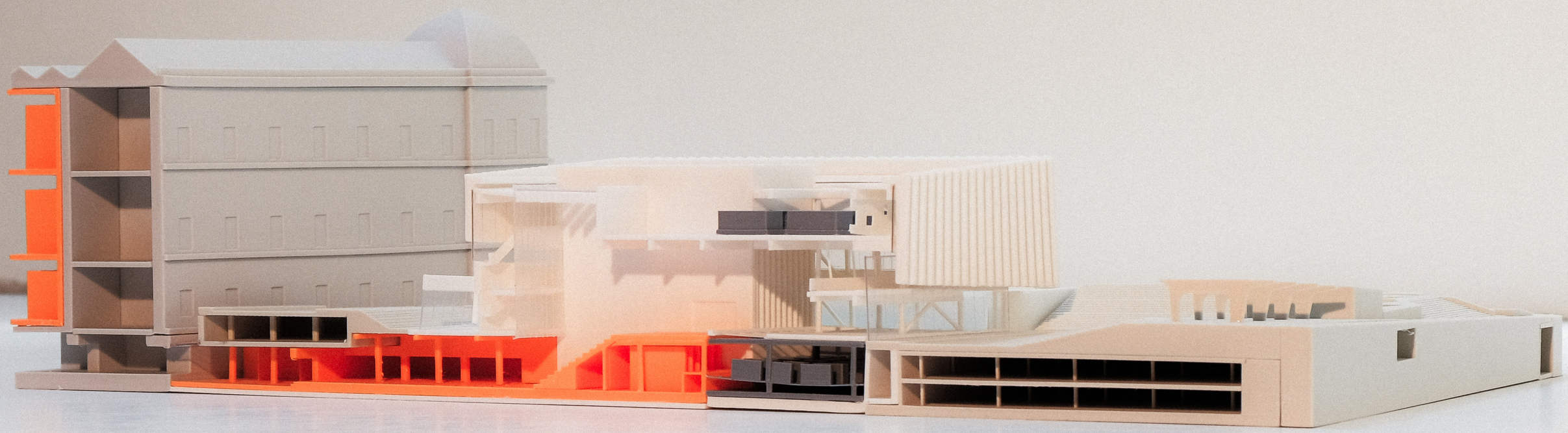
(From top to bottom)
1.Insulated structural curb
2.Insulated glass Unit
3.Metal frame
4.Roof Truss with attachment points
5. Overhang metal Mesh

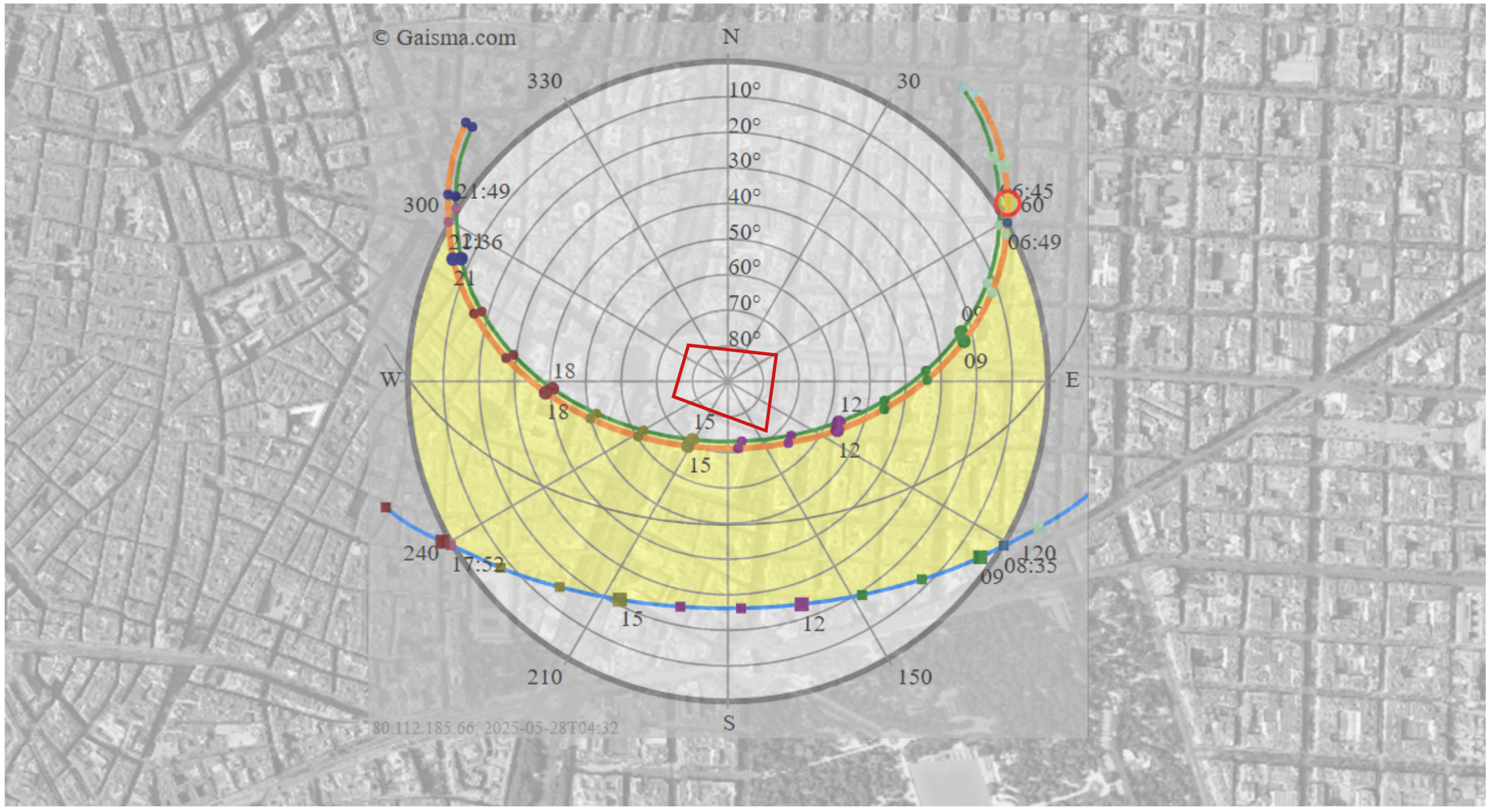


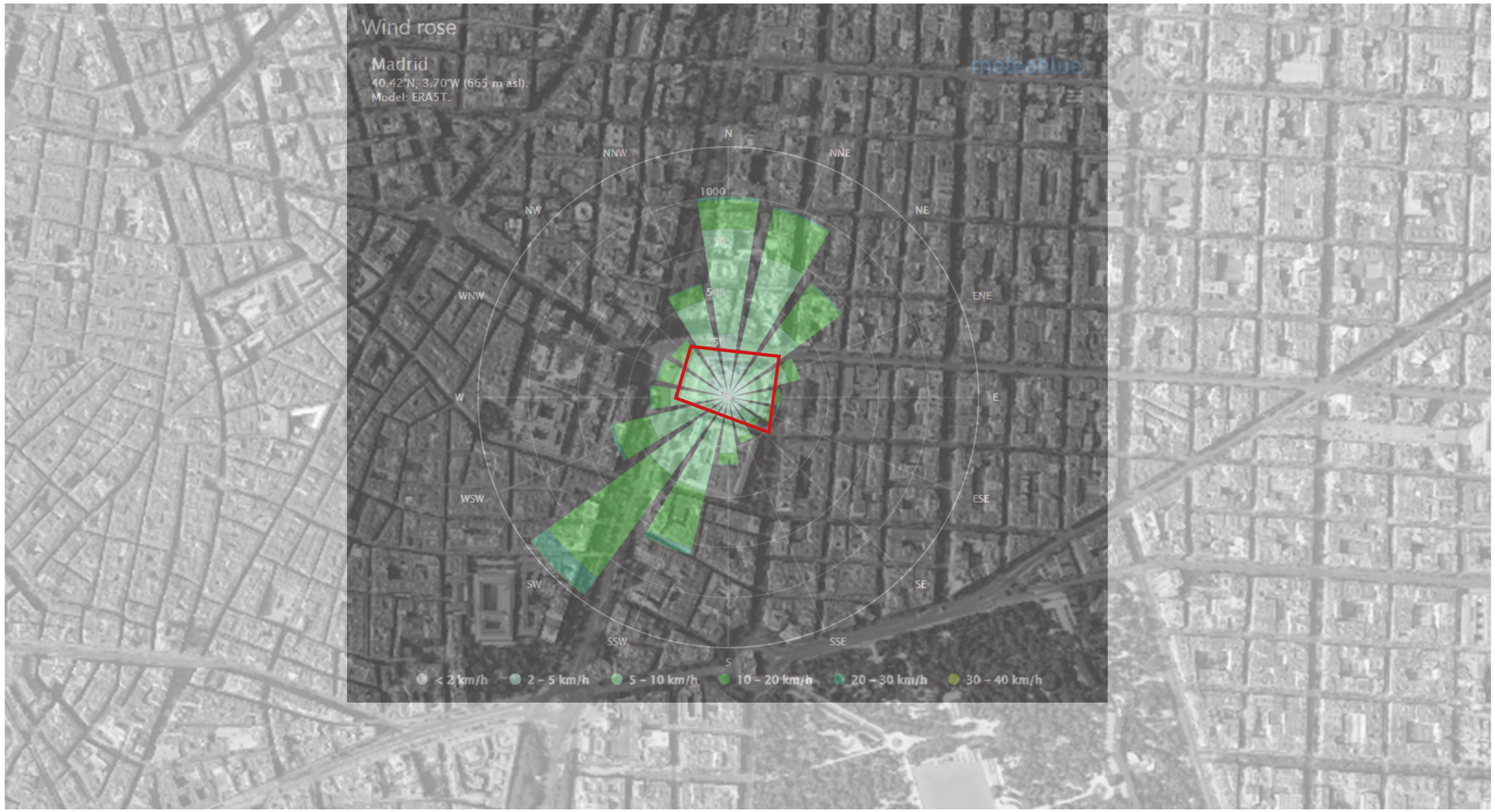
Deck Structure Structural Plan

Climate Response

Madrid as Warm-Temperate Subtropical Climate



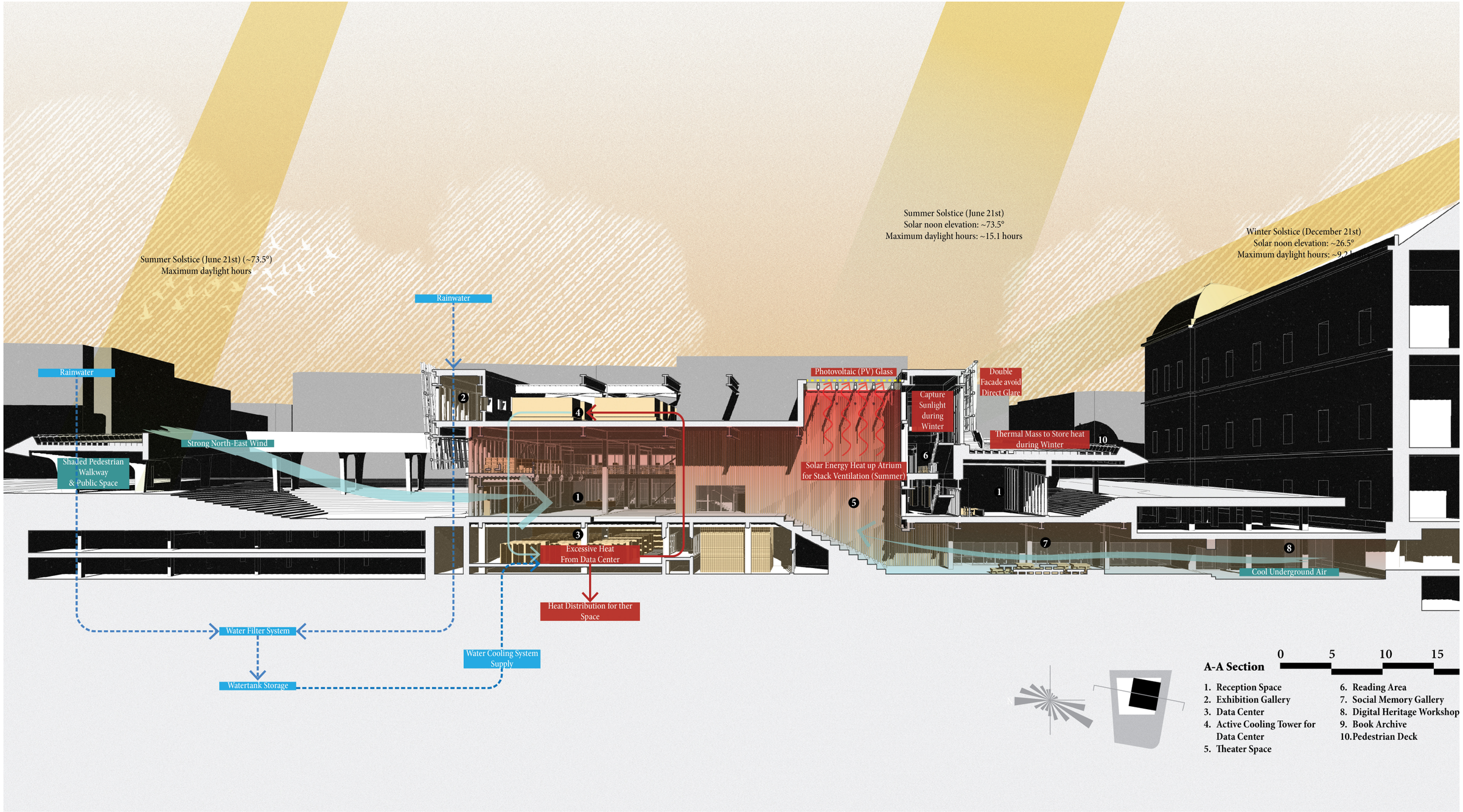

© Gaisma.com
N
330
30
10°
20°
30°
40°
50°
60°
70°
80°
300
60
W
E
240
120
210
150
S
21:49
06:49
18
15
12
09
17:52
08:35
80.112.185.66, 2025-05-28T04:32


Wind rose
Madrid
40.42°N, 3.70°W (665 m asl).
Model: ERA5T.
meteoblue
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
1000
500
< 2 km/h
2 – 5 km/h
5 – 10 km/h
10 – 20 km/h
20 – 30 km/h
30 – 40 km/h

Climate data for Madrid (667 m), Buen Retiro Park in the city centre (1991–2020) [hide]													
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Mean daily maximum °C (°F)	10.0 (50.0)	12.2 (54.0)	16.2 (61.2)	18.9 (66.0)	23.2 (73.8)	28.9 (84.0)	32.8 (91.0)	32.0 (89.6)	26.5 (79.7)	19.7 (67.5)	13.5 (56.3)	10.3 (50.5)	20.3 (68.6)
Daily mean °C (°F)	6.5 (43.7)	8.0 (46.4)	11.3 (52.3)	13.6 (56.5)	17.5 (63.5)	22.8 (73.0)	26.2 (79.2)	25.7 (78.3)	21.0 (69.8)	15.4 (59.7)	10.0 (50.0)	7.0 (44.6)	15.4 (59.8)
Mean daily minimum °C (°F)	3.0 (37.4)	3.7 (38.7)	6.3 (43.3)	8.2 (46.8)	11.9 (53.4)	16.5 (61.7)	19.5 (67.1)	19.3 (66.7)	15.5 (59.9)	11.1 (52.0)	6.4 (43.5)	3.7 (38.7)	10.4 (50.8)
Source: Agencia Estatal de Meteorología[5][6]													

Climate data for Madrid, Retiro Park (1991-2020) [hide]													
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Average precipitation mm (inches)	32.0 (1.26)	34.0 (1.34)	35.0 (1.38)	46.0 (1.81)	48.0 (1.89)	20.0 (0.79)	9.0 (0.35)	10.0 (0.39)	24.0 (0.94)	64.0 (2.52)	52.0 (2.05)	42.0 (1.65)	416 (16.37)
Average precipitation days (≥ 1 mm)	5.5	5.1	5.4	6.7	6.8	3.3	1.5	1.5	3.5	7.2	6.7	5.9	59.1
Source: Agencia Estatal de Meteorología[16]													

Hot summers and relatively cool winters with somewhat frequent frosts (15 days have lows under 0 °C (32 °F) on average) and occasional snowfalls


Summer Solstice (June 21st) (~73.5°)
Maximum daylight hours
Summer Solstice (June 21st)
Solar noon elevation: ~73.5°
Maximum daylight hours: ~15.1 hours
Winter Solstice (December 21st)
Solar noon elevation: ~26.5°
Maximum daylight hours: ~9.2 h
Rainwater
Rainwater
Strong North-East Wind
Shaded Pedestrian Walkway & Public Space
Photovoltaic (PV) Glass
Double Facade avoid Direct Glare
Capture Sunlight during Winter
Thermal Mass to Store heat during Winter
Solar Energy Heat up Atrium for Stack Ventilation (Summer)
Excessive Heat From Data Center
Heat Distribution for ther Space
Water Filter System
Watertank Storage
Water Cooling System Supply
Cool Underground Air
A-A Section
0 5 10 15
1. Reception Space
2. Exhibition Gallery
3. Data Center
4. Active Cooling Tower for Data Center
5. Theater Space
6. Reading Area
7. Social Memory Gallery
8. Digital Heritage Workshop
9. Book Archive
10. Pedestrian Deck



CLIMATE RESPONSE

Recess street to open up the underground space

ARCHITECTURAL DESIGN CROSSOVER

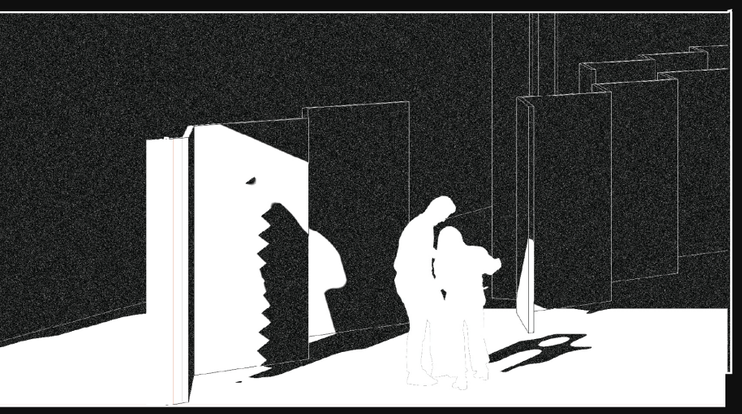
Winter Solstice (December 21st)
Solar noon elevation: ~26.5°
Maximum daylight hours: ~9.2 hours

Summer Solstice (June 21st)
Solar noon elevation: ~73.5°
Maximum daylight hours: ~15.1 hours

Capture Winter Sun through Skylight pond

Water Pond absorb and filter Heat Energy from the Sun

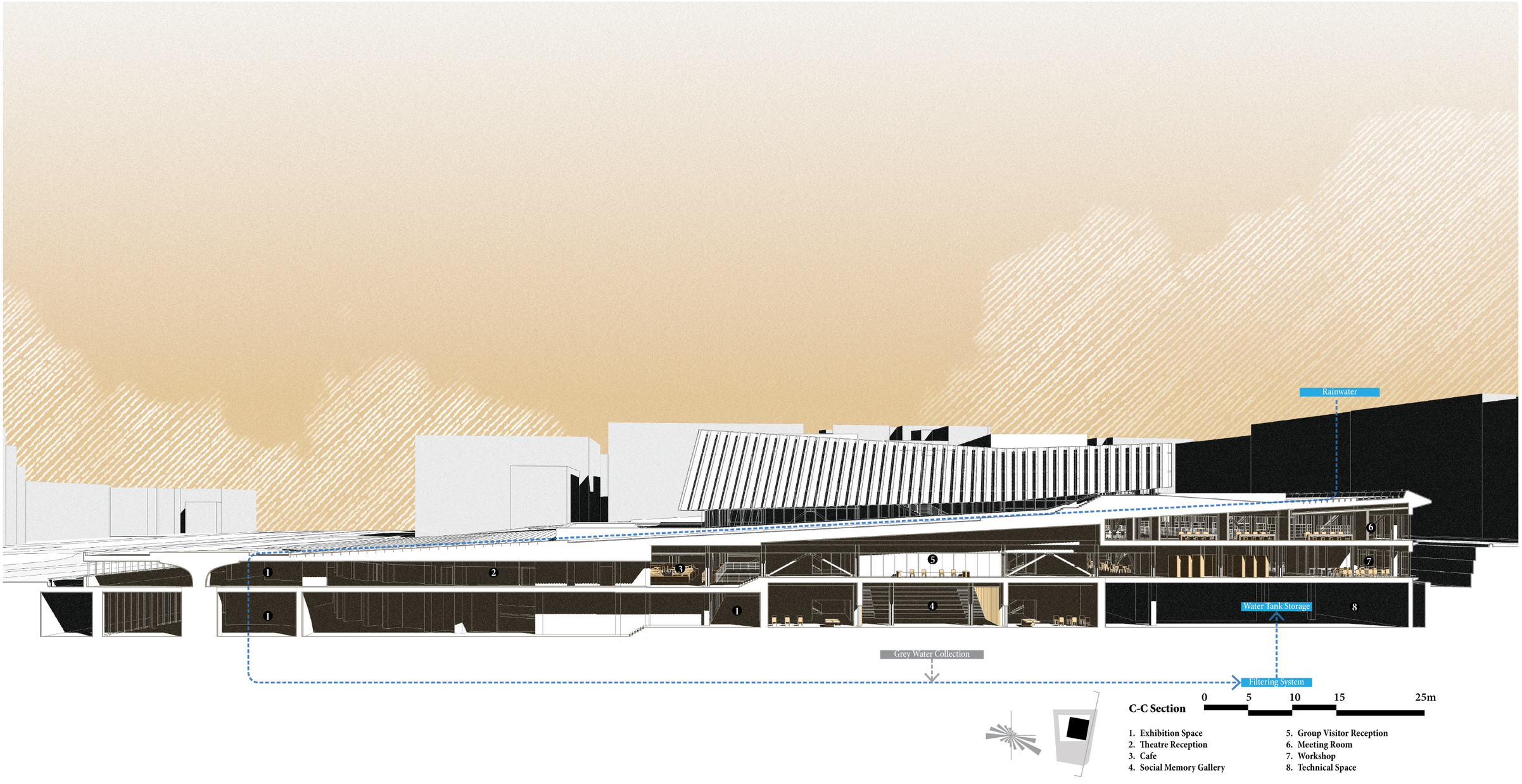
Green Atrium Cool the Interior Space



CLIMATE RE

Underwater Skylight

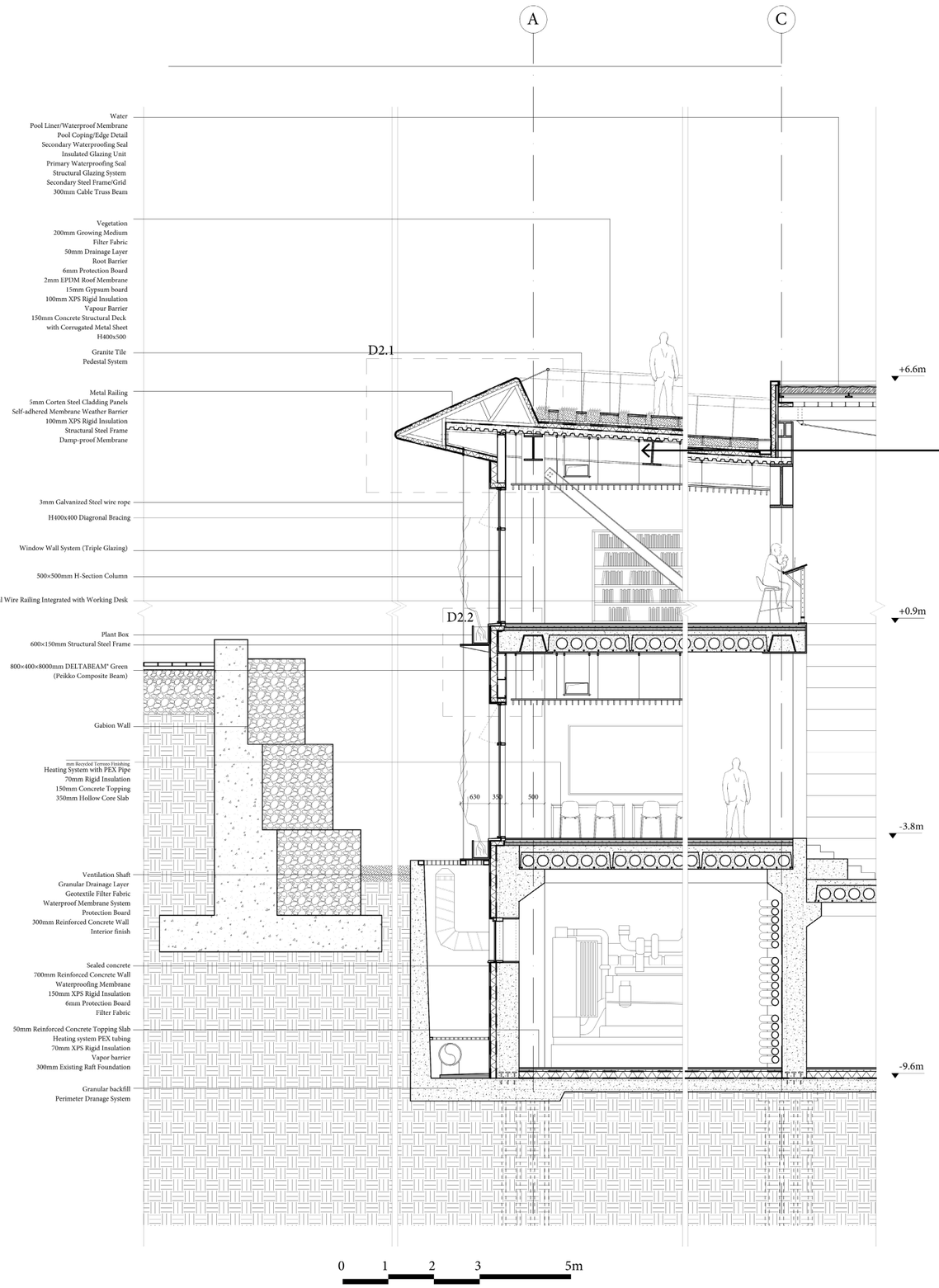
ARCHITECTURAL DESIGN CROSSOVER



C-C Section

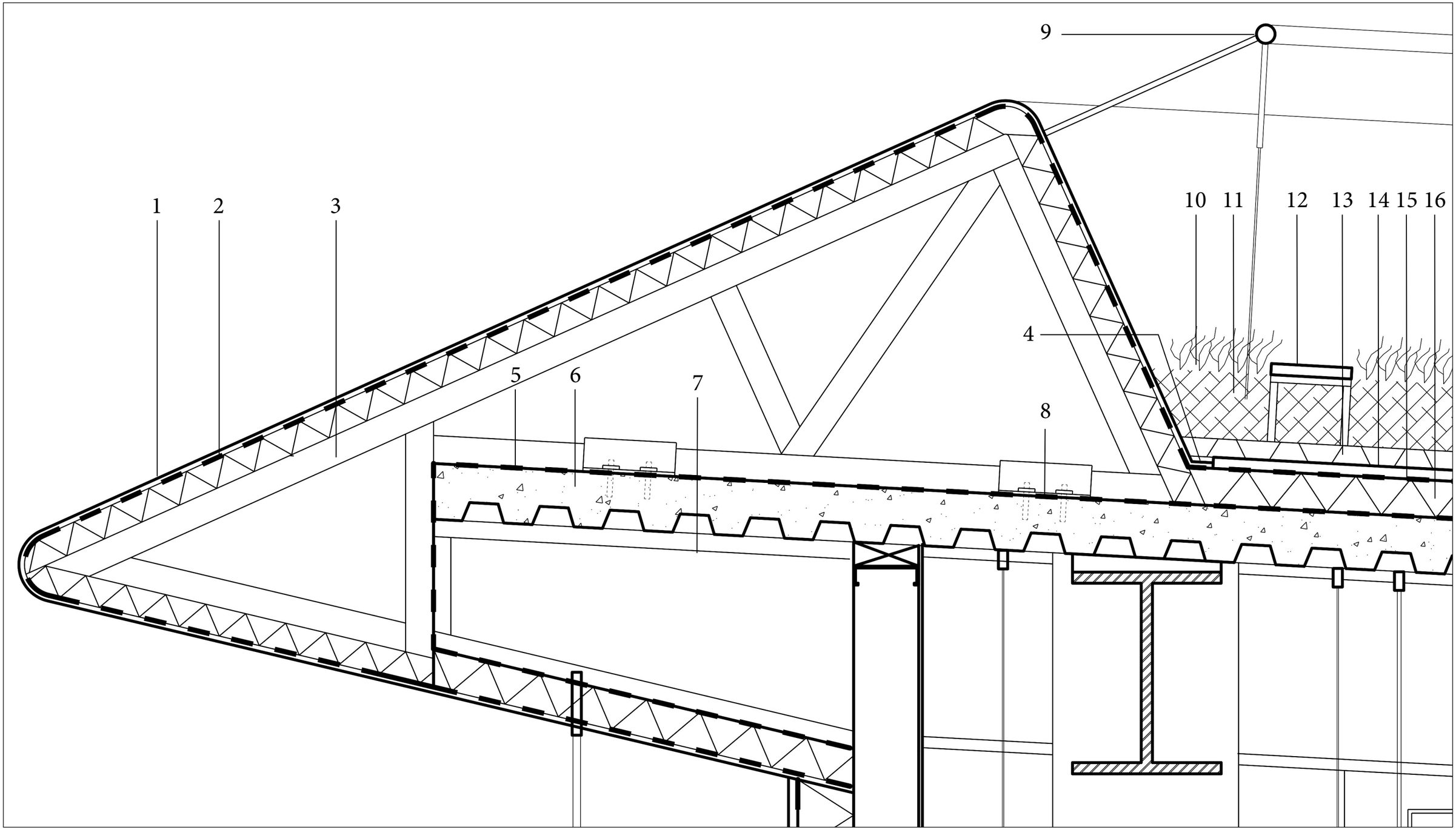
0 5 10 15 25m

1. Exhibition Space
2. Theatre Reception
3. Cafe
4. Social Memory Gallery
5. Group Visitor Reception
6. Meeting Room
7. Workshop
8. Technical Space



Tilt Steel Structure

This gentle tilt allows rainwater to flow naturally through the planted areas and collect in integrated drainage channels that feed the data center's cooling systems, creating a visible demonstration of sustainable water management without steps or terracing.



1. 8mm Corten steel cladding
2. Waterproofing Layer
3. Metal frame parapet with insulation infill
4. Continuous flashing and sealant
5. Vapor control layer
6. 100mm Reinforced concrete deck with corrugated aluminum formwork
7. Steel H-beam primary structure
8. Anchor plates with thermal breaks
9. 25-50mm Seismic joint with flexible sealant
10. 100m Extensive vegetation
11. 150mm Growing medium/soil substrate
12. 20mm Granite tiles with Adjustable pedestal
13. Root barrier membrane
14. 25mm rigid Protection board
15. Primary EPDM waterproofing membrane
16. 150mm - XPS insulation

Concept of the Skin

Skin that insulates, breathes, displays and gives privacy

Perforated Alumnium Sheet

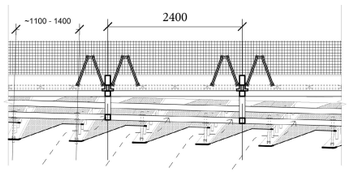
The perforated aluminum double facade features precisely calibrated openings that allow natural airflow through the cavity while maintaining visual transparency from interior to exterior.

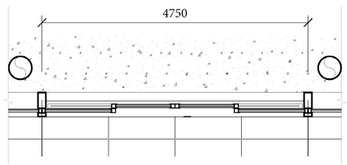
The perforation pattern enables occupants to see outward while preserving sufficient surface opacity for exterior projections to display public information.

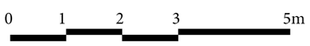
Strategic inter-panel gaps channel prevailing winds through the facade cavity, creating passive ventilation that reduces mechanical cooling loads.

NORTH FACADE ELEVATION & PLAN 1:50

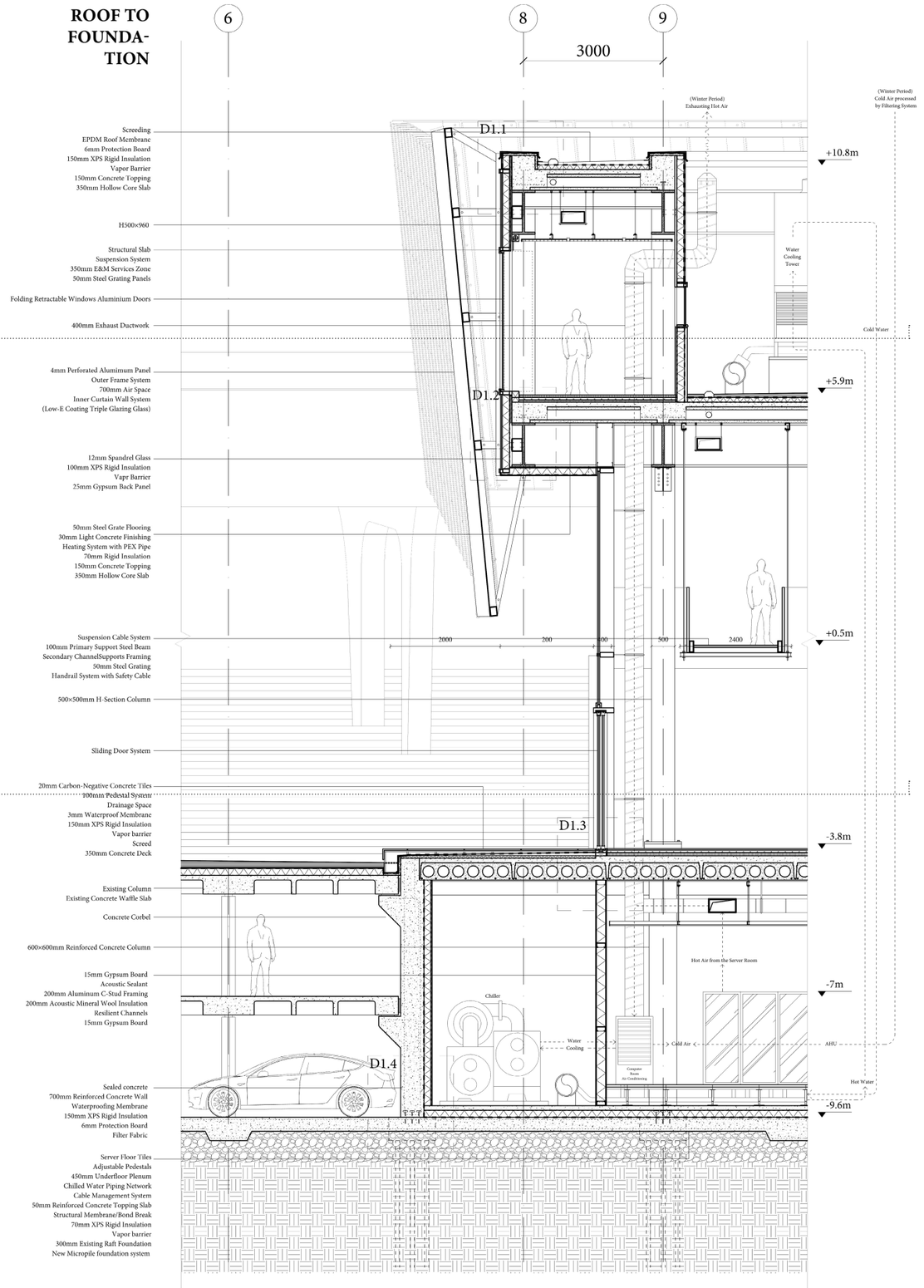


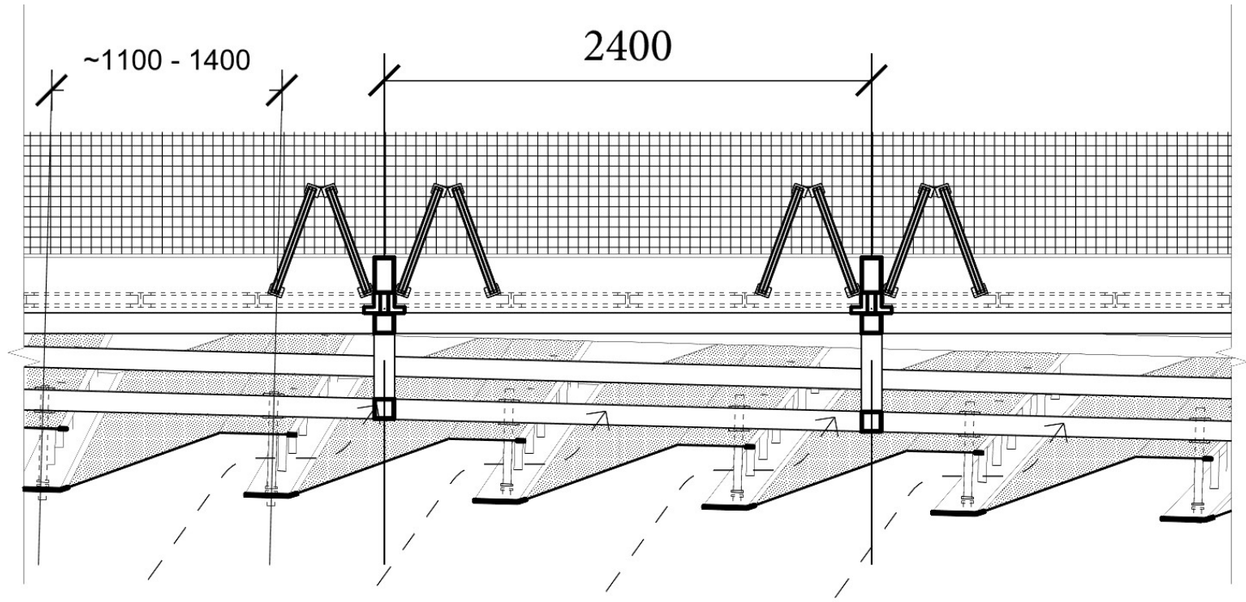


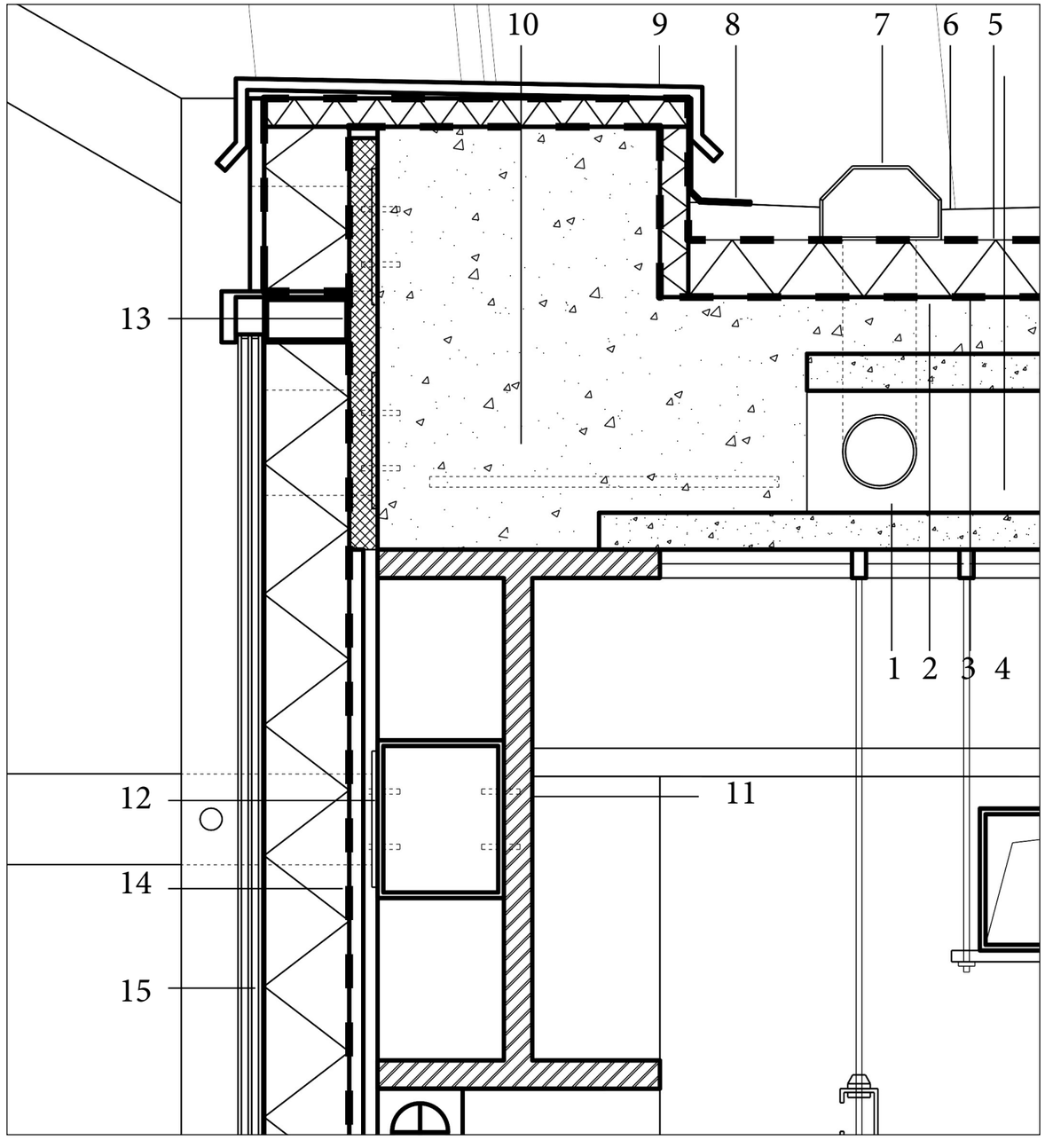




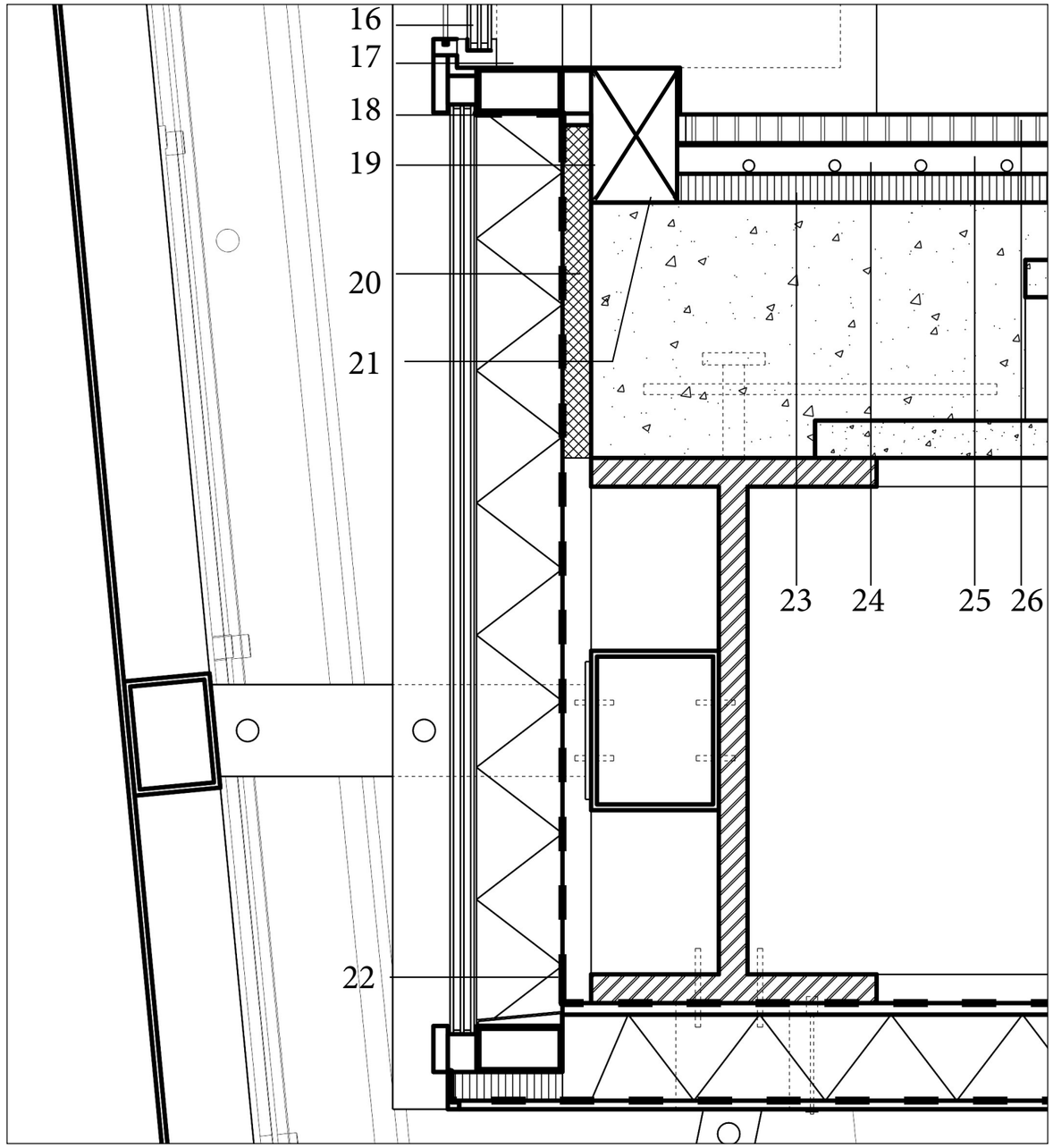
ROOF TO FOUNDATION




~1100 - 1400
2400

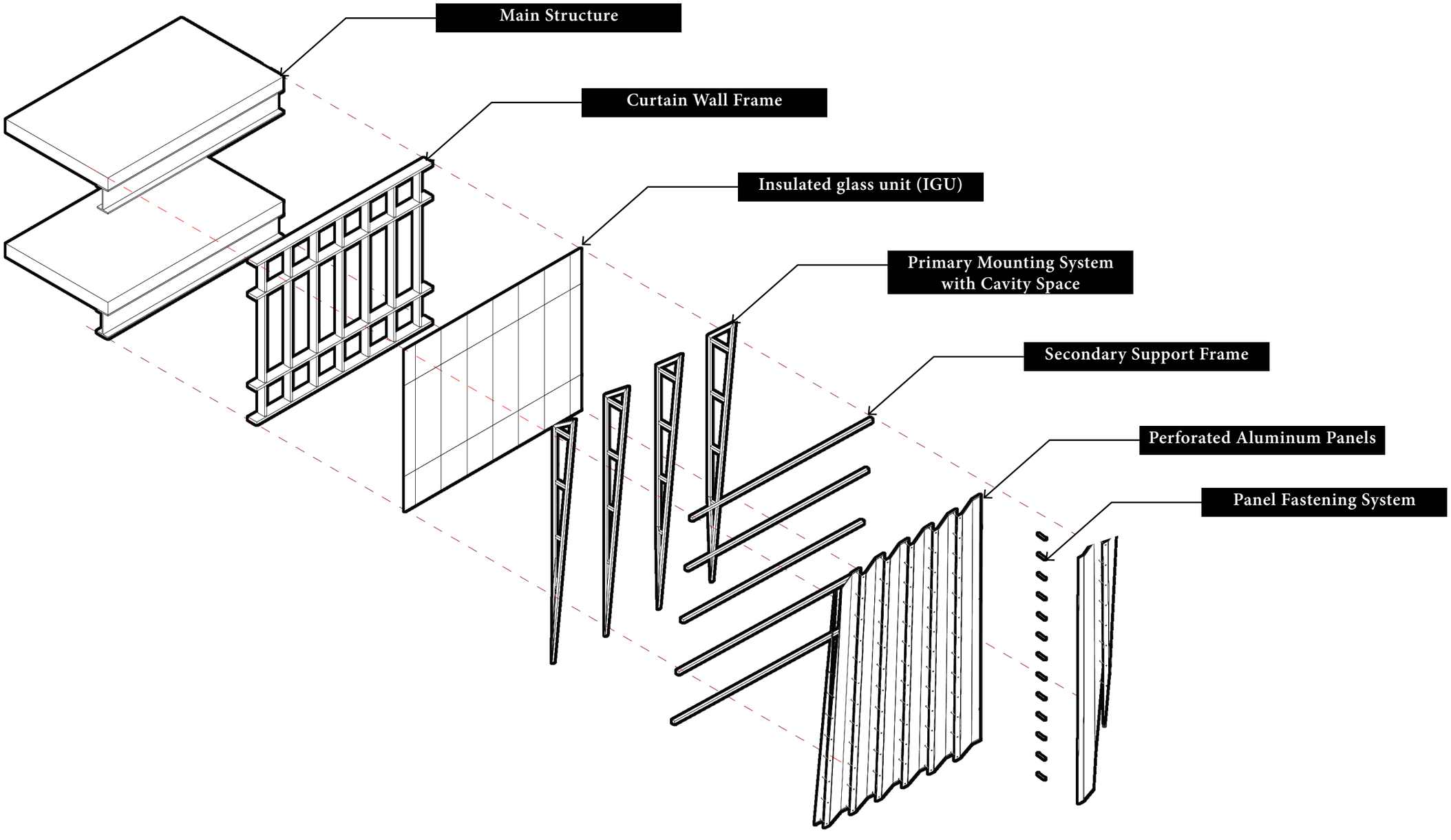


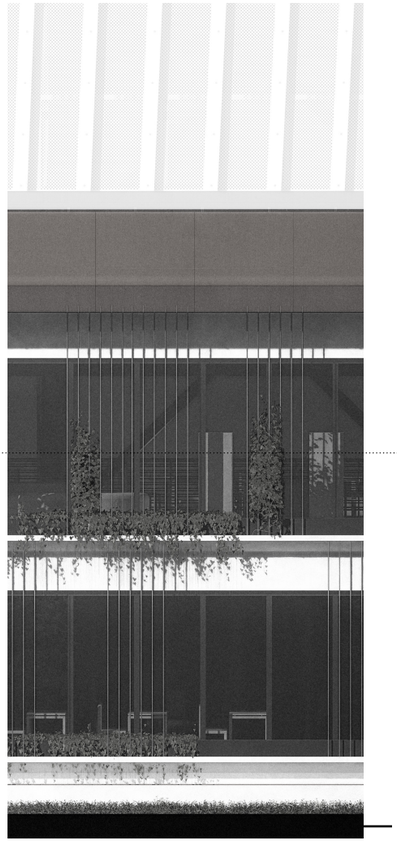
1. 340mm Hollow Core Slab
2. 150mm Concrete Topping
3. Vapor barrier/Air barrier membrane
4. 100-150mm XPS rigid insulation boards
5. Waterproofing membrane system
6. Fall to drain screed (1:80 slope)
7. Drainage System
8. Metal flashing and counterflashing
9. 150mm Aluminum parapet cap with drip edge
10. Shear Connector
11. H500x960 structural steel beam
12. Curtain wall mounting bracket/anchorage
13. Curtain wall transom
14. Back panel/spandrel panel system
15. Spandrel glass unit

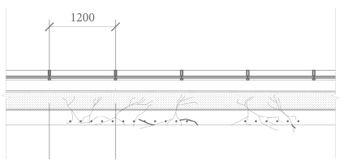


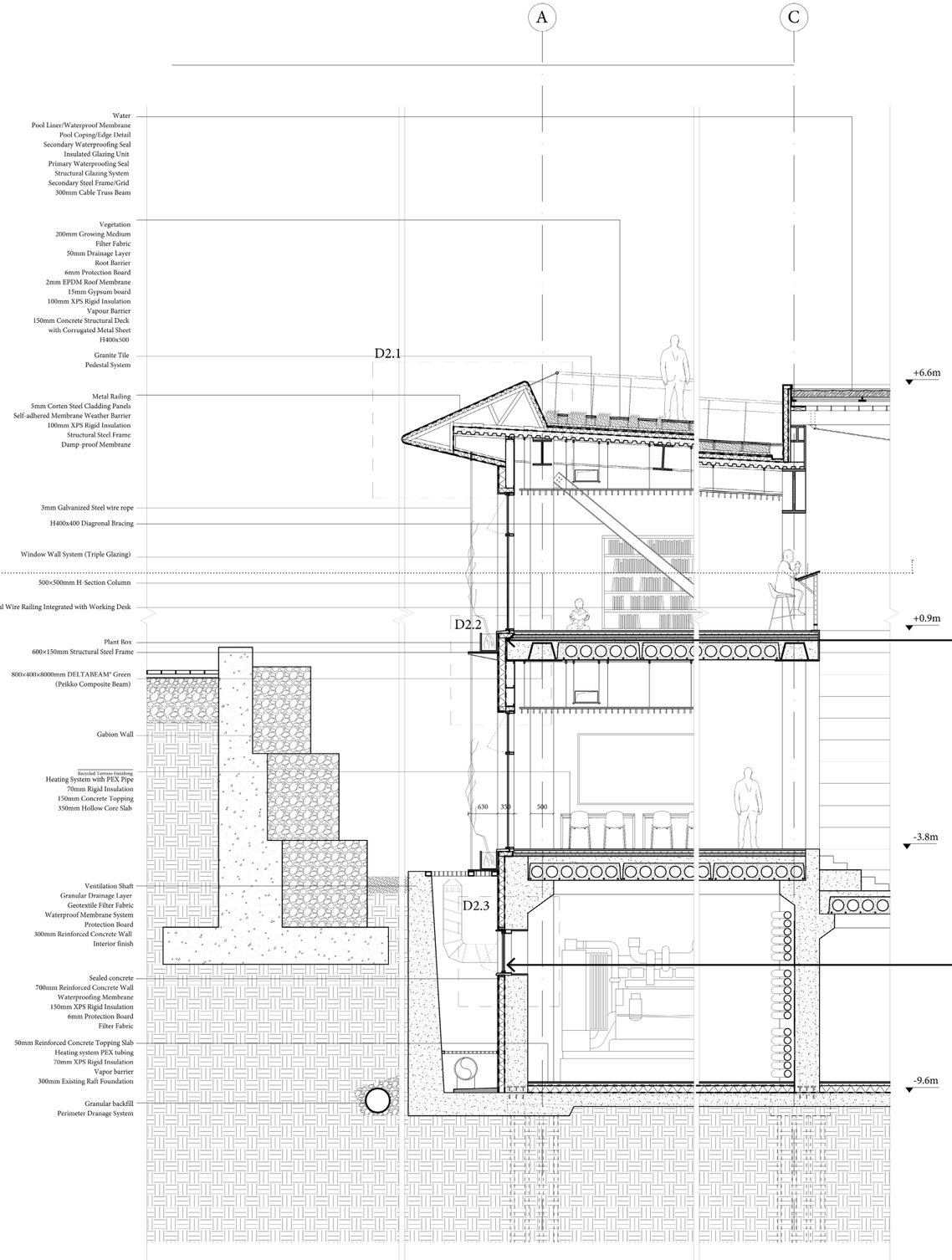
16. Triple Glazing Unit
17. Curtain wall mullion/frame system
18. Thermal break gasket/seal
19. Structural connection to slab edge
20. 50mm Mineral wool fire barrier
21. Fire-rated smoke sealant
22. Vapor barrier membrane

23. 50mm Rigid insulation board (under heating system)
24. Underfloor heating pipe system in screed
25. 50mm Heating screed/topping
26. Metal grate flooring finish


Main Structure
Curtain Wall Frame
Insulated glass unit (IGU)
Primary Mounting System
with Cavity Space
Secondary Support Frame
Perforated Aluminum Panels
Panel Fastening System





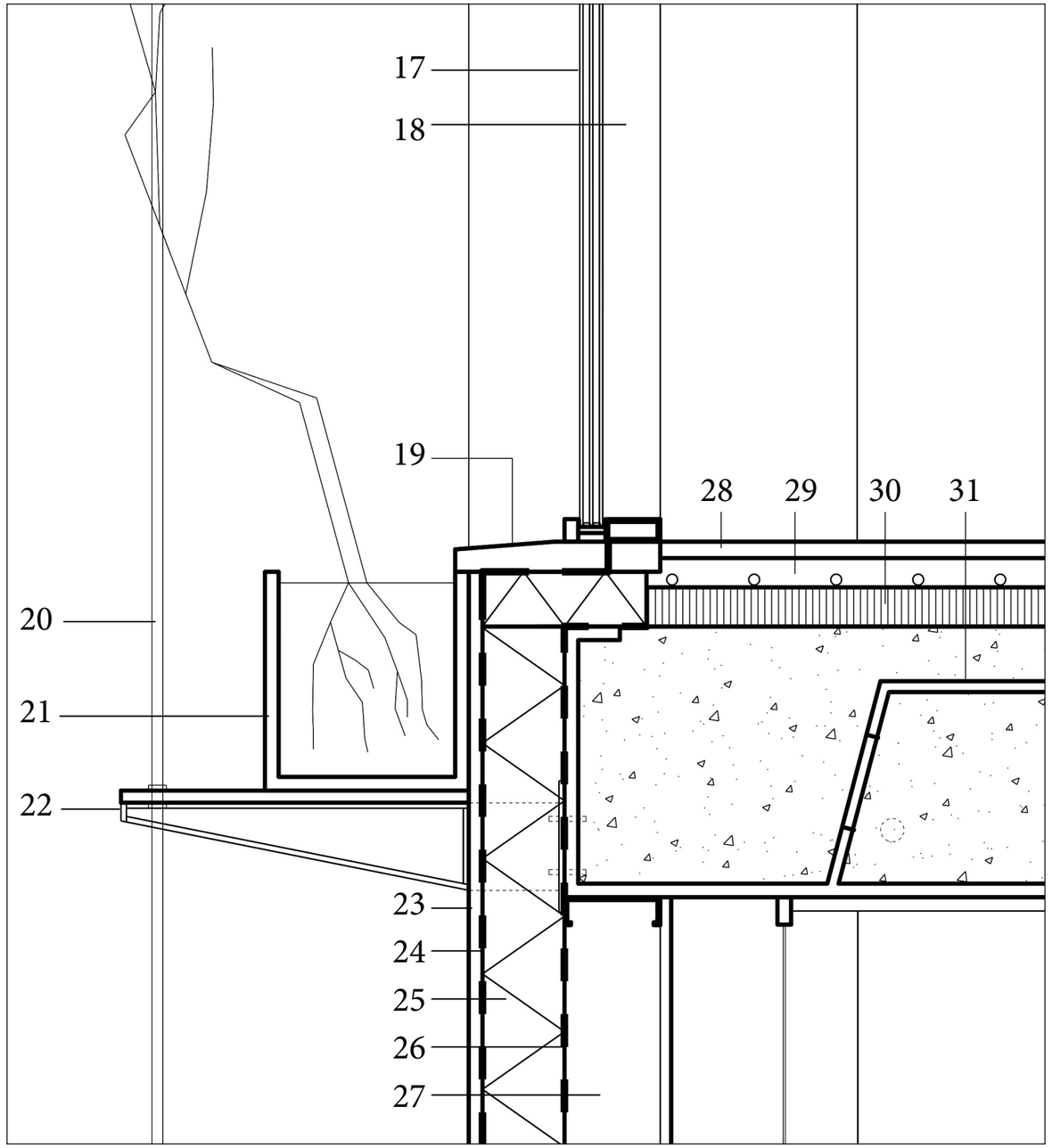


Planter Box with Climbing Cable

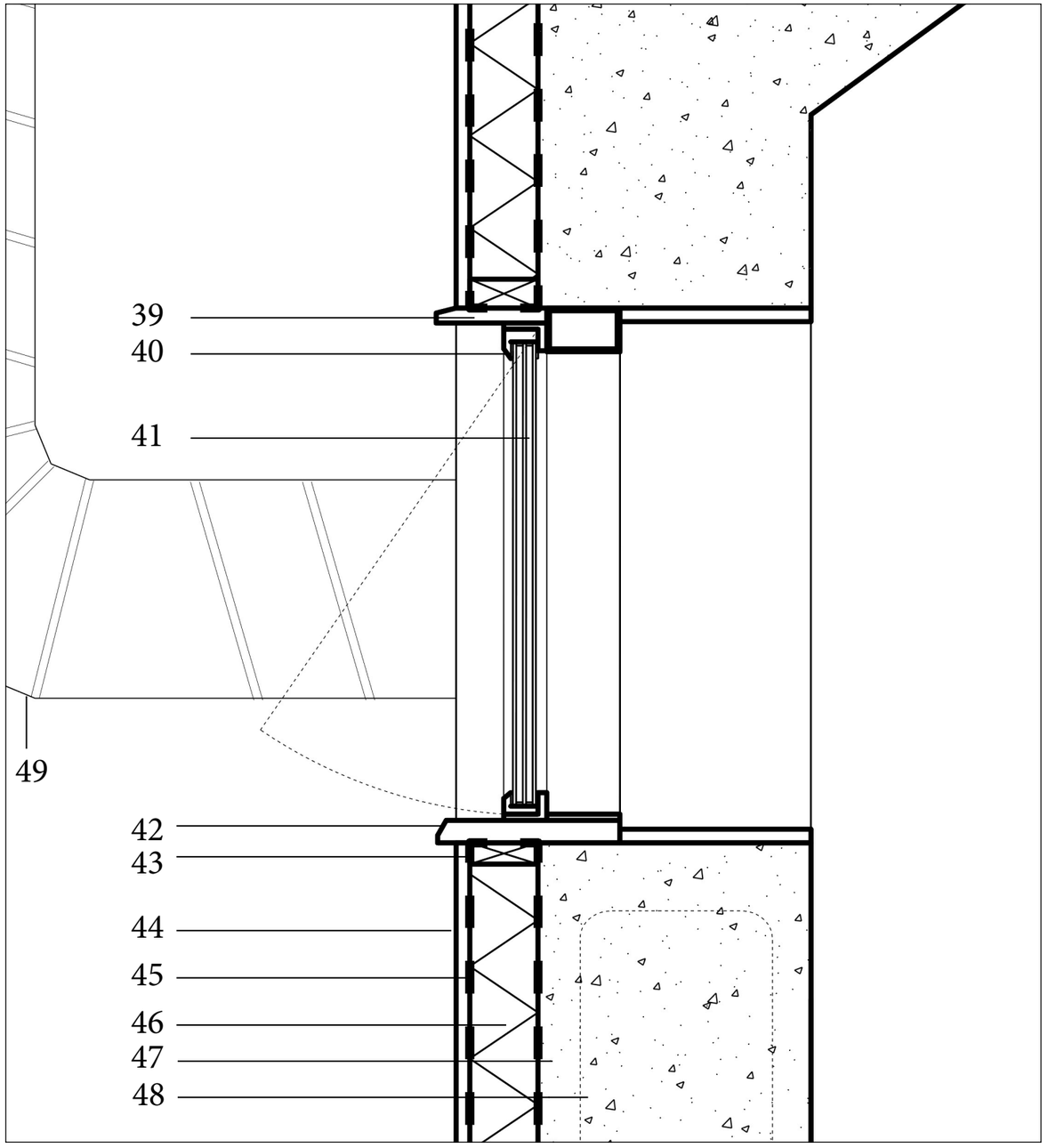
The East facade plant box provides natural screening with greenery, enhancing privacy for building occupants.

Additional Basement Ventilation Shaft

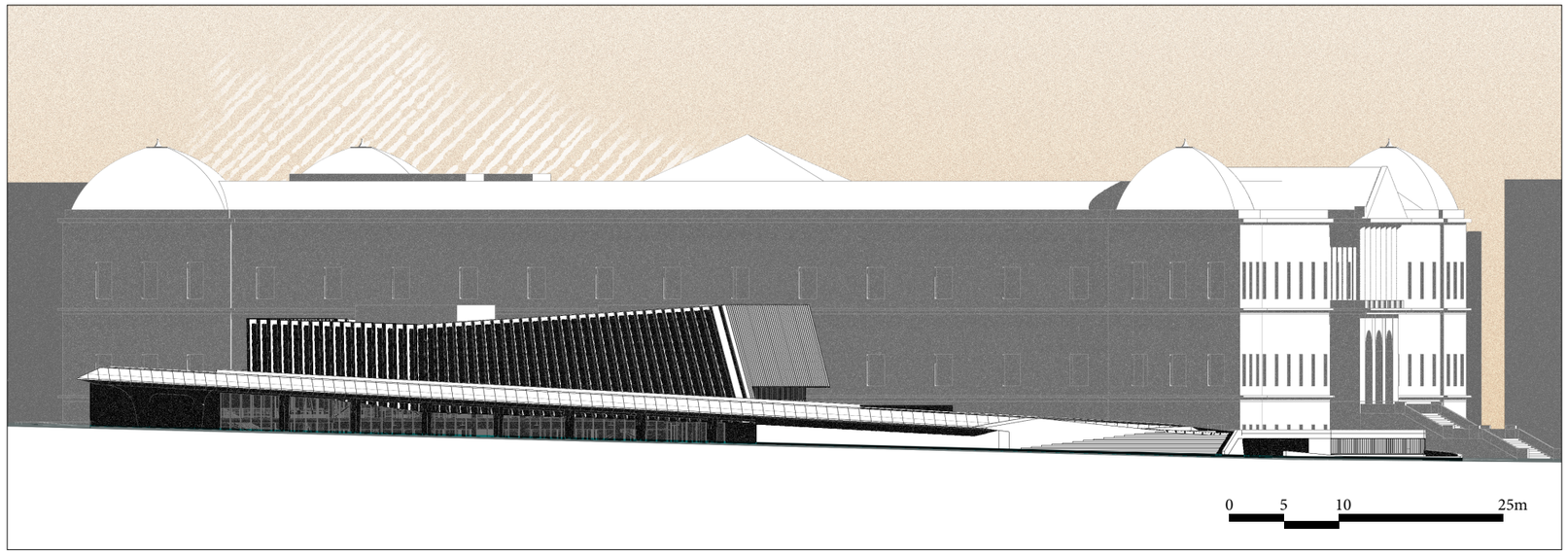
The basement level accommodates the data center's support infrastructure, including emergency power generation and mechanical systems. Dedicated ventilation shafts are incorporated to manage the thermal loads and air quality requirements of this underground equipment space.



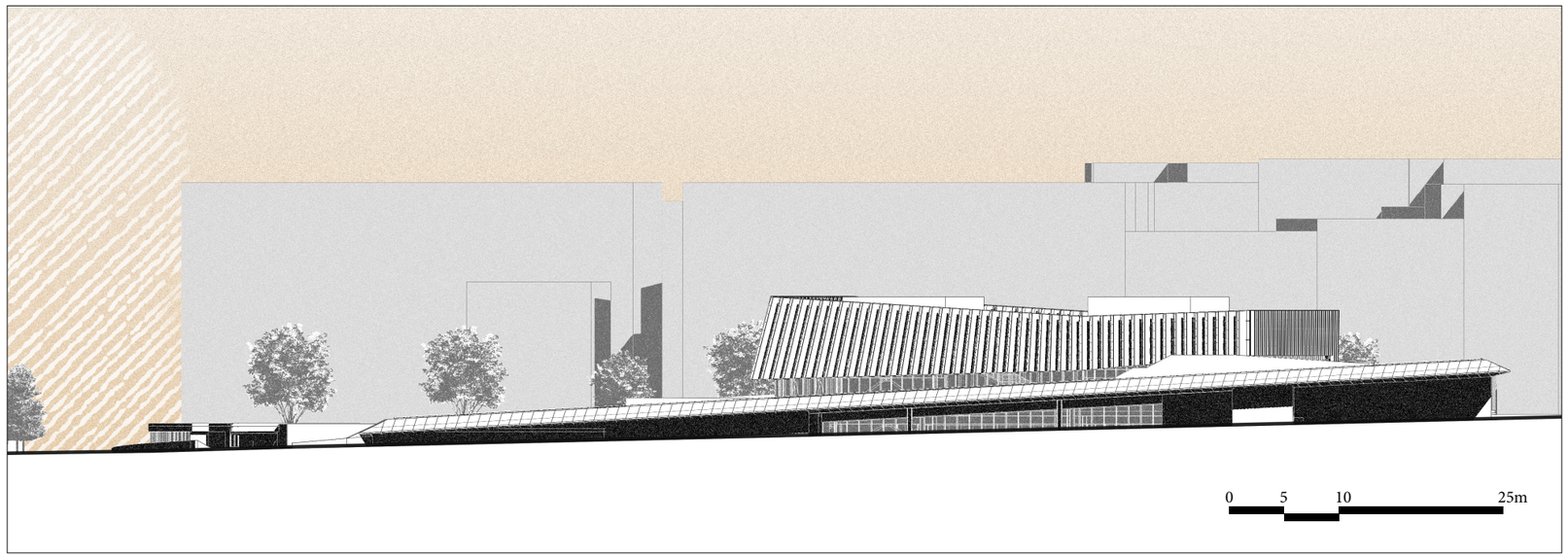
27. 50mm Concrete pavers
28. Adjustable Pedestals
29. Drainage Mat
30. 25mm Additional fall screed
31. 100mm rigid insulation
32. Protection board over Waterproofing membrane
33. Exterior concrete finishing topping with 25mm Additional fall screed
34. Water Drianage
35. 25-50mm Seismic joint with flexible sealant
36. Bearing Pad
37. Concrete Corbel
38. 400mm Existing Waffle Slab



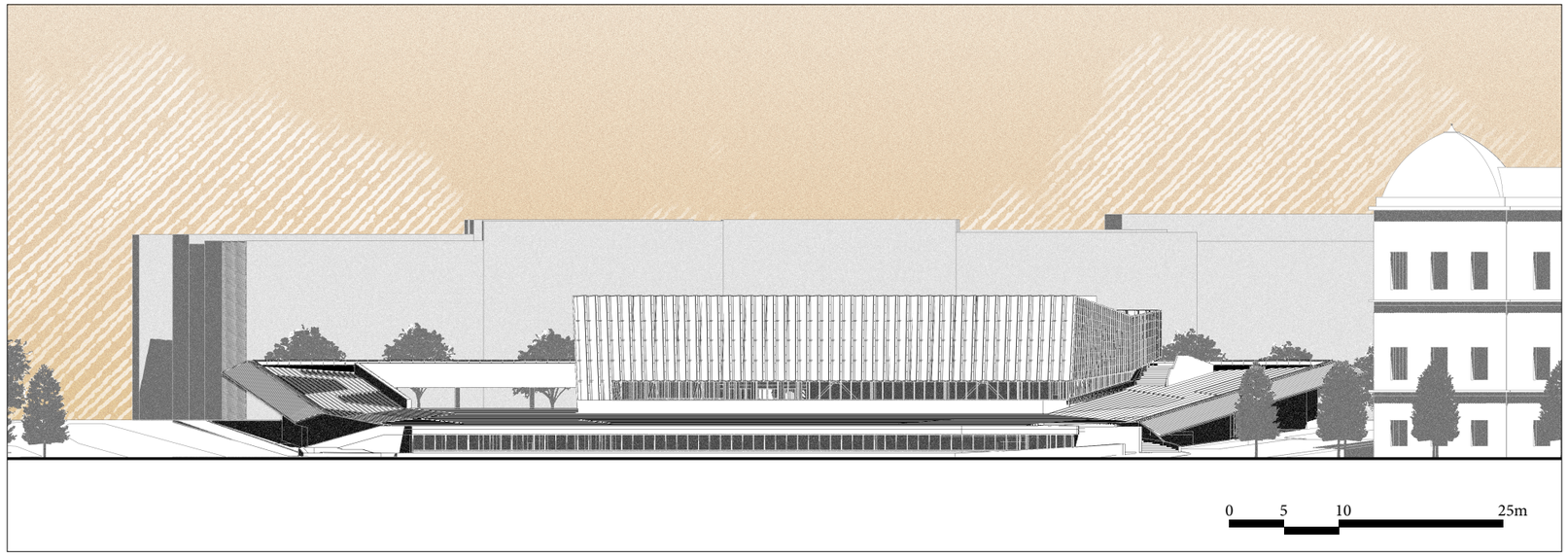
39. Precast concrete sill with integrated drip edge
40. Window Frame
41. Triple Glazing Unit
42. Precast concrete sill with integrated drip edge
    Sill flashing membrane (lapped under window)
43. Sealant bead
44. 25mm Protection board
45. Weather resistant barrier/membrane
46. 100mm - External insulation (mineral wool)
47. Air/vapor barrier
48. 500mm - Reinforced concrete wall structure
49. Ventilation Pipe



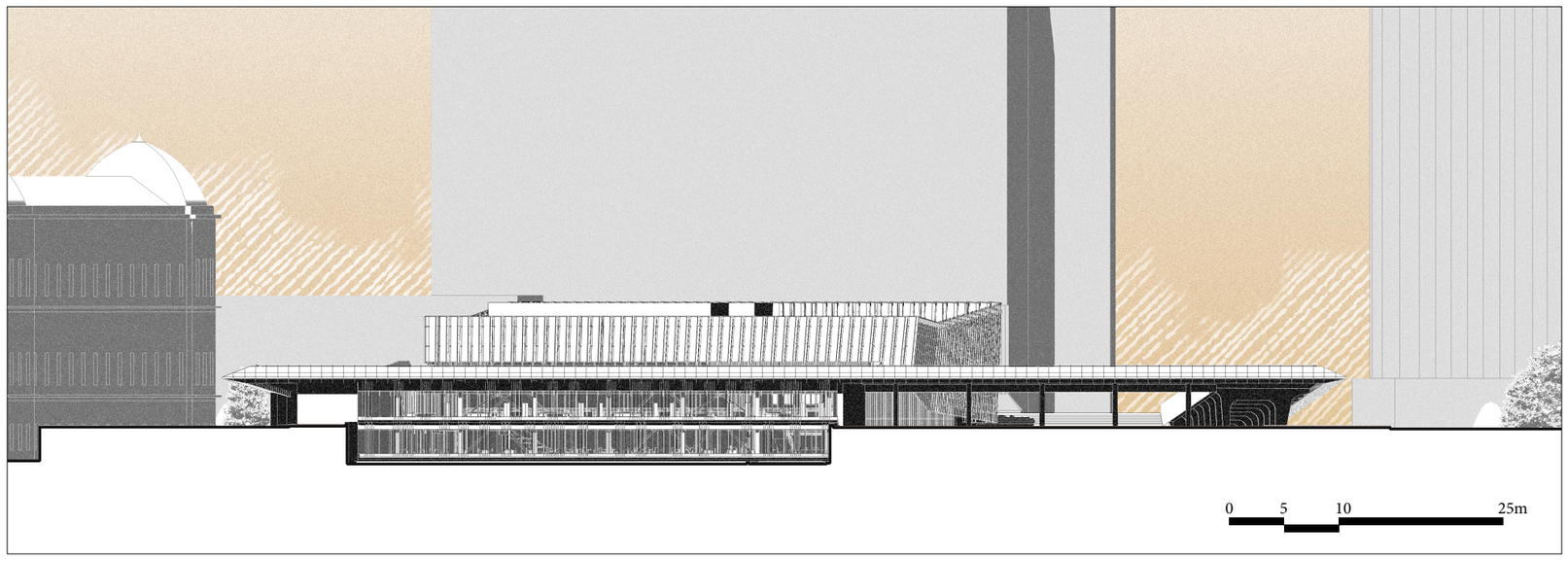
North Elevation 1:250



South Elevation 1:250



West Elevation 1:250

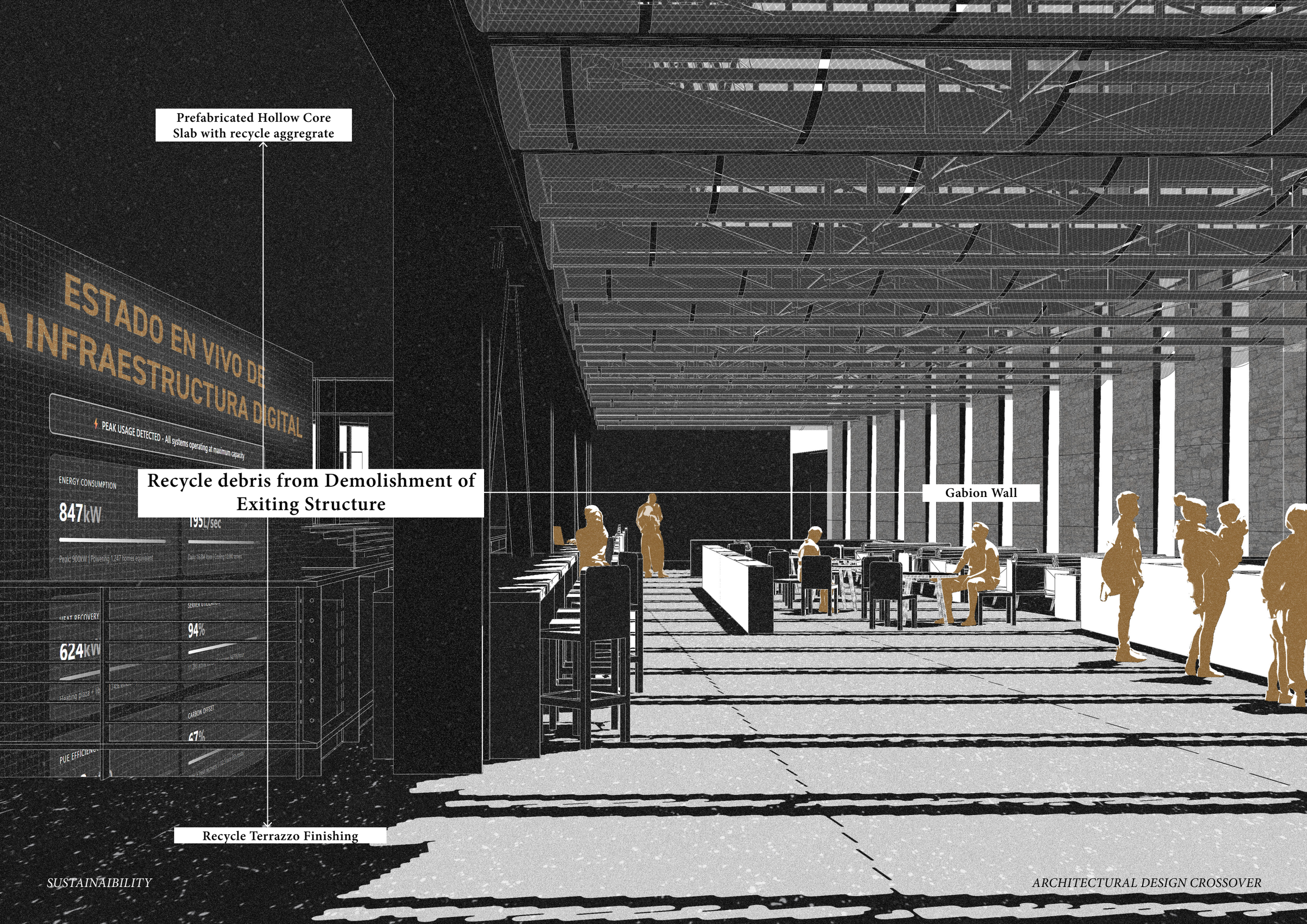


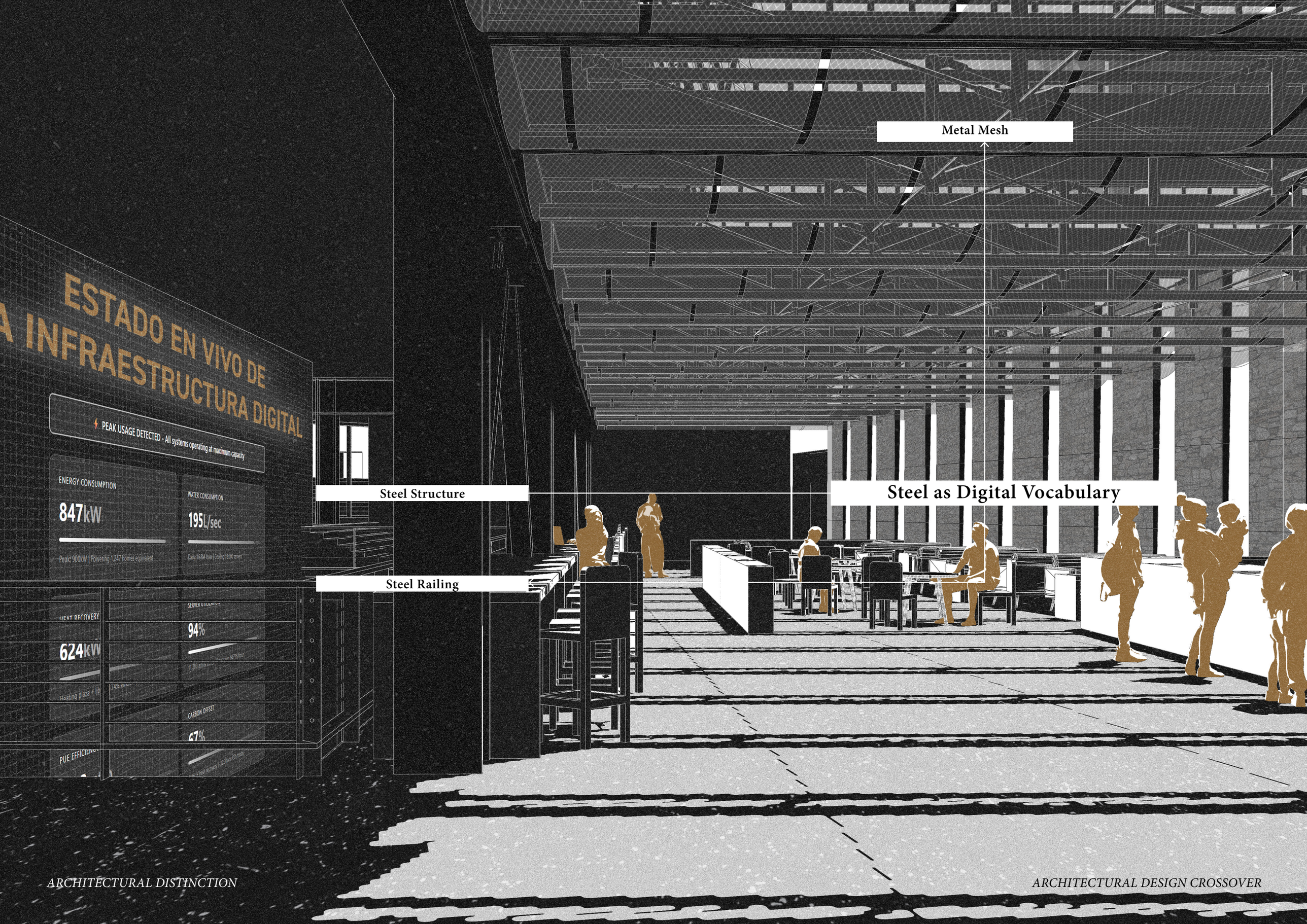
Elevation 1:250

Materialization

Sustainable Pragmatism? or Architectural Distinction?




Prefabricated Hollow Core Slab with recycle aggregrate
ESTADO EN VIVO DE
A INFRAESTRUCTURA DIGITAL
PEAK USAGE DETECTED - All systems operating at maximum capacity
ENERGY CONSUMPTION
847kW
Peak: 900kW | Powering 1,247 homes equivalent
195L/sec
Daily: 16.8M liters | Cooling 12,000 homes
HEAT RECOVERY
624kW
SERVER UTILIZATION
94%
CARBON OFFSET
67%
PUE EFFICIENCY
Recycle debris from Demolishment of Exiting Structure
Gabion Wall
Recycle Terrazzo Finishing



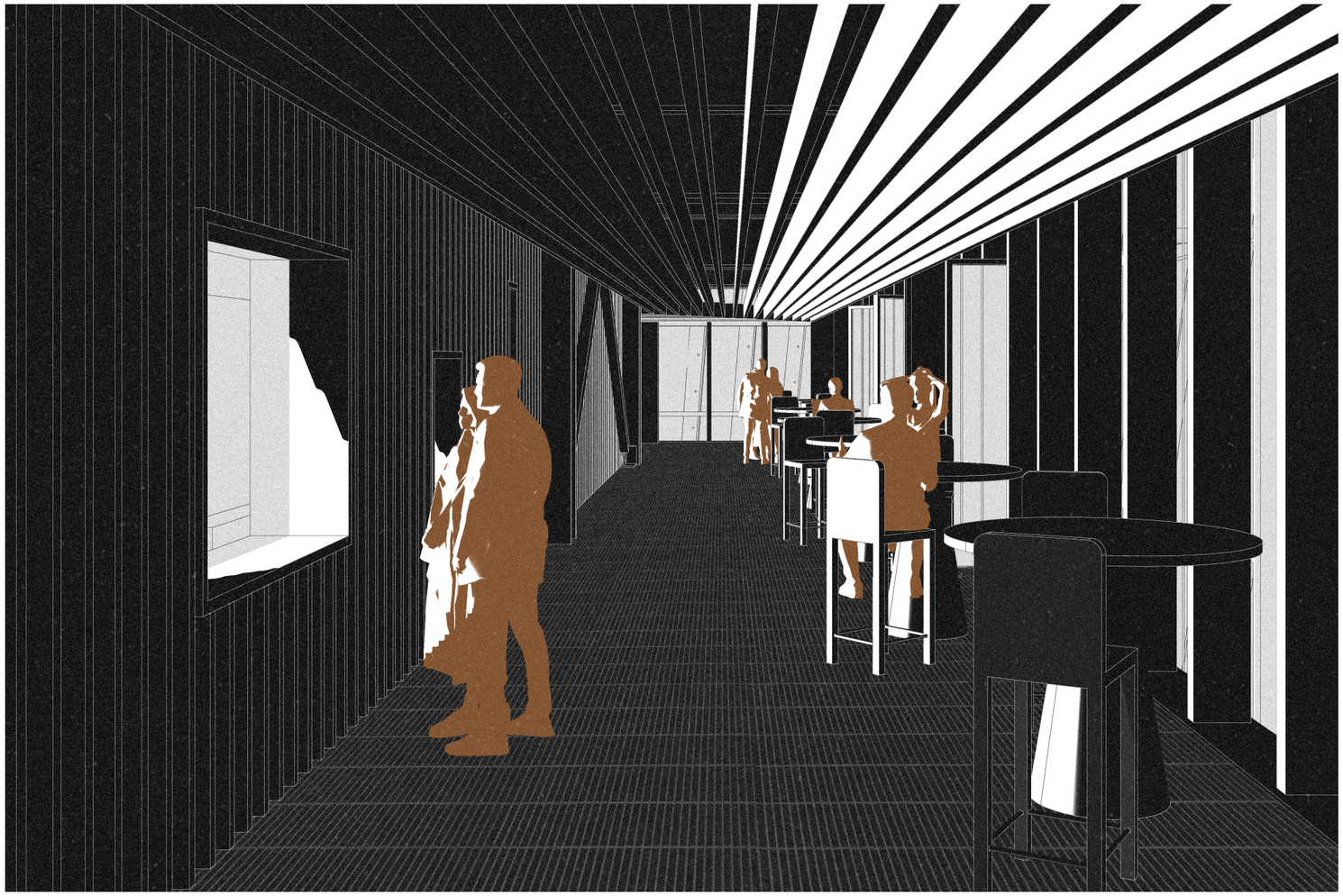
ARCHITECTURAL DISTINCTION

ARCHITECTURAL DESIGN CROSSOVER



Metal Grate Raise floor in the Server Room for Ventilation





Aluminum Lourver/ Drop Ceiling as guideline to navigate the visiting route



Different form & Function of metal

Reflection

Human-Machine Co-ownership
Buildings as Living Systems
Multi-Species Design
Temporal Complexity