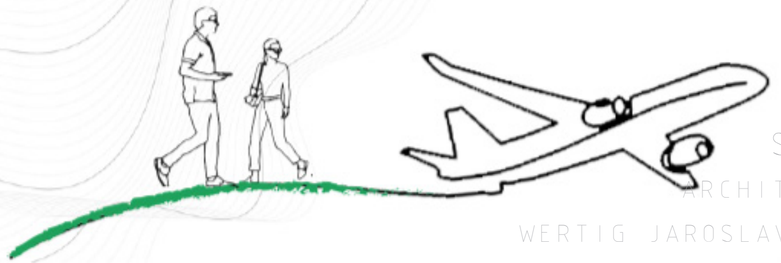
SKYVAULT

PORTFOLIO



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ARCHITECTURAL DESIGN 6
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In contemporary urban challenges, the adaptive reuse of abandoned structures presents a compelling avenue for sustainable development.

This report investigates the potential transformation of one of Prague's six abandoned military barracks into a vibrant, functional space that contributes positively to the local community and environment.

Framed within the thematic framework of this semester's 'empty buildings', this research focuses on the intersection of history, architecture, and social dynamics inherent in military sites.

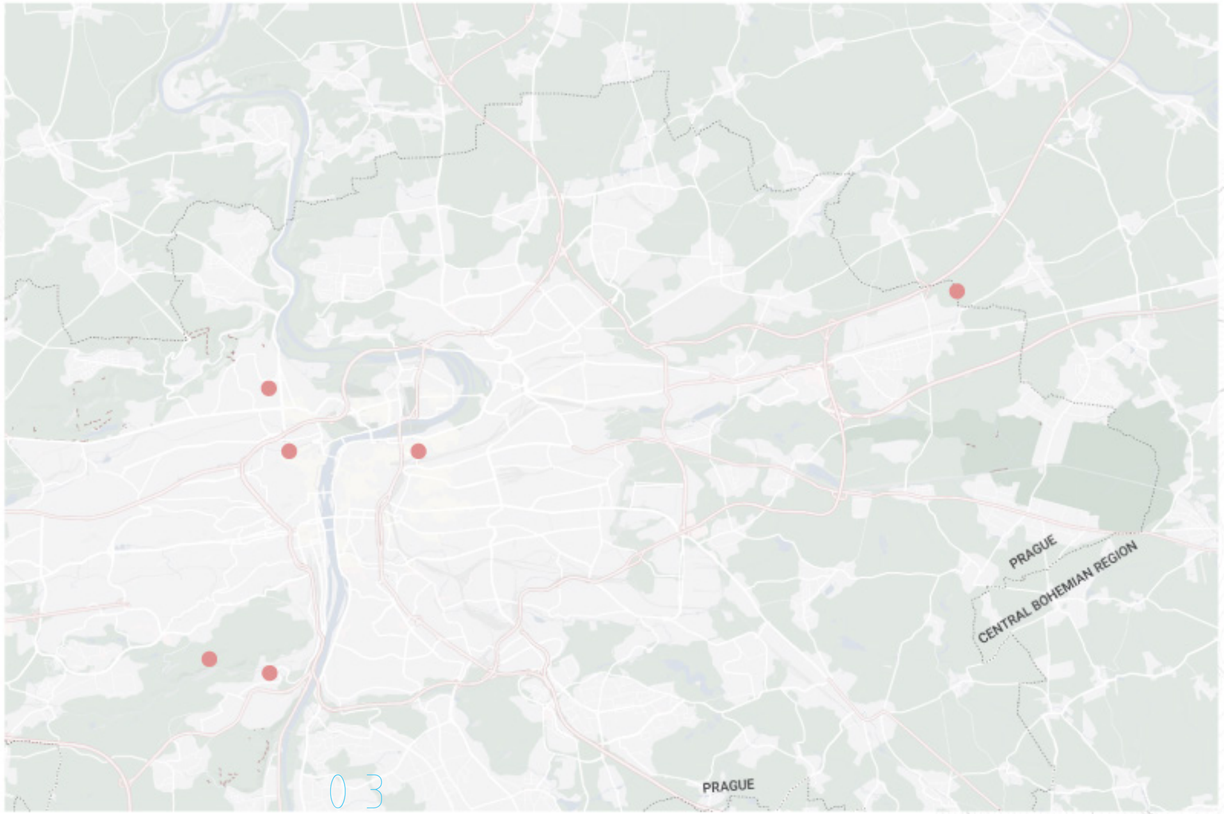
By selecting a specific barracks as the intervention site, the study delves into the unique characteristics and historical significance of the chosen location, and urban evolution.

Drawing upon principles of adaptive reuse and sustainable design, the proposed intervention seeks to breathe new life into the derelict barracks while preserving its architectural heritage.

Through a combination of sensitive restoration, and innovative design interventions, the aim is to repurpose the site into a multifunctional hub for aviation enthusiasts that addresses contemporary needs and aspirations.

'A long - term rmpty house is a problem for its locality, it attracts negative social phenomena, deteriorates the quality of living of the neighbors, and also reduces the value of the surrounding properties.

New and new area are being built up, and it is not only in city centers that empty properties are waiting to be used.
No one knows how many dilapidated properties there are in cities, because no database of vacant properties has existed until now.'
- says Empty Houses Platform.



The military category is divided into two more categories called the Kasárna and the Others.

The Kasarny subcategory contains three military complexes on both west and east side of the Vltava river bank.
The Hradčanská Kasarny is located in Prague 6 and is in pretty good state.
The Kasárna Karlín is located in Prague 8 and is partly repurposed now. The Kasárna Bílý vrch is located on borders of Prague 20 and has only the structural frame intact.

The other subcategory also contains three military objects on the west side of the Vltava river bank.
In Prague 6 we can find the Garáže Dejvická, in Prague 5 we have RD Slivenec and vojenský objekt prokopské údolí.
All of these are located within 20kms distance range.

The MILITARY category contains in total six complexes which are either abandoned, demolished or are been repurposed into something else.

We had to analyse the phenomenon of empty houses in Prague, and classify the buildings into categories, estimate the approximate area occupied by each category, where each of these houses are located, etc.
Me and my teammates chose the category of MILITARY abandoned/empty places in Prague.

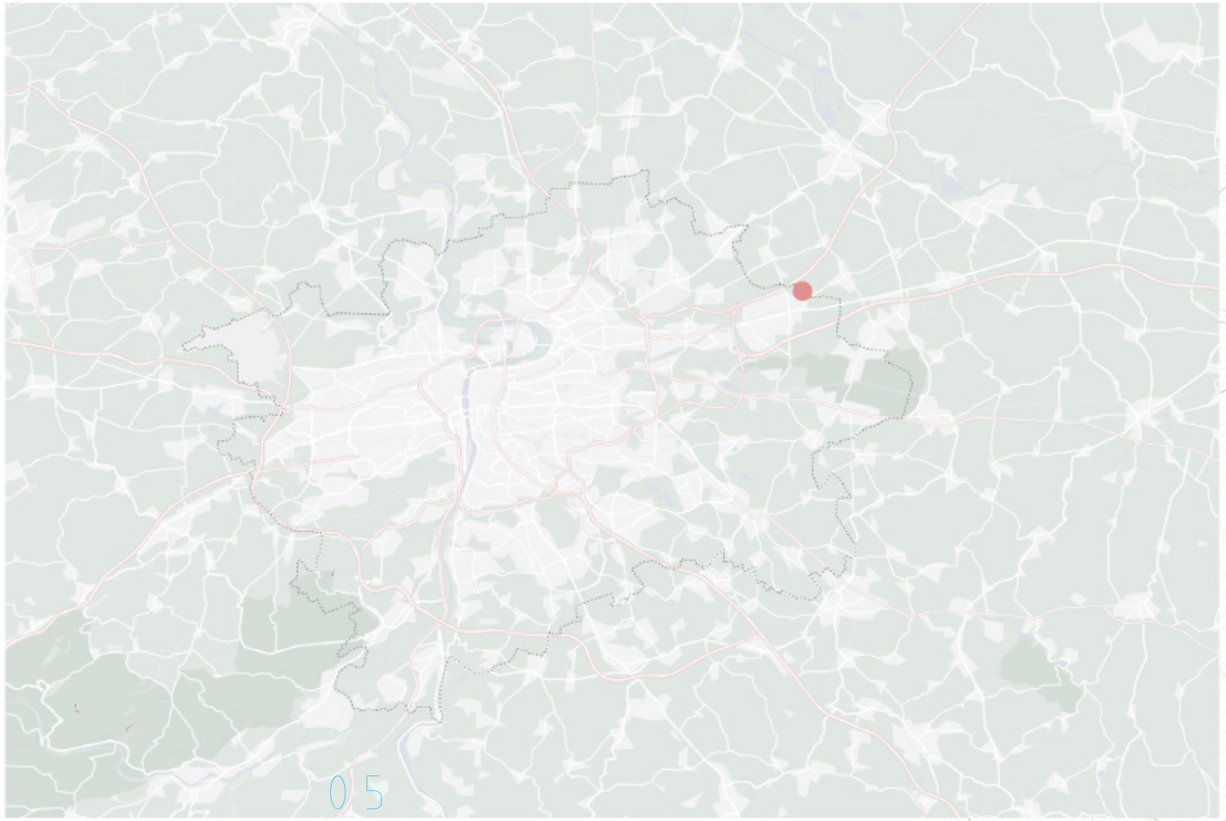
PRAGUE CONTEXT

The chosen site Kasarna Bílý vrch, also known as the White Mountain Barracks, is a historic military complex located in Prague, Czech Republic.

It was constructed in the early 20th century, specifically between 1910 and 1912, during the Austro-Hungarian Empire era.

Architect Antonín Balšánek designed the barracks in the Art Nouveau style, which was popular at the time.

These Barracks served as a military facility for the Austro-Hungarian army and later for the Czechoslovak Army after the dissolution of the Austro-Hungarian Empire at the end of World War I.



The barracks are now recognized as a cultural heritage site by the Czech government, with several buildings listed for their architectural and historical significance.

Today, the entire complex is abandoned except for the former warehouses, which a private company uses. The barracks as a whole were never completed.

Since 1991, the barracks have fallen into disrepair and only serve to attract the curious glances of people passing by on the adjacent highway or train line.

Neighborhood context

Situated on the outskirts of Prague, the barracks are surrounded by green fields and a mix of residential neighborhoods, and industrial zones, offering views of the surrounding hillsides and distant city skyline, creating a picturesque setting.

Transportation

The barracks are accessible by road via Novopacká, with public transit connections available nearby. The barracks are well connected to surrounding neighborhoods and amenities, with pedestrian pathways linking to nearby parks and recreational facilities.

Greenery

As the site is situated on the outskirts of Prague, it is surrounded by green feilds.

It is a barracks area in which the 1st road construction battalion of auxiliary production of Horní Počernice was based.

The department specialized in various building mechanisms.
Today, the entire complex is abandoned except for the former warehouses, which are used by a private company.

The barracks as a whole were never completed. The unit that was supposed to serve here was abolished after the revolutionary changes in 1991.

Since then, the barracks have fallen into disrepair and only serve to attract the curious glances of people passing by on the adjacent highway or train line.










While many buildings are structurally sound, some areas show deterioration, particularly in roof structures and façade detailing. The complex is in fair condition but requires maintenance and repairs to preserve its historical integrity.

CONCEPT

As the barracks are on the border of Prague and are surrounded by green fields, I came up with an idea to repurpose these barracks into an aviation museum with other different programs.

The proposal aims to outline a concept that draws inspiration from military tactics of hiding and concealment, such as hidden underground bunkers or camouflaged structures to protect valuable technology during times of conflict.

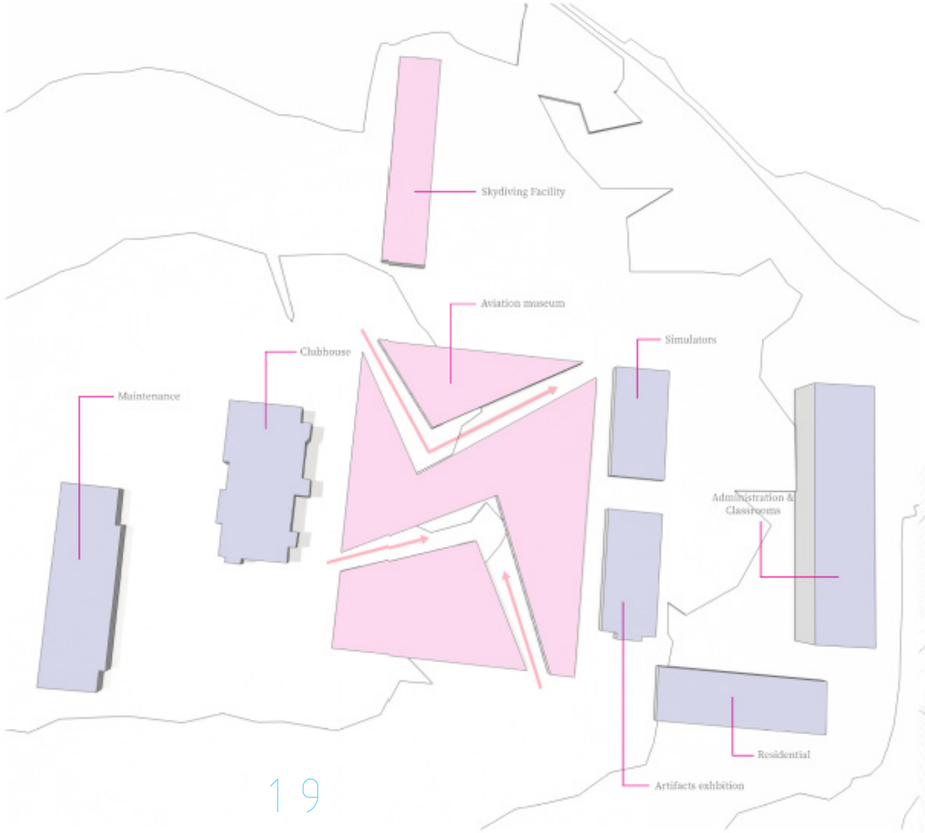
This approach is adapted to create an aviation museum that integrates seamlessly with its surroundings while preserving the historical significance of the site.

The existing buildings would be repurposed into different functions like a clubhouse for aviation enthusiasts, an artifacts exhibition, simulators, a sky diving facility, administration and class-rooms, residential, and maintenance.

The empty parade ground would be repurposed into an aviation museum with a similar concept of hidden military bunkers.

The aviation museum is hidden under artificial terrain, and the underground location of the museum provides optimal conditions for the preservation of aircraft and other artifacts, pro-tecting them from exposure and ensuring their long-term conservation.

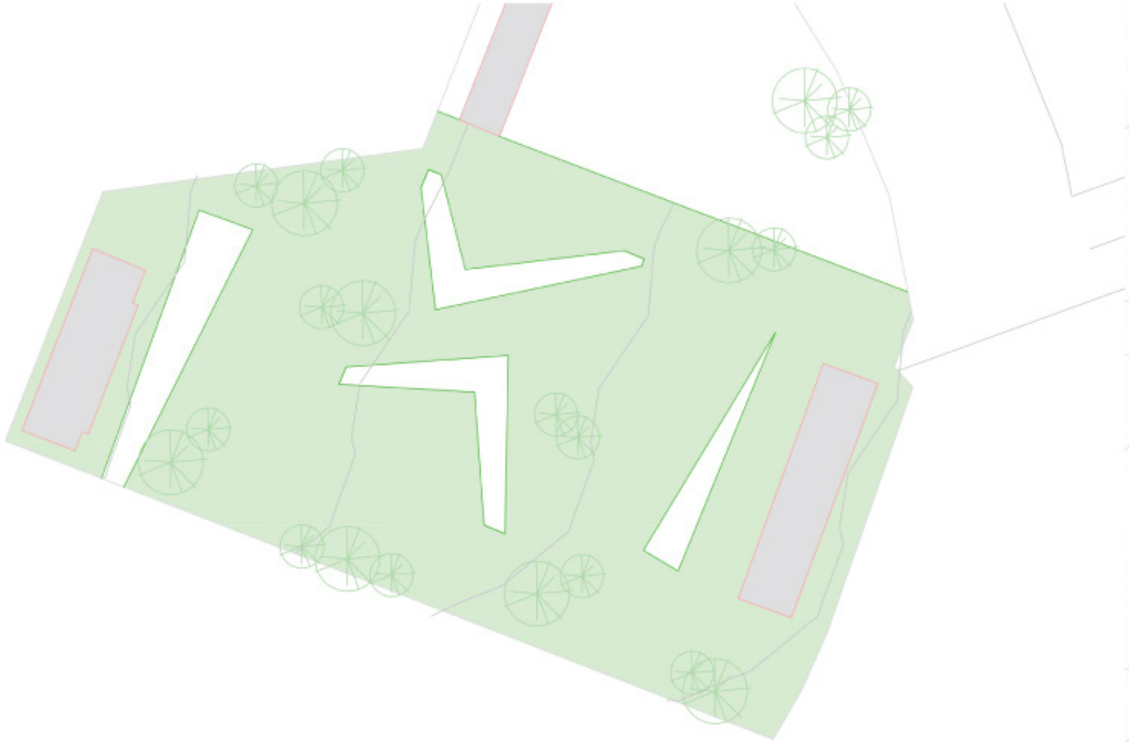
The museum's entrance is discreetly integrated into the landscape, mimicking the appearance of natural terrain, navigating through a con-cealed passage or hidden doors to access the museum, evoking a sense of discovery and intrigue.




RUNWAY
REMOTE
POSITION
TAXIWAY
SITE


SKY DIVING FACILITY
CLUBHOUSE
MAINTENANCE
SIMULATORS
CAR PARK
ENTRANCE
ARTIFACTS EXHIBITS
ADMINISTRATION & CLASSROOMS
RESIDENTIAL

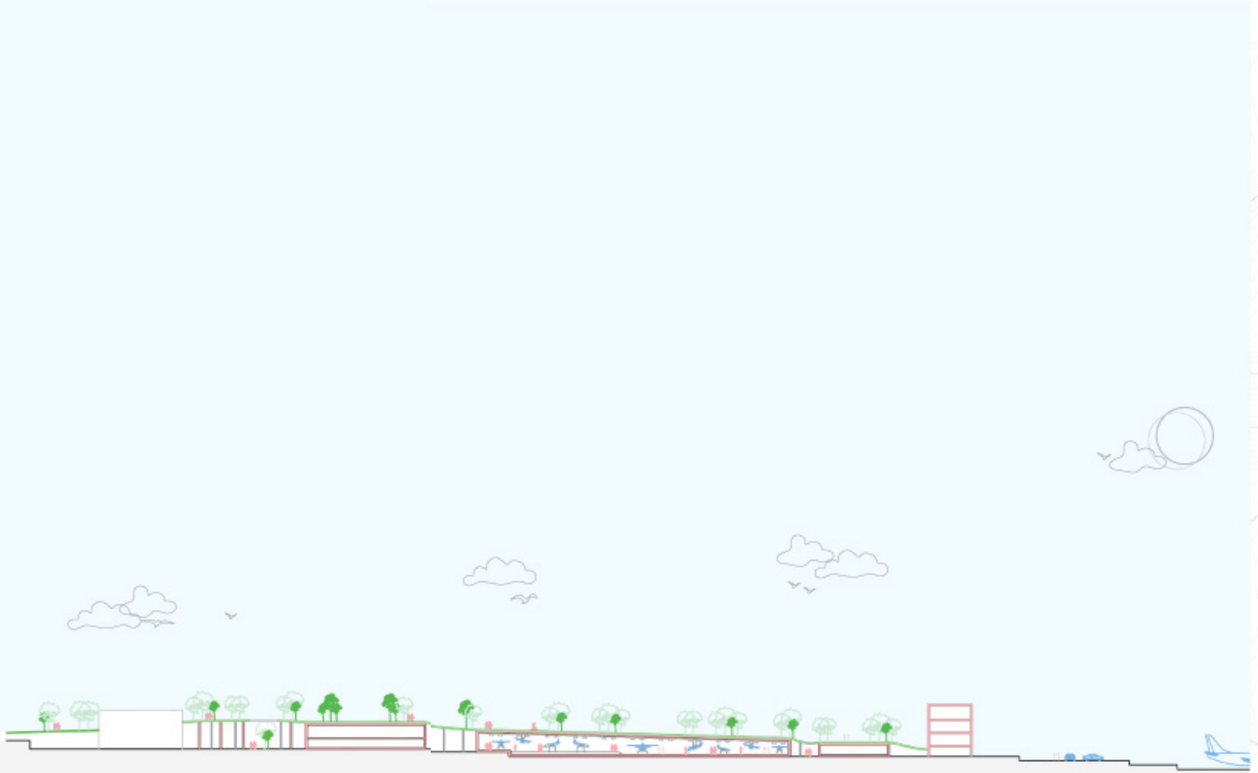
Scale 1:1000



0 20 50 100 200

Scale 1:1000

SECTIONS



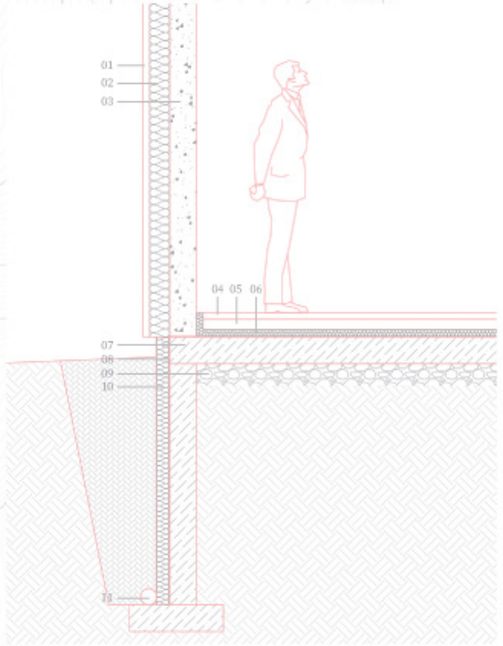
The longitudinal section cutting through almost every building on site.
This section shows how the new terrain above the new building works.

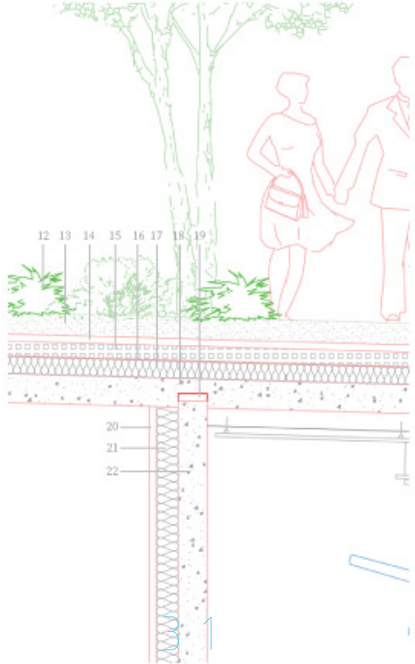
0 20 50 100 200

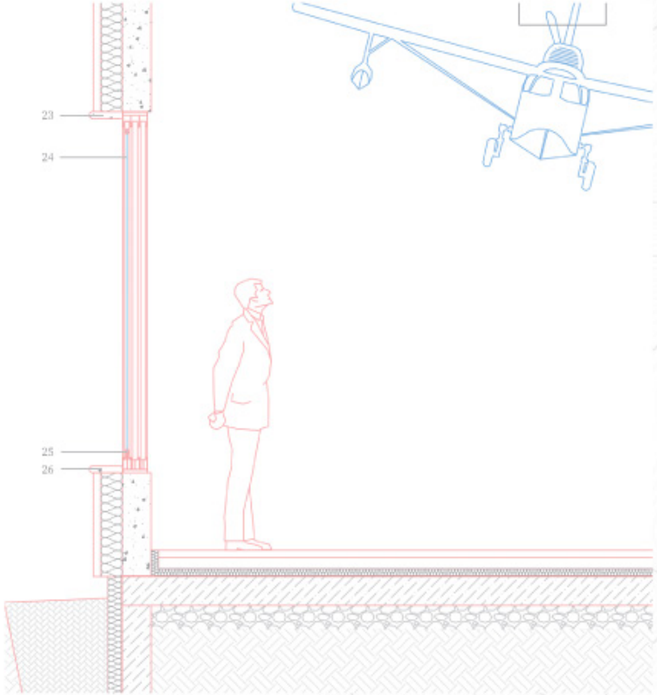
Scale 1:1000

The horizontal section mainly cutting through the Aviation museum.
This section shows how the spaces created because of the void on the roof act as public spaces.

Scale 1:500







01 Shotcrete
02 Thermal Insulation
03 Exposed concrete wall
04 Flooring
05 Cement
06 Thermal Insulation
07 Concrete slab
08 Waterproofing
09 Hardcore bed
10 Thermal Insulation
11 Drainage

12 Vegetation
13 Engineered soil
14 Irrigation
15 Drainage
16 Waterproofing
17 Thermal Insulation
18 Concrete slab
19 Thermal bridge
20 Shotcrete
21 Thermal Insulation
22 Exposed concrete wall

23 Marble lintel
24 6mm thk. clear glass
25 Aluminium hardware
26 Marble sill

0 0.2 0.4 0.6 0.8 1 2m
Scale 1:50

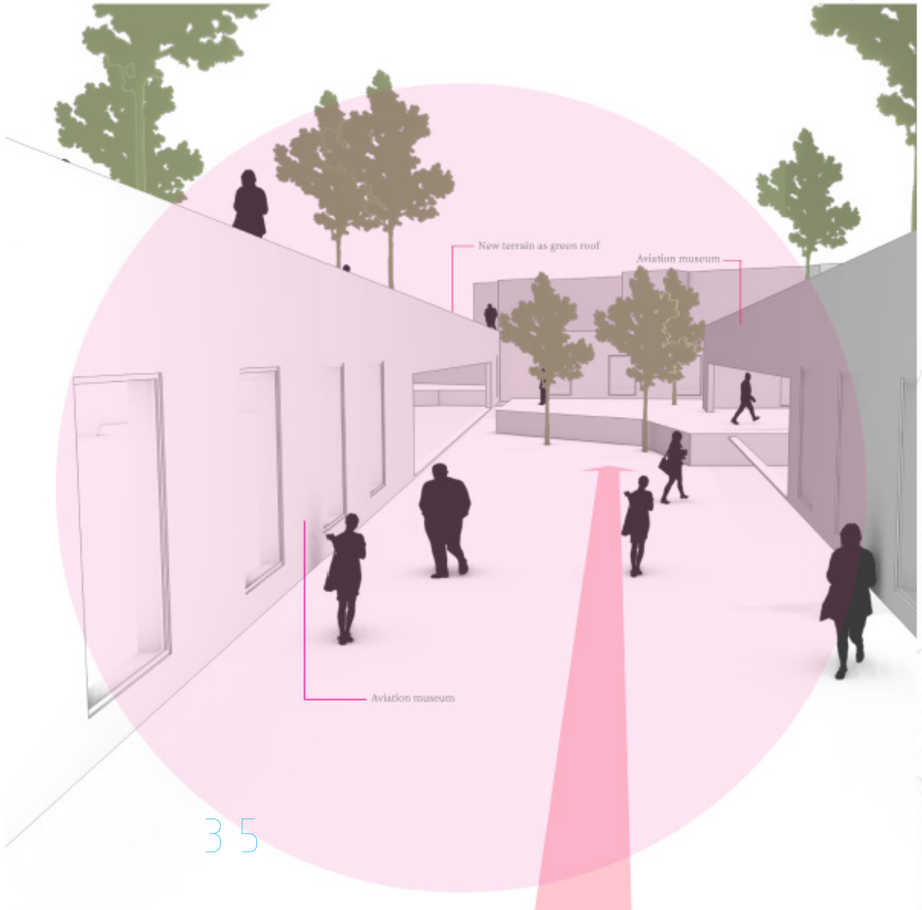
MATERIAL PALLETE

Existing buildings: Even though most of them are in despair, they are all constructed with concrete.

New Terrain: Walkable green roof.

Exterior cladding and finishes: Most of the museum is designed using exposed concrete (shotcrete) to create modern and industrial aesthetics.
Glass curtain walls are incorporated into the museum's design to maximize natural light, also energy efficient glazing materials help to minimize heat gain and optimize thermal performance.

Interior finishes: Wood flooring is used throughout the museum's interior to create a warm and inviting atmosphere. Concrete accent walls add texture and visual interest to the museum's interior design. Decorative techniques such as stamping, scoring, or staining can be applied to customize the appearance of these walls.



The visual shows the cracks on the roof of aviation museum acting as public spaces.

LOCATION

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Today, the entire complex is abandoned except for the former warehouses, which a private company uses. The barracks as a whole were never completed.
Since 1991, the barracks have fallen into disrepair and only serve to attract the curious glances of people passing by on the adjacent highway or train line.

SITE ANALYSIS

Physical Characteristics -
The barracks complex covers approximately 42800 m2, comprising multiple buildings arranged in a rectangular layout around a central parade ground.

Architectural style -
The barracks feature a distinctive Art Nouveau style, characterized by decorative elements such as ornate facades, curved lines, and intricate metalwork.

Current condition -
While many buildings are structurally sound, some areas show deterioration, particularly in roof structures and façade detailing. The complex is in fair condition but requires maintenance and repairs to preserve its historical integrity.

Surrounding environment -
Situated on the outskirts of Prague, the barracks are surrounded by green fields and a mix of residential neighborhoods, and industrial zones, offering views of the surrounding hillsides and distant city skyline, creating a picturesque setting.

Accessibility and transport -
The barracks are accessible by road via Novopacká, with public transit connections available nearby. The barracks are well connected to surrounding neighborhoods and amenities, with pedestrian pathways linking to nearby parks and recreational facilities.

CONCEPT

As the barracks are on the border of Prague and are surrounded by green fields, I came up with an idea to repurpose these barracks into an aviation museum with other different programs.

The proposal aims to outline a concept that draws inspiration from military tactics of hiding and concealment, such as hidden underground bunkers or camouflaged structures to protect valuable technology during times of conflict.

This approach is adapted to create an aviation museum that integrates seamlessly with its surroundings while preserving the historical significance of the site.

PROPOSAL

The existing buildings would be repurposed into different functions like a clubhouse for aviation enthusiasts, an artifacts exhibition, simulators, a sky diving facility, administration and classrooms, residential, and maintenance.
The empty parade ground would be repurposed into an aviation museum with a similar concept of hidden military bunkers.

The aviation museum is hidden under artificial terrain, and the underground location of the museum provides optimal conditions for the preservation of aircraft and other artifacts, protecting them from exposure and ensuring their long-term conservation.

The museum's entrance is discreetly integrated into the landscape, mimicking the appearance of natural terrain, navigating through a concealed passage or hidden doors to access the museum, evoking a sense of discovery and intrigue.

Structure –
New and Old -
The existing buildings on site have fallen into despair leaving only their structural framework. I propose to repurpose and repair these buildings and give them a new look while keeping their history intact.

The new structure, that is the aviation museum, sits on the parade ground with concrete structure and glass curtain walls, hidden under an artificial terrain.

Heating and ventilation -
Passive heating and cooling techniques are essential components of the museum's design, as well as other underground structures on the site.

Harnessing the earth's natural insulation properties, these buildings maintain stable temperatures year-round. The earth's thermal mass acts as a buffer, absorbing heat during the day and releasing it gradually at night, effectively moderating temperature fluctuations.

This sustainable approach minimizes the need for active heating and cooling systems, reducing energy consumption and environmental impact while ensuring comfortable indoor environments for visitors and occupants alike.

Roof structure -
The roof of the underground museum is designed to support the weight of the artificial terrain above while also providing a walkable surface for visitors.
The roof is constructed using reinforced concrete with concrete beams, designed to withstand the load of the soil and vegetation placed on top.

Vegetation -
Given that the underground aviation museum is located in Prague, the choice of vegetation for the roof takes into account the local climate, which is characterized by cold winters, mild summers, and moderate precipitation throughout the year.

Some vegetation options suitable are Hardy Sedums, Alpine plants, ornamental grasses, wildflowers and herbs, and evergreen shrubs. Additionally, incorporating native and adaptive plant species can help preserve the region's biodiversity and connect visitors to the natural heritage of Prague.

Waterproofing and drainage -
Given the underground location of the museum, exterior waterproofing is essential to prevent water ingress and maintain a dry environment.
Waterproof membranes or coatings are applied to the roof surface and the walls to create a barrier against moisture infiltration.

Drainage systems including gutters, and pipes, are installed to channel rainwater away from the roof and prevent leakage into the museum below.

Insulation and climate control -
Insulation materials are installed within the roof structure and walls of the museum to regulate temperature and humidity levels within the museum.

HVAC systems are integrated into the maintenance building to provide climate control and maintain optimal conditions for the preservation of artifacts and visitor's comfort.

Display -
Several approaches are considered for displaying the aircraft in the museum like, the suspending displays from the ceiling of the museum using cables or structural supports.

This approach maximizes floor space and allows visitors to view the aircraft from various angles.

The second approach depends on the size and configuration of the airplanes, they could be partially disassembled and reassembled within the museum space.

This approach allows for the display of larger aircraft while accommodating the limitations of the underground environment, and visitors can observe these different components of the aircraft up close.

Materials

Exterior cladding and finishes:
Most of the museum is designed using exposed concrete (shotcrete) to create modern and industrial aesthetics.

Glass curtain walls are incorporated into the museum's design to maximize natural light, also energy efficient glazing materials help to minimize heat gain and optimize thermal performance.

Interior finishes:
Wood flooring is used throughout the museum's interior to create a warm and inviting atmosphere.

Concrete accent walls add texture and visual interest to the museum's interior design. Decorative techniques such as stamping, scoring, or staining can be applied to customize the appearance of these walls.

MEP

HVAC Systems:
The HVAC system is installed in the maintenance building to provide heating, ventilation, and air conditioning for the museum's interior spaces.
Ductwork and air handling units are concealed within the building envelope to maintain the aesthetics.

Electrical:
In an underground museum, ensuring a reliable and safe electrical system is essential for illuminating exhibits, powering interactive displays, and providing necessary amenities.

Electrical wiring is discreetly integrated into the walls, ceilings, and floors using concealed conduits and channels to maintain the museum's aesthetic appeal.

Strategically placed outlets and fixtures provide power where needed without disrupting the clean lines of the interior design.
Additionally, backup power sources placed in the maintenance building such as generators or battery systems can be employed to ensure uninterrupted operation in case of power outages.

Plumbing:
Plumbing infrastructure in an underground museum facilitates essential functions such as restroom facilities, and HVAC systems.

Plumbing pipes are carefully routed behind walls or beneath the floors to provide water supply and drainage while minimizing visual intrusion.

Water conservation measures, such as low-flow fixtures and greywater recycling systems, are also incorporated to minimize the museum's environmental impact.

Sustainability

The museum prioritizes sustainability in its design and operation as follows:

Green roof -
The museum is designed with a green roof system, with vegetation planted on the roof surface.
This helps to mitigate the urban heat island effect, reduce storm water runoff, and provide habitat for local wildlife.
Additionally, the green roof provides natural insulation, reducing the energy required for heating and cooling.

Energy efficient design -
The museum employs passive design strategies to optimize energy efficiency.
This includes orientation to maximize natural daylighting and ventilation, as well as the use of high–performance building materials such as shotcrete, recycled concrete, etc to minimize heat gain and loss.

Water conservation -
Water-efficient fixtures and fittings are installed throughout the museum to minimize water consumption.
Additionally, rainwater harvesting systems may be implemented to collect and reuse rainwater for irrigation and toilet flushing, further reducing demand for municipal water supplies.

Sustainable materials -
The museum utilizes sustainable building materials, such as recycled concrete aggregates, shotcrete, and low-impact finishes.
These materials minimize environmental impact and promote resource conservation throughout the construction process.

CONCLUSION

In conclusion, the proposed aviation museum stands as a testament to the seamless integration of architectural ingenuity and sustainability principles.

Inspired by military tactics of concealment, the museum's design exudes a sense of intrigue and discovery, with its hidden entrance concealed beneath an artificial terrain reminiscent of military bunkers.

Once inside, visitors are immersed in a captivating environment where architectural elements, structural details, and sustainability principles converge to create a transformative experience.

Constructed with enduring materials such as concrete, wood, and glass, the museum embodies a commitment to sustainability at every level. Its green roof systems, energy-efficient design strategies, and utilization of renewable energy sources minimize environmental impact while promoting ecological stewardship.
By prioritizing water conservation, waste reduction, and sustainable transportation options, the museum sets a new standard for environmentally responsible architecture.

In essence, the proposed aviation museum not only honors the rich history of aviation but also serves as a beacon of architectural innovation and environmental consciousness.

Structural Engineering report

Green roof calculations –

Calculating the load of a green roof on a 309 sq.m. area with layers such as engineered soil, irrigation layer, drainage layer, waterproofing layer, and concrete structure layer.

a) Engineered soil:
Area – 309 sq.m
Density – 1,500 kg/m3
Thickness – 0.2m
Soil load – 309 * 0.2 * 1500 = 92,700 kg

b) Irrigation layer:
Weight per unit area – 10 kg/m2
Irrigation layer load – Area * weight = 3,090 kg

c) Drainage layer:
Weight per unit area – 30 kg/m2
Drainage layer load – Area * weight = 9,270 kg

d)Waterproofing layer:
Weight per unit area – 2 kg/m2
Waterproofing layer load – Area * weight = 618 kg

e) Concrete layer:
Weight per unit area – 200 kg/m2
Concrete layer load – Area * weight = 61,800 kg

Total dead load = 92700 + 3090 + 9270 + 618 + 61,800 = 167478 kg = 17,080.34 kN
For a walkable roof, let's assume typical maximum live load values per square meter – 3.0 kN/m^2
Total load (max) = Total dead load + live load = 17,080.34 KN + 927 KN = 18,007.34 KN
Load per unit area = Total load / area = 58.26 kN/m^2

Beam stability analysis –

To know the beam stability, we need to calculate the buckling, deflection, shear, and bending moment of a beam.
So we know that

a. beam is simply supported
b. The effective length of a beam = 33m
c. Applied loads = 58.26 kN/m^2
d. Moment of inertia = 675,000,000 mm4
e. Beam cross section = 300mm x 300mm

i) Buckling factor –
For a simply supported beam, the buckling factor is considered as 1.0

ii) Maximum deflection –
For a simply supported beam uniformly loaded, the maximum deflection occurs at the center
δmax = 3845×675,000,000(58.26×103) × (33×103)4
δmax ≈ 0.287 mm

iii) Maximum shear force –
For a simply supported beam uniformly loaded, the maximum shear force occurs at the supports and is half the total applied load
Vmax = 0.5 × (58.26×103) × (33×103) = 962,070N.

iv) Maximum bending moment –
For a simply supported beam uniformly loaded, the maximum bending moment occurs at the center
Mmax = 0.125 x (58.26x103) x (33x103)2 = 66,876,300,000Nm.

v) Stress analysis –
Calculating the stresses induced by the applied loads determining the shear stress (τ) at critical points along the beam cross-section.
Given:
Applied loads on the beam ( ) = 58.26 kN/m^2
Beam cross-section: Rectangular, with dimensions 300 mm×300 mm
Calculating the maximum shear stress (max).
Tmax = Vmax / A = 962, 07090000 / 90000 = 10.69 N/mm2.