

ZAHA HADID ARCHITECTS

Zaha Hadid & Patrik Schumacher

Pasargad Hotel Elahieh, Teheran



01 INTRODUCTION / CONCEPT



Pasargad Hotel Elahieh, Teheran

Zaha Hadid Architects

Concept

The new Pasargad Hotel Elahieh offers the opportunity to create a vertical Icon that will interact with the city's other significant landmarks and views in and around Teheran: The mountains in the north, the Russian Embassy with its park in the east, urban sprawl towards the east, south and west. Our design is a development that aims at dissolving the podium into the tower's body and creating a one single entity. At this, the entire site is considered as a single composition and integrated whole with a fluid extension into the public realm and a podium roofscape with generous outdoor terraces viewing Teheran from above. The building uses the sites inclined topography to redesign the landscape and maximize fluidity. The mass of the towers is described and carved by sinuous lines in a choreographed movement, creating an arrangement of three bodies, joined by a system of structure and cores. Rather than by means of a static and unflexible extrusion in a simple vertical fashion, the geometry grows by means of an elastic and organic extrusion, incorporating diversity in its primary volume and enabling the creation of different apartment typologies. Seeking to diverge from the standard high-rise design protocol of a uniform floor plate that is replicated to maximise rationalism and sterile repetition, our design focus is the building's envelope and a sculptural interior atrium/entrance to establish clear identity and everchanging appearance. The fluid shape provides different views from all sides.

The distinct formal language is derived from organizational systems found in the natural world. Growth-simulation processes were used to develop a set of basic geometries, and then superimposed with programmatic diagrams into a series of repeated cycles. The primary components of this biological analogy (branches, stems, butterfly's fruits and leaves) were then transformed from these abstract diagrams into architectural design.

Program

The tower comprises a hotel, residential apartments, spa facilities, retail areas, offices, restaurants and around 9 levels of underground parking.

Vertical "cuts" or subdivisions give definitions to the facades and allow for cross ventilation. At the top of the tower the shape culminates with a series of fingers stepped at different heights, blending the transition between the architectural fabric and the sky.

Access

The main public access for retail and the conventional center is from the eastern Mahdiah Street through a lobby at level -27m with a multi level void, creating a transfer lobby void through the podium.

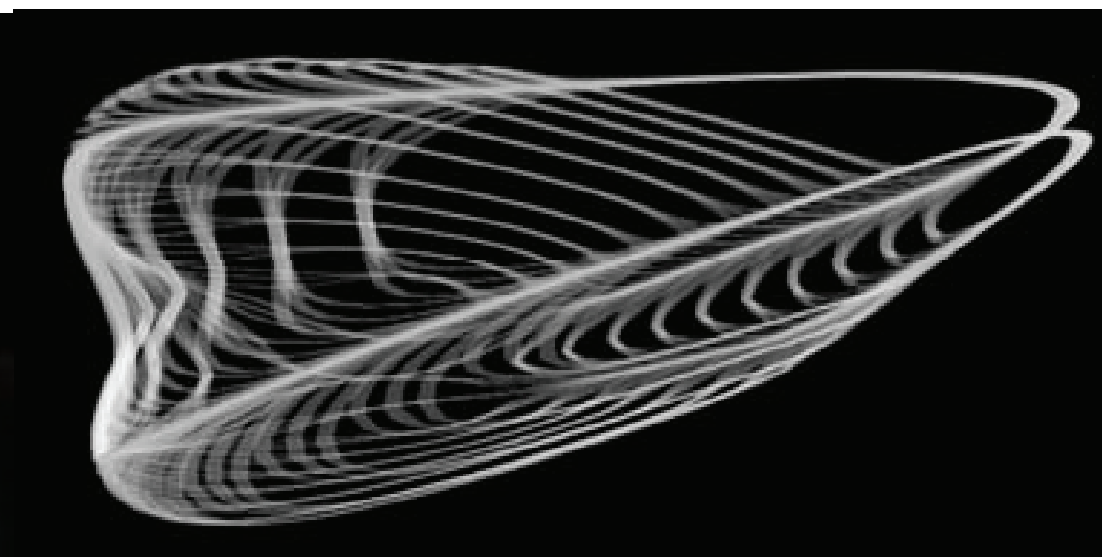
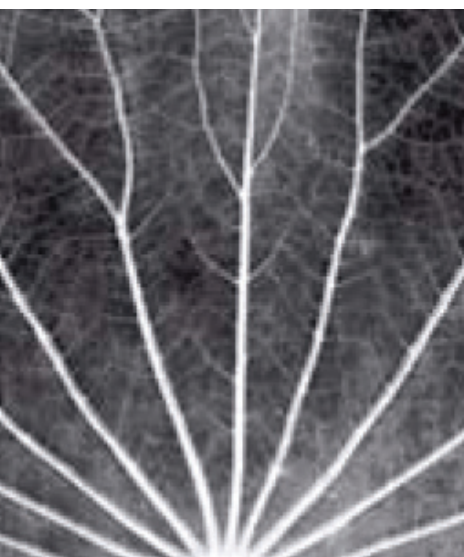
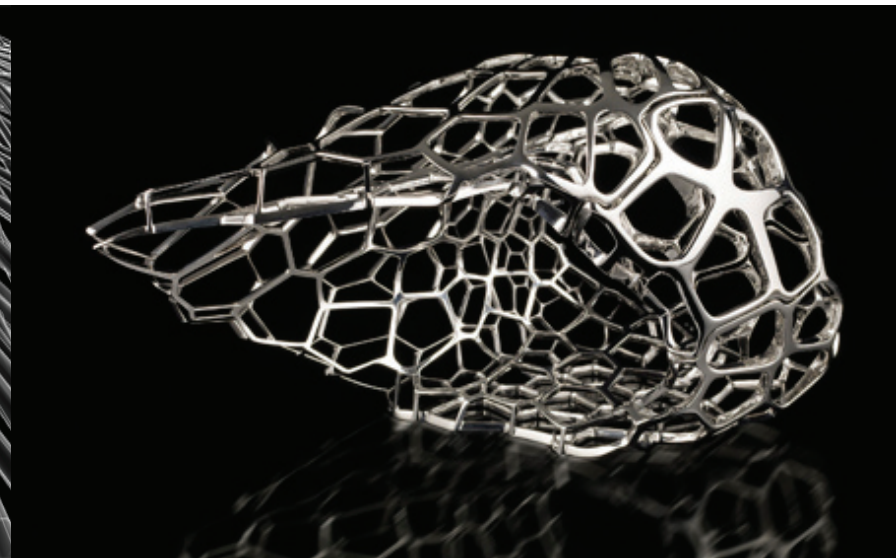
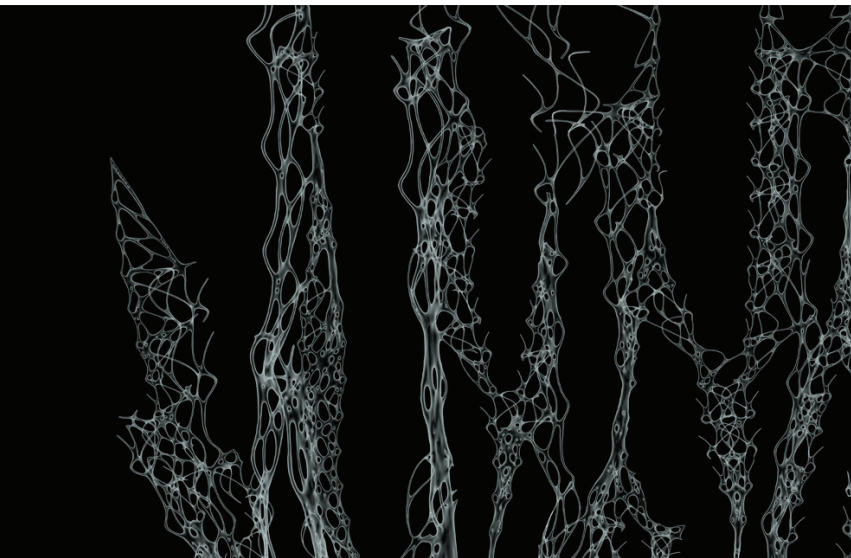
The main access for the hotel and residential units is from western Golpad Street around 27 m above the main access.

A newly provided road along the north side of the plot from East Maryam Avenue provides a shortcut to the upper access. This access provides a generous lobby for the hotel and residential users on a plateau with more privacy and stunning views in a scenographic fashion.

Design Proposal –three Tower Arrangement – Unfold Triple Butterfly

Biological Analogy (branches) generates structure from inside the entity, grows to the outside and exposes the pockets of hotel- and apartment-units in three axis like a triple butterfly unfolding its beauty by spreading out and covering 360 degree of views. The towers wings vertically branch out from a common podium that seems intersected from the east, offering generous insights via a multi level vertical transfer-lobby and visually connecting the 2 levels of the site by means of a topographically arranged public program within the podium and stunning views up the transfer lobby-void getting all hotel and residential users up to the main lobby.

The transformation of floorplates is a result of formal studies dealing with an organic silhouette curvature in the skyline of Teheran. With respect to the flow of forces, the structure develops from the lower basement from a more dense and diagonal to a more vertical direction in the upper area. Within the convex parts of the envelope's façade, balconies emerge and provide outdoor levels for the serviced apartment units, whereas the concave facades visually sub-divide the shape into three vertical and elegant shafts rising into the sky.



Pasargad Hotel Elahieh Tehran (Concept Design /Competition)

Area - Program / Guidelines and Target
ZAHA HADID ARCHITECTS

Site Area

before revision	4574	sqm
after revision	3722	sqm

Group	Levles / Area	Amount	% Faktor Cover Ratio Site	Gross Area per Level	Gross Area Total	% of Total Gross Area	Programm Demand
A	Basement Levels	9	1	3,722.00	33,498.0	30.81 %	about 1500 mechanized sytem parking lots
B	Half Basement Levels	7	1	3,722.00	26,054.0	23.96 %	Geschäftsräume, Büros, Konferenz, Einzelhandel, Coffee, Restaurant
C	Ground Floor	1	0.6	2,744.40	2,744.4	2.52	Ballräume, Auditorium
D	First Floor	1	0.35	1,600.90	1,600.9	1.47	
E	Levels 2-29	28	0.35	1,600.90	44,825.2	41.23 %	Hotel (200-250 Units), Service Apartments (80 Units, 1/2/3-bed)

TOTAL Levels / Gross Area	46				108,722.5	100.00 %	
					108,722.50		
Budget Demand without Fit-Out!!!				108,722.5	1,000.00		108,722,500.00 \$US

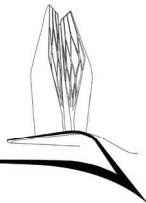
Program Demand Client / given by GHP&ASAR	ca Total sqm	Amount	sqm /Unit	% of Total Gross Area	
Office-&Conference	2,100			1.93 %	
Lobbys	7,500			6.90 %	
Retail	4,500			4.14 %	
Sport, Pool, Gym., SPA, Leisure	5,000			4.60 %	
Auditorium, Official Spaces	3,300			3.04 %	
Restaurants, Cafeteria	6,700			6.16 %	net area of restaurants! The main kitchen and food courts kitchen area have t
Hotelunits	13,000	250 Units	52.00 sqm/Unit Average	11.96 %	
		200 "deluxe"	48.75 sqm/Unit Average		40-50 sqm (Target)
		50 "Suites"	65.00 sqm/Unit Average		60-70 sqm (Target)
rentable/sellable Resi-Units	10,000	80 Units	125.00 sqm/Unit Average	9.20 %	
		20 1-bedroom	82.50 sqm/Unit Average		79-90 sqm (Target)
		41 2-bedroom	122.50 sqm/Unit Average		110-135 sqm (Target)
		20 3-bedroom	165.00 sqm/Unit Average		150-180 sqm (Target)
Parking	24,000	680 Lots	35.29 sqm/Unit	22.07 %	
Technical Space	4,500			4.14 %	
Stairs, Lifts, Ramps etc	17,000			15.64 %	
Service and Storage	10,100			9.29 %	
ca	107,700.0			99.06 %	% of GFA allowed

Deltas Programm

max GFA on site	108,722.5		
Area Demand Client > GHP	107,700.0		
Area Demand Client > ASAR	106,601.0		
Delta max GFA / Area Demand Client GHP	1,022.5 sqm	-0.94 %	
Delta max GFA / Area Demand Client ASAR	2,121.5 sqm	-1.95 %	

Tower Cover Ratios Site / Occupancy

Tower Cover Ratios Site / Occupancy	% Faktor Cover Ratio Site	% Exceedance	% Total	Gross Area per Level	
Range Option 1:	0.25			1,143.50	
	0.3			1,372.20	
	0.35			1,600.90	
	0.4	14.29	114.29	1,829.60	: Range Option2 0.25 - 0.5
	0.45	28.57	128.57	2,058.30	
	0.5	42.86	142.86	2,287.00	
	0.7	100.00	200.00	3,201.80	

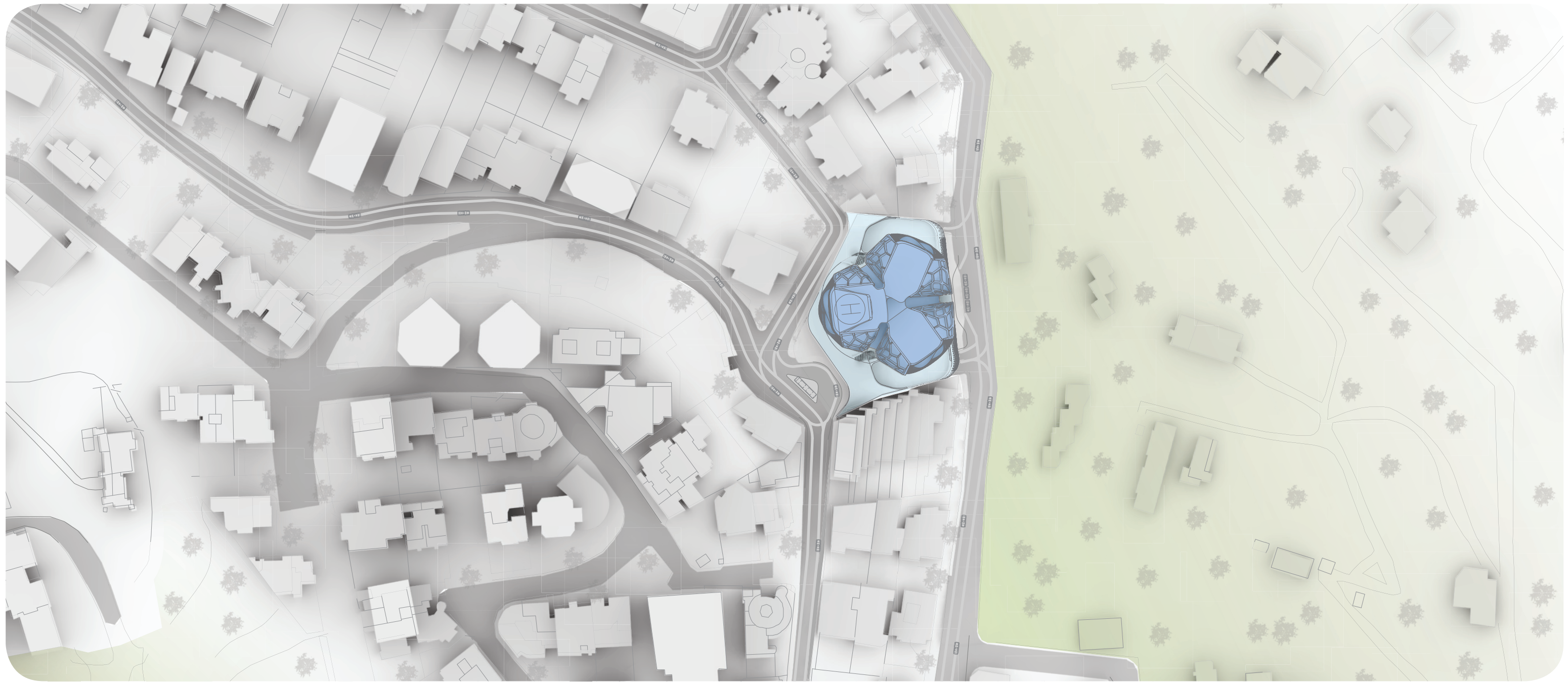


02 ARCHITECTURE/ DESIGN

- Site Context
- Mood Boards
- Initial Studies
- Proposed Design
- Circulation
- Program Distribution
- Layout - Floorplates
- Drawings

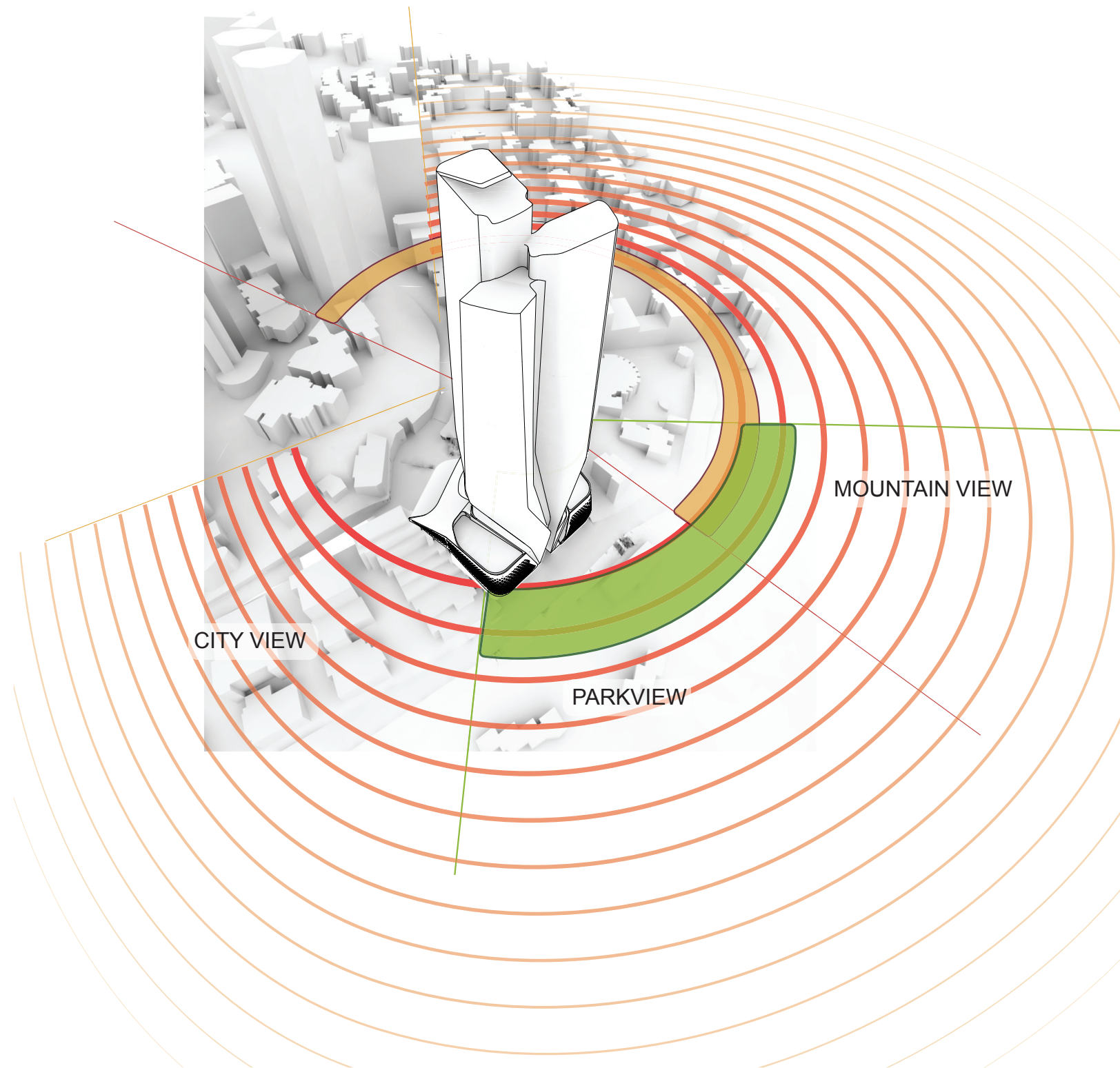






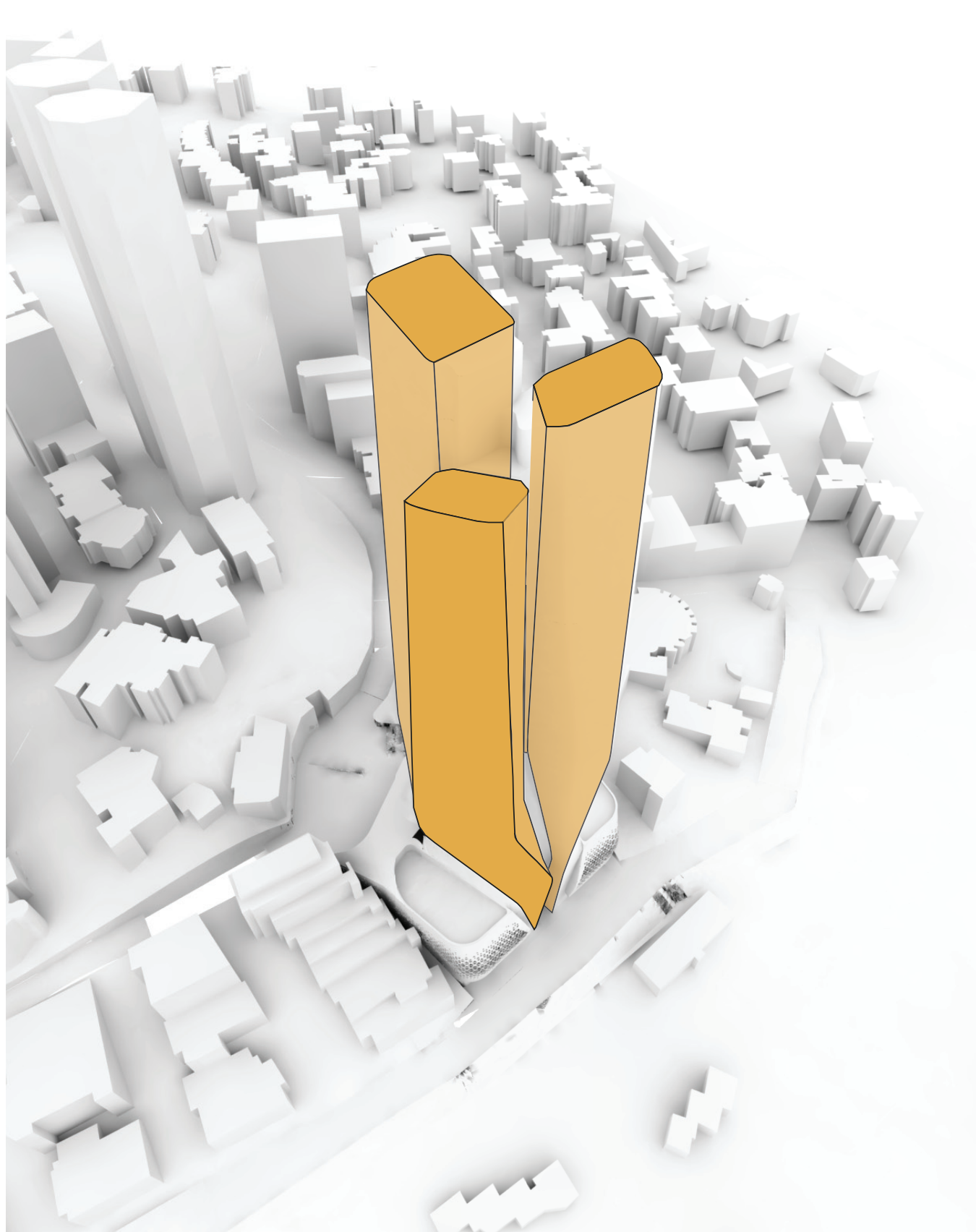
SITE PLAN M 1.1000



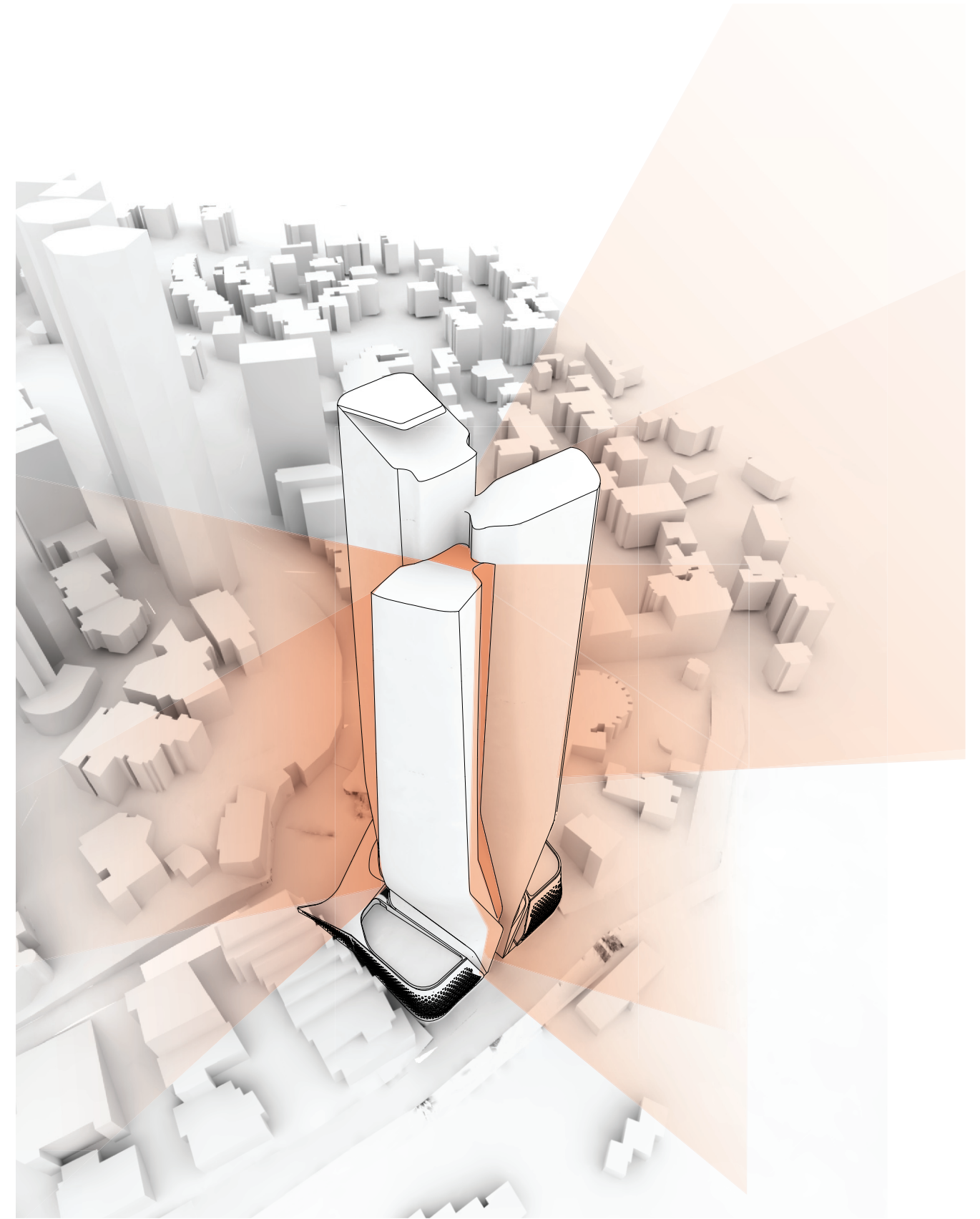


VIEW DIAGRAM





CONCEPT OF 3 FINGERS



CONCEPT OF GAP WITH VIEW

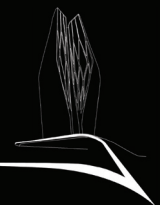


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PROGRAM - MOOD BOARDS

ONE ENTITY: TOWER & PODIUM
MULTISTOREY PODIUM - LIFTED PLATEAU - SCENEGRAPHIC VIEW
RECEPTION / LOBBY / SKYLINEBAR
RETAIL - RESTAURANTS
HOTEL / LIVING / DINING
SPA - SWIMMING - LEISURE
PARKING



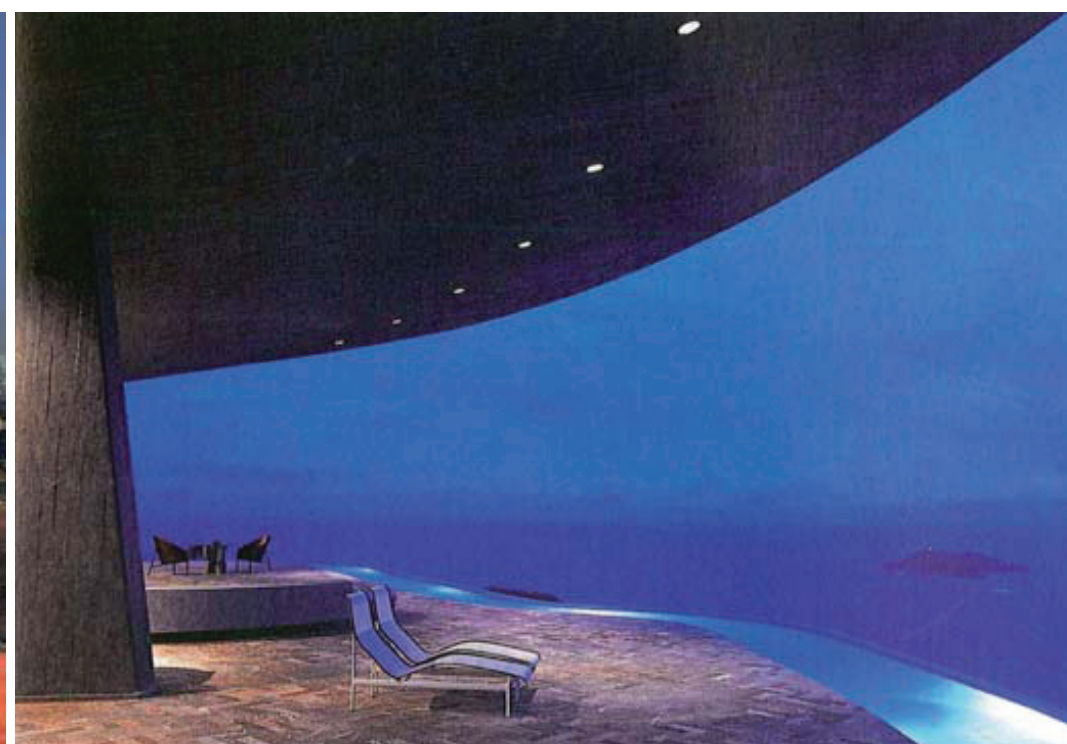
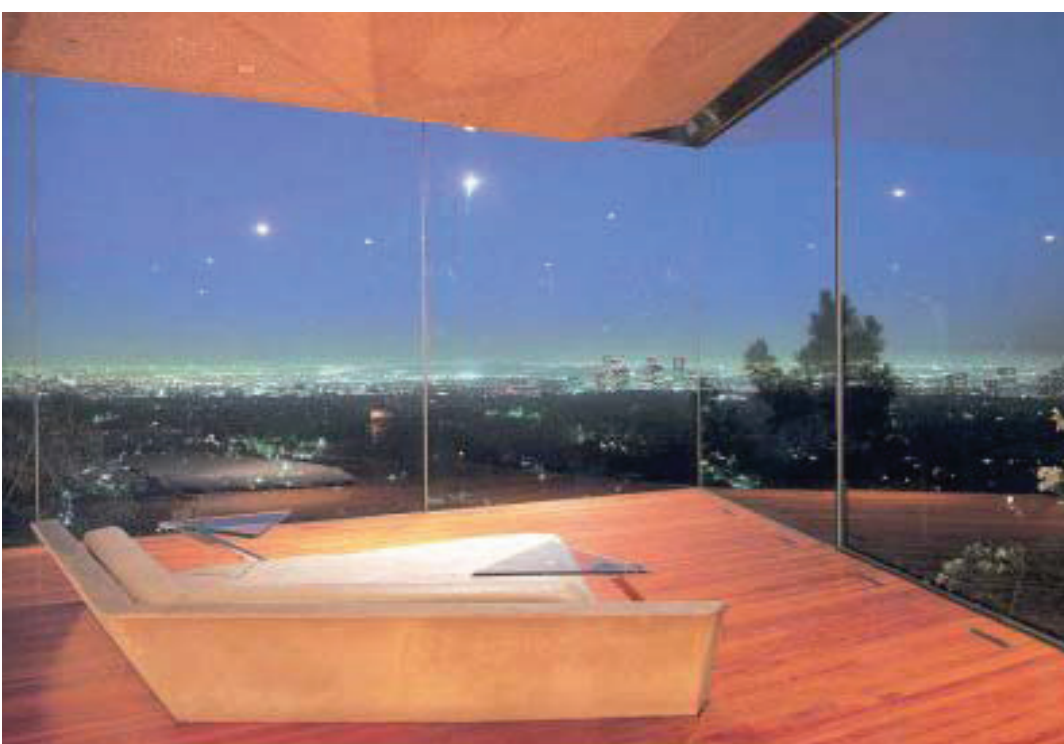
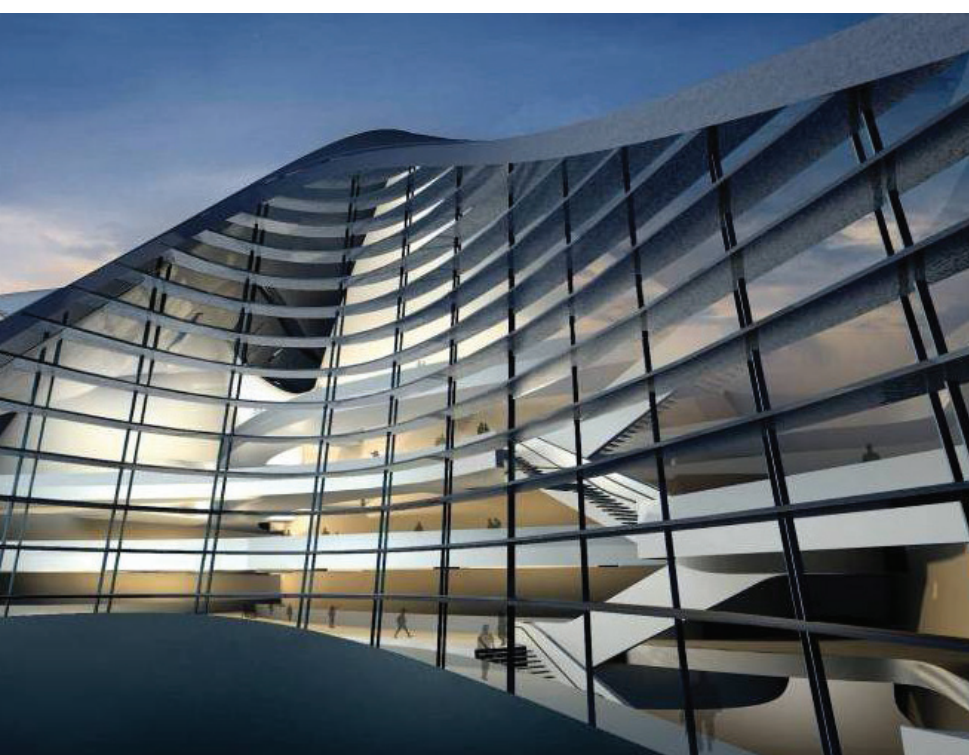


ONE ENTITY. TOWER & PODIUM

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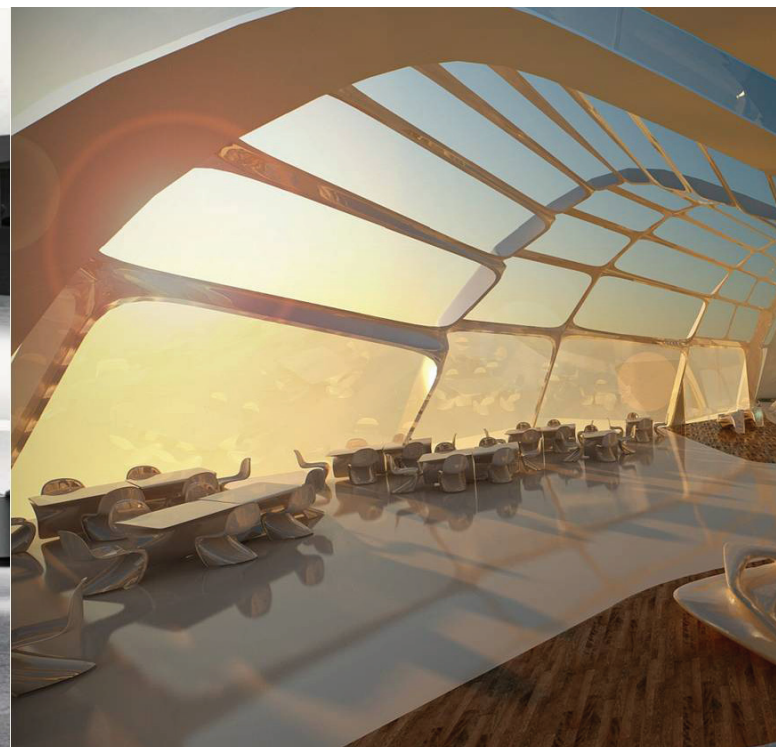
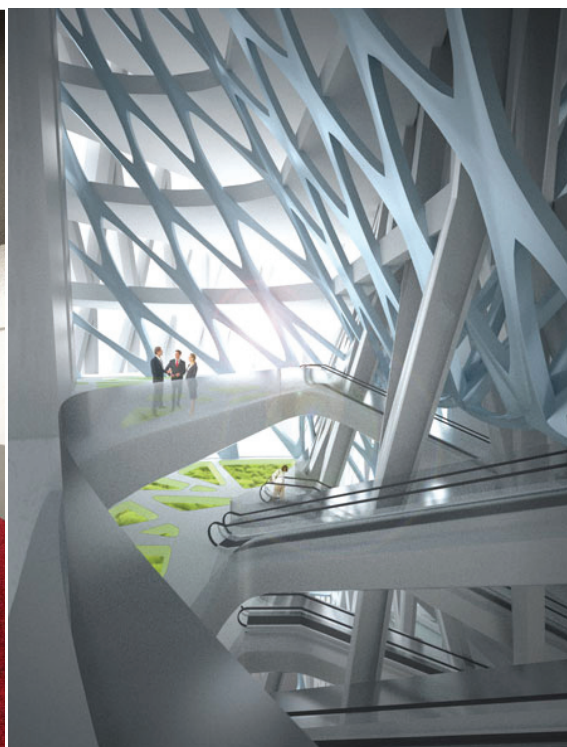
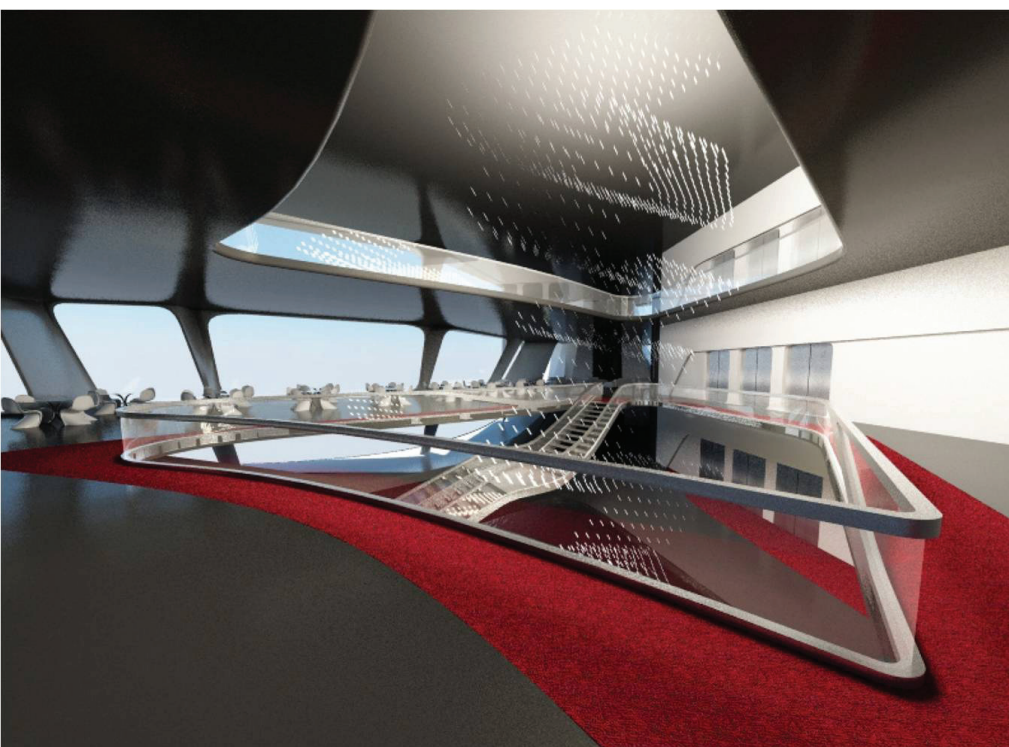
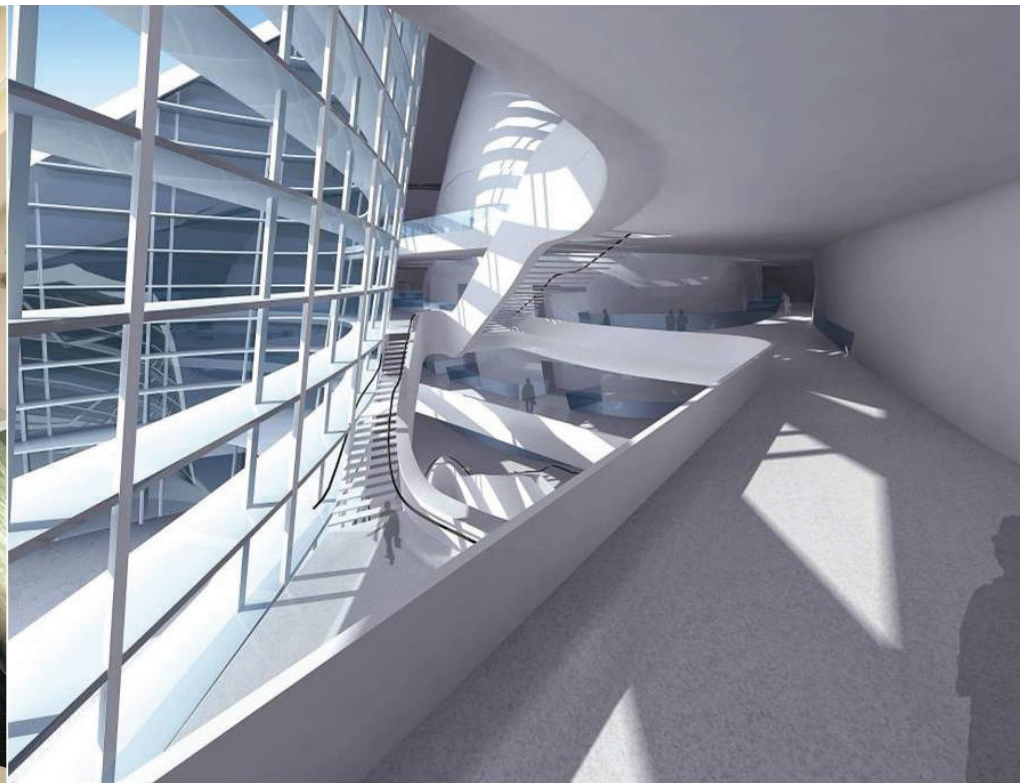


MULTISTOREY PODIUM - LIFTED PLATEAU - SCENEGRAPHIC VIEW

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RECEPTION / LOBBY / SKYLINEBAR

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RETAIL - RESTAURANTS

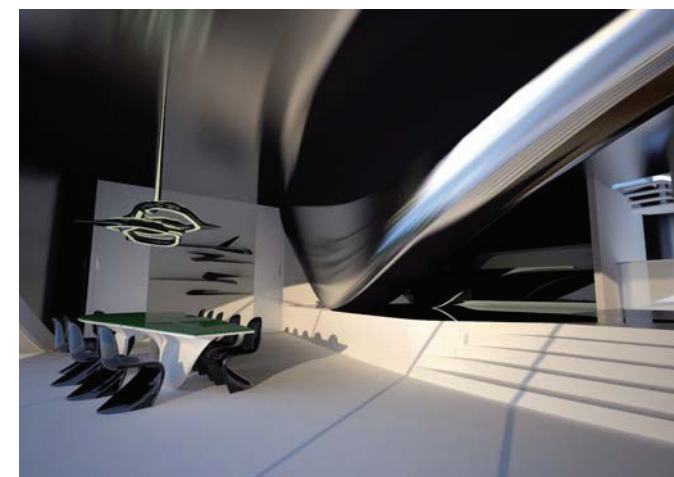
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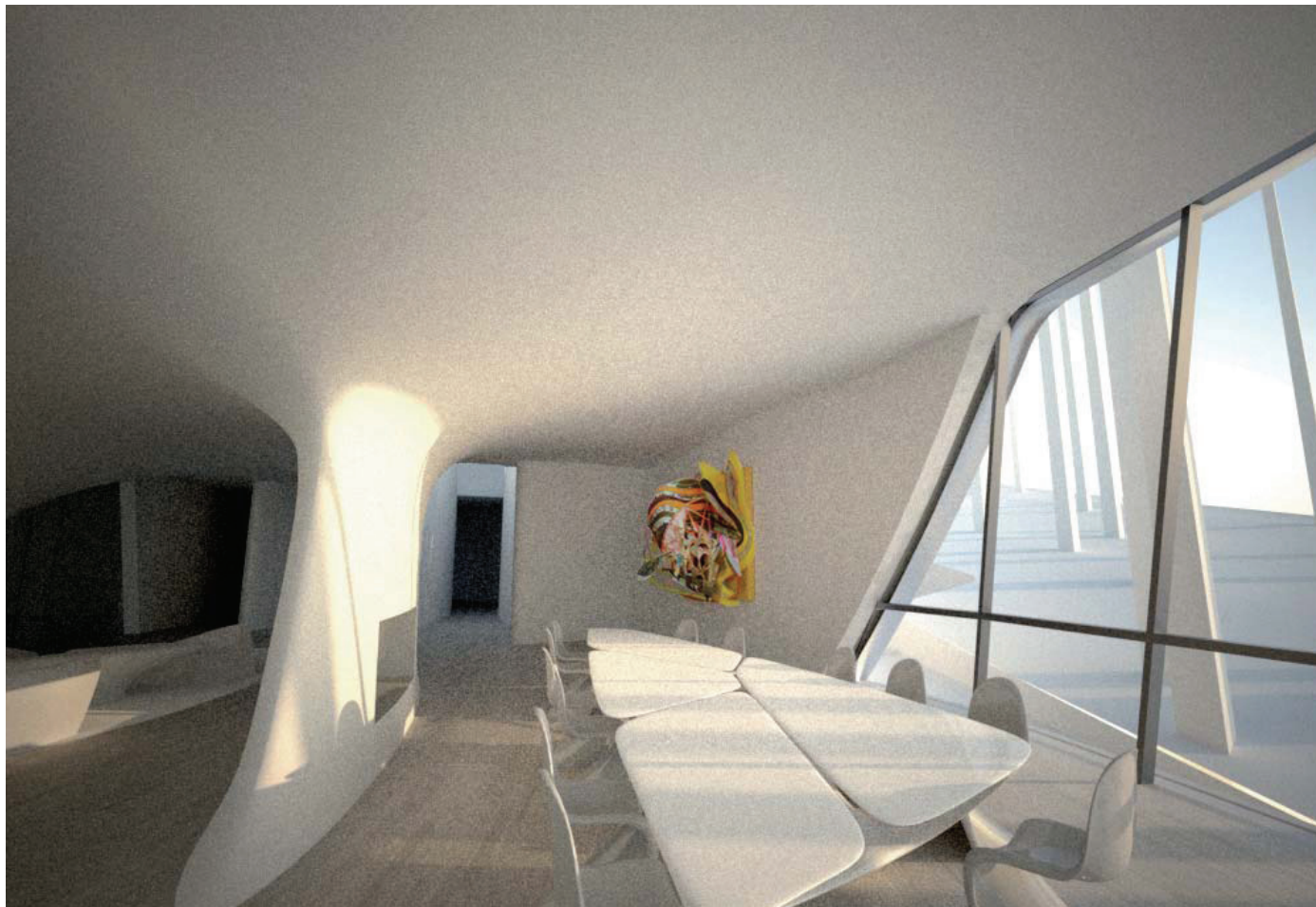
DINING AREA VIEW- VILLA NASSIM
Designed by Zaha Hadid Architects



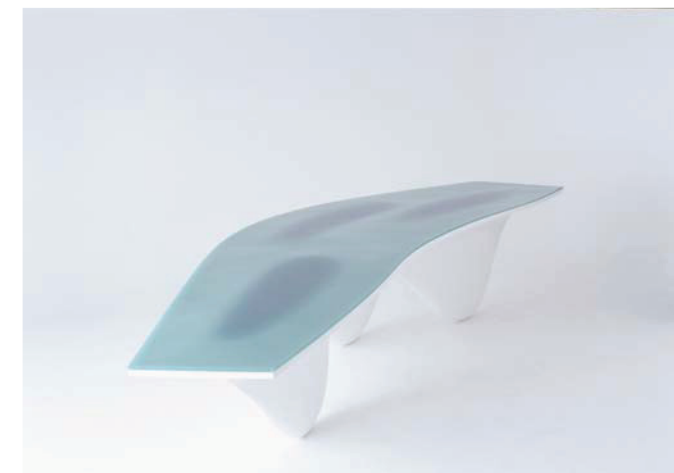
DINING AREA VIEW- VILLA NASSIM
Designed by Zaha Hadid Architects



MESA TABLE
Designed by Zaha Hadid Architects



DINING AREA VIEW- VILLA CAPITAL HILL
Designed by Zaha Hadid Architects



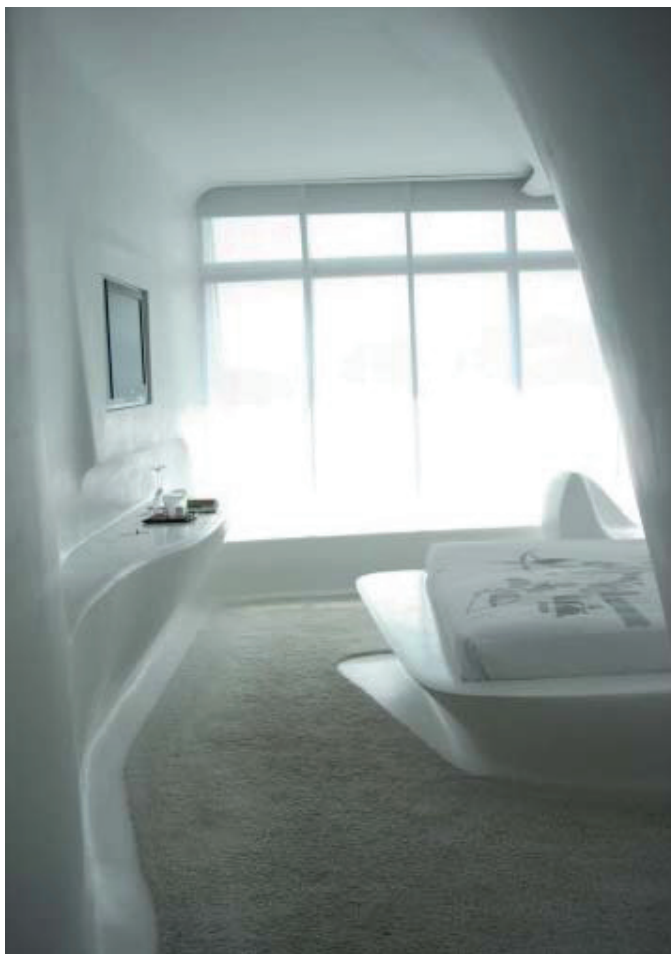
AQUA TABLE
Designed by Zaha Hadid Architects

HOTEL / LIVING / DINING

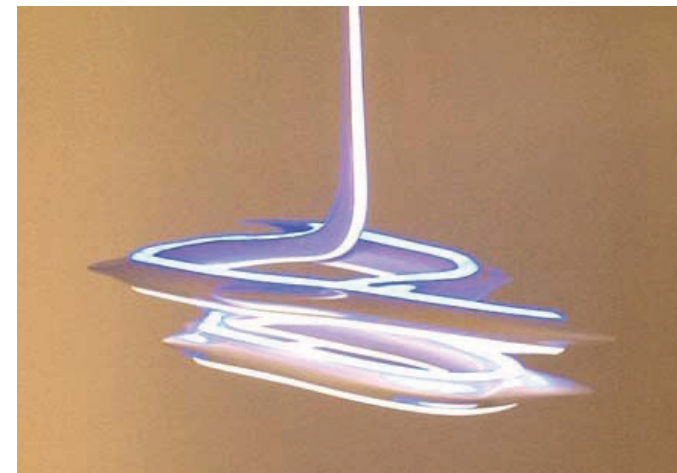
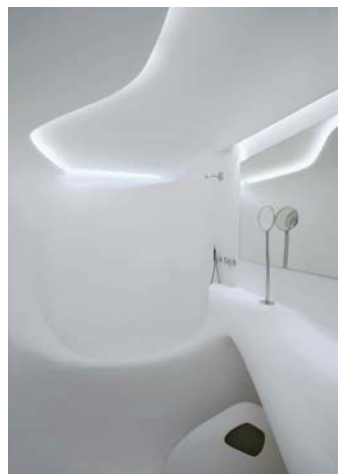
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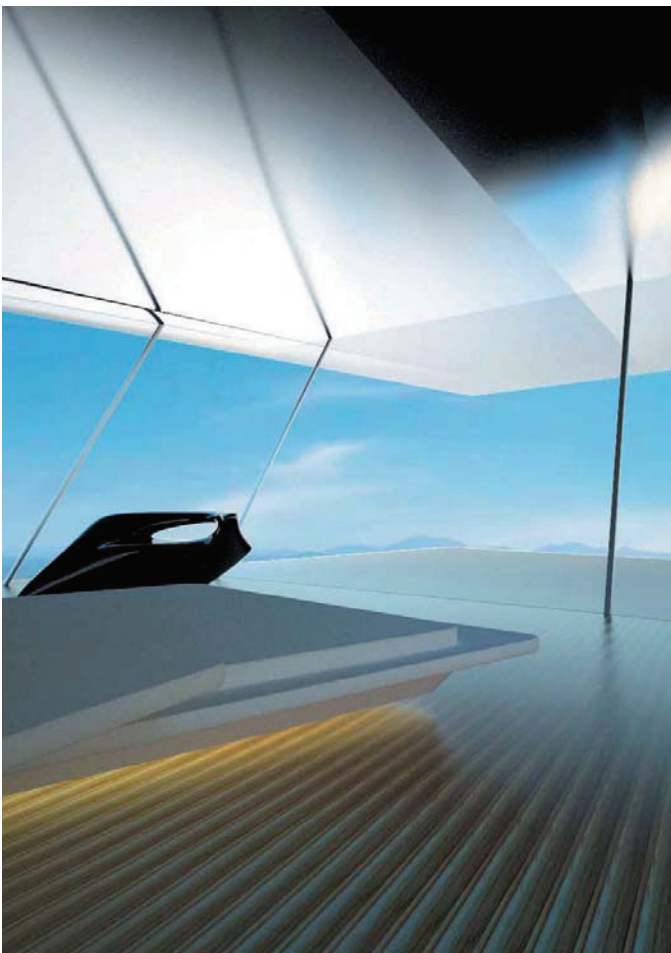




INTERIOR VIEWS OF HOTEL PUERTA AMERICA
 Designed by Zaha Hadid Architects



VORTEX CHANDELIER
 Designed by Zaha Hadid Architects



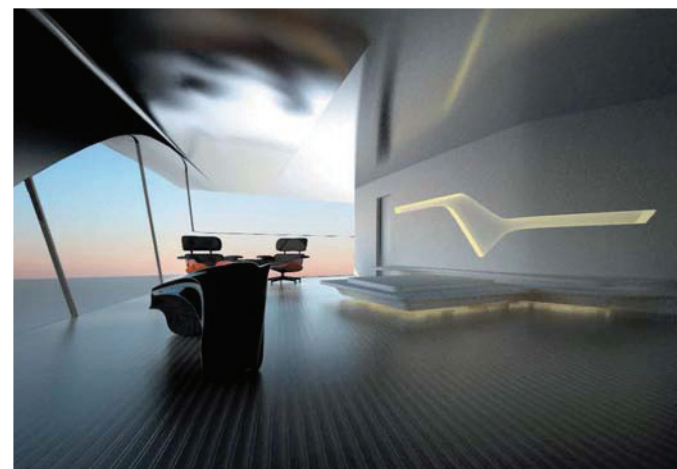
SUITE - VILLA NASIM
 Designed by Zaha Hadid Architects



INTERIOR VIEWS OF HOTEL PUERTA AMERICA
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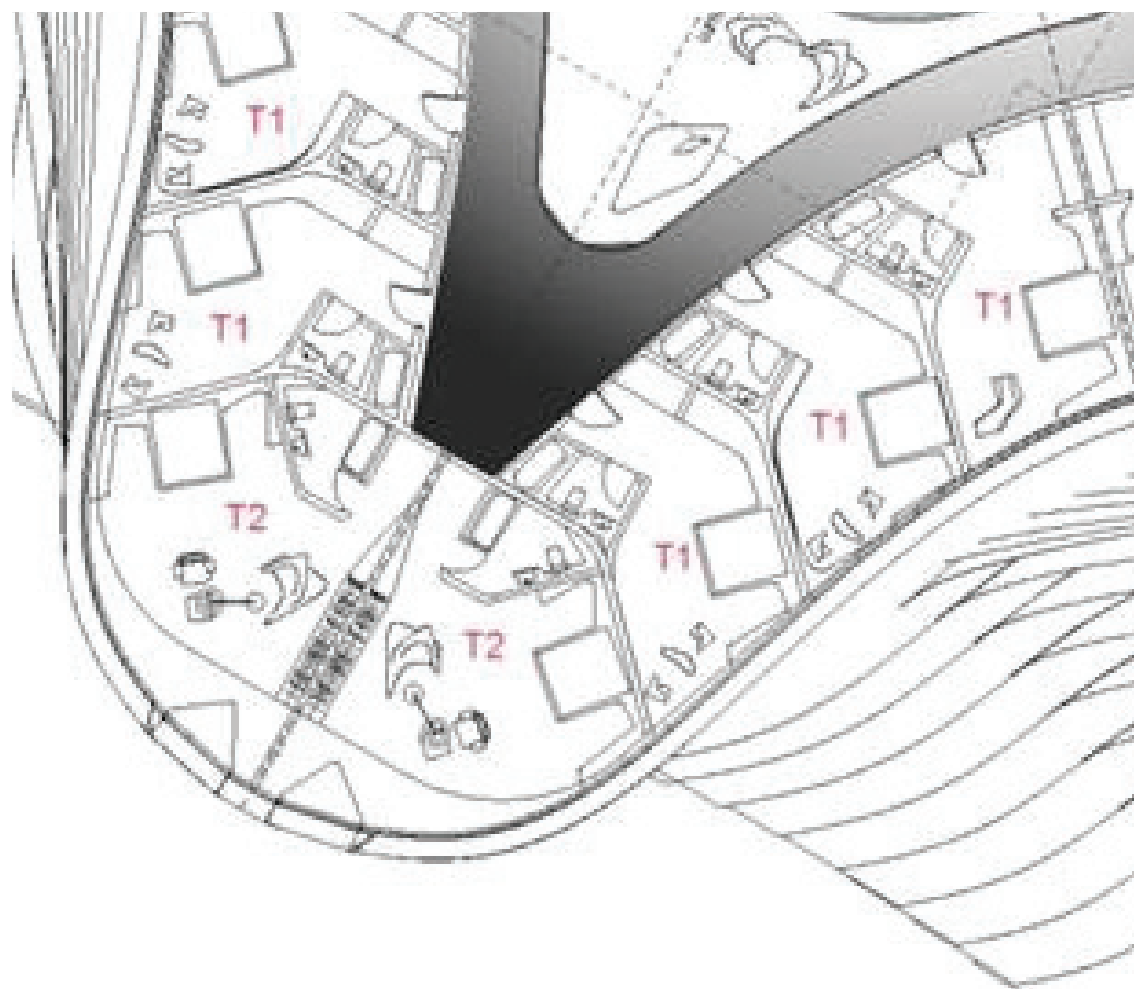
SUITE - VILLA NASIM
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HOTEL PUERTO AMERICA
Designed by Jason Bruges



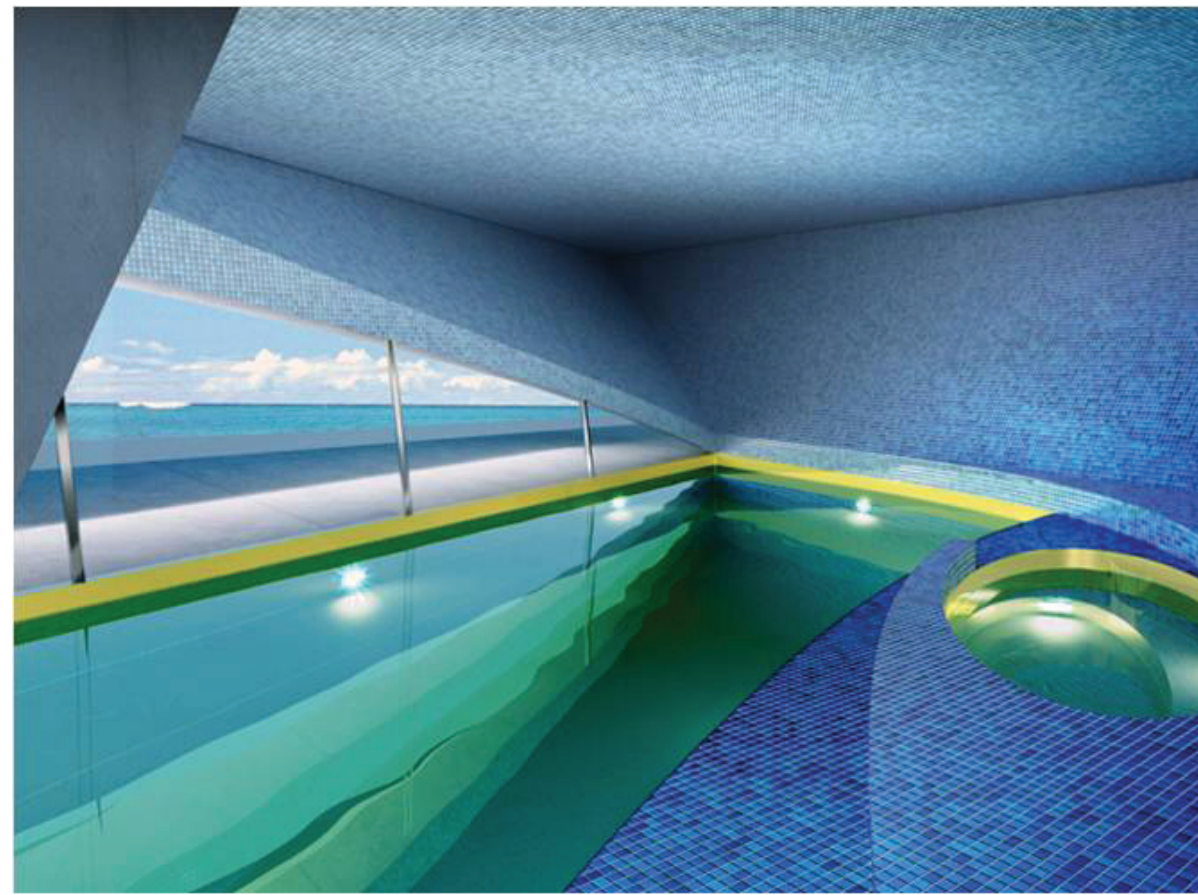
Designed by Anish Kapoor



VORTEX CHANDELIER
Designed by Zaha Hadid Architects



HOTEL PUERTO AMERICA
Designed by Zaha Hadid Architects



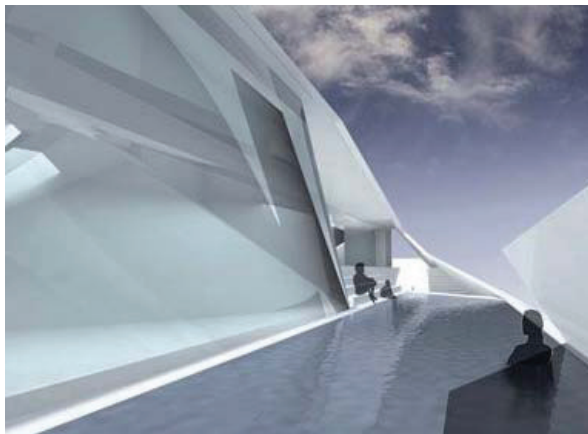
VILLA NASSIM
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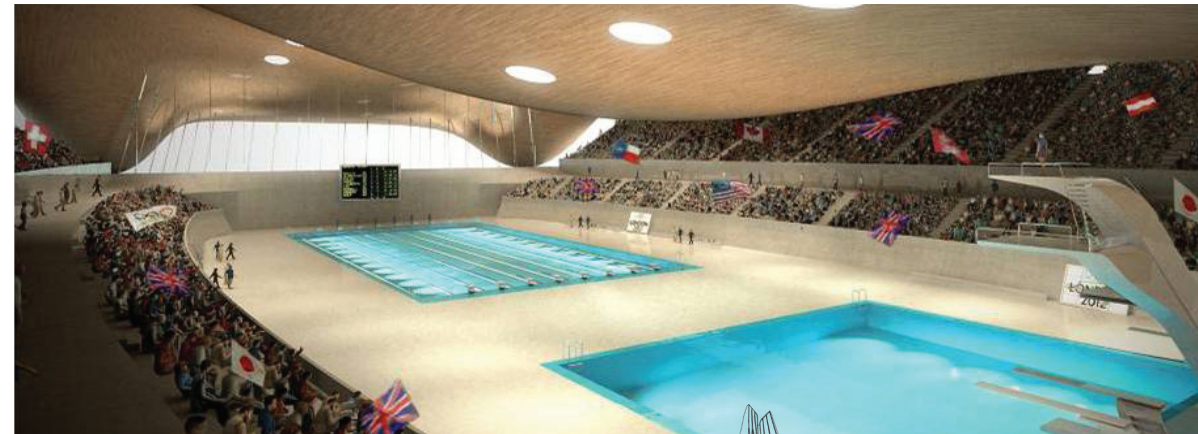
VILLA DELLIS CAY
Designed by Zaha Hadid Architects



VILLA KUESNACHT
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VILLA CAPITAL HILL
Designed by Zaha Hadid Architects

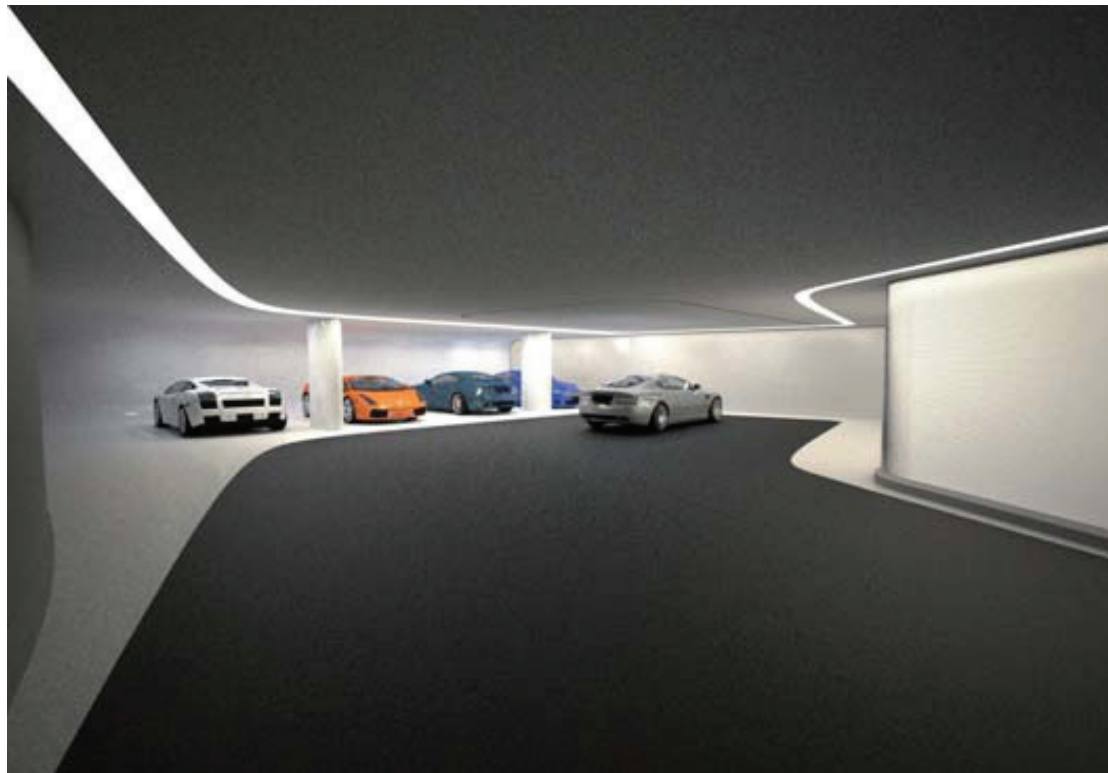
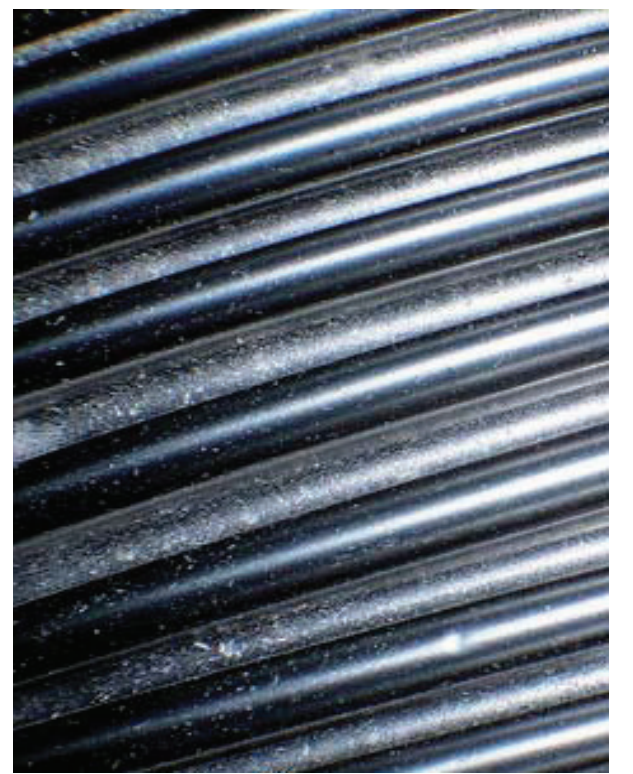


SPA - SWIMMING - LEISURE

ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran





CAPITAL HILL
 Designed by Zaha Hadid Architects

PARKING

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Pasargad Hotel Elahieh, Teheran



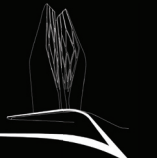
02 ARCHITECTURE/ DESIGN

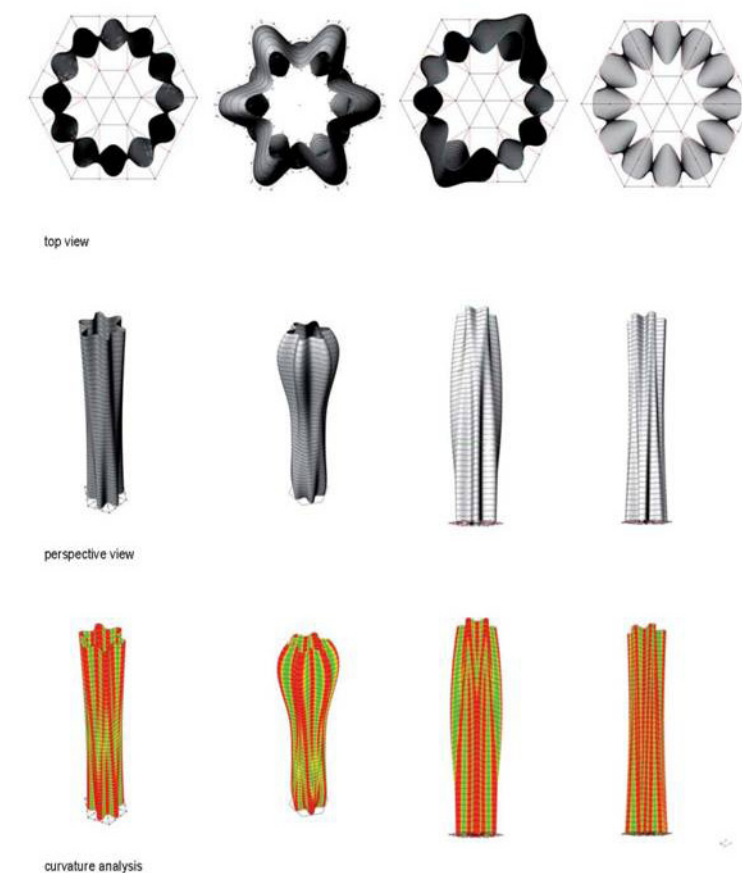
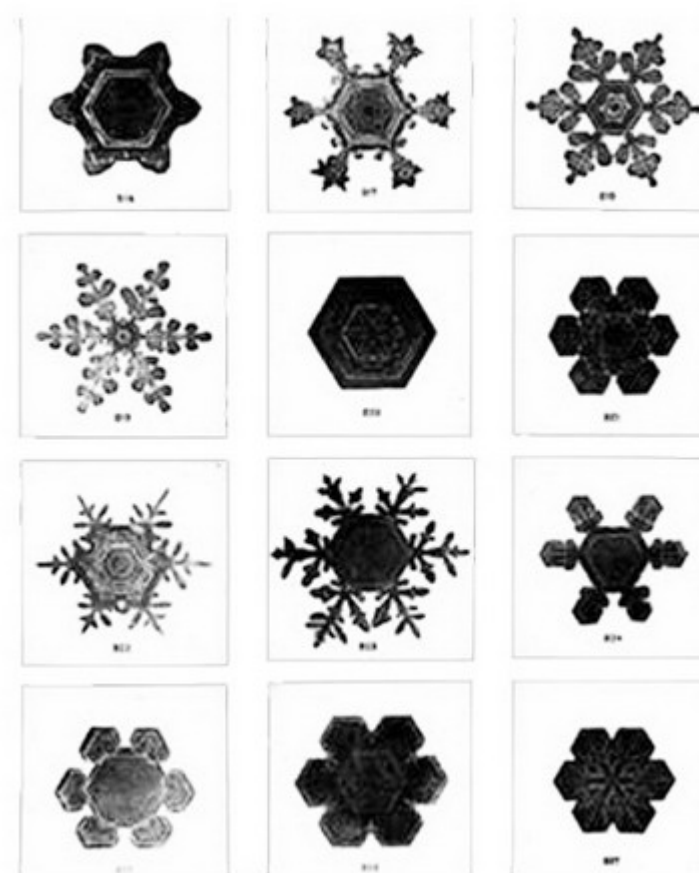
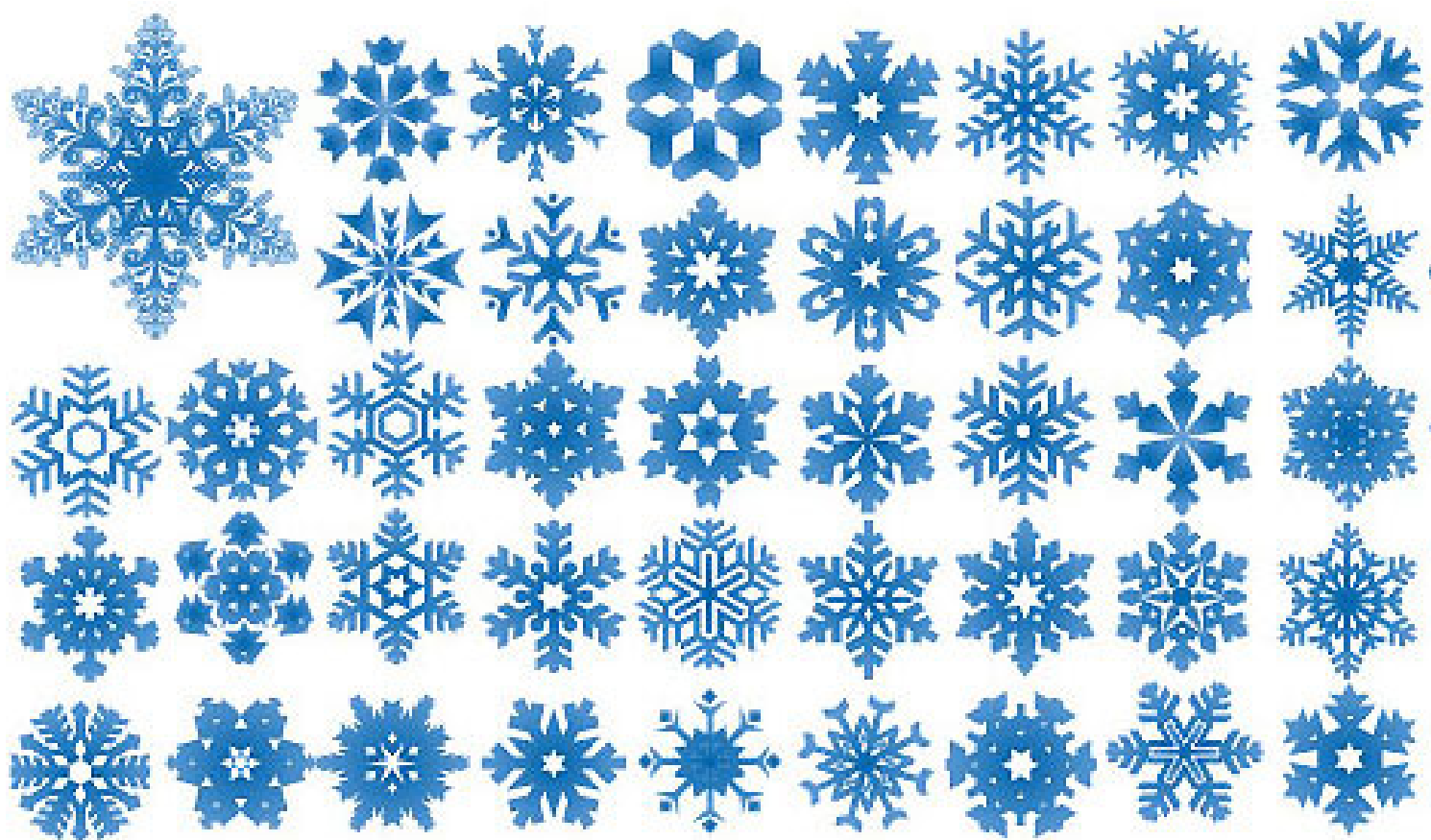
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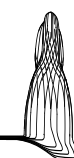
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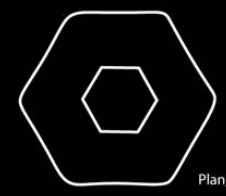
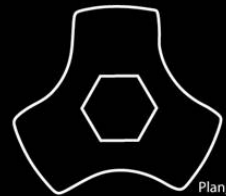
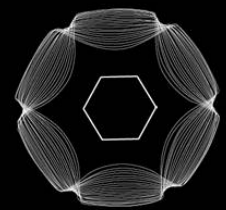
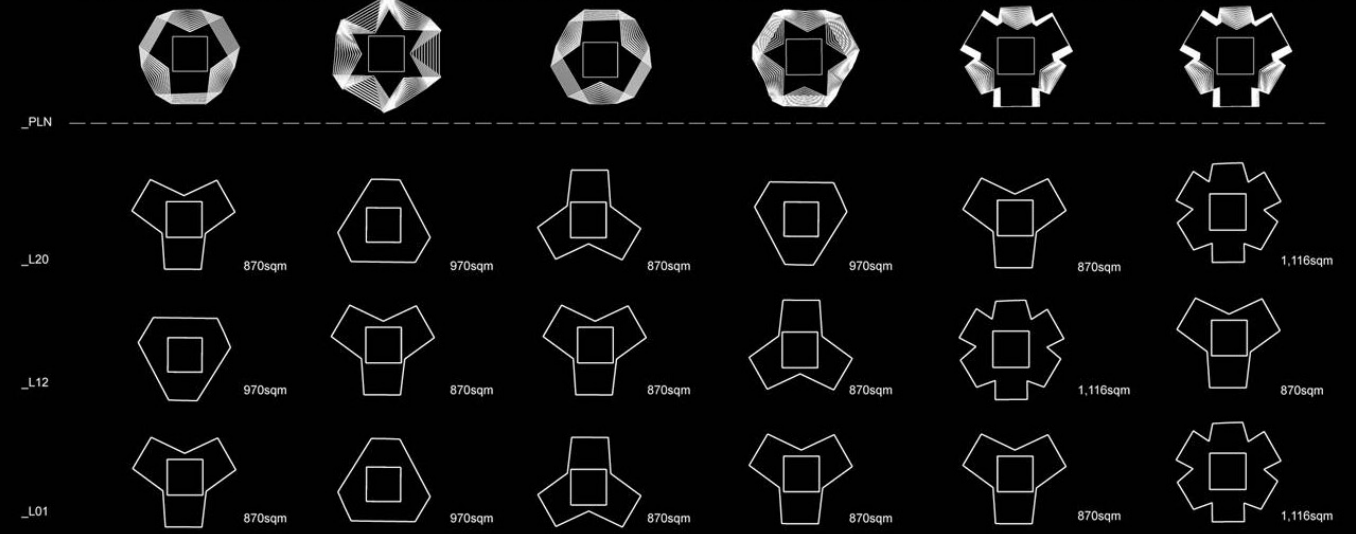
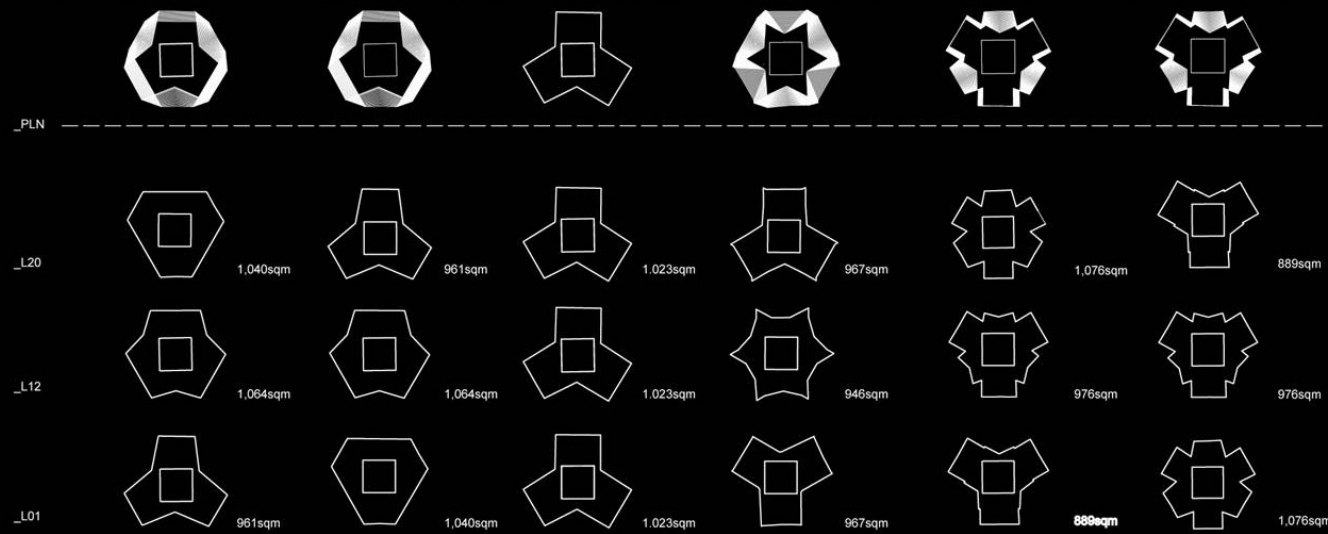
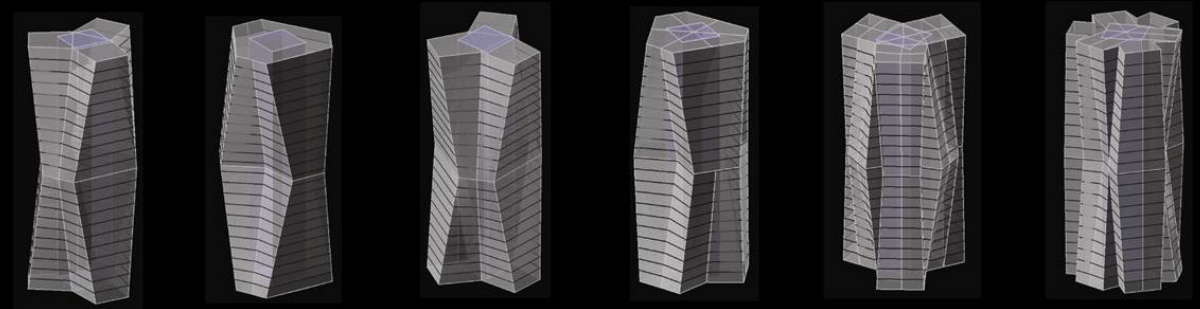
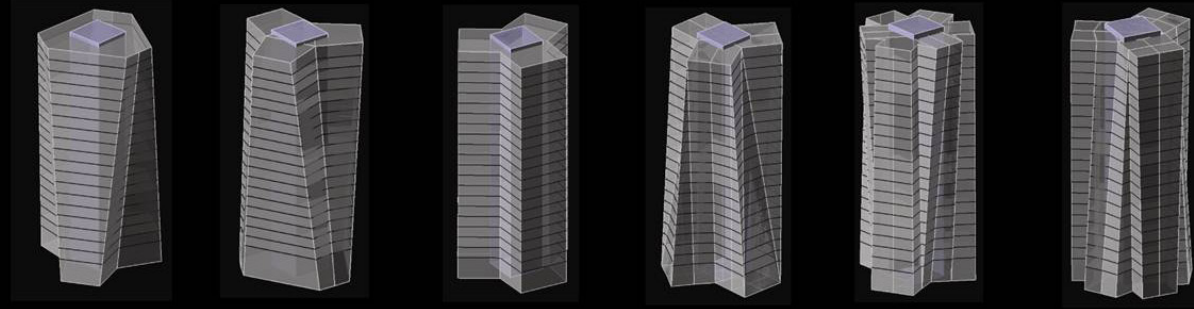
INITIAL STUDIES: GENERATION OF FORM



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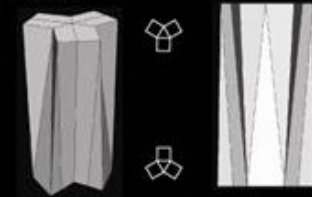
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Plan_

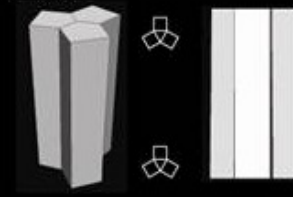
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3 Pockets

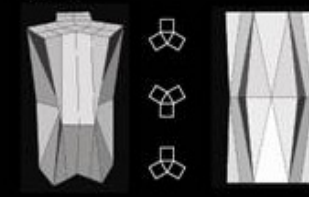
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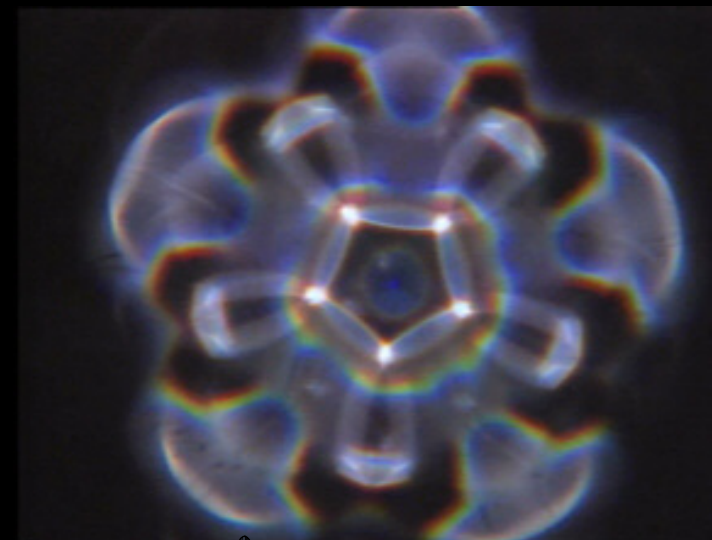
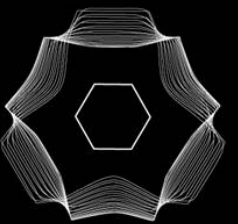
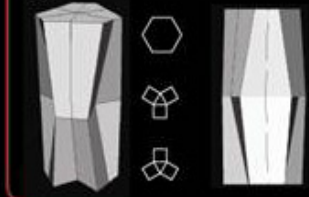
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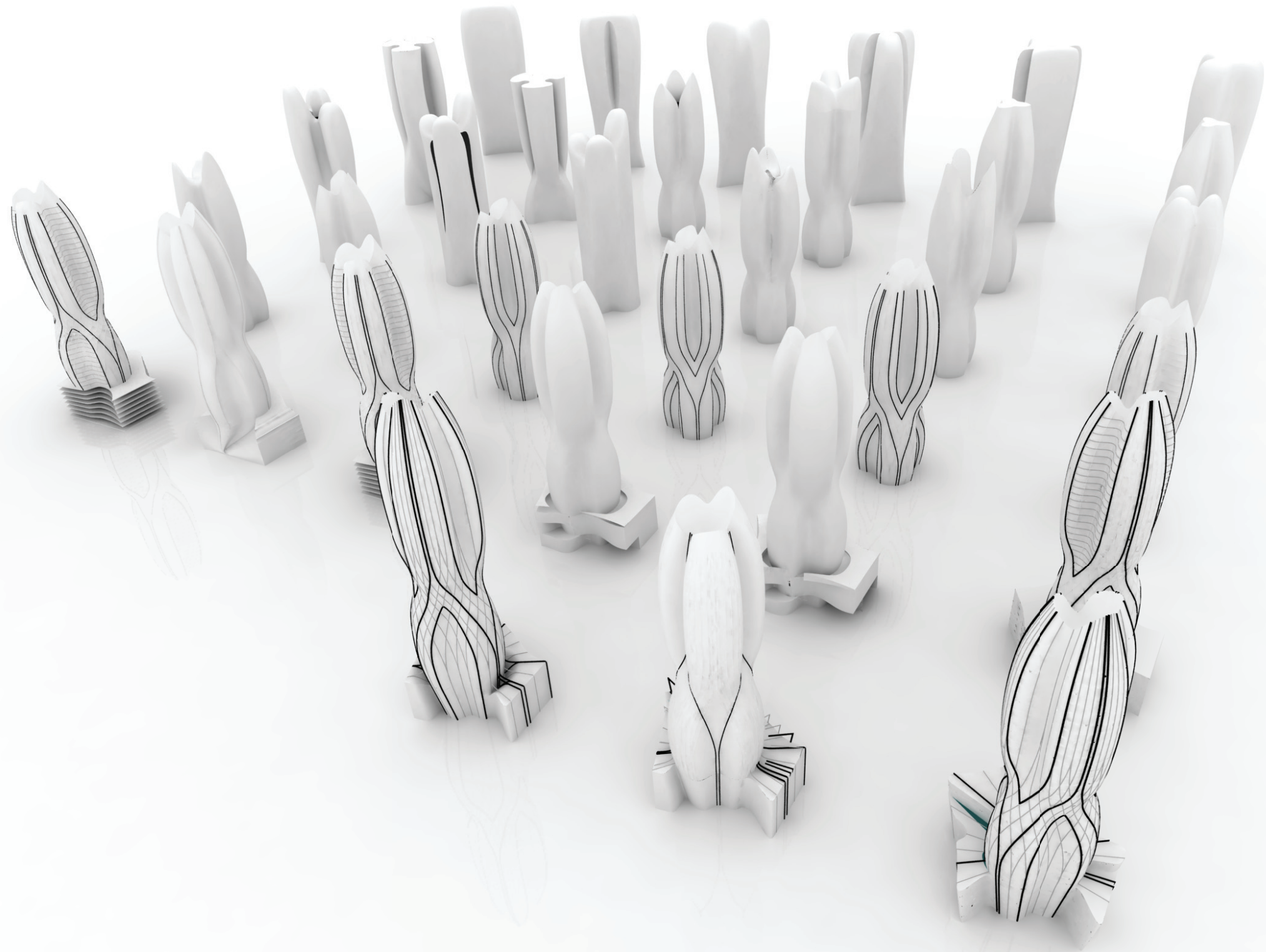
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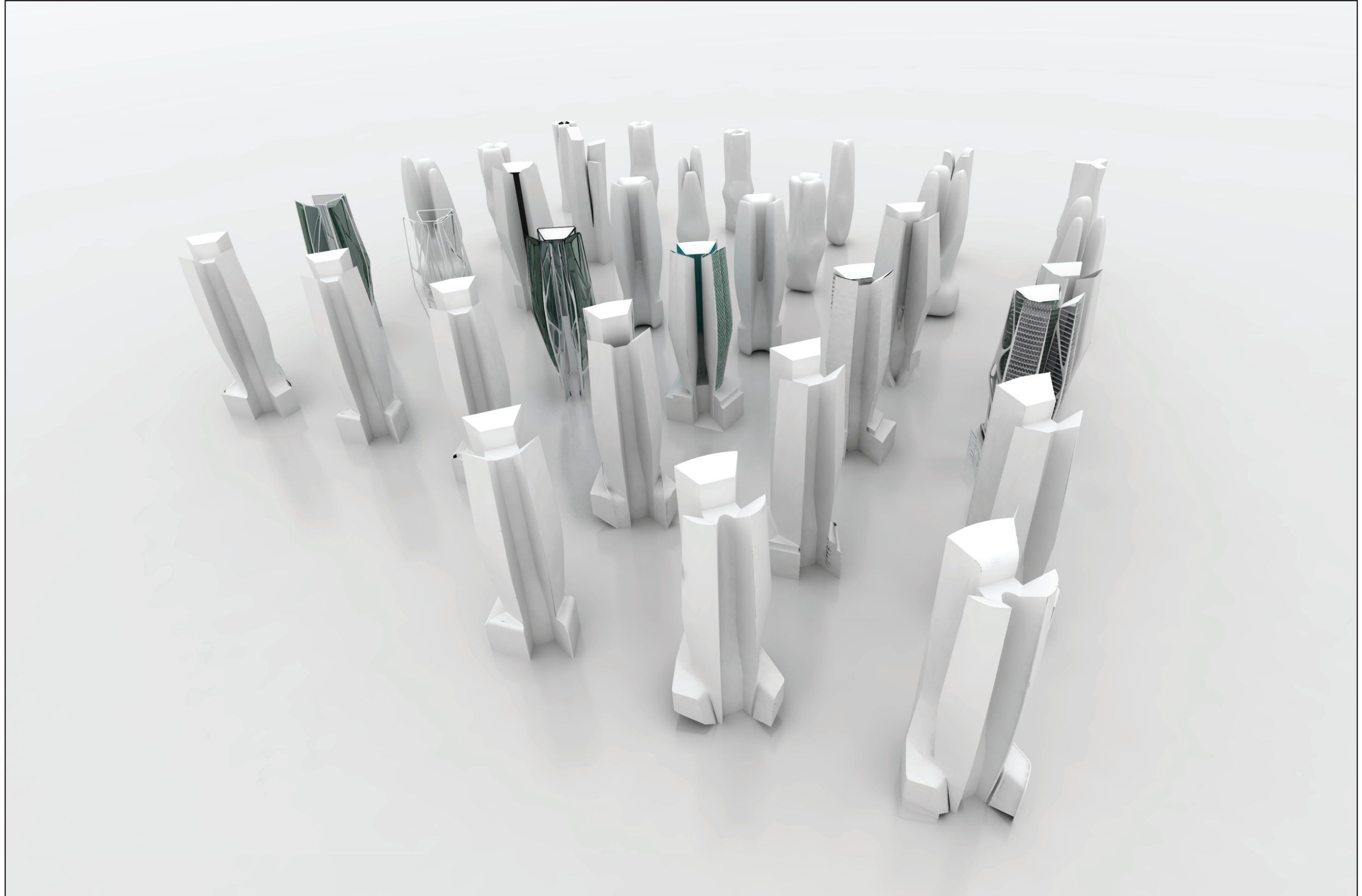


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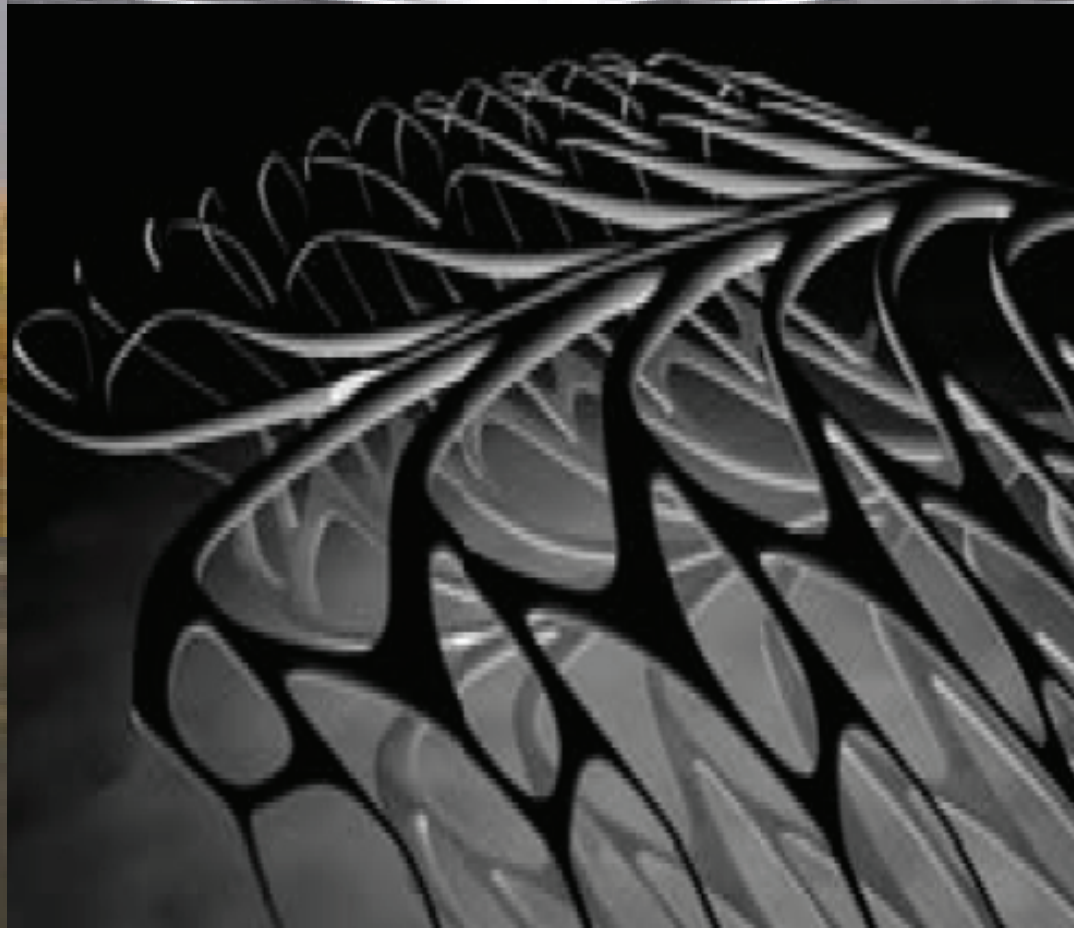
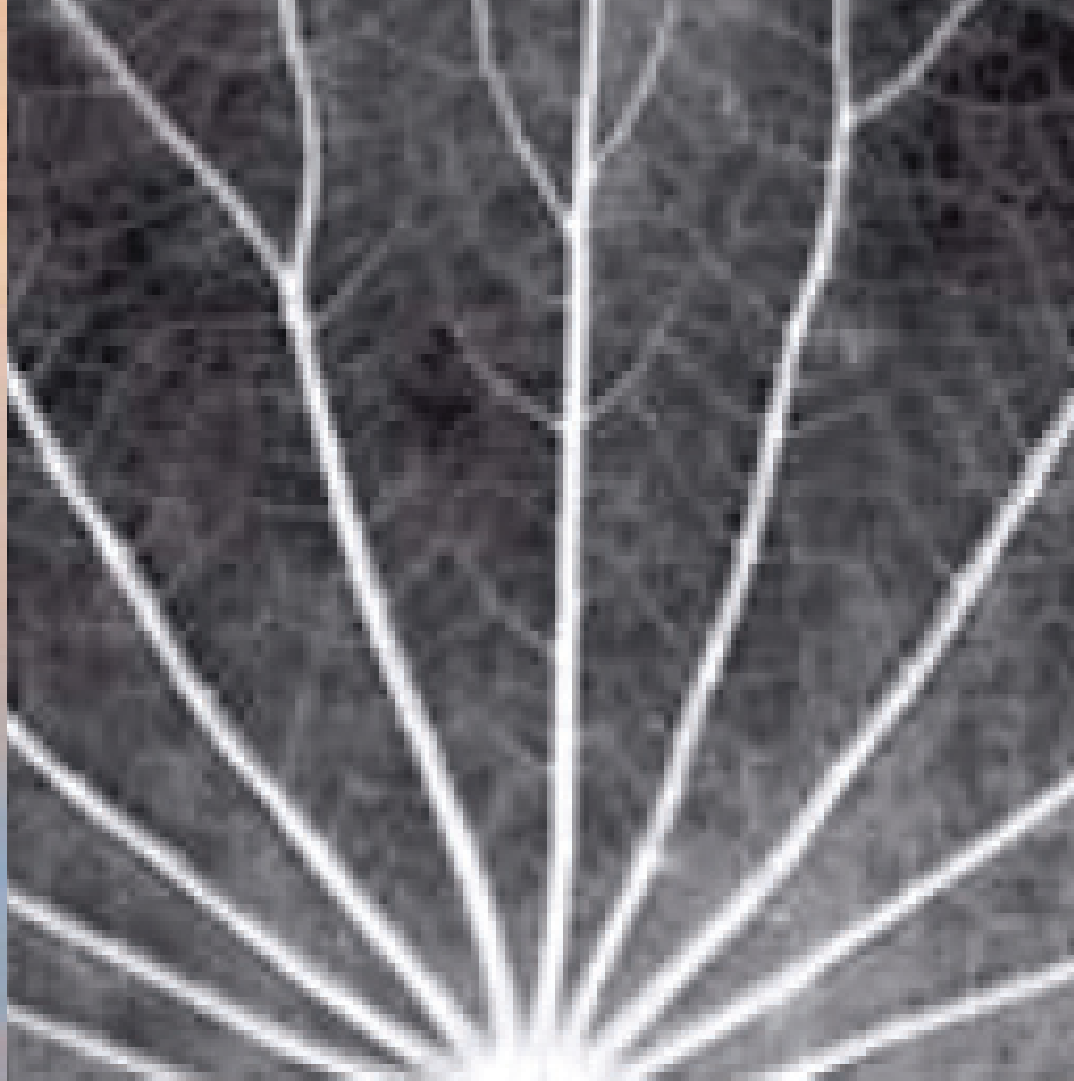




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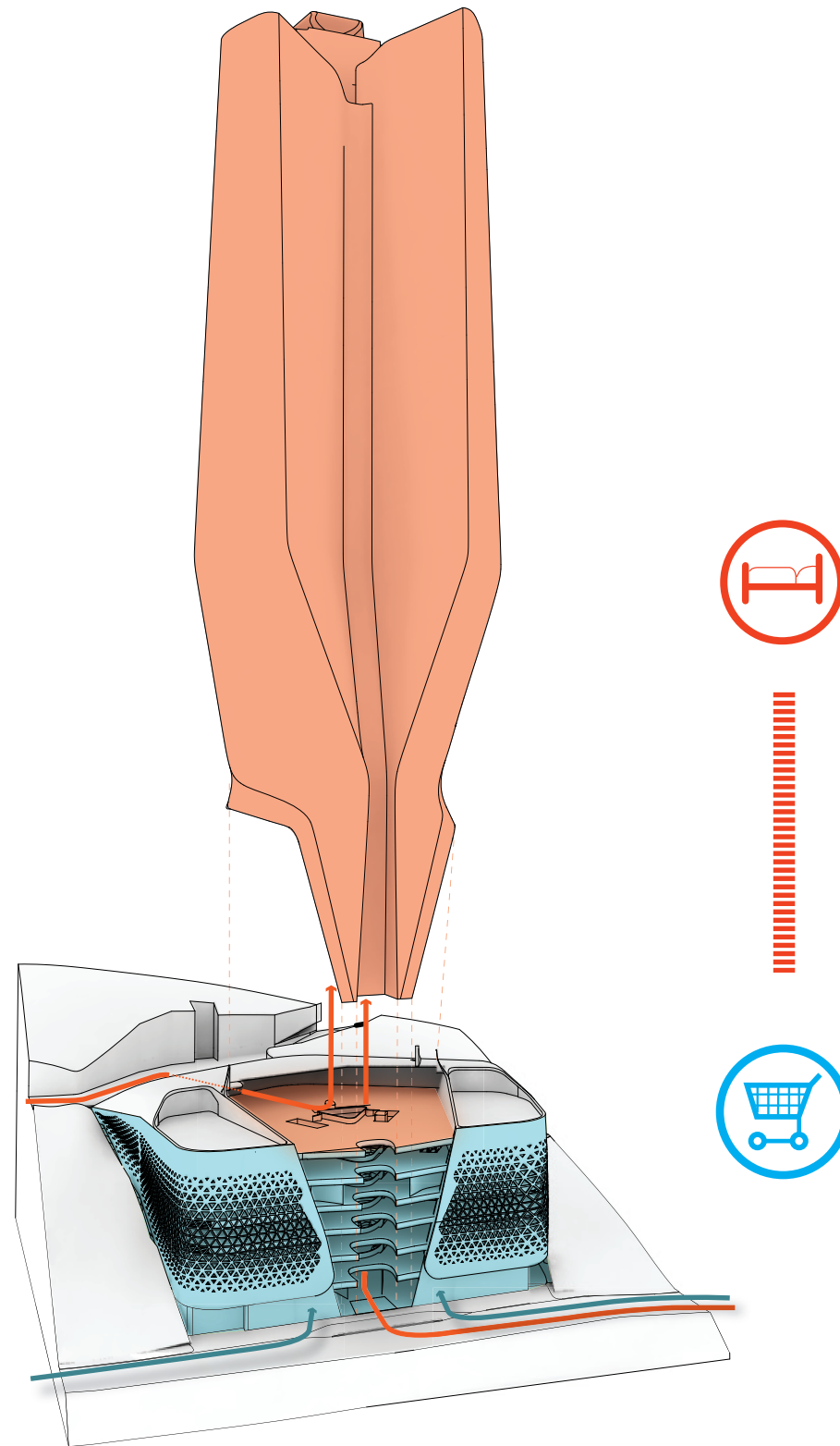


PERSPECTIVE
FROM EAST

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HOTEL TOWER IS DIVING INTO
SHOPPING PODIUM

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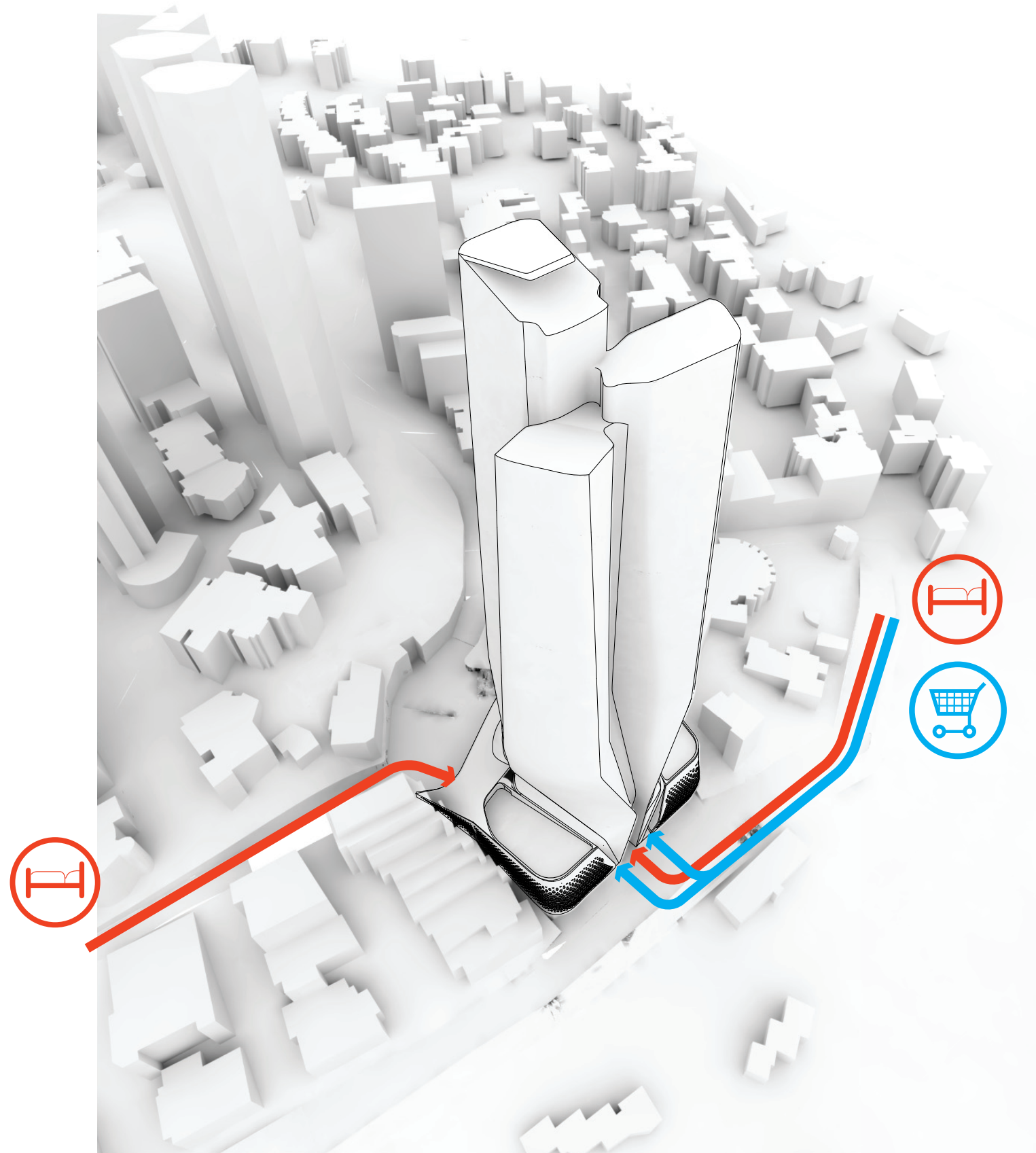
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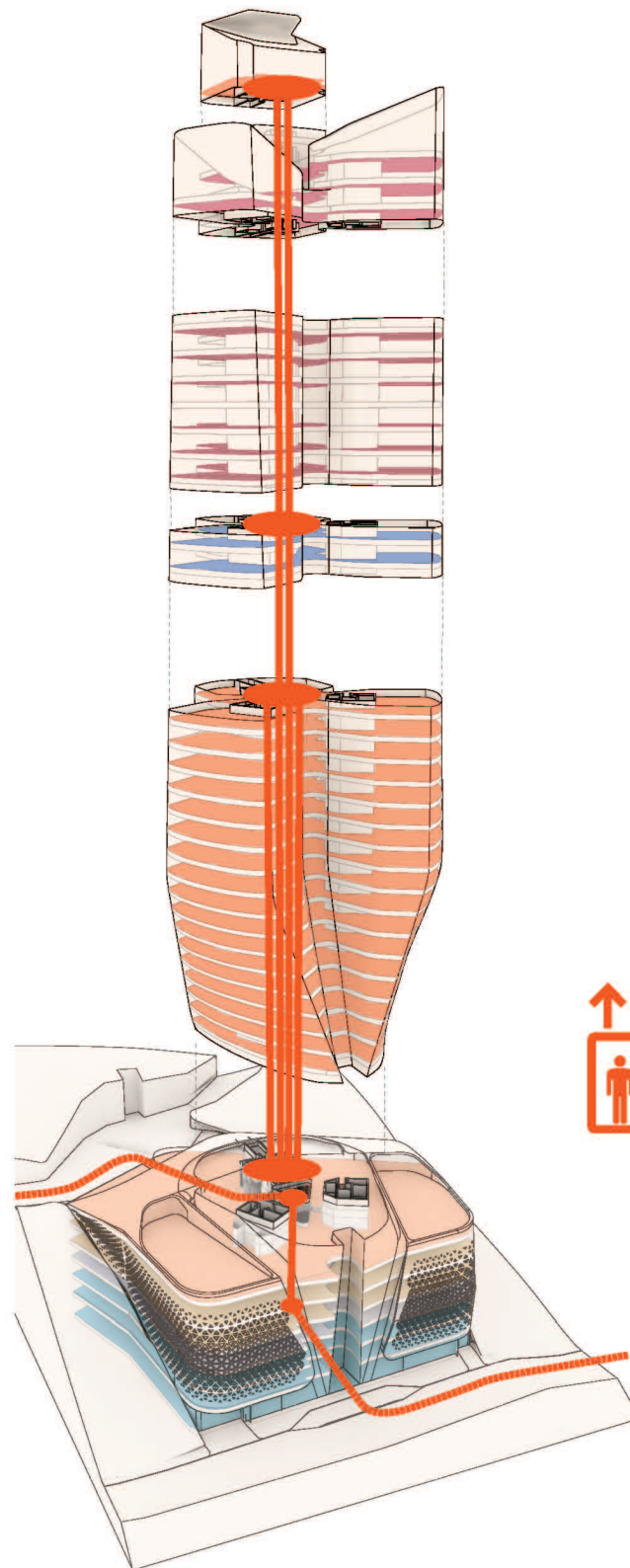
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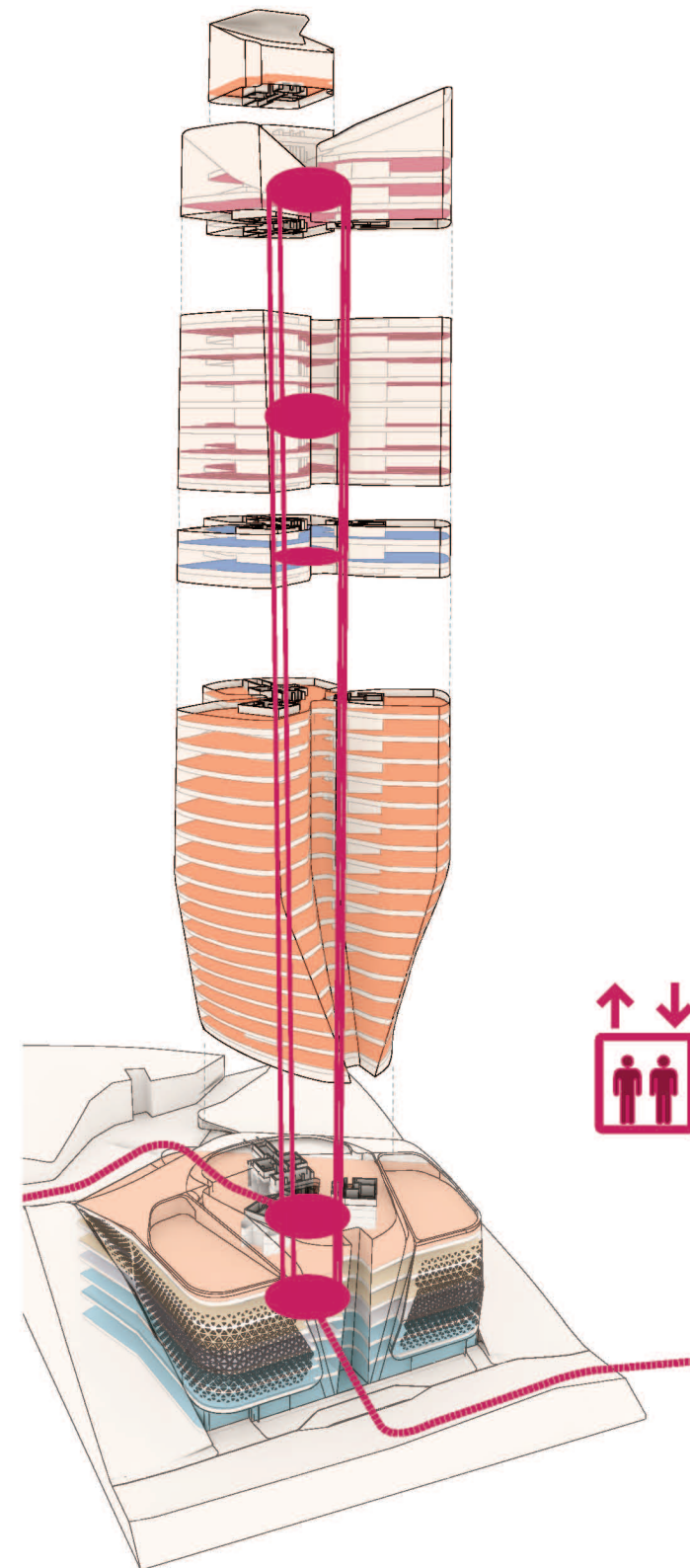


MAIN APPROACH



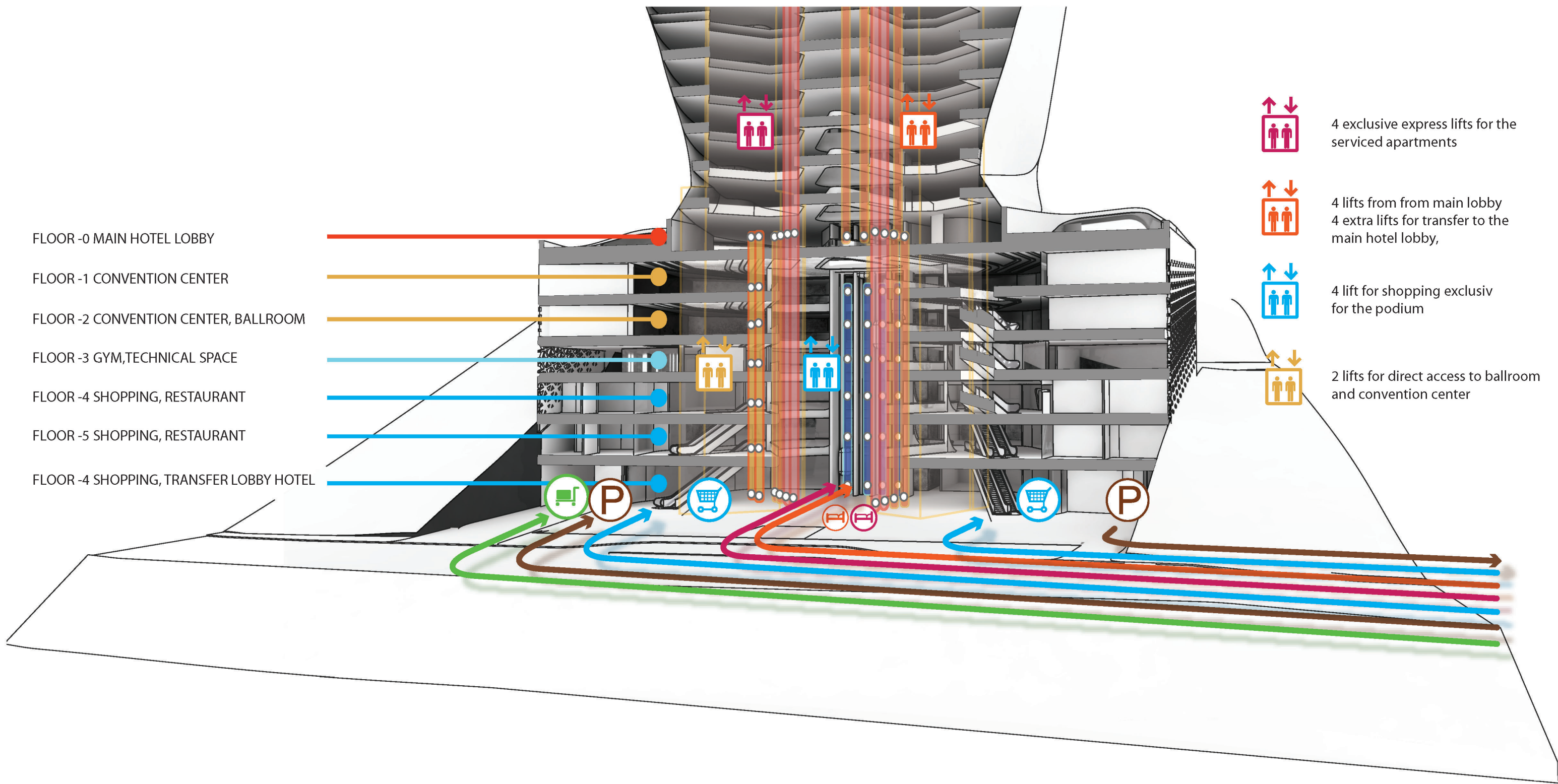


VERTICAL CIRCULATION HOTEL GUESTS



VERTICAL CIRCULATION RESIDENTS

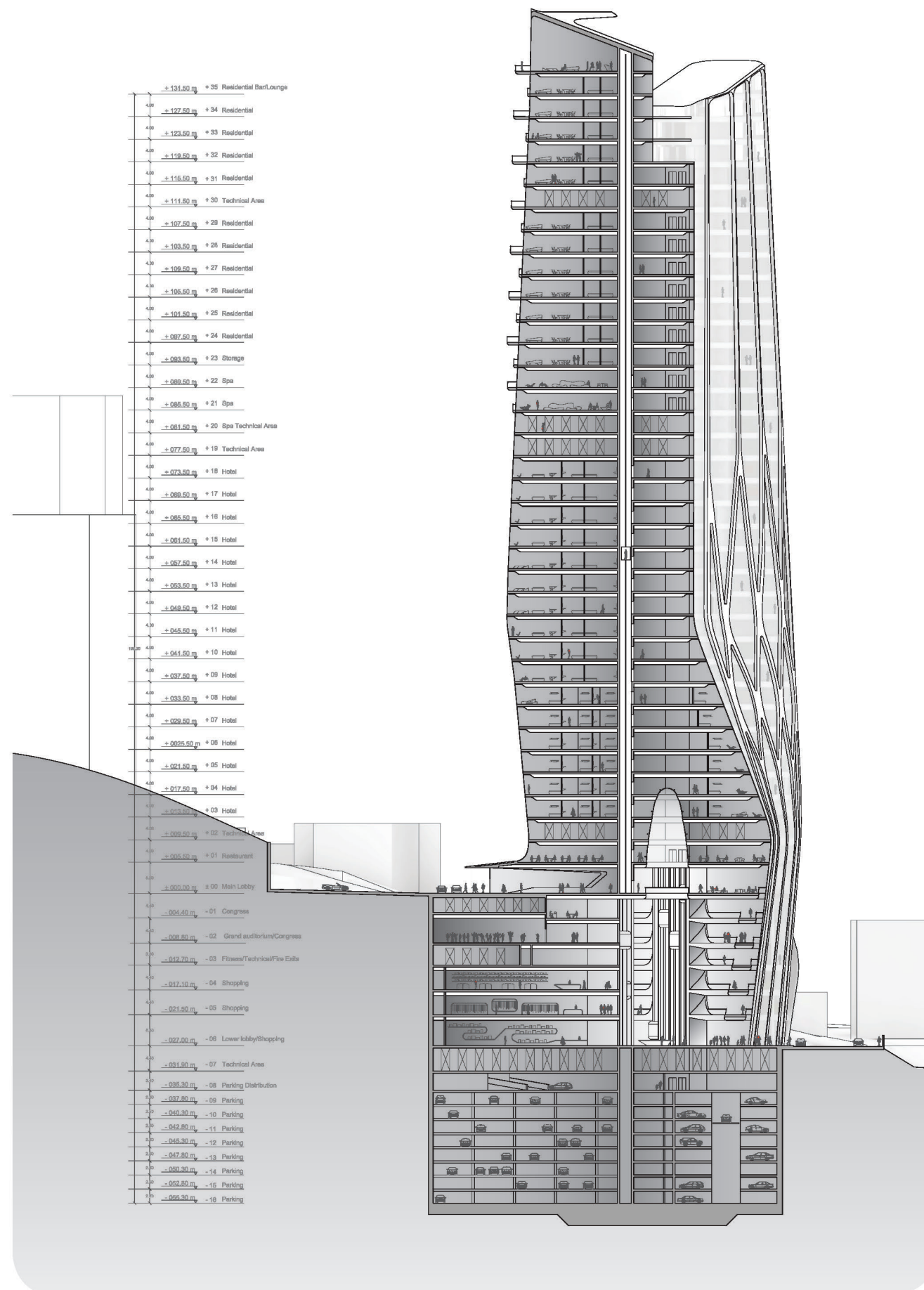




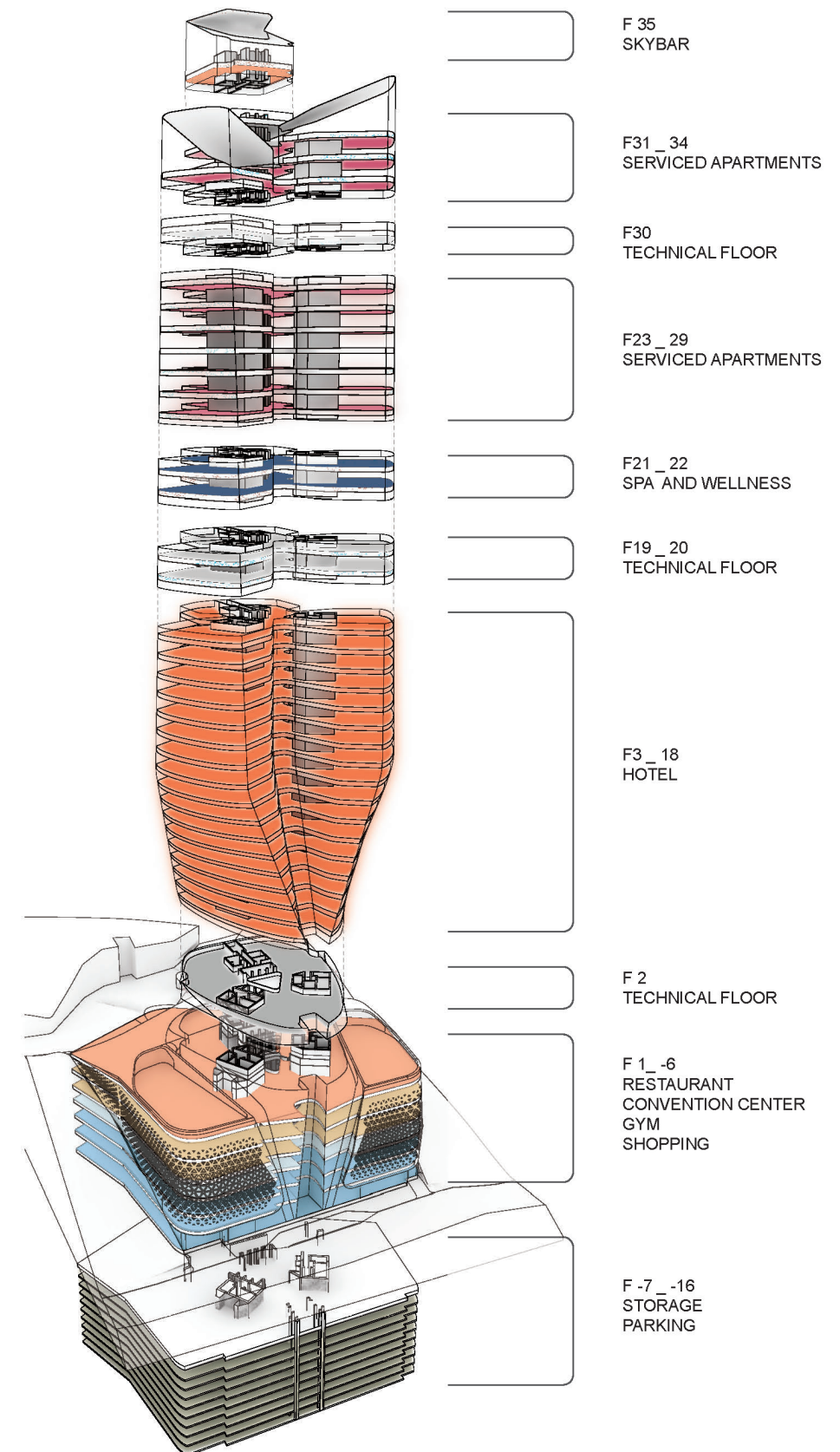
02 ARCHITECTURE/ DESIGN

- Site Context
- Mood Boards
- Initial Studies
- Proposed Design
- Circulation
- Program Distribution
- Layout - Floorplates
- Drawings





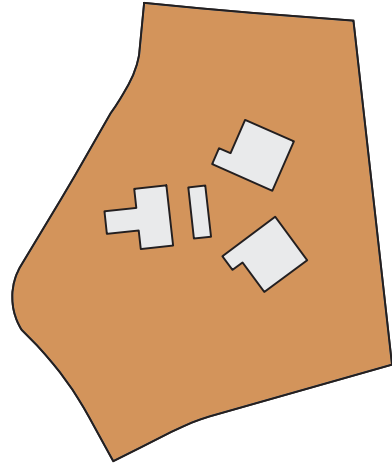
SCHNITT M 1: 500



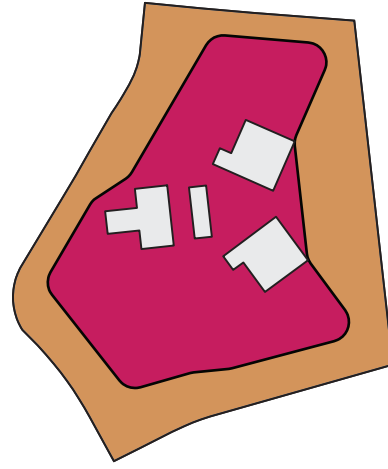
PROGRAM DISTRIBUTION



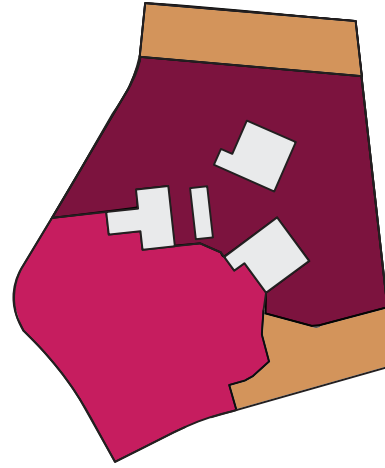
Level -05
GFA: 3722m²
Use: Natural Parking



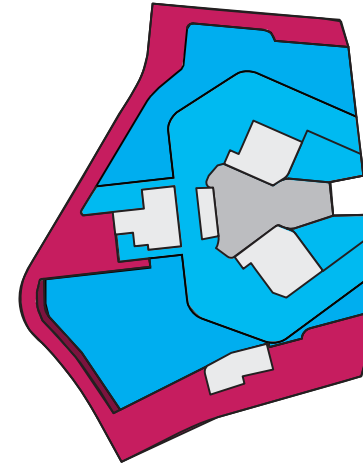
Level -08
GFA: 3722m²
Use: Natural Parking/Shop Storage



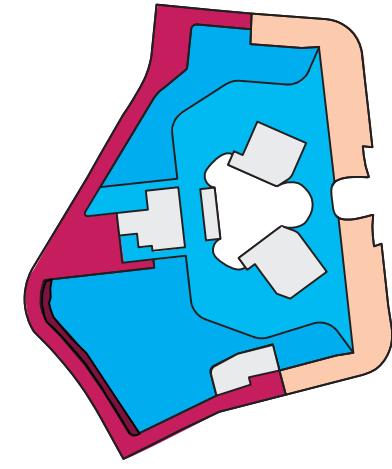
Level -07
GFA: 3722m²
Use: Hotel Service/Technical Area



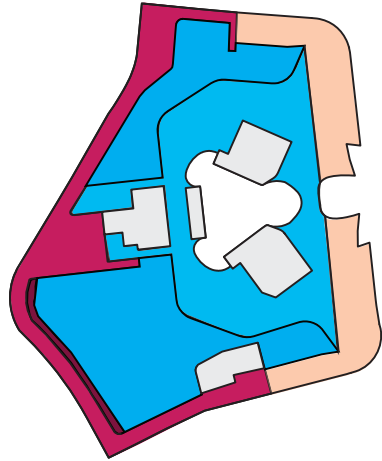
Level -06
GFA: 3485m²
Use: Retail, Podium Lobby



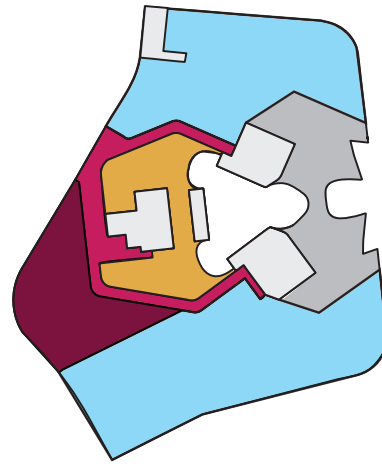
Level -05
GFA: 3509m²
Use: Retail, F&B



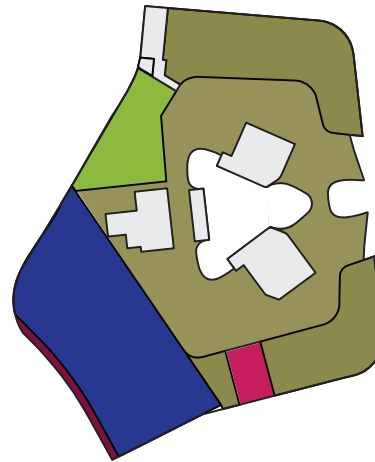
Level -04
GFA: 3535m²
Use: Retail, F&B



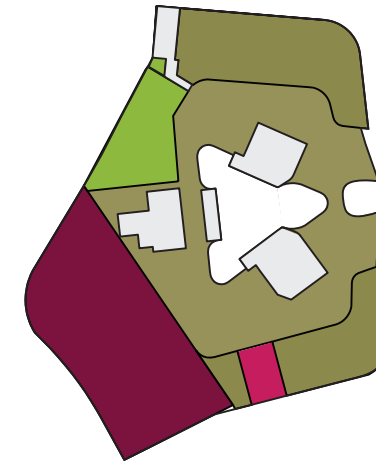
Level -03
GFA: 3571m²
Use: Fitness, Technical Area



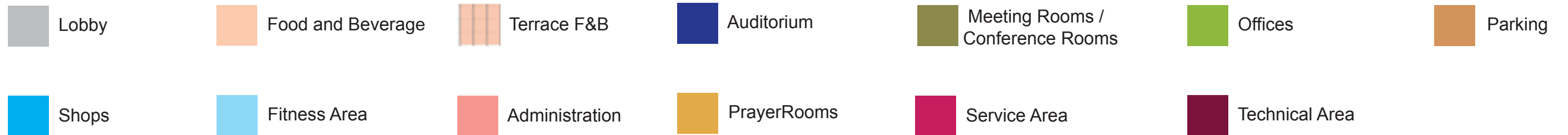
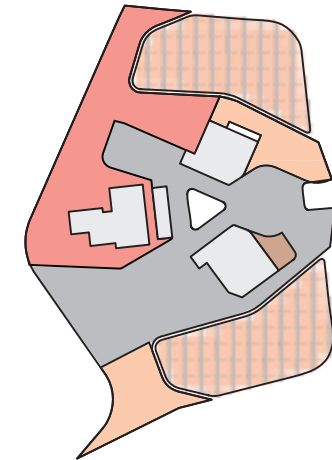
Level -02
GFA: 3645m²
Use: Convention Center (Auditorium)



Level -01
GFA: 3652m²
Use: Convention Center, Technical Area



Level 00
GFA: 2115m²
Use: Hotel Lobby, F&B, Administration



ZAHA HADID ARCHITECTS

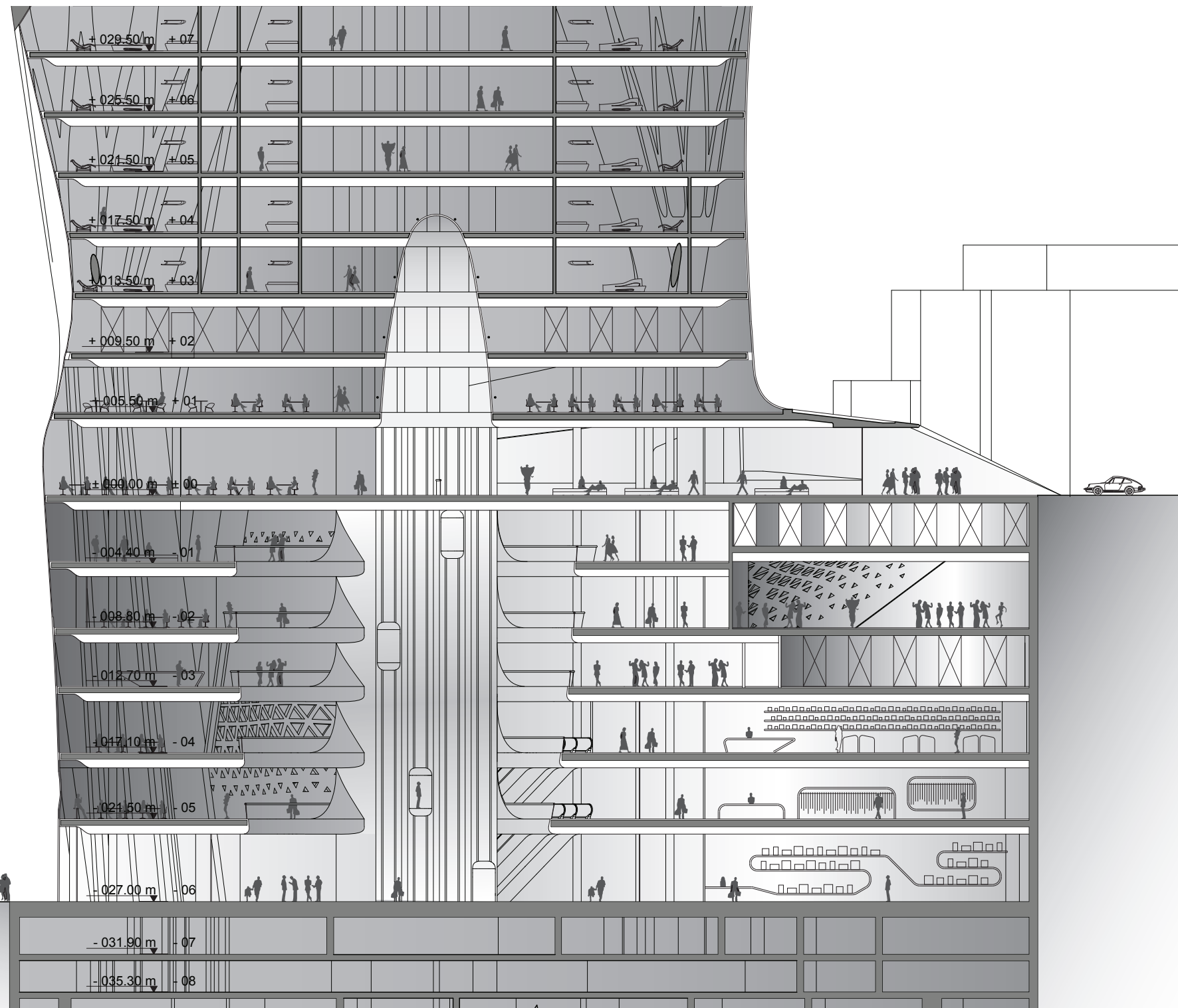
Pasargad Hotel Elahieh, Teheran



02 ARCHITECTURE/ DESIGN

- Site Context
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 - Drawings
 - Layout - Floorplates
- PODIUM
 - PODIUM BASEMENT
 - TOWER





- FLOOR 7 HOTEL
- FLOOR 6 HOTEL
- FLOOR 5 HOTEL
- FLOOR 4 HOTEL
- FLOOR 3 HOTEL
- FLOOR 2 TECHNICAL SPACE
- FLOOR 1 BREAKFAST ROOM, RESTAURANT
- FLOOR 0 MAIN HOTEL LOBBY
- FLOOR -1 CONVENTION ROOMS
- FLOOR -2 BALLROOM, CONVENTION ROOMS
- FLOOR -3 GYM, TECHNICAL SPACE
- FLOOR -4 SHOPPING
- FLOOR -5 SHOPPING
- FLOOR -6 SHOPPING, LOBBY

SECTION PODIUM M 1:250

ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran





PERPECTIVE
TRANSFER LOBBY - VOID
SHOPPING / CONFERENCE / BANQUETTE

ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran





FLOOR PLAN FLOOR 0
M 1:500



FLOOR PLAN FLOOR -1
M 1:500





FLOOR PLAN FLOOR -2
M 1:500



FLOOR PLAN FLOOR -3
M 1:500



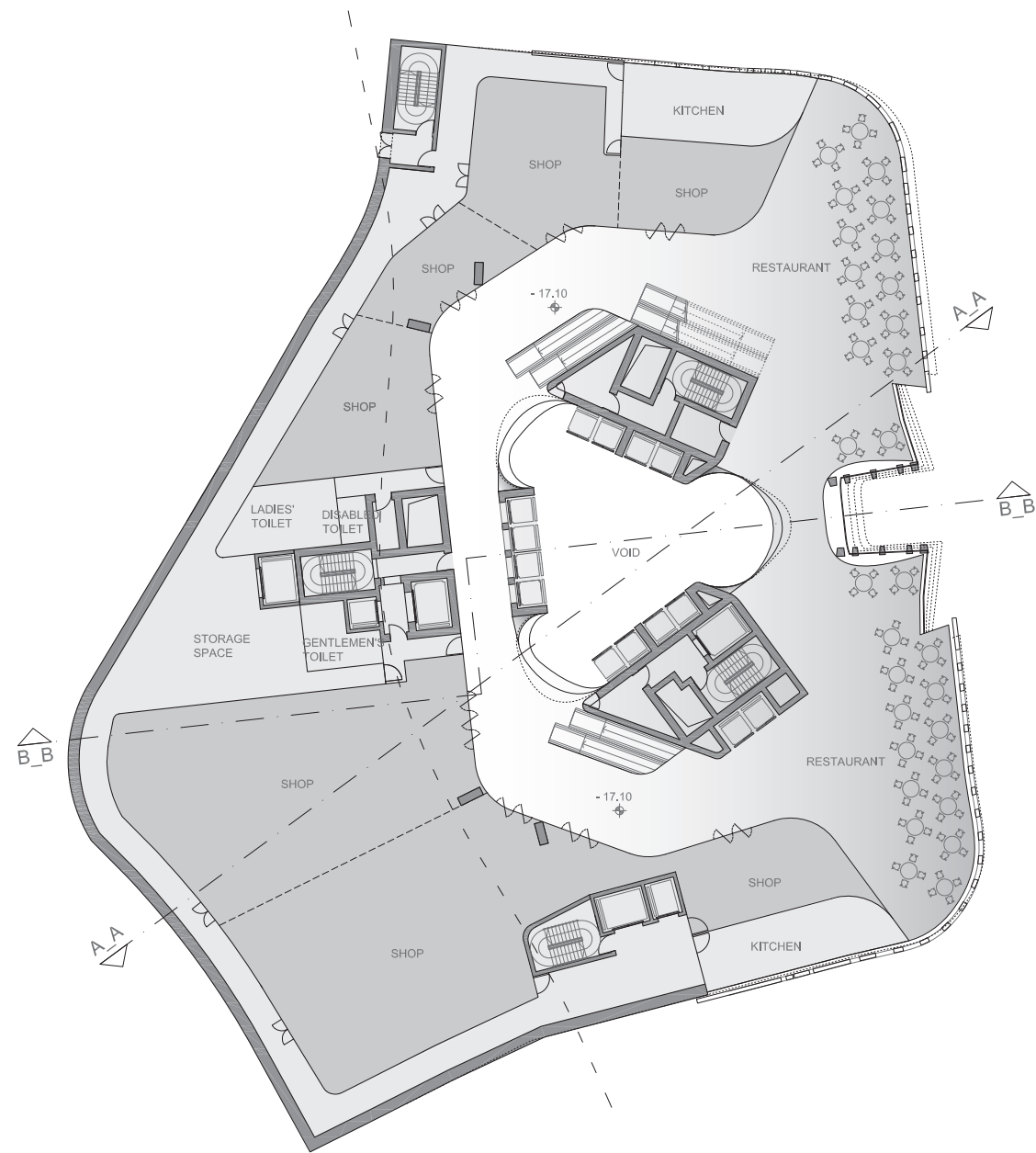


FLOOR PLAN F-2
BALLROOM, CONVENTION ROOMS

ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran



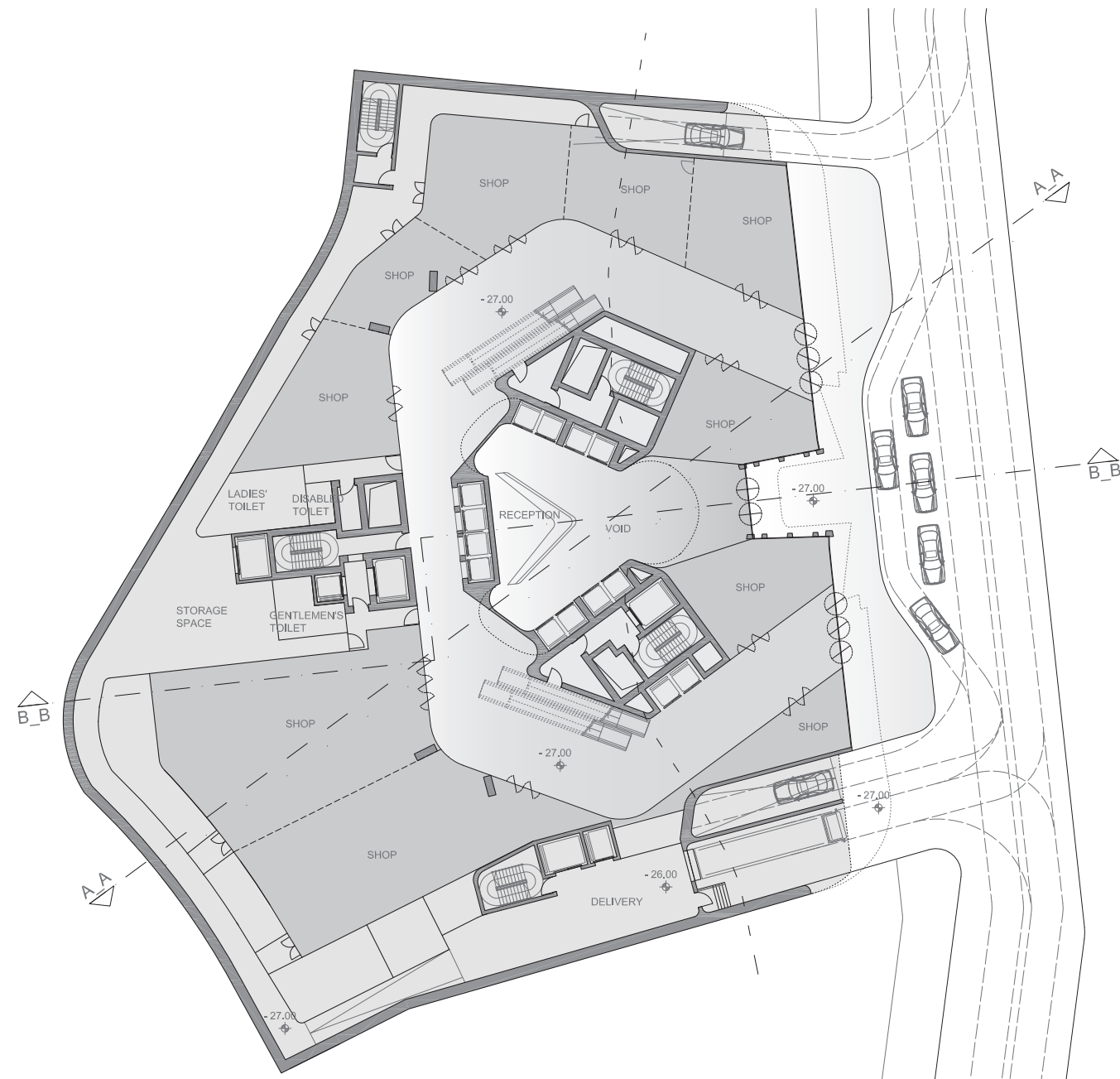


FLOOR PLAN FLOOR -4
M 1:500



FLOOR PLAN FLOOR -5
M 1:500





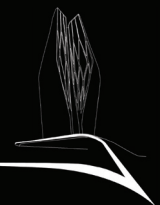
FLOOR PLAN FLOOR -6
M 1:500

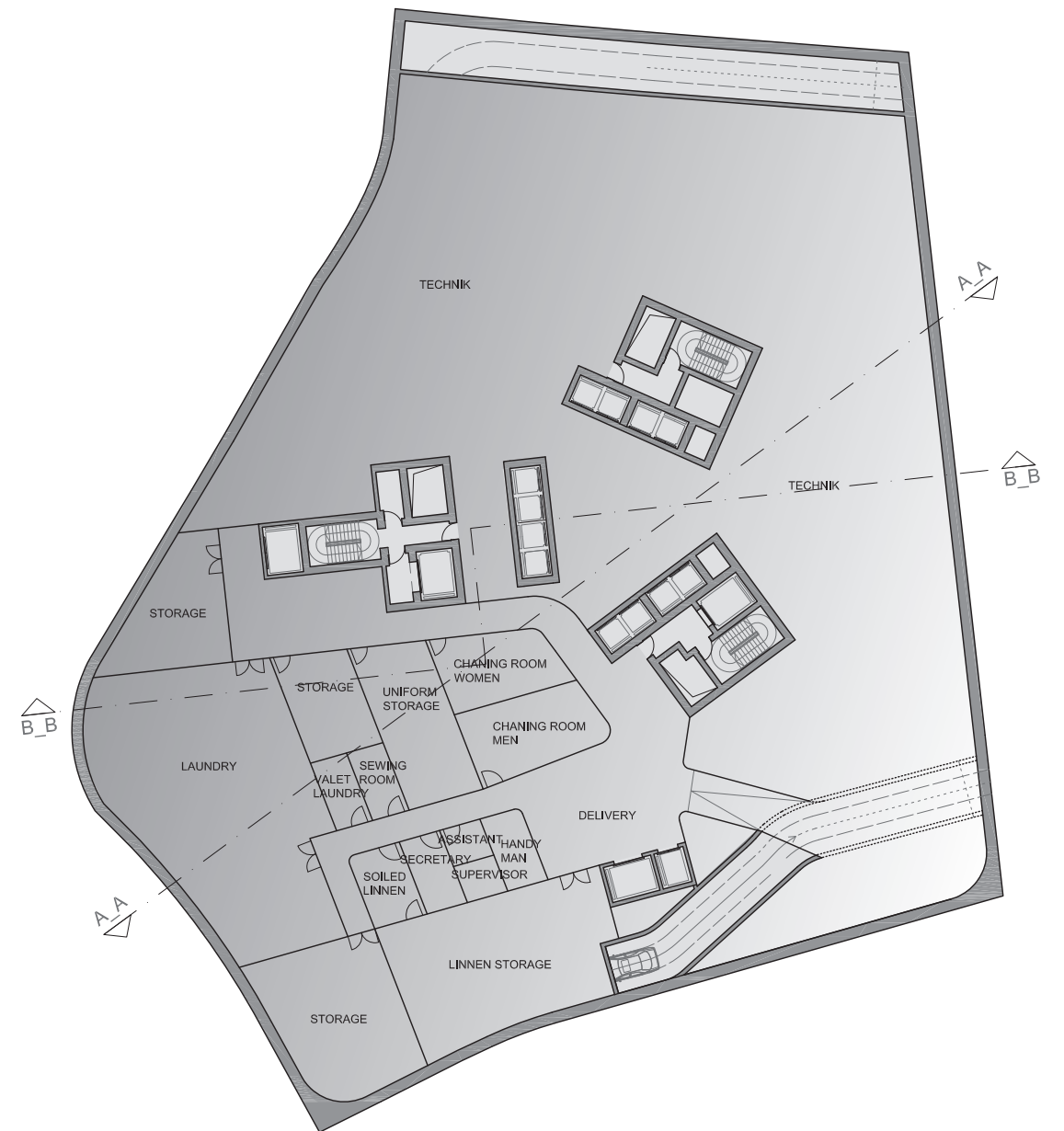




02 ARCHITECTURE/ DESIGN

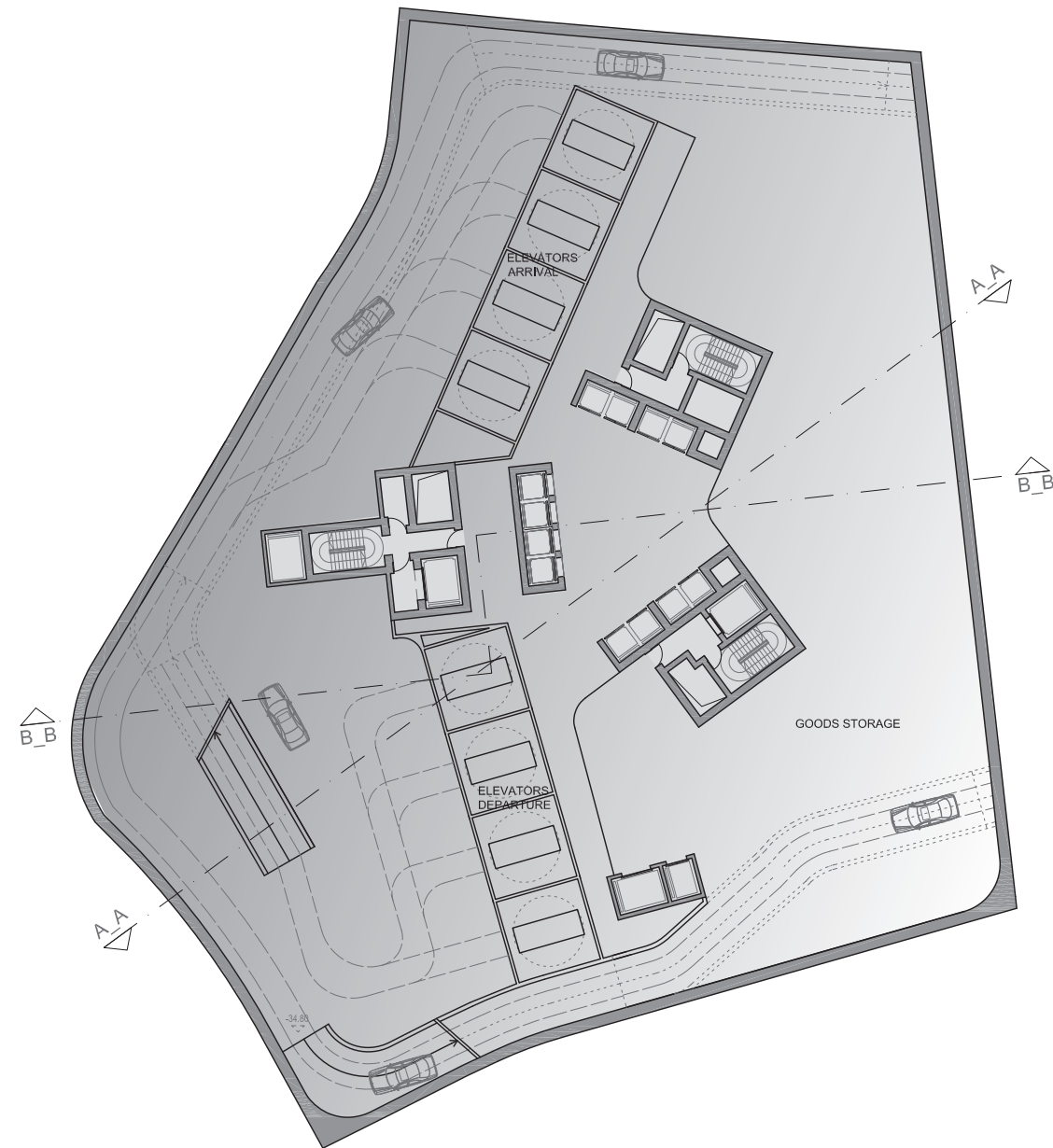
- Site Context
 - Mood Boards
 - Initial Studies
 - Proposed Design
 - Circulation
 - Program Distribution
 - Drawings
 - Layout - Floorplates
- PODIUM
 - PODIUM BASEMENT
 - TOWER



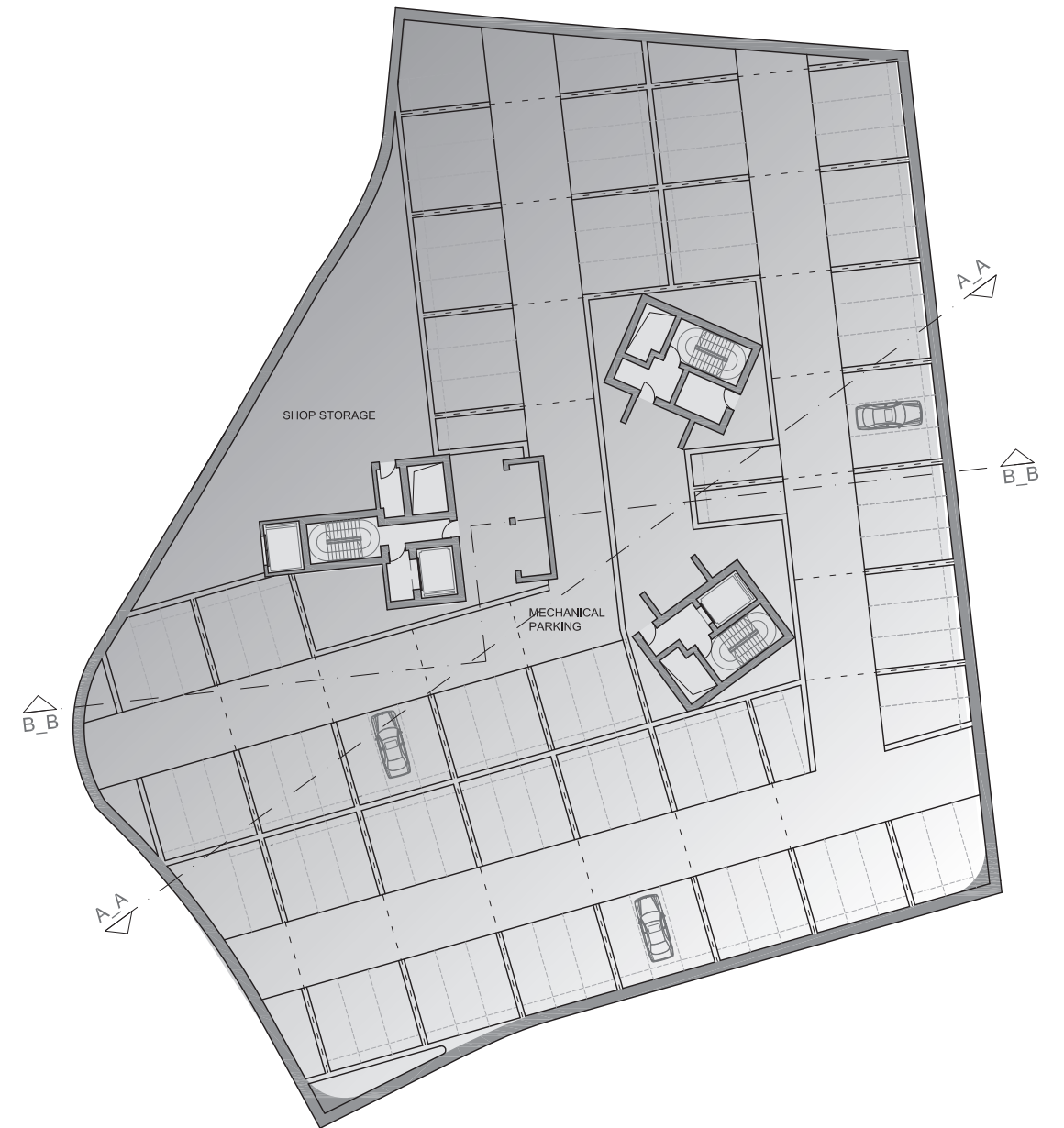


FLOOR PLAN FLOOR -7
M 1:500



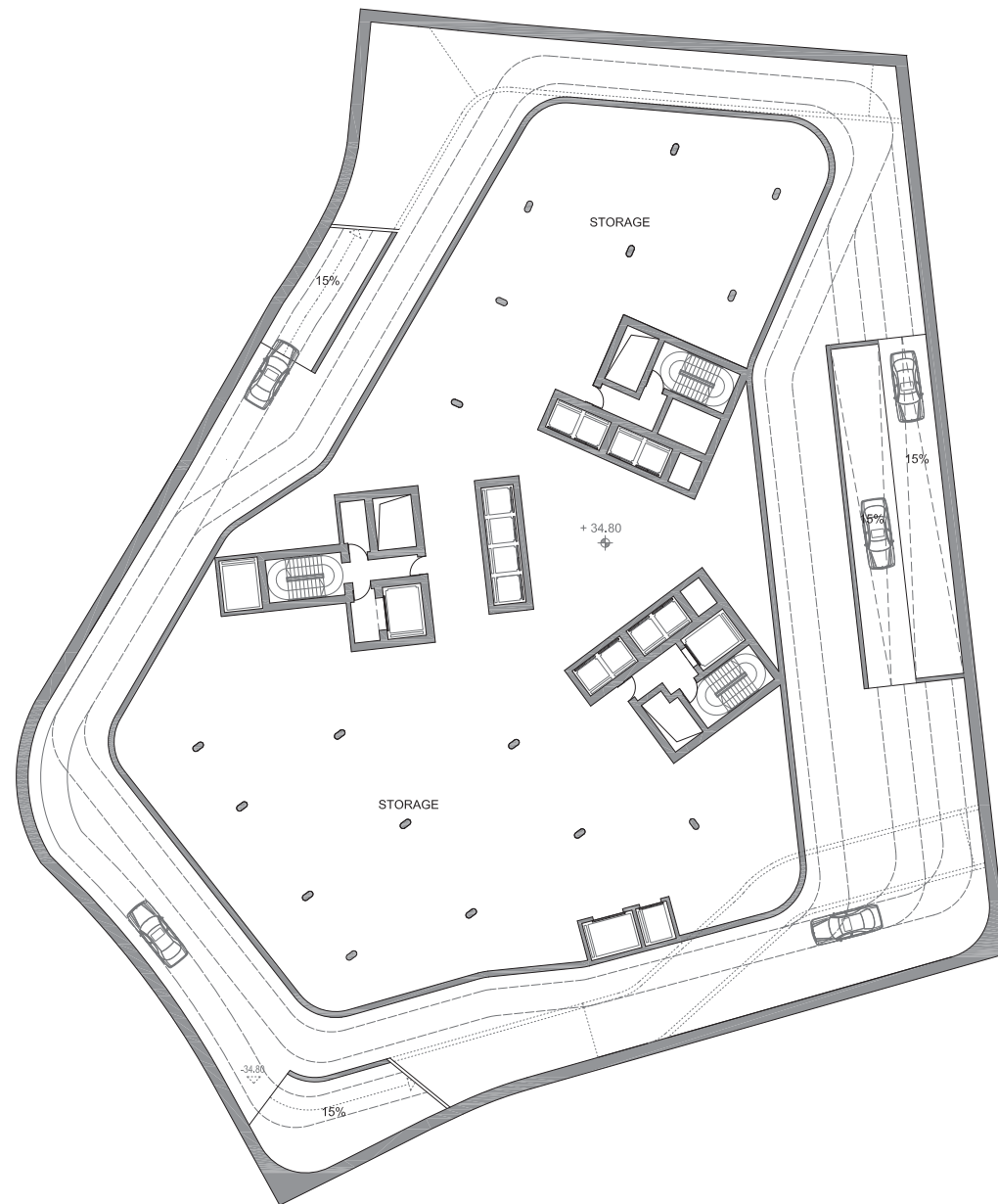


FLOOR PLAN FLOOR -8
M 1:500



FLOOR PLAN FLOOR -9
M 1:500
3 *





FLOOR PLAN FLOOR -8
M 1:500



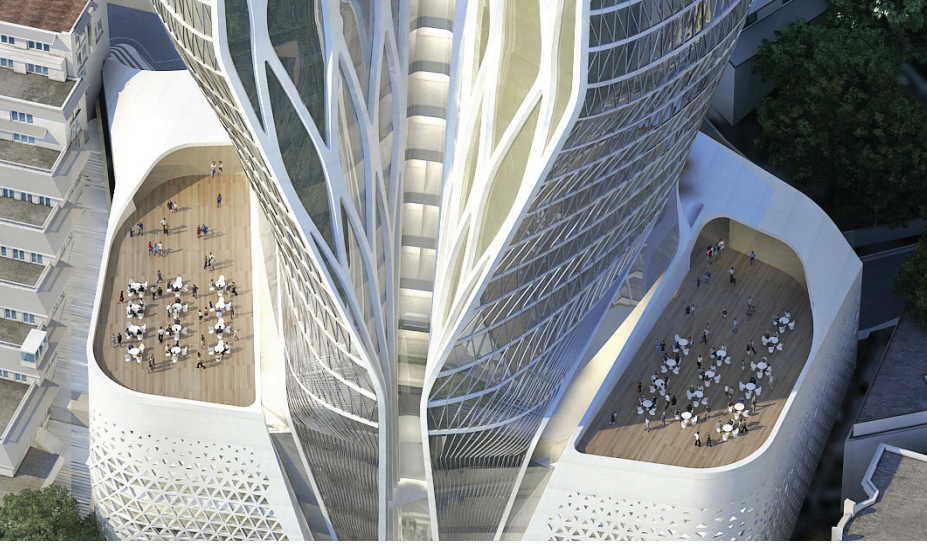
FLOOR PLAN FLOOR -9
M 1:500
9 * or more



02 ARCHITECTURE/ DESIGN

- Site Context
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 - Proposed Design
 - Circulation
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- PODIUM
 - PODIUM BASEMENT
 - TOWER





FLOOR PLAN HOTEL
F0 M 1:250

ZAHA HADID ARCHITECTS

HOTEL DROP-OFF
Pasargad Hotel Elanien, Teheran

MAIN LOBBY

SCENOGRAPHIC PLATEAU





PERSPECTIVE FROM SOUTH

HOTEL DROP-OFF
MAIN LOBBY
SCENOGRAPHIC PLATEAU
OUTDOOR TERRACES
30m ABOVE TEHERAN

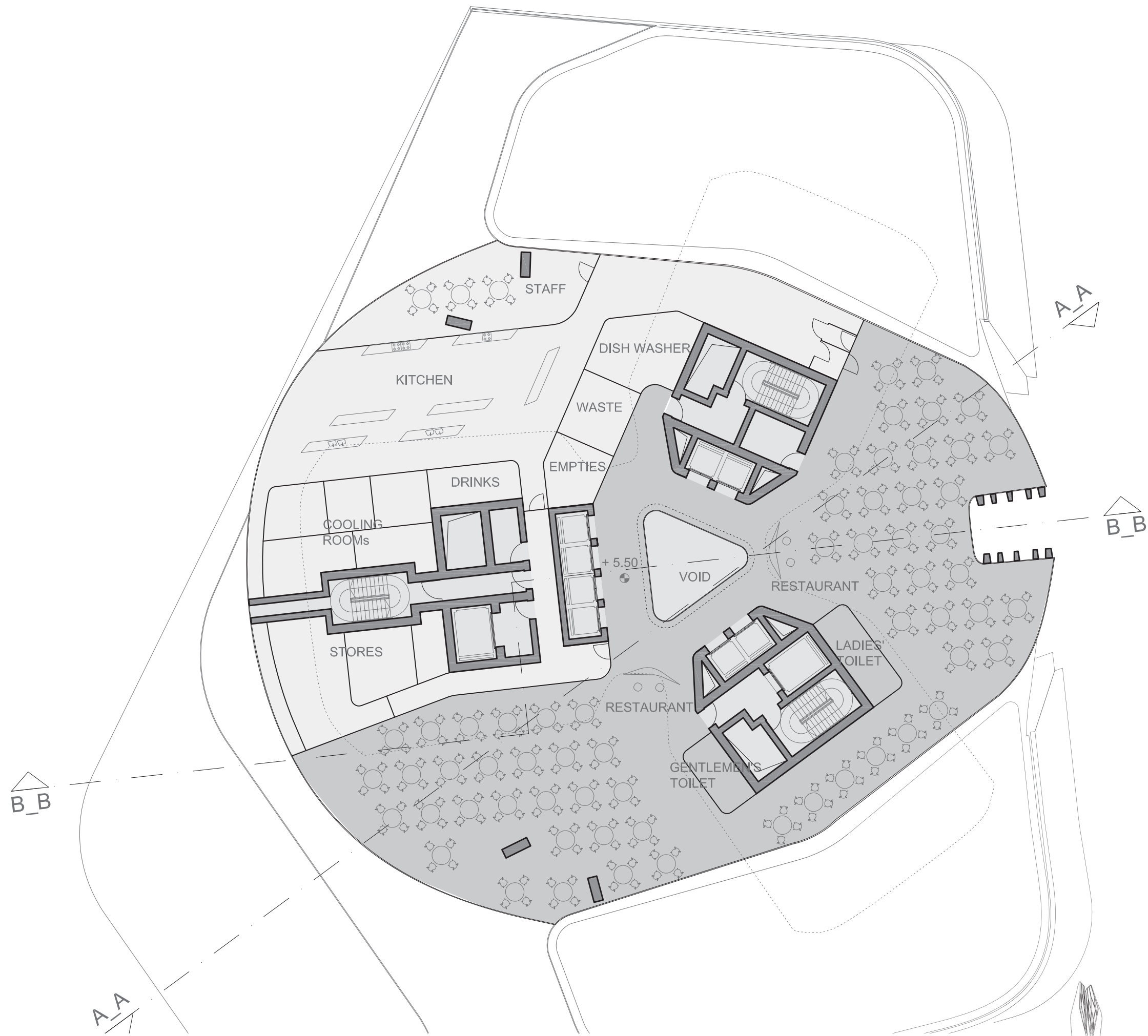


ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran

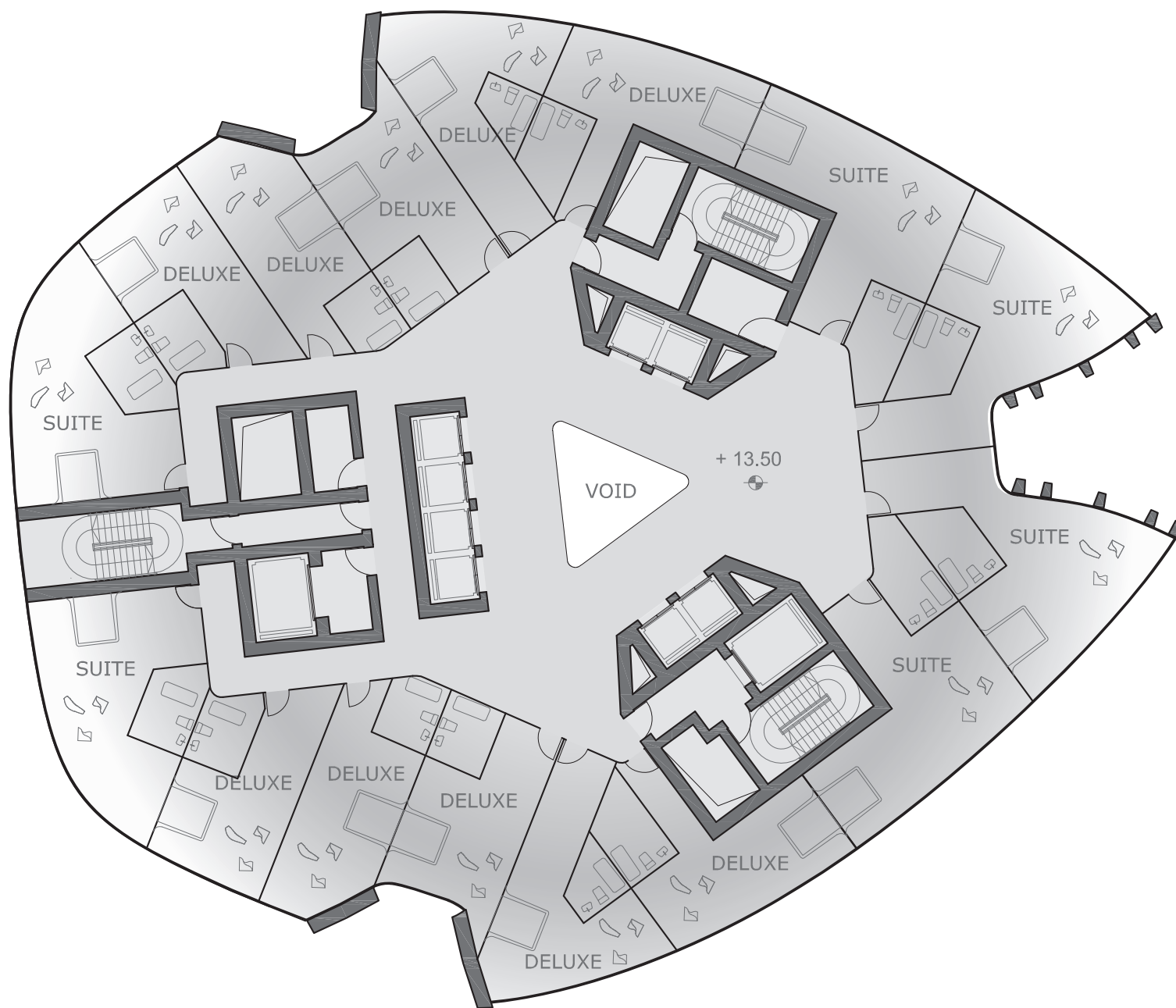
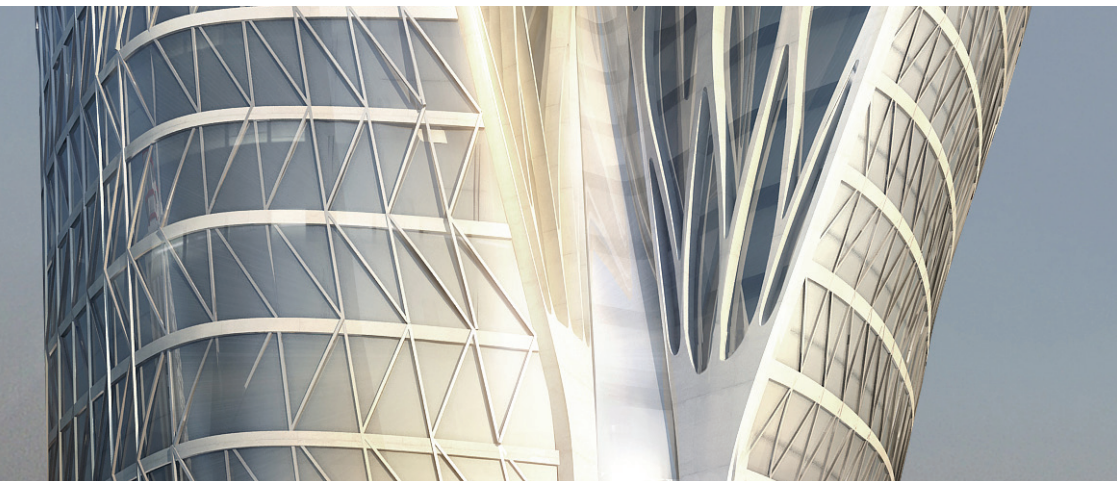


FLOOR PLAN RESTAURANT
F1 M 1:500



ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran

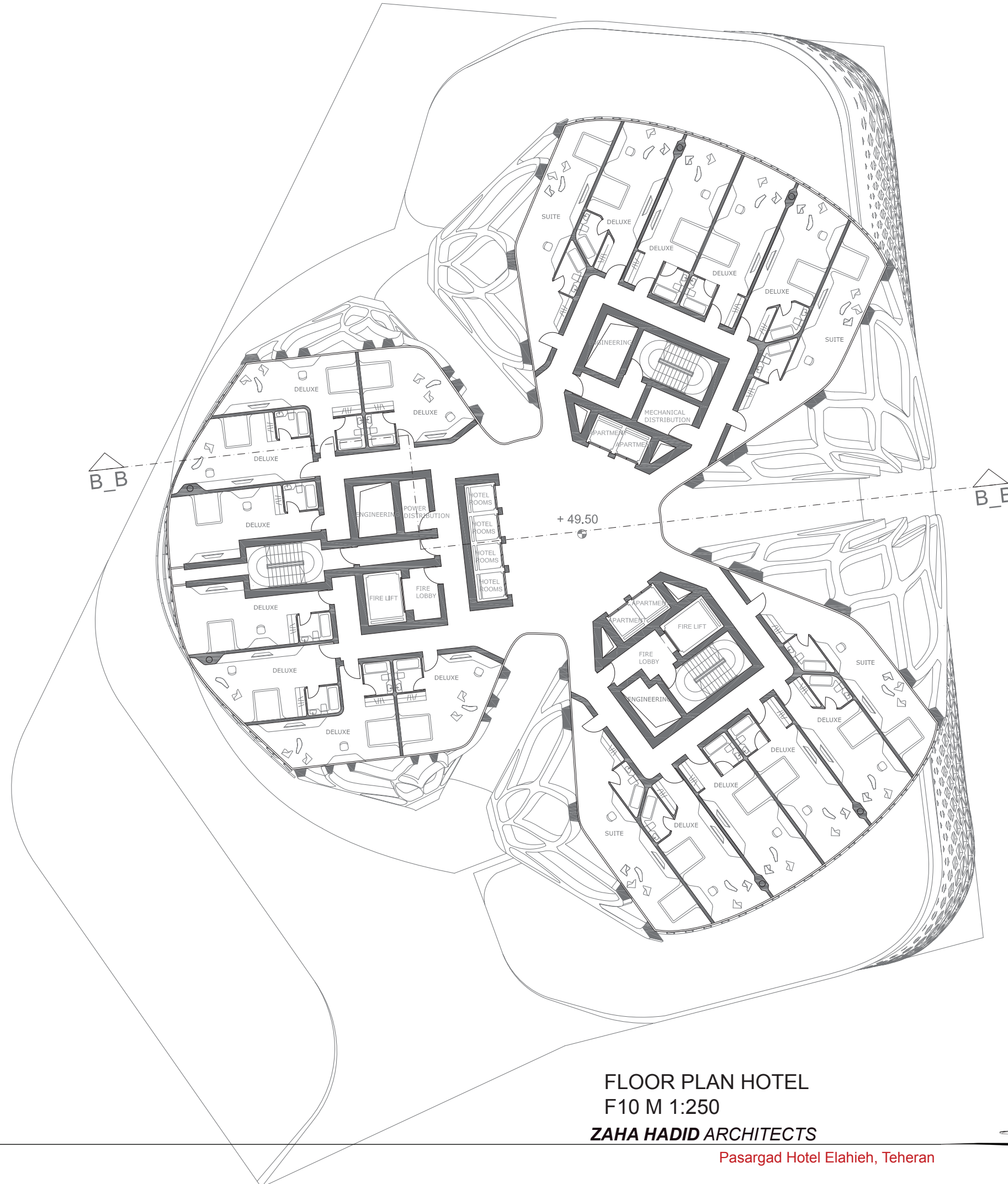


FLOORPLAN HOTEL
F3 M 1:500

ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran

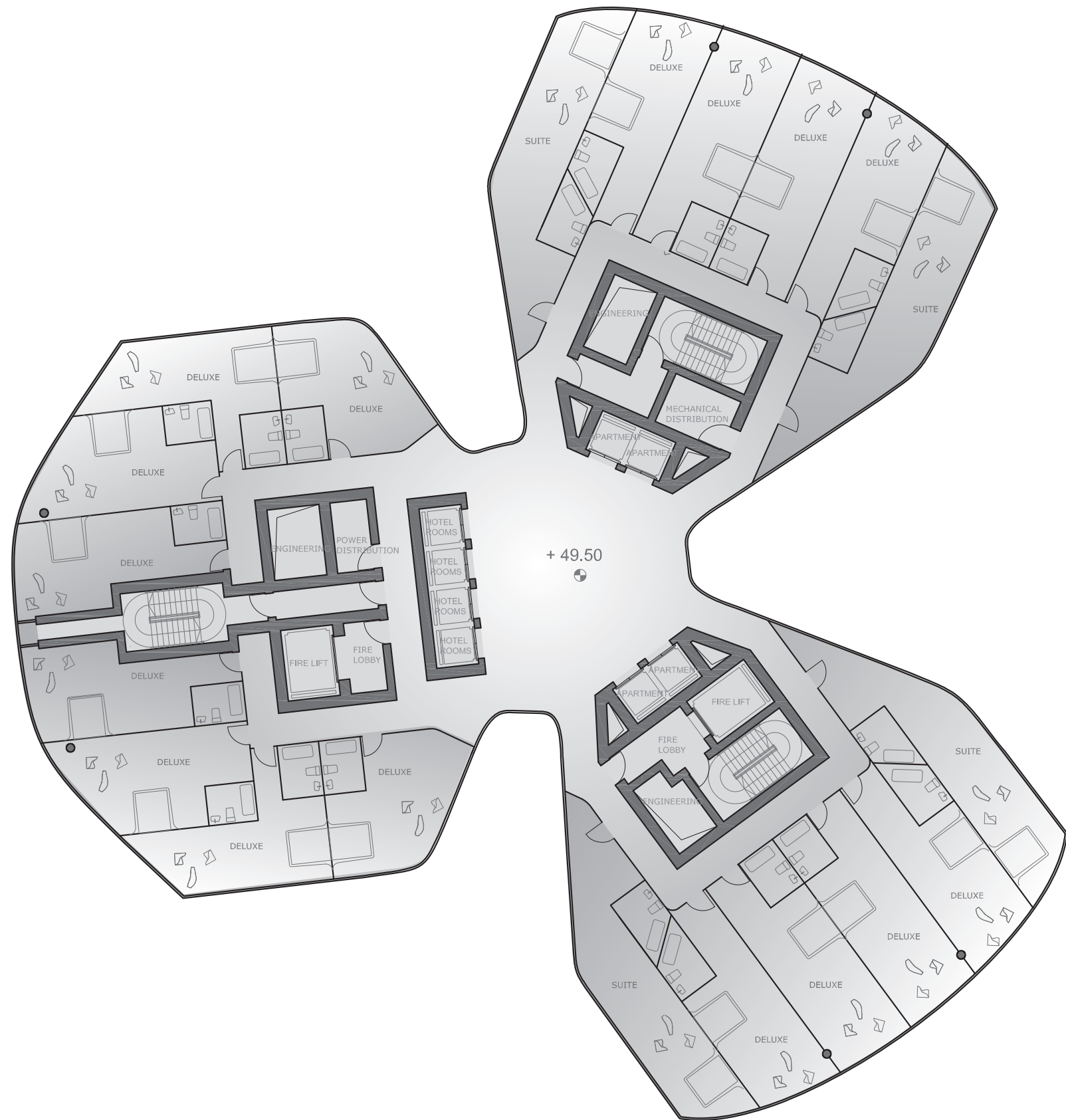




FLOOR PLAN HOTEL
F10 M 1:250
ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran





FLOOR PLAN HOTEL
F12 M 1:250

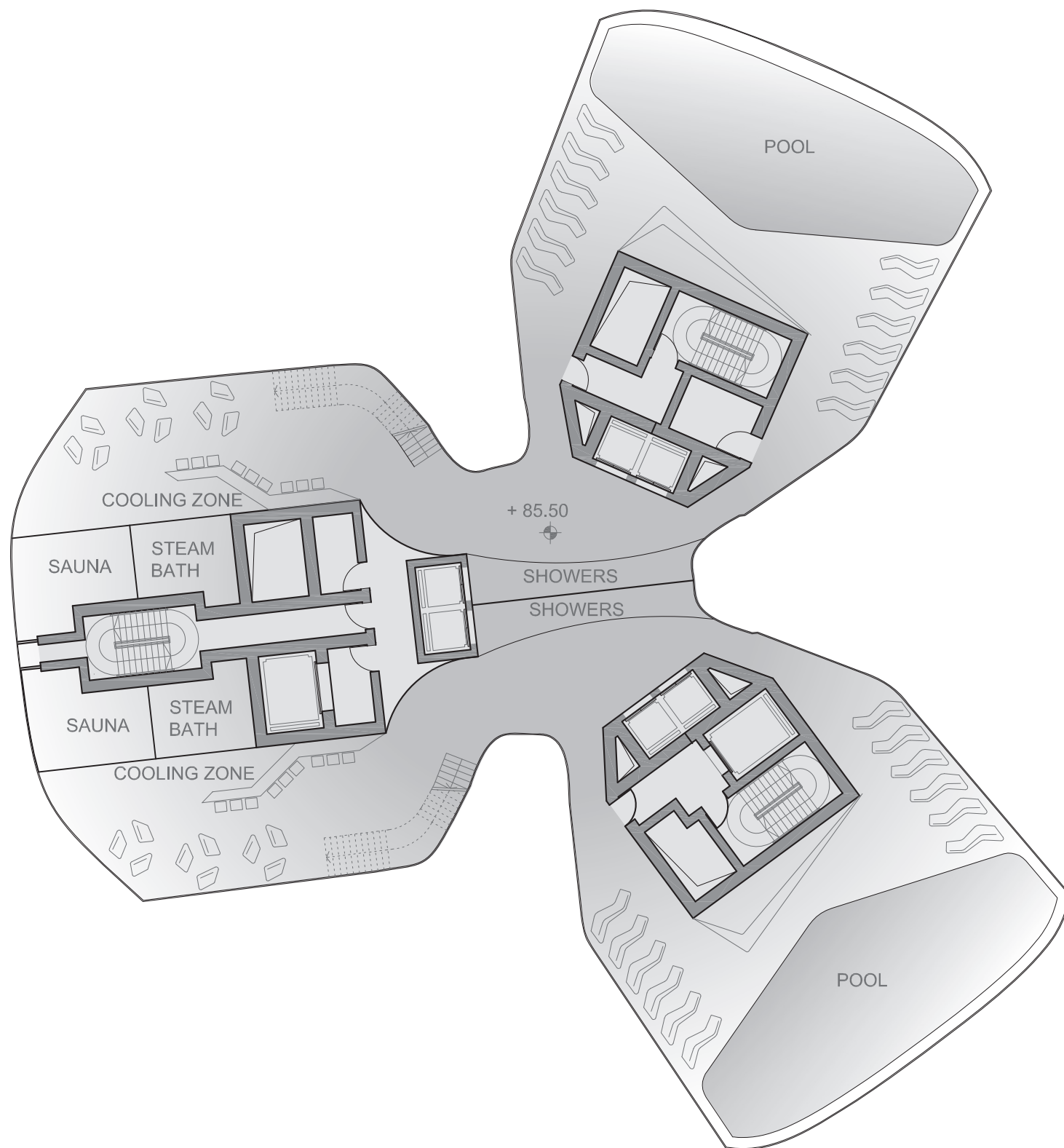




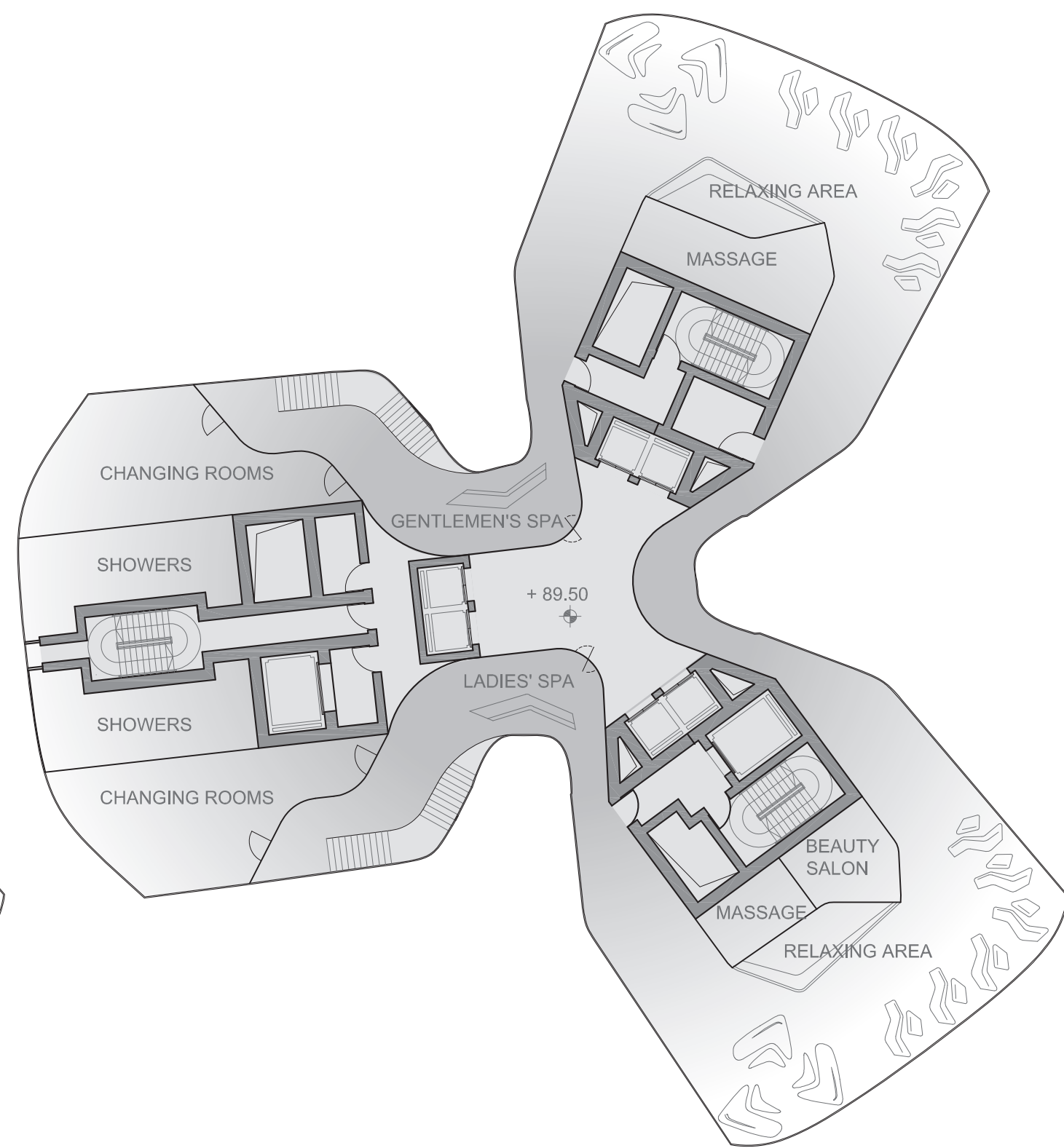
ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran



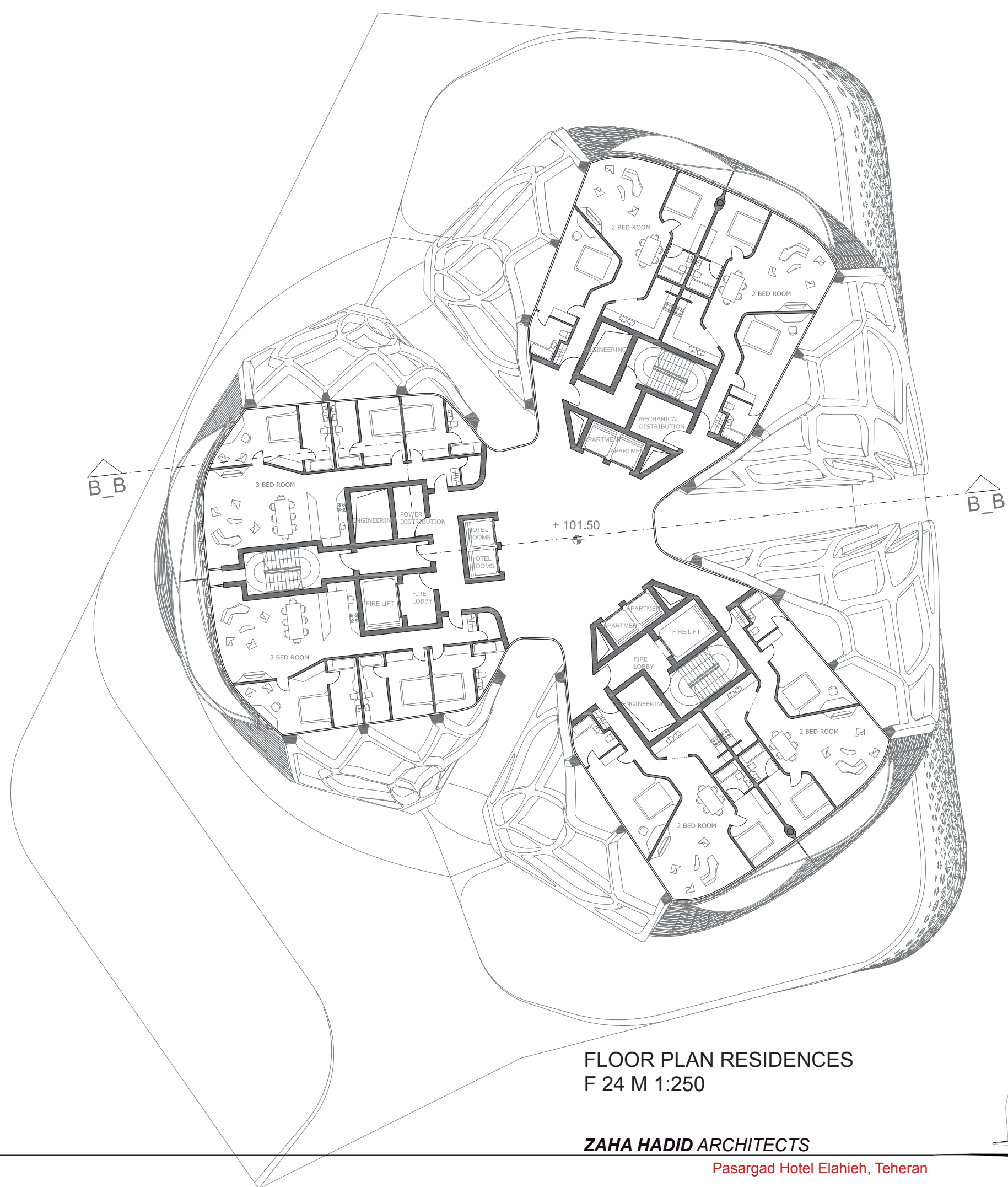


FLOOR PLAN SPA
F 20 M 1:500



FLOOR PLAN SPA
F 21 M 1:500



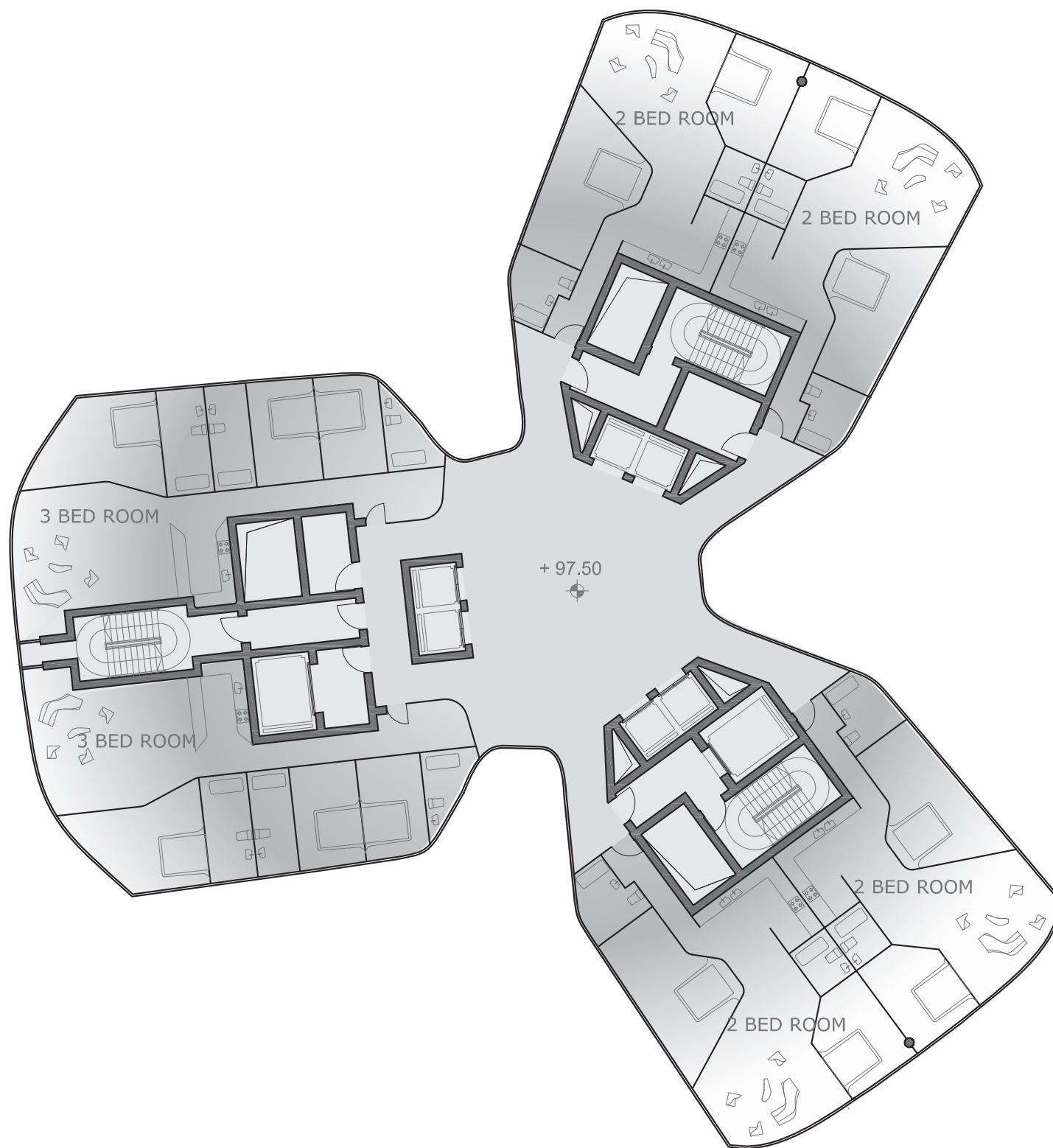


FLOOR PLAN RESIDENCES
F 24 M 1:250

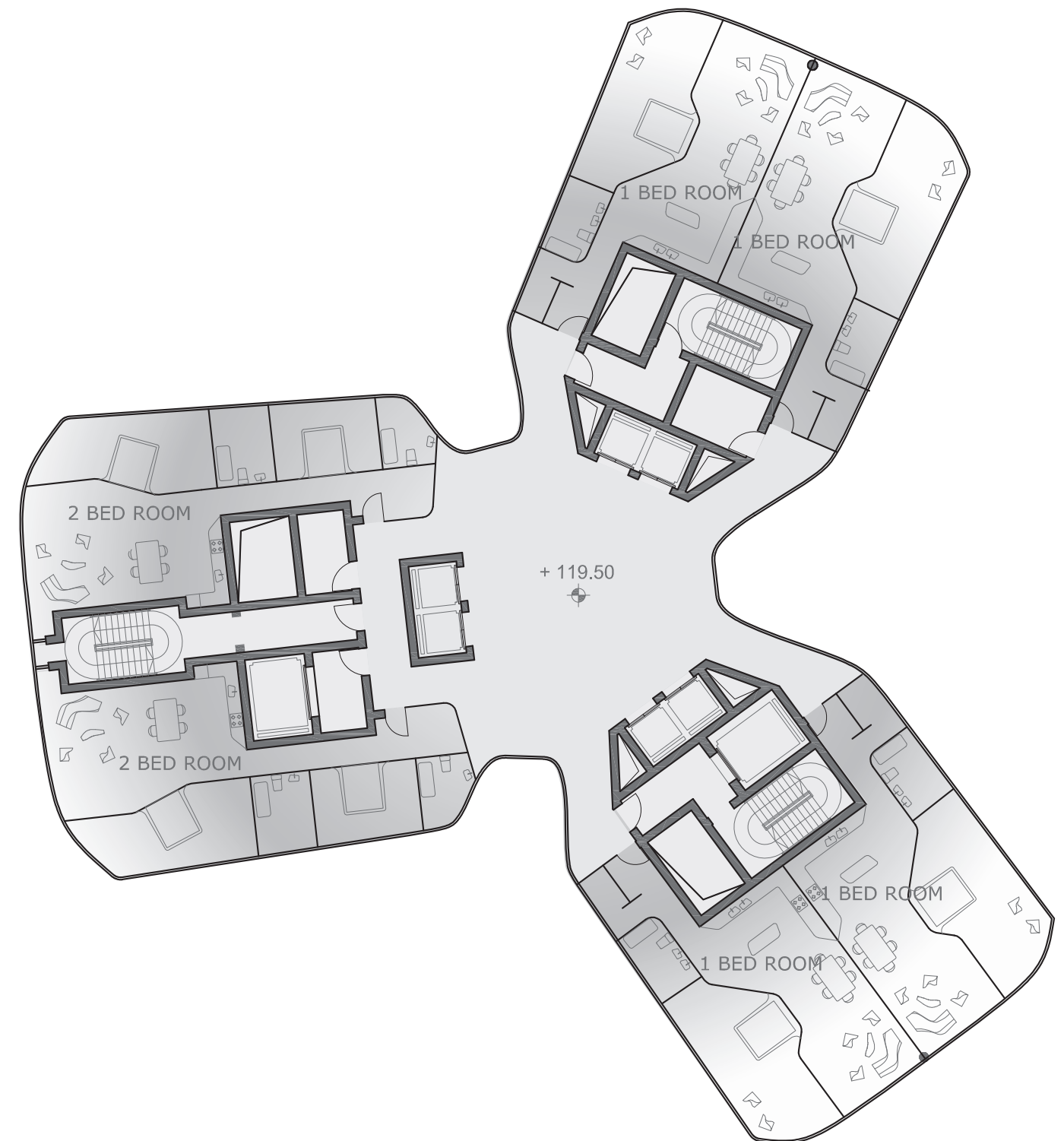
ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran





FLOOR PLAN SERVICED APARTMENTS
F 24 M 1:250



FLOOR PLAN SERVICED APARTMENTS
F 32 M 1:250





PERSPECTIVE HOTEL ROOM

ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran

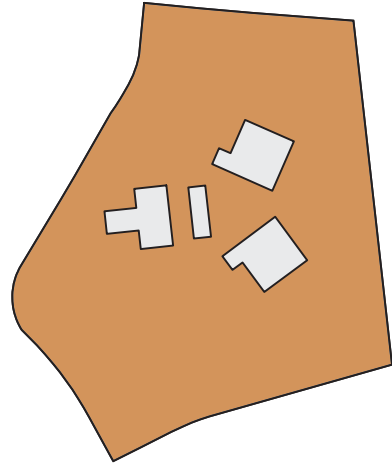


02 ARCHITECTURE/ DESIGN

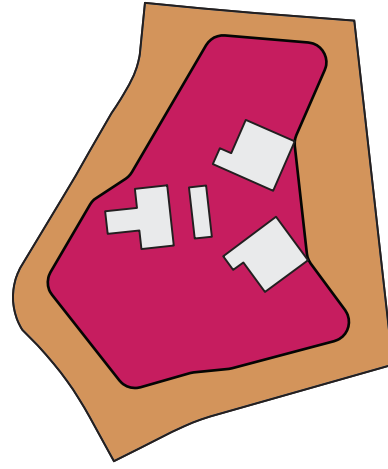
- Site Context
- Mood Boards
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- Circulation
- Program Distribution
- Drawings
- Layout - Floorplates



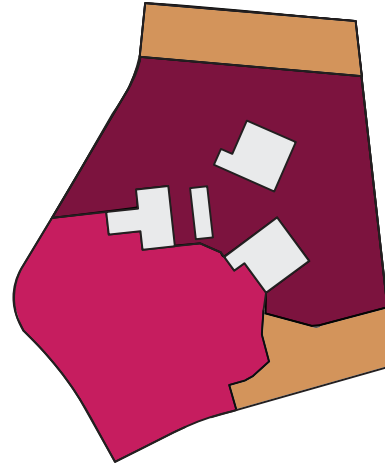
Level -05
GFA: 3722m²
Use: Natural Parking



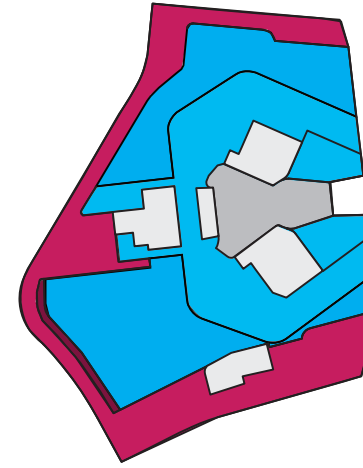
Level -08
GFA: 3722m²
Use: Natural Parking/Shop Storage



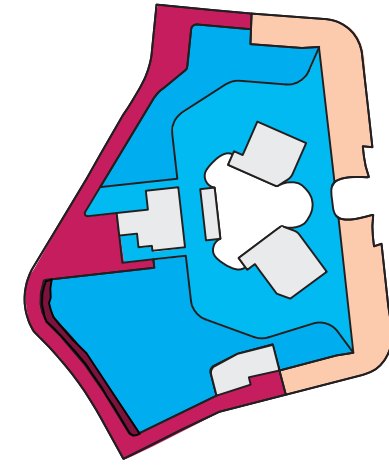
Level -07
GFA: 3722m²
Use: Hotel Service/Technical Area



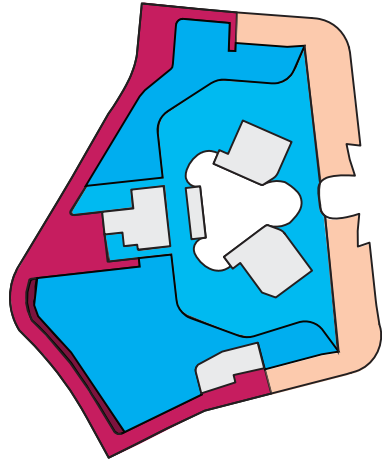
Level -06
GFA: 3485m²
Use: Retail, Podium Lobby



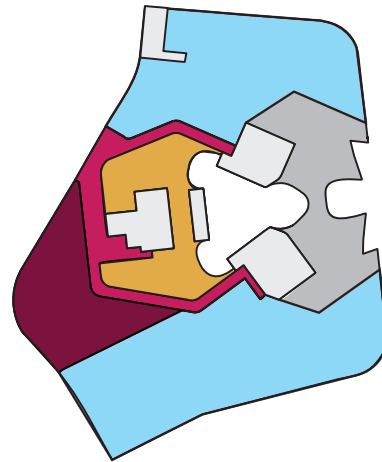
Level -05
GFA: 3509m²
Use: Retail, F&B



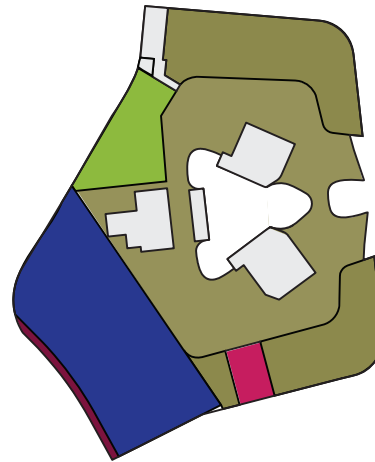
Level -04
GFA: 3535m²
Use: Retail, F&B



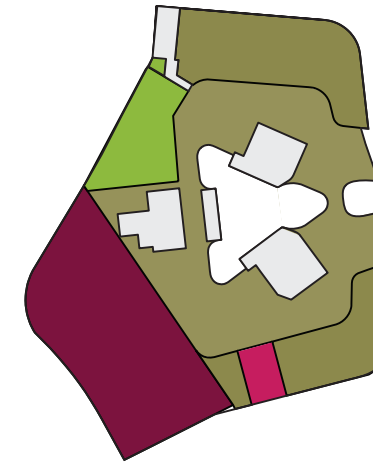
Level -03
GFA: 3571m²
Use: Fitness, Technical Area



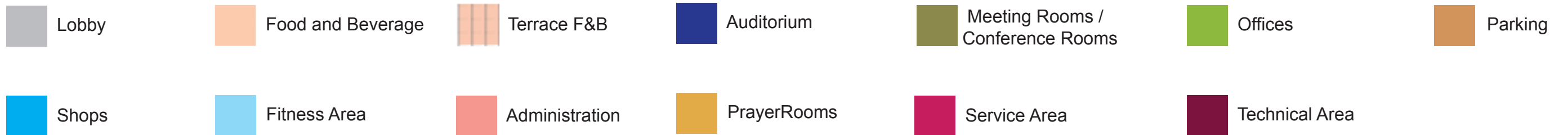
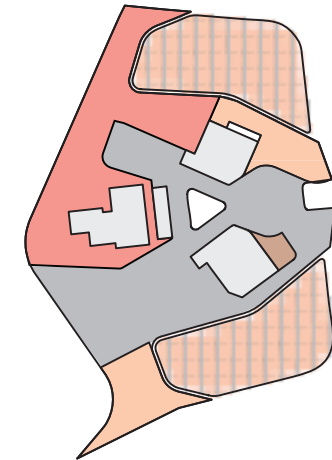
Level -02
GFA: 3645m²
Use: Convention Center (Auditorium)



Level -01
GFA: 3652m²
Use: Convention Center, Technical Area



Level 00
GFA: 2115m²
Use: Hotel Lobby, F&B, Administration

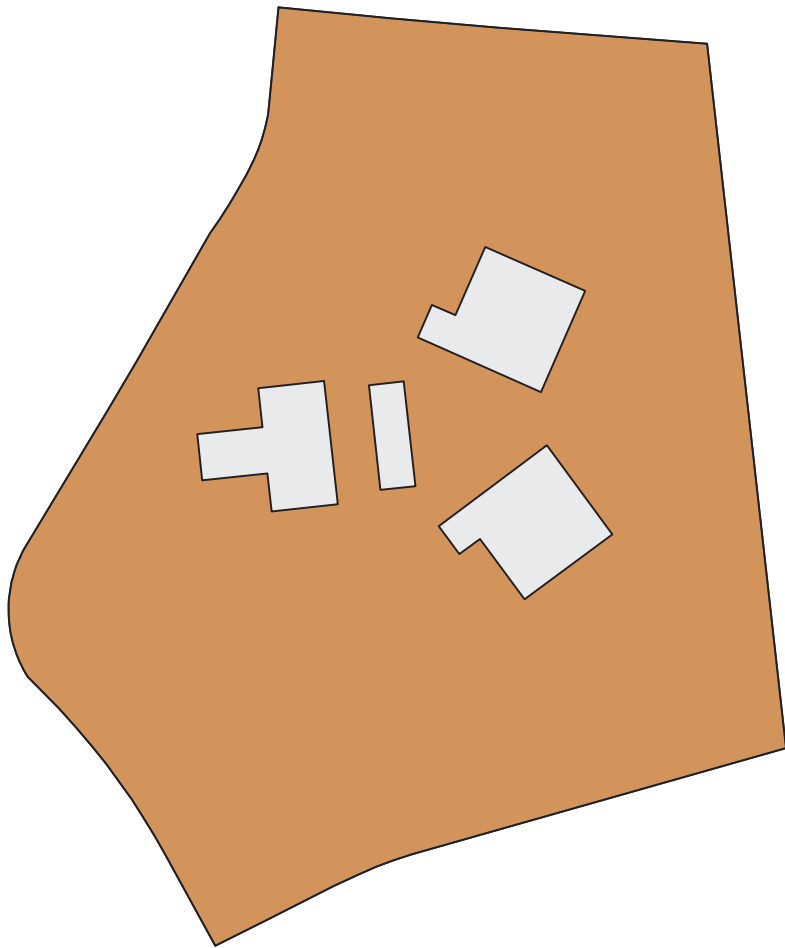


ZAHA HADID ARCHITECTS

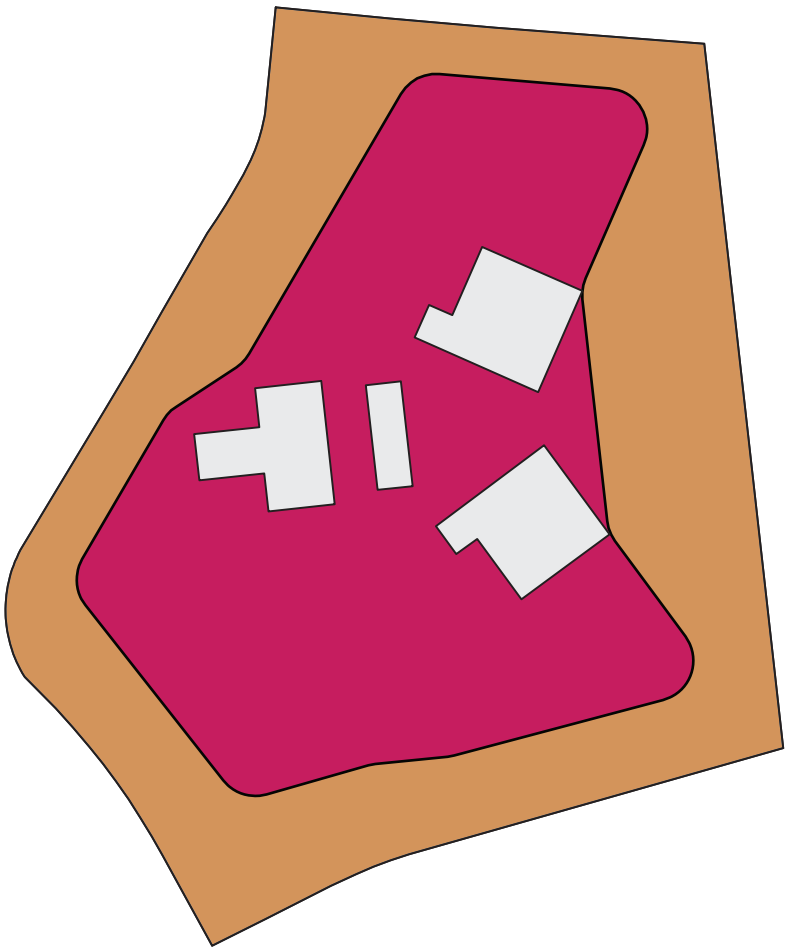
Pasargad Hotel Elahieh, Teheran



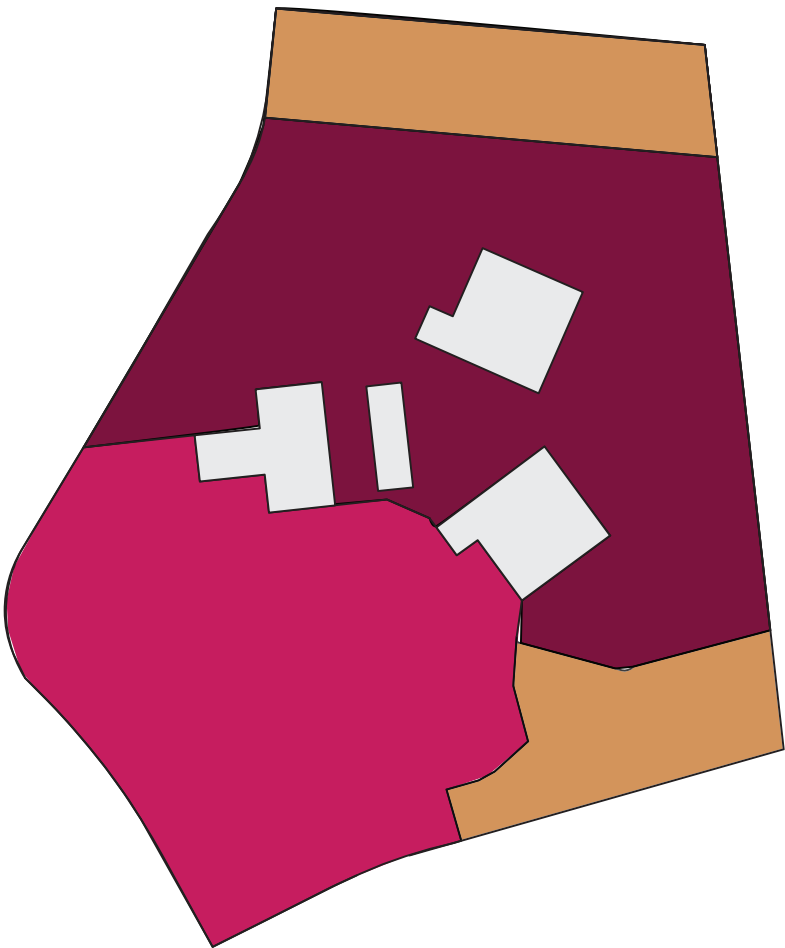
Level -05
GFA: 3722m²
Use: Natural Parking



Level -08
GFA: 3722m²
Use: Natural Parking/Shop Storage



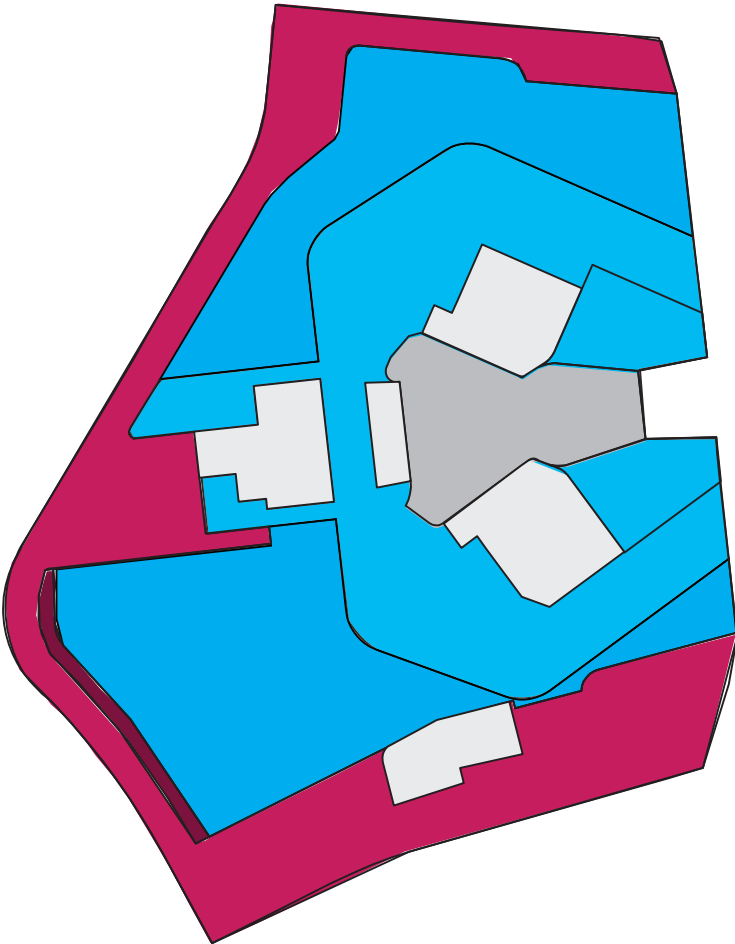
Level -07
GFA: 3722m²
Use: Hotel Service/Technical Area



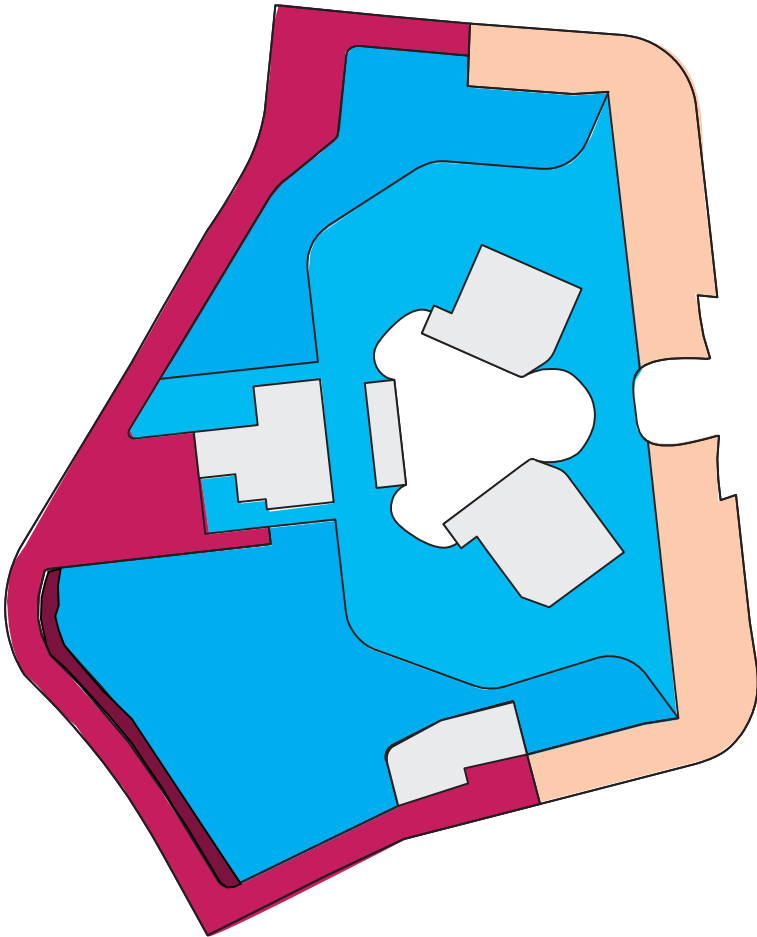
- | | | | | | | |
|-------|-------------------|----------------|-------------|----------------------------------|----------------|---------|
| Lobby | Food and Beverage | Terrace F&B | Auditorium | Meeting Rooms / Conference Rooms | Offices | Parking |
| Shops | Fitness Area | Administration | PrayerRooms | Service Area | Technical Area | |



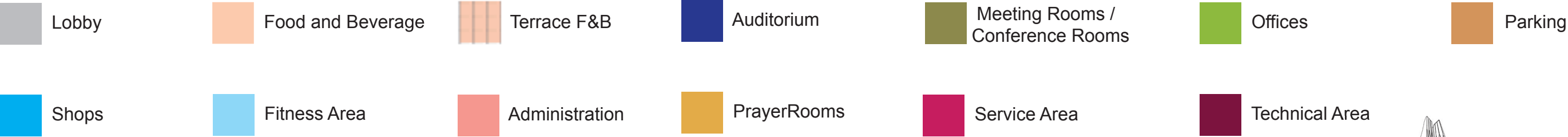
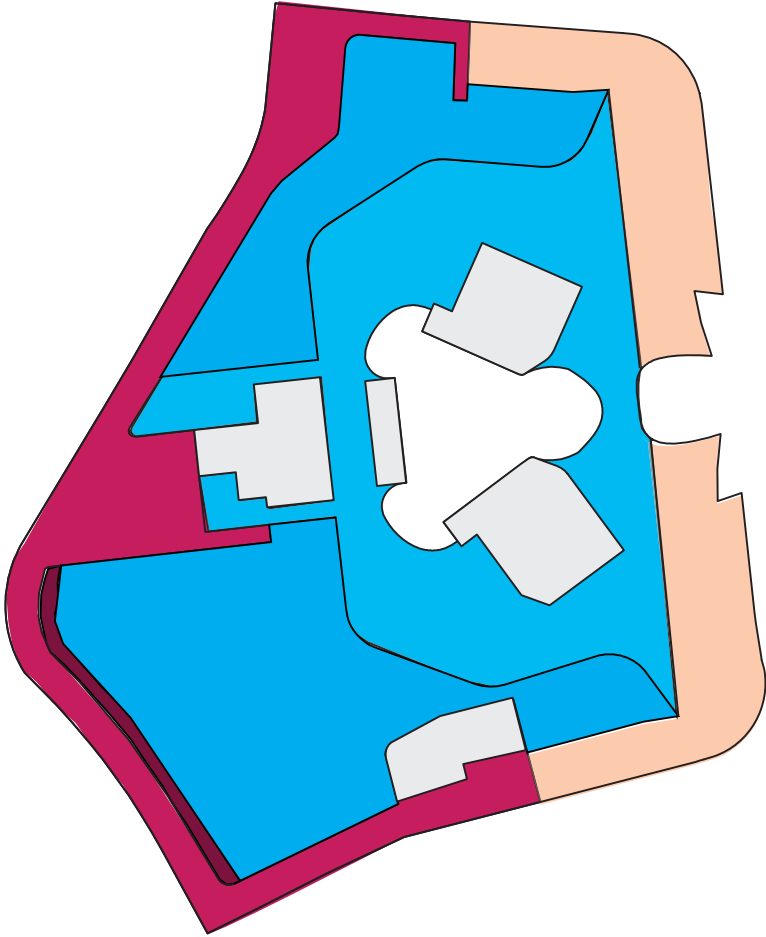
Level -06
GFA: 3485m²
Use: Retail, Podium Lobby



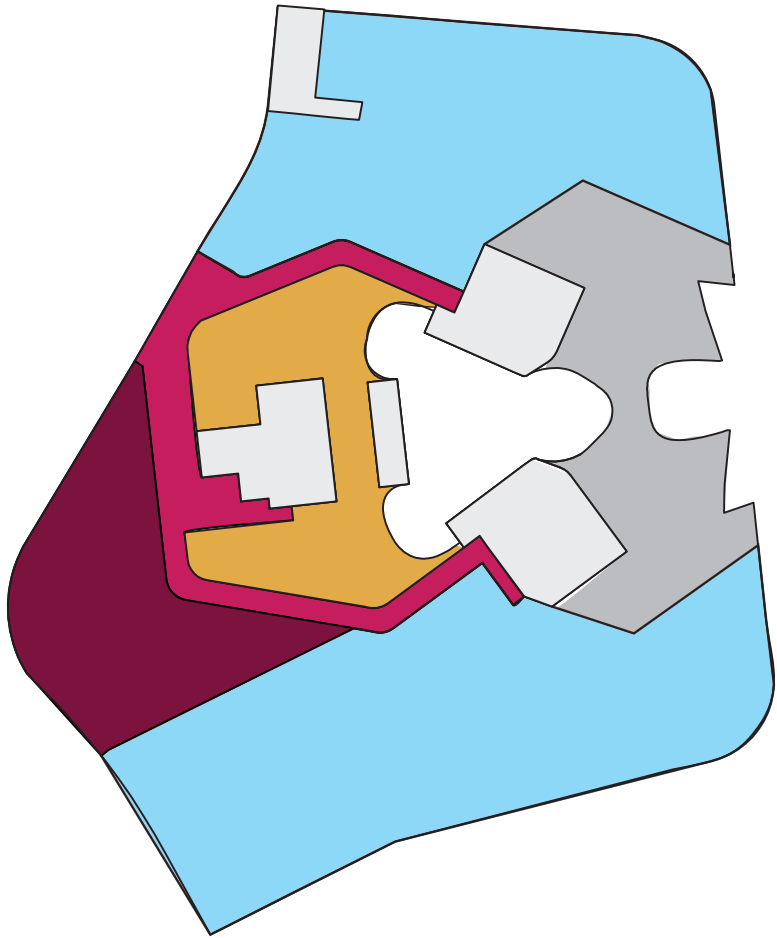
Level -05
GFA: 3509m²
Use: Retail, F&B



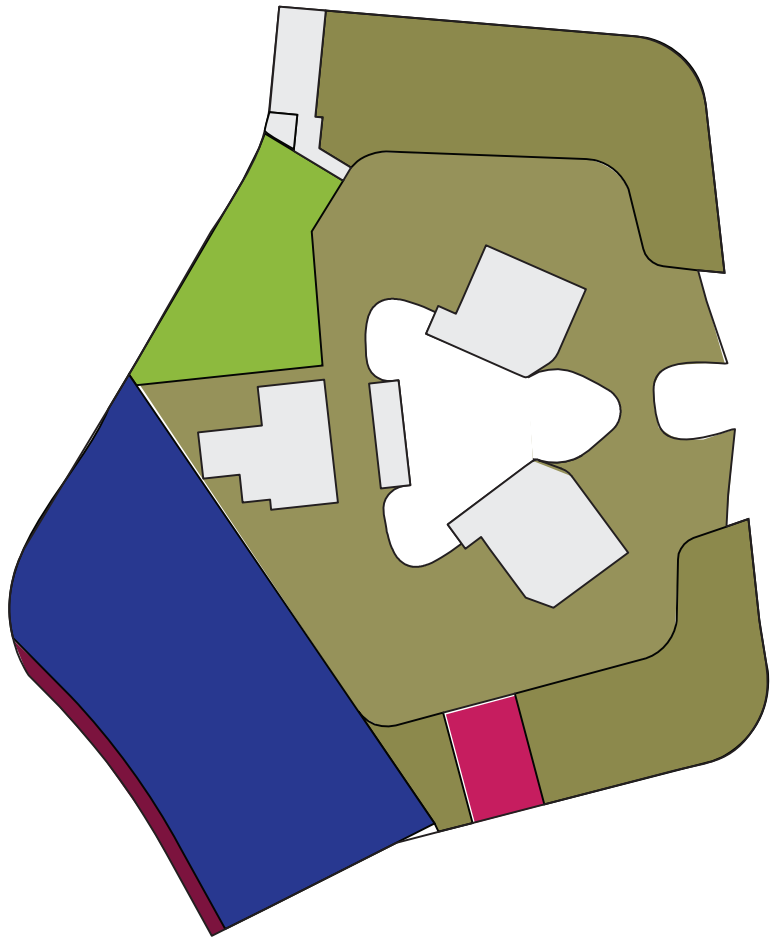
Level -04
GFA: 3535m²
Use: Retail, F&B



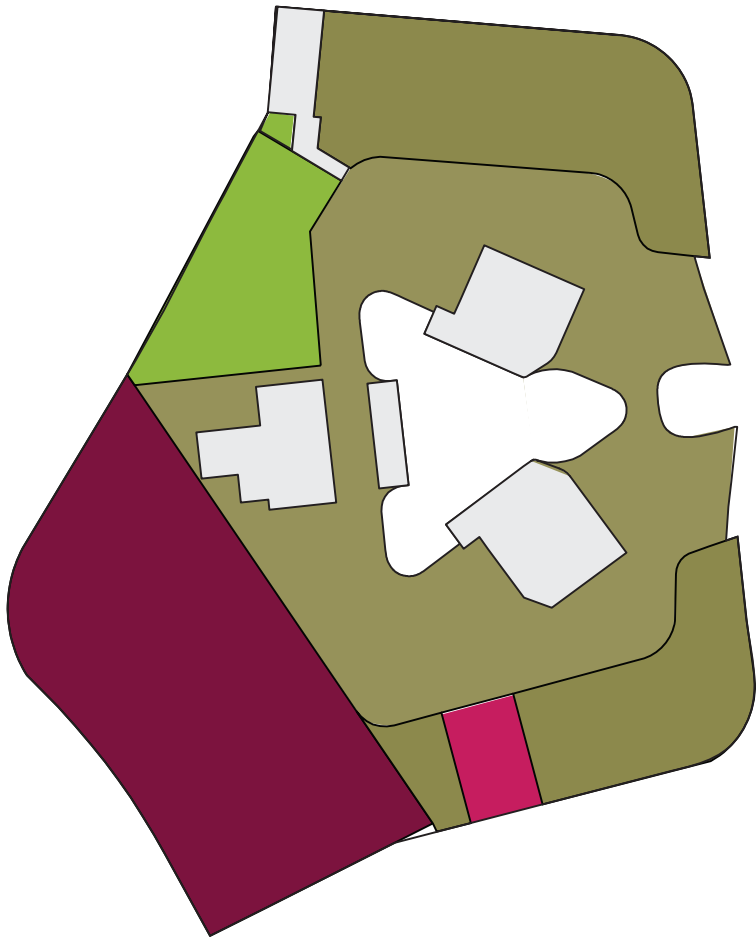
Level -03
GFA: 3571m²
Use: Fitness, Technical Area



Level -02
GFA: 3545m²
Use: Convention Center (Auditorium)



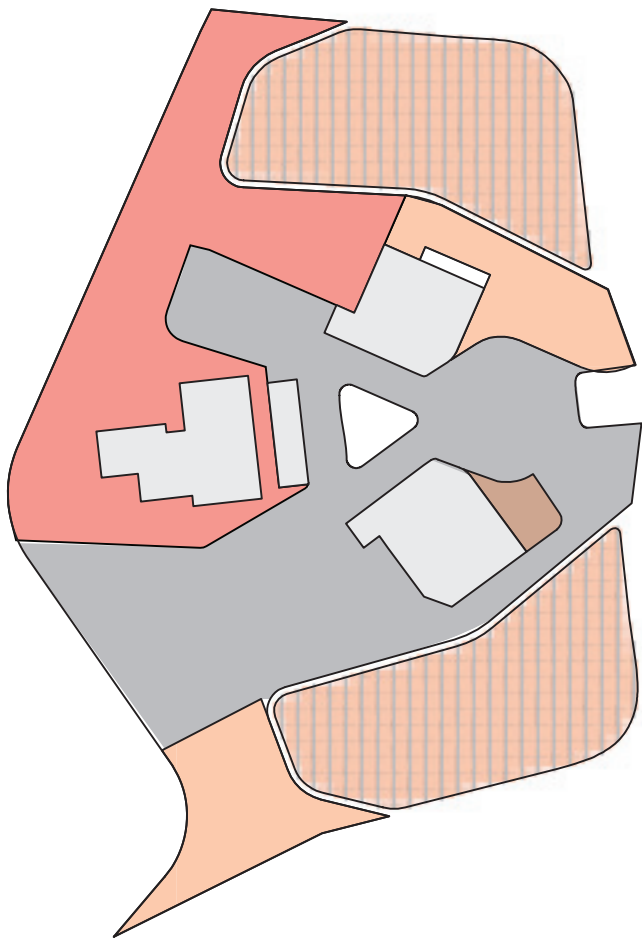
Level -01
GFA: 3652m²
Use: Convention Center, Technical Area



- | | | | | | | |
|---|---|---|---|--|--|---|
|  Lobby |  Food and Beverage |  Terrace F&B |  Auditorium |  Meeting Rooms / Conference Rooms |  Offices |  Parking |
|  Shops |  Fitness Area |  Administration |  PrayerRooms |  Service Area |  Technical Area | |



Level 00
GFA: 2115m²
Use: Hotel Lobby, F&B, Administration



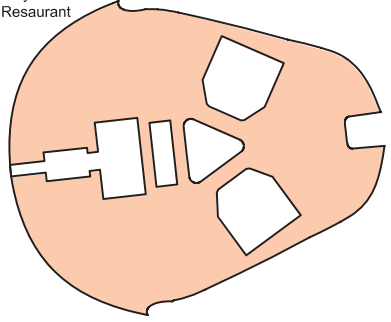
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|---|---|---|---|--|--|---|
|  Lobby |  Food and Beverage |  Terrace F&B |  Auditorium |  Meeting Rooms / Conference Rooms |  Offices |  Parking |
|  Shops |  Fitness Area |  Administration |  PrayerRooms |  Service Area |  Technical Area | |

ZAHA HADID ARCHITECTS

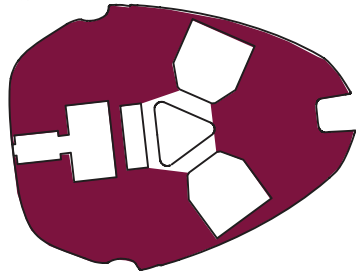
Pasargad Hotel Elahieh, Teheran



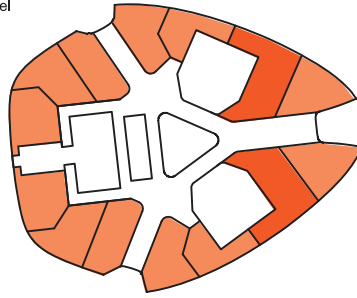
Level +01
GFA: 1637m²
Efficiency: 83%
Use: Restaurant



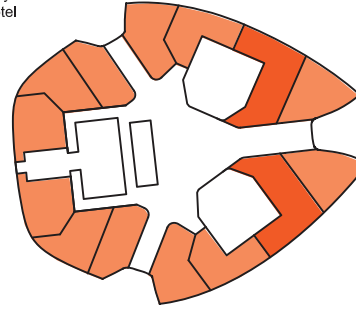
Level +02
GFA: 1329m²
Efficiency: 79%
Use: Technical



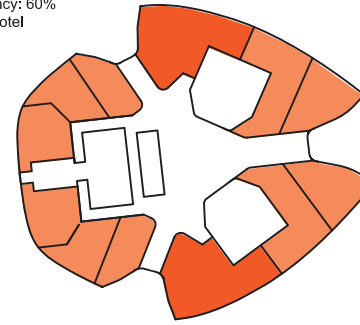
Level +03
GFA: 1391m²
Efficiency: 62%
Use: Hotel



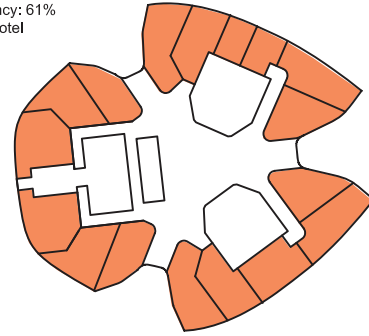
Level +04
GFA: 1430m²
Efficiency: 62%
Use: Hotel



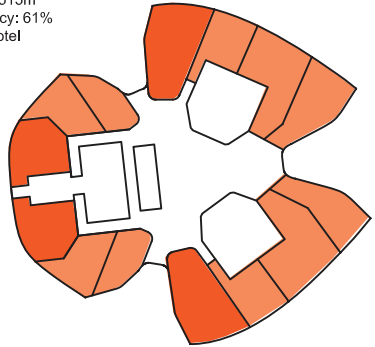
Level +05
GFA: 1462m²
Efficiency: 60%
Use: Hotel



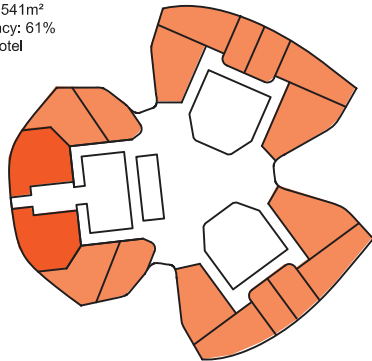
Level +06
GFA: 1490m²
Efficiency: 61%
Use: Hotel



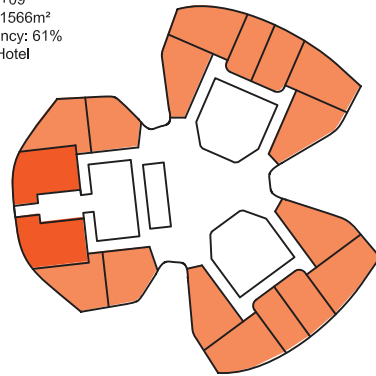
Level +07
GFA: 1515m²
Efficiency: 61%
Use: Hotel



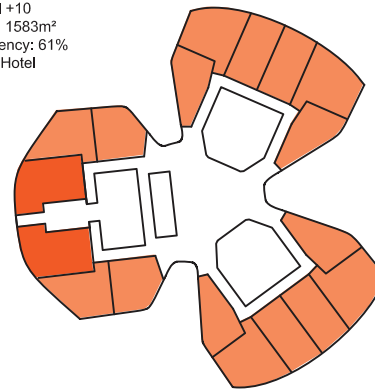
Level +08
GFA: 1541m²
Efficiency: 61%
Use: Hotel



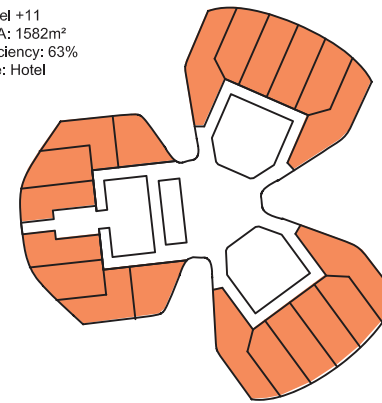
Level +09
GFA: 1566m²
Efficiency: 61%
Use: Hotel



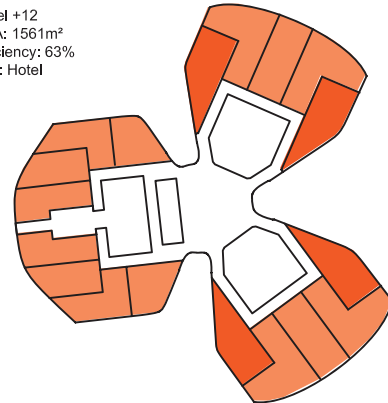
Level +10
GFA: 1583m²
Efficiency: 61%
Use: Hotel



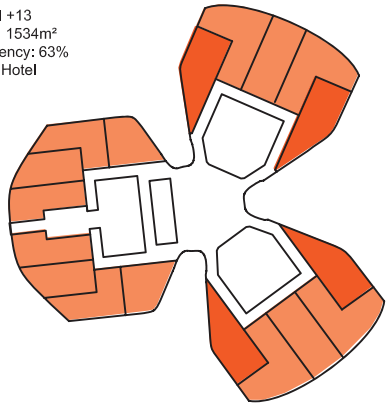
Level +11
GFA: 1582m²
Efficiency: 63%
Use: Hotel



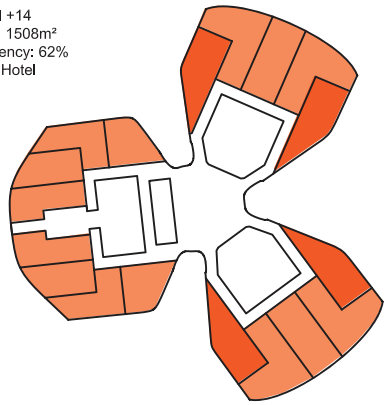
Level +12
GFA: 1561m²
Efficiency: 63%
Use: Hotel



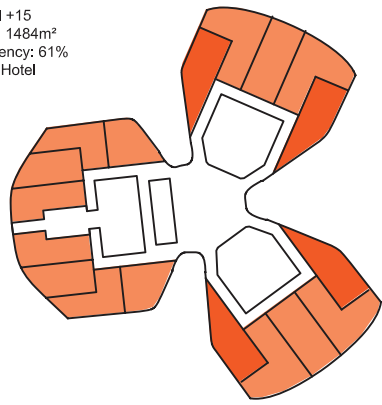
Level +13
GFA: 1534m²
Efficiency: 63%
Use: Hotel



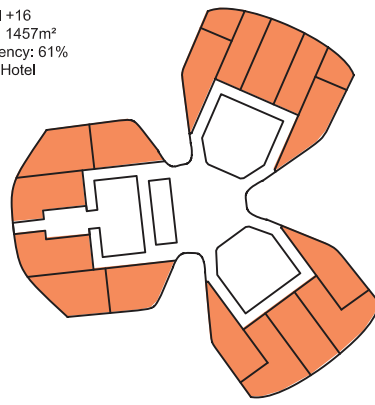
Level +14
GFA: 1508m²
Efficiency: 62%
Use: Hotel



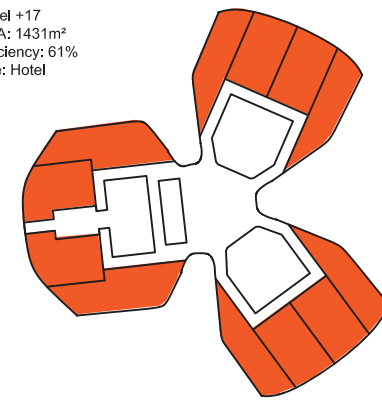
Level +15
GFA: 1484m²
Efficiency: 61%
Use: Hotel



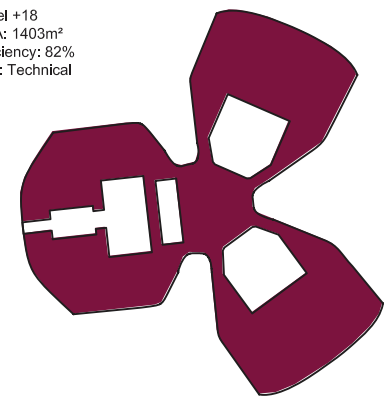
Level +16
GFA: 1457m²
Efficiency: 61%
Use: Hotel



Level +17
GFA: 1431m²
Efficiency: 61%
Use: Hotel



Level +18
GFA: 1403m²
Efficiency: 82%
Use: Technical



Food & Beverage



Spa



Technical



1 Bedroom



2 Bedroom



3 Bedroom



Deluxe

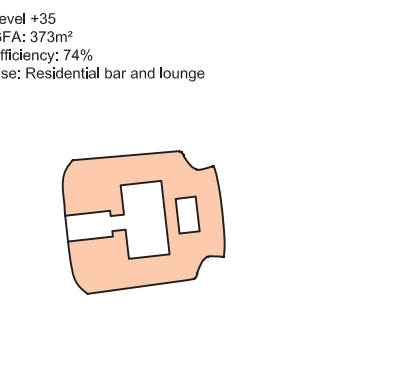
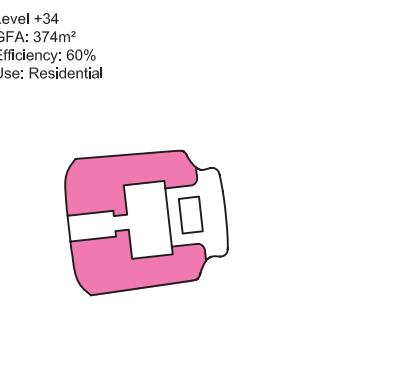
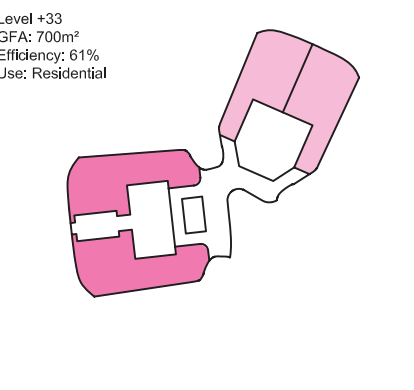
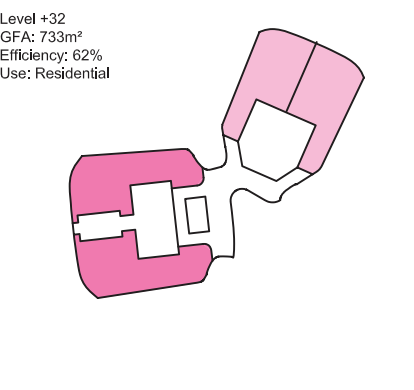
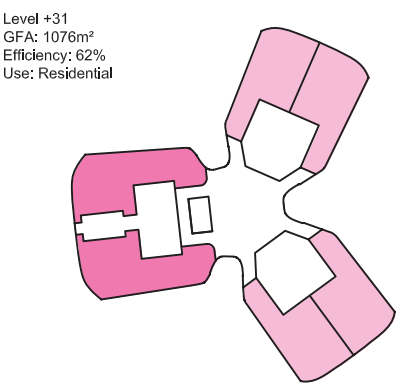
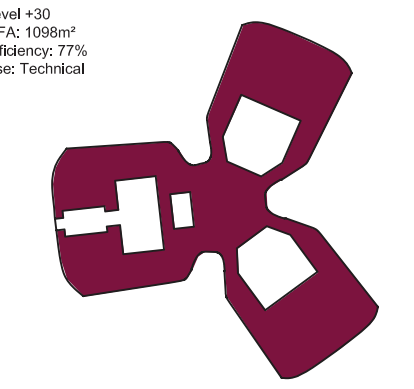
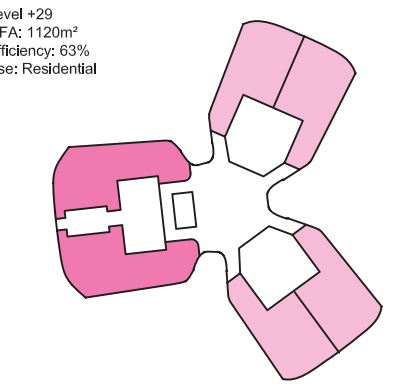
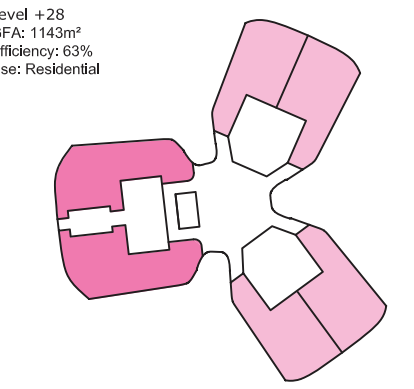
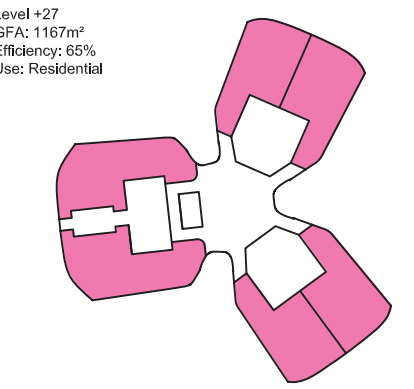
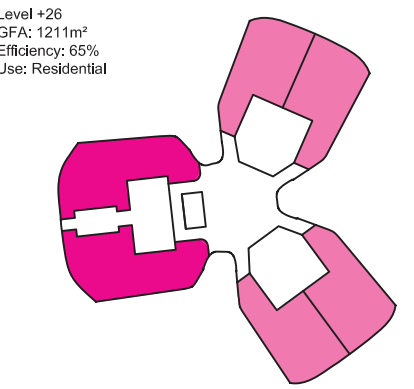
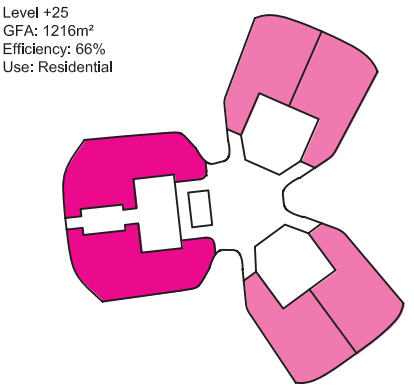
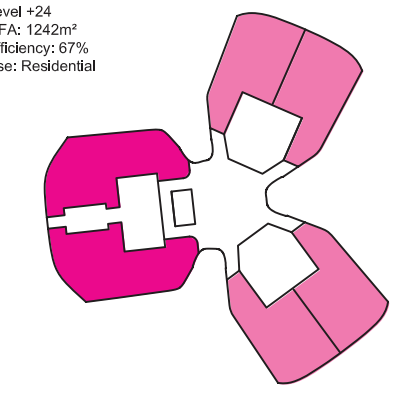
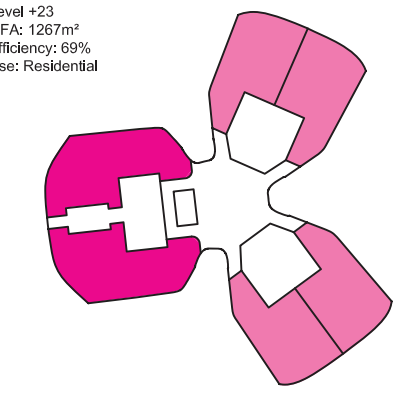
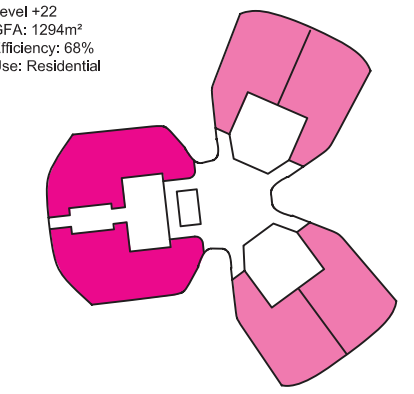
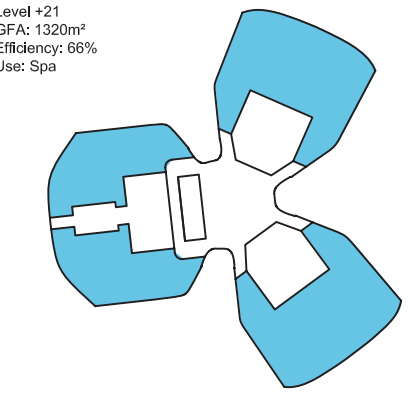
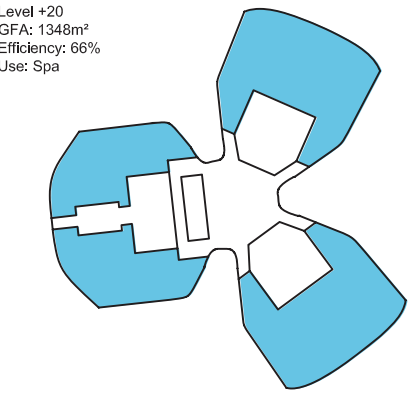
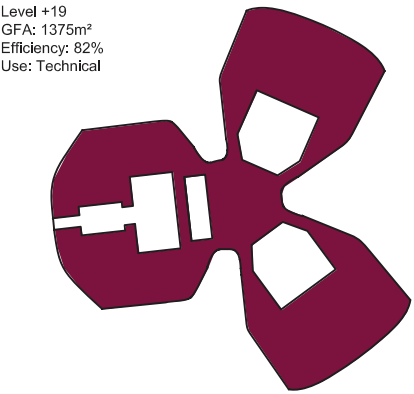


Suite

ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran





Food & Beverage

Spa

Technical

1 Bedroom

2 Bedroom

3 Bedroom

Deluxe

Suite

ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran

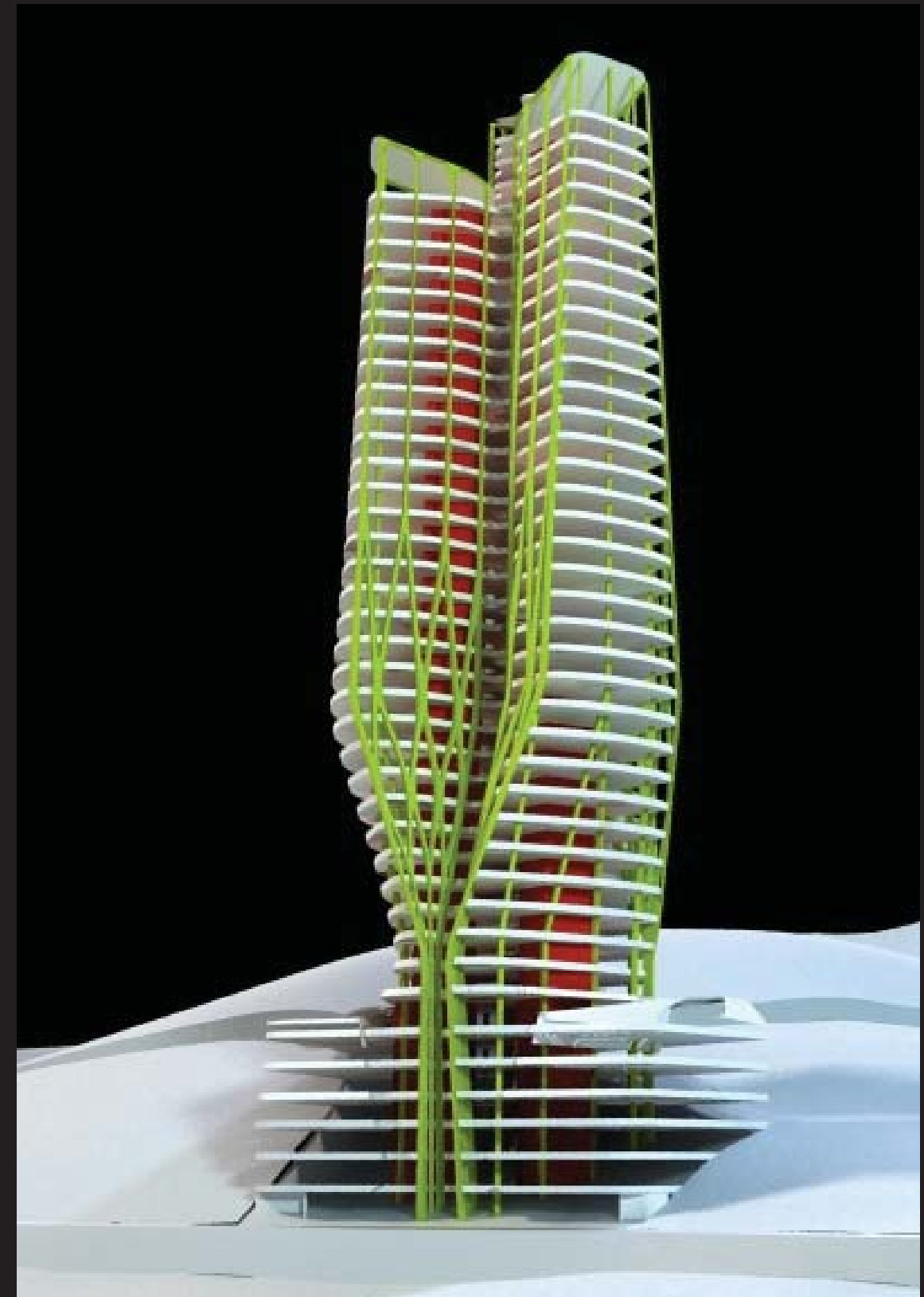


03 TECHNICAL DESIGN

- Structural Engineering
- Facade
- MEP Services
- Fire Prevention
- Sustainability and Lighting



Pasargad Hotel Elahieh, Teheran Structural Engineering



Pasargad Hotel Elahieh, Teheran

Structural Engineering

WRDNRZ 803MML .

Content

1. Introduction and Project Description
2. Codes and Loadings
3. Structural System
 - General Remarks
 - Lateral Load Resisting System
 - Columns
 - Slabs
 - Foundation
4. Construction Phases

1. Introduction and Project Description

The Pasargad Hotel Elahieh Project in Teheran is an appr. 160m high rise building.

In addition to the 35 tower levels used as hotel and residential apartment floors, 6 retail as well as congress levels and 10 parking basement levels are part of the building.

Level utilization of the tower:

Level +24 - +35: Apartments

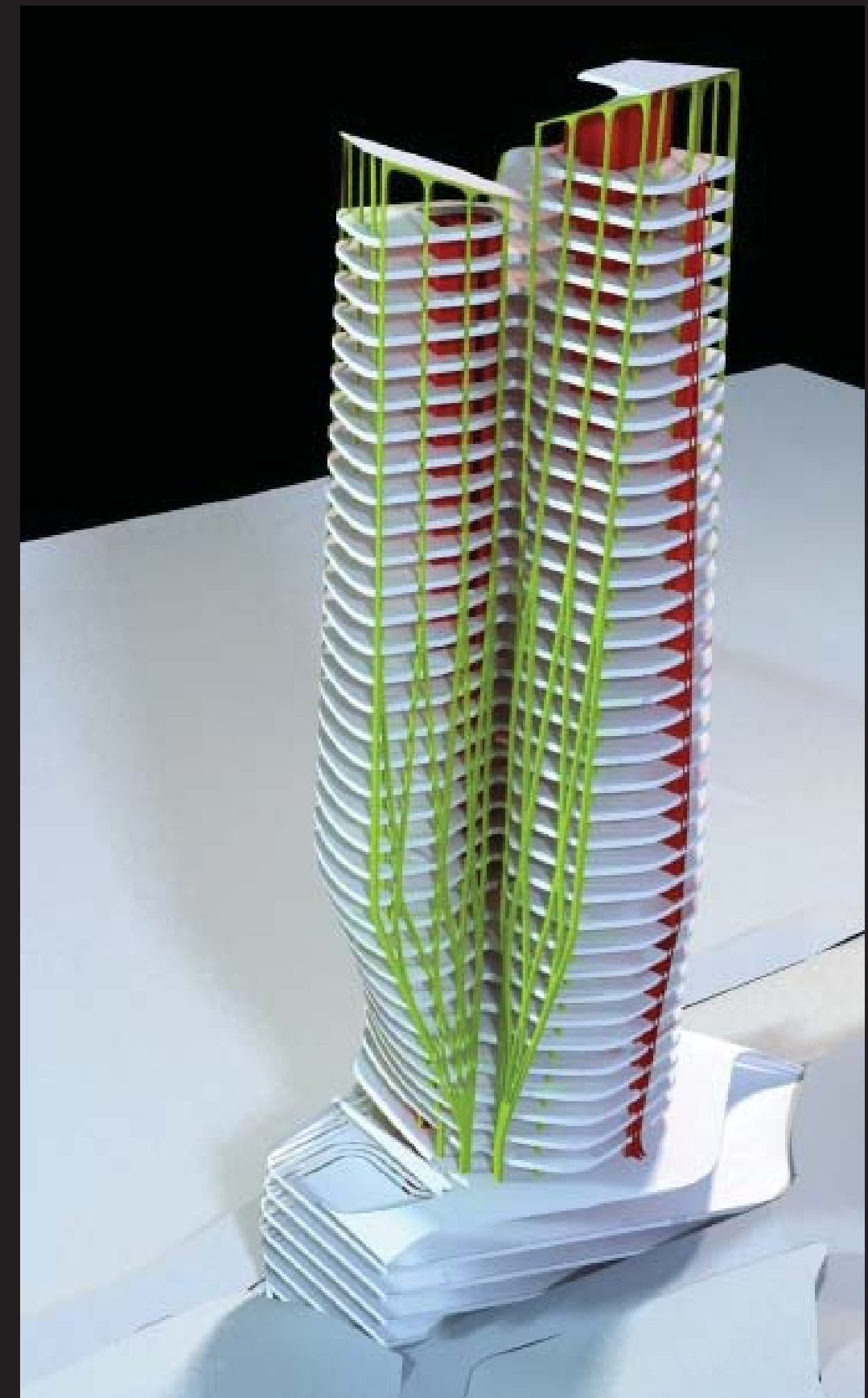
Level +21 - +23: Spa

Level +00 - +20: Hotel

Level -06 - -01: Retail area, fitness, congress

Level -16 - -07: Parking area

WR2NR2 503M .



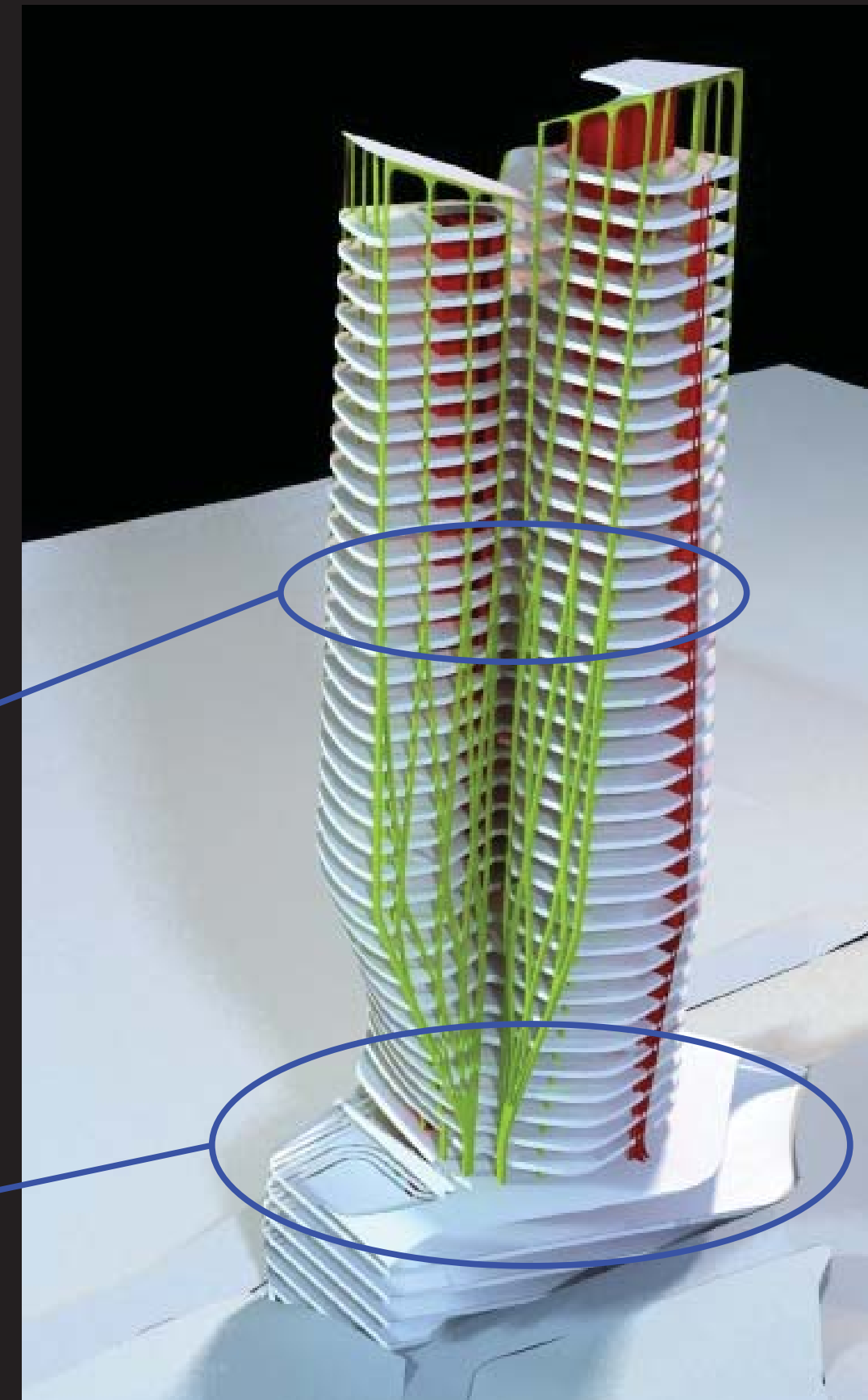
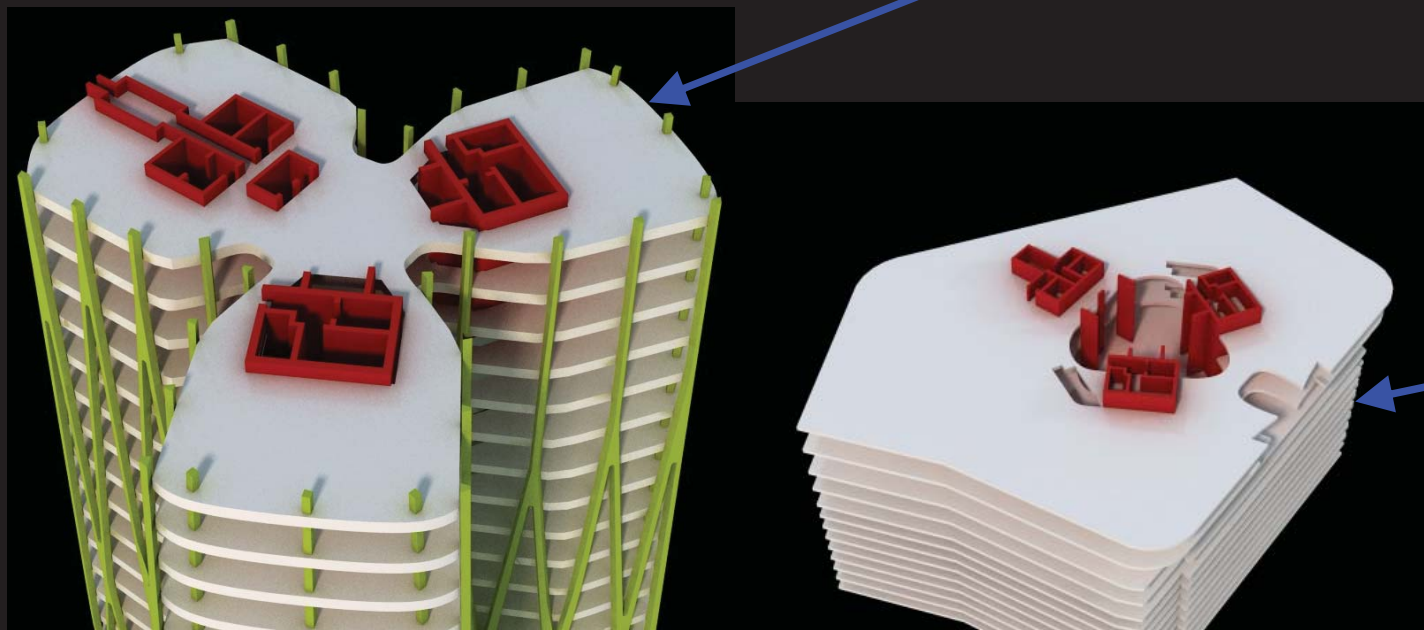
Structural Engineering

1. Introduction and Project Description

The design of floor plans changes significantly from basement up to the roof level.

The general height between the floors is 4m for the regular levels. The clearance height will be finally 3m.

The concrete cores are running straight up from the foundation to the upper level of the high-rise building.



WR2NR2 803M2 .

Structural Engineering

2. Codes and Loadings

Codes

As requested by the client, the project is designed in accordance to international standards. For the preliminary structural analyses the latest Euro-Code is taken. In addition, for the seismic resistant design the Iranian Standard No. 2800 (3rd edition) is considered.

Loadings

Dead load:

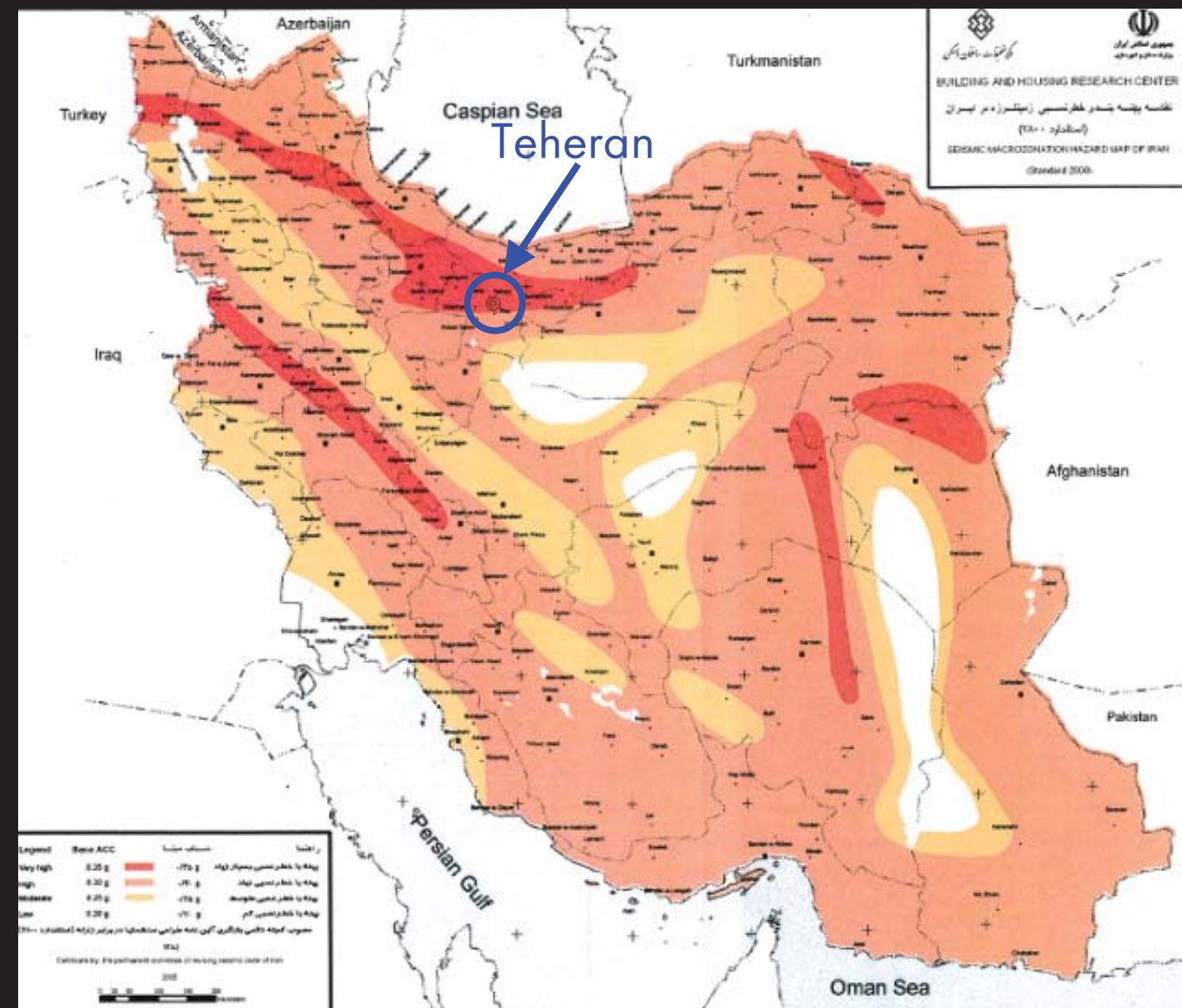
- Reinforced concrete 25kN/m^3
- Structural steel $78,5\text{kN/m}^3$

Live load:

- Residential, hotel $2,0\text{kN/m}^2$
- Wind load $\text{max. } 2,5\text{kN/m}^2$
(wind- & leeward)

Seismicity:

- Seismic relative hazard very high
- Base acceleration $0,35 * g$



Structural Engineering

3. Structural System – General Remarks

General Remarks

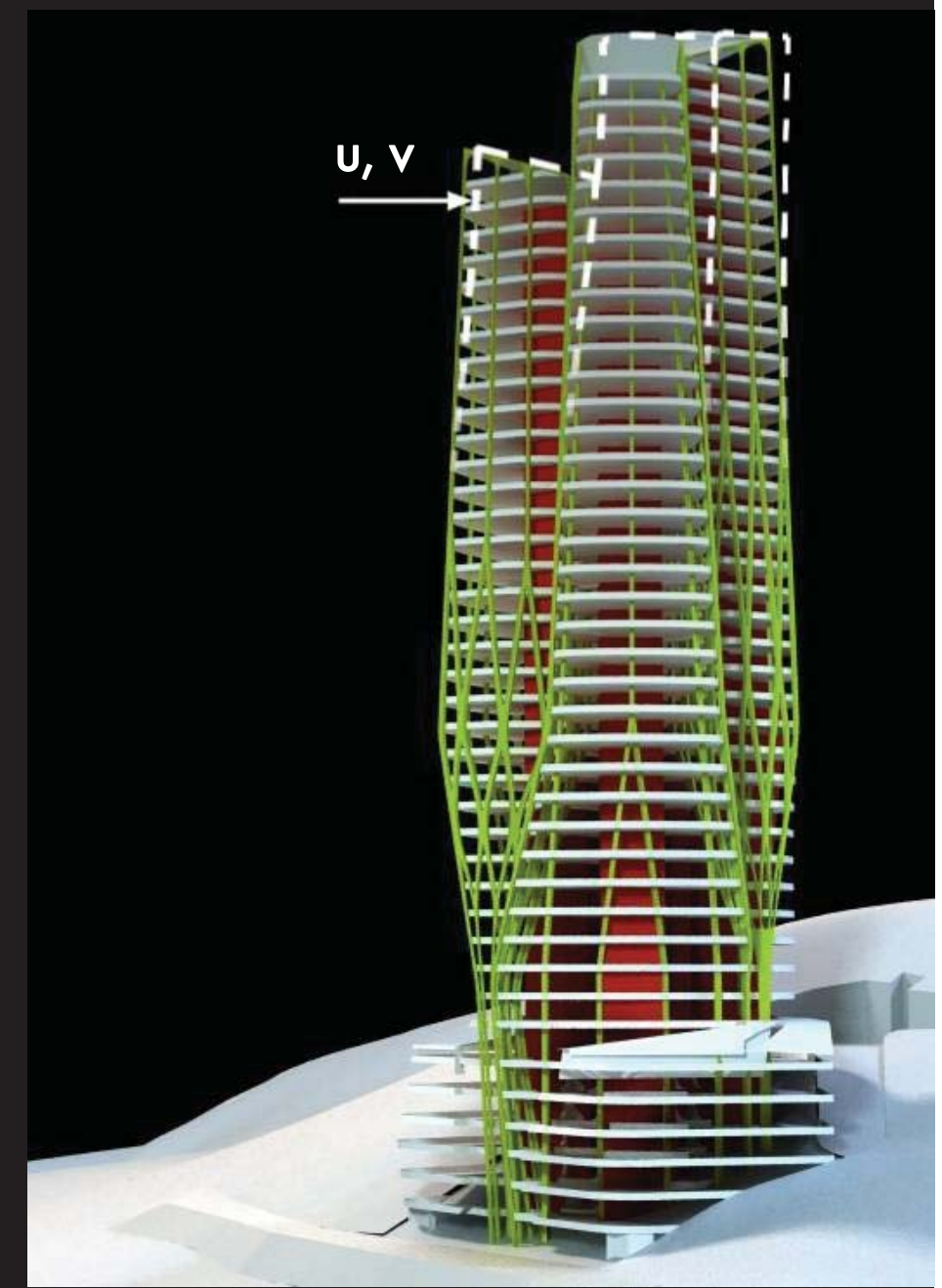
The lateral stiffness of the tower is provided by three concrete cores.

These three concrete cores and columns placed along the building perimeter are transferring vertical loads. The vertical columns are inclined over the building height and partially splitted up or merged in the lower levels.

The Wind Expertise is recommended for the next design phase.

The maximum tip deformation of $1/500$ and the maximum tip acceleration of $0,15 \text{ m/s}^2$ for the residential apartments is ensured.

	Value due to preliminary analyses	Design criteria (max. value)
Tip deformation u	150mm	320mm
Tip acceleration v	$0,11 \text{ m/s}^2$	$0,15 \text{ m/s}^2$

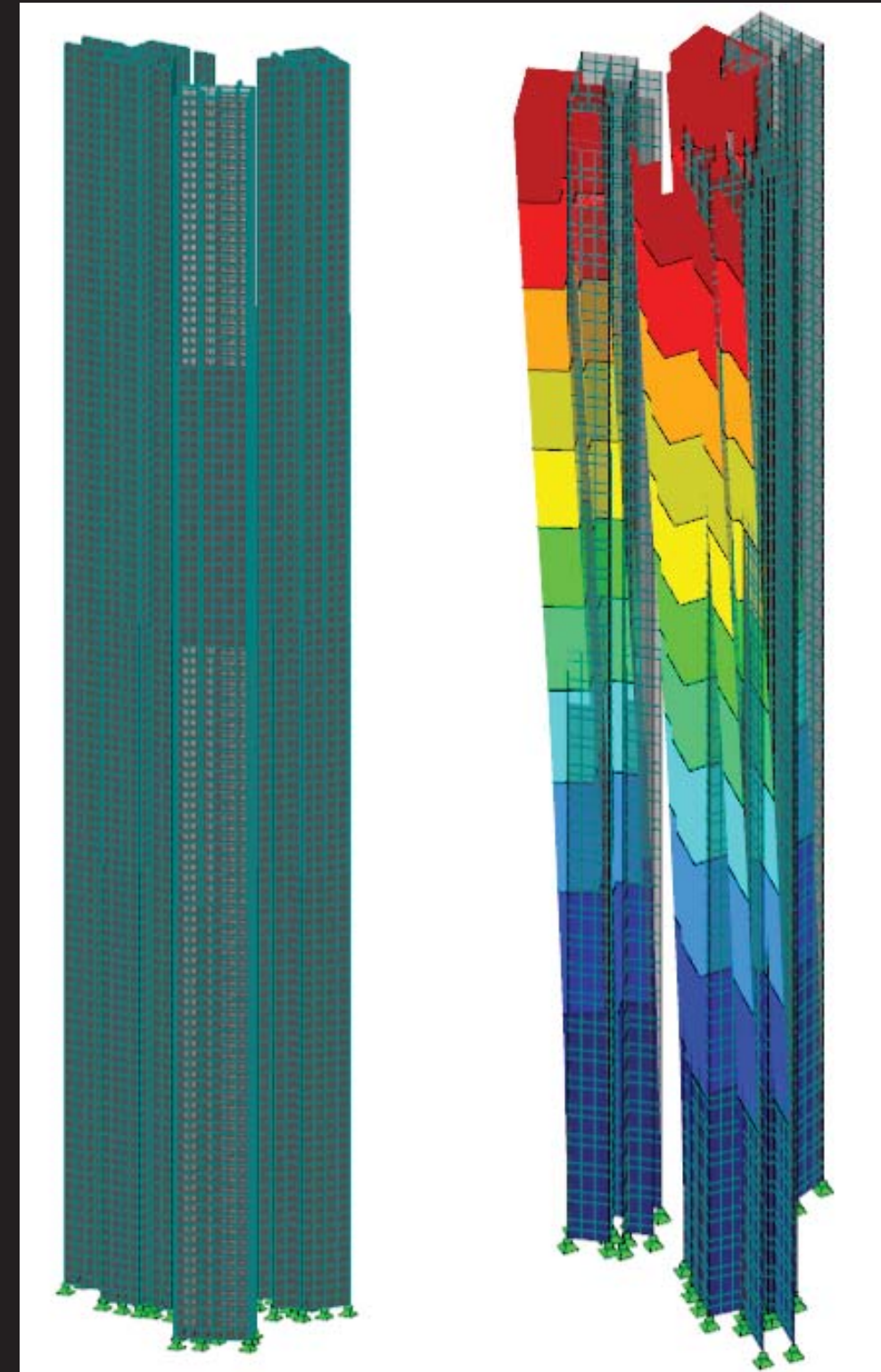
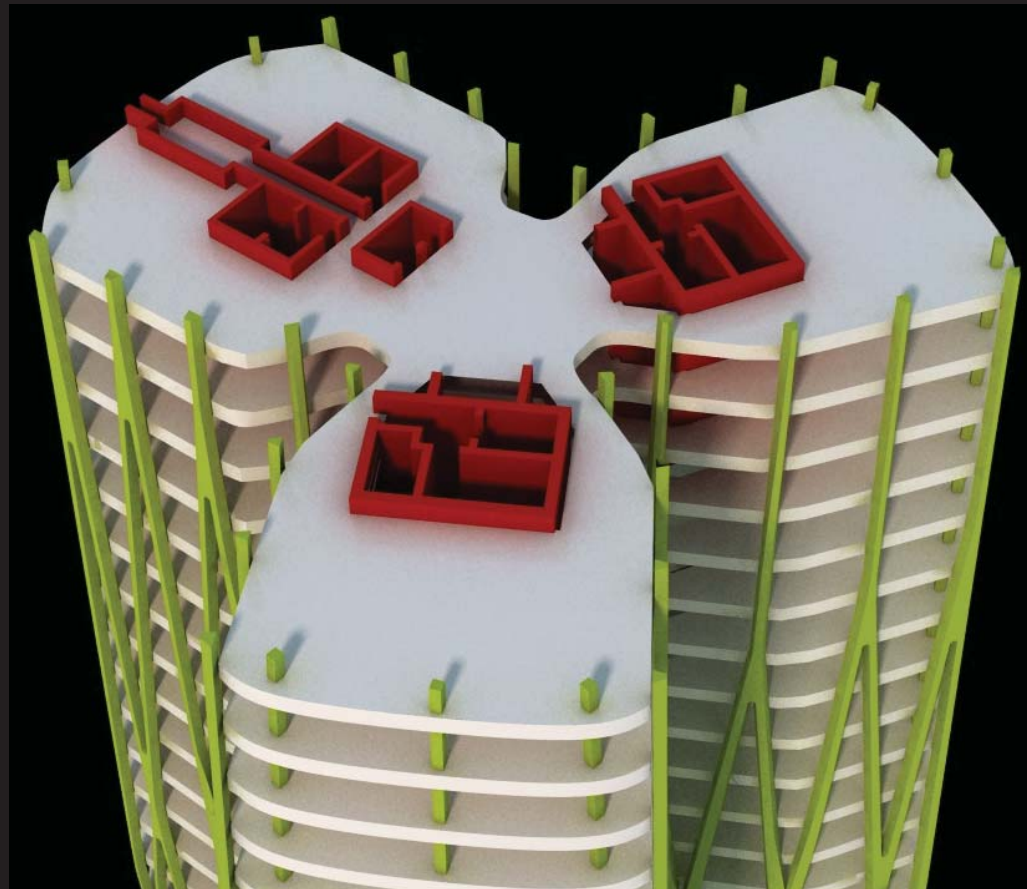


Structural Engineering

3. Structural System – Lateral Load Resisting System

Lateral Load Resisting System

As mentioned above, the lateral stiffness of the tower is provided by three concrete cores (red walls). They are located in the three main axes of the building and they ensure the stability of the building by using the shear core walls surrounding the lift, stairs and MEP shafts.



Structural Engineering

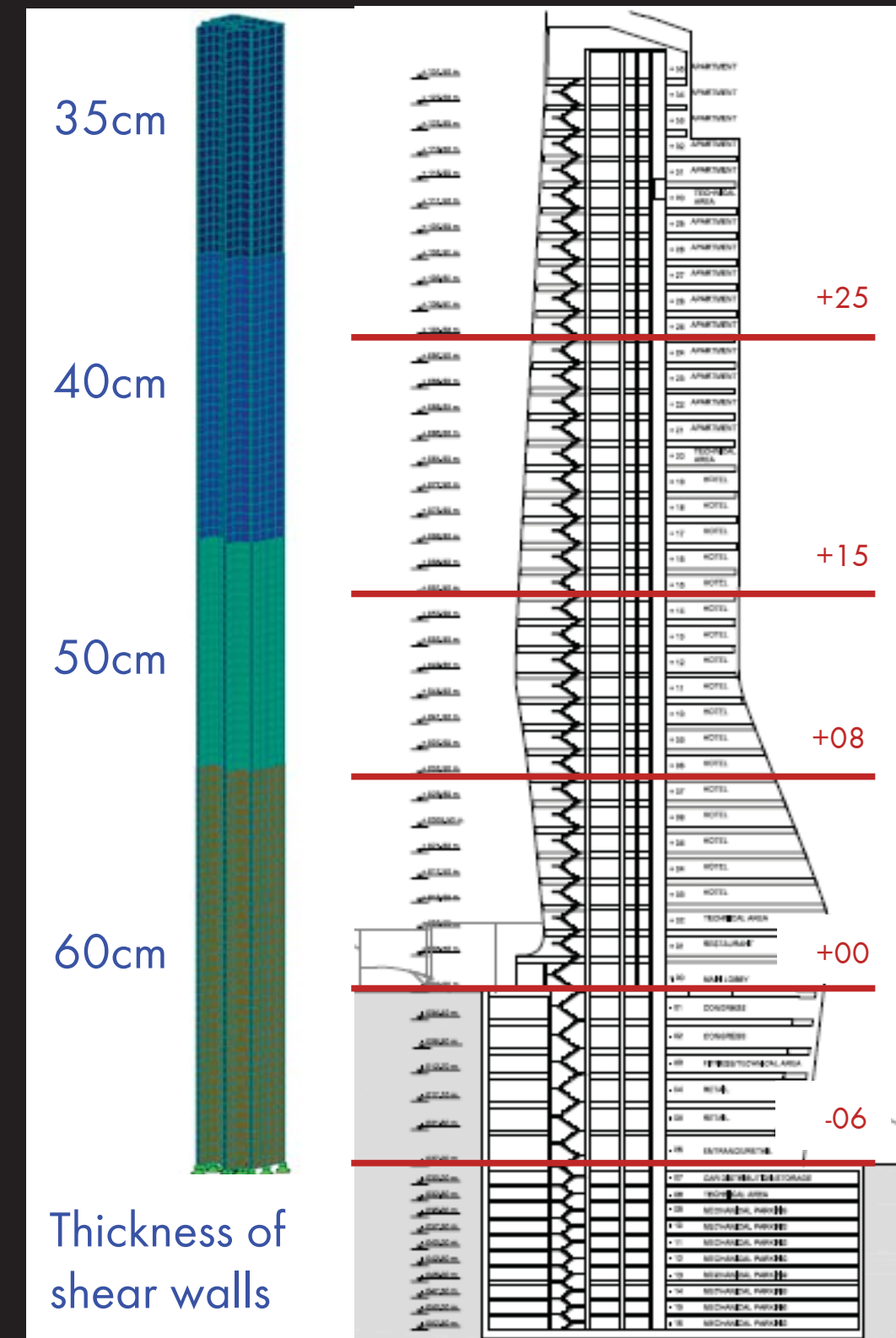
3. Structural System – Lateral Load Resisting System

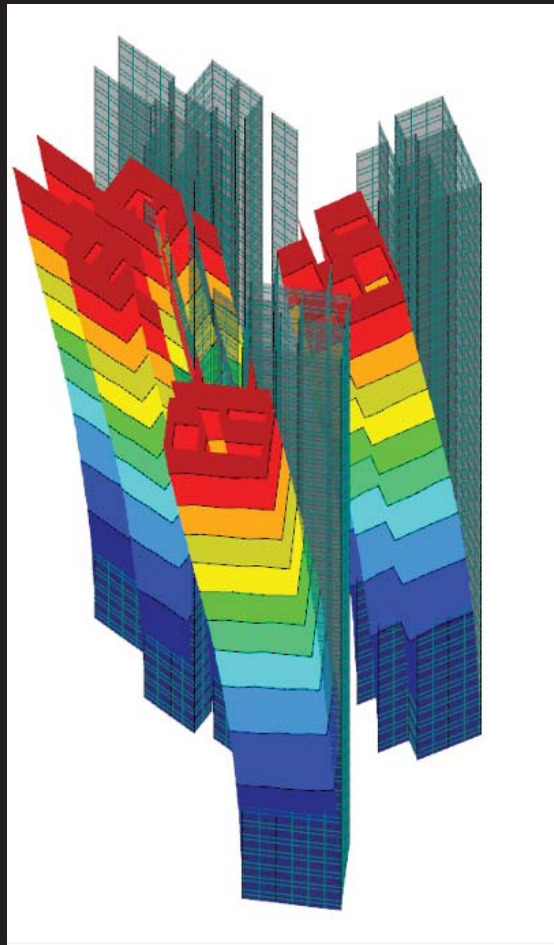
Lateral Load Resisting System

Since the core walls are running straight from the foundation to the upper level the appearing forces can be transferred continuously to the ground. This lateral stiffness design without any Outrigger and/or transfer switches ensures maximum economy.

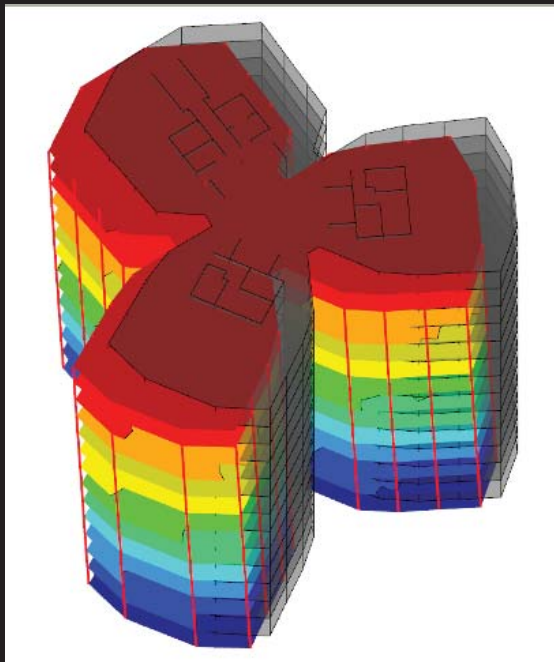
The thicknesses of the shear walls with a concrete strength of C40/50 have been determined preliminarily on the basis of a FE-Model by considering openings for MEP-installations.

Additionally, the first three Eigenfrequencies of the tower are determined by dynamic analyses.

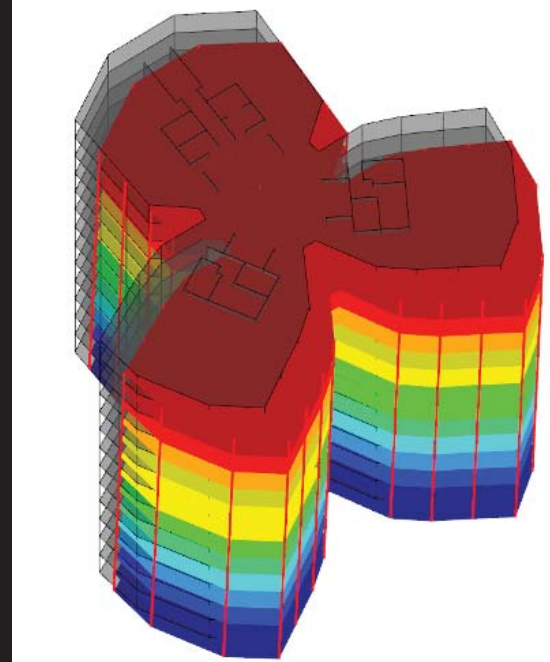




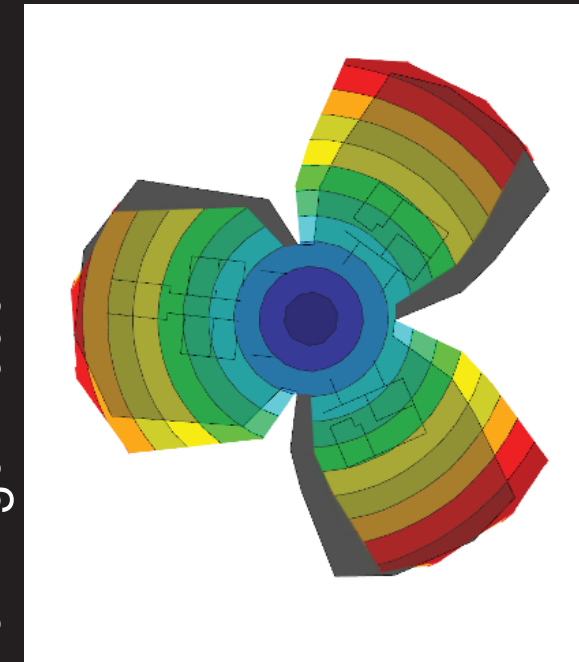
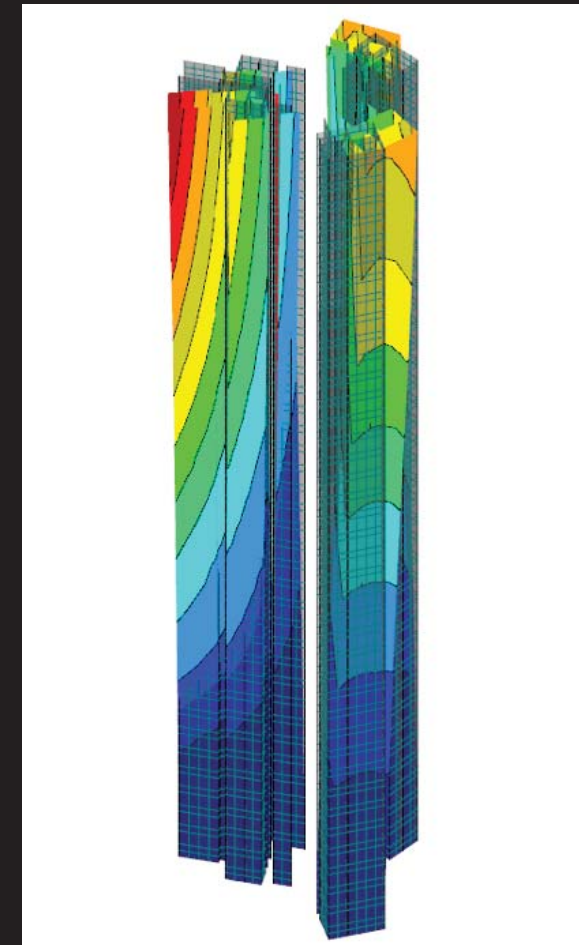
1st Eigenmode



2nd Eigenmode



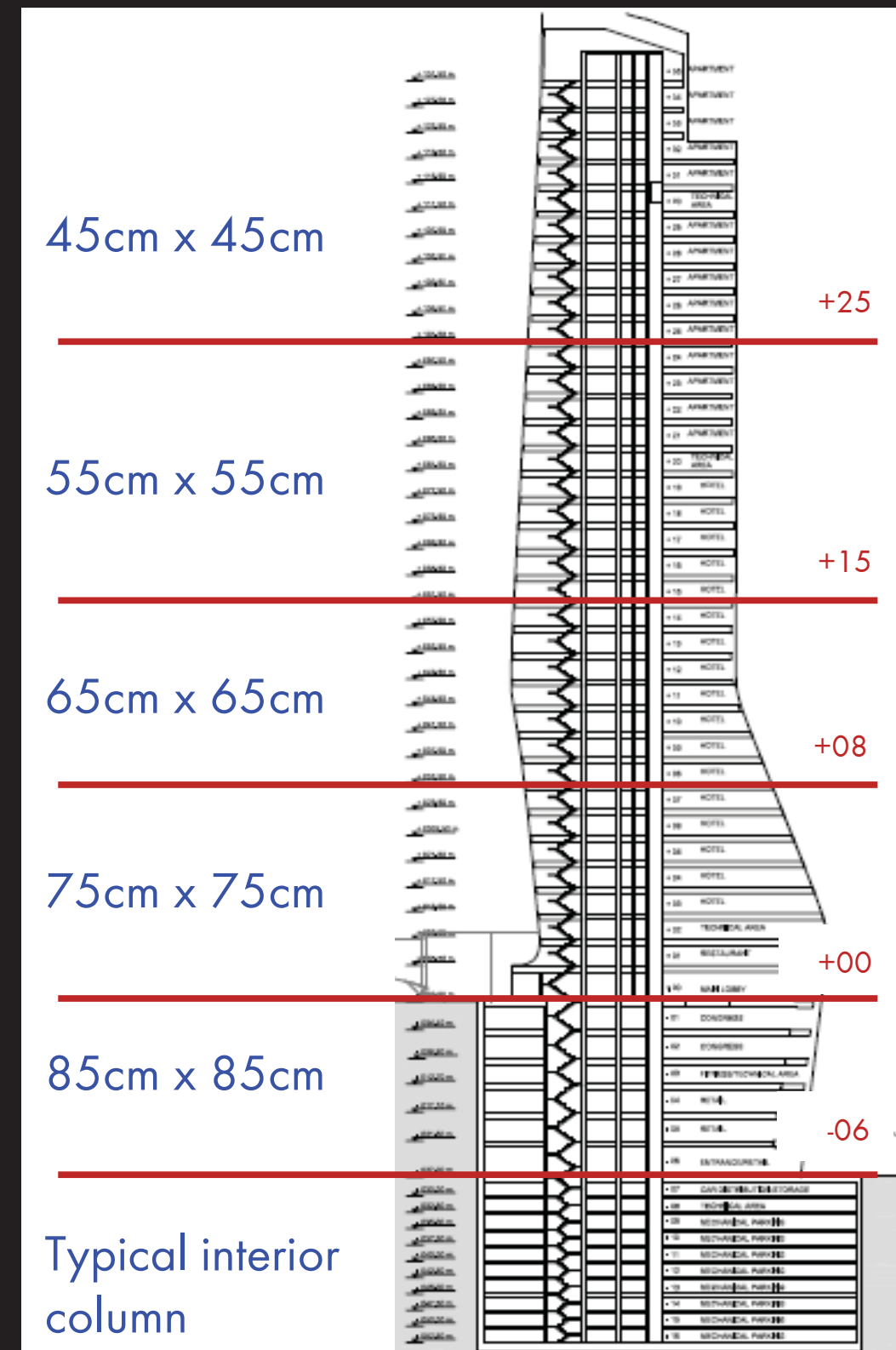
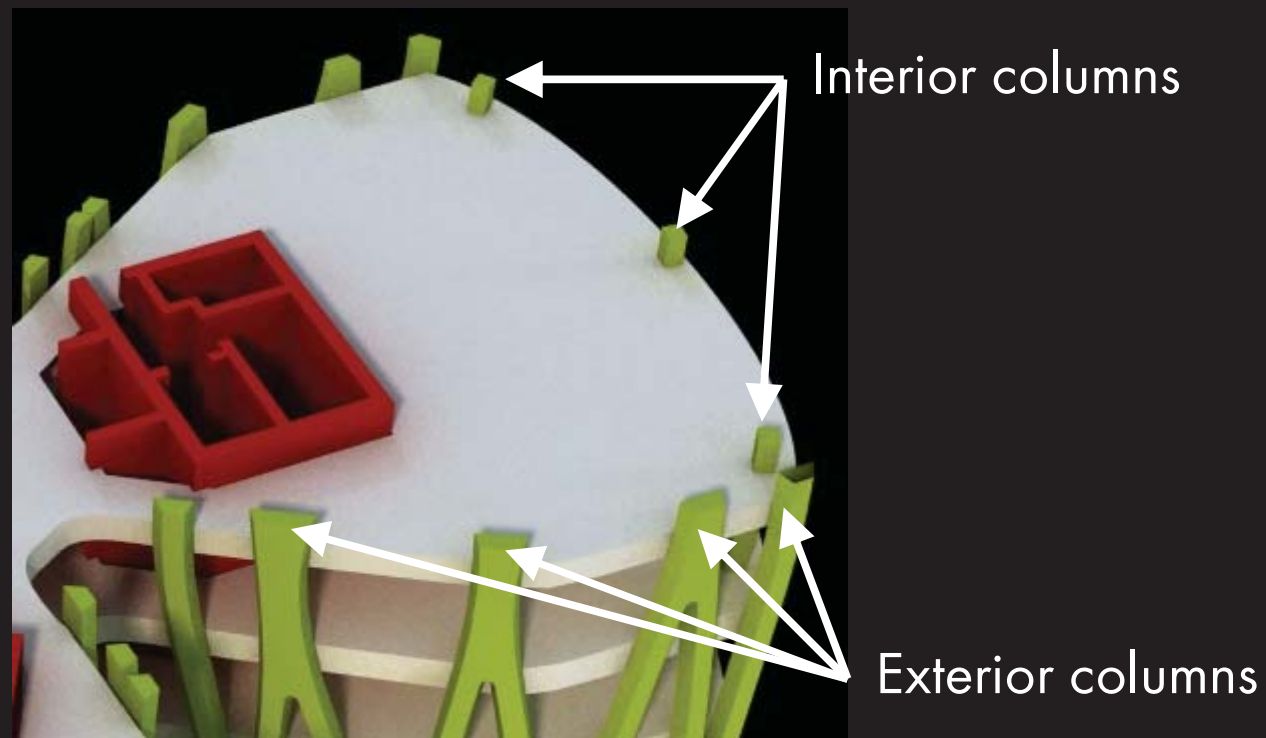
3rd Eigenmode



3. Structural System – Columns

The columns are allocated as perimeter bearings to provide maximum free spaces in each level. They are designed for the transfer of vertical loads of the slabs, so they are not part of the lateral load resisting system. To amplify the shape of the building most of the columns are inclined – the horizontal forces are transferred by the slabs to the cores.

As shown below, two types of columns can be defined:



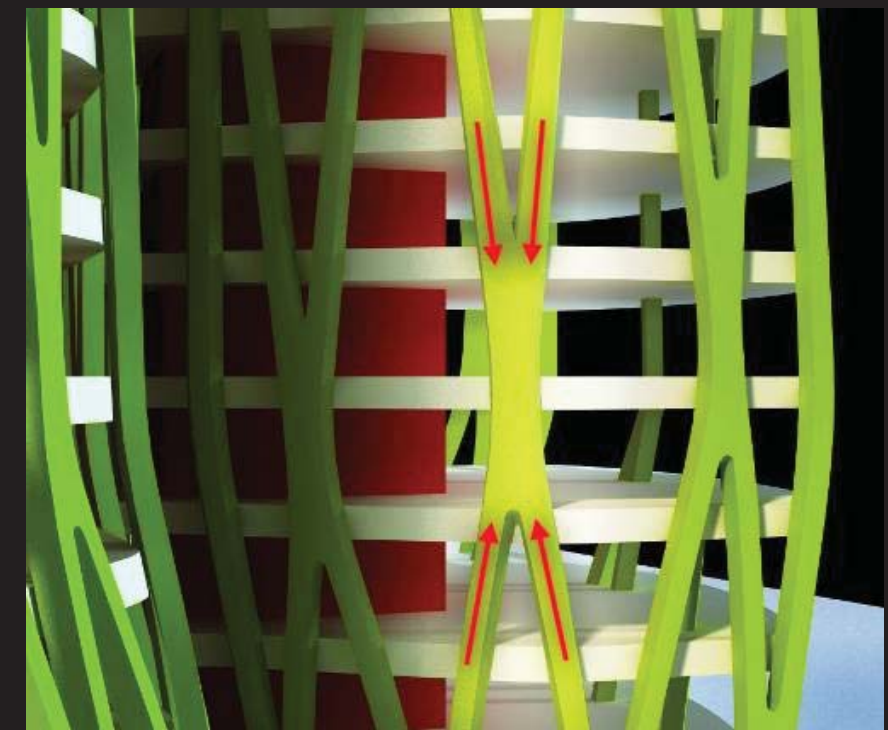
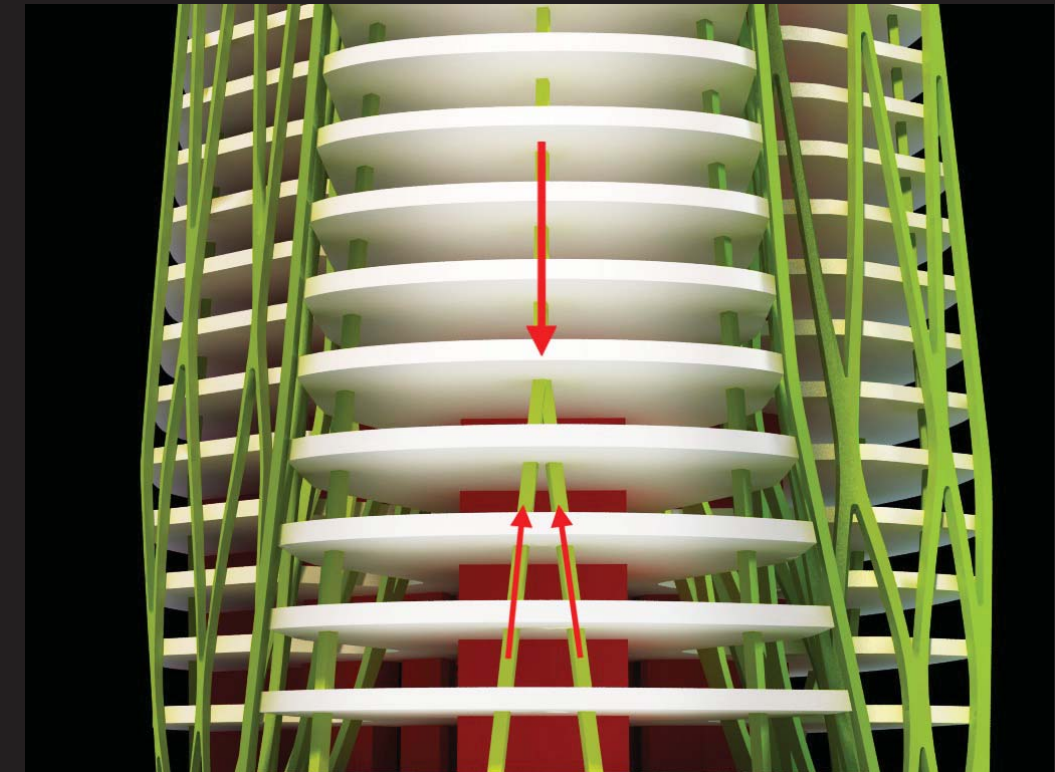
3. Structural System – Columns

The interior columns with a concrete strength of C40/50 are located behind the meshed façade whereas the exterior columns are used as a prominent element of the façade design.

The interior columns are allocated as perimeter bearings in a distance of 8.0–9.0m. Since the dimensions of slabs increase in several levels, additional columns are partly necessary. In these cases the loads will be transferred as shown here.

Also for the exterior columns several crossings with inclined columns are generated. The symmetric design ensures an equilibrium of the horizontal forces in these crossings. The continuous connections of the columns to the slabs in every storey provides sufficient support with regard to flexural buckling. The slabs are therefore acting as horizontal panels connecting the columns to the stiff core.

WR2NR2 503M2 .



3. Structural System – Slabs

The floors are designed with a maximum span of 9m x 13.5m. Here, two floor options with a concrete strength of C35/45 are provided:

- PT-slab
- Slab with binding beams

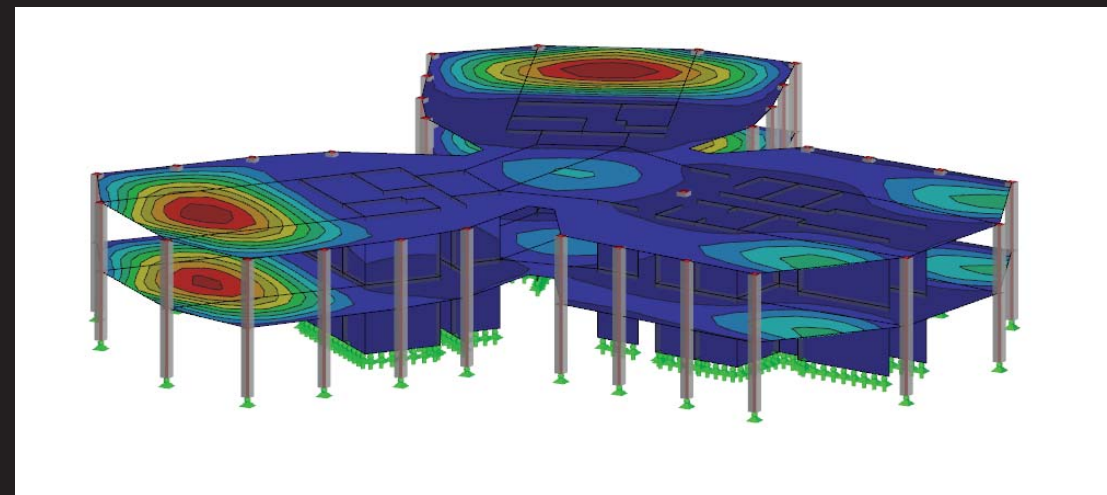
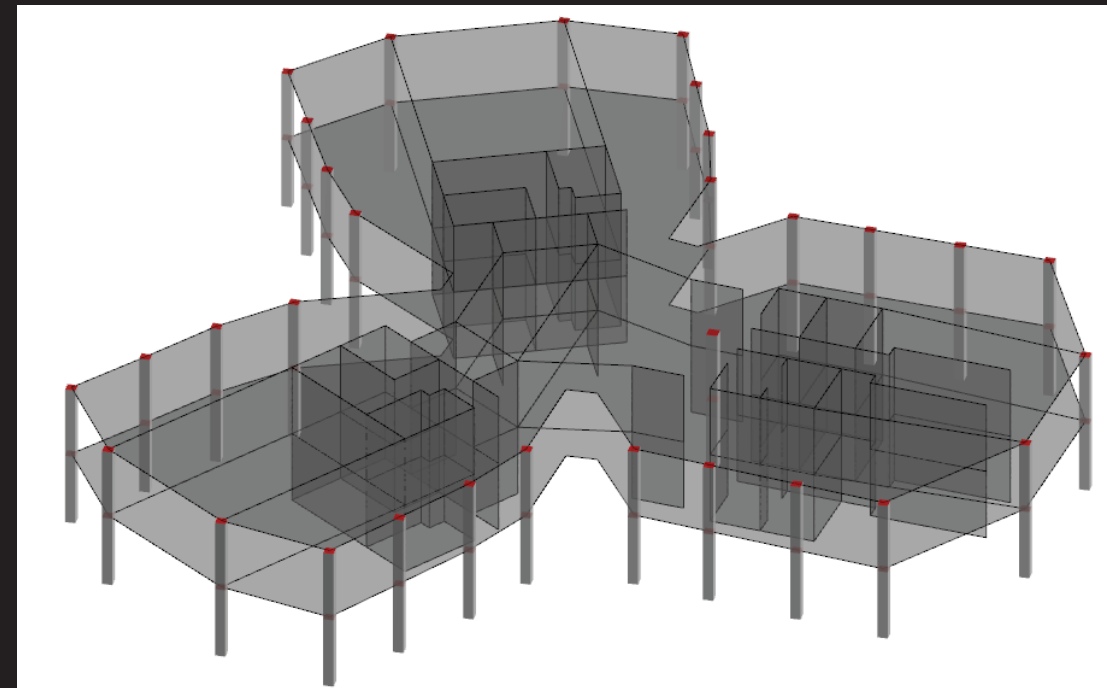
A 'bubble deck' flat slab would also be possible, with a thickness of about 43cm.

PT-slab

The PT-slab with $t = 38\text{cm}$ provides column free spaces between core and perimeter columns (in a distance up to 8.0-9.0m) as well as an efficient structural solution for a maximum main span up to 13.5m.

The flat soffit to the underside of the slab allows services to run through without obstructions.

WR2NR2 503MML .



Structural Engineering

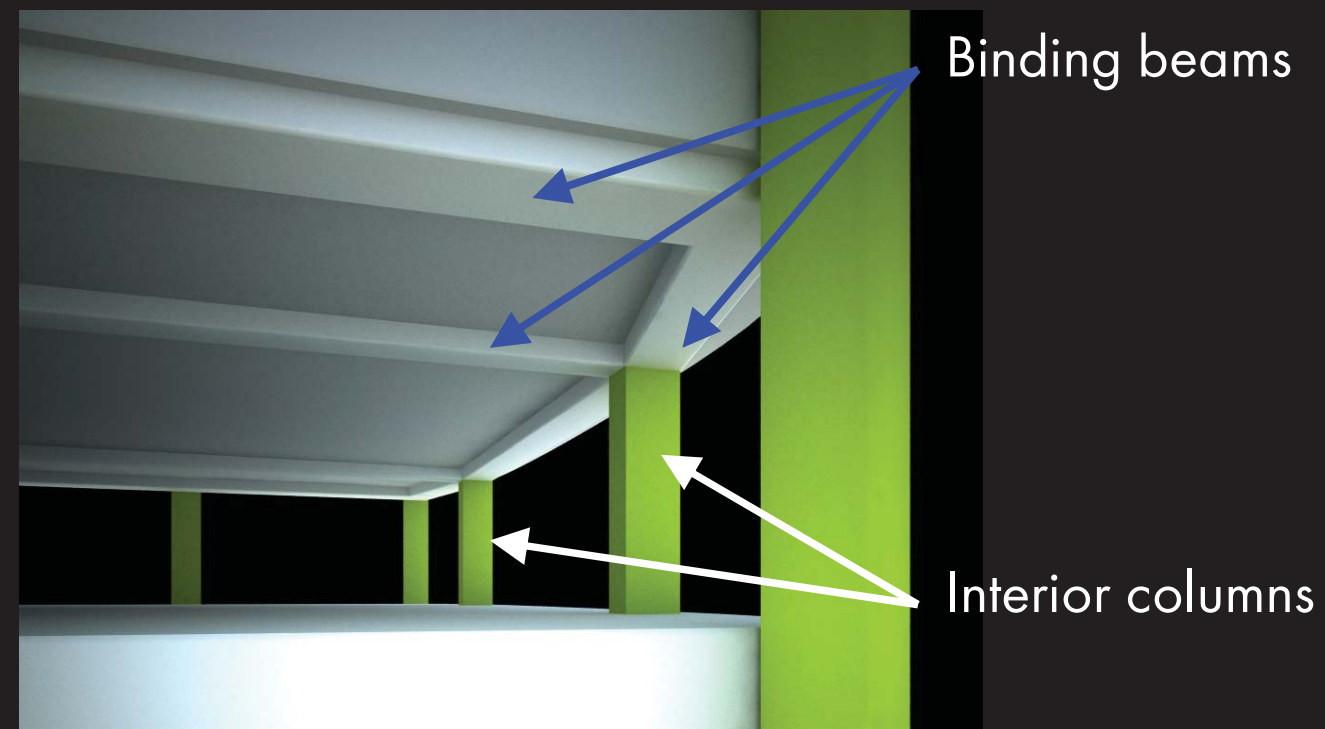
3. Structural System – Slabs

Slab with binding beams

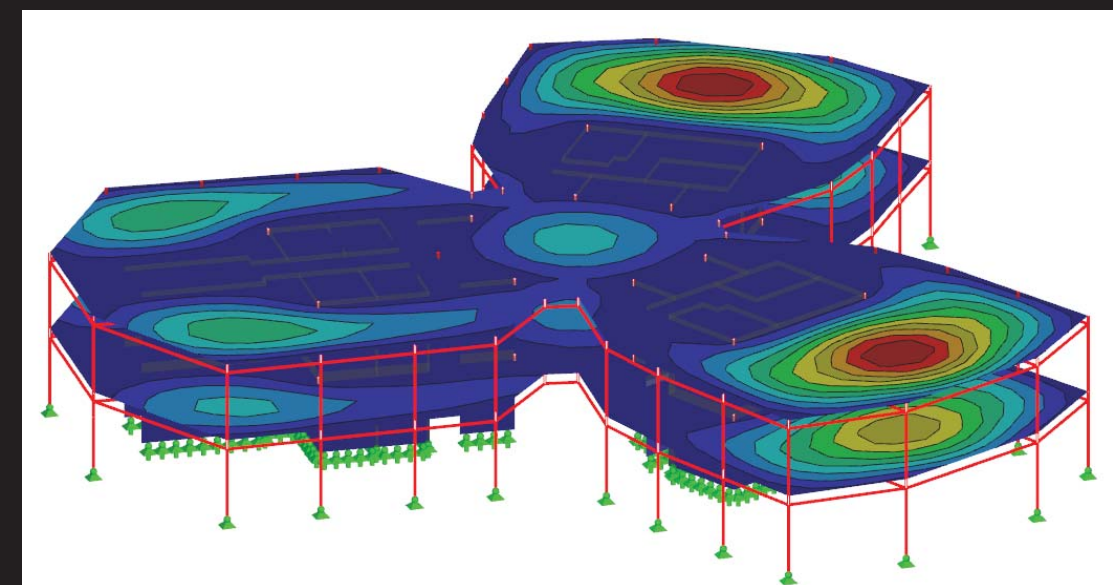
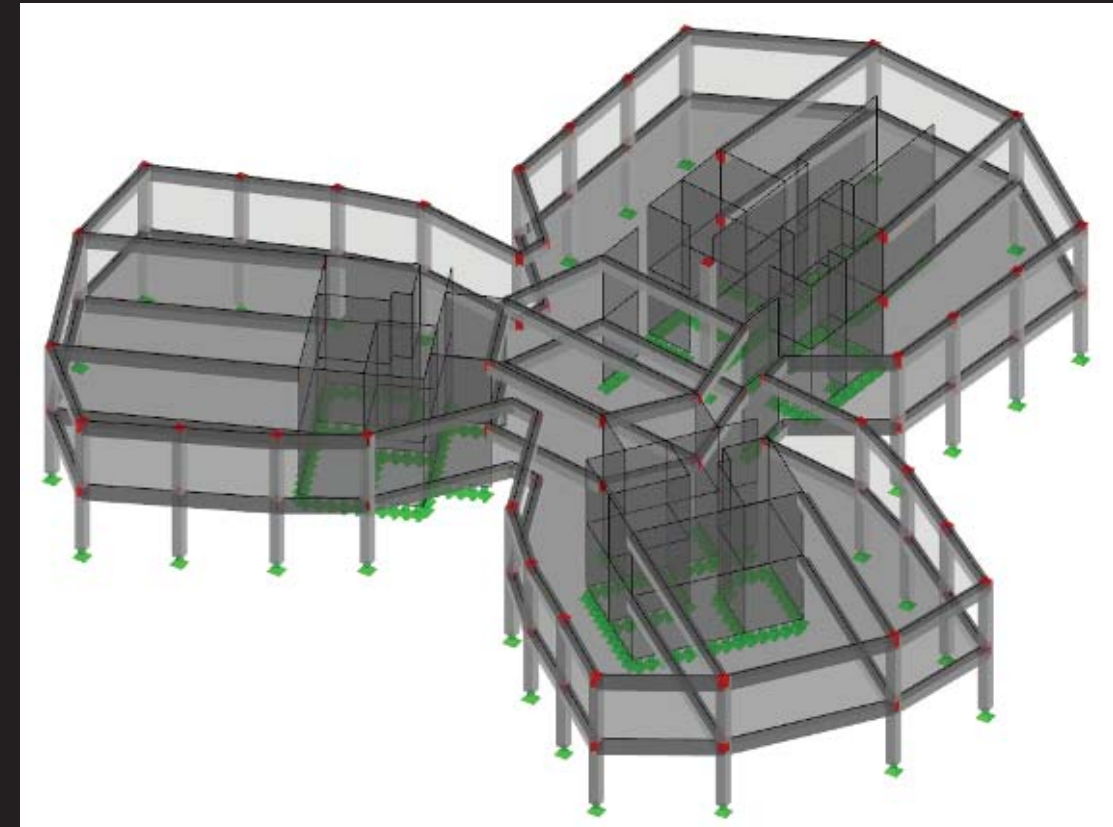
The slab with $t=28\text{cm}$ is determined with concrete beams spanning from the interior columns to the cores. Additionally, edge beams between the single columns are required.

The beams have dimensions of $60\text{cm} \times 60\text{cm}$, which means a height of 88cm for the binding beam plus slab.

Openings for MEP-services running through these beams can be provided.



WR2NR2 803MML .



Structural Engineering

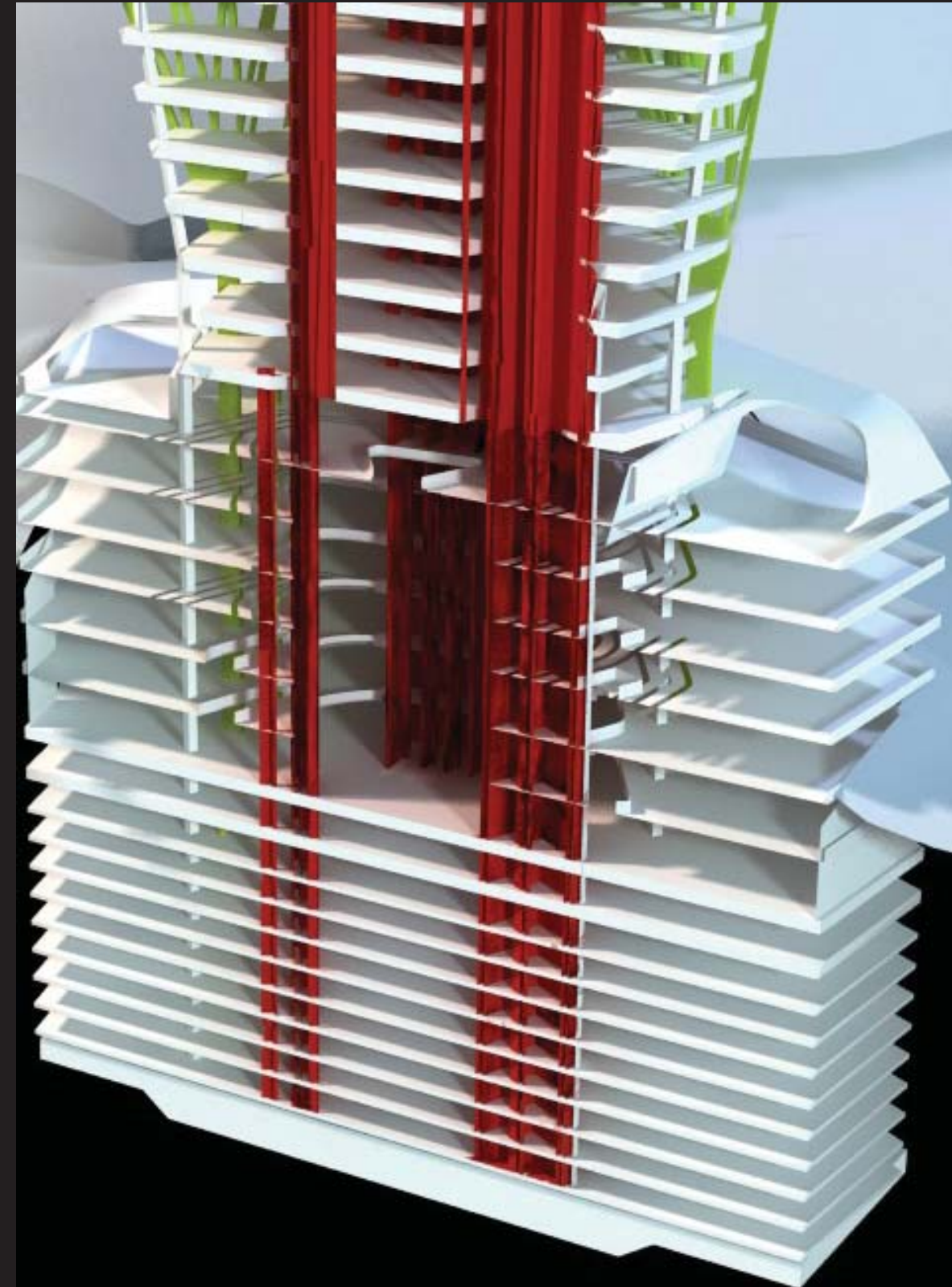
3. Structural System – Foundation

According to our latest information the tower is located on bedrock.

Since the high rise building can be supported by an usual raft foundation instead of a pile foundation this ground offers significant economic and structural advantages.

The thickness of the base plate is about 2m in the regular area and 4m below the cores depending on the geotechnical report.

The Geotechnical Report is recommended for the next design phase.



Structural Engineering

4. Construction Phases

WR2NR2 503ML .

The construction phases are simplified shown in seven steps.

Basement works for the excavation have to be developed in collaboration with the Geotechnical Engineer with special regard to the ground water level (e.g. anchors, shotcrete, underpinning, contiguous or secant piled wall, diaphragm retaining wall, sheet piled wall etc.).

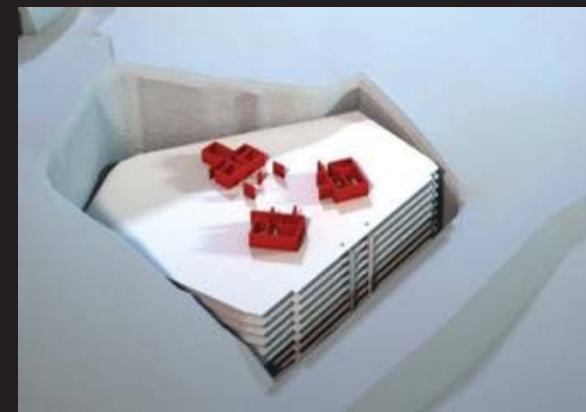
1st step - Excavation



2nd step - Foundation



3rd step - Parking basement



Structural Engineering

4. Construction Phases

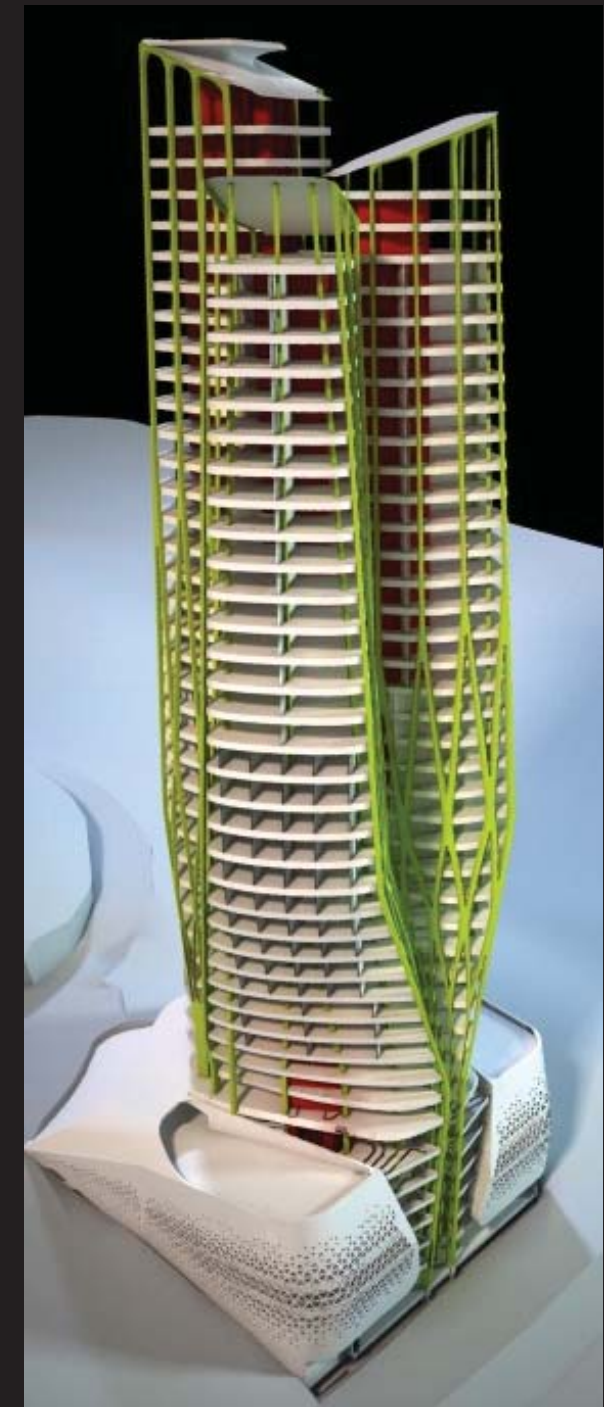
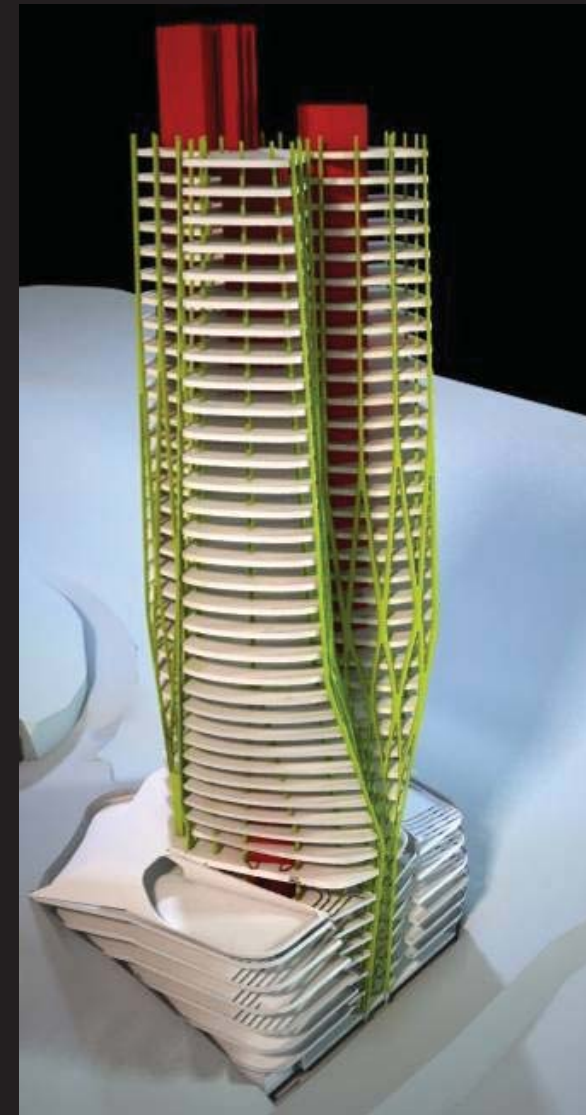
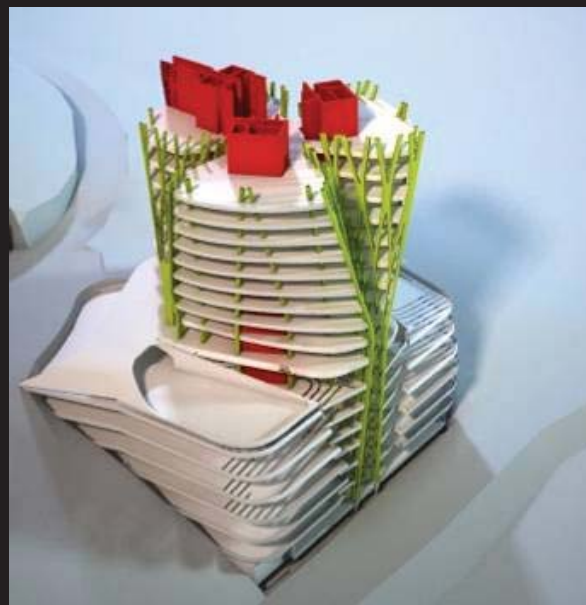
۷ مرحله ساخت .

7th step – Residential,
Rooftop

6th step – Hotel, lower
Residential

5th step – Hotel

4th step – Retail, Confer-
ence, lower Hotel



ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran

03 TECHNICAL DESIGN

- Structural Engineering
- Facade
- MEP Services
- Fire Prevention
- Sustainability and Lighting



Pasargard Hotel Elahieh, Teheran Façade Systems



Pasargard Hotel Elahieh, Teheran

Façade Engineering

۱۳۸۲/۰۲/۰۱

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1. Introduction and Project Description
2. Climate
3. Heat protection in summer
4. Thermal protection in winter
5. Façade Types
 - Façade Type I
 - Façade Type II
 - Façade Type III
 - Façade Type IV
6. Façade assembly
7. Ventilation and Air Conditioning (HVAVC)

1.Introduction and Project Description

The façade should be designed as a fully unitized system. This assures high quality as well as a quick and crane-independent erection without scaffolding.

The construction has the following principles:

- Highest-possible degree of prefabrication
- The façade is unitized, thus all components, sealing, gluing etc. will be mounted in the shop, not on site.
- Erection as quick and simple as possible
- Few and simple connections on site, without additional sealing etc.



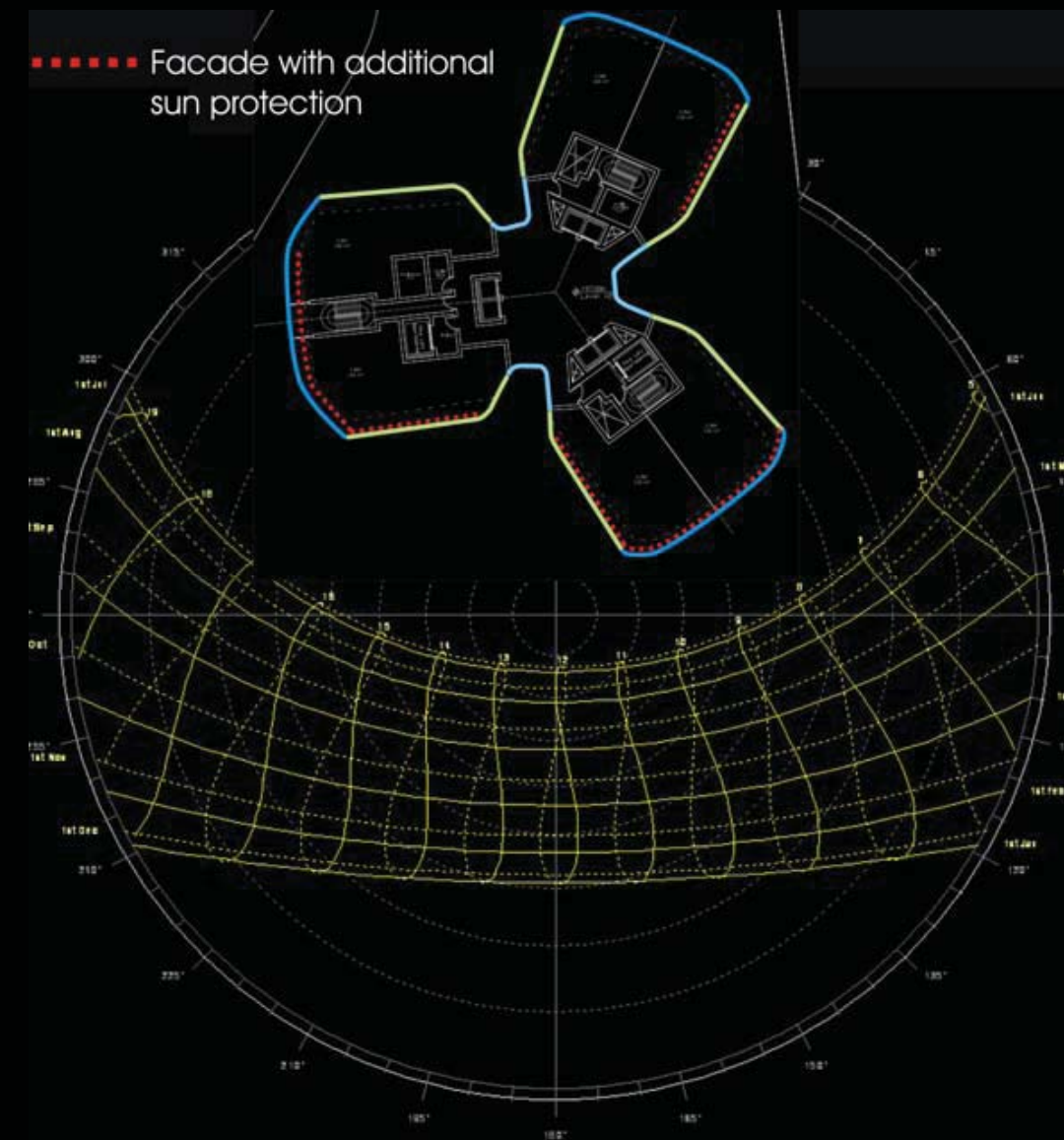
Example for unitized curtain wall façade
Highlight Towers, Munich, Germany

2. Climate

The sun position is one main criteria for the planning of urban layouts, but also for effective shading devices.

The sun path diagram projects the sky dome onto a horizontal plane. The graph shows a stereographic diagram where sun angles for Tehran can be identified over the time of the day, the orientation and over the month of the year. The highest sun angle in summer is about 77° , the lowest in winter about 30° (midday situation). The dotted line indicates facades with additional sun protection.

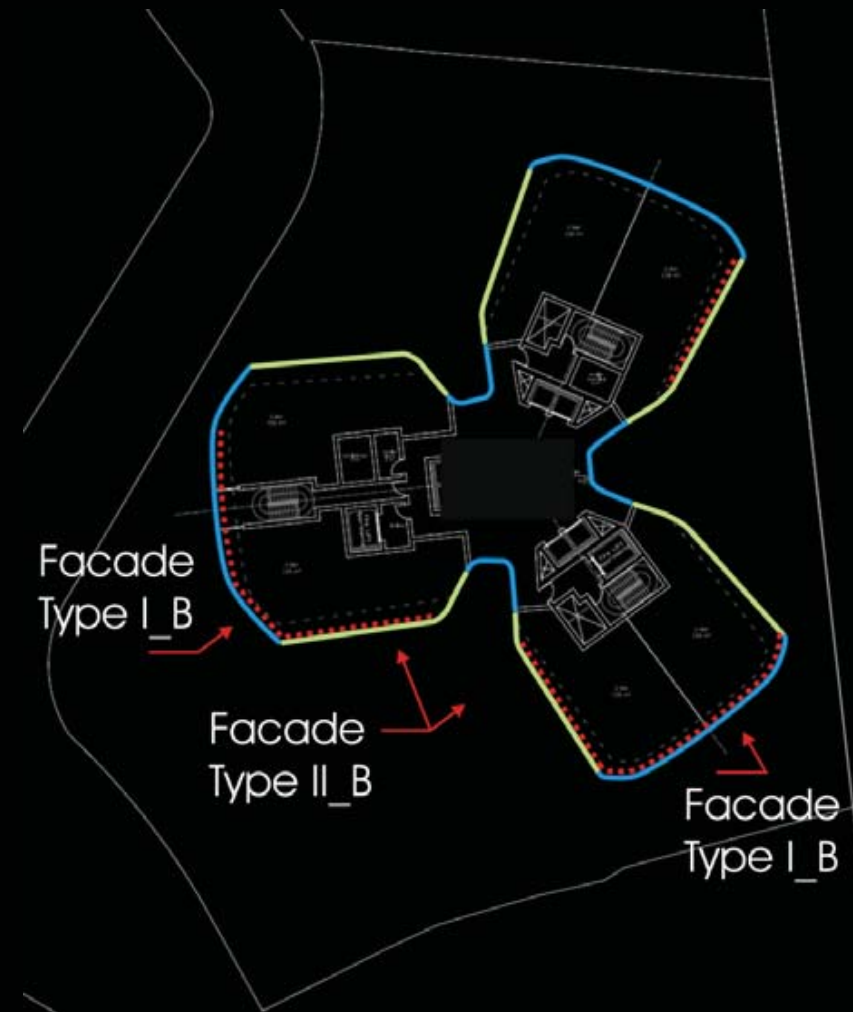
Location	Tehran, Iran
Latitude	35.67°
Longitude	51.43°
Elevation	1140m



sun path diagram and major façade elevations

3. Heat protection in summer

Heat protection in summer will be realized with integrated sun lamella for the tower facades facing south. Perforated glazing elements act as sunscreens at congress, retail, and fitness area.



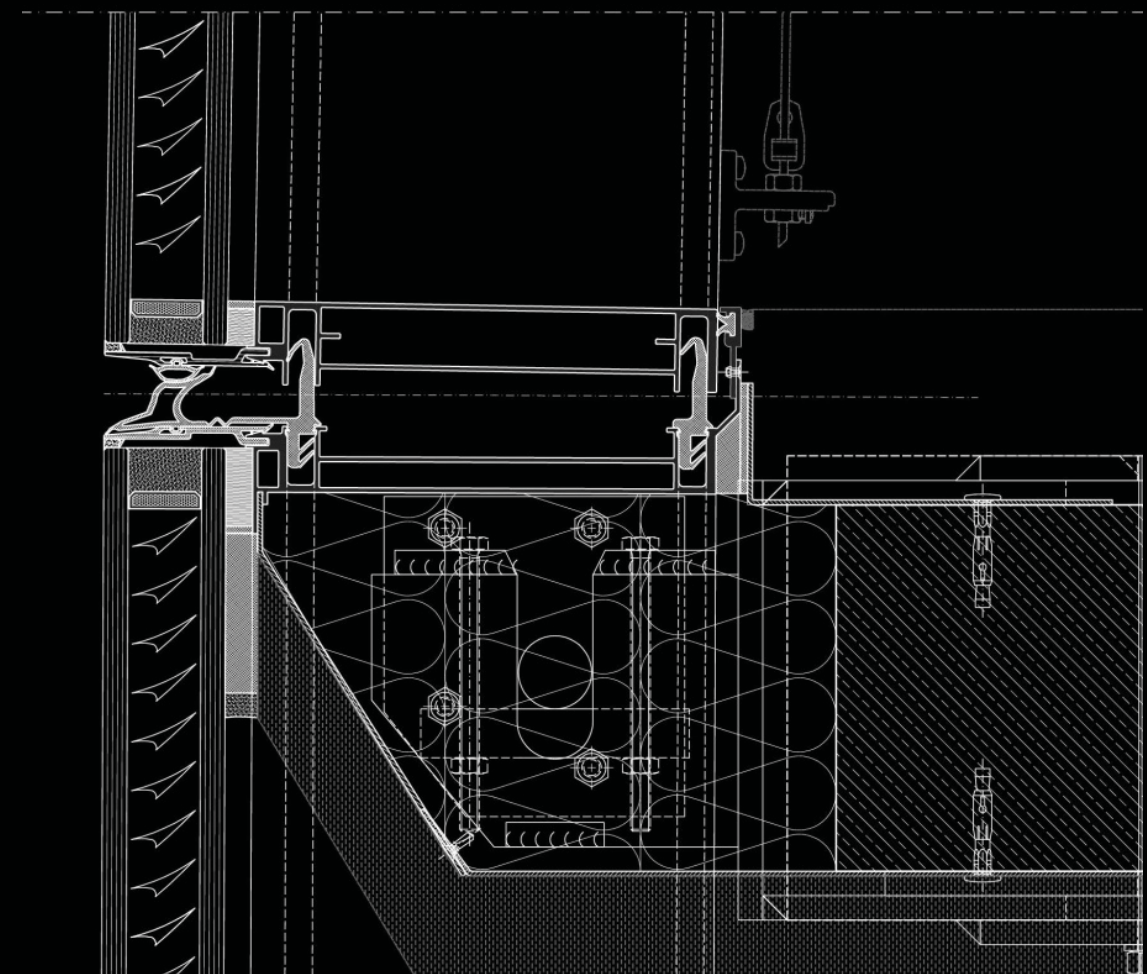
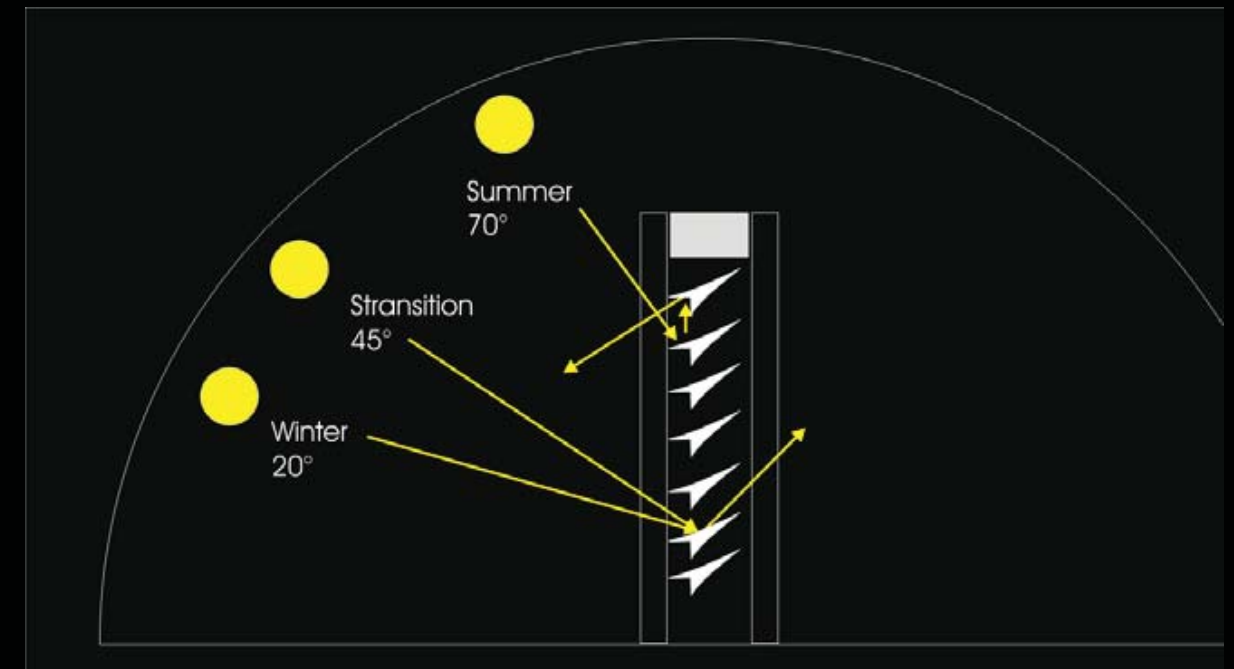
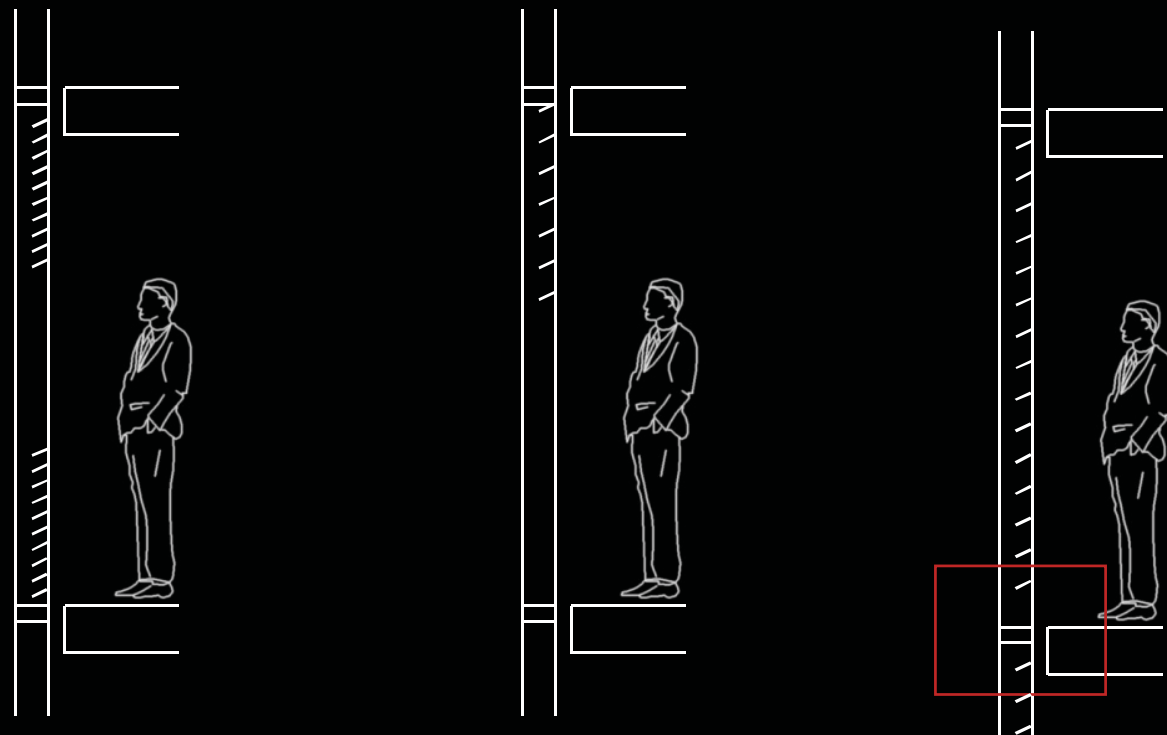
Tower at level +25



Podium -05

3. Heat protection in summer

Insulated glass unit with fixed sun shading lamella in the cavity of facade Type I B and facade type II B. The lamella position and distance can be precisely adjusted to user and to physical demands.



4. Thermal protection in winter

Double Glazing

Since there are more heating than cooling days in Tehran, the glazing quality is essential for the reduction of energy loss due to thermal transfer and therefore the reduction of the heating demand.

The U-value of the glazing is set to $1,1\text{W/m}^2\text{K}$. Glazing with integrated sun protection lamella have a lower U-value due to the extended cavity. This might be compensated by an additional noble gas infill. U-value between $1,1\text{W/m}^2\text{K}$ and $1,5\text{W/m}^2\text{K}$ can be realized.

High quality glazing might be more cost-intensive in the first place, but it contributes to reducing the life-cycle-costs of the building.

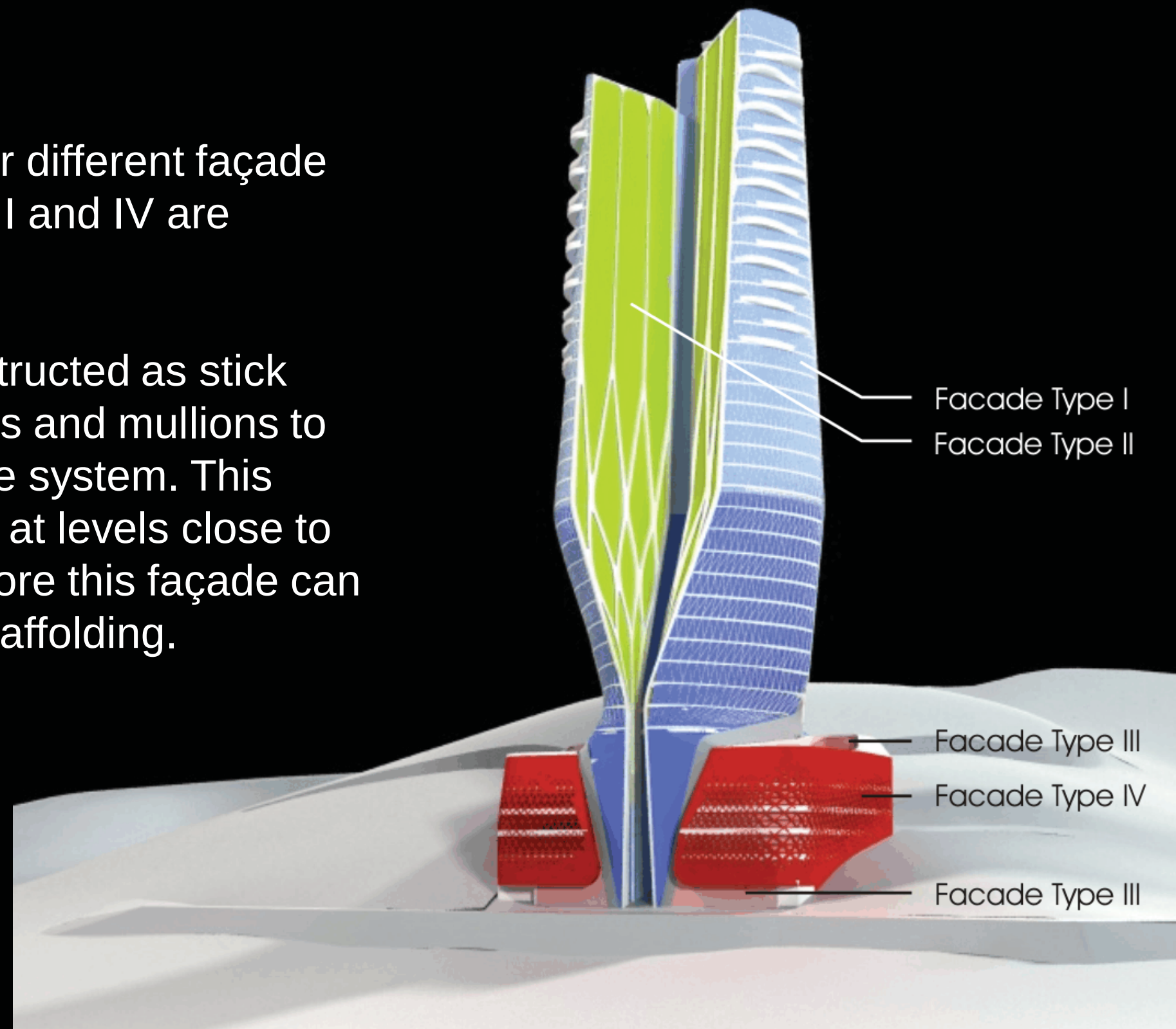
Advantages of double glazing:

- Reduction of thermal transfer loss across the building envelope
- Reduction of energy demand for heating and cooling
- Higher living comfort due to less thermal radiation/subjective well-being

5. Façade Types

There are basically four different façade types. Façade type I, II and IV are unitized systems.

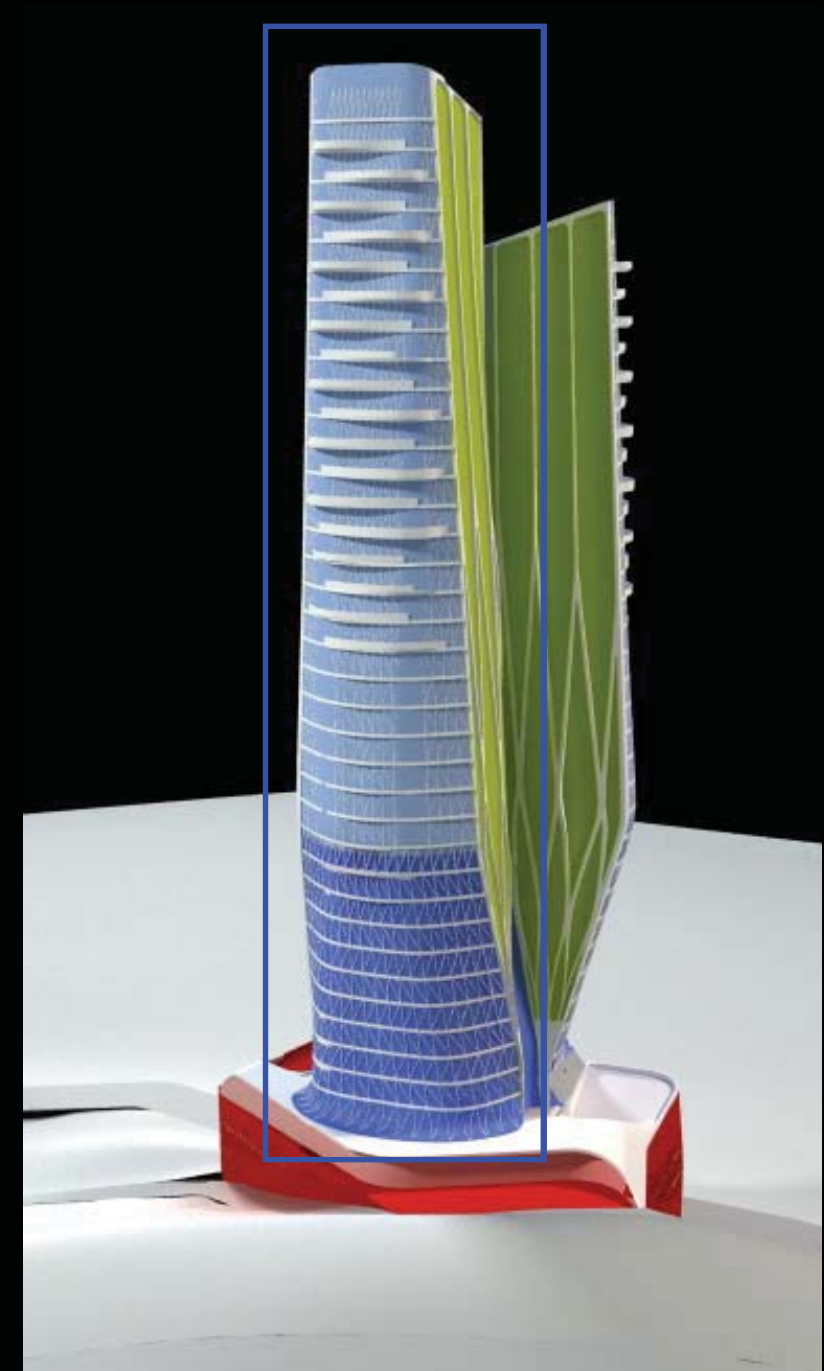
Façade type III is constructed as stick system using transoms and mullions to reduce the costs of the system. This façade type is located at levels close to the ground and therefore this façade can be reached without scaffolding.



Façade Types

Façade Type I

Façade type I is a unitized façade located at all face sides of the three towers. The façade is inclined at the lower part and it provides balconies at the upper part. The outer appearance is triangulated.

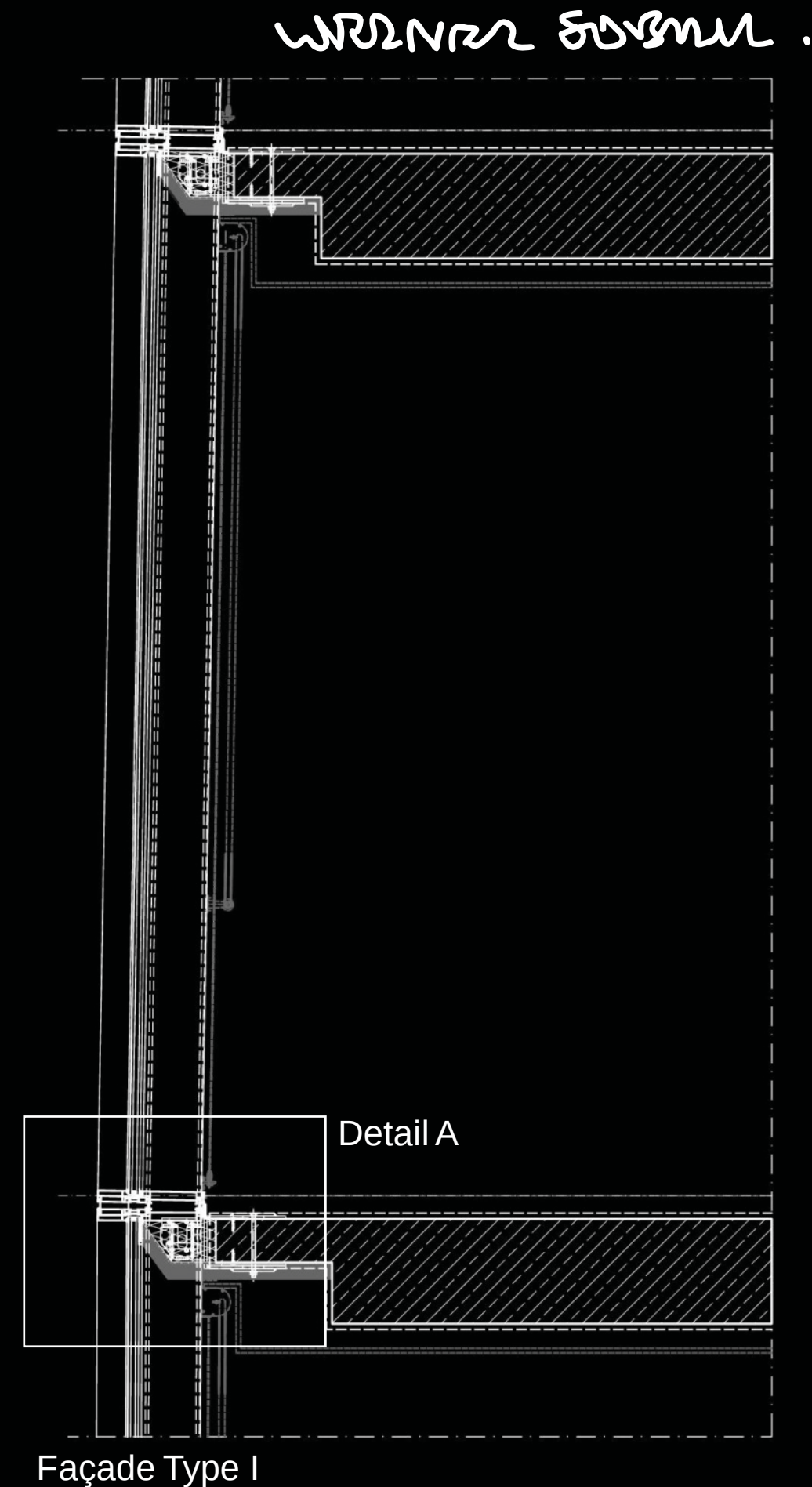


Façade Type I

Façade Engineering

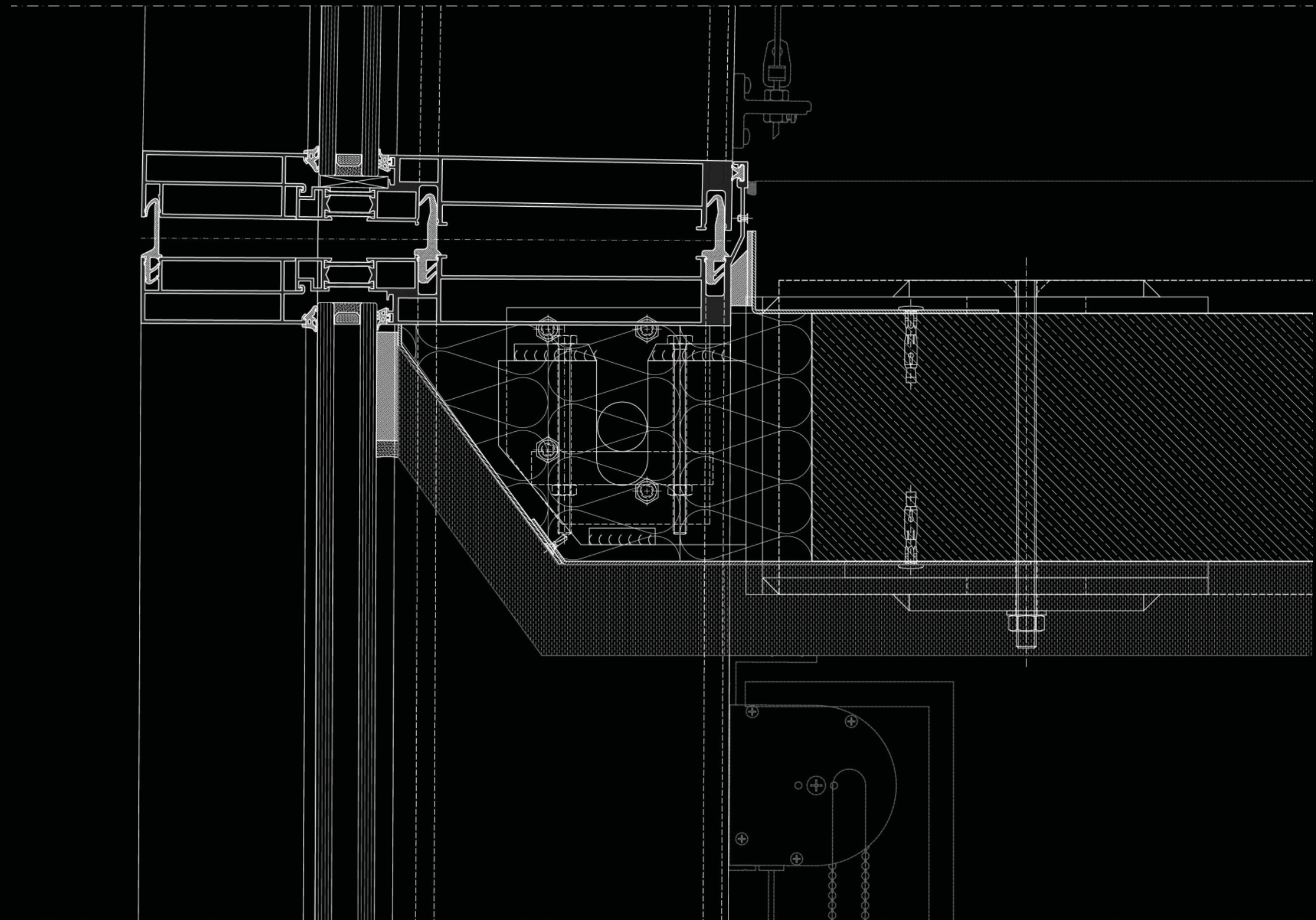
Façade Type I

Façade type I is a unitized façade with an additional triangulated structure outside. The outside structure is also prefabricated and attached to the unitized façade so that it can be installed as one element. The diagonal bar is detached from the glass. All elements are rectangular or trapezoidal and can be produced reasonable priced.



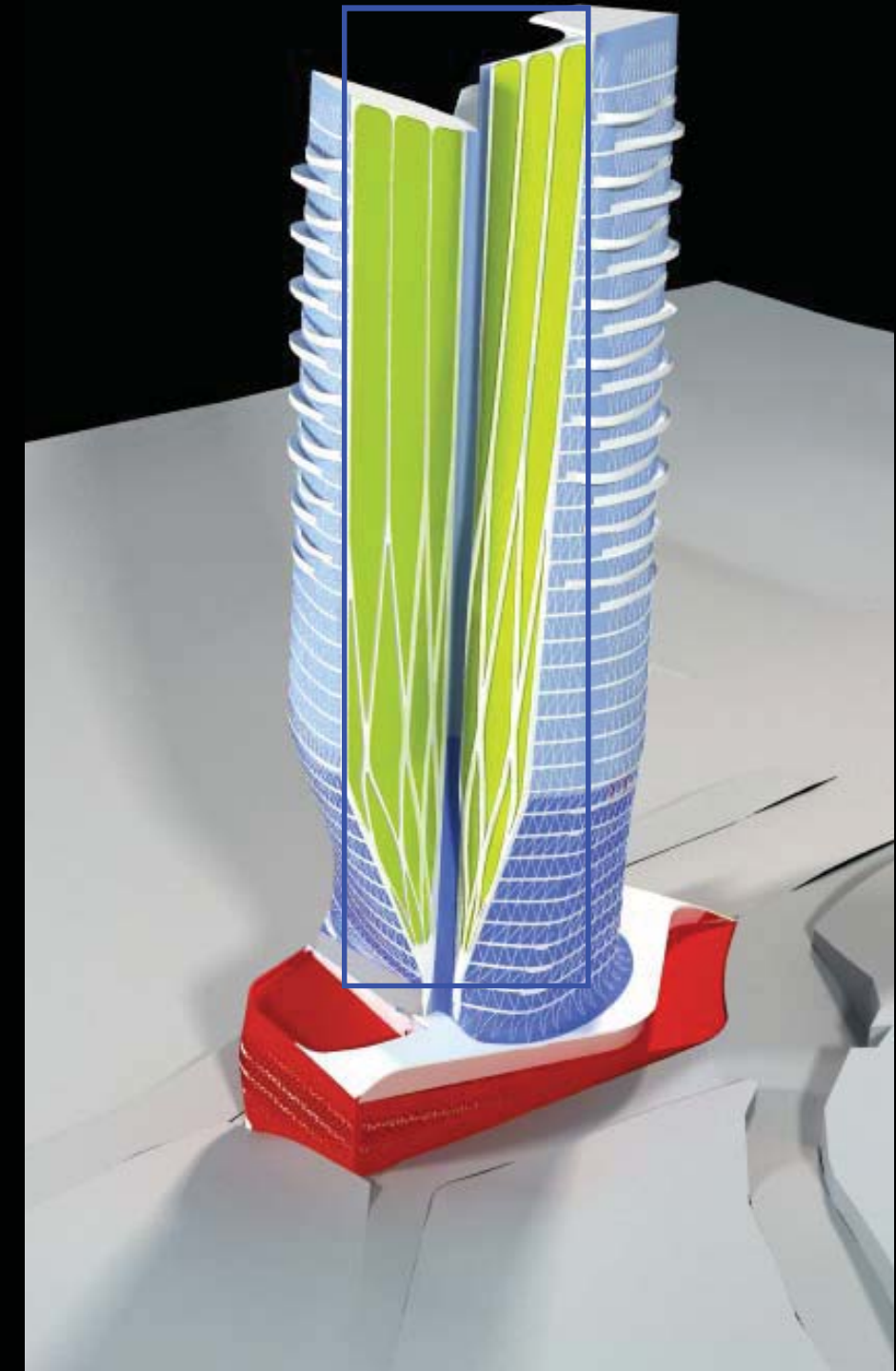
Façade Type I

Detail A



Façade Type II

Façade type II is a unitized façade located at the sides of the three towers. Between the unitized façade a mega structure is taking the building loads to the ground.

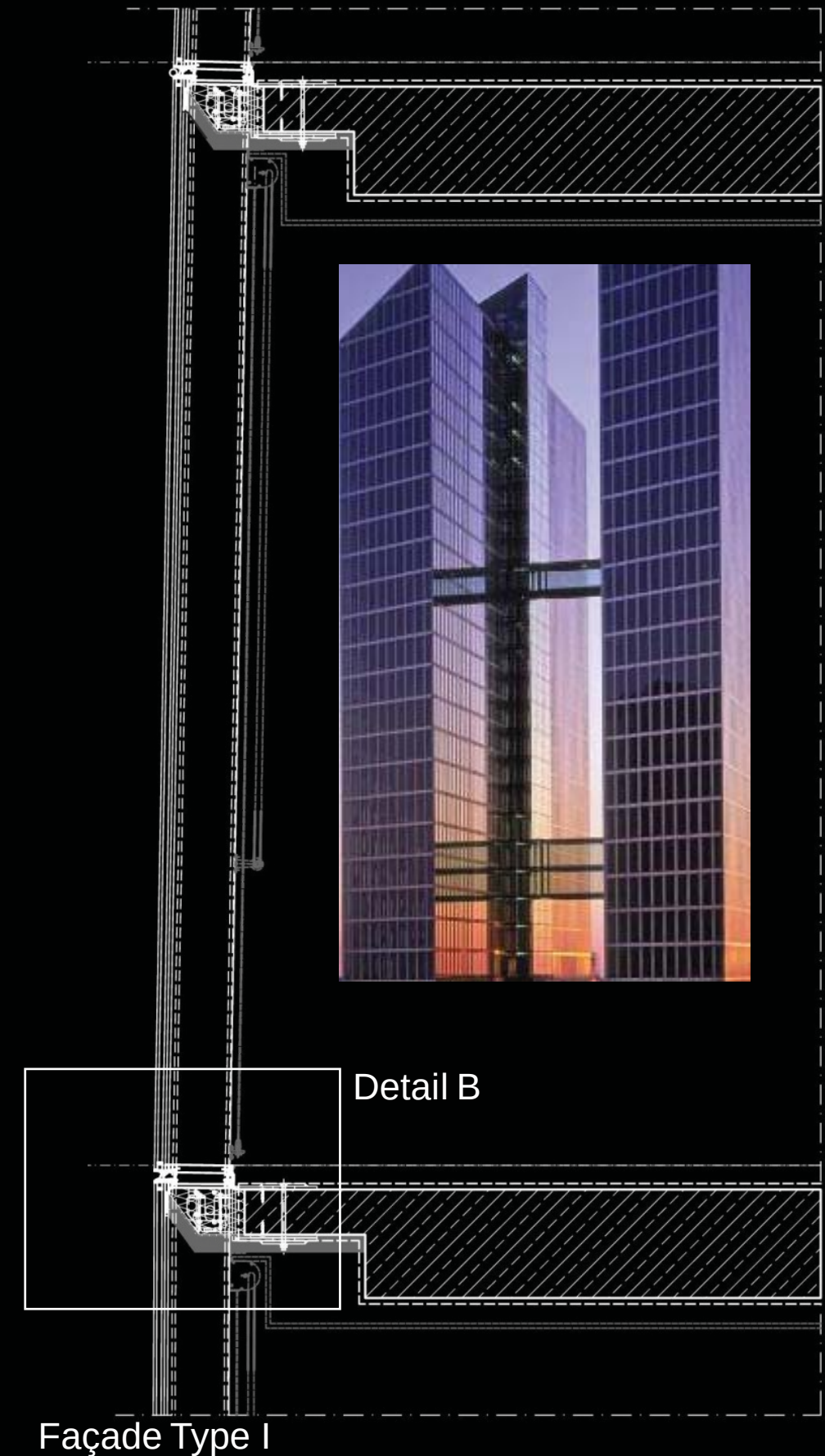


Façade Type II

Façade Type II

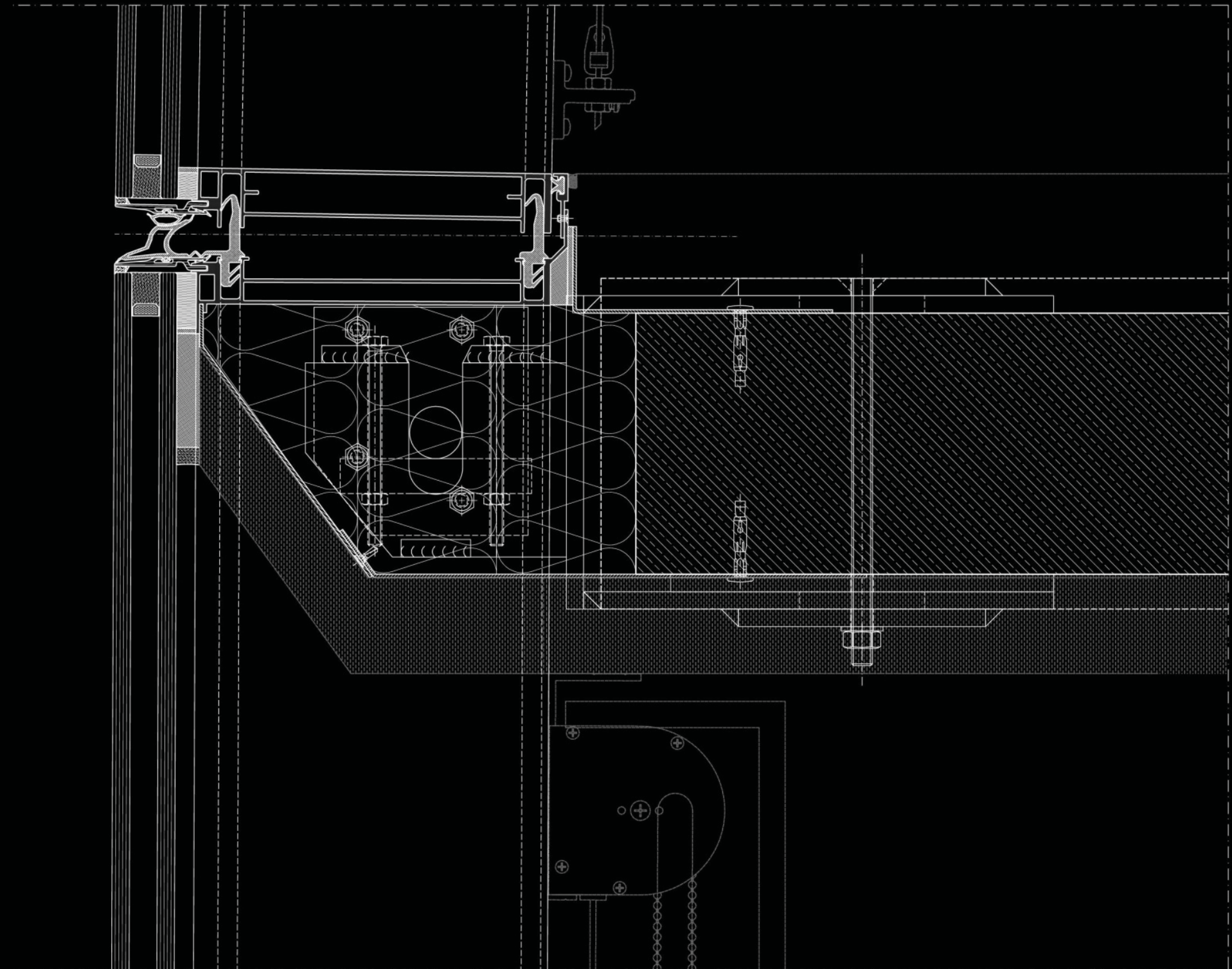
Façade type II is a unitized façade constructed out of the same profiles than façade type I without the additional triangulated structure outside. The façade will be installed between the mega structure.

All elements are rectangular or trapezoidal and can be produced reasonable priced.



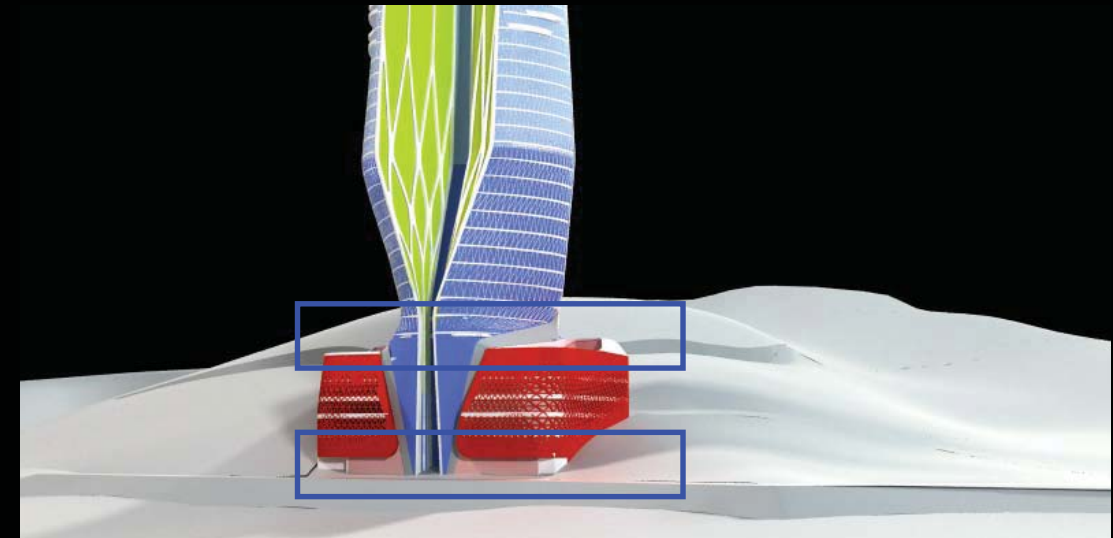
Façade Type II

Detail B

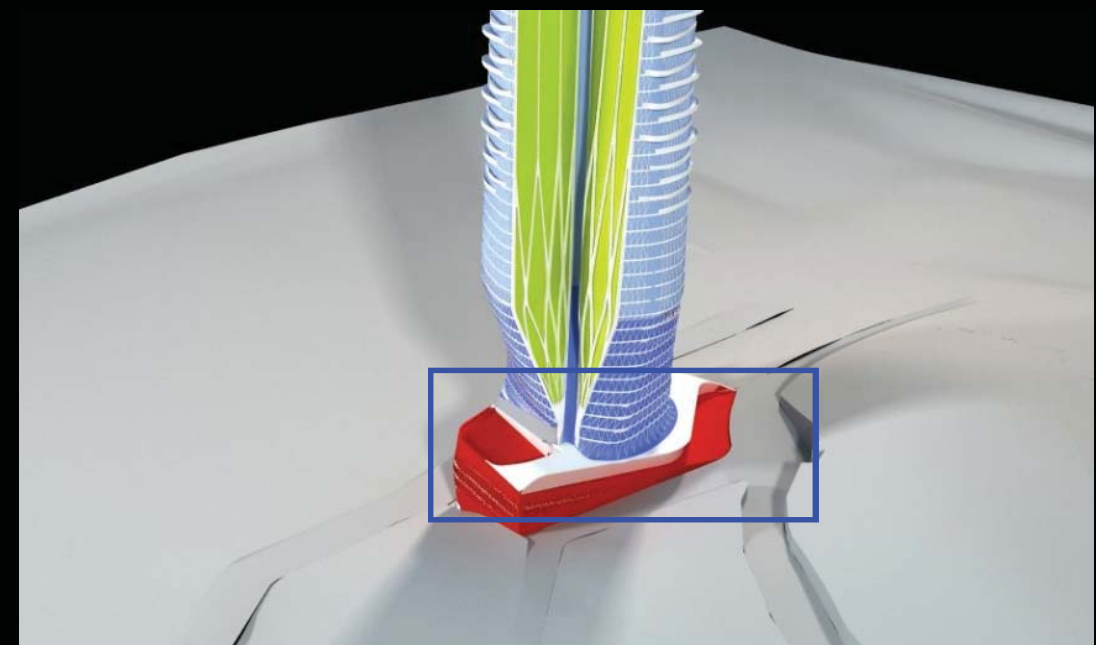


Façade Type III

Facades made of stick system are advisable for the envelope area with multiple openings. Since the stick systems can be reached from outside (from ground floor) they have an economic advantages. Levels above ground floor need to provide an outside scaffold since stick systems need to be glazed from outside.



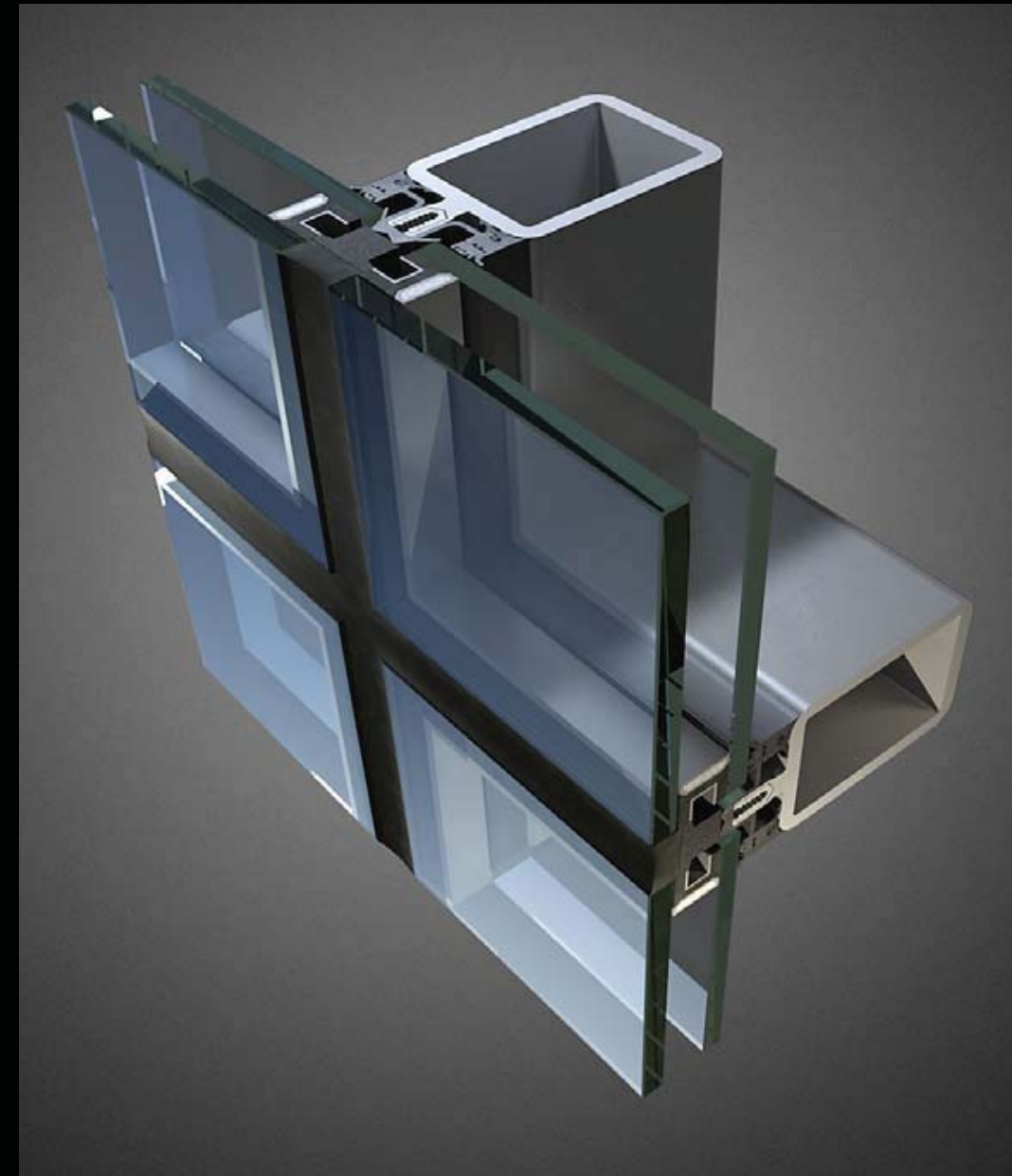
Façade Type III



Façade Type III

Façade Type III

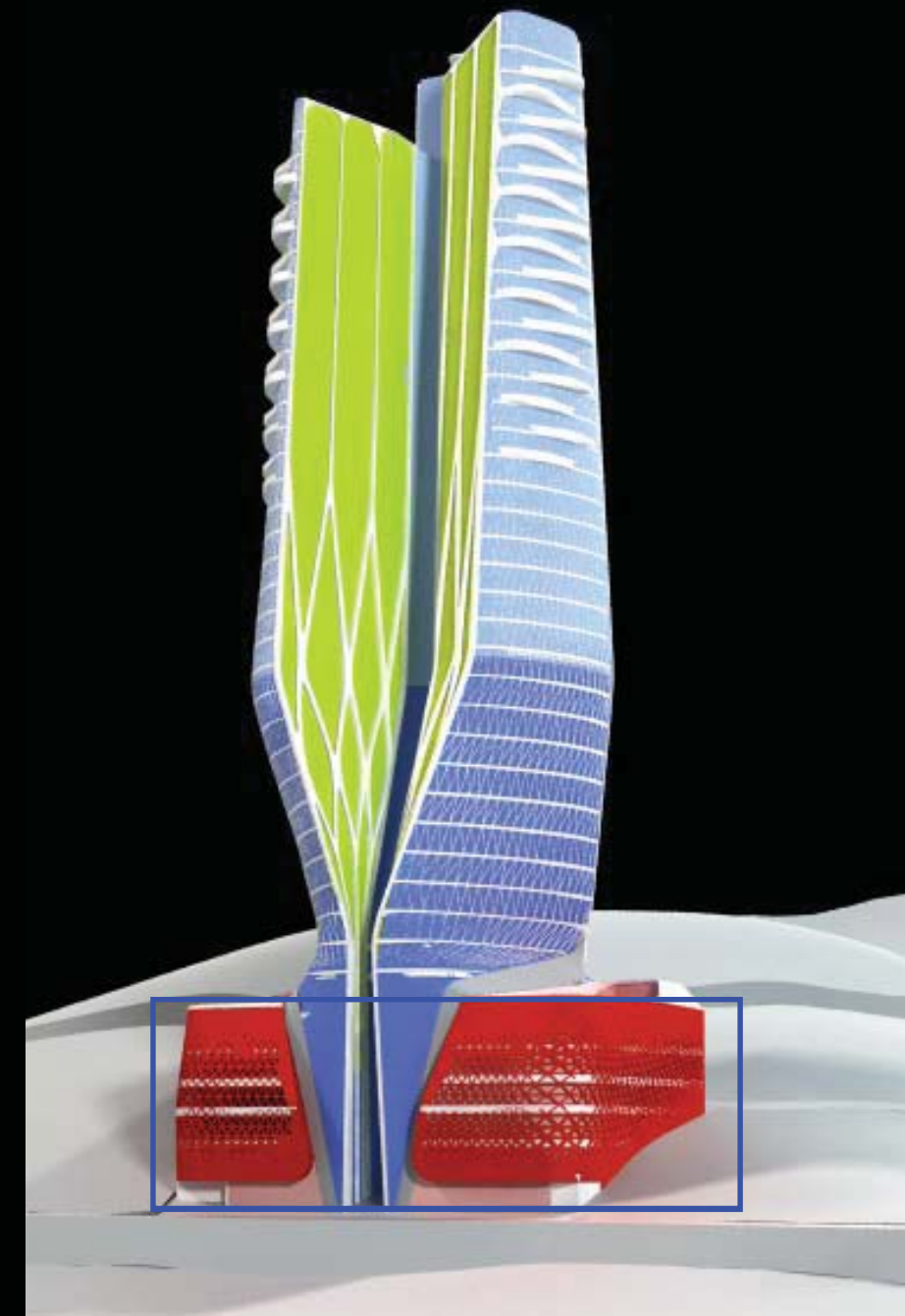
All material (framing and glazing) can easily and safely be carried into the cores to the final installation position. First the frames are installed. Afterwards, the glass units will be put into the frames, fixed and sealed from outside. A structural glazing system without pressure strips can be used for this type of façade.



Façade constructed with a stick system

Façade Type IV

Façade type IV is a unitized façade located at the retail, fitness, and congress area. The façade has a double skin façade in front of the glazing.



Façade Type IV

Façade Type IV

Façade type IV is a unitized façade with an extra glazing system constructed out of perforated sheets. The connection detail to the slab edges is adjusted to the outer glazing system.

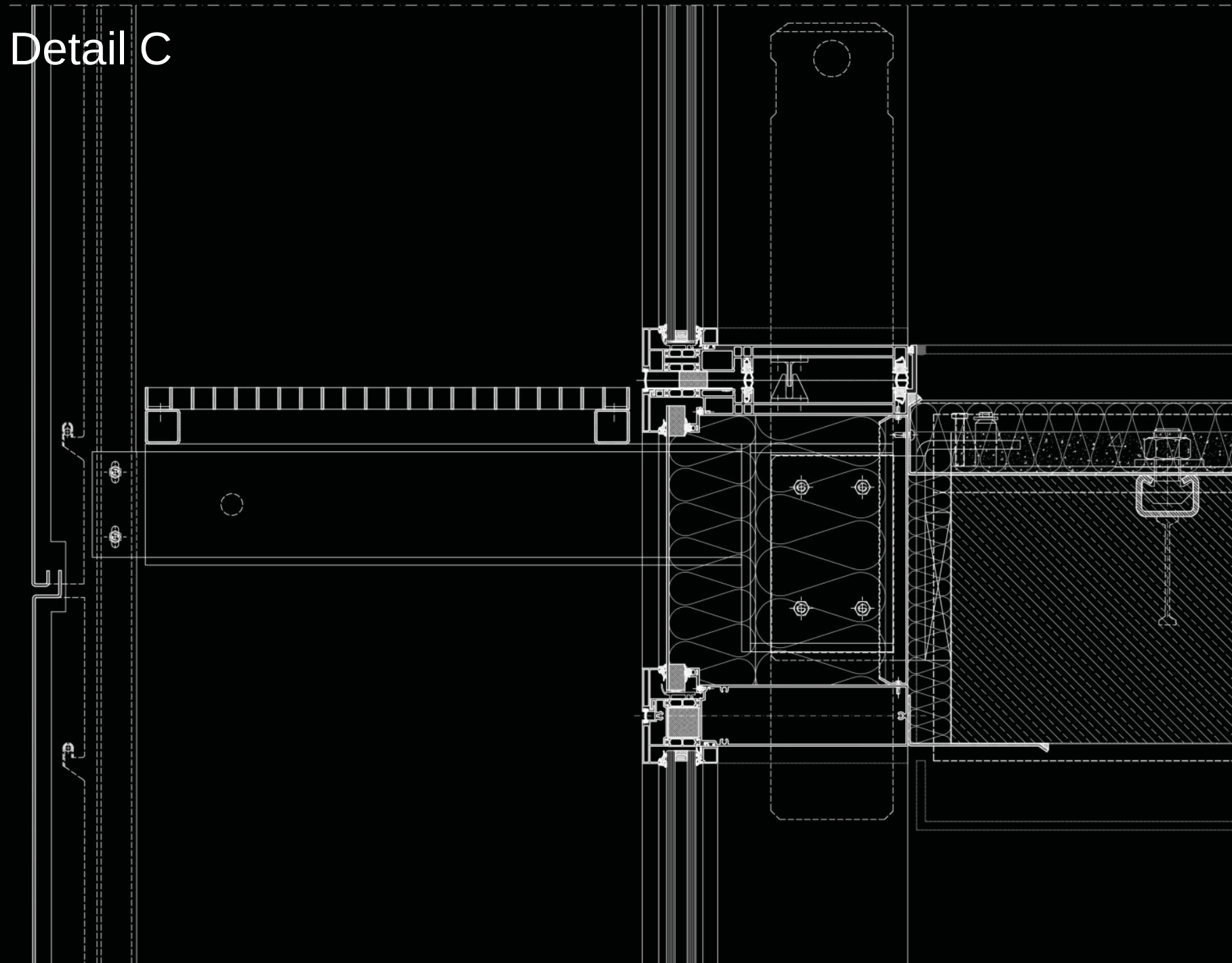
All elements are rectangular or trapezoidal and can be produced reasonable priced.



Façade Type IV

Façade Type IV

Detail C



Example for a façade with a double skin sun protection. Suedwestmetall building, Reutlingen, Germany

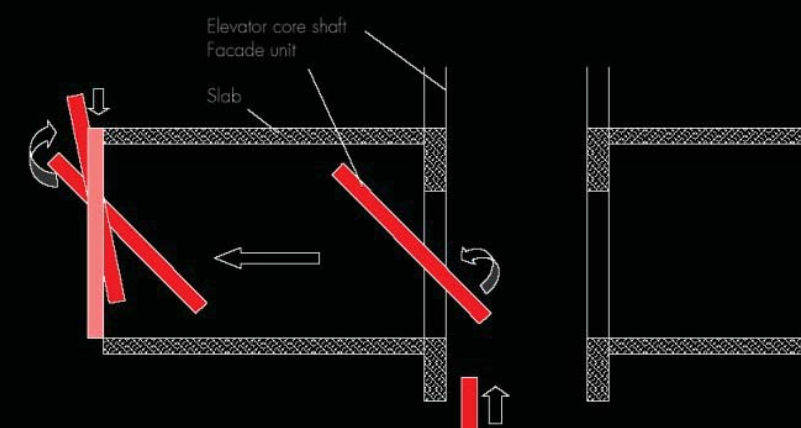
6. Façade assembly

The façade should be designed as a fully unitized system. This assures high quality as well as a quick and crane-independent erection without scaffolding. The façade can be assembled using a monorail system. As alternative the elements can be transported inside or on top of the elevator.

- Erection as quick and simple as possible: Few and simple connections on site, without additional sealing etc. The result is a unitized system with an assured, constant high quality as well as a quick and crane-independent erection without scaffolding.



Fassade assembly using monorail system (example)



Principle scheme of façade element transportation and positioning

7. Ventilation and Air Conditioning (HVAVC)

To guarantee a homogeneous appearance of the tower the technical area at level +20 and +30 are built with an identical unitized façade as applied for the regular residential and hotel levels.

Ventilation channels run vertical and parallel to the structural system of the mega structure at façade type II.

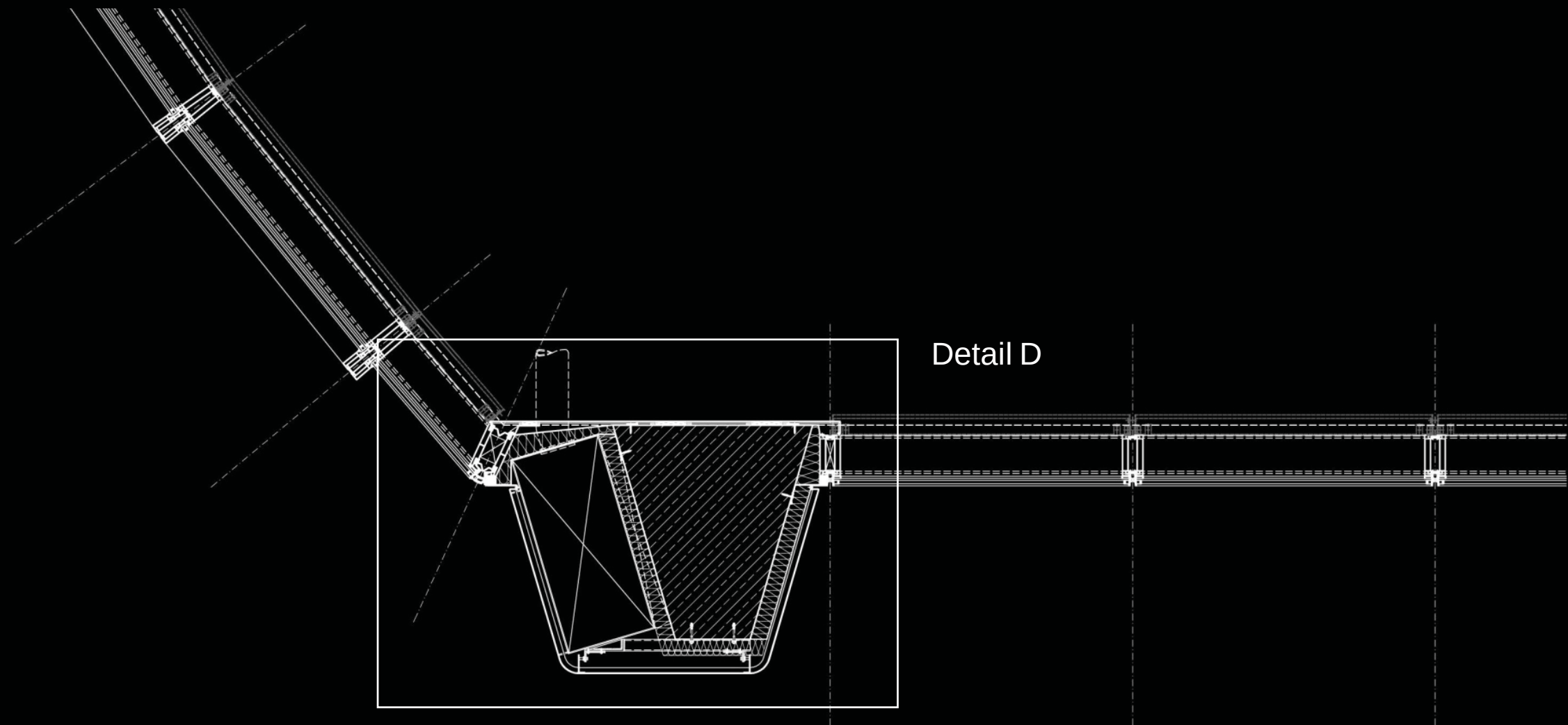
A further technical area at level - 02 is also hidden behind the double skin façade.



Section

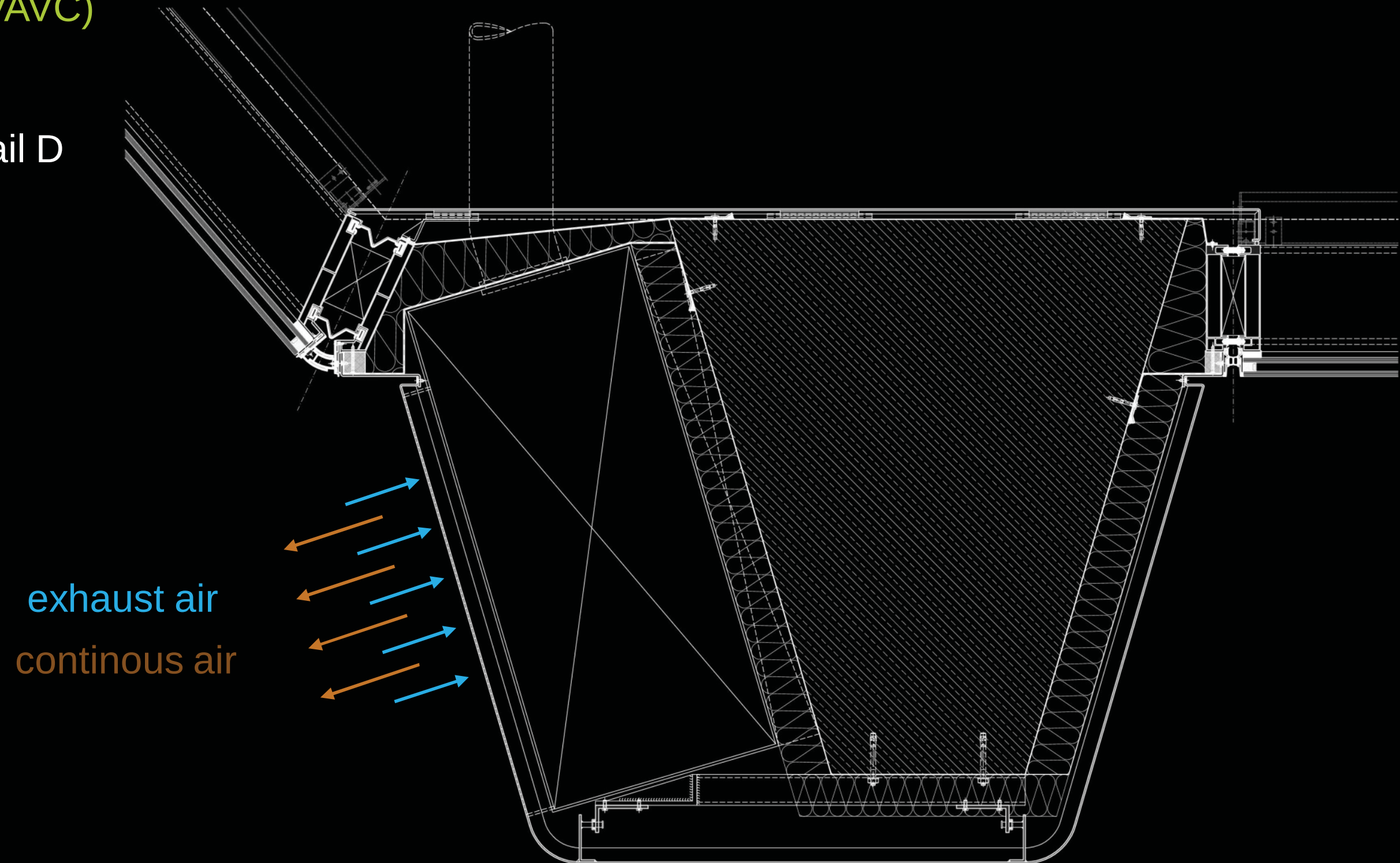
7. Ventilation and Air Conditioning (HVAVC)

Ventilation channels run parallel to the structural system of the mega structure at façade type II.



7. Ventilation and Air Conditioning
(HVAVC)

Detail D



03 TECHNICAL DESIGN

- Structural Engineering
- Facade
- MEP Services
- Fire Prevention
- Sustainability and Lighting



Climatic starting position and influence on the building
air conditioning

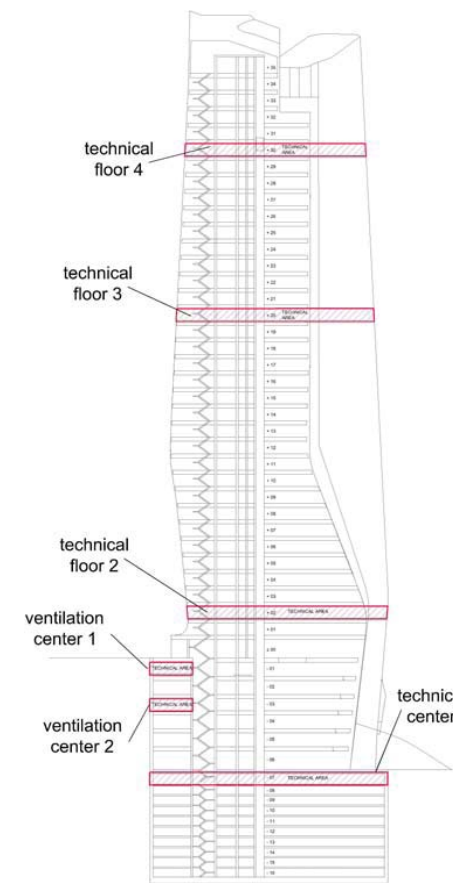
The climate in Teheran is generally a continental climate. The summers are dry and hot. In summer temperatures can reach about 40°C, with minimum temperatures in summer, about 15°C below the daily high temperatures. In winter from December to March the average temperatures are between 1° and 5°C. There is little rainfall, the total annual average is about 230 mm, 75% falls between early December and late May.

For air conditioning the cool summer nights are interesting. Hence it makes sense to produce energy-efficient cold at night and save it. A component activation and possibly additional cold storage would definitely make sense.

A humidification of the incoming air in winter is recommended only for very high standards. A dehumidification of air during summer is not necessary.

The entire building will be monitored through fire alarm, video, access and intrusion-dean. There will be installed an electroacoustic system for announcements in case of danger which will be also used for audio and video equipment for entertainment.

Technical development

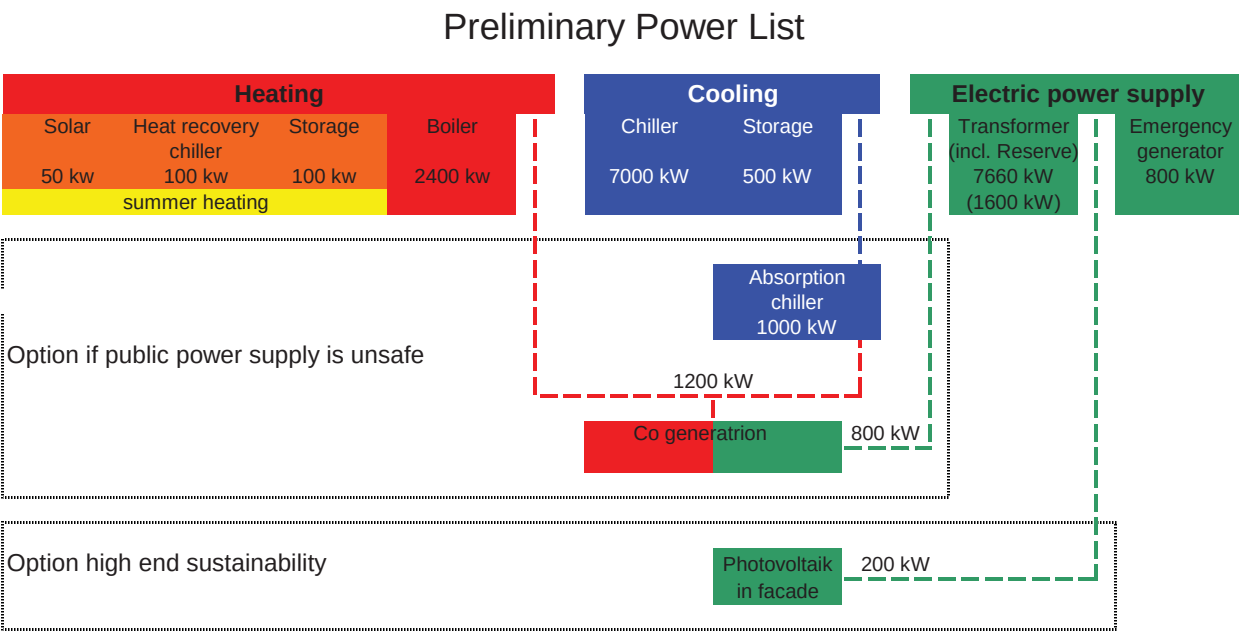


The building provides a total of 4 technical centers. The technical centre 1 is located in Level -07. The technical centers 2,3 and 4 are located in the tower and each occupies the entire floor level 2, level 20 and 30. All systems are meeting the international standards.

Each floor gets additional electrical distribution rooms, which are connected via high current rails and ensure the power supply. The emergency generator and emergency power distribution are located in the techn. center. The whole building gets a sprinkler system for active fire-fighting. Sprinkler pumps and water storage are located in technical center. Every 30 to 40 m there are located wet hydrants with fire hose and fire extinguisher powder.

Preliminary Power List

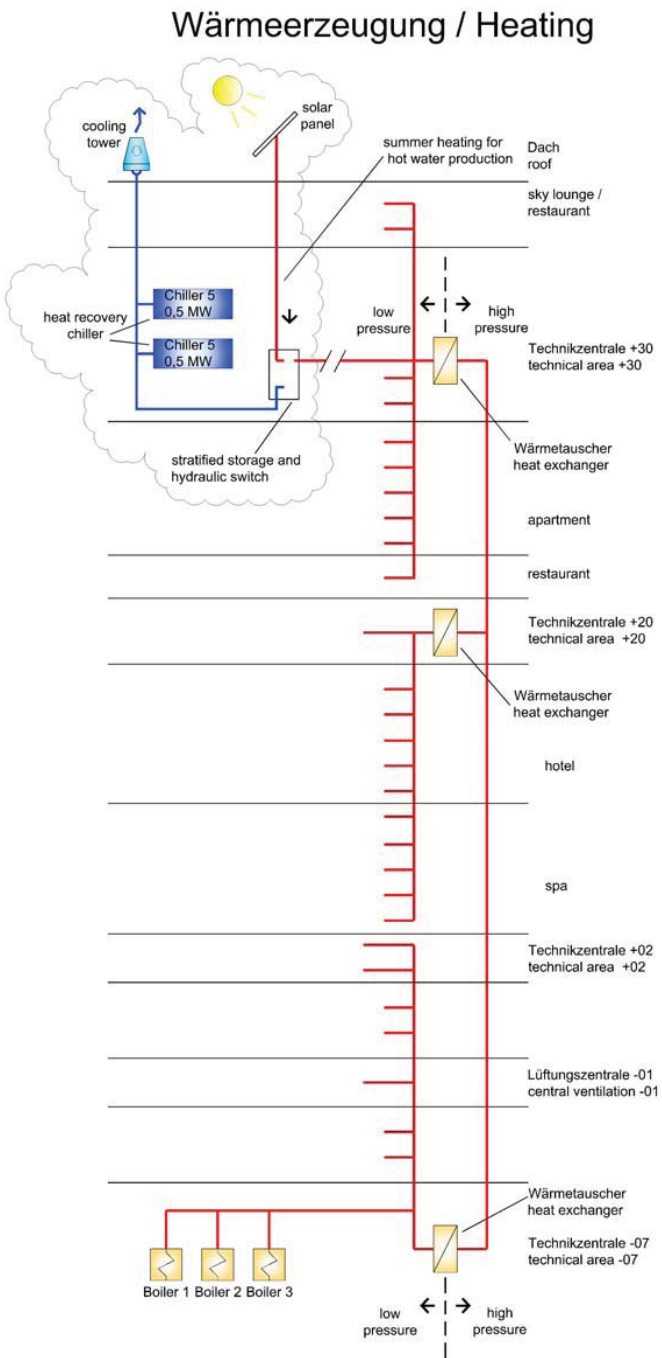
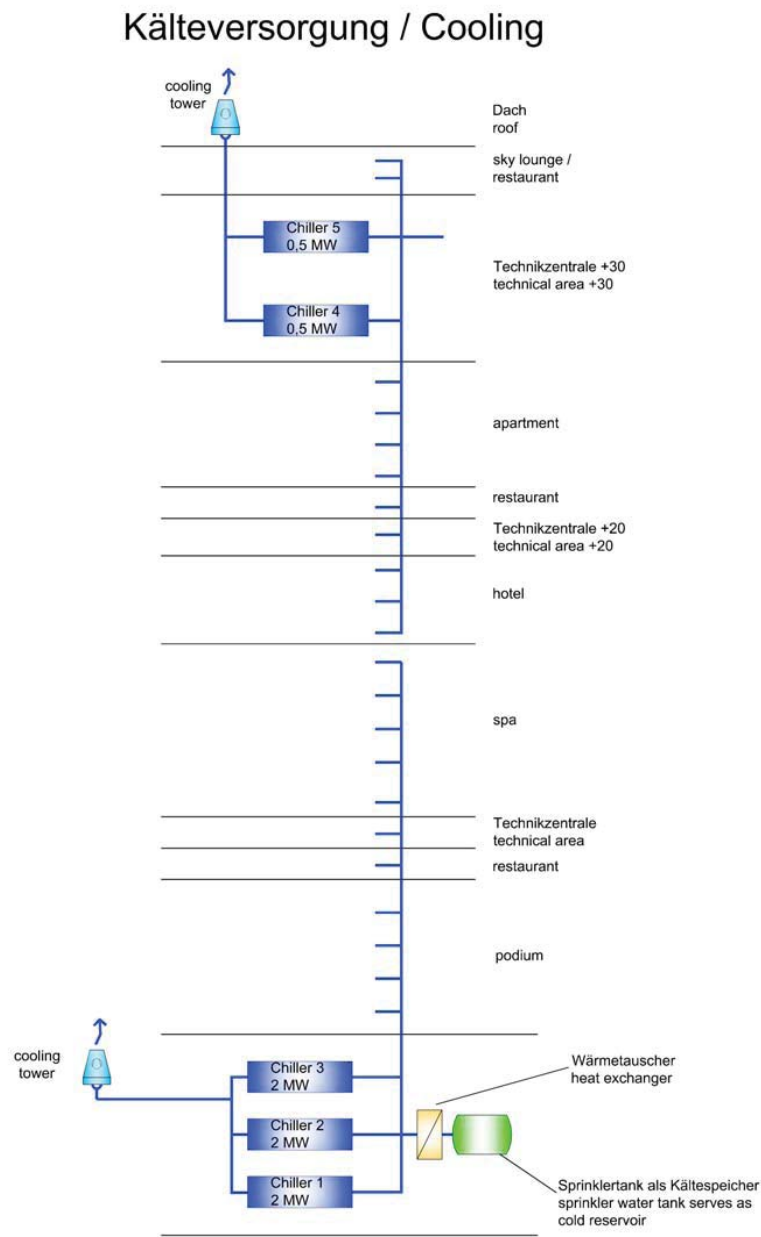
The following overview shows the necessary power to the operation of the building.



Heating and Cooling

The heat and cooling takes place in technical centre 1, an additional cooling is provided in this technical centre 4 for the upper floors of the tower. In each of the technical centre the heat, cold, and water distributions for the adjoining areas are located. Each floor in the tower is replaced by an additional distribution space.

The warm water production for the heating is carried out exclusively via 3 boilers in winter. The warm water production for hot-water is carried out via the heat recovery of the chillers and solar panel in summer. A connection between the technical centres is made via high pressure tubes.

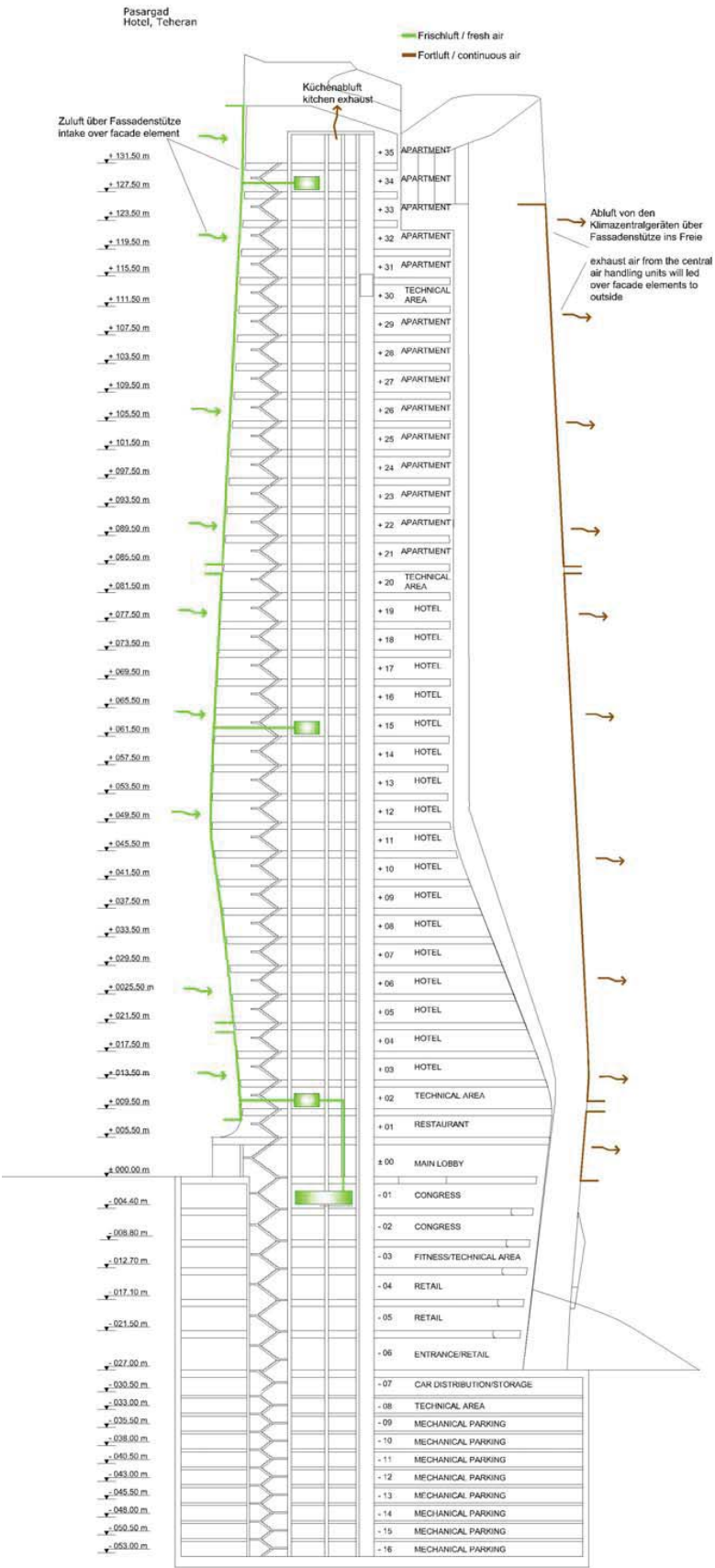
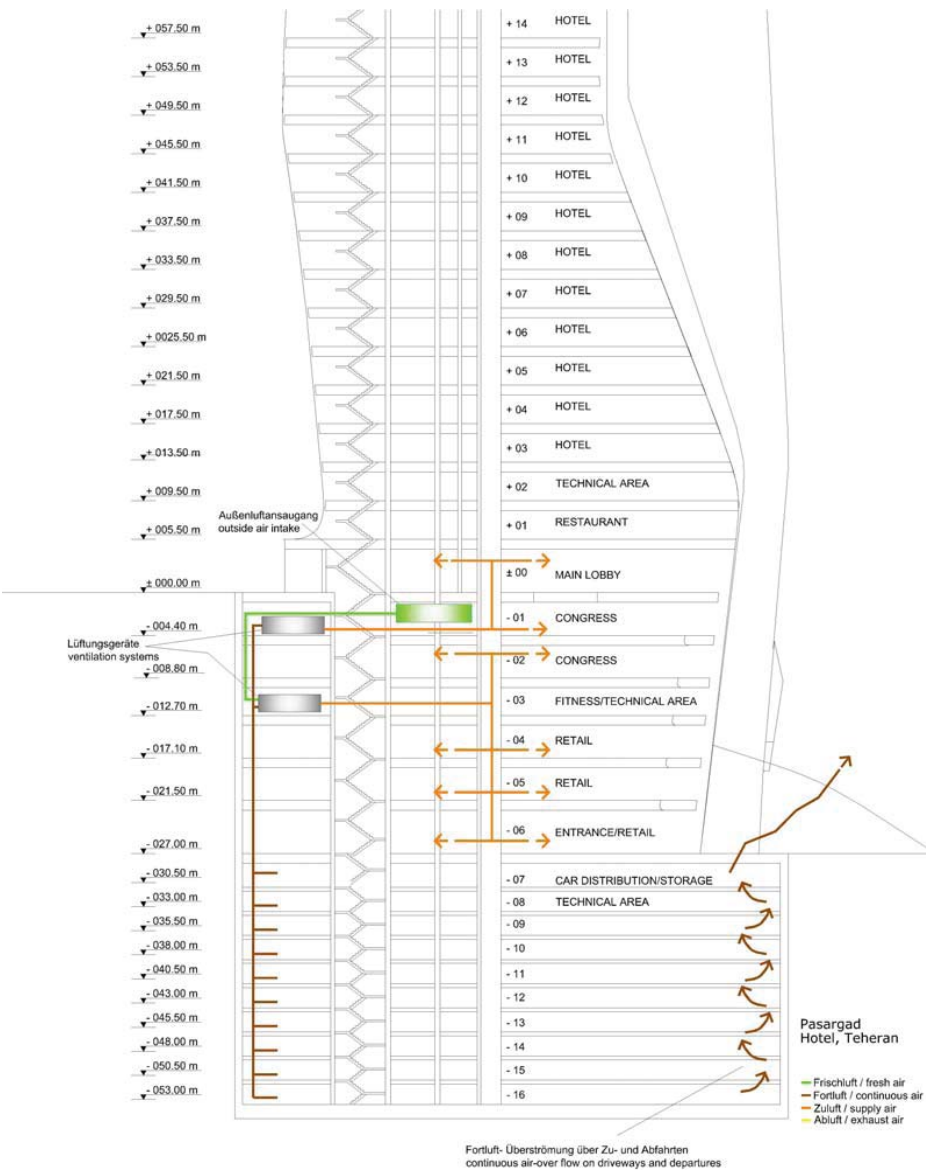


Ventilation

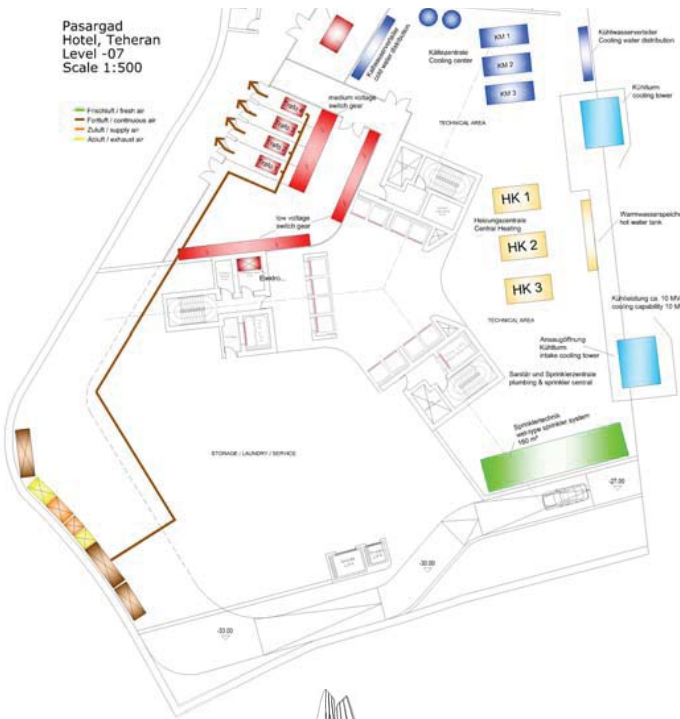
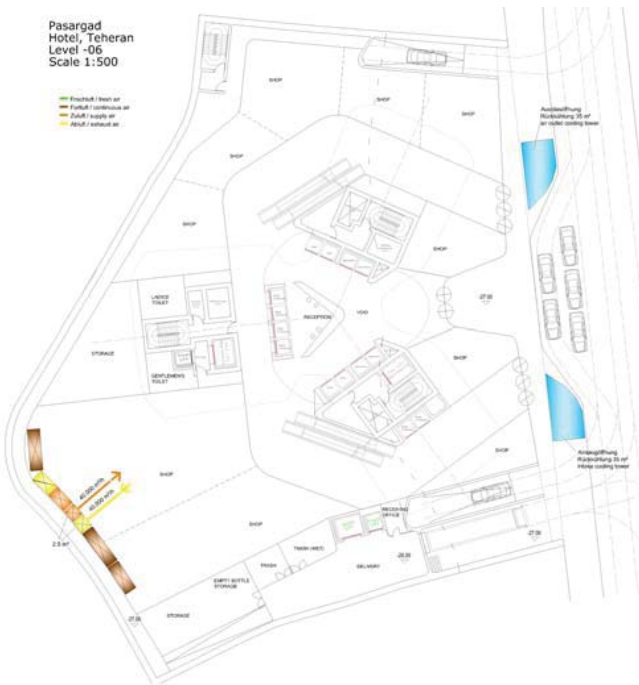
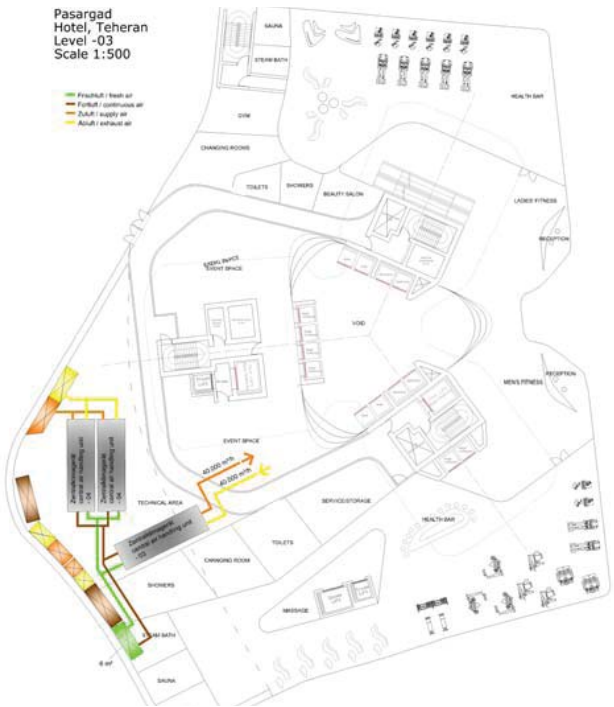
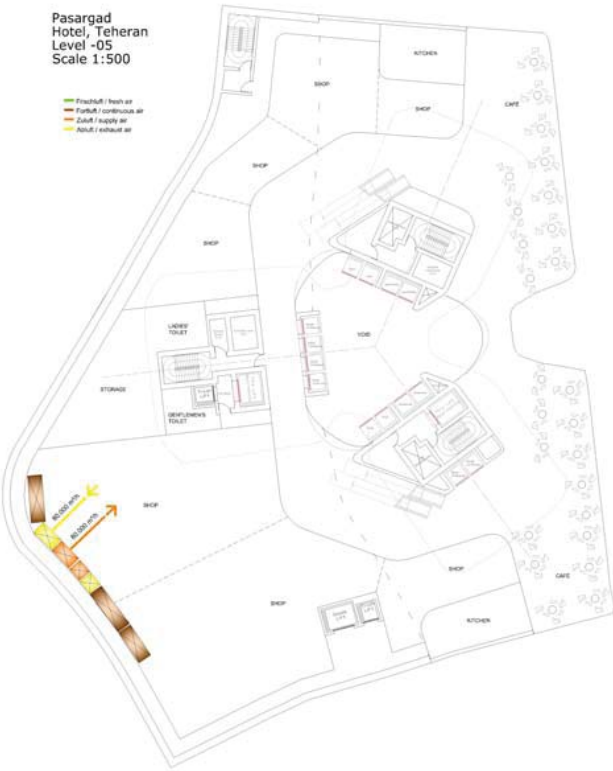
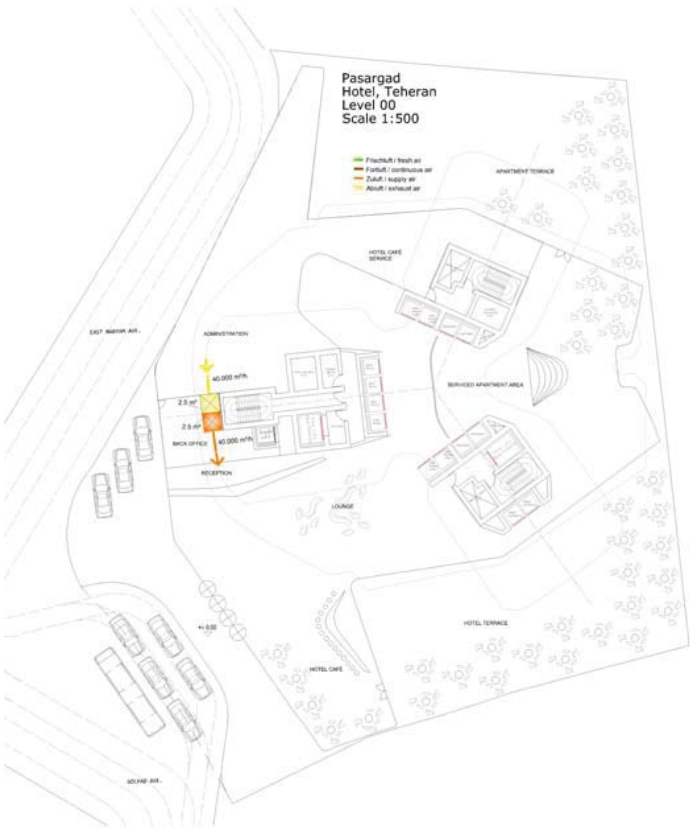
The whole building is ventilated mechanically. The amount of air will be introduced into the building, ensuring the use according to international standards a high air quality. All ventilation systems will provide heat recovery systems.

For the tower the fresh air supply and the exhaust air are carried out via the columns in the façade.

The fresh air For the Podium will be absorbed over an air inlet grill in the façade. With the exhaust air technological plants were cooled and are absorbed via the accesses in the car parking area



Central ventilation stations and air distribution



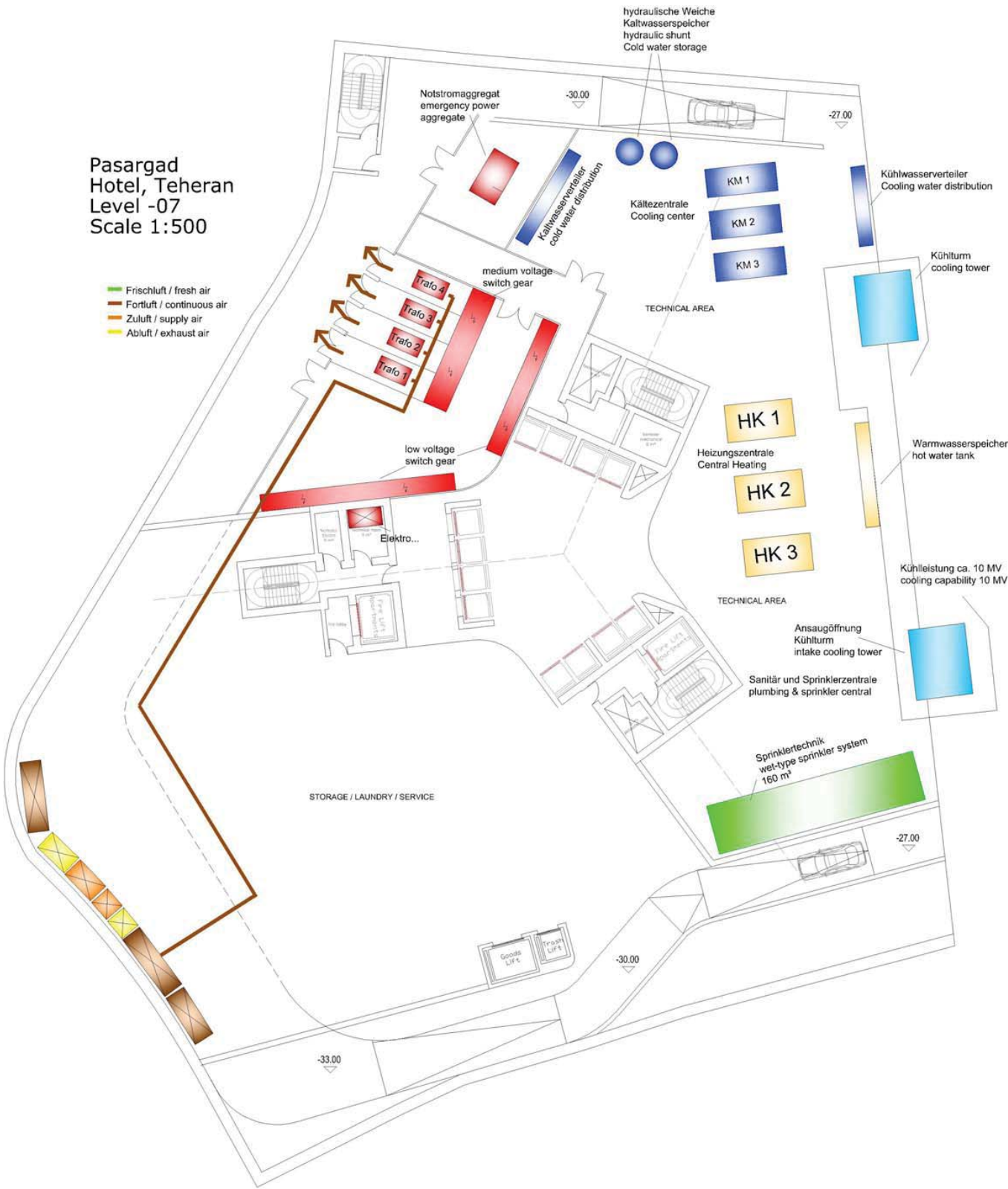
Technical Centre Level -07

The main technology head office is on the story -07. All central plants for electric supply, heating, cold water production and fire-fighting equipments inklusiv sprinkler tank are located here.

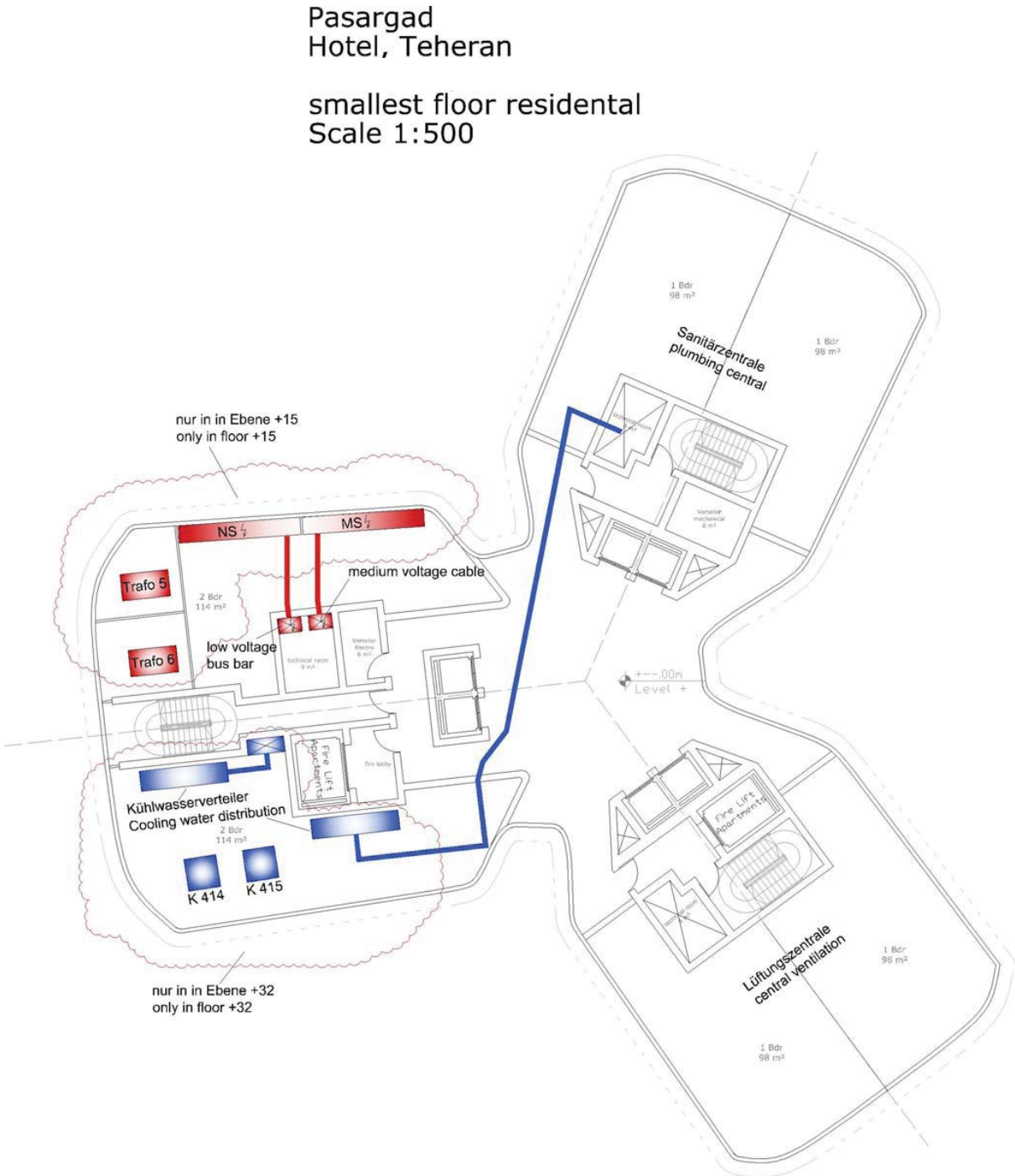
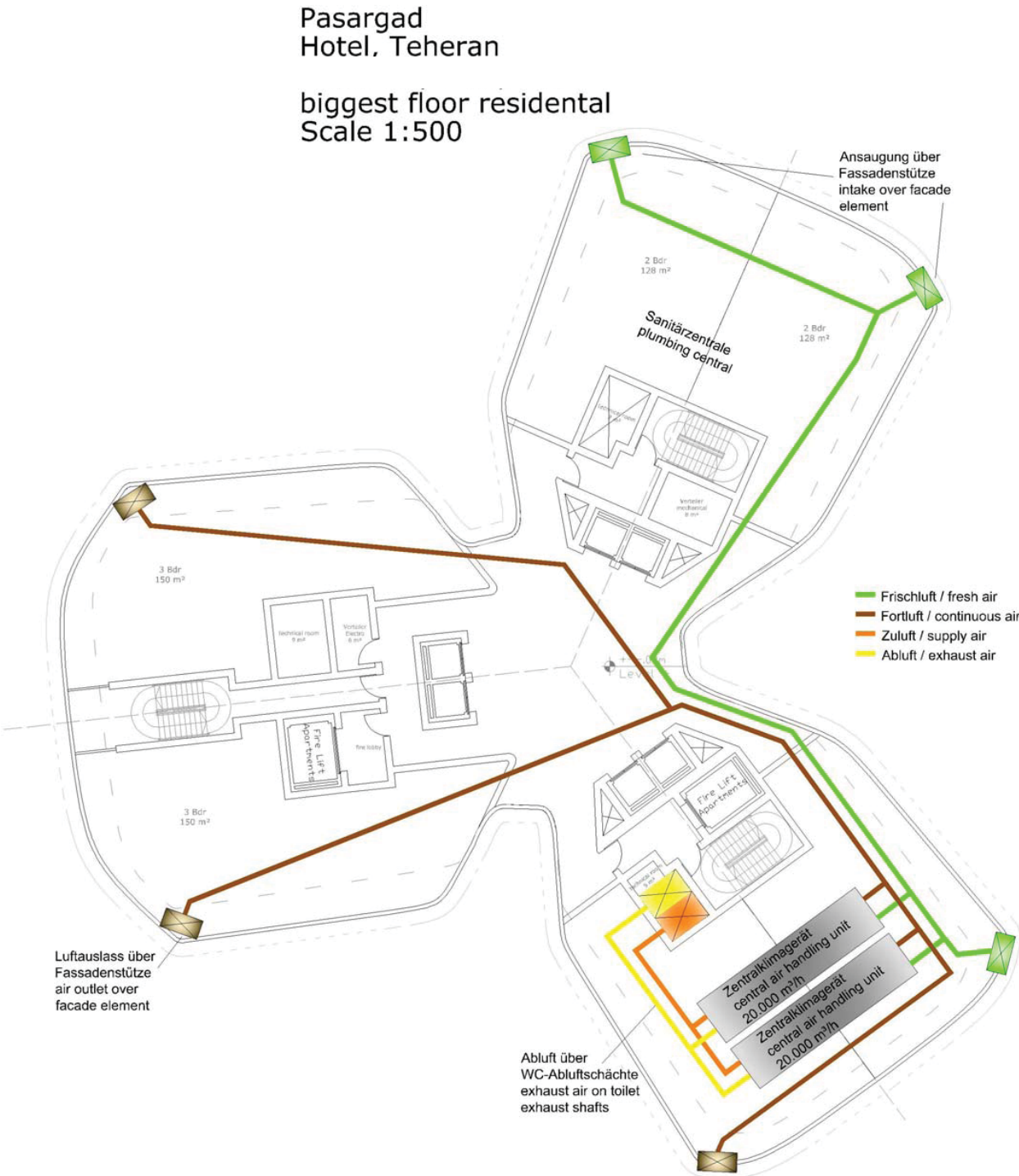
The electric rooms are accessible from the outside. Be able to about the underground car park entry heavy be plant part delivered and exchanged.

The sprinkler tank serves as cold storage at the same time.

The cooling tower stands on the same level but outside the building. The necessary cooling air will come over openings to the street.



Tower technical systems



Tower technical systems and distribution

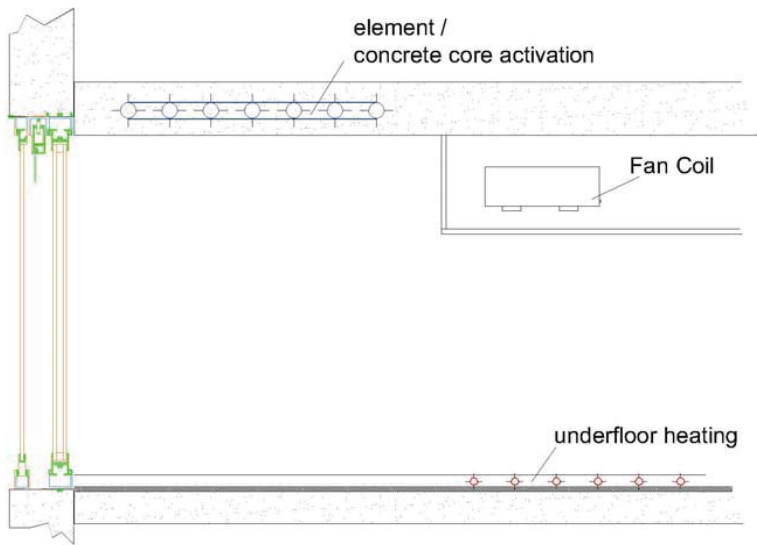
Pasargad
Hotel, Teheran

Scale 1:500



For heating and cooling of the building different secondary systems are provided.

In the residential and hotel area (rooms) the outer areas of the building will obtain a concrete core activation and fan coils to cover the peak load. The inner areas receive a floor heating.



Conveying

For the perceived quality of a skyscraper the handling, especially with the elevators, is of crucial importance.

The building has two main entrances. One is situated in the 6th sub basement in the main lobby, the other main entrance of the building is located in the reception area on ground floor level. The aim is that the guests coming from the underground car parking area and the entrance of level -6 will be gathering in level 00 and distributed after registration from here by each elevator into their suites. Hence in our concept 4 lifts are provided in which all guests can be transported without problems even at peak traffic times where 2 of them are going to the sky lounge. The apartment area is omitted.

The tenants of the apartments will have direct access to their own elevators from the underground parking area and the 2 main entrances into the building. In these elevators only tenants are being transported. The breakpoints are located only on the apartment floors. In the podium area 6 elevators and 2 escalators are provided. Shops are located in the sub basement 6 to 4. These are covered by the escalators, In this area the 6 lifts won't be used very often apart from wheelchair users or pushchairs. Thus, in the levels sub basement to ground level 6 lifts are available for the remaining use.

Gebäude- und Grunddaten Hotel:
Building and real data Hotel:

Haltestellen / stops:	18 Stockwerke / floors
Aufzugsnennlast / Lift rated load:	1275 KG
Förderhöhe / pressure height:	65 m
Nenngeschwindigkeit/ rated speed:	2,5 m/s

Ergebnis / result

Anzahl der benötigten Aufzüge:	4 Aufzüge
Required number of lifts:	4 Lifts
Mittlere Wartezeit:	36 Sekunden
Average Latency	36 seconds
Förderleistung der Aufzüge	816 Pers./h
Capacity of the lifts	816 Pers./h

Gebäude- und Grunddaten Apartment:
Building and real data Apartment:

Haltestellen / stops:	14 Stockwerke / floors
Aufzugsnennlast / Lift rated load:	1275 KG
Förderhöhe / pressure height:	45 m
Nenngeschwindigkeit/ rated speed:	4 m/s

Ergebnis / result

Anzahl der benötigten Aufzüge:	2* 2 Aufzüge
Required number of lifts:	2* 2 Lifts
Mittlere Wartezeit:	26 Sekunden
Average Latency	26 seconds
Förderleistung der Aufzüge	521 Pers./h
Capacity of the lifts	521 Pers./h



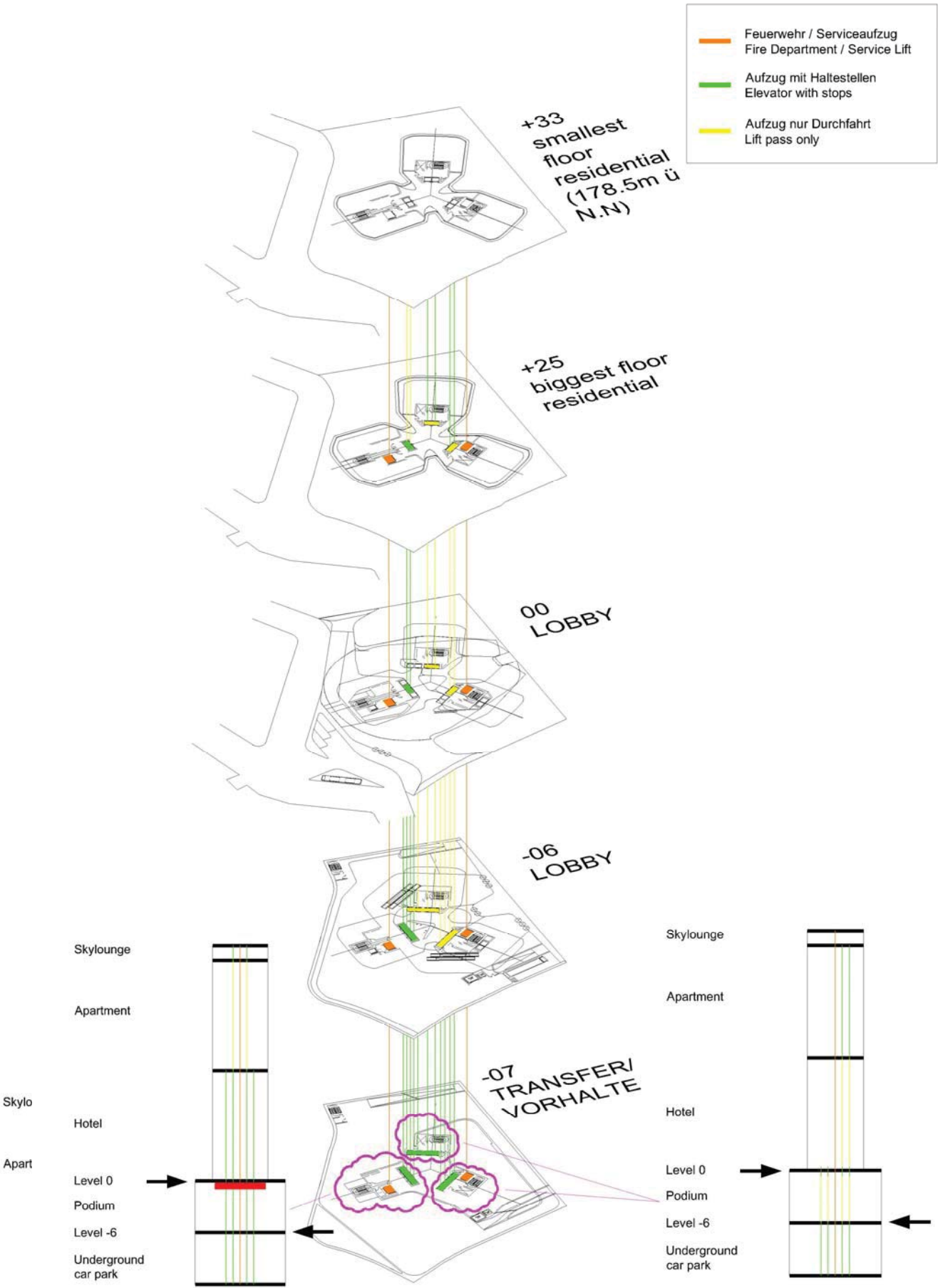
Gebäude- und Grunddaten Podium:
Building and real data Podium:

Haltestellen / stops:	8 Stockwerke / floors
Aufzugsnennlast / Lift rated load:	1275 KG
Förderhöhe / pressure height:	35 m
Nenngeschwindigkeit/ rated speed:	1,6 m/s

Ergebnis / result

Anzahl der benötigten Aufzüge: Required number of lifts:	4 Aufzüge 4 Lifts
Mittlere Wartezeit: Average Latency	33 Sekunden 33 seconds
Förderleistung der Aufzüge Capacity of the lifts	1.152 Pers./h 1.152 Pers./h
Förderleistung der 2x Rolltreppen Capacity of the 2x escalators	9.000 Pers./h 9.000 Pers./h

Gesamte Förderleistung pro Stunde Total capacity per hour	10.152 Pers./h 10.152 Pers./h
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Automatische Parksysteme

SCHOLZGRUPPE

INGENIEURE | CONSULTANTS



ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran



Option 1

SCHOLZGRUPPE

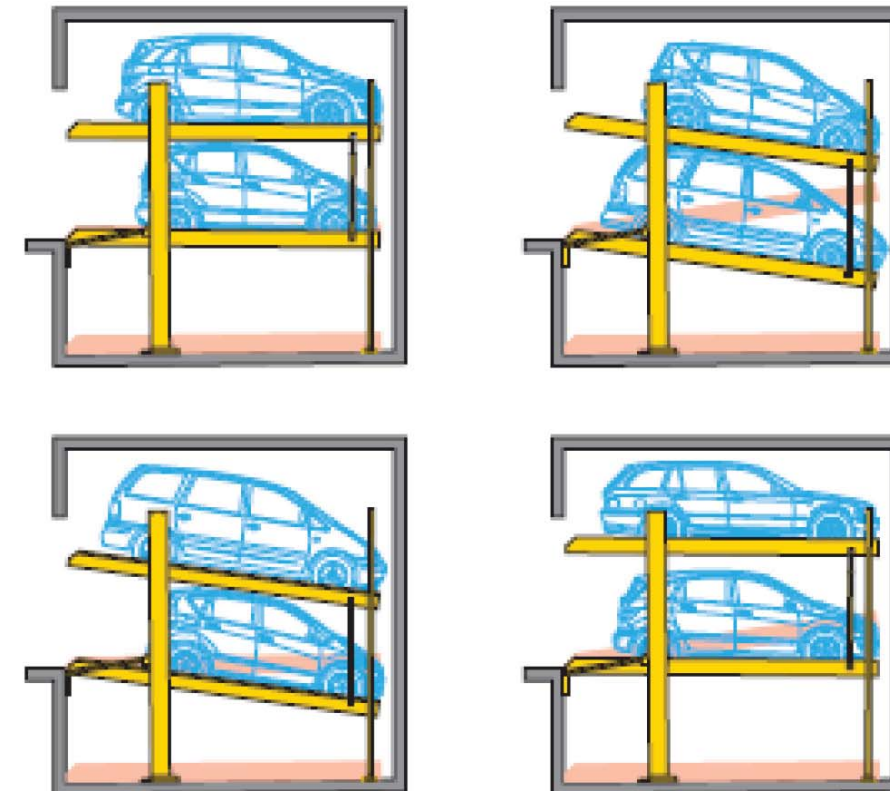
INGENIEURE | CONSULTANTS

Dieser Parklift ist ein modular variables mechanisches Parksystem, das dem Erwerber er ermöglicht, seinen Stellplatz veränderten Autogrößen anzupassen.

Bisher mussten sich Architekten und Bauherren möglichst frühzeitig für die Verwendung eines Produktes entscheiden und sich damit festlegen, was Grubentiefen, Raumhöhen und Pkw-Größen angeht.

Vorteile: Er beinhaltet die gängigsten Parklifttypen für Grubentiefen von 155 bis 200 cm und lässt bei entsprechender Raumhöhe Pkw-Höhen von 150 bis 195 cm zu.

Damit kann zu einem x-beliebigen Zeitpunkt, z.B. bei Neukauf eines anderen Pkw-Typs, das bereits eingebaute Parksystem nachträglich den veränderten Anforderungen angepasst werden.



ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran



Option 2

Dieses automatische Parksystem ermöglicht raumsparendes Parken im Hochregal.

Die Parkebenen und die Baustruktur sind aus Beton ausgeführt. Betonstrukturen können preisgünstiger sein, insbesondere bei unterirdischen Baukörpern, die ohnehin aus statischen Gründen Zwischendecken erfordern.

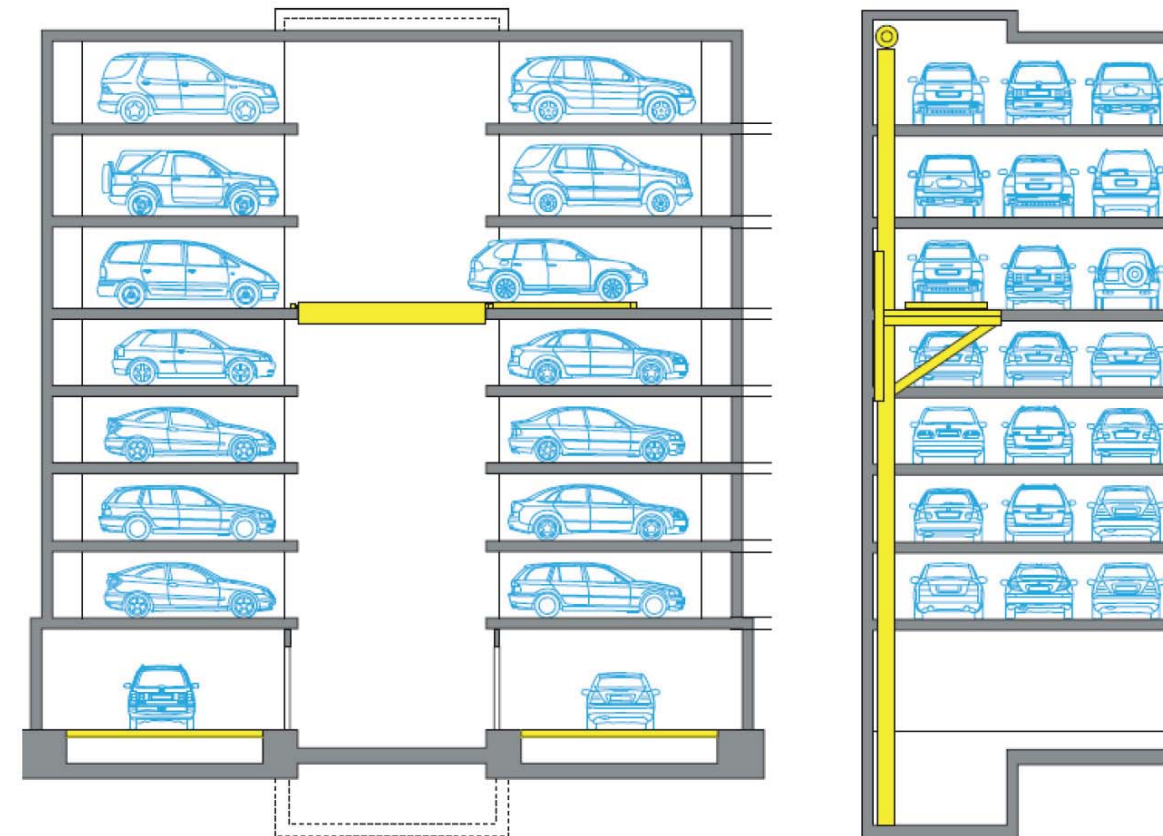
Die Besonderheit ist das LAT (Längsaufnehmendes Transportsystem).

Der Pkw wird im Übergabebereich aufgenommen und anschließend direkt auf einer ebenen Betondecke abgestellt.

Dieses System eignet sich für kleine Grundflächen und bis zu 30 Parkebenen.

Die Übergabebereiche lassen sich in jeder der Parkebenen anordnen als Turm-, Schacht- oder Turm-/Schachtvariante.

Die Stellplätze lassen sich auch in 2 Reihen hintereinander anordnen.



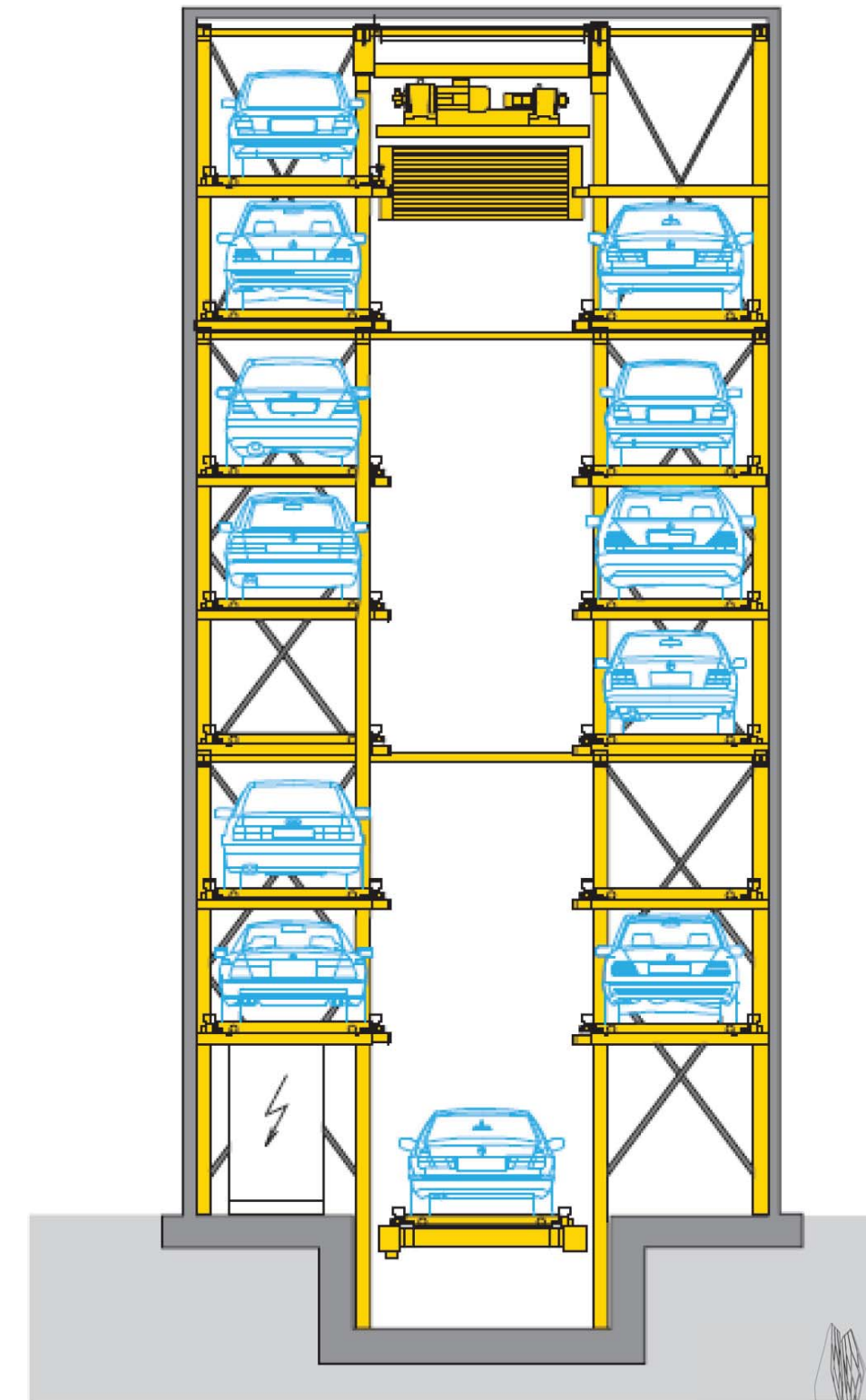
Option 3

SCHOLZGRUPPE

INGENIEURE | CONSULTANTS

Der Parksafe ist ein automatisch gesteuertes Auto-Parksystem mit einem zentralen Vertikalförderer und rechts und links von ihm angeordneten Regalfächern.

Der Parksafe macht Rampen und Fahrgassen überflüssig, bietet Sicherheit vor Diebstahl, Beschädigungen und Vandalismus, spart teure Haustechnik im Vergleich zu konventionellen Garagenbauten und ist umweltfreundlich im Sinne einer verdichteten Bauweise und verminderter Abgasimmission.



ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran

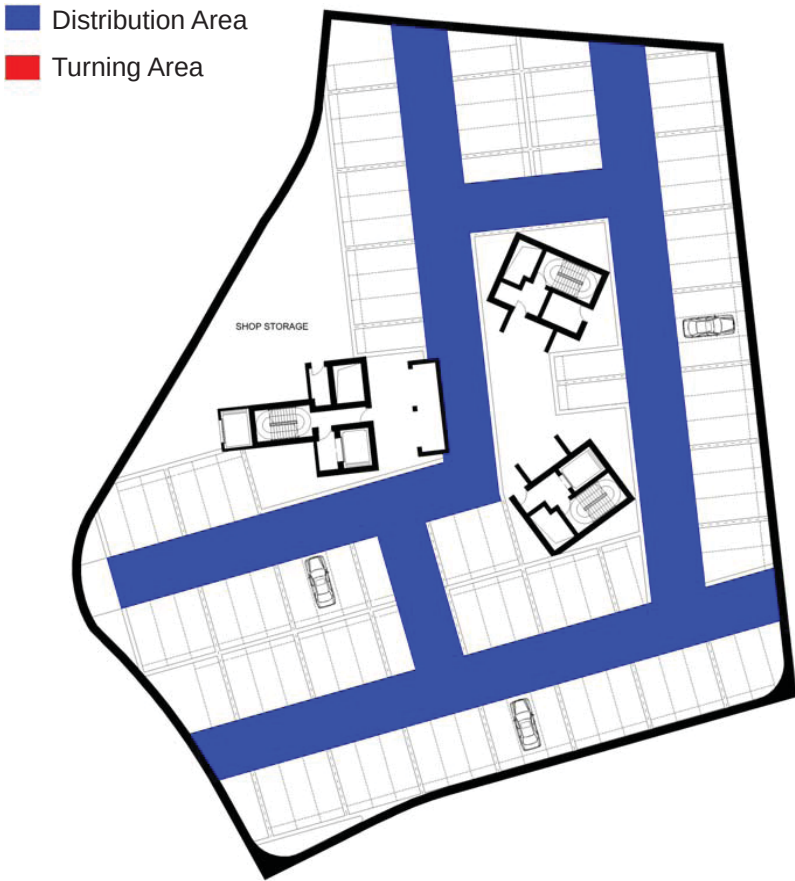
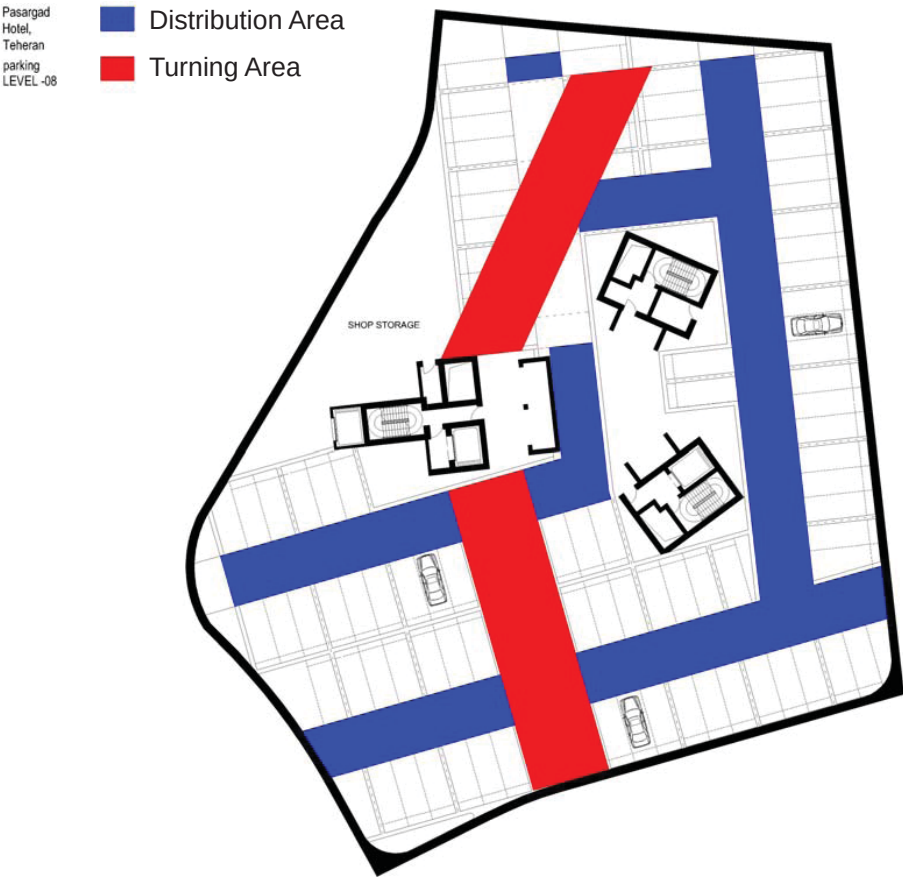
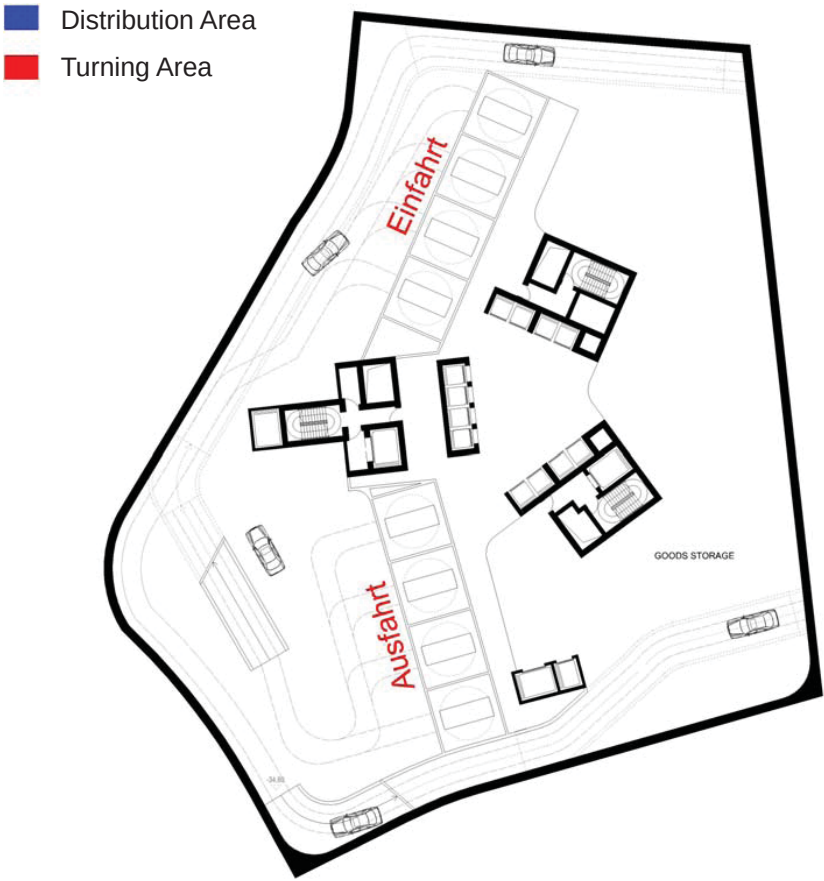


Mechanical Parking

On request of the customer we have planned an automatic park system.

The guest drives up to the second basement (level -08). Five single car boxes are located here. The guest drives into a vacant box and leaves the vehicle. The vehicle is parked automatically as soon as the guest has left the box. The function remembers of a high bay warehouse. The guest can pick up his vehicle in 5 separate boxes upon request. With 4 boxes to pick up the vehicle and another 5 boxes distributing the vehicles in the vacant car parking area, a number of 280 vehicles in total can be parked.

Automatic park systems are not suitable for peak load operation and are requiring consistent maintenance.



03 TECHNICAL DESIGN

- Structural Engineering
- Facade
- MEP Services
- Fire Prevention
- Sustainability and Lighting



HHP West Beratende Ingenieure GmbH
Herforder Straße 20 • 33602 Bielefeld • GERMANY

fire protection planning
fire protection consulting
court opinions
determination of fire causes
checking of fire precautions

Zaha Hadid Ltd.
Architecture
Bei den Mühlen 70
20457 Hamburg
Germany

your reference
ZHA
(Ms. von Roeder)

dated
20.10.2010

our reference
Zi/Sm
10BI-1404S

date
21.10.2010
10BI-120V
Digitale Ausfert.

Building project: Pasargard Hotel Teheran
re: Fire Protection Plan on the basis of the planning stage
„competition“

FIRE PROTECTION PLAN

In the following the main points of the fire protection plan for the “Pasargard Hotel Teheran” are described on the basis of the planning stage “competition”.

1. Fire brigade access road

Along three sides of the building site public streets are located that will serve as fire brigade access roads.

2. Water supply

Along the streets close to the building hydrants must be provided. The total output of the system must be ≥ 1.600 l/min, the output of a single hydrant ≥ 800 l/min.

3. Fire resistance of the construction

The fire resistance of the construction is ≥ 90 min.

4. Fire resisting closures

The system of the fire resisting closures in the apartment levels, in the standard hotel levels, in level -02 and in level -06 can be understood from the plans (→ see attachment to this fire protection plan). For the other levels the fire resisting closures will be defined later in the planning.

Considering the almost area-wide sprinkler network no fire break walls are defined.

5. Escape ways

From all areas of the building at least three escape ways will be provided. Each unit adjacent to the hall will be provided with at least one escape way that is independent from the hall.

The three main staircases and the firemen's lifts will be accessible via emergency locks. The staircases, the emergency locks and – in the standard levels – the lobbies of the other elevators will not contain any combustible material.

The staircases will be provided with safe exits to outside.

The minimum width of the main escape ways is 1,20 m, the grading of the width will be a multiple of 60 cm. The maximum capacity of a 60 cm-module is 100 persons (→ inside the building) respectively 300 persons (→ outside the building [e. g. on the terraces]).

6. Elevators

Two firemen's lifts will be erected.

All elevators will be provided with fire control systems.



7. Emergency lighting

All public areas of the building, the staircases, the corridors, the lobbies of the elevators, the emergency locks and the areas for the mechanical equipment will be provided with emergency lighting.

8. Venting systems

The venting systems will be subdivided into sections by fire stoppings that have the same fire resistance like the wall respectively the floor. The system ensures that smoke cannot be spread in areas that are not affected by the destructive fire.

9. Smoke exhaust venting systems

The staircases and the lift cages of the firemen's lifts will be provided with overpressure venting systems.

The other lift cages will be provided with smoke vent openings at the highest point. The dimension of each opening will be at least 5 % of the area of the lift cage respectively 0.20 m² at a minimum.

The hall will be supplied with mechanical smoke exhaust venting systems. The capacity corresponds to an hourly air change of ≥ 20 .

For the smoke clearance of all other rooms with an area of $> 100 \text{ m}^2$, that contain combustible material (e. g. subterranean garages), the venting systems are used. The output is $\geq 12 \text{ m}^3/(\text{m}^2\text{h})$.

10. Fire alarm installations

Audible alarm devices will be provided area-wide in the building.

In all public areas understandable loudspeakers will be installed, in the other parts of the building alarm sirens will be provided.

11. Extinguishing devices

Sprinkler will be installed in all areas of the building with the exception of the apartments and rooms that don't contain combustible material (e. g. staircases).

Wall hydrants (wet system, 30 m shape-retaining hoses) will be provided in all parts of the building.

Fire-extinguishers will be provided area-wide in all parts of the building.

12. Emergency power supply

All security systems will be provided with emergency power supplies (→ emergency power batteries, emergency power generators).

The cables of the security systems will be erected in a way that makes sure that a (realistic) local destructive fire can only result in a local failure of the security systems.

13. Lightning protection system

The building will be supplied with a lightning protection system that also protects the security systems.

14. Fire detection system

The building will be supplied with a fire detection system. Automatic fire detection elements (preferably optical smoke detectors or linear smoke detectors) will be installed in all areas except for the Garage.

The fire alarm system control unit will be installed in the room for the fire brigade, which will be accessible from outside.

15. Wireless equipment

Wireless equipment that can be used by the fire brigade will be provided for the building.

16. Lightning protection system

A lightning protection system will be provided for the building.

17. Escape and rescue plans / fire brigade operation plans

Not only escape and rescue plans but also fire brigade operation plans will be provided for the building.

18. Operational fire protection

Fire regulations will be provided for the building.

A fire prevention officer must be designated.

Special Remark

The fire protection plan for the “Pasargard Hotel Teheran” will be reconciled with the local fire brigade later in the planning.

Heiko Zies

civil-engineer
authority on fire protection

distribution list: anna.roeder@zaha-hadid.com
philipp.vogt@zaha-hadid.com
jahann.shah@zaha-hadid.com



Pasargad
Hotel,
Teheran
Level +25
biggest floor Resi
Scale 1:200

- | | | | |
|---|---------------------|--|----------------|
|  | fire break wall |  | emergency lock |
|  | fire resistant wall |  | staircase |
|  | void |  | firemen's lift |



ZAHA HADID ARCHITECTS

Pasargad
Hotel,
Teheran
Level +10
biggest floor Hotel
Scale 1:200



ZAHA HADID ARCHITECTS

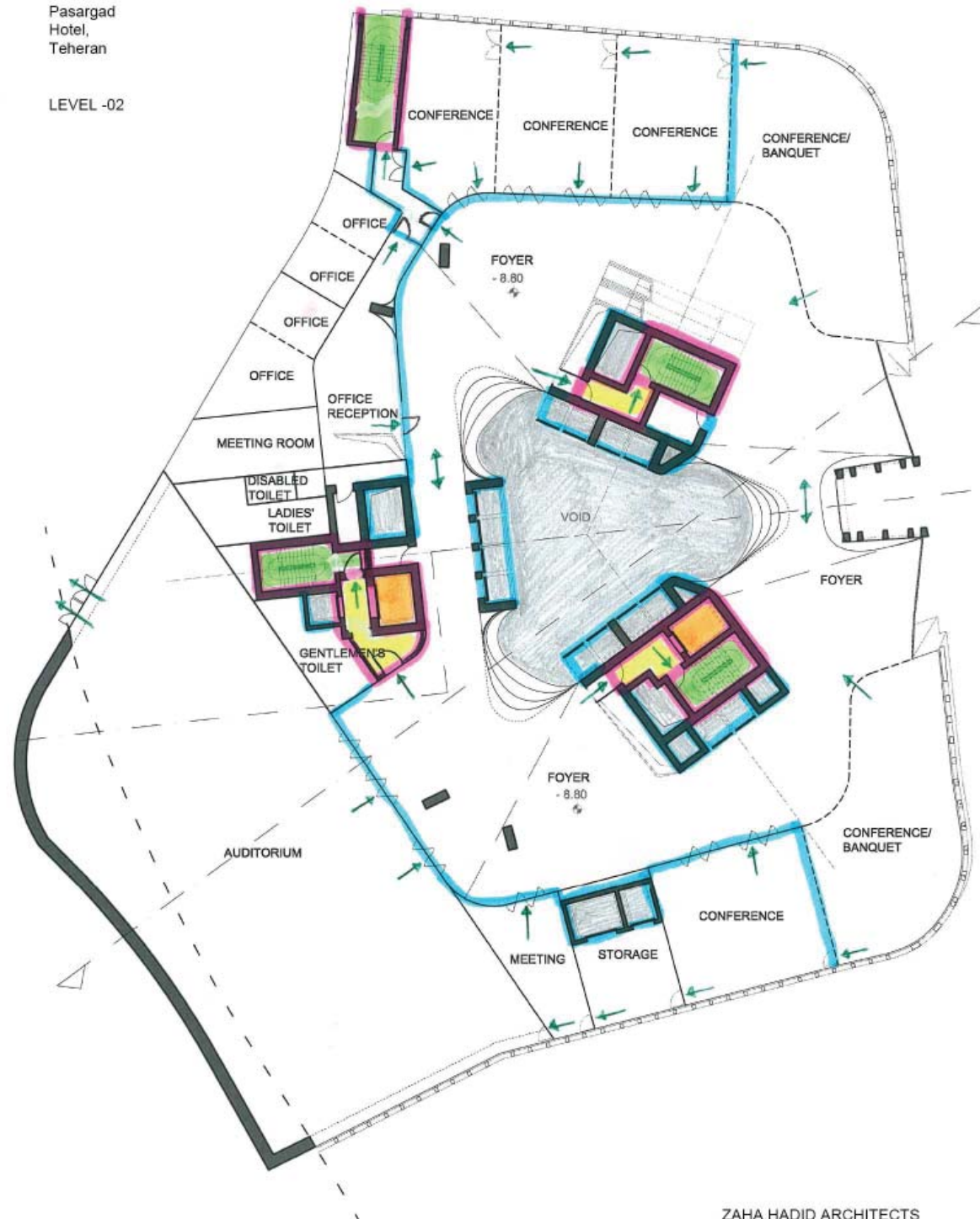
ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran



Pasargad
Hotel,
Teheran

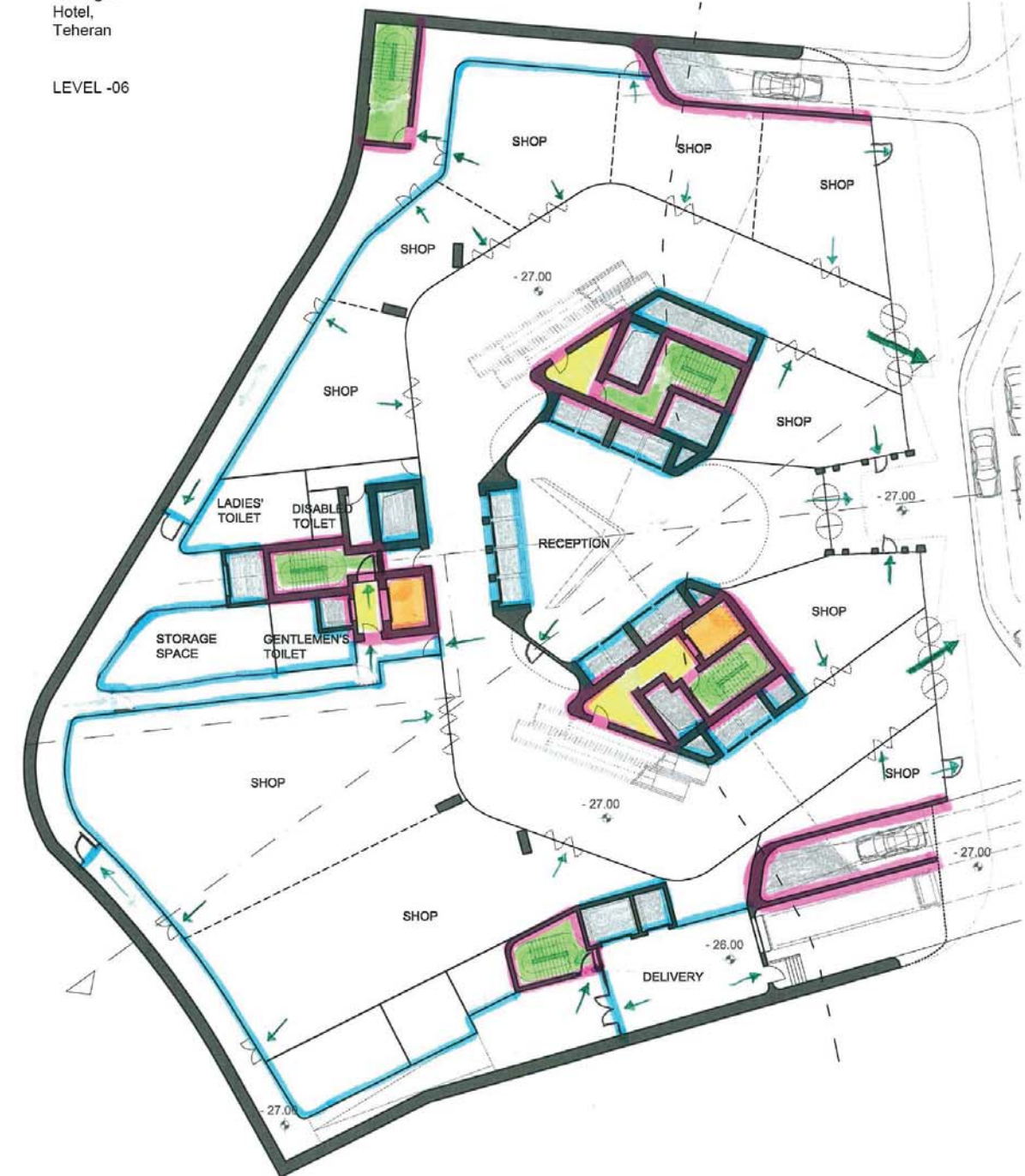
LEVEL -02



ZAHA HADID ARCHITECTS

Pasargad
Hotel,
Teheran

LEVEL -06



ZAHA HADID ARCHITECTS

ZAHA HADID ARCHITECTS

Pasargad Hotel Elahieh, Teheran



03 TECHNICAL DESIGN

- Structural Engineering
- Facade
- MEP Services
- Fire Prevention
- Sustainability and Lighting



INITIAL SUSTAINABILITY DESIGN CRITERIA

18.10.2010, Prepared by WSGreenTechnologies

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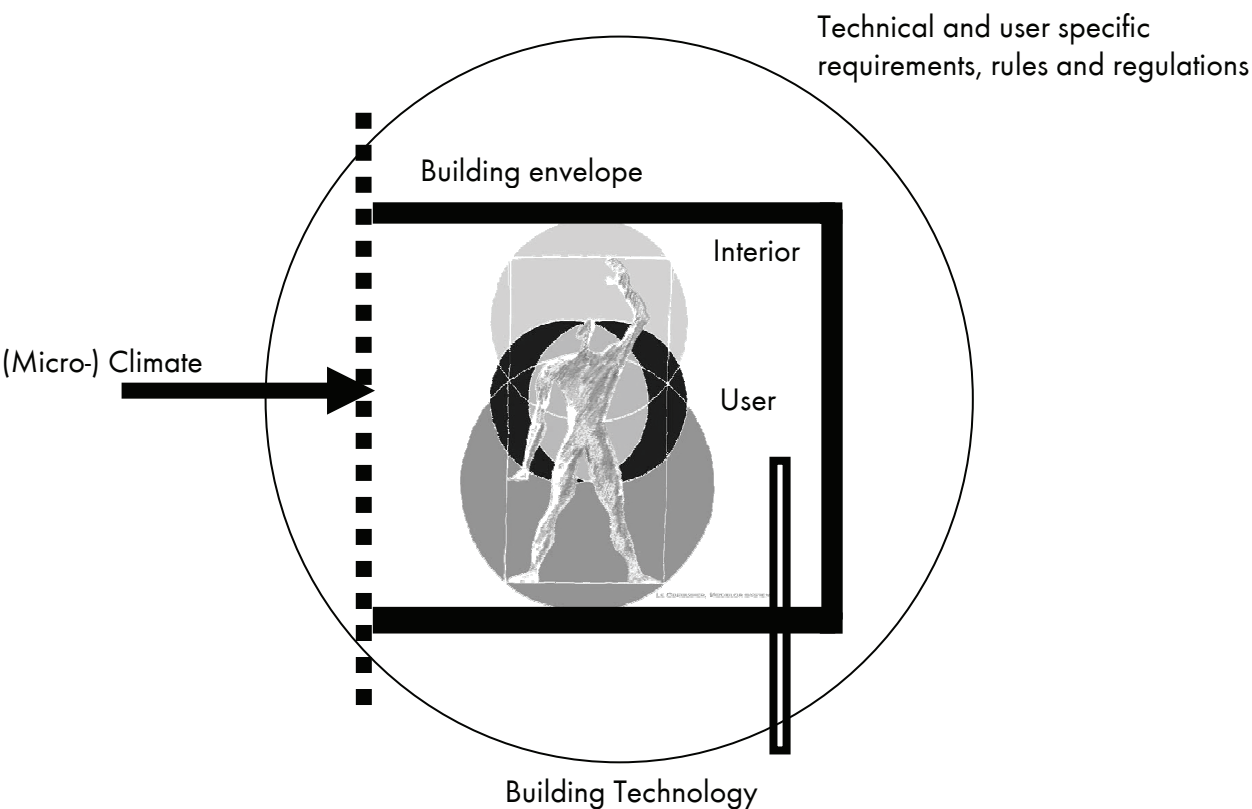
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1. SUSTAINABLE APPROACH: FROM THE CLIMATE TO THE BUILDING USER

At WSGreenTechnologies, we implement a holistic approach in our sustainable consulting. By analyzing aspects from the site’s bioclimate to the optimisation of the building envelope, WSGT makes comprehensive recommendations that lower the environmental impact and simultaneously improve the thermal comfort of urban developments. In our analytical methodology at WSGT, we also consider the life cycle of the entire project to ensure that there is little material waste, high recyclability, low CO₂ emissions and effective sustainable deconstruction for post-life.

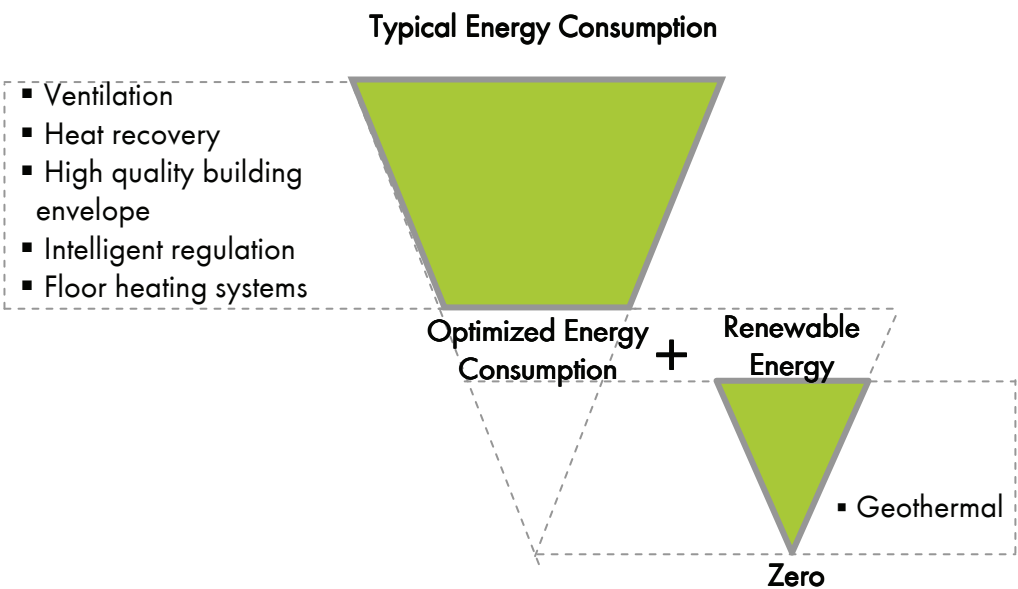
WSGreenTechnologies will prepare an initial climate study for the site in Tehran, Iran, which will demonstrate the important factors that should influence the design. This climate study will be the starting point, from which design solutions should be made.



2. OPTIMISED BUILDING PERFORMANCE

The energy demand of buildings has a wide range of influencing factors shown in the graph on the right. Most important is the climate which has a large impact on the resulting cooling and heating energy demand of the building. Minimisation of the energy demand will be achieved by creating a high quality envelope and optimising the solar gains to cover part of heating demand in winter and cooling demand in summer. Renewable energy sources and an innovative MEP system will contribute to cover the energy demand and to reduce operation costs.

- High quality envelope
- Optimised MEP
- Renewables
- Saved Energy
- Saved Emissions
- Diverted Waste



3. CLIMATE ANALYSIS

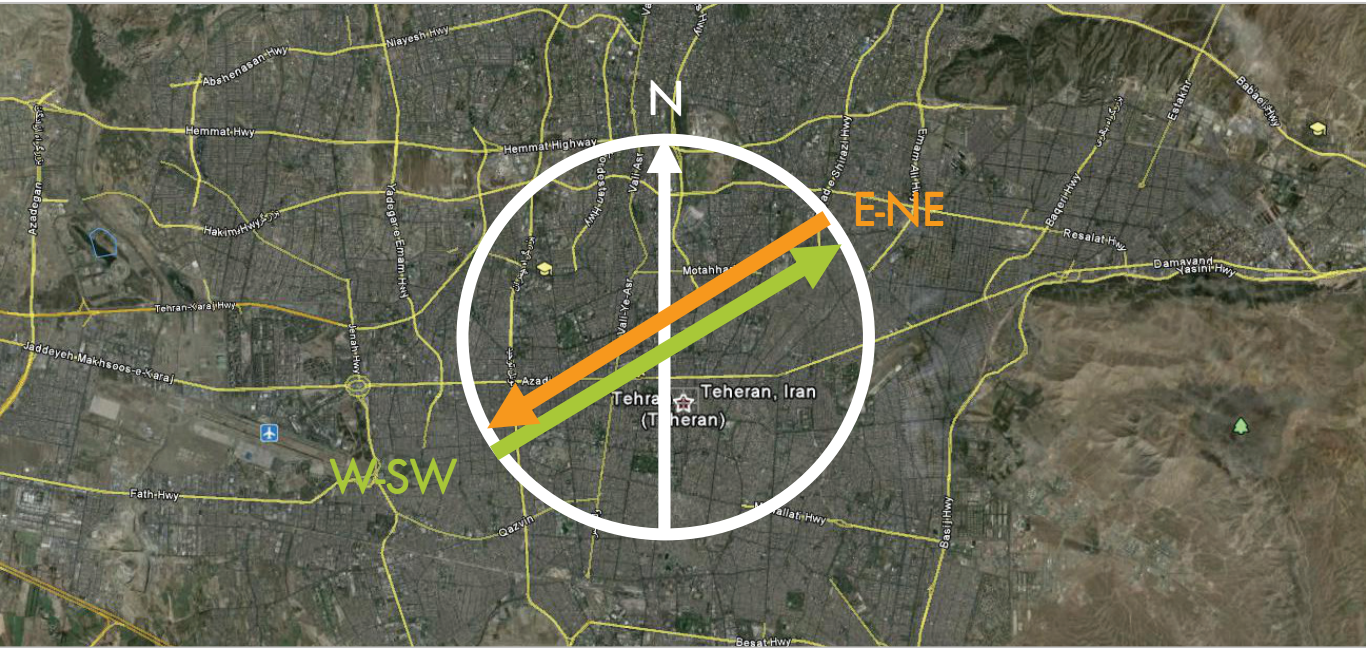
The climate analysis has a major impact on all the topics of this report, such as the building program placement, the building envelope and of course energy, water and light strategies for a development on this specific site.

Sun Path Diagram

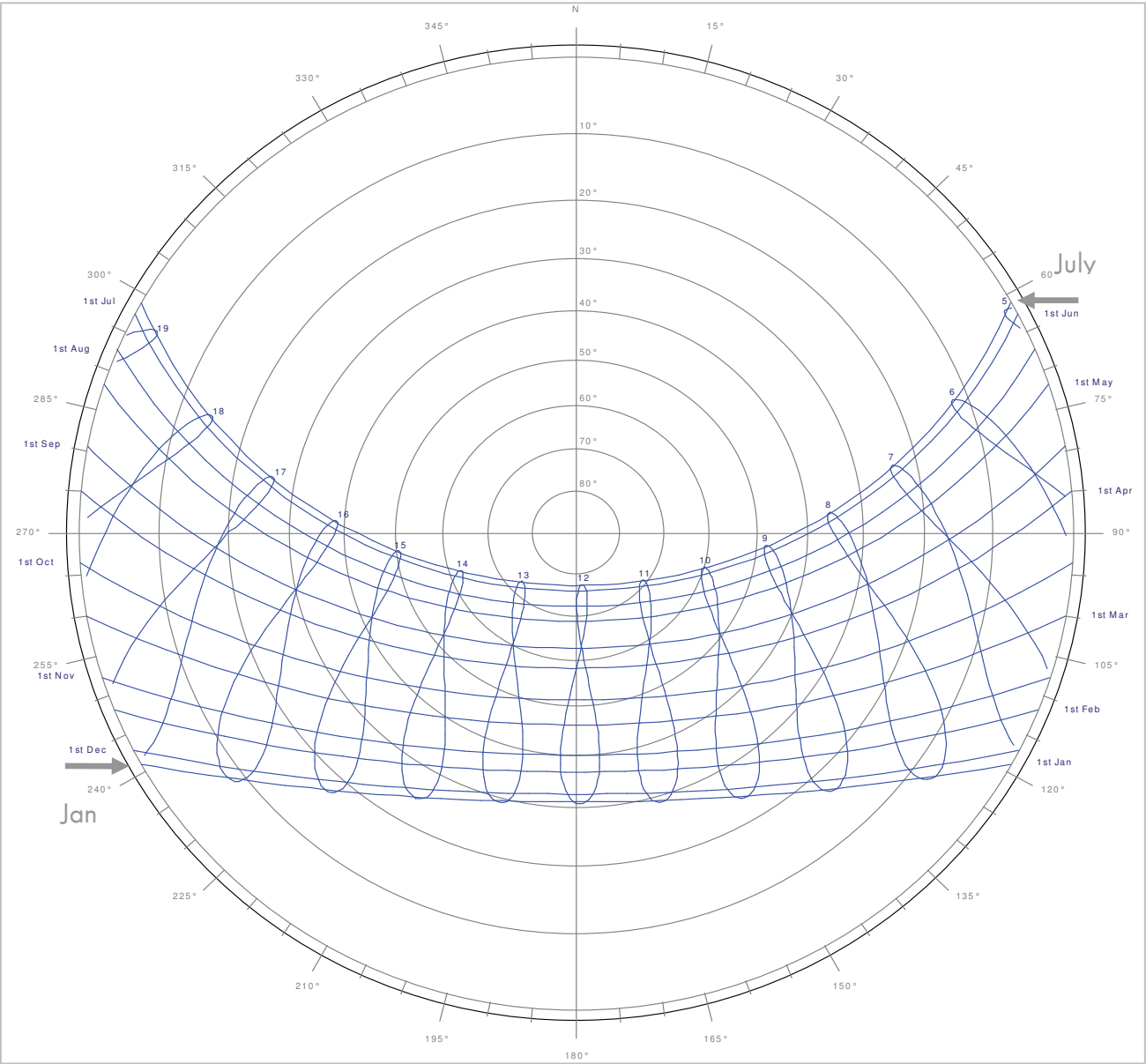
The sun position is one main criterion for the planning of urban layouts, but also for effective shading devices. The sun path diagram projects the sky dome onto a horizontal plane. The graph shows a stereographic diagram where sun angles for Tehran can be identified over the time of the day, the orientation and over the month of the year. The highest sun angle in summer is about 77°, the lowest in winter about 30° (midday situation).

Wind

The table on the right shows the prevailing winds over the whole year. Prevailing winds are from W-SW (260°) in January until May. The wind directions for the month June until December vary from this mean value; here the wind basically comes from E-NE (70°). The average wind speed for Tehran is 5.78 m/s which equals a moderate breeze (Beaufort number 4) Average monthly wind speeds are quite equally distributed over the year, with slightly higher wind speeds in July and August.



Prevailing Wind Directions (Source NASA Data)



Stereographic Diagram (Source Meteornorm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Wind Speed @ 50m in m/s	4.8	5.3	5.89	5.97	6.14	6.74	7.37	7.04	5.82	5.08	4.59	4.72	5.78
Wind direction @ 50m in °	253	241	243	256	305	69	69	69	68	69	71	73	xx

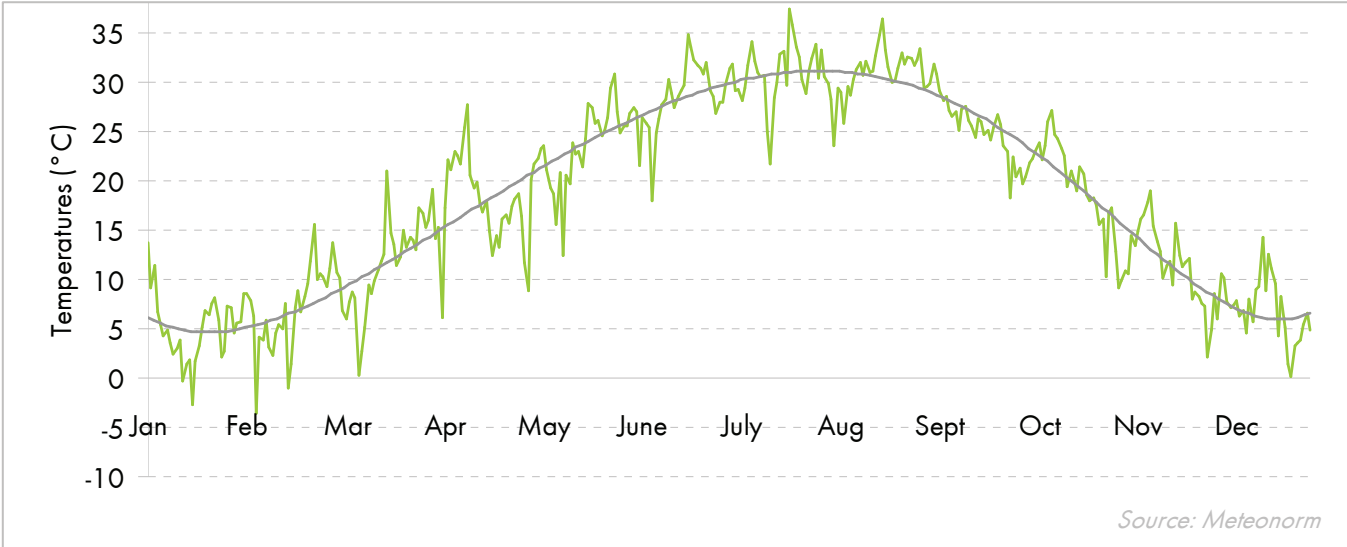
Monthly Wind Directions and Speeds (Source NASA Data)



Air Temperature

Outdoor temperatures in the area of the Tehran can rise up to about 42° C during the summer months with the hottest month being August (mean = 13.1° C). The coldest month is January with an average temperature of 5° C and minimum temperature of about -7.4° C. The annual average air temperature is 18.4° C.

The daily outdoor temperature is only at the thermal comfort level during a few months of the year. Particularly for the winter, steps need to be taken to improve thermal comfort.



Daily Mean Air Temperatures

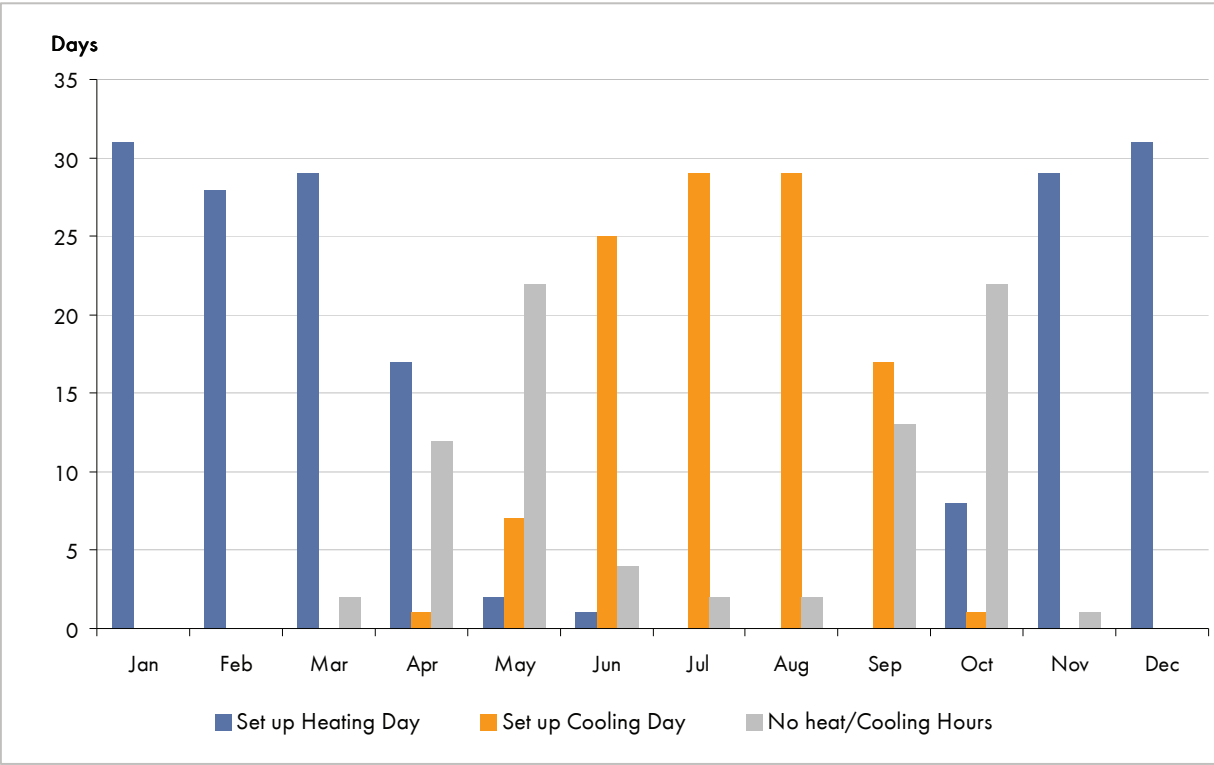
Monthly Temperatures	Minimum	Mean	Maximum
January	-7.40	5.08	18.90
February	-5.80	6.94	19.90
March	-3.20	11.50	25.80
April	2.80	17.45	31.70
May	8.10	23.15	36.00
June	13.30	28.21	38.50
July	15.30	30.97	41.70
August	19.20	31.01	41.60
September	12.10	26.21	35.30
October	8.00	20.28	32.80
November	-1.40	11.60	23.80
December	-6.60	7.05	19.50

Minimum, Maximum and Mean Air Temperatures (Source Meeonorm)

Cooling Days and Heating Days

One example of our work is this diagram, showing the number of cooling and heating days per month. The results will help to optimize the HVAC system of the building and guarantee a comfortable living and working environment for the occupants. The energy demand for heating and cooling can be minimised.

There are 176 heating days per year for Tehran where the daily average temperature is below 18° C. The daily average consists of the values during day and night.
In 109 days of the year there is a cooling demand where daily average temperatures rise above 26° C. That means in conclusion that in 80 days there is neither a cooling nor a heating demand.

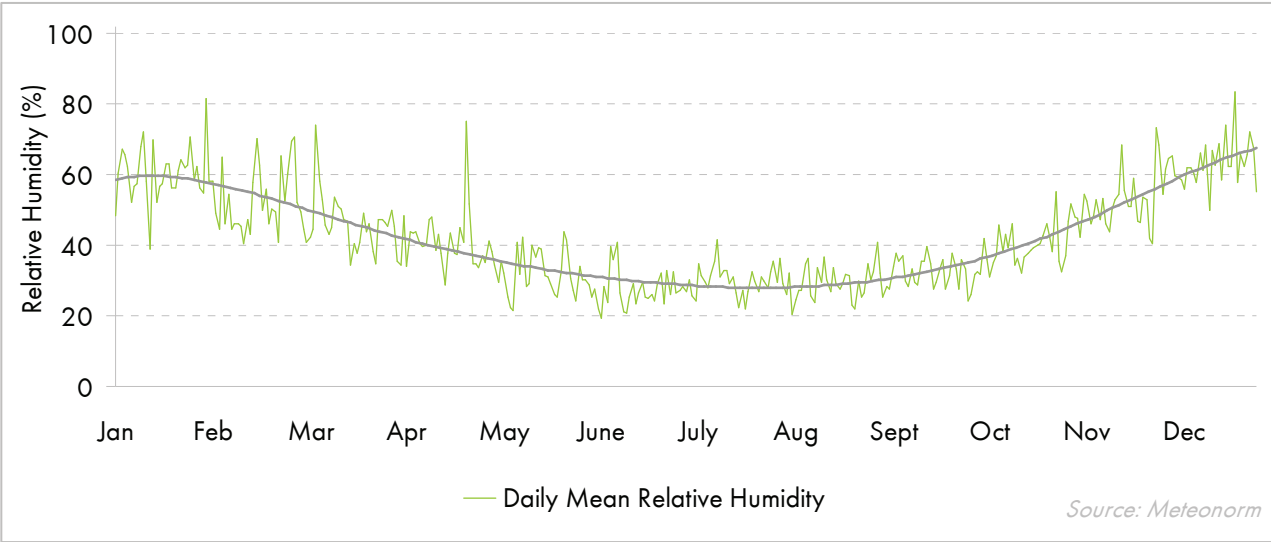


Heating and Cooling Days



Relative Humidity

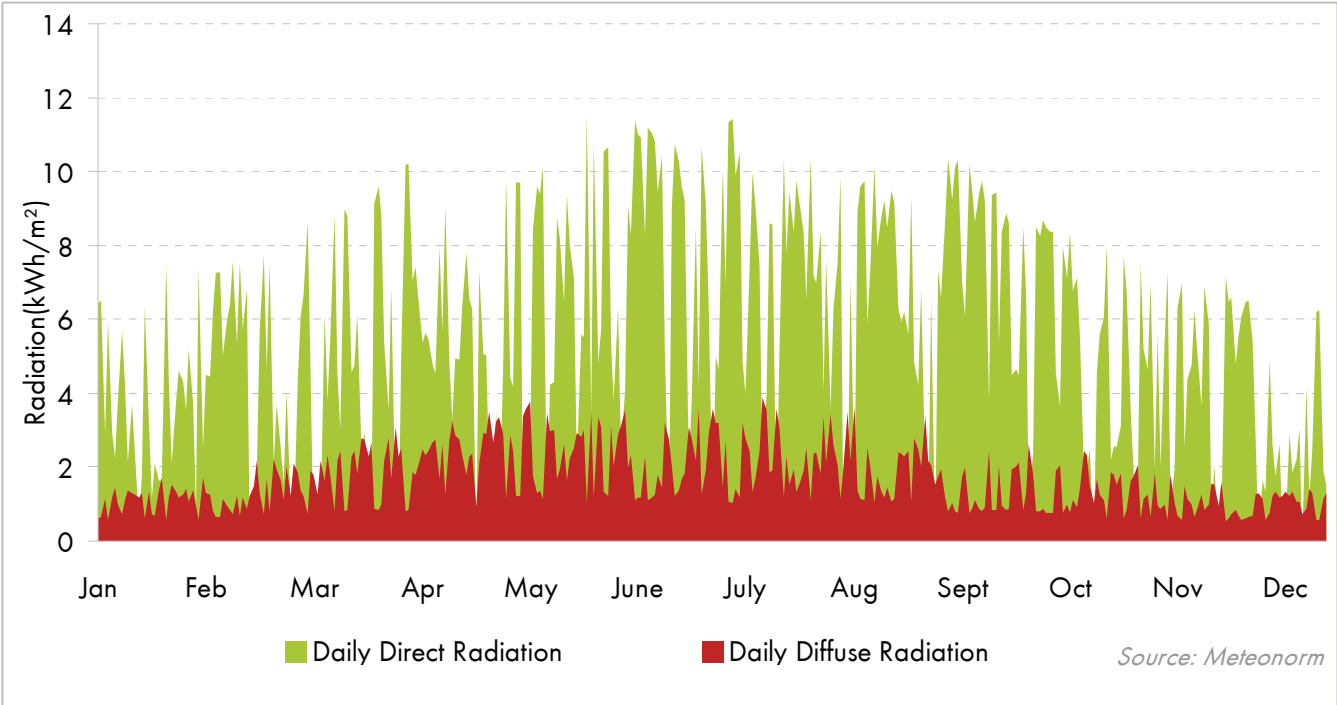
The average yearly relative humidity is around 42%. The highest monthly average with 62% occurs in January and lowest in August with 29%. Overall the humidity is lower in summer (about 30%) and higher (about 56%) in winter.



Relative Humidity (Source Meteornorm)

Direct Radiation

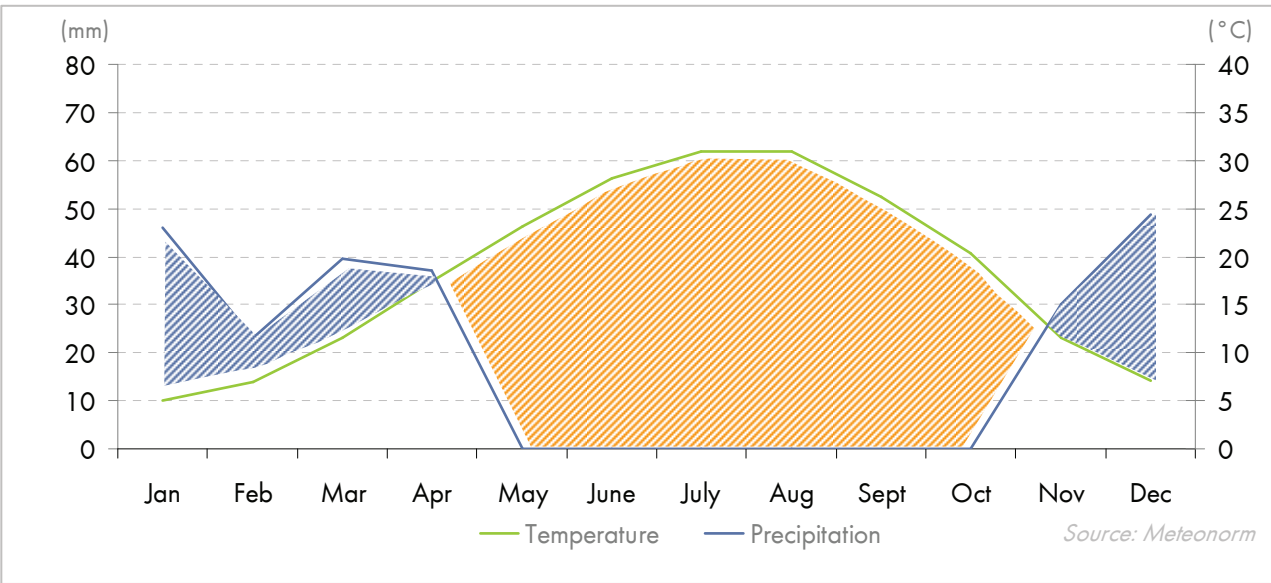
The direct solar radiation in Tehran for the whole year is 2046 kWh/m². The yearly diffuse radiation is 610 kWh/m² and the total global radiation adds up to 1836 kWh/m².



Direct and Diffuse Radiation (Source Meteornorm)

Precipitation

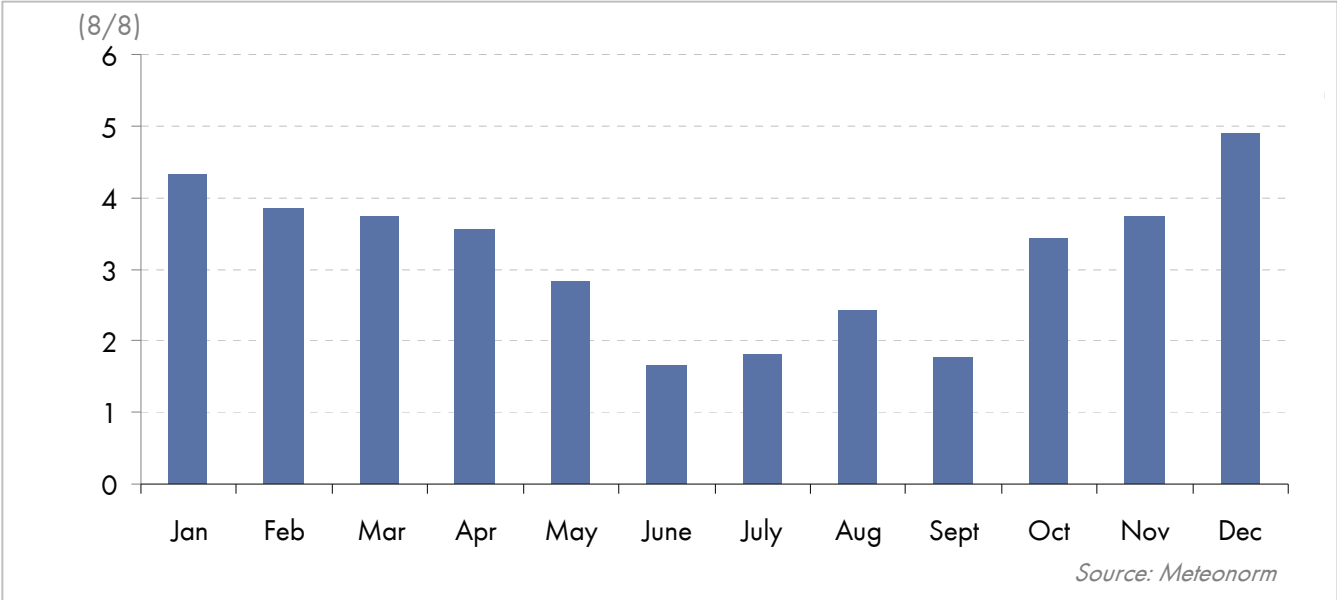
Tehran has a diverse climate. It is very arid during the summer month (May until October) when no rainfall at all occurs. The climate changes to humid from November to April when temperature drop and monthly rainfall up to 49mm occurs. The yearly amount of rainfall is 253 mm.



Monthly Precipitation and Air Temperature

Cloudiness

The cloudiness is average over the entire year. It is less clouded in the summer months when no rainfall occurs. In times of possible rainfall from October until April it is slightly more clouded.



Cloudiness (Source Meteornorm)



Climate Summary

Tehran features a semi-arid, continental climate (Köppen climate classification BSk). Tehran's climate is largely defined by its geographic location and its elevation of more than 1000m, with the towering Alborz Mountains to its north and the central desert to the south. It can be generally described as mild in the spring, hot and dry in the summer, pleasant in the autumn, and cold in the winter. As a large city with significant differences in elevation among various districts, the weather is often cooler in the hilly north as compared to the flat southern part of Tehran. Summer is usually hot and dry with very little rain, but relative humidity is generally low and the nights are cool.

Climate Conditions	Values
Winter dry bulb temperature (21 st December)	4.3 °C
Winter (min/mean/max) temperatures	-3.5 / 6.5 / 21.0 °C
Winter daily temperature range (21 st December)	day (max 6.0) / night (min 3.2) °C
Winter relative humidity	56.3 %
Spring dry bulb temperature (21 st March)	12.2 °C
Spring (min/mean/max) temperatures	6.1 / 21.2 / 34.8 °C
Spring daily temperature range (21 st March)	day (max 16.4) / night (min 8.2) °C
Spring relativ humidity	35.7 %
Summer dry bulb temperature (21 st June)	32.3 °C
Summer (min/mean/max) temperatures	21.8 / 30.8 / 37.5 °C
Summer daily temperature range (21 st June)	day (max 38.2) / night (min 26.1) °C
Summer relativ humidity	29.3 %
Autum dry bulb temperature (21 st September)	25.1 °C
Autum (min/mean/max) temperatures	2.1 / 15.2 / 27.2 °C
Autum daily temperature range (21 st September)	day (max 30.6) / night (min 19.9) °C
Autum relative humidity	47.0 %
Yearly average temperature	18.4 °C
Precipitation per year (mm)	225 (mm)
Yearly average humidity	42 %
Yearly direct beam radiation	2046 kWh/m ²
Yearly global radiation	1838 kWh/m ²
Yearly direct radiation	1228 kWh/m ²
Yearly diffuse radiation	610 kWh/m ²
Yearly average wind speed	4.0 (m/s)
Main wind direction	N & N-E

*** Stations of the year: Winter (21.Dec - 20.March); Spring (21.march - 20.june); Summer (21 June - 20.Sept); Autum (21.Sept - 20.Dec)*
Climate Summary



4. SHADING STUDIES

To ensure the highest comfort for the users and an optimized building performance, site specific conditions regarding shading and self-shading of the building as well as availability of natural light for rooms with different orientation, have been analysed and evaluated.

With its diverse program including hotel units, residential apartments, retail and offices spaces, the program placement plays an important role for the Pasagard Hotel Elahieh.

In general, apartments and residencies that will be used all year should not be placed on the North side of buildings; hotel rooms however will only be occupied for a couple of days by one person and could therefore be oriented towards North.

The building shape of the Pasagard Hotel Elahieh with its three towers has certain advantages in terms of natural lighting. Even though one of the towers is located North, there are no typical north-side conditions, since apartments and hotel rooms will always get direct sun light from either East or West all year long. Due to those conditions sun protection and daylight control will be foreseen even for the northern tower, but only on the Eastern façade.

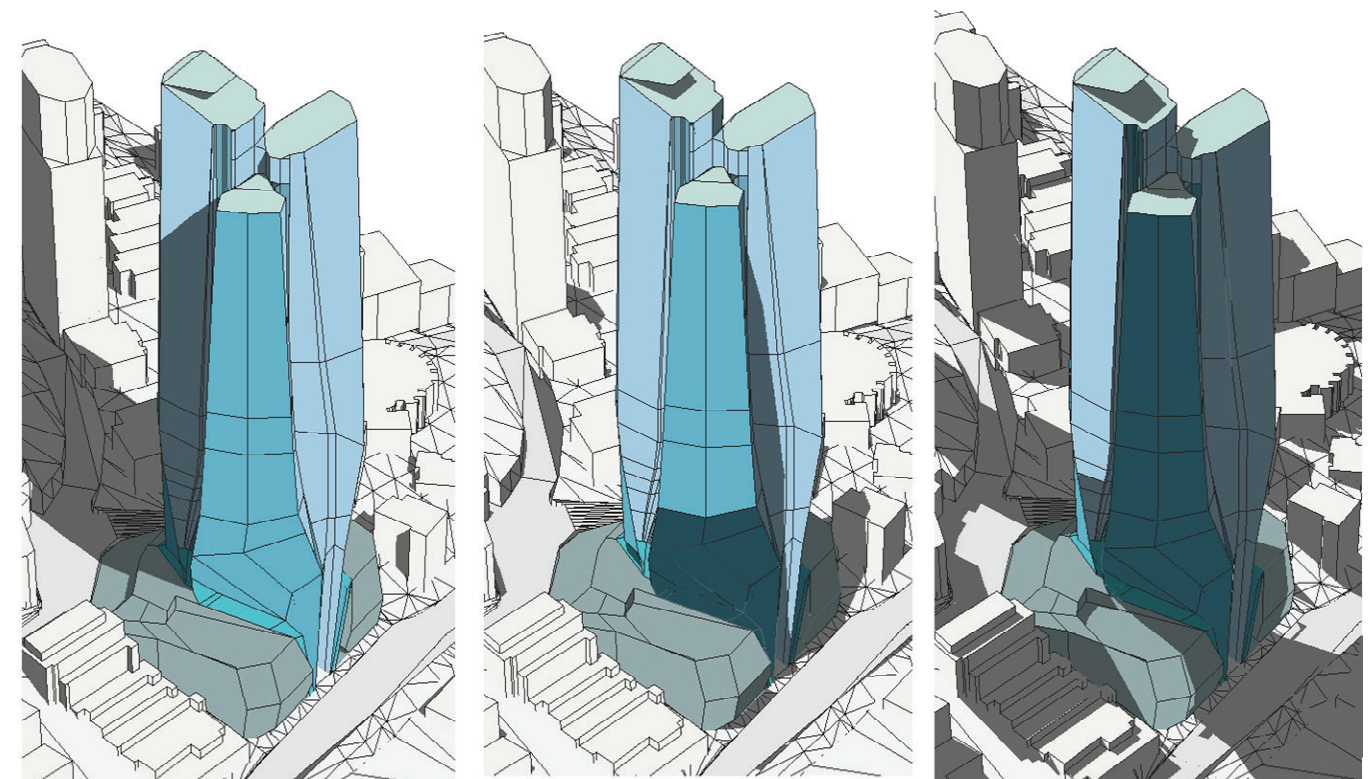
The Southern facades of the two other towers of the building are exposed to the sun all year long. To guarantee a high thermal and visual comfort, while keeping the operation costs for heating and cooling low, sun and glare protection, as well as daylight control are particularly important here. The North-Eastern façade gets sunlight mainly in the mornings. The South-West oriented sides will be exposed to direct sun light in the afternoons all year. Sun protection is as important here, especially because the sun light angle can be very low and the light will reach deep inside the building.

5. BUILDING PROGRAM PLACEMENT BASED ON ORIENTATION

The orientation of a building is important for many aspects of sustainable developments

The Pasagard Hotel Elahieh with its three towers allows for a good use of daylight, since all apartments get at least some sunlight hours in the morning or evenings. Nonetheless self-shading of the building has to be taken into account. To make sure all rooms will get enough light, the orientation of the program has to be optimised in terms of daylight and solar radiation, as well as view and noise.

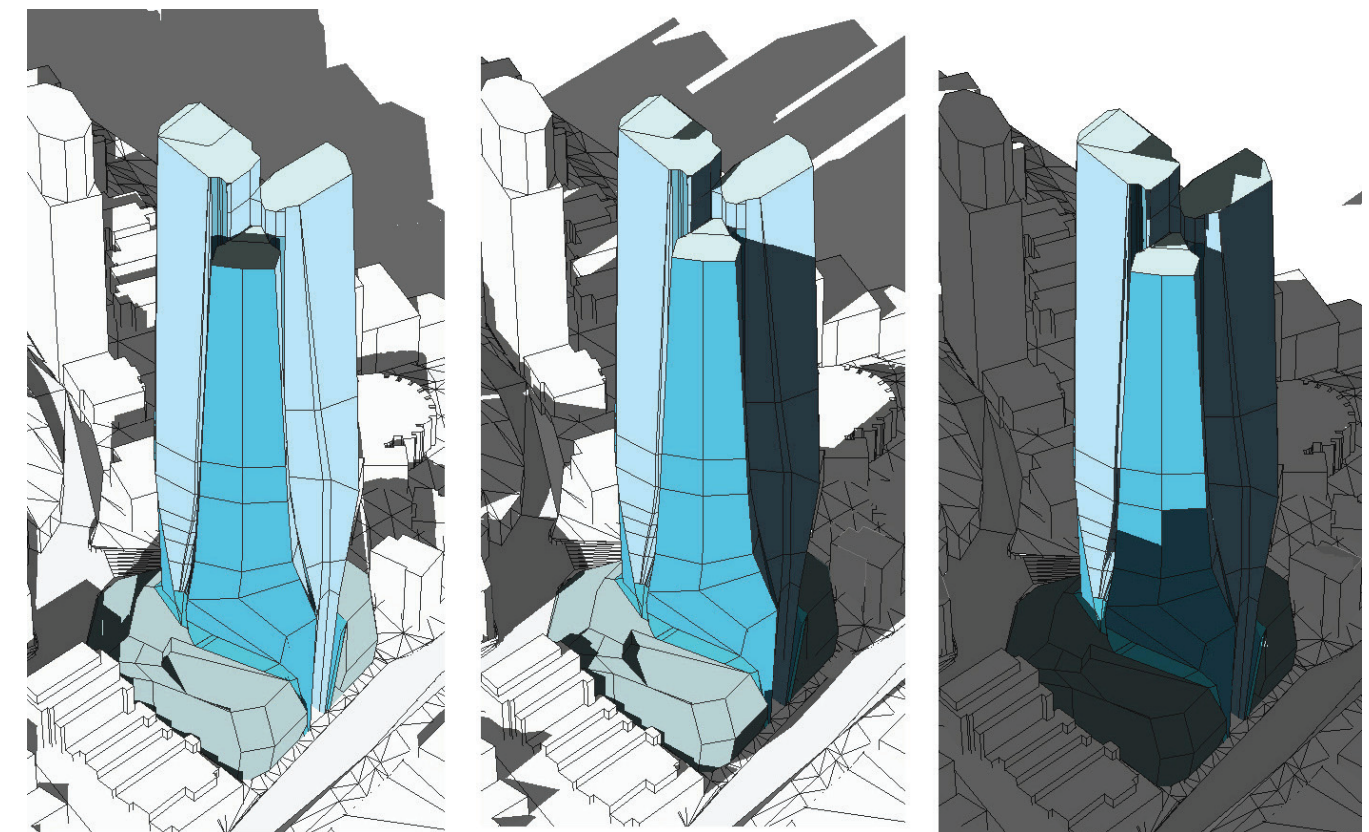
- Reduction of the self-shading and direct light for all of the towers
- Attractive view/high visual comfort



9am
South-East view. 21st of June

12am

3pm

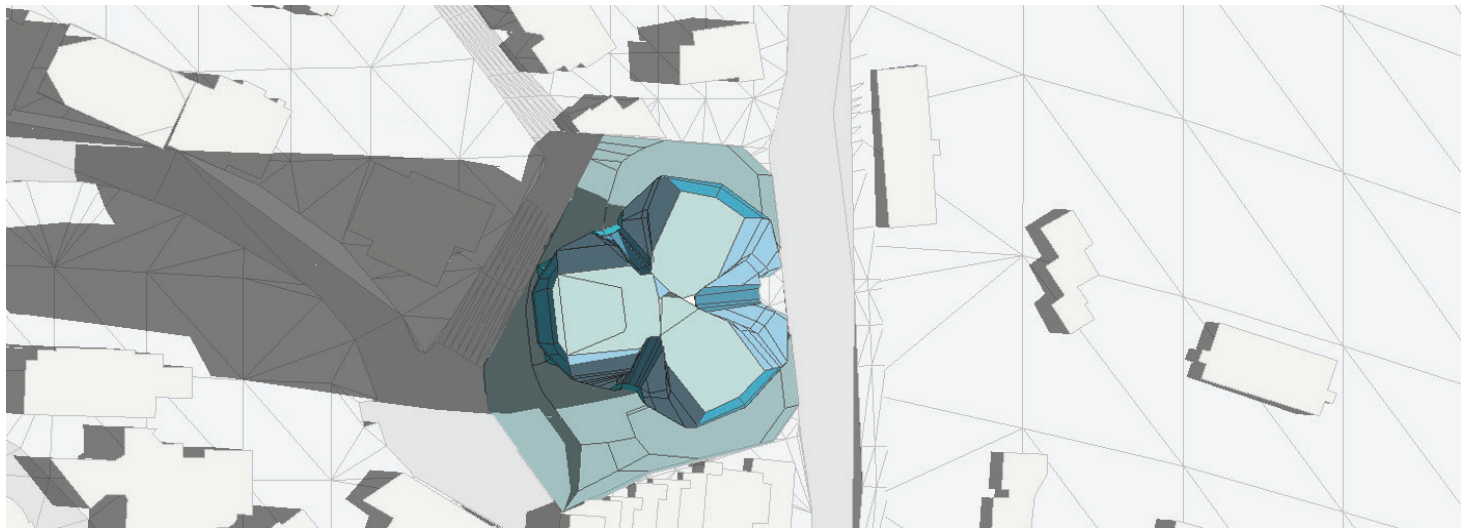


9am
South-East view. 21st of December

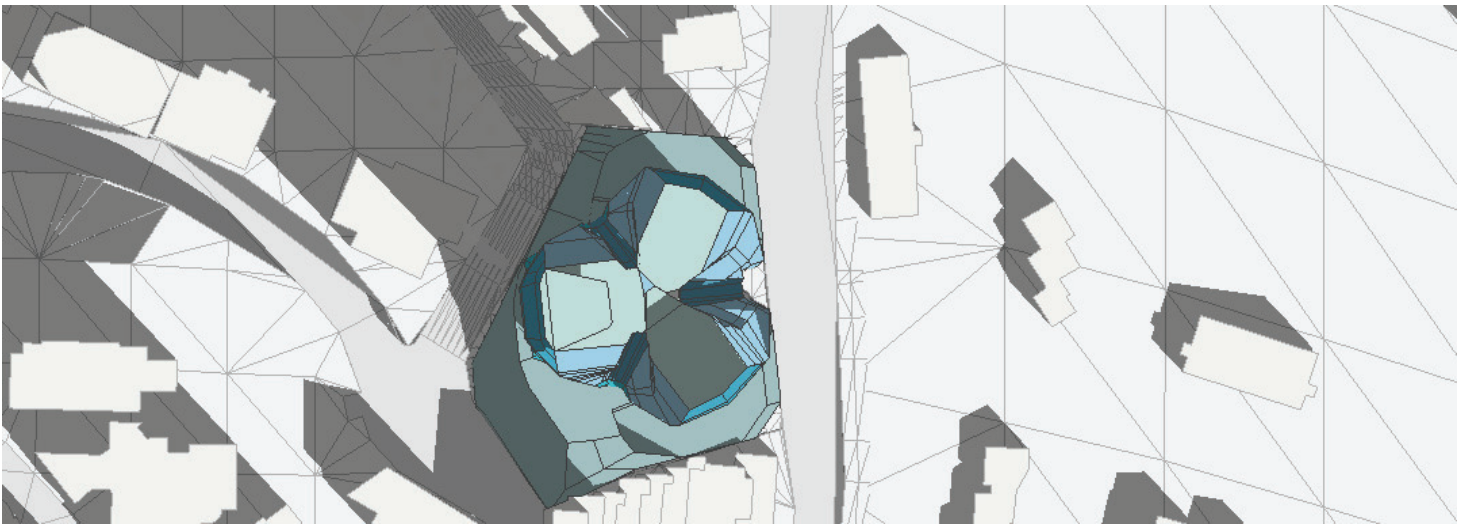
12am

3pm

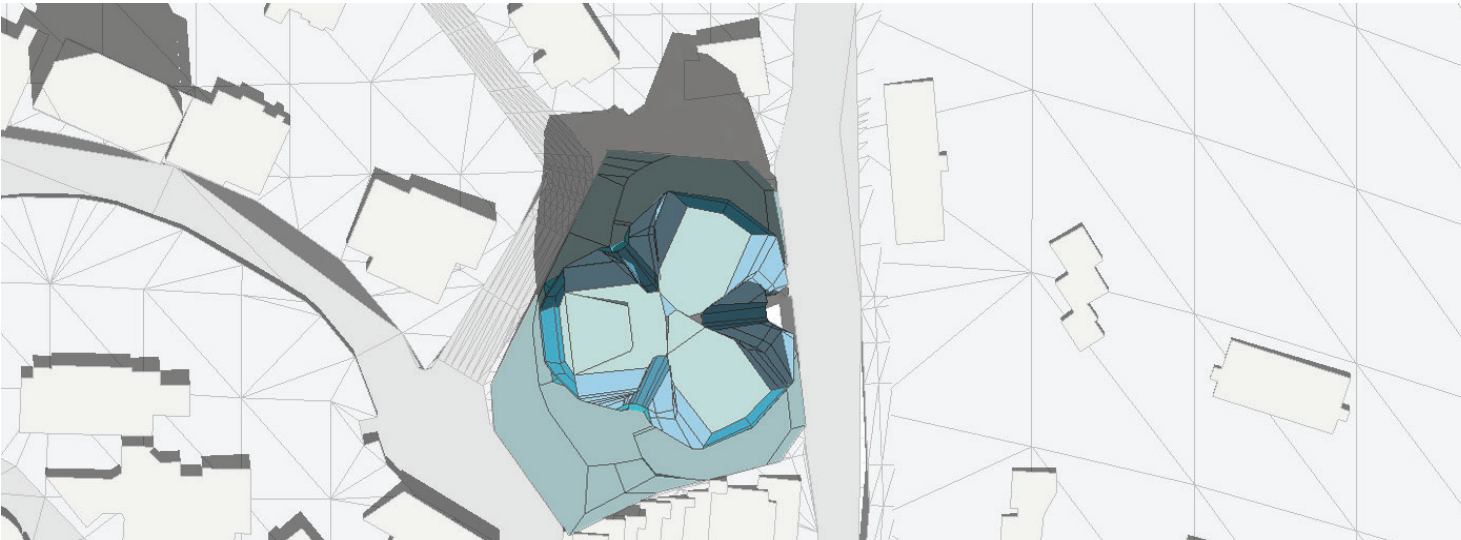




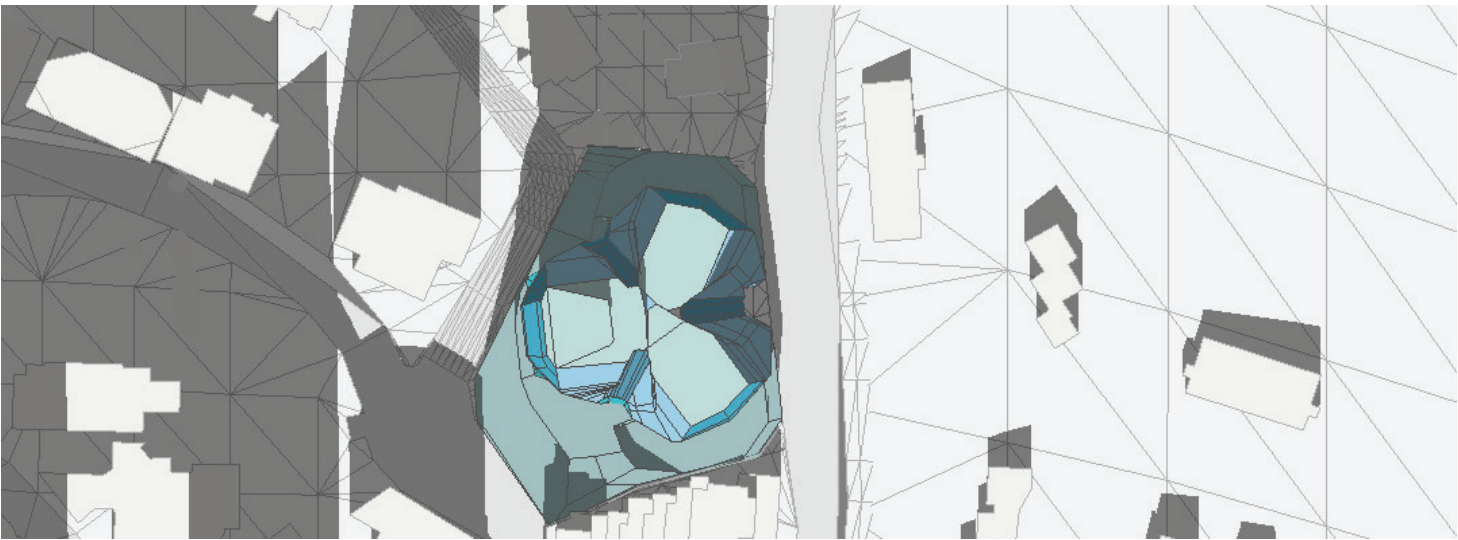
Shadow on the 21st of June at 9am



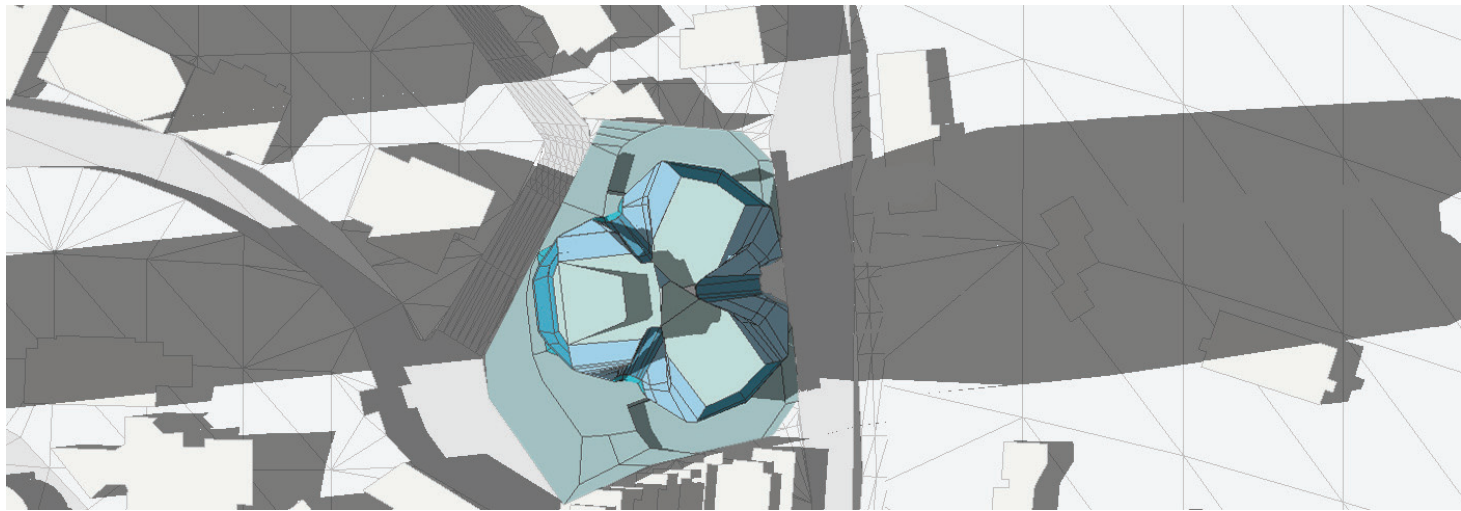
Shadow on the 21st of December at 9am



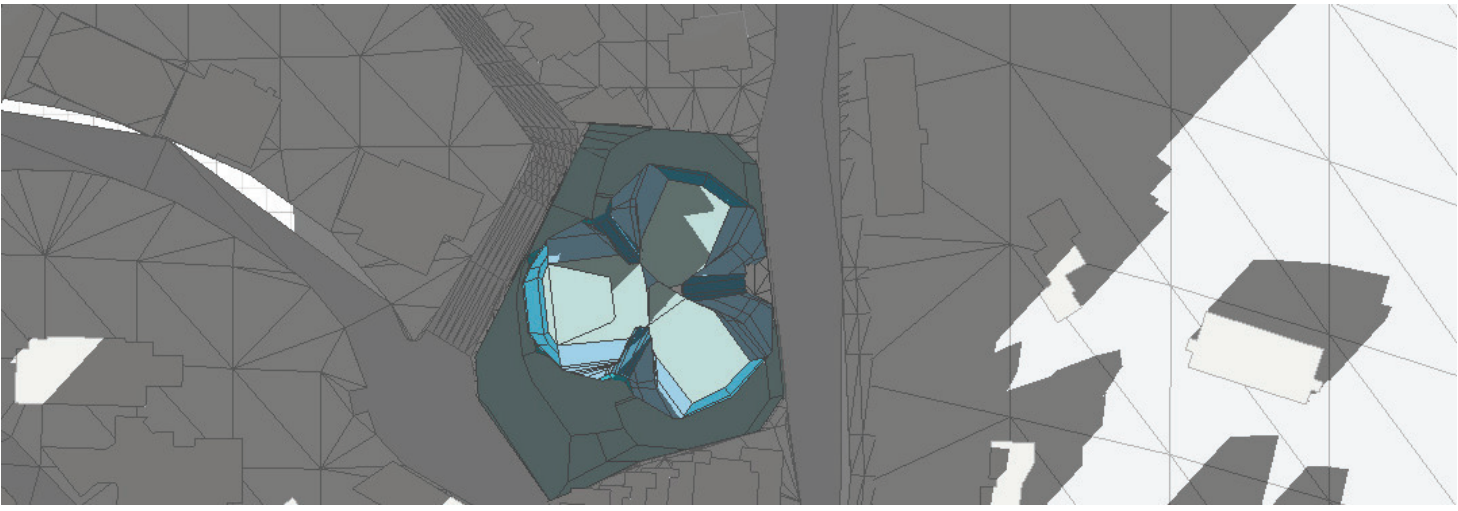
Shadow on the 21st of June at 12am



Shadow on the 21st of December at 12am



Shadow on the 21st of June at 3pm



Shadow on the 21st of December at 3pm



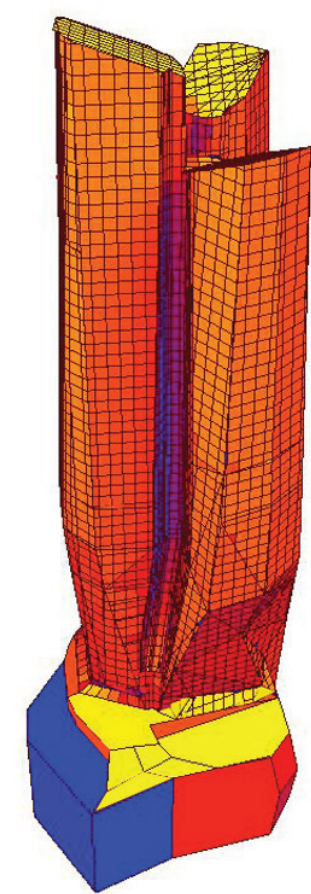
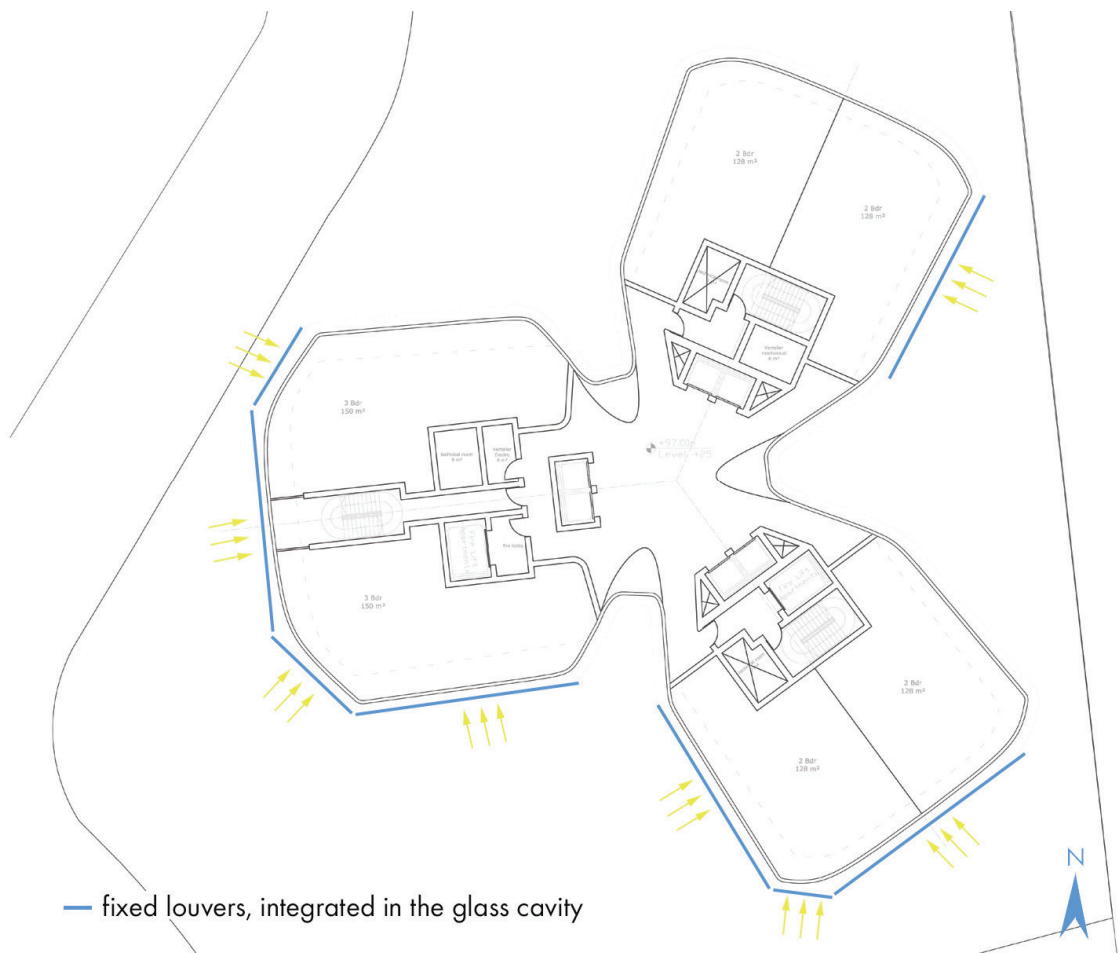
6. RADIATION STUDIES

For further optimisation and in order to get more detailed information on the specific demand for sun protection on each tower, the solar radiation on the building envelope has been studied.
The graphics on the right show the cumulative yearly direct solar radiation on areas with an average size of 2,5 m x 2,5 m.

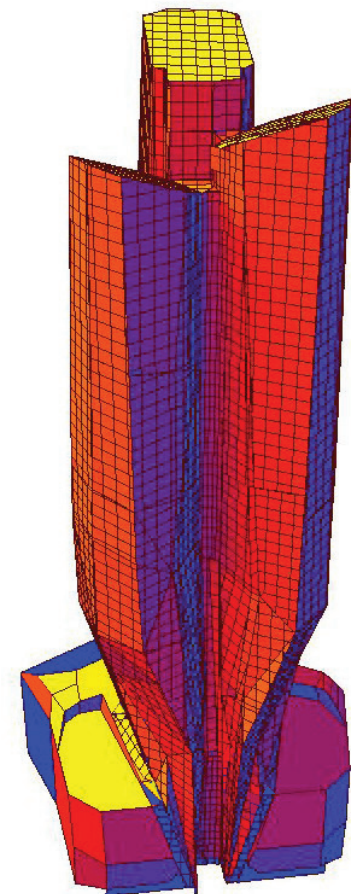
The areas with the highest radiation are indicated yellow; areas with the least yearly radiation are marked blue.
The highest direct radiation values reach up to 1390 kWh/m² (global radiation: 1950 Wh/m²) and can be found on the roof surface.

This study shows in detail which facades receive large amounts of solar radiation (yellow and orange areas) and where therefore external shading is required.

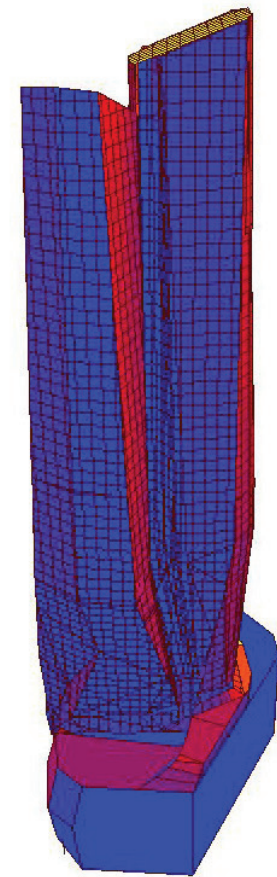
According to those results, shading devices are planned to be installed as shown in the graphic below:



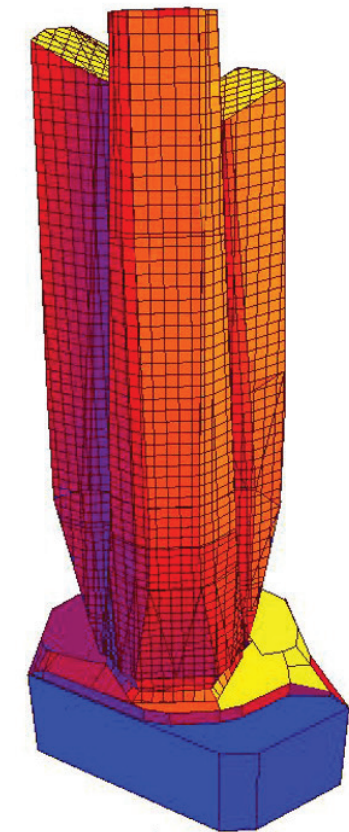
View from South



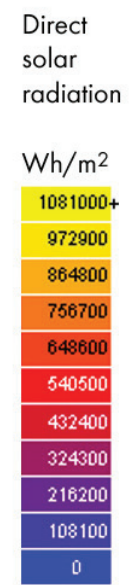
View from East



View from North



View from West

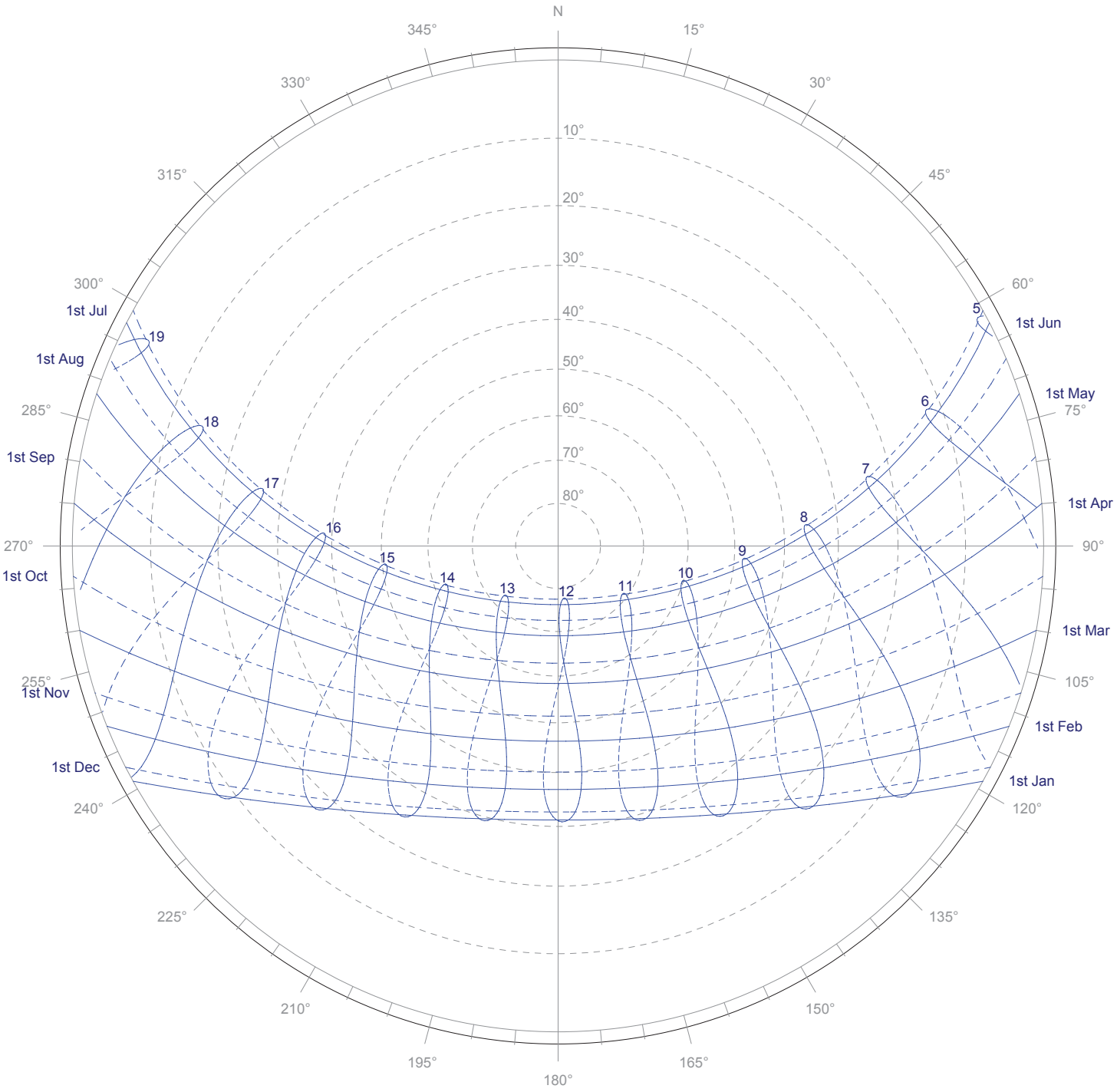


Lighting Design Concept for the Pasagard Hotel Tehran

The Pasargard Hotel light concept is based on an organic composition. Whose pattern formation determines the surface of the epidermis (glass facade) by a light source integrated in the structure. This accentuates its silhouette and creates a visual interface between façade and life inside the building. The interior lighting interplays with the hierarchy of layers. Different situations of the building, public areas, facility areas, hotel and private housing are displayed, picturing the living organism.

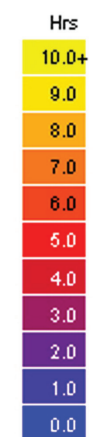
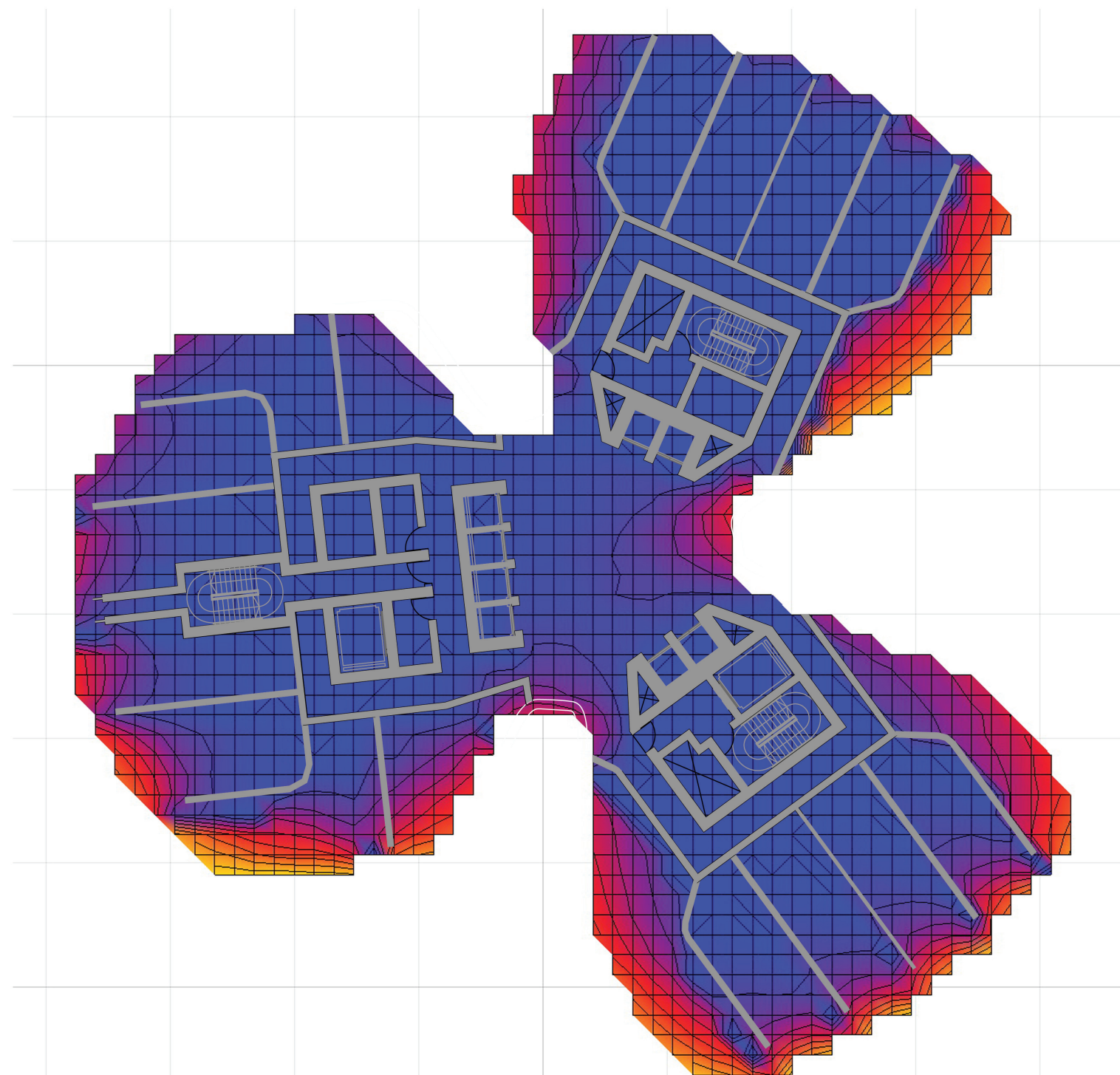
Based on a warm-white light color, the temperature correlates to the inside ambiance. The lighting scheme tells a story that generates an atmosphere of a breathing building. An interesting interaction of light and structure: light from inside and light inducted into the façade provide a living atmosphere. Light is softly fading from the supporting structure of the tower, with a higher luminance in the shaft. The different intensities determine the atmosphere and delineate the structure of the building.

The efficient use of daylight correlates with a lighting concept that reduces operating costs - a sustainable design in terms of energy saving and maintenance cost. The layout of the tower enables a well balances daylight distribution inside the hotel suites. The inside walls, on the other side, regulate sunlight penetration. Interior lighting is combined with intelligent lighting control, and benefits of use of day light. LED technology allows the illumination of the façade by sustainable means and in high visual comfort.



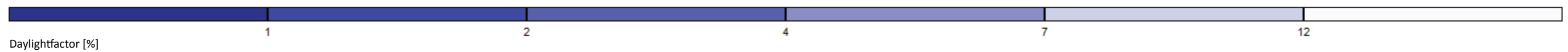
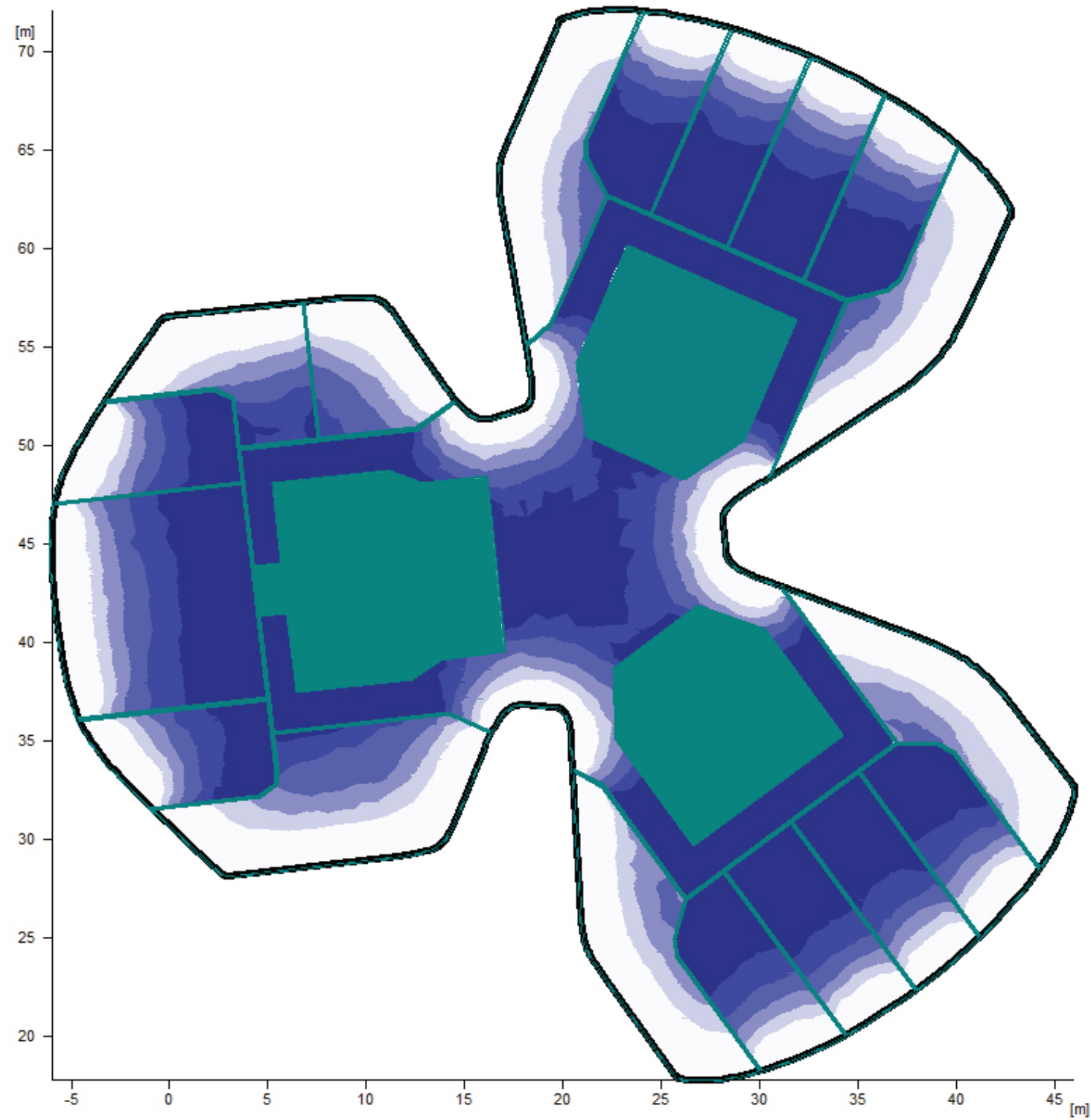
Stereographic Diagram
Location: 35.7°, 51.3°

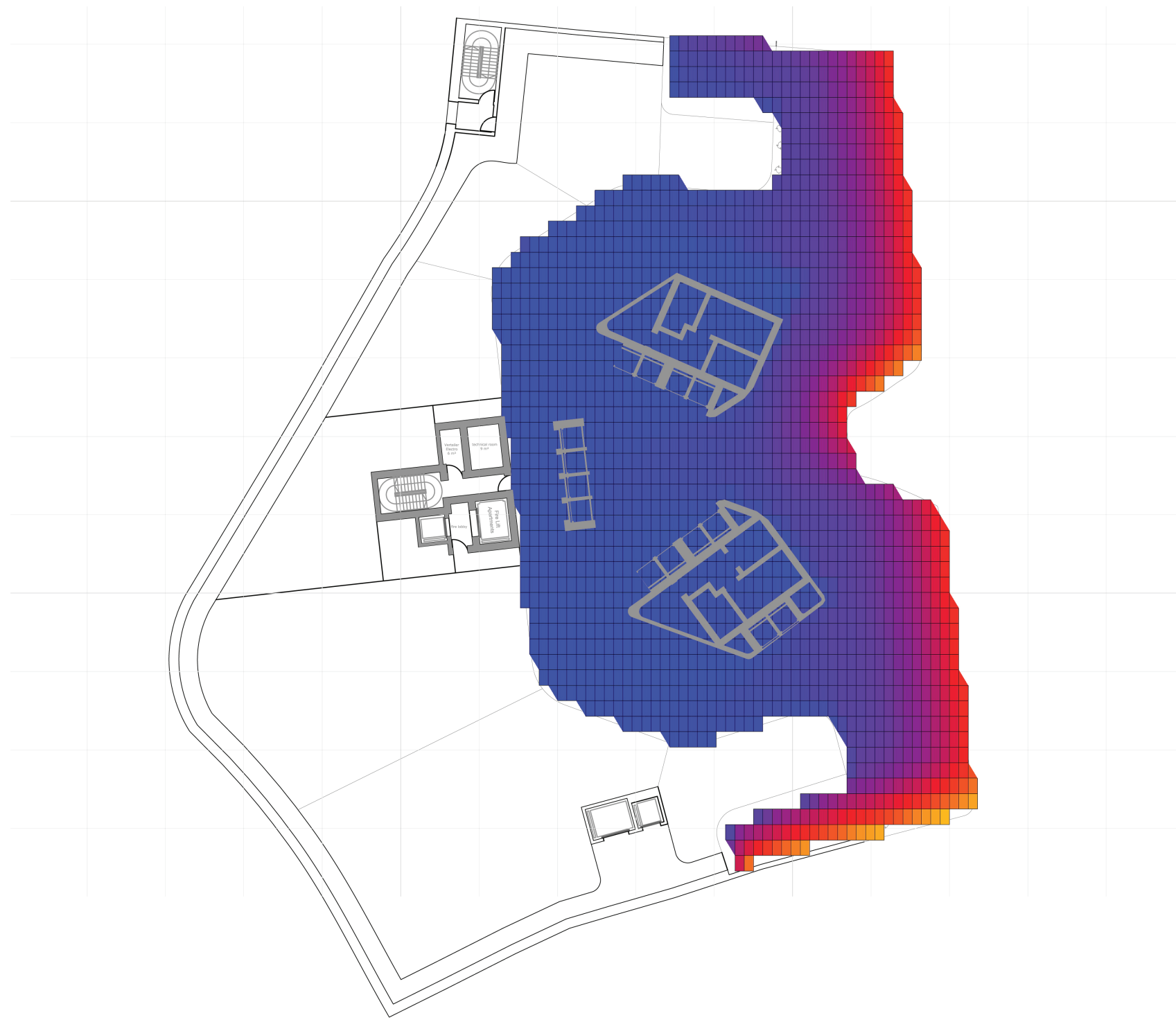




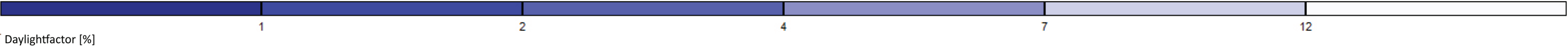
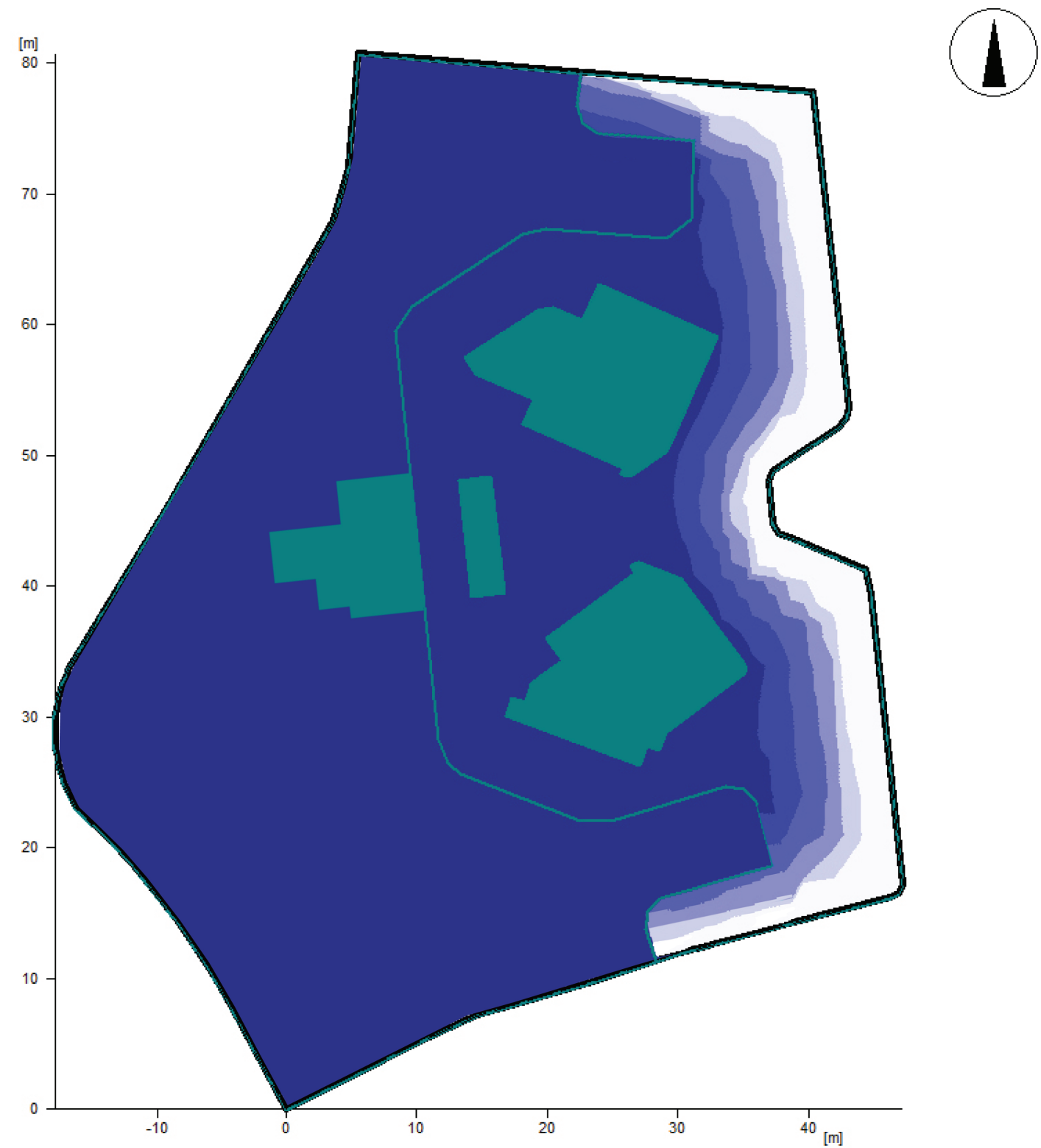
Daylightfactor of Floor +12

*calculation does not consider
window design or glazing*





Daylightfactor of Floor -04
*calculation does not consider
window design or glazing*



7. HIGH QUALITY BUILDING ENVELOPE

High Insulation for Podium façades

High Insulation should be installed on all opaque areas of the façade.

- Reduction of the energy consumption for heating and cooling
- Reduction of the thermal transfer losses through the building envelope
- Higher internal thermal comfort for a longer period of time without need for HVAC

Double Glazing

Since there are more heating than cooling days in Tehran, the glazing quality is essential for the reduction of energy loss due to thermal transfer and therefore the reduction of the heating demand. We recommend glazing with an U-Value of at least $1,1 \text{ W}/(\text{m}^2 \cdot \text{K})$. High quality glazing might be more cost-intensive in the first place, but it contributes to reducing the life-cycle-costs of the building.

- Reduction of thermal transfer loss across the building envelope
- Reduction of life-cycle-costs
- Reduction of energy demand for heating and cooling

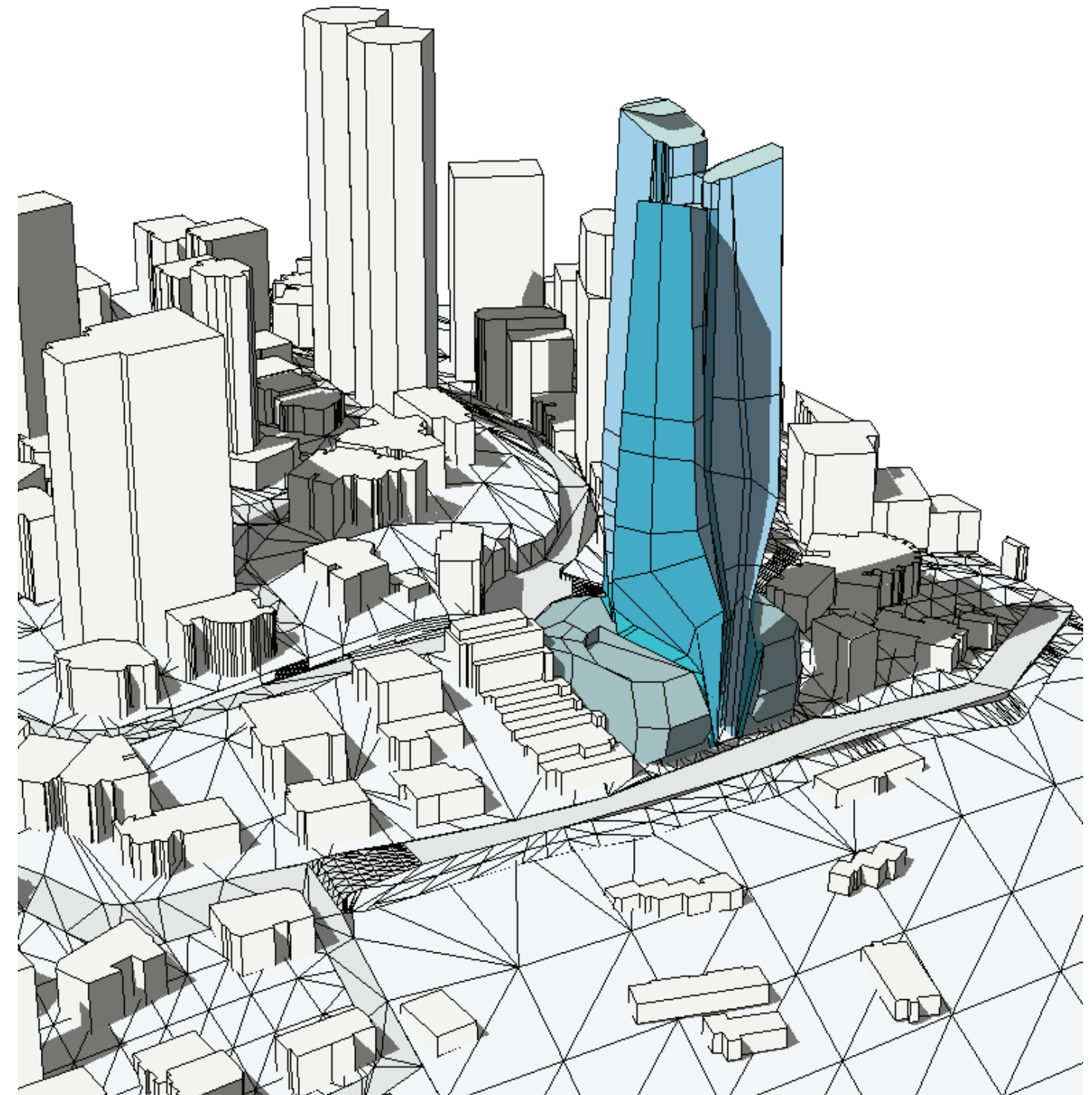
Shading + Sun Protection

For economic reasons and due to high wind loads, fixed louvers, integrated in the glass cavity will be used as shading elements for façade areas that are exposed to direct sunlight from South, East und West.

To enhance the use of day-lighting for the interior spaces, the shading elements have a high light direction capability. They will act as a so called light shelf and reflect daylight into the room. At the same time they function as shading devices and also help to control glare.

For the northern façades on each tower, sun protection glazing with low g-Values will be installed to prevent over heating of the building.

- Reduction of the solar gain in the room areas
- Reduction of the cooling need
- Optimised use of daylight
- Glare protection



Shadow on the 21st of March at 12 am. View from South-East



8 . GREEN SPACES

For horizontal surfaces we recommend the installation of vegetated roofs. Because of the low rainfall, vegetation that should be planted on the horizontal surfaces of lobby and basement should implement xeroscaping, which is the exclusive selection of native plant species.

- Reduction of CO₂
- Reduction of the Heat-Island Effect
- Enhancement of the microclimate
- Reduction of surface sealing
- Exterior social spaces



9. RECYCLABILITY & MATERIAL SELECTION

One way in which you could distinguish your project's sustainability is by focusing on material re-use and recycling. We highly recommend considering the potential re-use of materials: perhaps concrete and glass. This would have a very positive impact on the reduction of the LCA of the building. By choosing materials with longer lifespans, the costs of the project can be reduced over the lifecycle.

Material Selection

- Ecological materials
- Recycled post-consumer content & recyclability
- Low energy use during extraction & fabrication
- Low GWP (global warming potential)

Recyclability

- Reduction of CO₂ emissions
- Reduced energy consumption through recycling opposed to new fabrication

Demountability

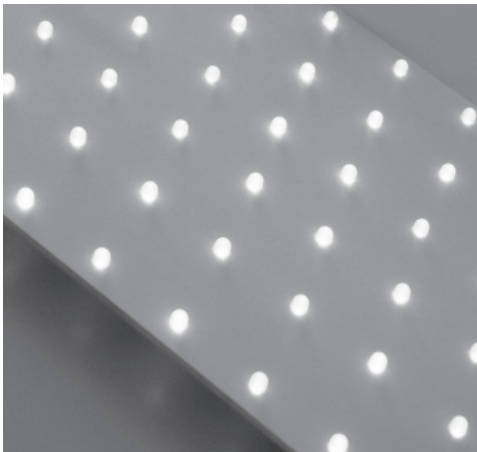
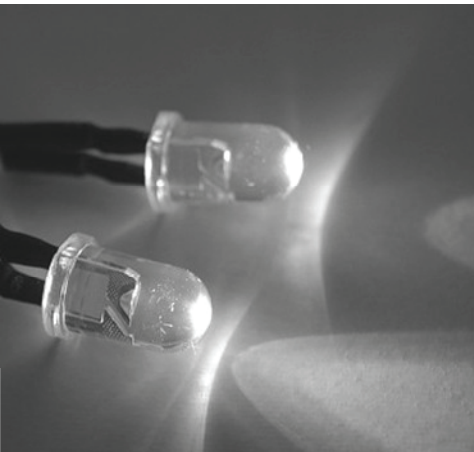
- Ensure the recyclability of building at end-of-life



10. OPTIMISED LIGHTING

Considering the daylighting needs for each apartment/hotel room will be an important aspect of planning the lighting system. The goal is to use as much natural lighting as possible; while ensuring a high thermal comfort in each room. In this respect orientation, room depth and daylight directing shading elements play an important role. For the artificial light we recommend LEDs, which guarantee a high light quality, low energy use and low internal heat gain. For additional abating of electricity consumption, automated controllers with daylight sensors should be installed.

- Use of daylight
- Reduction of energy demand
- High light quality
- Reduction of internal heat gain/cooling demand



11. RENEWABLE ENERGIES

The use of renewable energies will help to reduce the CO₂ emission of the building and lower the operation costs at the same time. For the Pasagard Hotel Elahieh we recommend onsite geothermal energy generation with vertical pipes. In Teheran the heat demand is balanced with the cooling demand as shown in the prior climate analysis. In winter, the heat extraction from the ground will cool the earth, but this heat will be recovered in summer through the heat injection due to the cooling demand of the building.

Geothermal heat pumps use this storing capacity of the ground to heat and cool buildings. In winter, a heat pump extracts heat from the heat exchanger and in summer, this process is reversed, the heat pump releases heat from indoors into the heat exchanger.

However, a Thermal Response Test (TRT) of the underground of Teheran is required to evaluate in details the feasibility of this technology.

- Geothermal power is cost effective, reliable and environmentally friendly
- Double function: can operate in heating and cooling mode
- High energy efficiency
- Low CO₂ emissions



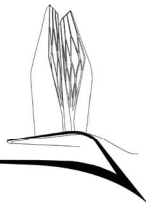
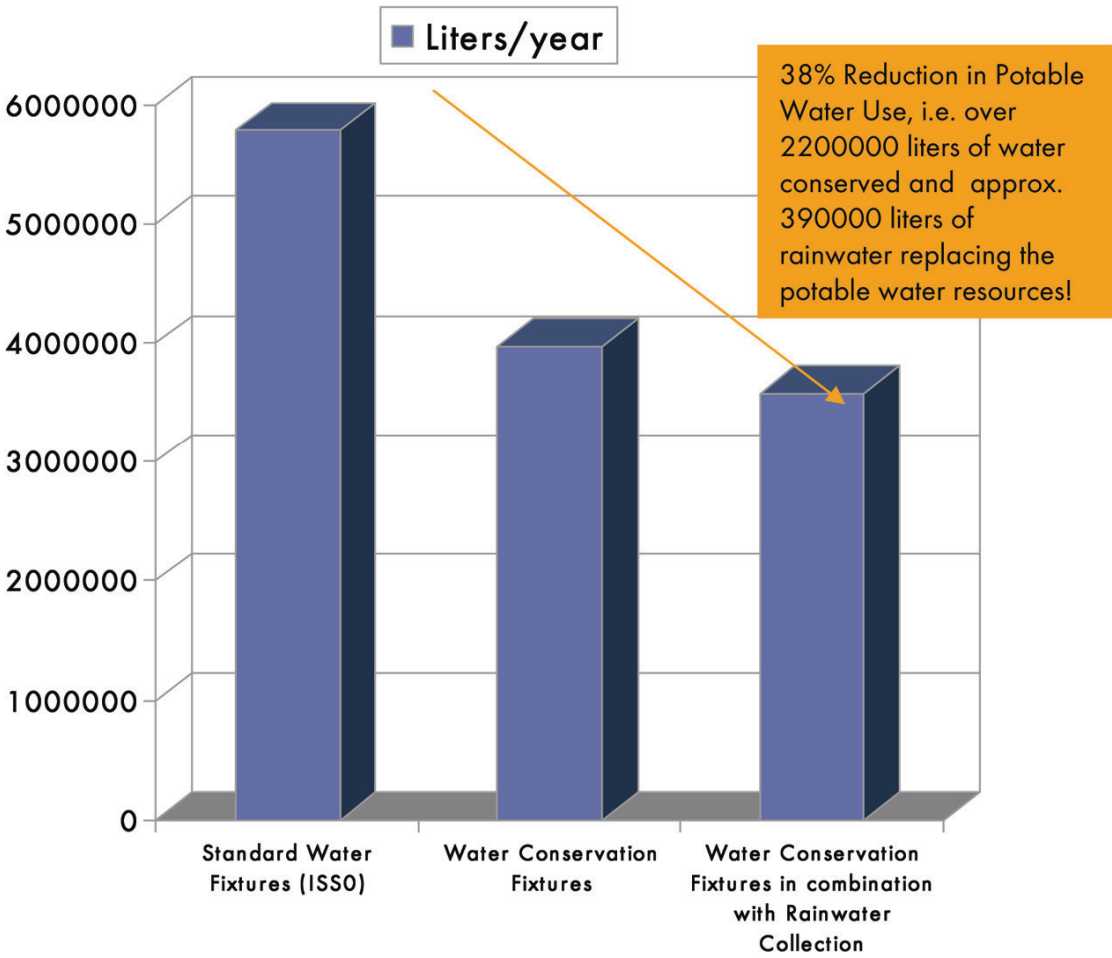
12. WATER CONSERVATION

Tehran has a low annual rainfall of approximately 230 mm. Therefore water conservation strategies are very relevant for this site. Reusing grey water for toilet flushing and irrigation could be one solution. We also recommend the use of water saving armatures and fixtures in addition to that.

With water conservation fixtures in combination with rainwater collection about 38% of portable water can be saved.

- Reduction of water demand
- Reuse of grey water

REDUCE THE WATER USE: WATER USAGE COMPARISON – Hotel+Residential



13. CERTIFICATION: POSSIBLE RESULTS

The Pasargad Hotel in Tehran will be planned to meet the highest standards in all phases of the building’s life cycle, including planning, construction and operation of the building. A holistic approach, which covers the following aspects, is the basis of planning a sustainable building:

- Ecological Quality
- Economical Quality
- Socio-cultural and Functional Quality
- Technical Quality
- Quality of the Planning
- Quality of the Site

LEED CERTIFICATION

LEED is a system to evaluate green buildings according to the requirements of the USGBC (US Green Building Council), currently Version 3.0 for New Construction is the latest release. In LEED, the following main criteria are evaluated:

The Pasargad Hotel in Tehran has been planned to achieve Gold LEED Certification. Through the use of highly energy efficient building utilities (including concrete core activation and mechanical ventilation with high efficiency heat recovery) as well as an optimised building envelope, the energy use of the hotel is reduced substantially. Additionally the site location, in a densely built city neighbourhood, the hotel will achieve many of the LEED sustainable sites credits. With careful selection of sustainable building materials, the hotel ensures a high user comfort (No VOCs will be used - Indoor Environmental Quality Credit 4 points will be diligently followed in the selection process). The use of natural daylight and views will be ensured for all required spaces and will fulfil the requirements of credits IEQ 8.1 and IEQ 8.2. With water efficiency fixtures and xeroscaping of the entry level courtyard, the water consumption of the building can be substantially reduced and will fulfil Water Efficiency Credits 1 and 3.

LEED GOALS AND FEASIBILITY

The pre-assessment shows that a LEED Gold standard for the Pasargad Hotel Elahieh is achievable. The table below visualises the feasibility of reaching points in each category: credits that are difficult to achieve are marked in red, credits with a medium difficulty in orange and in green credits, which are easy to achieve.

	Total Points	Hard	Mid	Easy	Goal
 Sustainable Sites [SS]	26	4	2	20	20
 Water Efficiency [WE]	10	0	10	0	8
 Energy and Atmosphere [EA]	35	26	9	0	14
 Materials and Resources [MR]	14	8	6	1	10
 Indoor Environmental Quality [IEQ]	15	0	11	4	14
 Innovation in Design [ID]	6	5	0	1	3
					↓
					69

CERTIFICATION LEVELS





ZAHA HADID ARCHITECTS

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Pasargad Hotel Elahieh, Teheran



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