FAB LIGHT

MANUAL

G7 · JANUARY 2019

FAB LIGHT

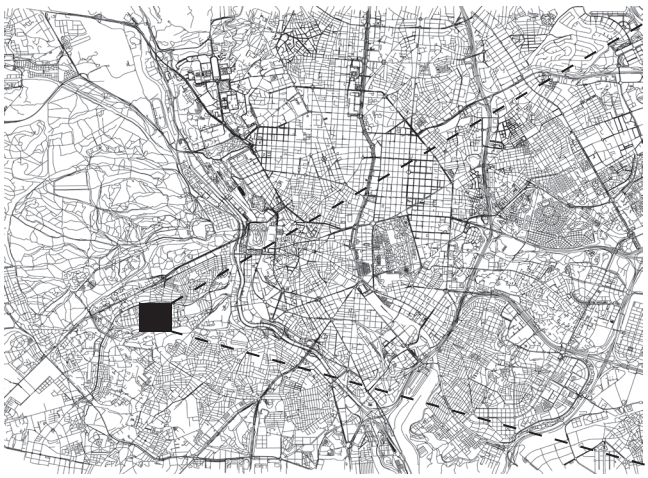
UNITED NATIONS HEADQUARTERS

-DRONE & HAND MADE
PROTOTYPE DEPLOYABLE BASE-

Paula Balmori Beltrán · Universidad Europea de Madrid

INDEX

CONTEXT



LOS CARMENES 28047 MADRID, SPAIN

WHAT ARE THE NEEDS?


INDUSTRIAL MACHINERY

PRINTING +PLOTTER

LASER CUTTER

3D PRINTER

MATERIAL +STORAGE

MILLING MACHINE


WORKING SPACE


INTERDISCIPLINARY

TEACHING

PRIVATE THINKING

COMPUTERS

PRESENTATION SPACES

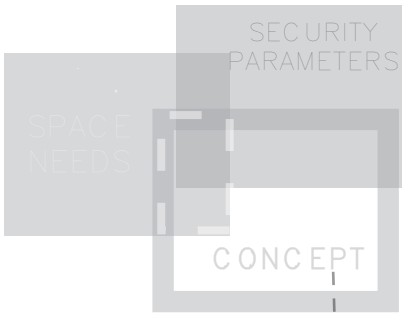
SOCIAL EATING


TOILETS

WHENEVER A DESIGN PROCESS FOR A PROJECT STARTS IT IS IMPORTANT TO HAVE IN CONSIDERATION THE CONTEXT, THE IMPACT ON THE SOURRANDINGS AND TOGETHER WITH THAT, THE NEEDS THAT THE CLIENT AND ITS SPACE DEMANDS.

WHAT IS **RESILIENCE** ARCHITECTURE AND HOW DOES IT AFFECT **PHYSICAL SECURITY**?

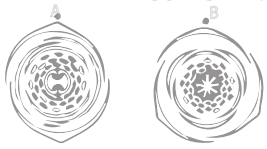
Physical security is a unexplore world where many improvements are yet to be done. That's where resilient design comes into play. According to the Resilient Design Institute, resilient design is defined as "the intentional design of buildings, landscapes, communities, and regions in response to vulnerabilities to disaster and disruption of normal life".



in this diagram we can see a visual representation of how would each of the different parameters of the proyect affect the design

CONCEPT:

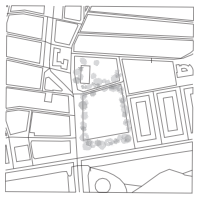
cleomaceae
plant+
triangle
coworking
base



FLORAL DIAGRAM OF (A) GLACIUM AND (B) PLATYSTEMON . THE FLOWER IN GLACIUM IS DIMEROUS WHILE IN PLASTYSTEMON IS TRIMERUS. THE STAMENS IN BOTH CASES ARE EXTRORSE.

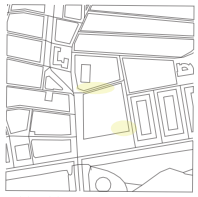
DESIGN PROCESS _ SECURITY SITE ANALYSIS

TO ENHANCE CONTROL BY:



USING BARRIERS TO PREVENT PASSAGE OF VEHICLES

SECURING ALL THE PERIMETER

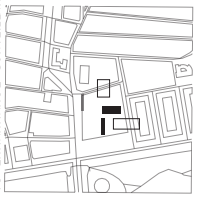


MINIMIZING ENTRANCES INTO THE BUILDING

SECURING VULNERABLE OPENING

INSTALLING ELECTRONIC SYSTEM ACCESS

TO ENHANHANCE SURVEILLANCE BY:

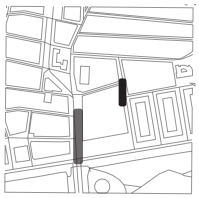


PLAZING WINDOWNS AND DOORS FOR VISIBILITY

AVOID SPACES THAT PERMIT CONCEALMENT

DEFINDING PUBLIC VERSUS PRIVETE INTERIOR SPACES

AVOID KNOCKING LINES OF SIGHT



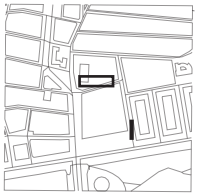
INSTALLING SCREENING AND TRACKING SYSTEM

TO MITIGATE BLAST EFFECT:

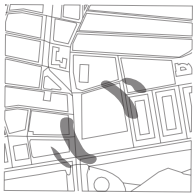
STRUCTURAL SYSTEM TO PREVENT COLAPSE OF THE BUILDING

OPTIMIZED BUILDING CONFIGURATION

MAXIMIZING DISTANCE WITH PARKING



LOCATIONG OF OPENING WITH DETONATION IN MIND



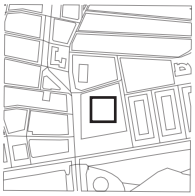
BLASTING RESISTANCE

to mitigate blast effect:

ELEVATING AIRE INTAKES

PROTECTING INCOME UTILITIES

APPLYING AIR FILTRATION



SECURING VULNERABLE AREAS

EMERGENCY PLANSFFOR BIOCHEMICAL ATTACKS

RESILIENCE ARCHITECTURE

PHYSICAL

strategies shape site and buildiing elements to encourage natural, or passive, access control and surveillance while creating perceptions of risk to would-be offenders.

ECHNOLOGICAL

strategies use hardware- intensive or mechanical means to achive access control and surveillance.

OPERATIONAL

strategies rely on a combination of human resources to reinforce access control and surveillance, and on operational policies and procedures for daily and emergency situations.

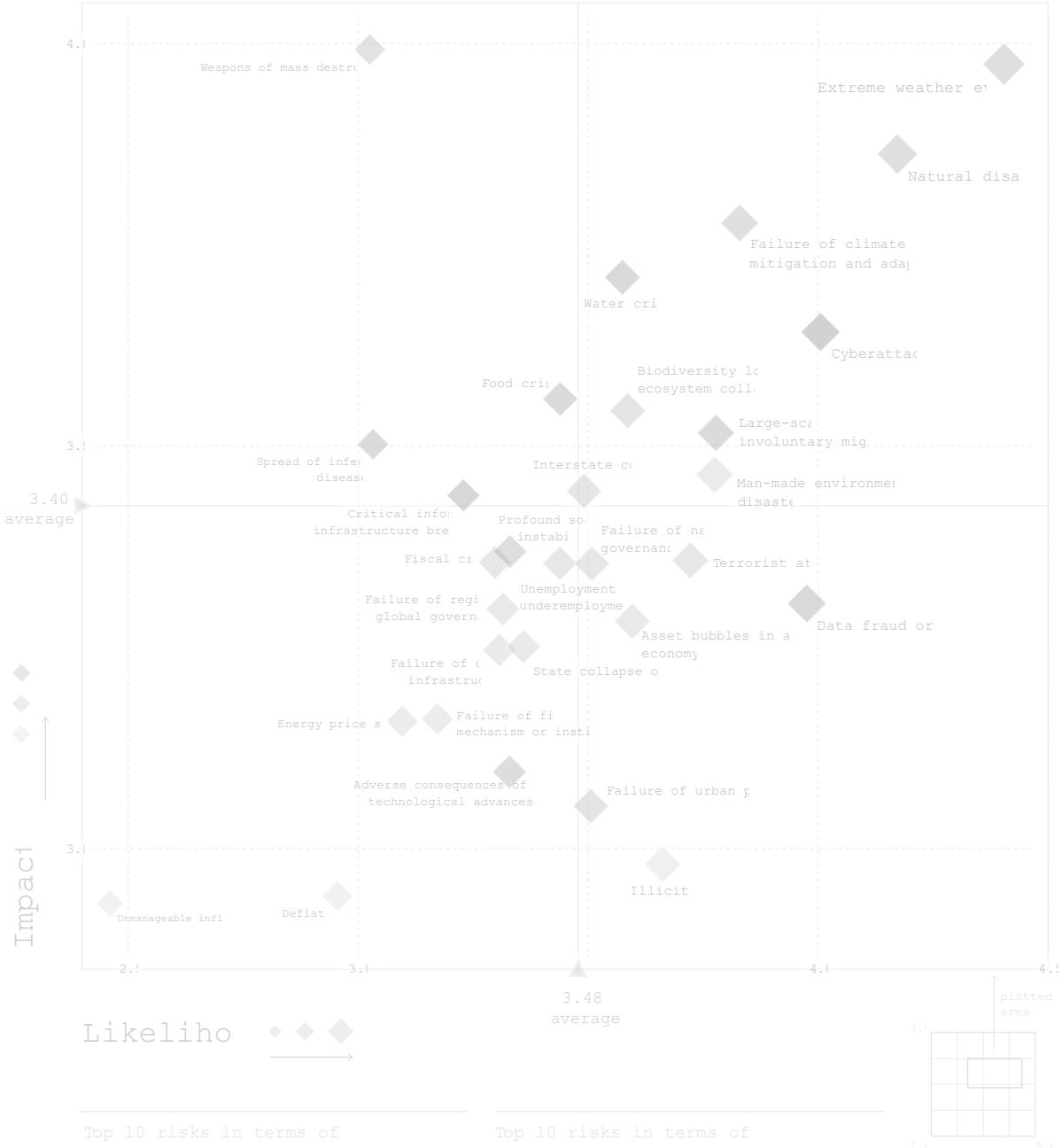
PURPOSE INTENT

MINISTERIO DEL INTERIOR
SECRETARIA DEL ESTADO DE SEGURIDAD

NIVEL DE ALERTA ANTITERRORISTA (NAA)
MADRID'S RISKS LEVEL

1 VERY LOW
2 LOW
3 MODERATE
4 HIGH
5 EXTREME

RISK PROFILE ANALYSIS



plotted area

Top 10 risks in terms of Likelihood

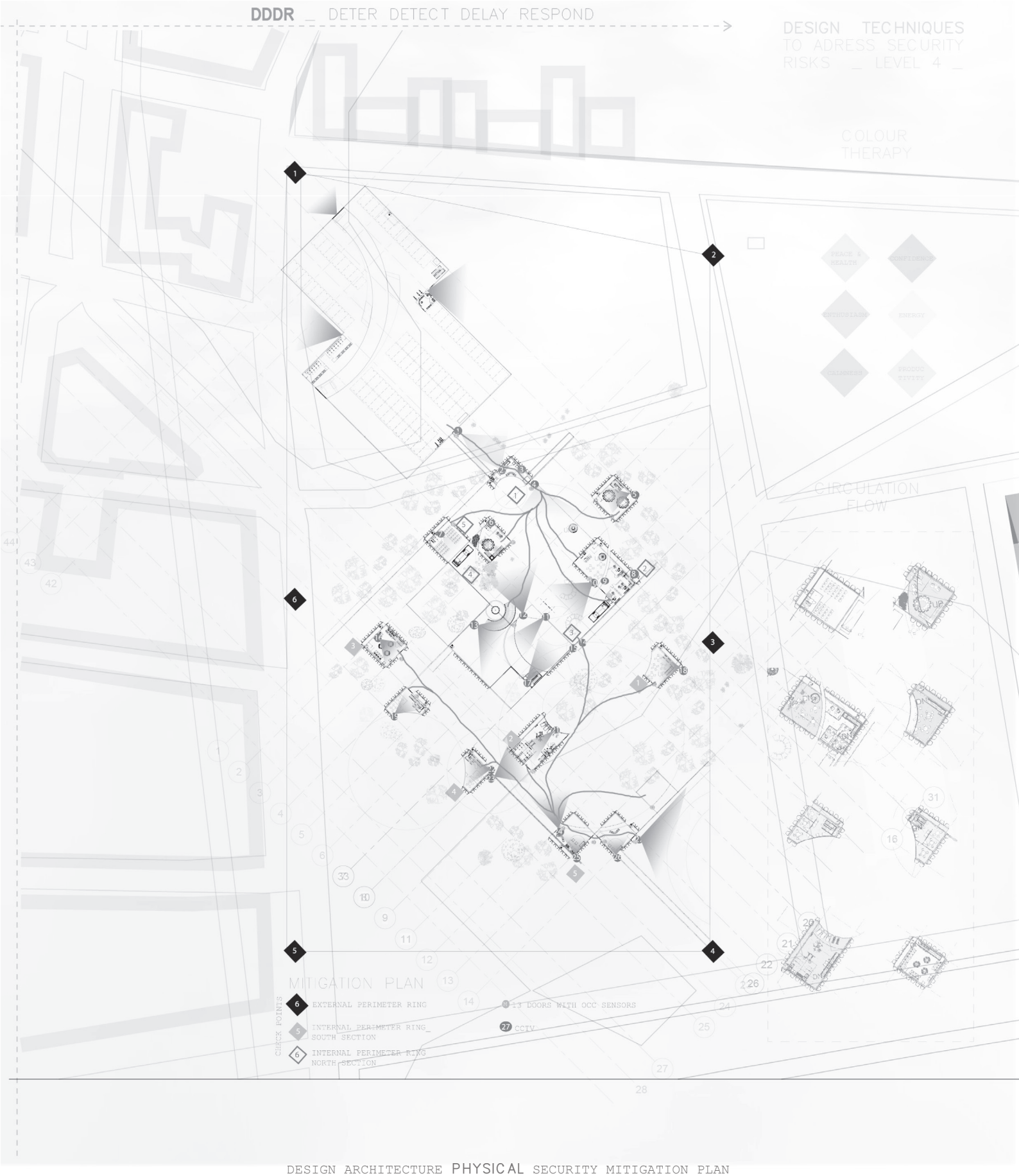
- Extreme weather events
- Natural disasters
- Cyberattacks
- Data fraud or theft
- Failure of climate-change mitigation and adaptation
- Large-scale involuntary migration
- Man-made environmental disasters
- Terrorist attacks
- Illicit trade
- Asset bubbles in a major economy

Top 10 risks in terms of Impact

- Weapons of mass destruction
- Extreme weather events
- Natural disasters
- Failure of climate-change mitigation and adaptation
- Water crises
- Cyberattacks
- Food crises
- Biodiversity loss and ecosystem collapse
- Large-scale involuntary migration
- Spread of infectious diseases

Categories

- Economic
- Environmental
- Geopolitical
- Societal
- Technological

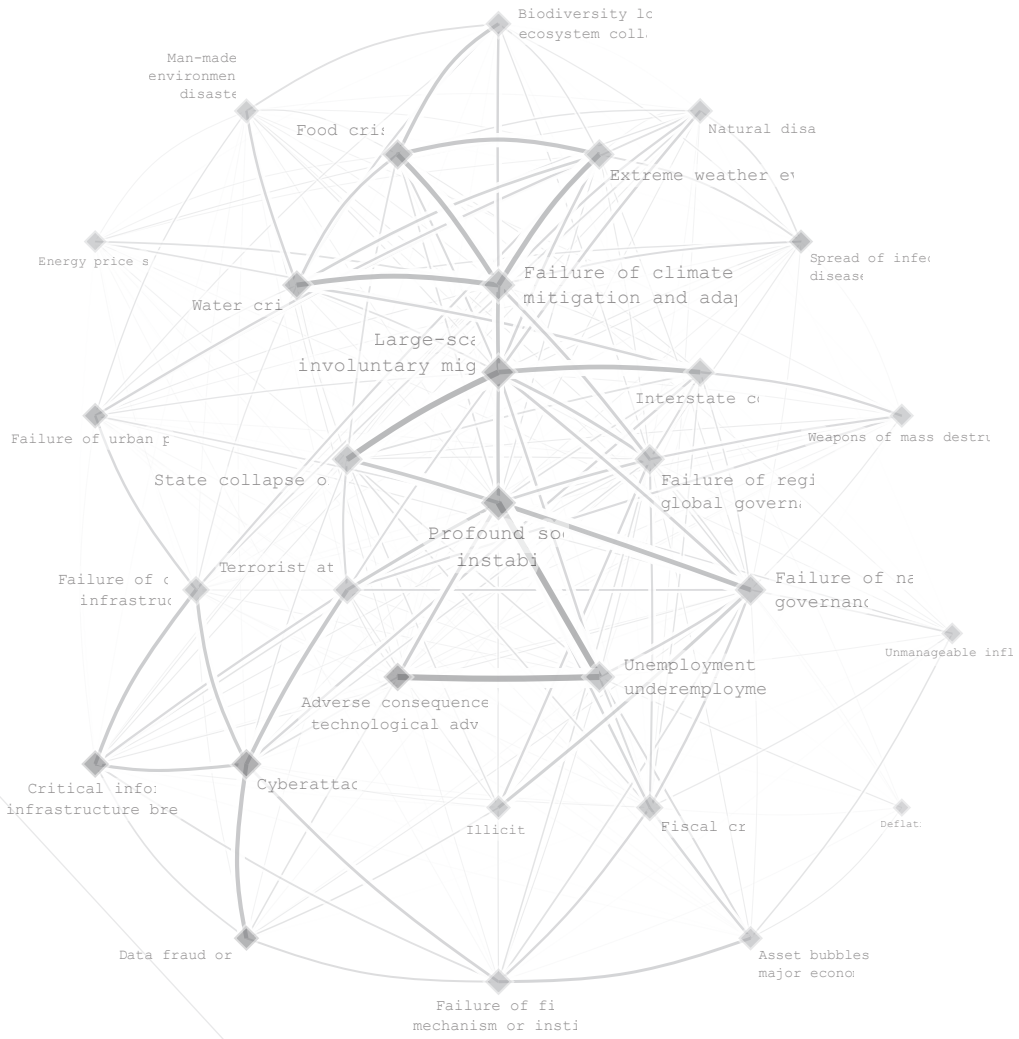


DESIGN ARCHITECTURE PHYSICAL SECURITY MITIGATION PLAN

THESE RISKS MATRIXES HAVE BEEN INSPIRED IN THE STUDIES DONE BY PETRAEUS IN THE ANALYSIS PLOT SHEET FROM THE COUNTERINSURGENCY MANUAL (US.GOV.2006).

IT IS BASED IN THE STUDY OF PATTERNS AND MOVEMENTS THAT ARE HAPPENING AROUND THE ENVIROMENT OF WHERE THIS PROJECT IS LOCATED.

The Global Risks Interconnections Map 2018



Economic Risks

Geopolitical Risks

Technological Risks

Environmental Risks

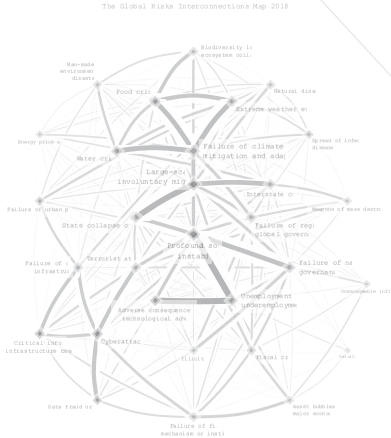
Societal Risks

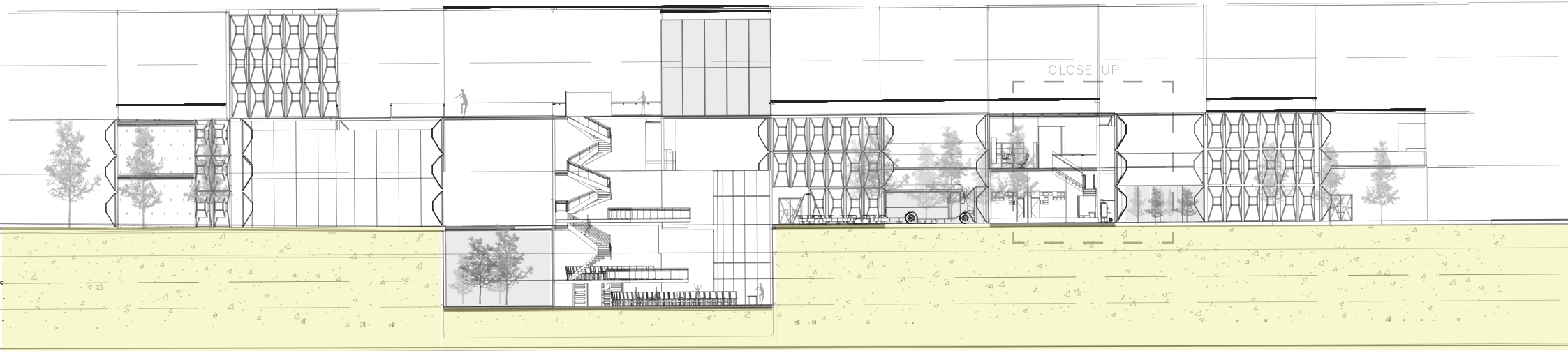
Number and strength of connections ("weighted degree")

THE WAY IN WHICH THIS ANALYSIS HAS BEEN USED IS BY TRANSFORMING THIS CUALITATIVE INFORMATION INTO CUANTITATIVE NUMBERS THAT ARE LATER TRANSLATED INTO DESIGN MOVES AND DECISIONS.

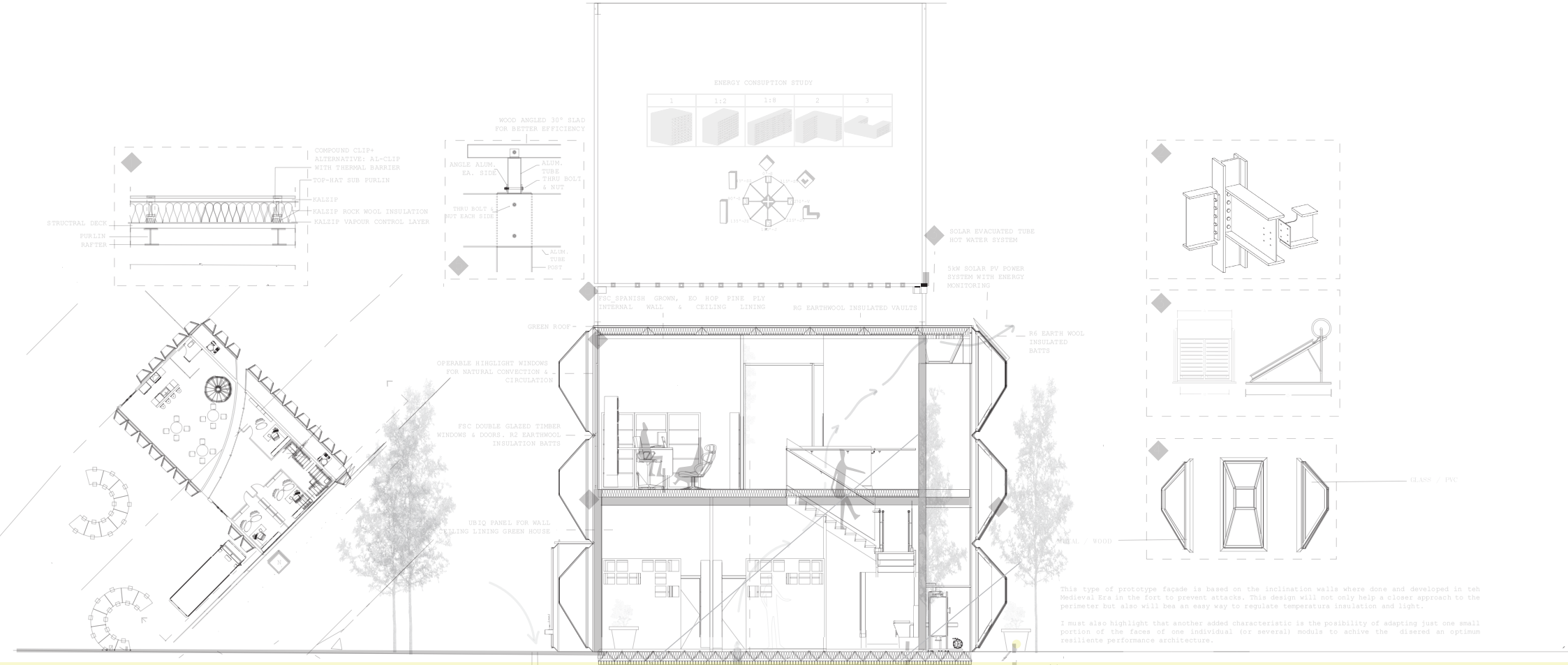
Paula Balmori Beltrán
Universidad Europea de Madrid

SECTION A





CLOSE UP SECTION
CARBON POSITIVE DEPLOYABLE MODULES

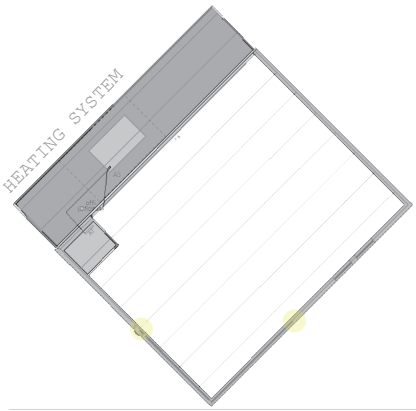


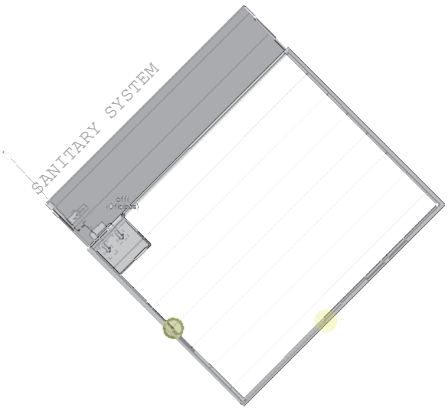
This type of prototype façade is based on the inclination walls where done and developed in teh Medieval Era in the fort to prevent attacks. This design will not only help a closer approach to the perimeter but also will bea an easy way to regulate temperatura insulation and light.

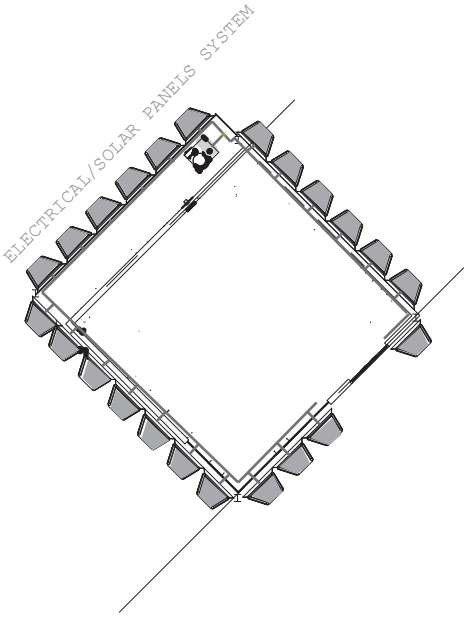
I must also highlight that another added characteristic is the posibility of adapting just one small portion of the faces of one individual (or several) moduls to achive the disered an optimum resilliente performance architecture.

INSTALLATIONS

The FAB LIGHT´s unique systems approach to design combines renewable
energy supply, thermal and electrical energy storage and reduced energy demand, to create an energy positive house at an affordable cost.







We have to pay secial attention to the connection areas between the glass and the walls. These are some of the **highest points of energy lost**

CARBON POSITIVE moves beyond carbon zero by making additional 'positive' or 'net export' contributions by producing more energy on site than the building requires and feeding it back to the grid. Carbon positive
projects can make significant contributions by helping to address the carbon intensity and damaging impacts of past building practices and lifestyles, and by offsetting situations where carbon zero homes are not possible.

INNOVATIVE ENERGY SYSTEMS. The energy systems combine solar generation and battery storage to power both its combined heating, ventilation, hot water system, and its electrical power systems which includes appliances and LED lighting. In winter, space heat is provided by passing external air through the upper south facing transpired solar air collector (TSC), then through a mechanical ventilation heat recovery unit (MVHR), and then delivered to the space. Exhaust air is passed through the MVHR and then through an exhaust air heat pump, which heats the thermal water store. The thermal store heats domestic hot water (DHW). The heat pump is powered by the PV and battery storage system. The house uses grid electricity supply when the PV - battery system is exhausted. The predicted energy performance is 70% autonomous, with a 1.75 grid export-to-input energy rati

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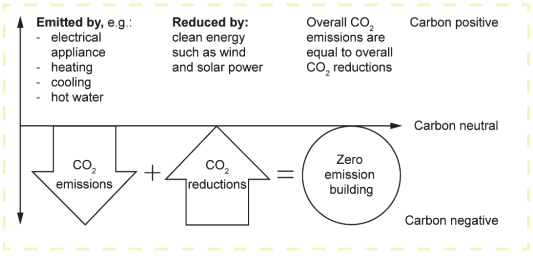
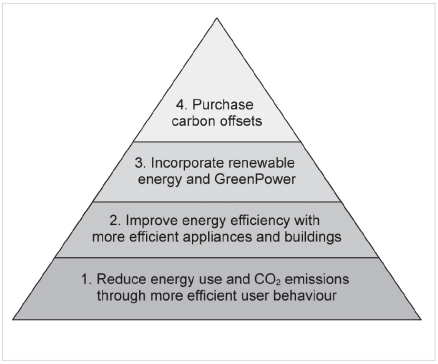
projects can make significant contributions by helping to address the carbon intensity and damaging impacts of past building practices and lifestyles, and by offsetting situations where carbon zero homes are not possible.

Reducing energy demand in each single module

Activity	Energy use	Initial load (kWh)	Energy efficiency measure	energy saving	New load (kWh)	Approx. annual savings assuming 0.2855€/kWh	0.5710€/kWh
Heating and cooling	40%	1900	Improve house energy rating by at least 2 stars	35%	1235	189.85€	379.71€
Water heating	21%	1250	Change to solar HWS	50%	625	178.43€	356.87€
Other electrical appliances	19%	800	Improve efficiency and reduce use	10%	720	22.84€	45.68€
Lighting	6%	350	Change to efficient lighting (e.g. LED)	75%	88	74.80€	149.60€
Cooking(if there is cooking)	5%	200	Improve efficiency by using induction or microwave	30%	140	17.13€	34.26€
Refrigeration	6%	350	Improve efficiency by 2 stars	30%	245	29.97€	59.95€
Stand-by	3%	150	Turn off at plug	90%	15	38.54€	77.08€
Total	100%	5000			3068	551.56€	1,103.15€

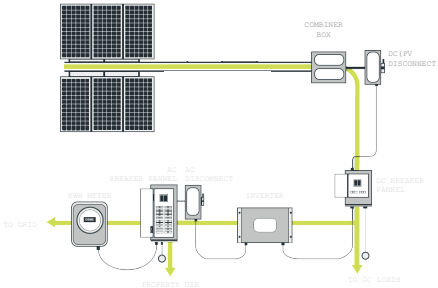




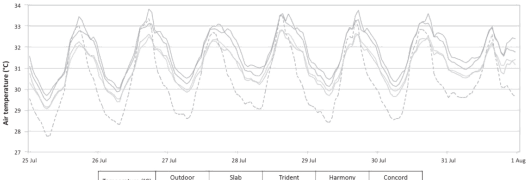
Behaviour levels for a carbon zero, carbon positive lifestyle.

CARBON POSITIVE SOLAR SYSTEM PANELS

SOLAR PANEL ARREY



Designing a carbon zero home requires that each designsolution be tailored to the specific location to maximise site advantages like solar or cool breeze access and diurnal temperature variations, or to identify alternative
solutions when these are not available.
It is necessary to have an understanding of how to incorporate renewable energy sources on site and consider actual energy use – which is affected by both building features and occupant behaviour.



Temperature (°C)	Outdoor	Slab	Trident	Harmony	Concord
Maximum	33.48	33.52	33.81	32.82	32.81
Median	30.10	31.80	31.64	31.12	31.01
Minimum	27.75	29.69	29.44	29.13	29.05

Figure 2. Outdoor air temperatures and simulated indoor air temperatures for the four PRH types under free running conditions from 25 to 31 July. The maximum, median and minimum temperatures are highlighted for easier comparison.

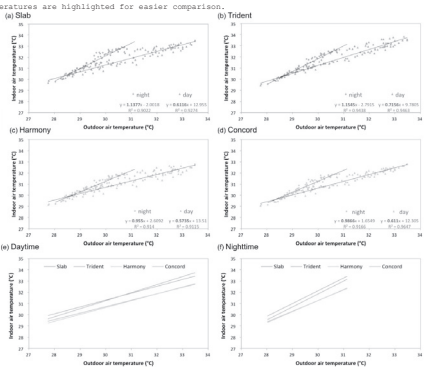
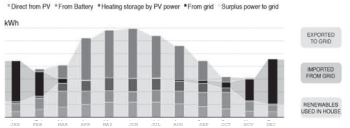
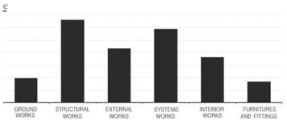


Figure 3. Simulated indoor air temperatures against outdoor air temperatures for (a) Slab, (b) Trident, (c) Harmony and (d) Concord types PRH. Comparisons of the responses of buildings to changes in outdoor temperatures during (e) daytime and (f) nighttime.

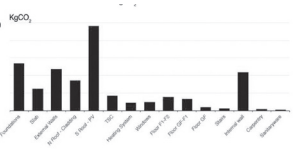
ENERGY POSITIVE
The predicted energy performance is 70%, with a 1.75 grid export-to-input energy ratio.



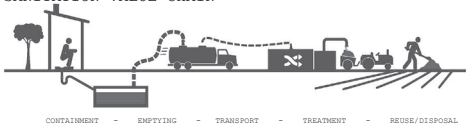
LOW COST
Estimated ost of the house is 1.000€/m2, compared with social housing benchmarck of 800€/m2-1000€/m2.



LOW CARBON
The embodied CO2 of the house materials is 340kgCO2/m2, compared with standard house benchmark of around 500 kgCO2/m2.

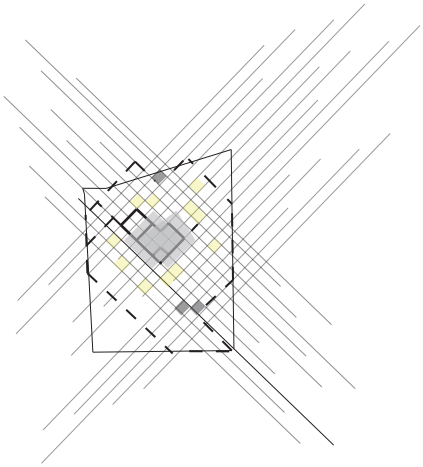


SANITATION VALUE CHAIN



CONTAINMENT - EMPTYING - TRANSPORT - TREATMENT - REUSE/DISPOSAL

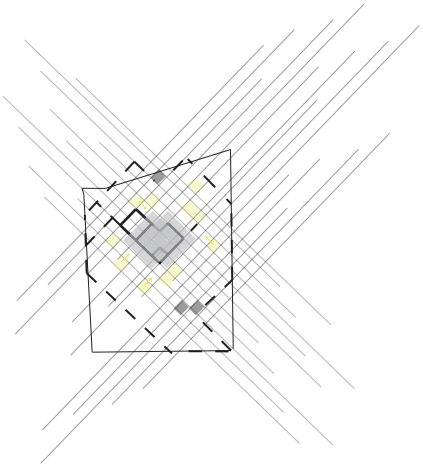
MODULES EMERGENCY MITIGATION PLAN
MOMENT AND PROJECT VERSATILITY



1

CURRENT STAGE

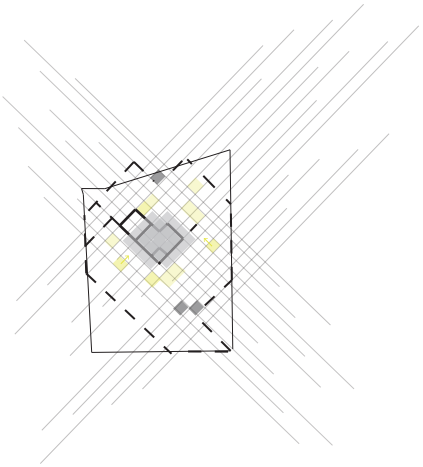
The actual stage of the UN HQ in Madrid is based on several studies and best mitigation plans options



2

MITIGATION PLAN STAGE 1

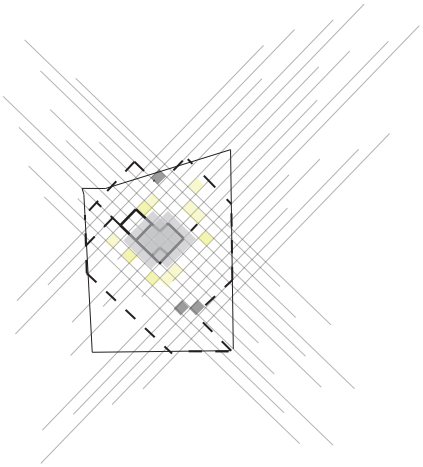
Part to the process into the EXTREME EMERGENCY PLAN to cover from attack.



3

MITIGATION PLAN STAGE 2

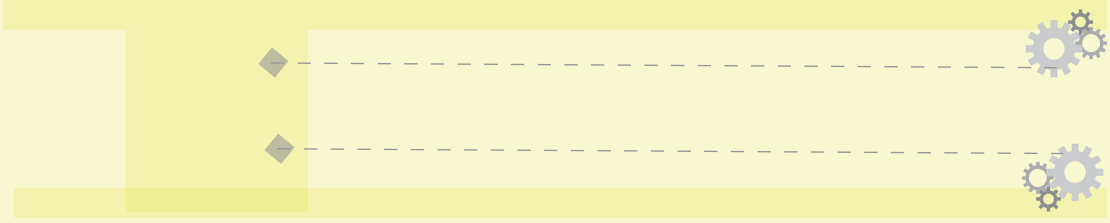
Part II to the process into the EXTREME EMERGENCY PLAN to cover from attack.



4

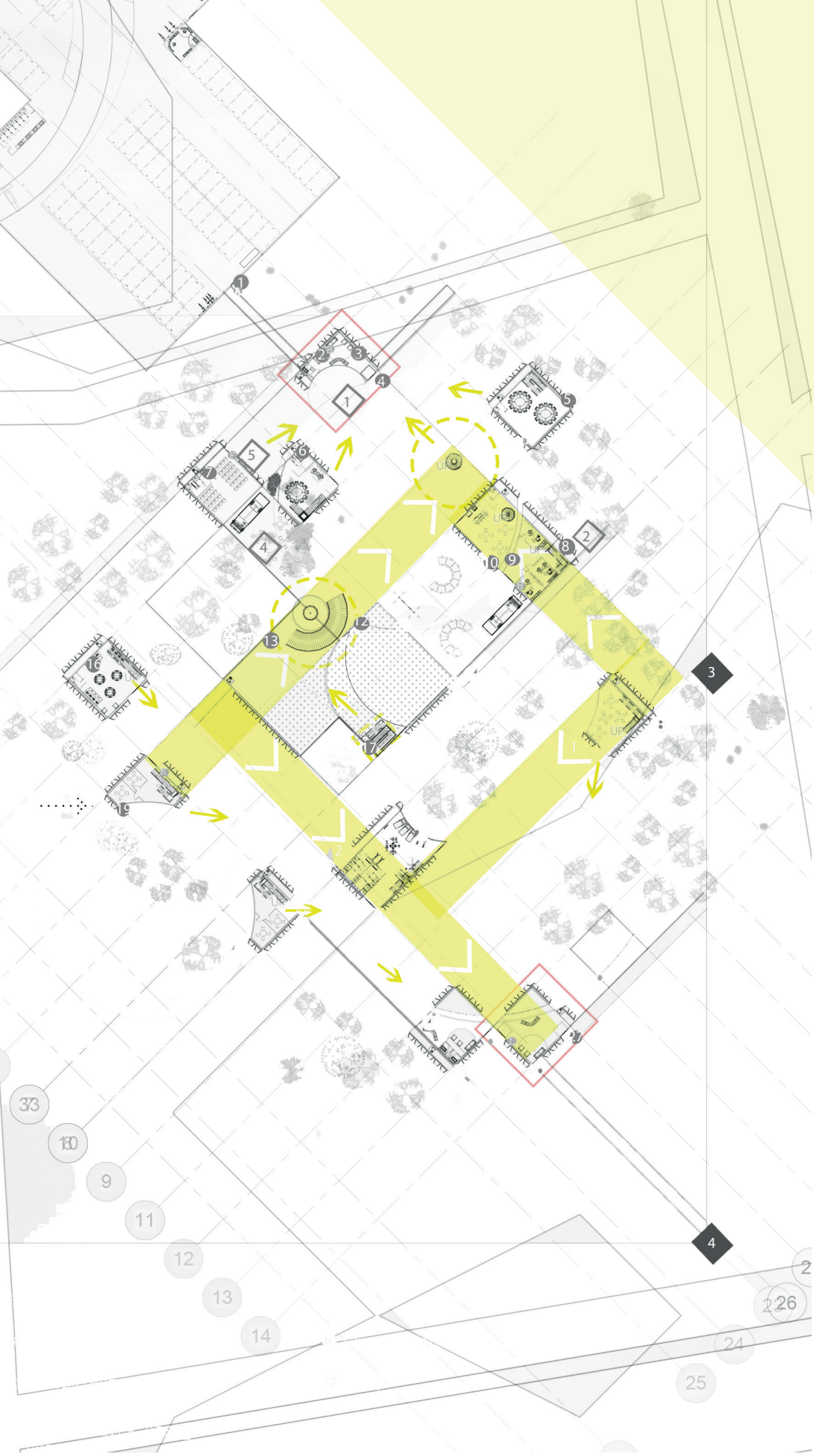
FINAL STAGE

This is the pattern to be consider the best option in case of attack.



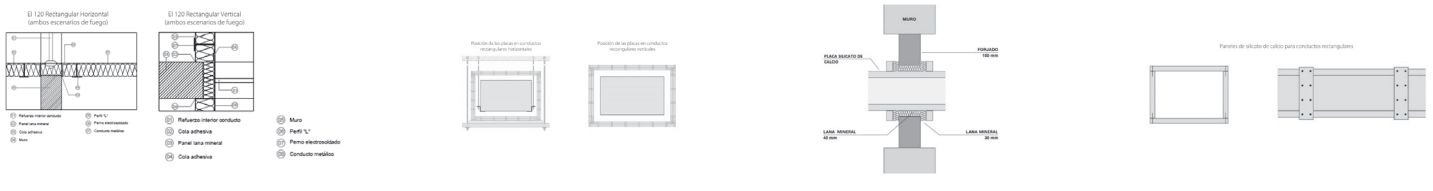
MOVEMENT SYSTEM
CHAIN PULLEY

At the end of the lifting chain is a grab hook, which allows to easily attach and detach a load. Also, most chain hoist lifting mechanisms have a ratchet or braking system that prevents the load from slipping back, but allows to lower a load by pulling the other side of the hand chain.



FIRE PRECTION ENGINEE-
TING AND SUSTAINABLE
DESIGN

Natural lighting from large open spaces and glass facades can provide benefits in reducing energy consumption while increasing population well-being and productivity when compared to artificial lighting alternatives. Despite the restrictions of building code, Through the assessment of the fire load within the space, fire protection can assess the smoke movement through interlinking spaces and develop technical solutions to address this while also tailoring the solutions towards a low energy, natural ventilation strategy. Additionally, the provision of elements such as active smoke or fire curtains can provide the code-required barrier between, for example, the SAFE HEVEN room and an adjacent escape route.

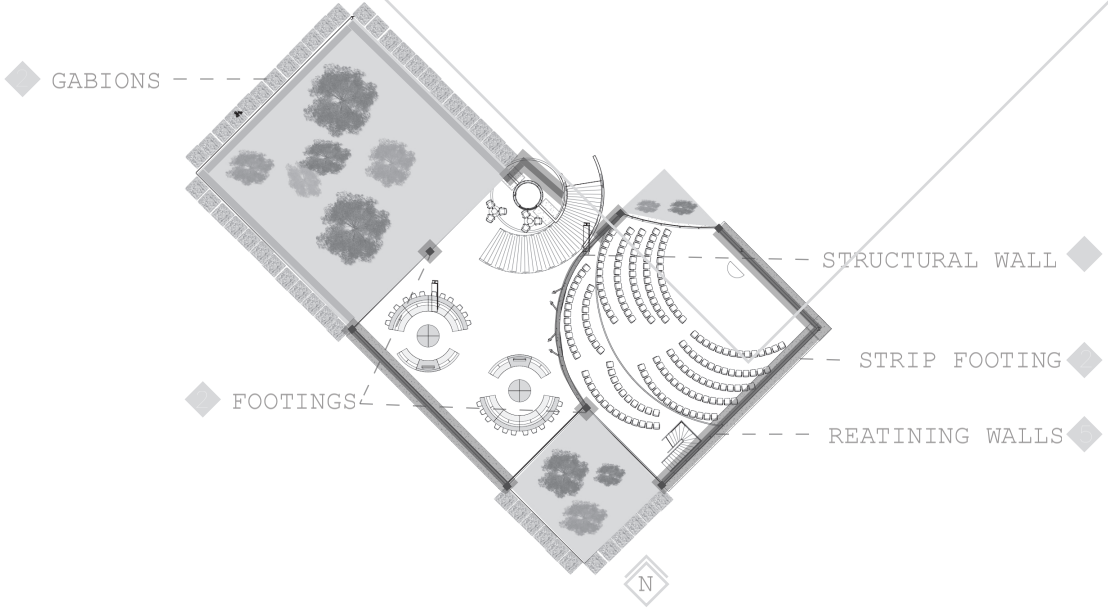


CONSTRUCTION PROCESS + DETAILS

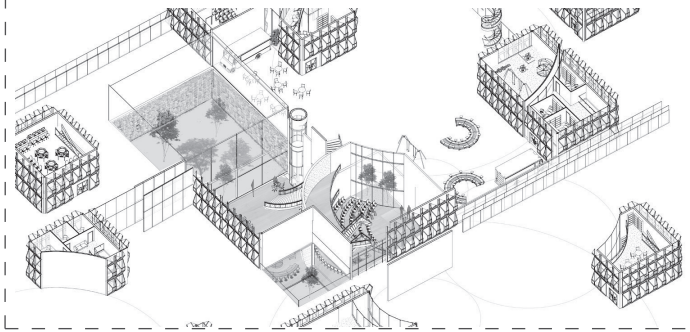
SAFE HEVEN (CONFERENCE ROOM)

STEPS

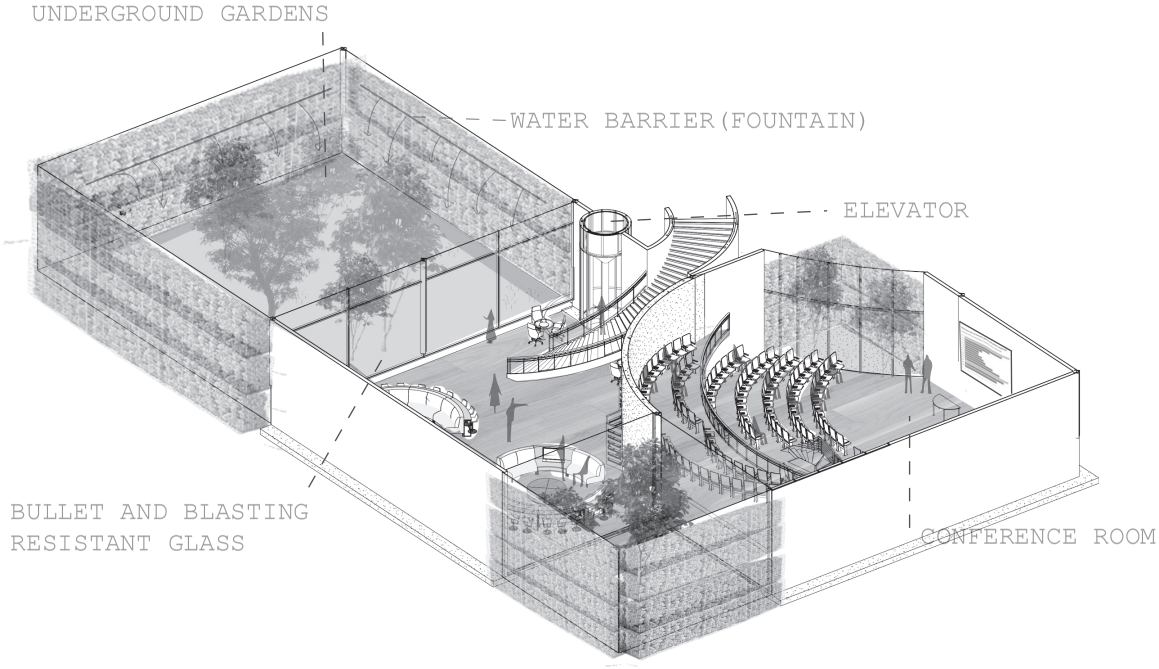
1. DIGGING
2. FOOTINGS + GABIONS (WITH FOUNTAIN INTALLATION ALREADY INTALLED)
3. SEAL THE FOOTINGS TO PROTECT THEM FROM MOISTURE
4. ONCE CONCRETE IS CURED, USE CONCRETE BLOCK TO CREATE STEM WALLS
5. BASEMENT RETAINING WALLS
6. WATERPROOFING OF THE FOUNDATION
7. INSTALLATION OF FOUNDATION WRAP AND GRAVEL
8. BACKFILLING OF SOIL AROUND THE ENTIRE FOUNDATION
9. POURING OF SUPPORT BEAM FOTINGS
10. COMPLETION OF INSTALLATION OF SUPPORT STRUCTURE



SOME IMPORTANT CHARACTERISTICS IN THE CONSTRUCTION PROCESS ARE BASED ON THE MATERIAL THAT IN THIS AREA NEEDS TO BE NOT ONLY FIRE RESISTANT, BULLET AND BLASTING RESISTANT BUT ALSO THE RIGHT MATERIAL (CONCRETE 203 MM) TO AVOID CYBER ROBBBERIES AND INTERFIERANCE.



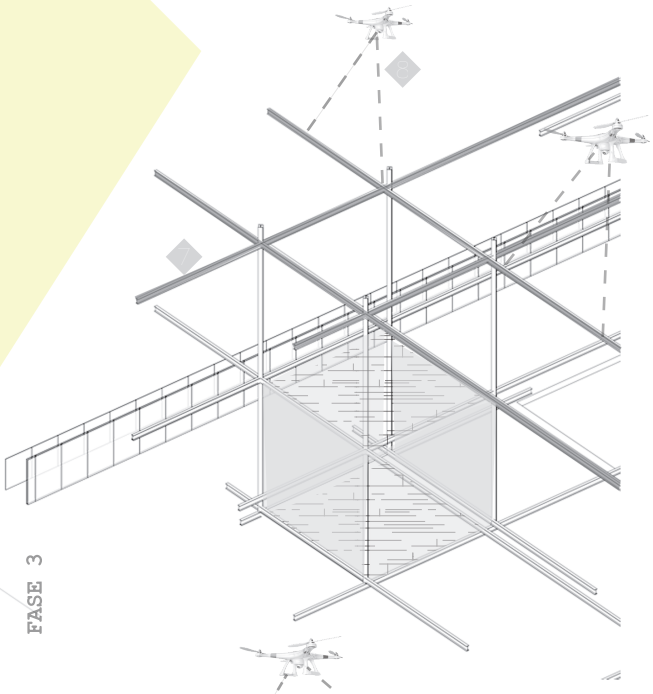
FLOOR -1

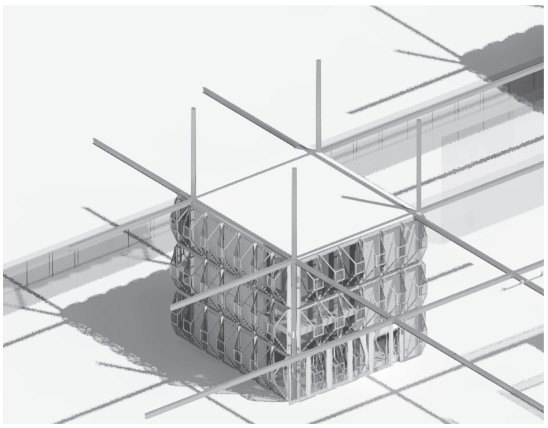


FLOOR -1

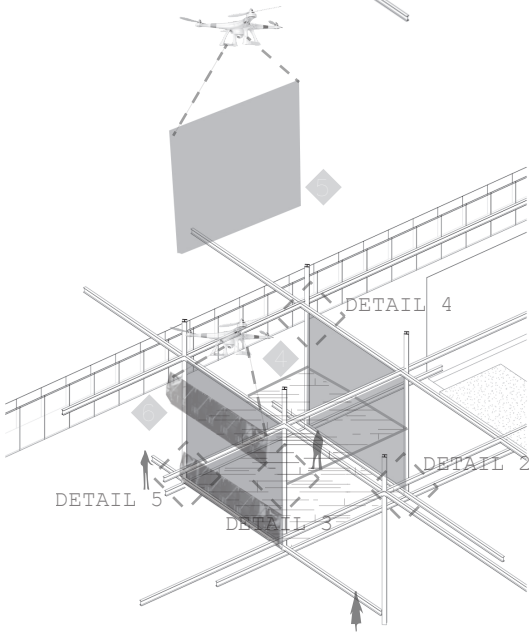
CONSTRUCTION PROCESS MODULE PROTOTYE

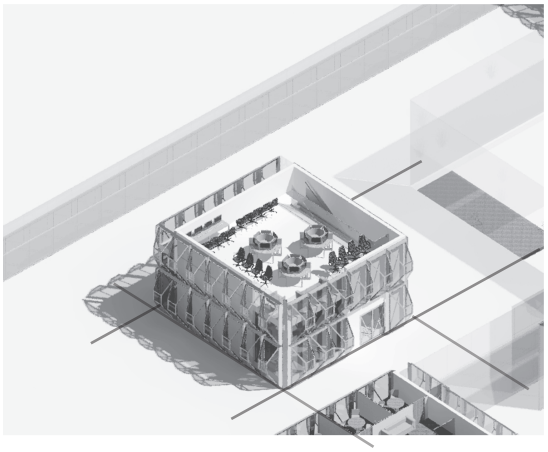
FASE 3



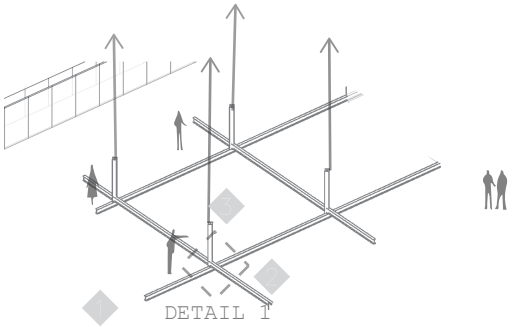


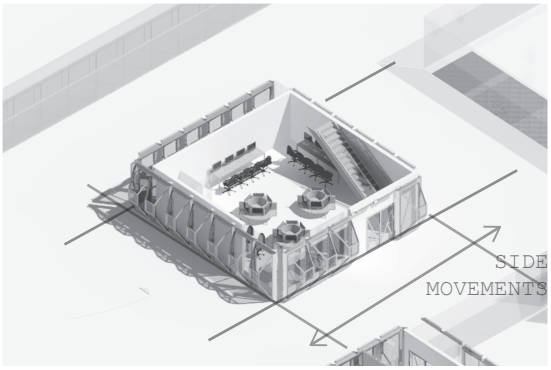
FASE 2





FASE 1





ASSEMBLE

4 PEOPLE MINIMUM

DRONE(FREEFLY SYSTEMS ALTA 8) 20KG EACH

FINISHES

HILTI DX460 PNG

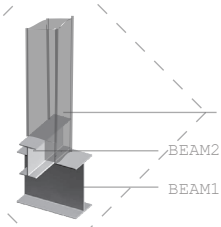
Arc 200 INVERTER WLDER

1. BEAM1(ISMB 300)
2. BEAM2 (ISMB 300)
3. COLUMNS (18M)
4. FLOOR/ CELLING
5. WALL ASSEMBLE
6. FAÇADE INSTALLATION
7. BEAM1.1(ISMB 300)
8. BEAM2.1(ISMB 300)

FOR FURTHER CONSTRUCTION STEPS LOOK AT THE DETAIL SECTION MANUAL

CONSTRUCTION DETAILS MODULE PROTOTYE

FASE 1
DETAIL 1



Simple Connection. Where the smaller beam sits on top of the larger member. This is easy to construct and the height from the floor that araises because of this type of construction provides an air cavity that not only helps with the irregularity of the terrain, but also with the conditioning of the interior spaces. The lower beam/girder provides a seat during erection.
The 8m colums come with an opening to perfectly fit and connect with the beams in order to get the most rigid structure possible.

BEAM ISMB 300

Position	-Interior, Exterior
Material	-Mild Steel
Brand	-Shree Ji
Shape	-Bar
Dimension	300 x 140 x 7.7 mm
Thickness	7.7mm
Features	Maximum Lifespan and Corrosion Resistance

SQUARE HOLLOW COLUMN

Specified side dimension	140
Specified thickness	6,3
Mass per unit length	26,10
Cross-section	33,30
Second moment of area	984,0
Radius of gyration	5,44
Elastic section modulus	141,0
Plastic section modulus	166,0
Torsional inertia constant	1540,0
Torsional modulus constant	206,0
Superficial area per metre length	0,544
Nominal length per tonne	38,3

TOOLS

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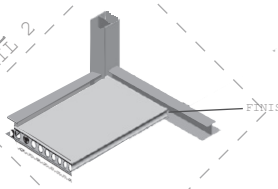
FASE 2
DETAIL 2



First floor attachment. The beams and columns have the spaces and necessary cuts to fix the floors and cellings. You need to carefully find the right orientation of the floor and fit it in the space.

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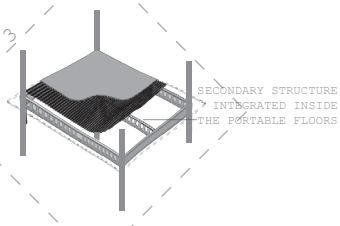
DRONE(FREEFLY SYSTEMS ALTA 8)
20KG EACH

FASE 2
DETAIL 3



Second floor attachment. The columns have some hollow corner to fit in the most fix possible the second floors. Then as the rest of the part fixed to the steel structure (walls, flores and façades) there is some screwing to do, which is visible indicated in each of the individual pieces. FSC, AUSTRALIAN EO HOOP PINE PLY

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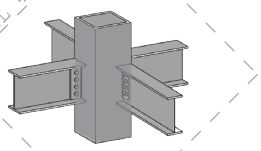
DRONE(FREEFLY SYSTEMS ALTA 8)
20KG EACH

FASE 2
DETAIL 4



Second floor beams attachemnt to columns. This process will conssist on screwing the beams around the hollow square columns.(The decision of making it this way is also because the maximum weight two drones can carry is th lenght of one 9m ISMB 300 that are used in the prject).

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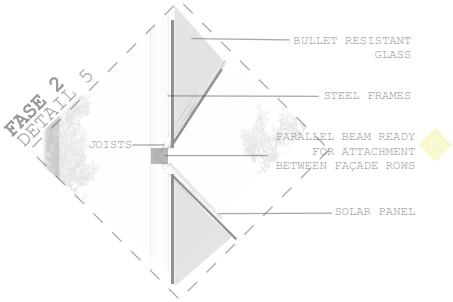
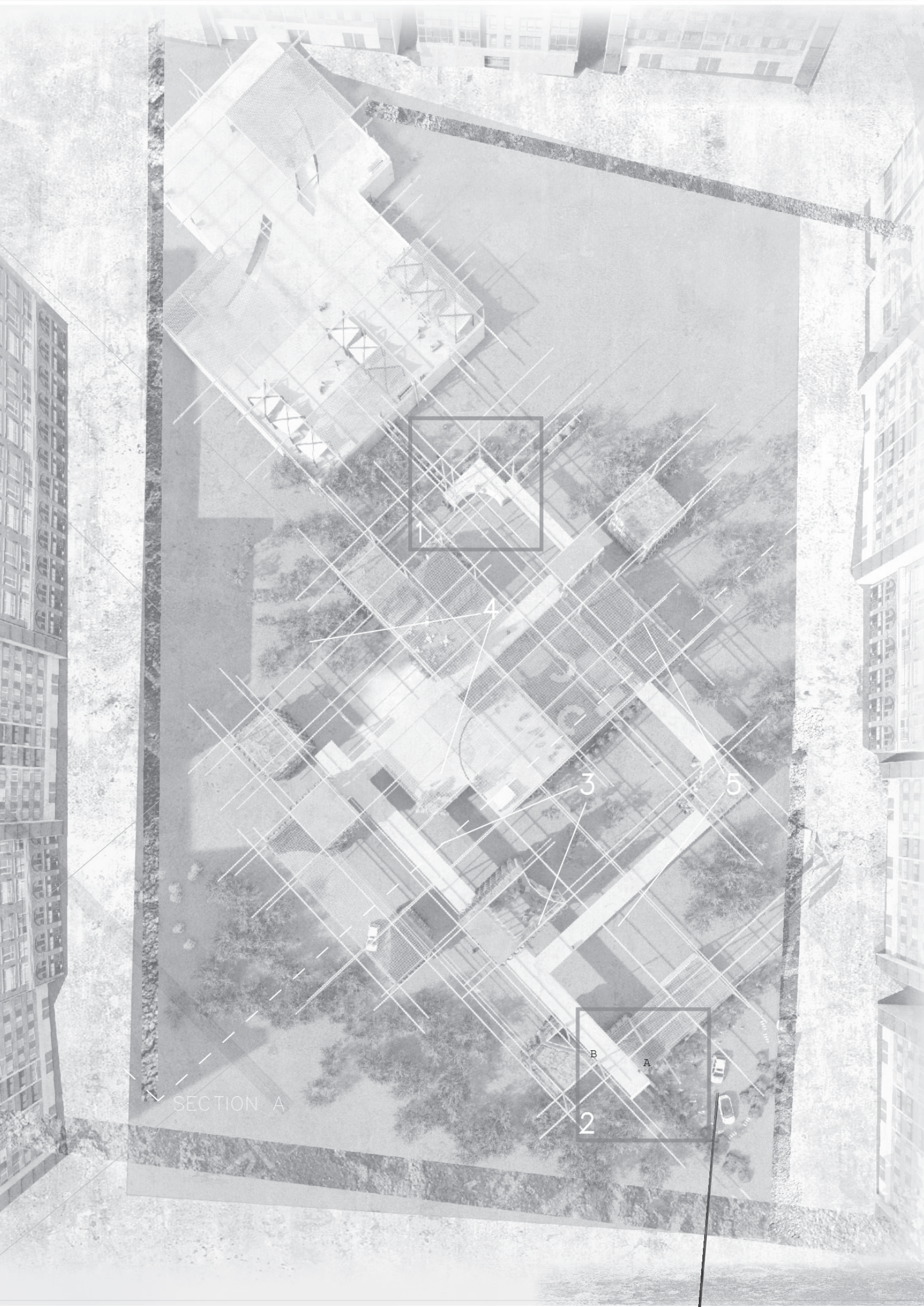
FASE 2
DETAIL 5



Parametric façade intallation. There are three rows of the parametric peces of the façade that will be connected to the walls and windows throw the connection of the steel frames of the parametric façade to the beams prepared to hold the façade. Once again srewing with the HILTI DX460 PNG will be necessary.

HILTI DX460 PNG

DRONE(FREEFLY SYSTEMS ALTA 8)
20KG EACH


1
2
3
4
5
B
A
SECTION A

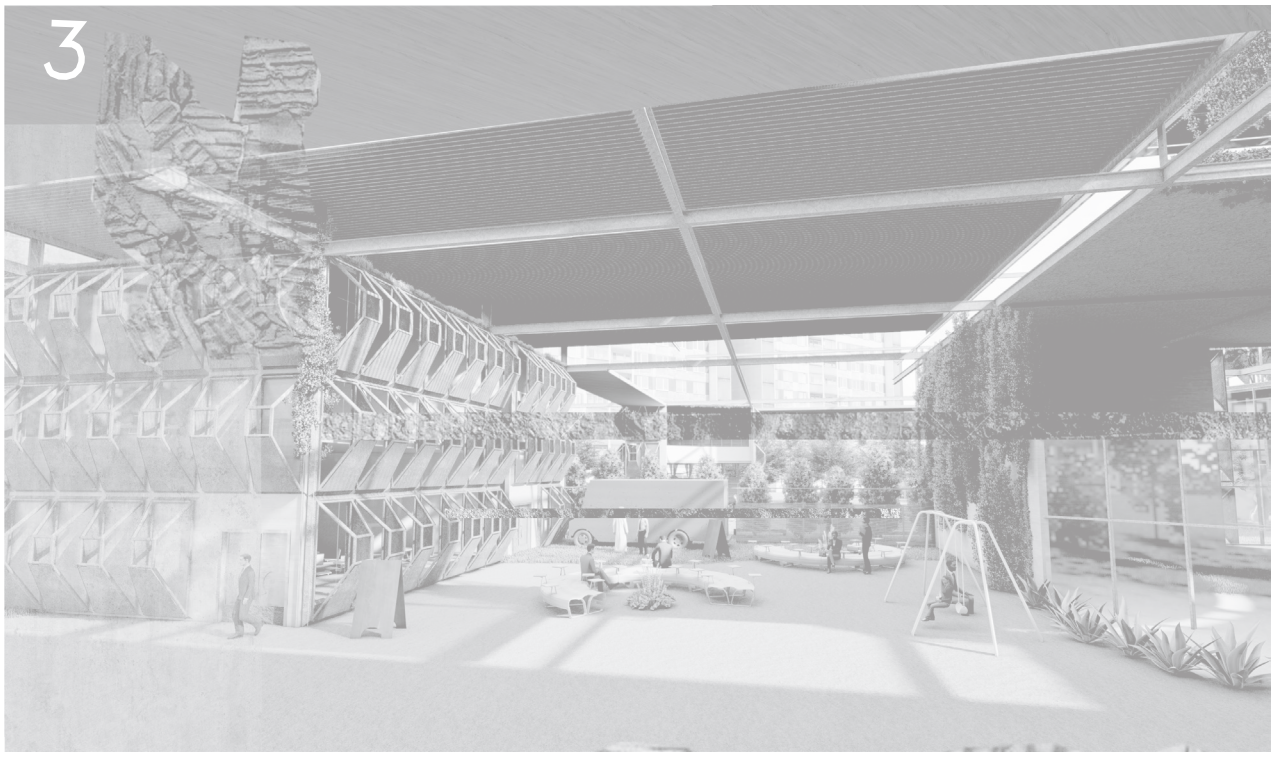
ENTRANCES ARE SOME OF THE MOST IMPORTANT AND CRITICAL POINTS OF THE PROJECT (1&2)

MAN GUARDING
CCTV
OCC SENSOR
BULLET RESISTANT GLASS
ANTI BLASTING DESIGN

THE EMERGENCY CIRUCLATION FOLLOW A VERY SIMPLE AND DIRECT PATH TO CREATE THE ADECUATE MITIGATION PLAN.
IT ALSO PROVIDES ACCESS TO THE MOST PRIVATE AREA OF THE BASE

THE LIGHTING AND WINDOW POSITIONS IS NOT ONLY IMPORTANT FOR THE SUSTAINABILITY AND EFFICIENCY OF THE BUILDING OF ALSO FOR THE SURVEILLANCE AND SECURITY PURPOSES

4

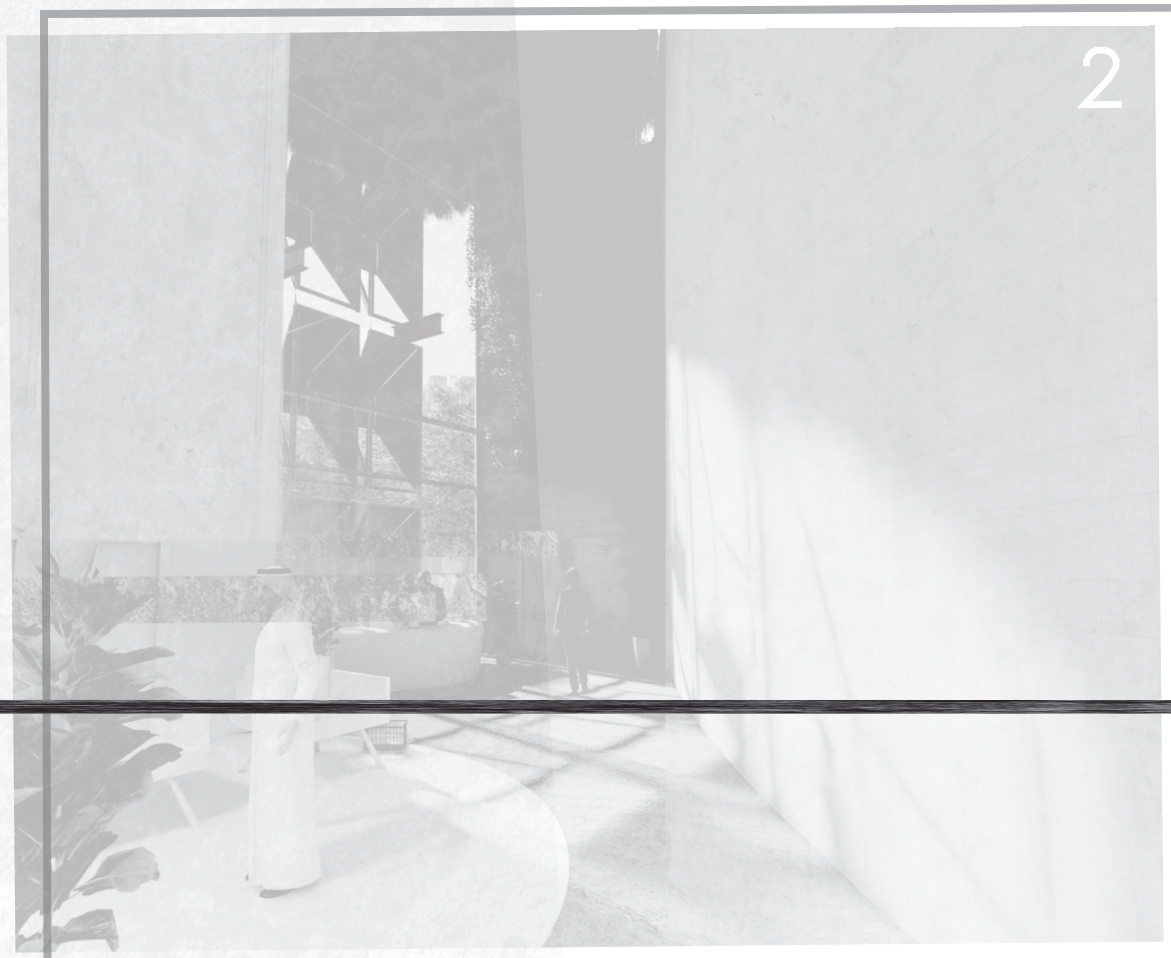


CONTROL OF THE HIGHEST DENSITY PUBLIC AREAS

MAN GUARDING
CCTV
OCC SENSOR
BULLET RESISTANT GLASS
ANTI BLASTING DESIGN

BUILDING ENTRANCE A

ENTRANCES ARE SOME OF THE MOST IMPORTANT AND CRITICAL POINTS OF THE PROJECT (1&2)

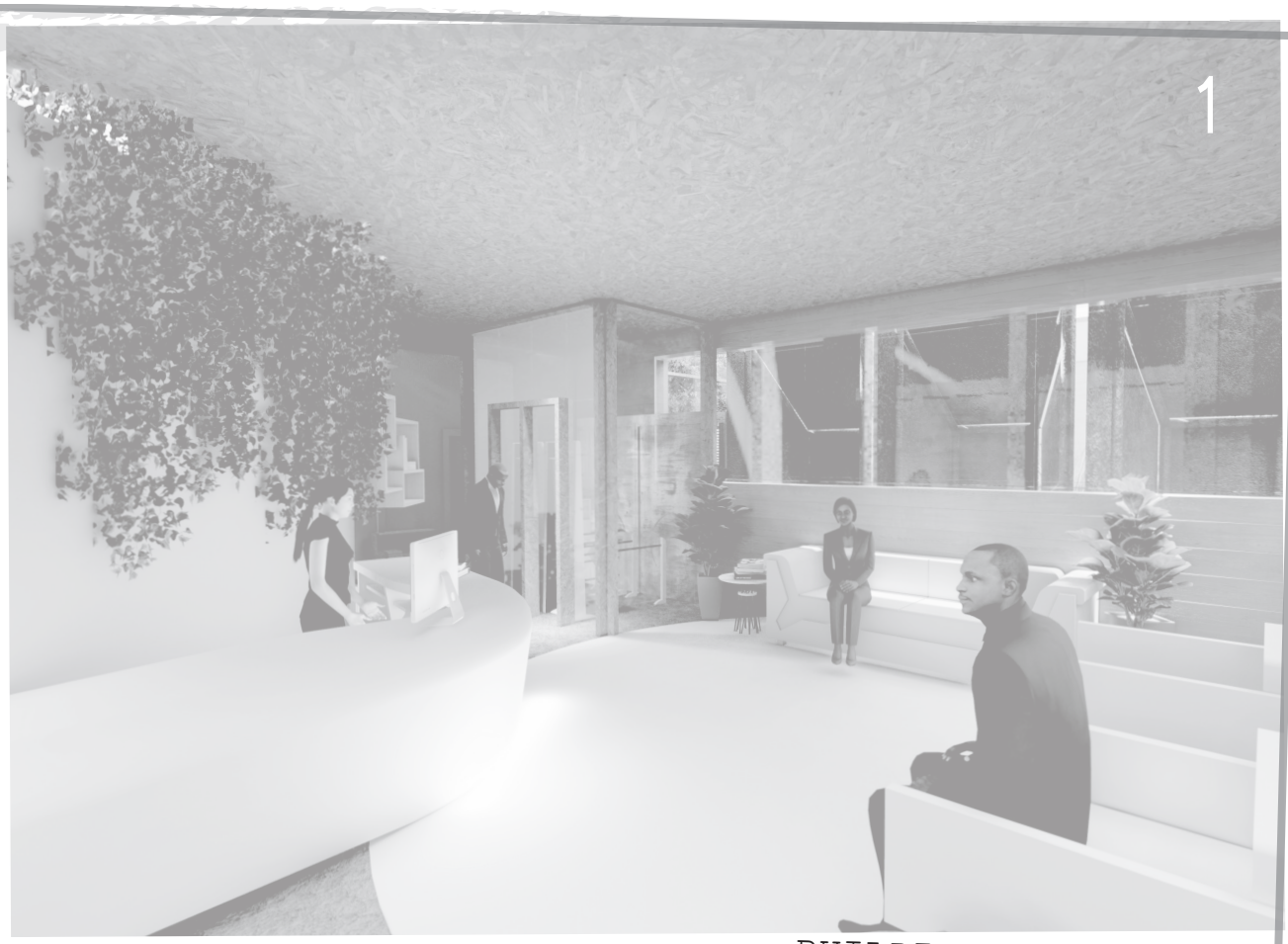


2

THE LIGHTING AND WINDOW POSITITIONS IS NOT ONLY IMPORTANT FOR THE SUSTAINABILITY AND EFFICIENCY OF THE BUILDING OF ALSO FOR THE SURVEILLANCE AND SECURITY PURPOSES

5

THE EMERGENCY CIRUCLATION FOLLOW A VERY SIMPLE AND DIRECT PATH TO
CREATE THE ADECUATE MITIGATION PLAN.
IT ALSO PROVIDES ACCESS TO THE MOST PRIVATE AREA OF THE BASE



BUILDING ENTRANCE B