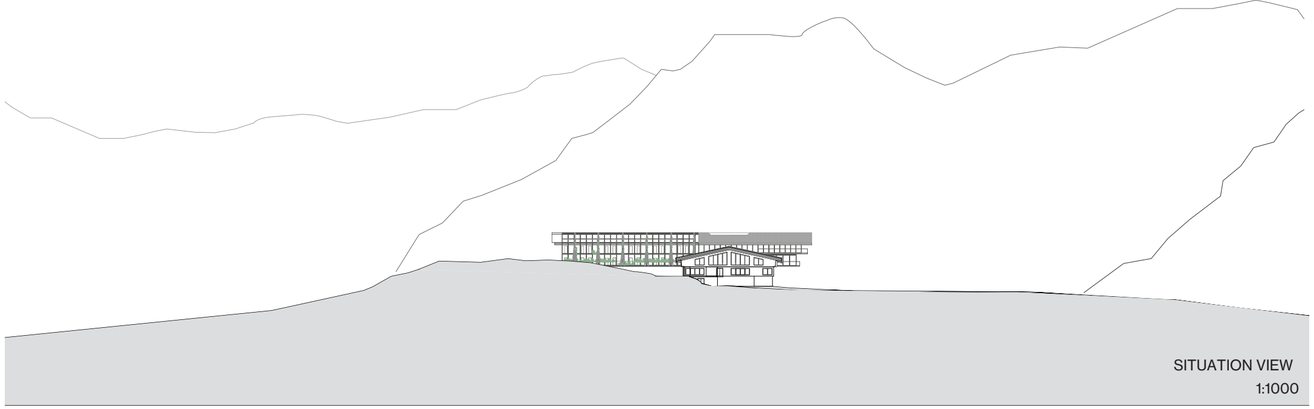
Sustainable Transformation Alpine Hospitality & Landscape

Sustainable Alpine Architecture & Tourism:
Reimagining through Circular Strategies

P5 PRESENTATION
Graduation Architectural Engineering
Catherijne Schot
14-01-2025


WILDER KAISER
STAHLSTADL


...across from the Wilder Kaiser Range



SITUATION VIEW
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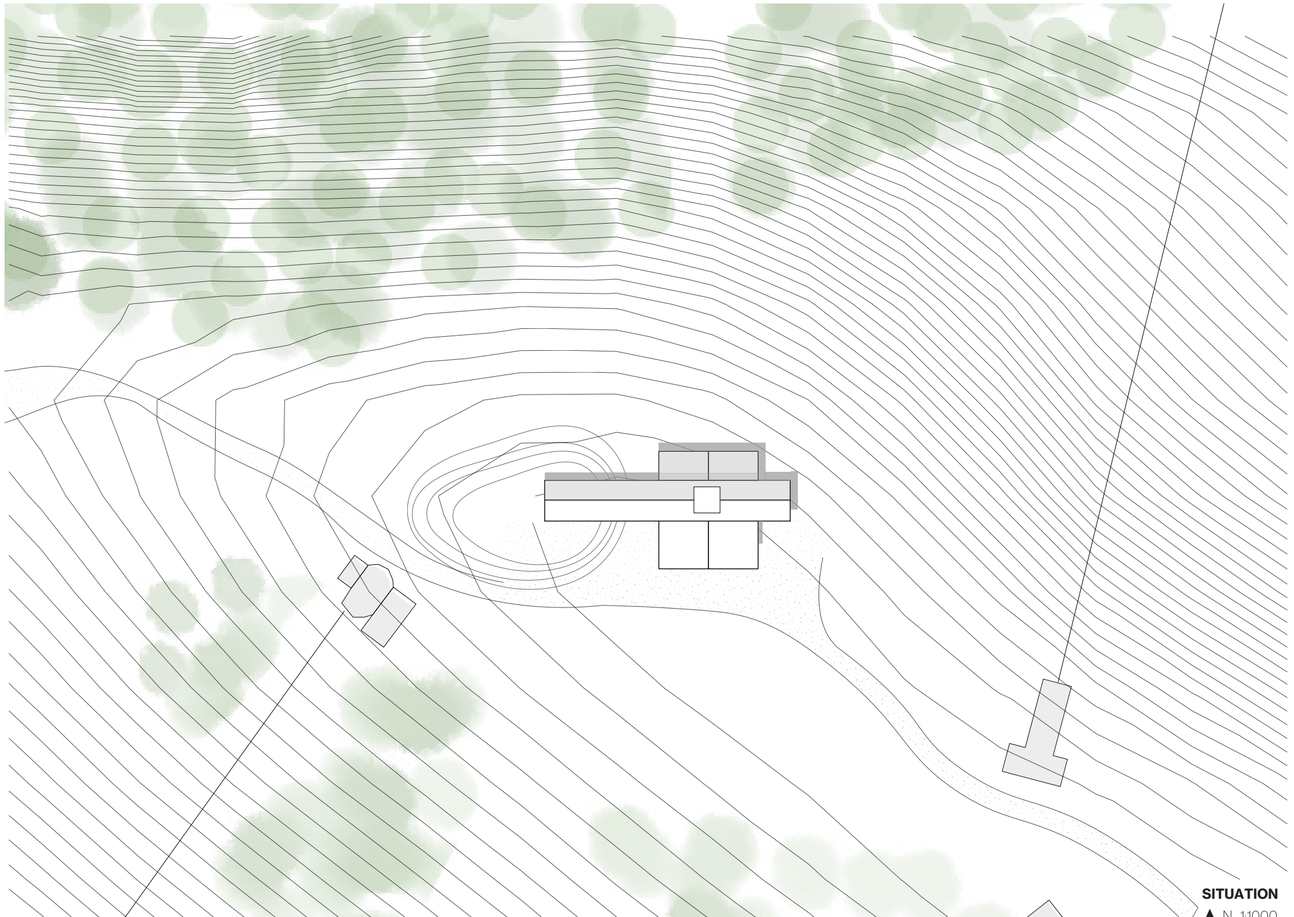

SITUATION
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STAHLstadl

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Transformation
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Hospitality &
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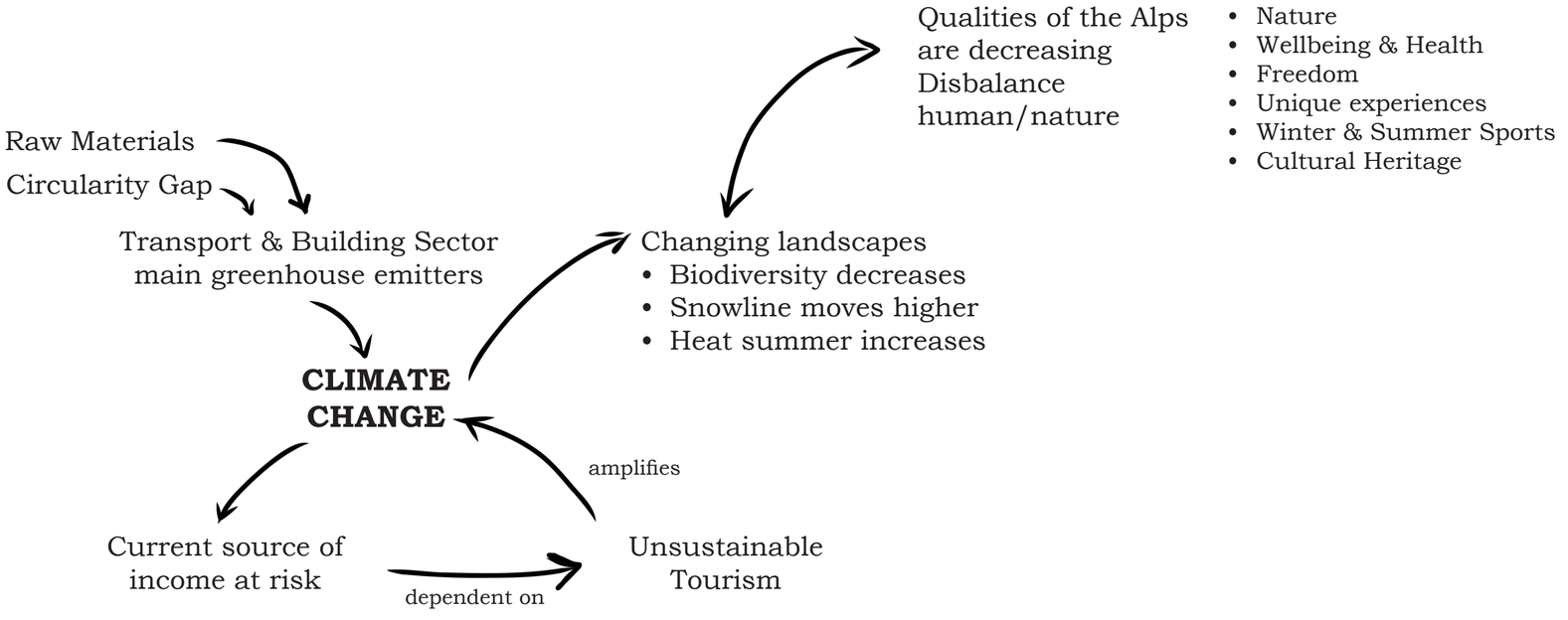
FASCINATION

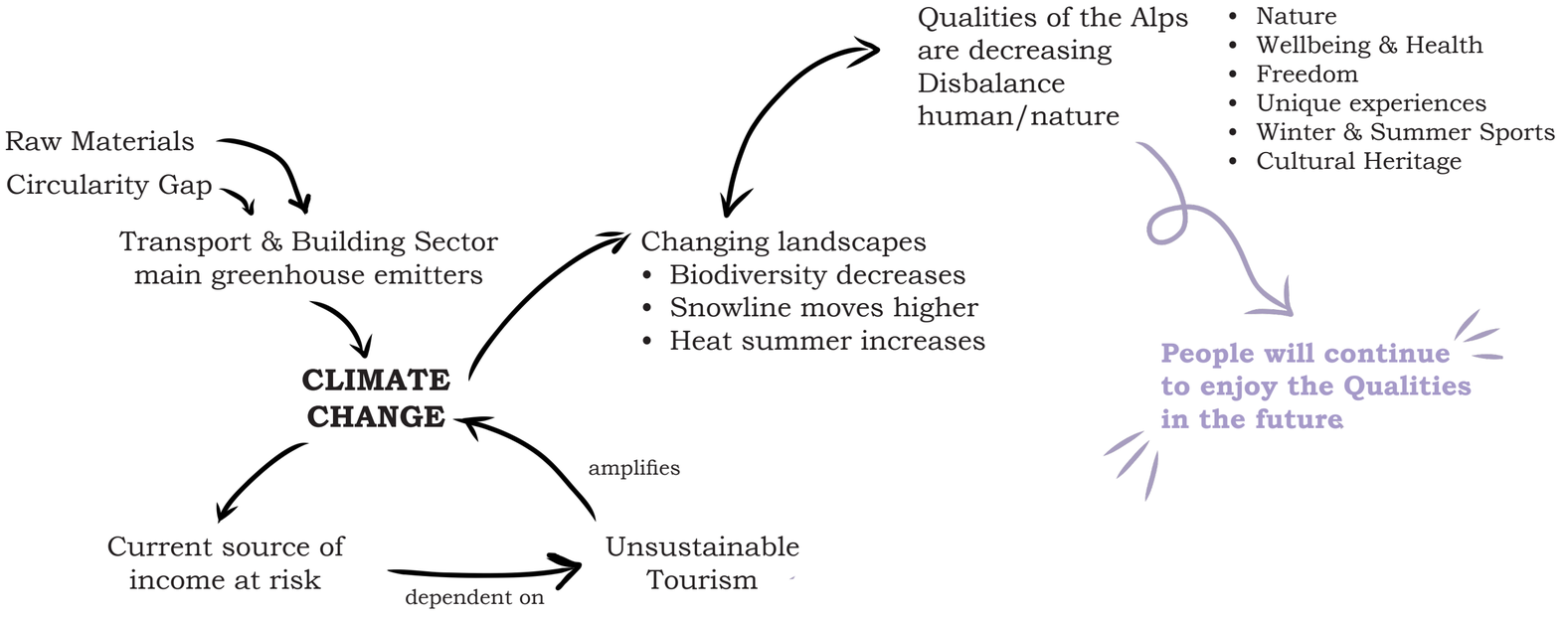
PRIORITIES OF THE ALPINE CONVENTION

"Goal: The Alps shall be a model region for a sustainable future worth living in for humans and all other species in 2030 and beyond." (The Alpine Convention, 2022)

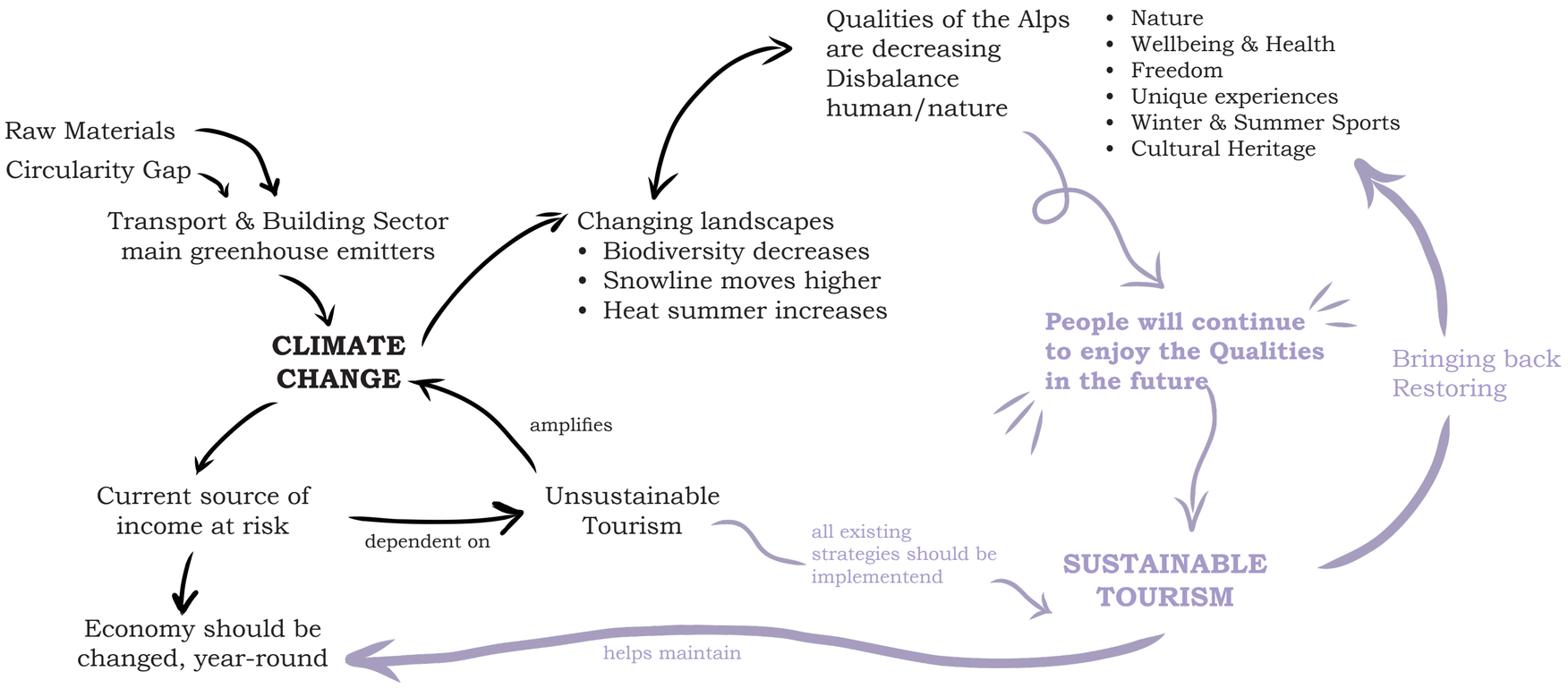
CHALLENGES IN ALPINE REGIONS: CLIMATE



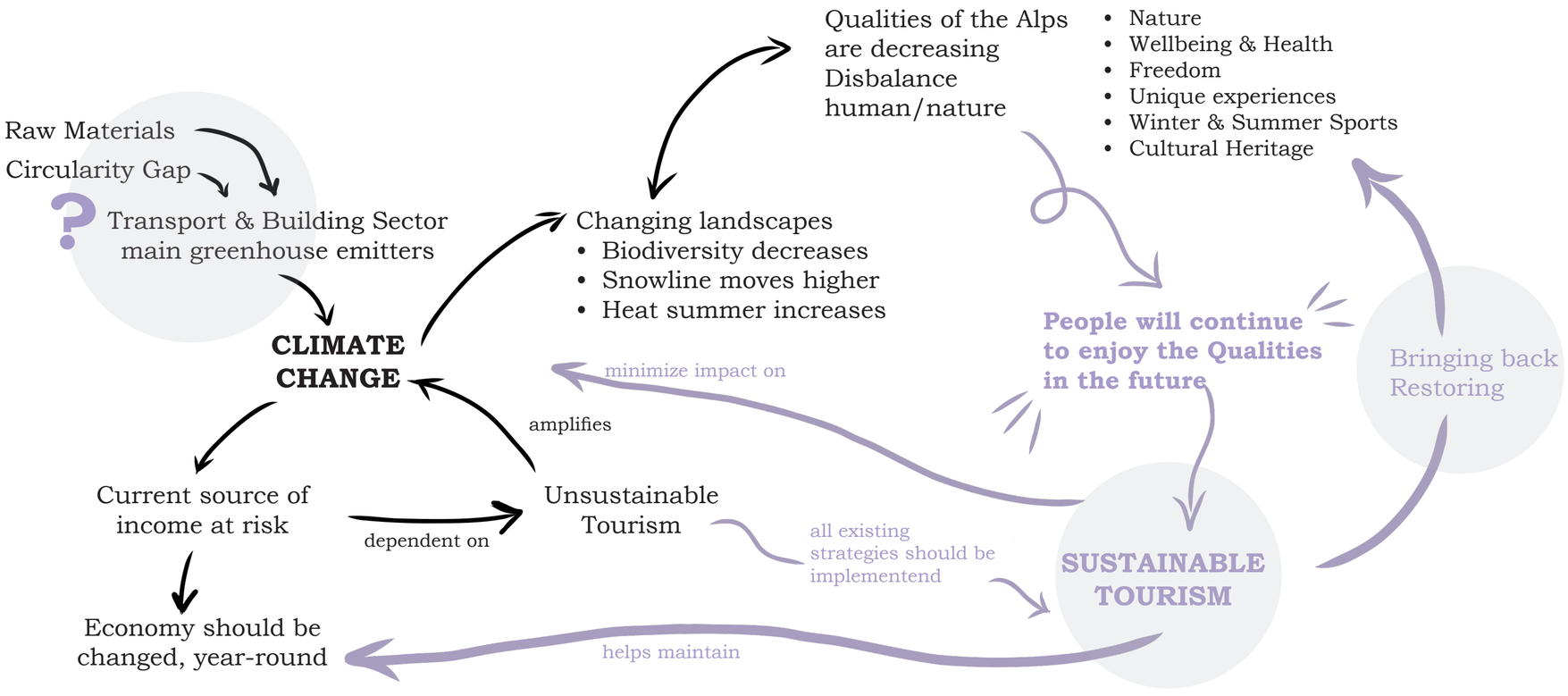
CHALLENGES IN ALPINE REGIONS



CHALLENGES IN ALPINE REGIONS



CHALLENGES IN ALPINE REGIONS



THEN…

Laboratory of Modernism

Sledge lift del Lago Nero by Carlo Mollino 1946-47

Les Arcs, Charlotte Perriand, 1960

THEN...

Laboratory of Modernism

Building in Alpine Regions felt
like an Accomplishment

THEN...

Laboratory of Modernism

Building in Alpine Regions felt like an Accomplishment

NOW!

Laboratory for Circular Building Methods

Contributing to closing the material loops is the Accomplishment

THEMATIC RESEARCH **QUESTION**

How can circular solutions be integrated into the design process of reimagining Architecture in the Austrian Alps to enhance ***the Sustainability of Tourism*** *and contribute to* ***closing the Circularity Gap in Austria?***

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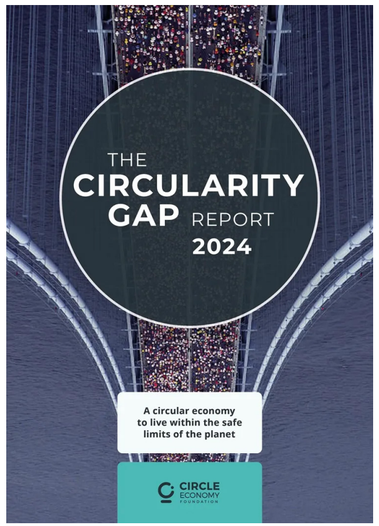
Which (combination of) circular solutions contribute to **closing the Circularity Gap in Austria?**

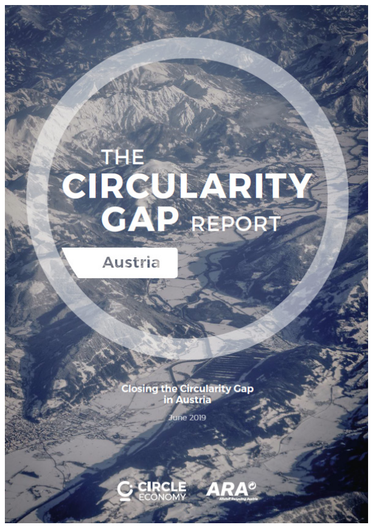
How (and in what forms) can **circular solutions be integrated (optimally)** within the design (process)?

Which (material) flows should be prioritized to enhance **the Sustainability of Alpine Tourism?**

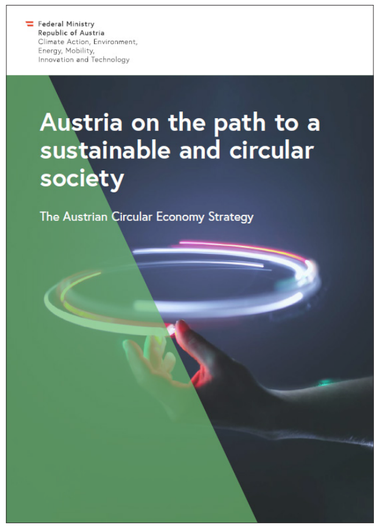
LITERATURE



GCGR (2024)

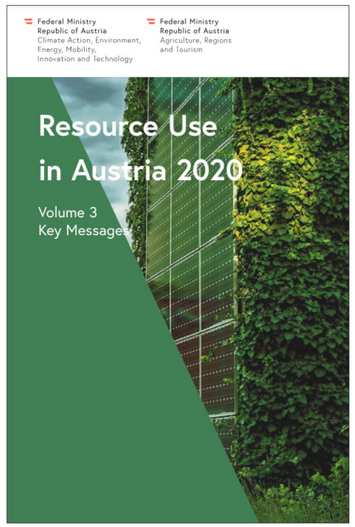


ACGR (2019)



ACES (2022)

RMM (2021)



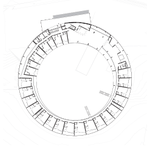
RU (2020)

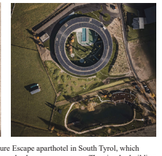
CASE STUDY ANALYSIS

Appendix V - Case Studies

OLM Nature Escape – Andreas Gruber Architekten

Location	Sand in Taufers, South Tyrol, Italy
Year	2019/2023
Maximising Existing Stock	No, newly built
Material Resources	Biological, Technical materials
Local Sourcing – distance to site	Larch wood (2nd most common tree in South Tyrol)
Energy Efficiency and Renewable Energy Integration	Self-sufficient: 126 geothermal probes (125 m deep, 15000 m³), solar energy systems (800 kW PV)
Circular Design Principles – Design Approaches	Design for Longevity
LCA: Skin, Structure, Services, Space plan, Stuff	Skin: natural mineral surfaces in the form of natural plasters and stone surfaces Structure: static structures (solid wood) are relocated inwards (the circle). Services: Slots and ceiling openings for building services, fire prevention. Water management through water-efficient fittings, greywater recycling, and rainwater harvesting systems Space plan: efficient utilisation of space & planning of the building.
Label/Certification	CasaClima Nature





An exemplary case of sustainable hotel design is the OLM Nature Escape aparthotel in South Tyrol, which achieves energy self-sufficiency through 126 geothermal probes and solar energy systems. The circular building has earned CasaClima Nature certification for its high construction standards, energy efficiency, and climate protection measures. It is circular in its form and function.
The project embraces the local rural context by predominantly using natural materials sourced from the immediate surroundings. These materials include natural mineral surfaces like plasters and stone, as well as natural wood, with generous glass surfaces connecting interior and exterior spaces. Developed and realised between 2019 and 2023, during a period of significant global events, the project aimed to overcome challenges and translate insights into a unique building. The result is an energy-efficient, self-sufficient structure powered by geothermal and solar energy, making it the first hotel building in the Alps with a positive energy balance. Water management systems, including water-efficient fittings, greywater recycling, and rainwater harvesting, were also integrated.

Local and recyclable materials were prioritised in the project's realisation, contributing to its sustainability and longevity. The simplicity and flexibility of Olm Nature Escape further enhance its sustainability. The circular building design was chosen to align with landscape considerations, guest needs, and architectural innovation, requiring close collaboration between planning teams and practical implementation. The building's opulent glass facades capture the landscape's qualities, while efficient space utilisation and planning from the operator's perspective ensure economic efficiency. Despite complexities in construction and infrastructure due to the building's size and unique shape, the project demonstrates a commitment to sustainability, innovation, and quality in both interior and exterior spaces.

Svart – Snøhetta (Concept)

Location	Svartisen Glacier, Norway
Year	2017-2019
Maximising Existing Stock	No, newly built, still concept
Material Resources	Biological, Technical materials
Local Sourcing – distance to site	unknown
Energy Efficiency and Renewable Energy Integration	Self-sufficient. Aim to reduce 85% of energy consumption. Nano-grids with passive production of renewable energy (solar mapping determined form of design)
Circular Design Principles – Design Approaches	Design for Longevity, Regenerative Design
LCA: Skin, Structure, Services, Space plan, Stuff	Skin: predominantly Glass Facades Structure: Wood (minimal footprint), Concrete? Services: no details Space plan: multifunctional design elements (e.g. boats as structure) efficient utilisation of space & planning of the building.
Label/Certification	-

In collaboration with Arctic Adventures of Norway, Asplan Viak, and Skanska, Snøhetta designed "Svart," envisioned as the world's first Powerhouse hotel at the foot of the Svartisen glacier in northern Norway. This project aimed to set a new standard in sustainability by reducing annual energy consumption by 85% compared to modern hotels and generating its own energy, crucial for preserving the Arctic environment.
The circular design of Svart, inspired by local vernacular architecture in the form of the "fiskehjell" (A-shaped wooden structure for drying fish) and the "rorbue" (a traditional type of seasonal house used by fishermen), extended into the Holandsfjorden fjord, minimising its environmental footprint. Wooden poles supported the structure, ensuring minimal physical impact and enhancing its transparent appearance in the pristine landscape. Energy optimisation was key, with extensive solar radiation mapping and Norwegian solar panels maximising energy capture. Secluded terraces and large windows utilised natural thermal energy, reducing the need for artificial cooling and heating. The use of materials with low embodied energy was crucial in meeting the Powerhouse criteria. As part of the Powerhouse collaboration, Svart aimed to generate more renewable energy over its lifecycle than the total energy required for construction, operation, and demolition. Although the project was terminated at the concept design stage in 2019, it remains a pivotal example of sustainable and circular design in architecture.

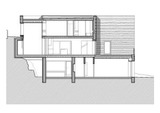
Hotel Ryttergården – 3XN, GXN

Location	Bornholm, Denmark
Year	2021
Maximising Existing Stock	No, newly built
Material Resources	Biological materials
Local Sourcing – distance to site	CLT prefabricated, tiles of upcycled glass from local sources
Energy Efficiency and Renewable Energy Integration	Rooftop Solar Cells
Circular Design Principles – Design Approaches	Design for Longevity, Design for Standardisation, showcase for material transparency
LCA: Skin, Structure, Services, Space plan, Stuff	Skin: Timber Cladding Structure: CLT Services: Natural ventilation, Solar cells, water recycling Space plan: Standardisation of units, efficient utilisation of space & planning of the building
Label/Certification	-

Efficient resource utilisation and fabrication are showcased by Hotel Ryttergården in Bornholm, Denmark. This hotel emphasises cross-laminated timber construction for its carbon-sequestering properties. Prefabricated cross-laminated panels were manufactured in a factory using highly accurate computer-controlled techniques, minimising construction time, waste and cost. The inside is based on a 'kit of parts' plan that sees box-like units fill the volume. Rooftop solar cells and water recycling systems further enhance sustainability. The design leverages the precision and repeatability of computer-controlled fabrication to deliver custom solutions at a lower cost than traditional methods. For example, elegant grills for natural ventilation are cut directly into the CLT panels, showcasing the advantages of a holistic design approach that integrates design, manufacturing, and performance. Additionally, the standardised design of the units allowed for accurate prediction of material offcuts, which were then repurposed to create furniture items for the hotel, minimising waste. Waste from granite and gas production has been processed locally into new, beautiful products at the hotel. In this way, the building itself is an expression of the hotel's ambition to make green solutions an attractive element for guests (Morris, 2024).

Haus Rauch – Lehm Ton Erde Baukunst

Location	Schlins, Austria
Year	2005-2008
Maximising Existing Stock	No, newly built
Material Resources	Biological
Local Sourcing – distance to site	Own excavation pit, 0 km
Energy Efficiency and Renewable Energy Integration	Thermal mass, acts as heat buffer
Circular Design Principles – Design Approaches	Design for Longevity, Regenerative Design
LCA: Skin, Structure, Services, Space plan, Stuff	Skin & Structure: Solid rammed earth Space plan: Efficient, Rectangular
Label/Certification	-



The residential building in Schlins, Austria, designed by Martin Rauch utilises excavated earth from the construction site itself. The structure and envelope of the building are formed by solid rammed earth walls, adhering to the concept of geobased local mining, where locally sourced earth is employed for construction. Rammed earth offers the significant advantage of being fully recyclable. A constructed wall can be deconstructed, rehydrated, and reused to produce the same quality of building material repeatedly. Any excess material can be returned to the ground without treatment, as it is free of chemicals. Rammed earth walls also provide excellent thermal mass, acting as a heat buffer by absorbing heat during the day and releasing it during cooler nights. This characteristic helps to moderate extreme temperature fluctuations, thereby reducing energy consumption passively. Additionally, these walls can store moisture, creating comfortable indoor environments with optimal air quality and humidity levels. In Austria and Switzerland, there are multiple examples of projects of Lehm Ton Erde Baukunst GmbH in which rammed earth is used.

House K - Seiler Linhart

Location	**Alpnach, Switzerland**
Year	2013
Maximising Existing Stock	No, newly built
Material Resources	Biological
Local Sourcing – distance to site	Earth, own excavation pit, local spruce/silver fir.
Energy Efficiency and Renewable Energy Integration	Thermal mass, heat distribution, wood-burning stove
Circular Design Principles – Design Approaches	Design for Longevity, Regenerative Design, Disassembly
LCA: Skin, Structure, Services, Space plan, Stuff	Skin: Untreated solid wood elements Structure: Solid wood, Rammed earth, concrete pedestal (reinforced with bamboo) Services: Stove Space plan: Efficient, Rectangular, Open around core
Label/Certification	

Rammed earth is also used in the project House K of Seilerlinhart Architects. The central development core, constructed from rammed earth sourced directly from its own excavation site, serves as the house's centrepiece, spanning four floors. This core provides a striking, earthy contrast to the bright and spacious rooms surrounding it. Its proximity to the wood-burning stove allows it to efficiently distribute heat gradually throughout the floors while also regulating the humidity levels within the entire house. Complementing the natural material palette, Tadelakt is used for the walls in wet areas, and casein is applied to the floors in both the entrance and bathroom areas. The house is built on a sturdy concrete pedestal reinforced with bamboo, providing a robust foundation. Rising above this base is a three-story timber structure, crafted entirely from the company's proprietary solid wood system (HolzPur). The exclusive use of wood defines the architectural character of the building. All exterior and interior walls, as well as the roof, are constructed from untreated solid wood elements, eliminating the need for additional insulation materials. The floor slabs are designed as substantial board-pile ceilings. This design approach results in a home free from metal, adhesives, and chemical building materials, relying solely on pure wood.

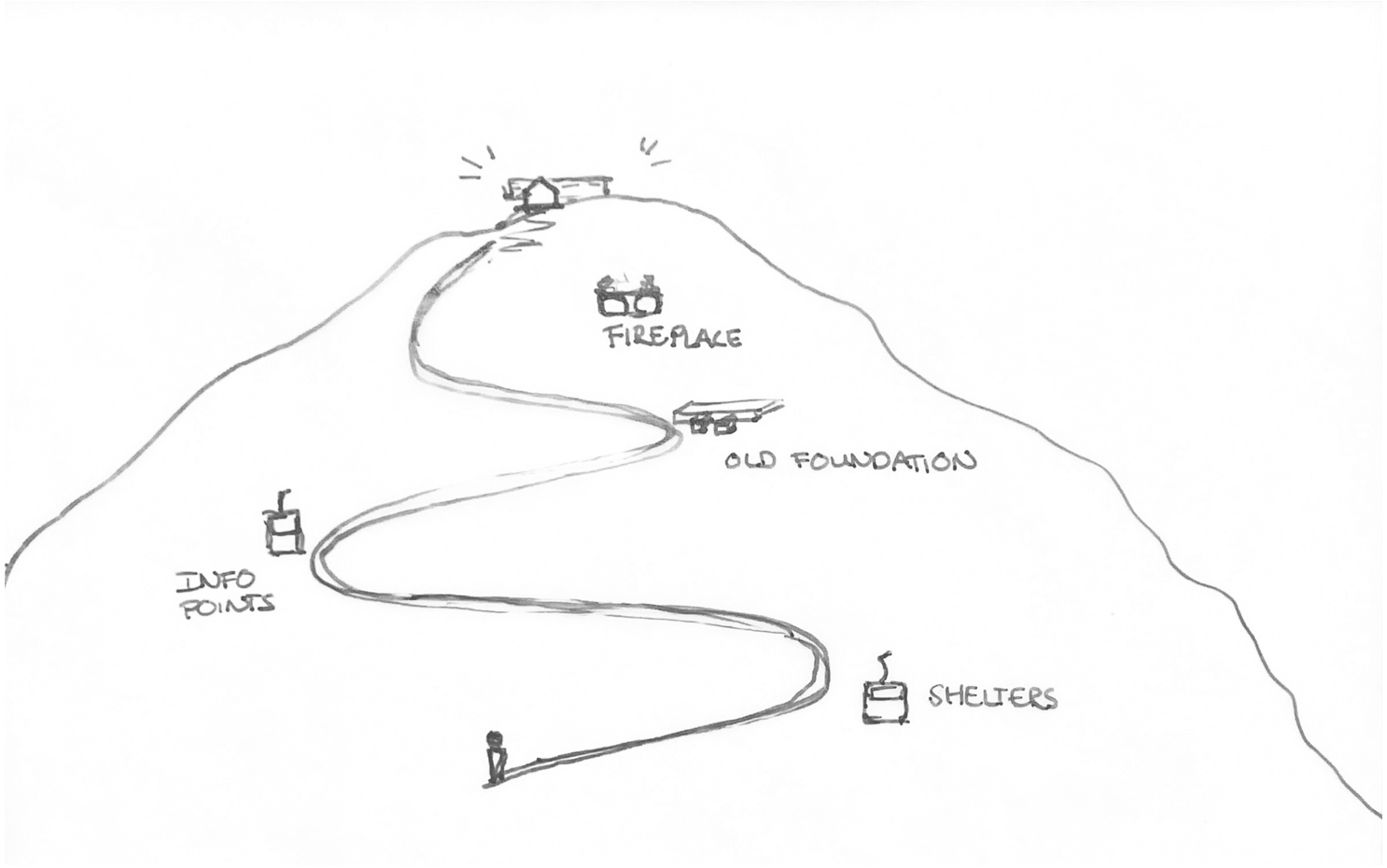
CONCLUSIONS RESEARCH?

CIRCULAR SOLUTIONS?

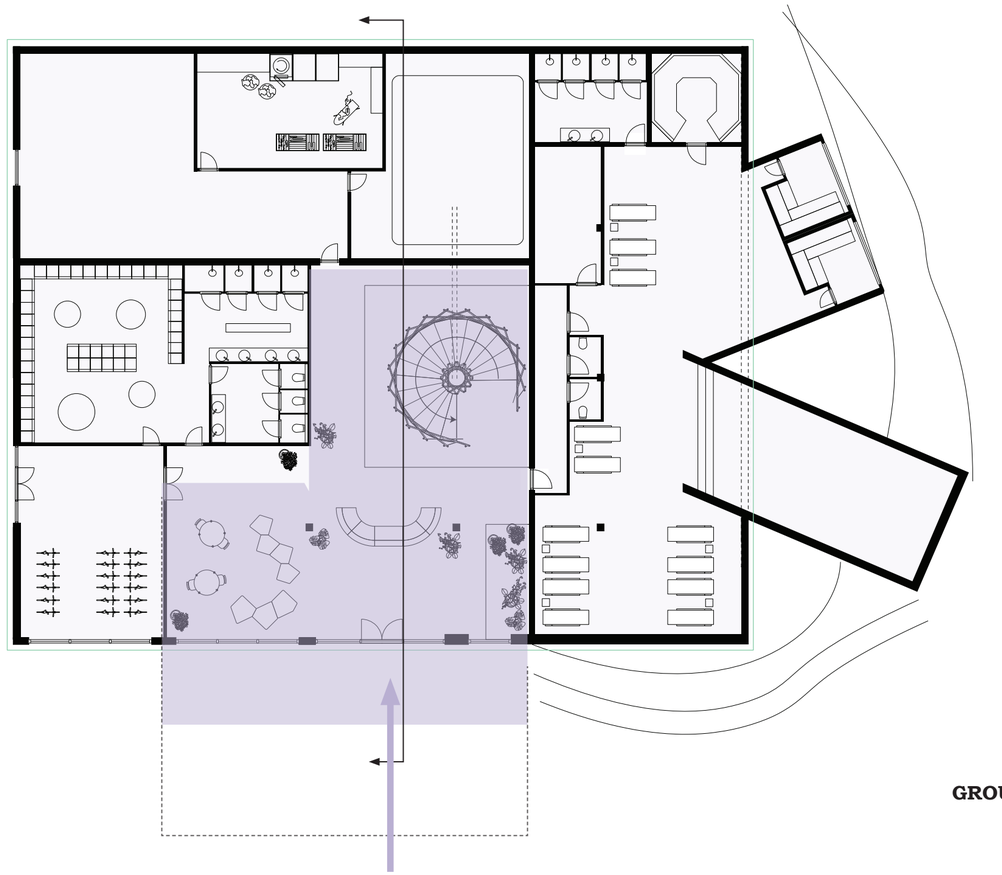
DESIGN INPUT?

POTENTIAL?

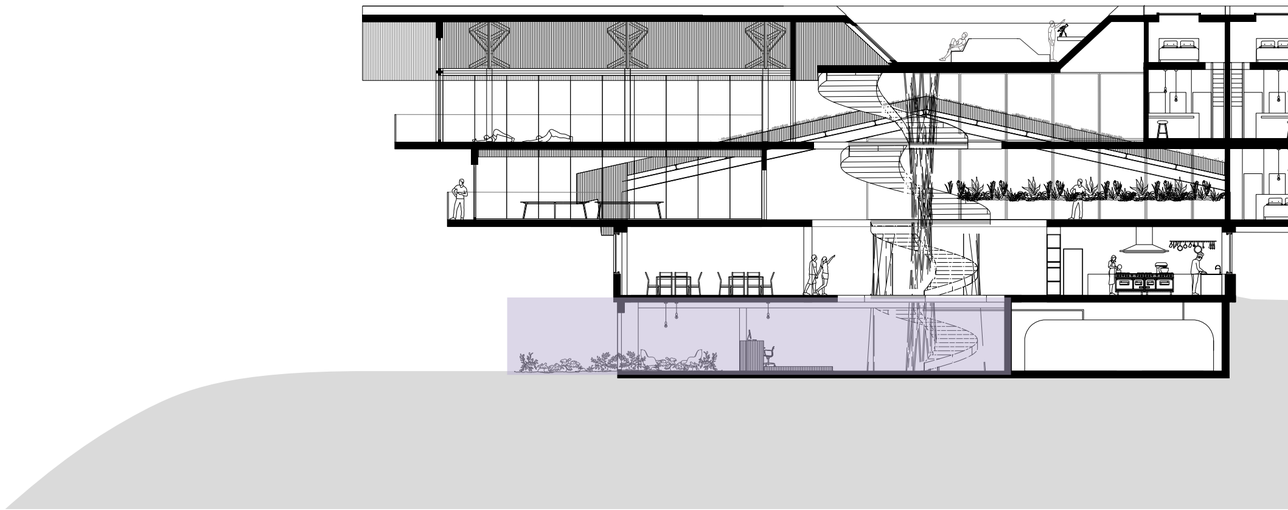
HIKE UP



ENTRANCE

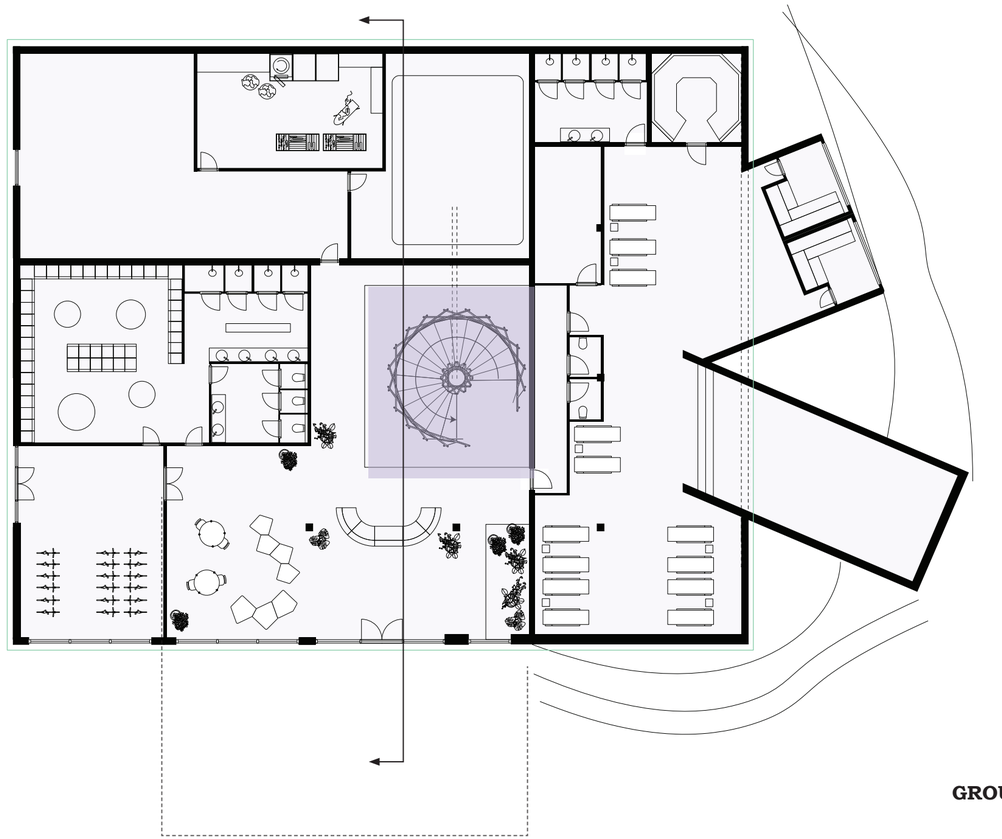


GROUNDFLOOR
1:200



LONG. SECTION
1:200

CIRCULAR CIRCULATION CORE



GROUNDFLOOR
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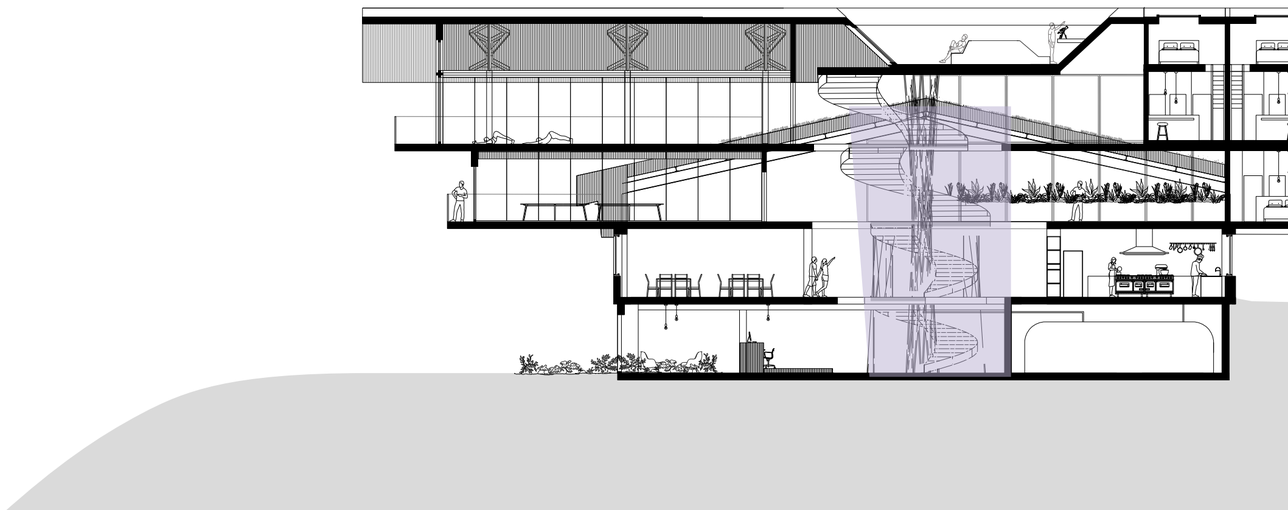
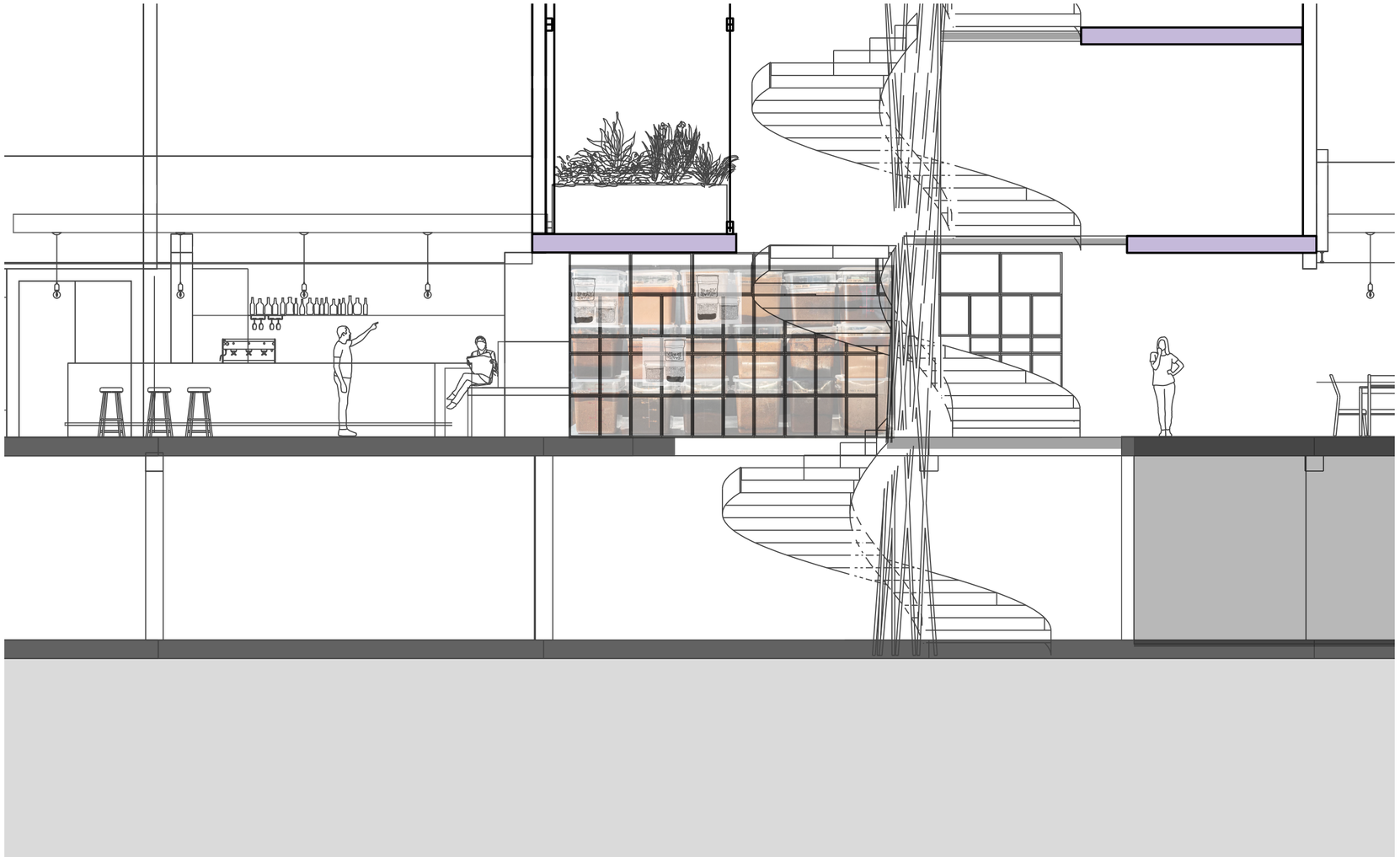


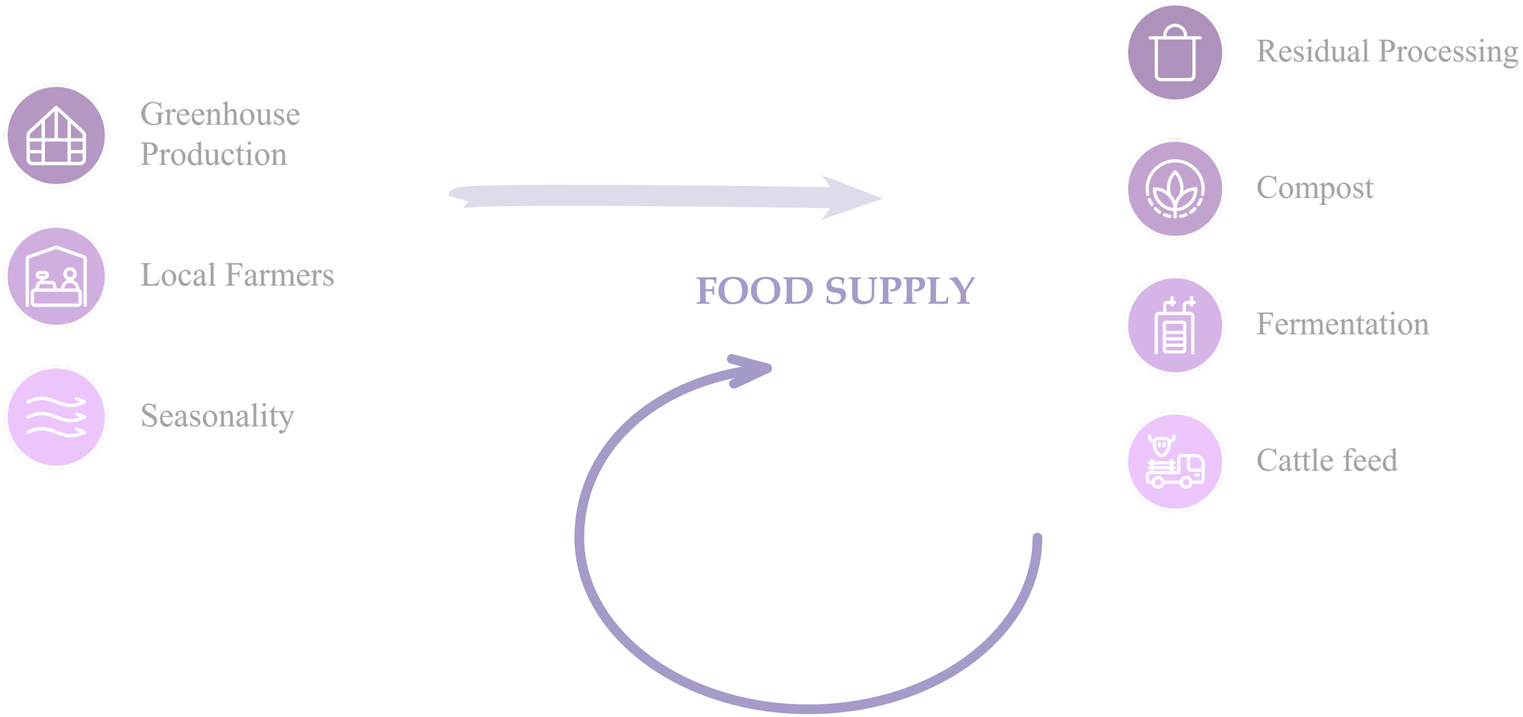
LONG. SECTION
1:200

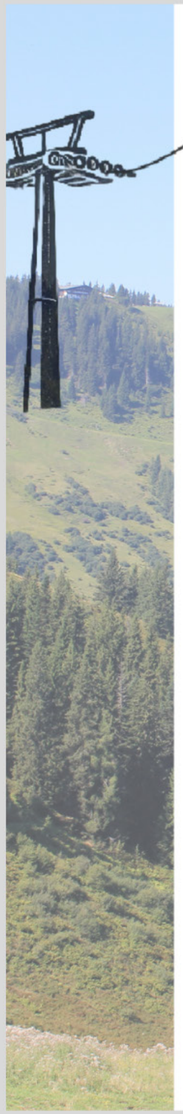
FERMENTATION WALL



FERMENTATION WALL

GREENHOUSE
CLOSING LOOPS, ZERO WASTE





Speisekarte

Starter

Tomatensuppe mit Basilikumöl

Made with ripe greenhouse tomatoes, finished with fresh basil oil and microgreens.

Main Course

Gefüllte Paprika

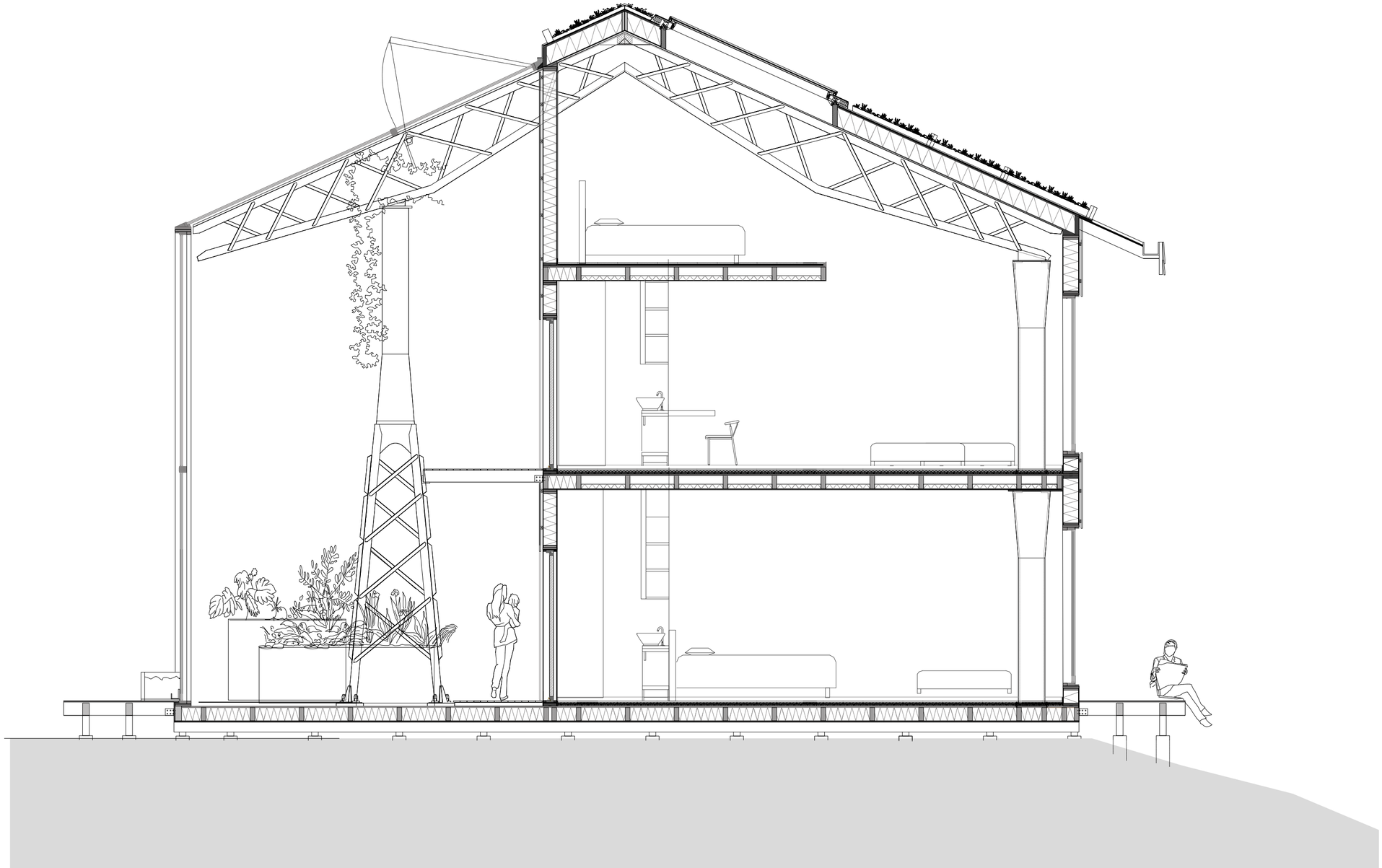
Greenhouse-grown peppers filled with spinach, herbs, and quinoa, served with a rich tomato sauce.

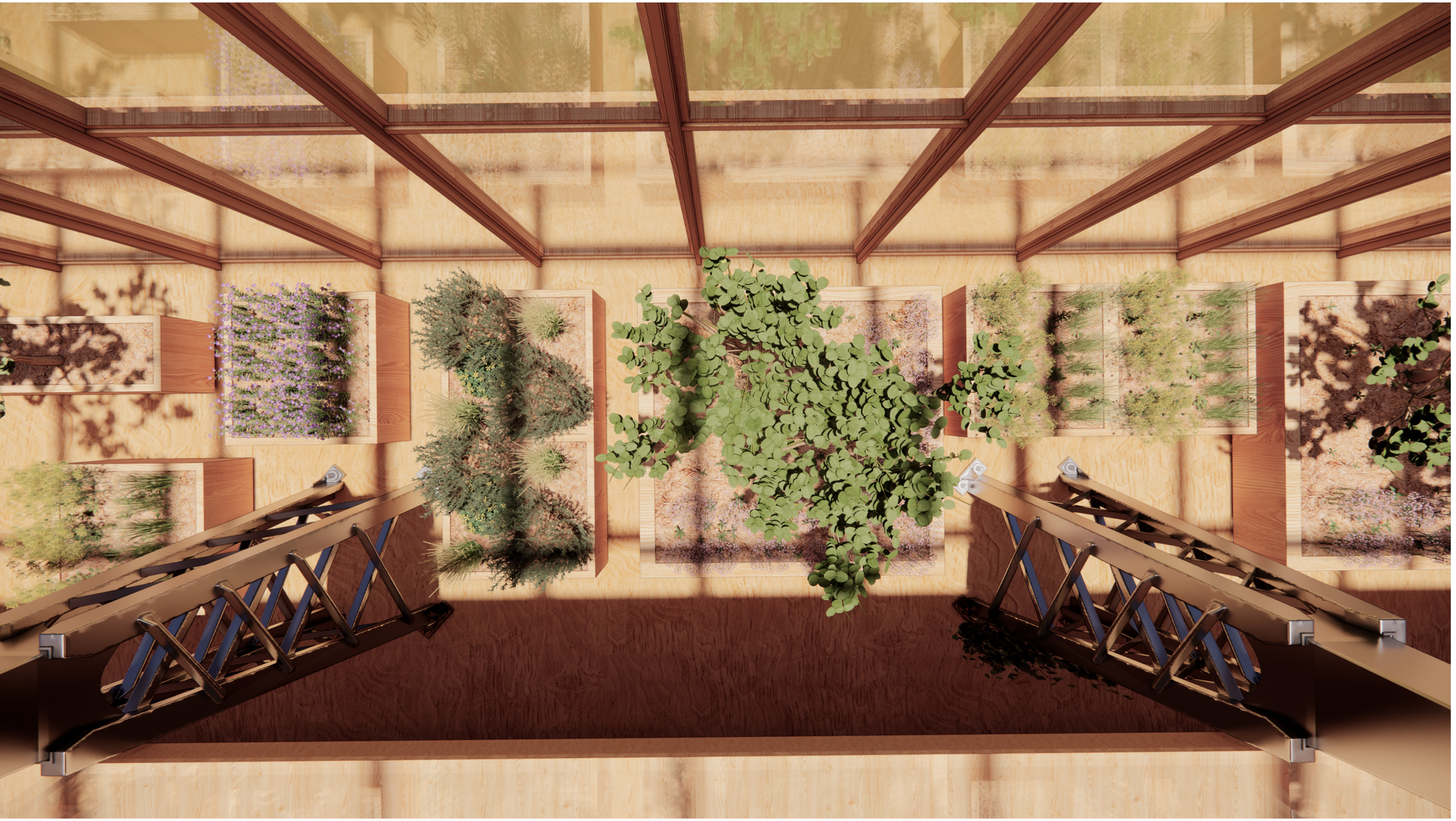
Dessert

Lavendel Panna Cotta

A creamy dessert infused with lavender from the greenhouse and a touch of honey.

STAHLSTADL





STAHLSTADL'S GREENHOUSE

WHAT IS GROWING WHERE?

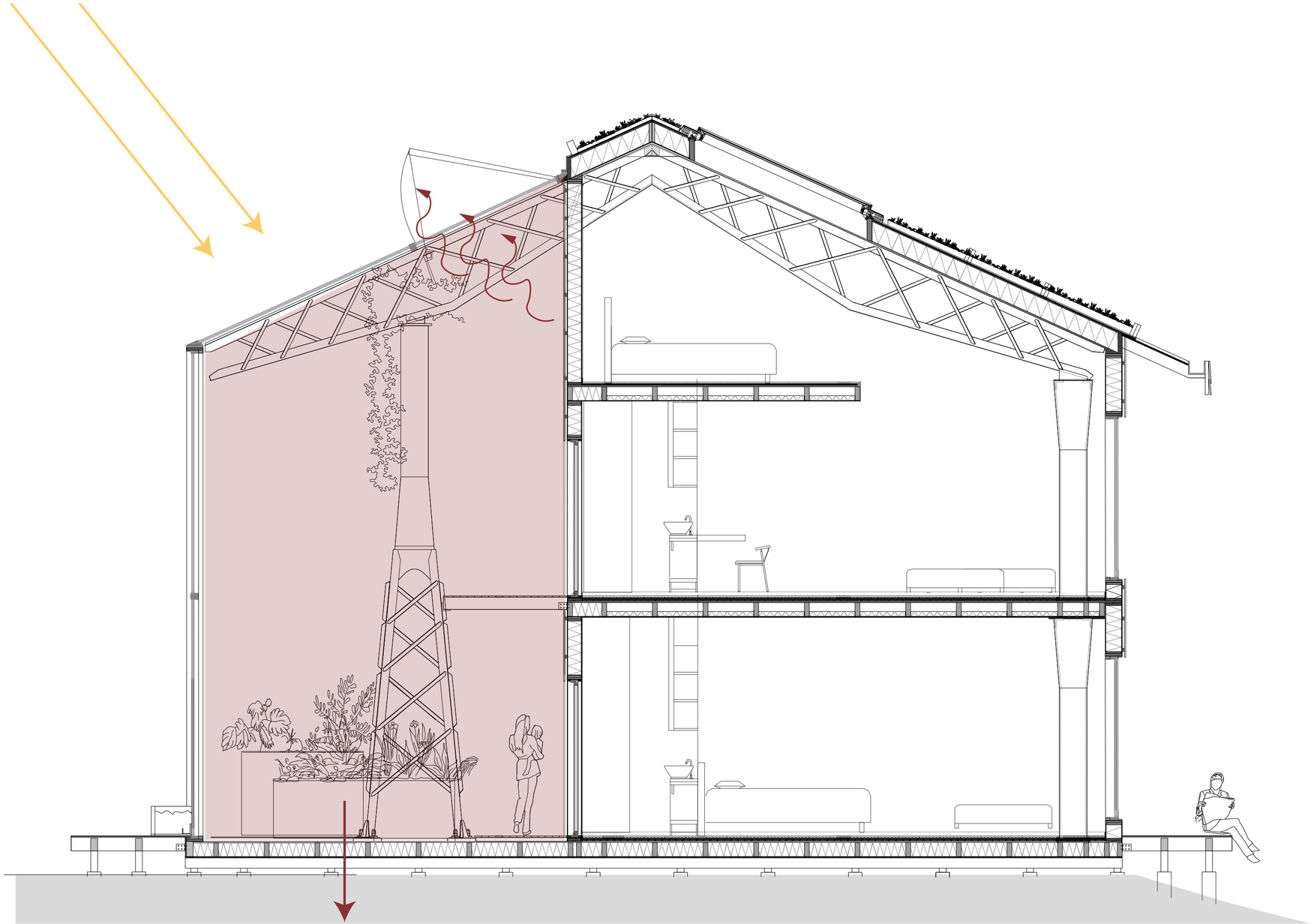
Vegetables
Leafy greens: Spinach, lamb's lettuce, Swiss chard, and lettuce (fast-growing and cold-tolerant).
Root vegetables: Radishes, carrots, and beets (adapt well to longer growing cycles).
Fruiting vegetables: Tomatoes, bell peppers, eggplants, and cucumbers (thrive with extra warmth in summer).
Legumes: Sugar snap peas and regular peas (tolerate cooler temperatures well).

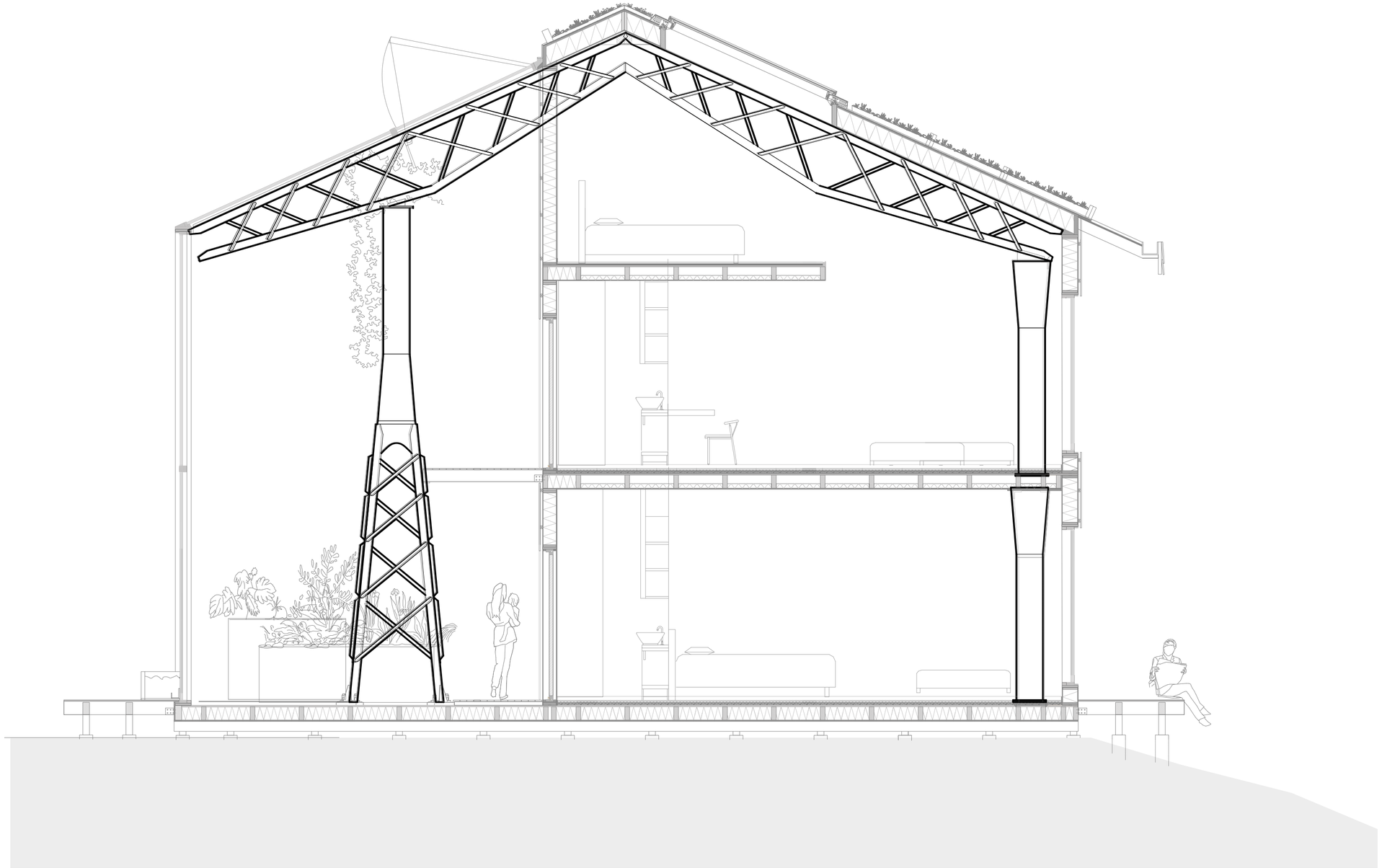
Herbs
Thyme, rosemary, lavender, basil, parsley, coriander, and mint. These herbs flourish in controlled humidity and temperatures.

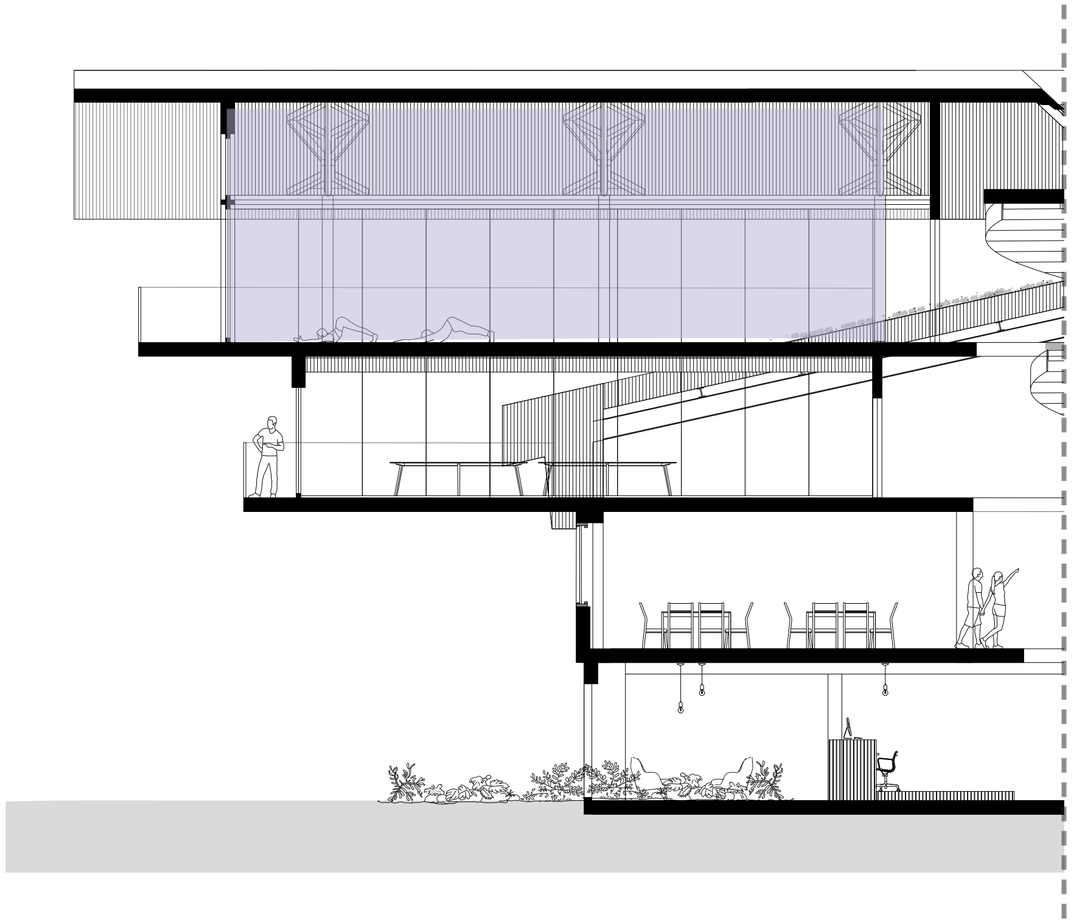
Fruits
Berries: Strawberries and blueberries.
Small fruit trees: Figs, lemons, mandarins, and peaches (require a warm microclimate).

Ideal for Sustainable Agriculture
Microgreens: Quick harvests for nutrient-rich additions to meals.
Mushrooms: Oyster mushrooms or shiitake, grown in a shaded part of the greenhouse.

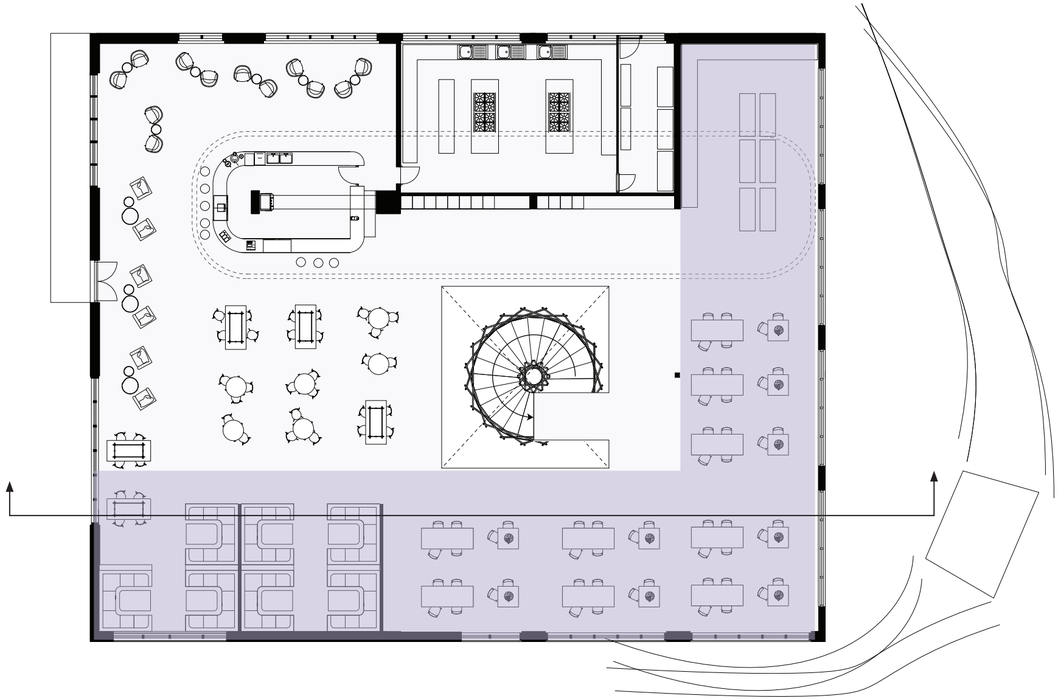
Seasonal
Winter vegetables: Kale, bok choy, and other hardy greens.
Summer crops: Tomatoes, cucumbers, and bell peppers (thrive under extended sunlight)







RESTAURANT



1ST FLOOR
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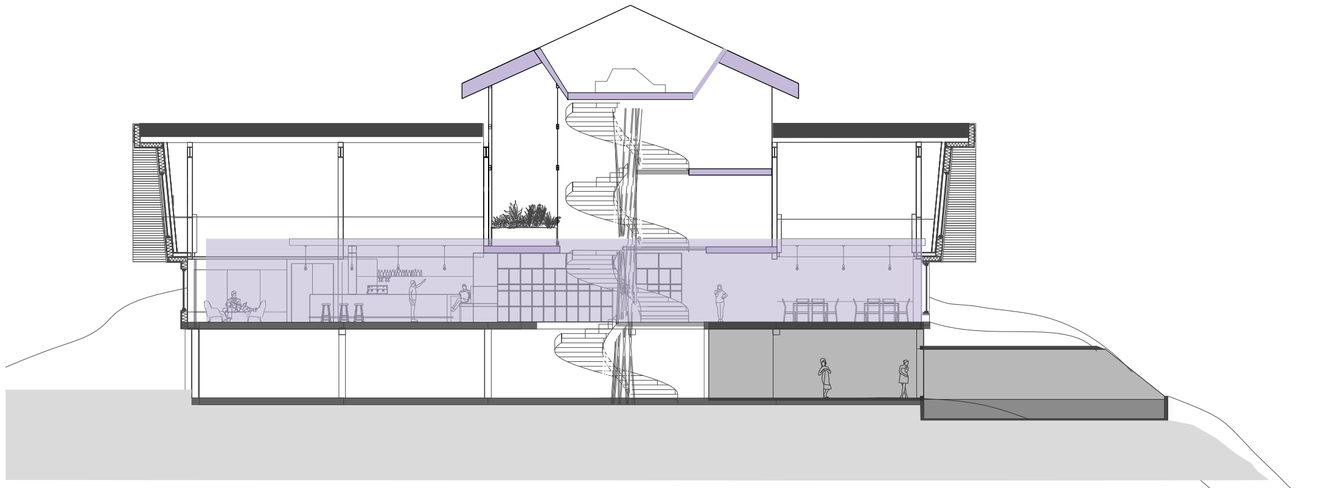

SECTION
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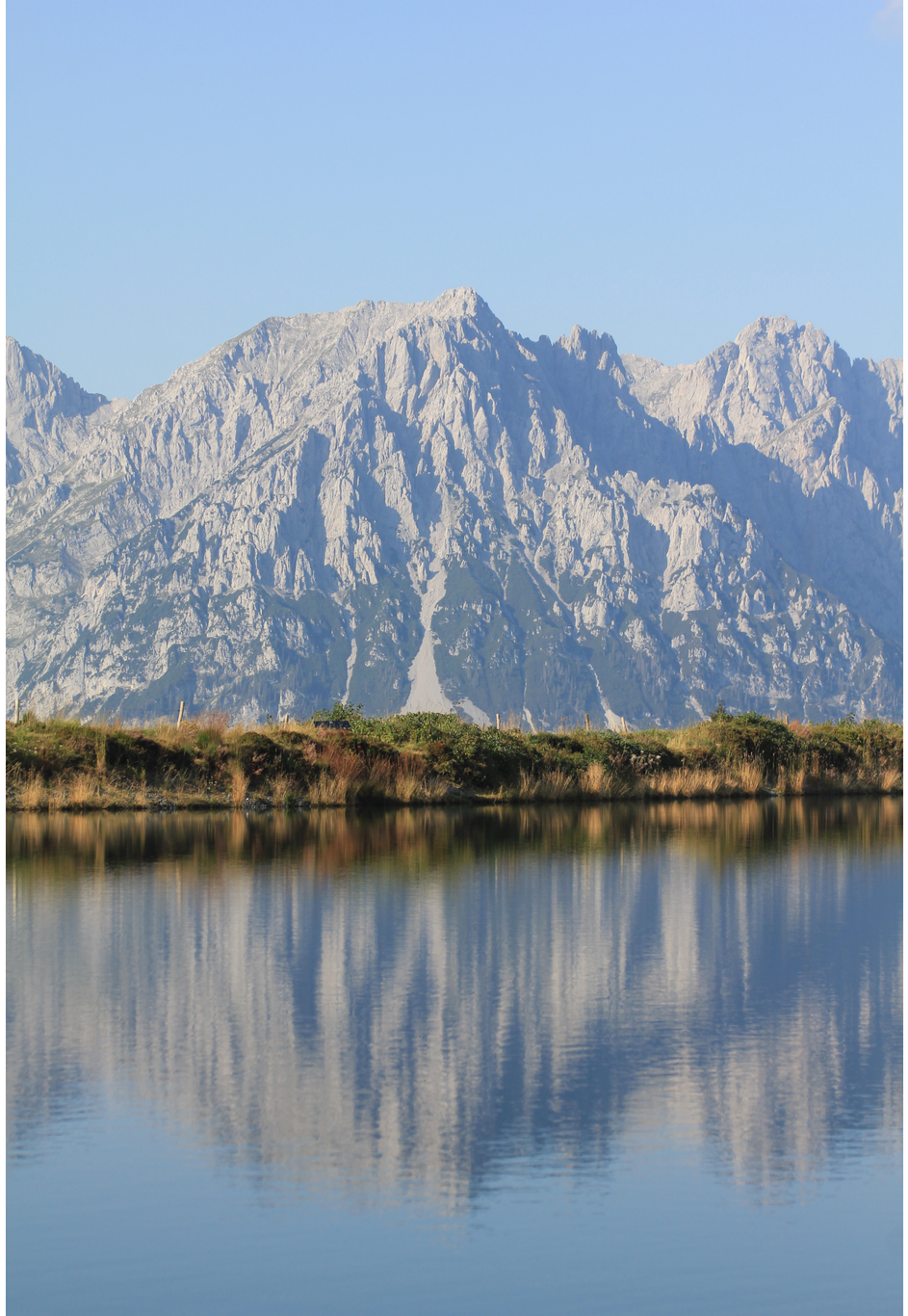
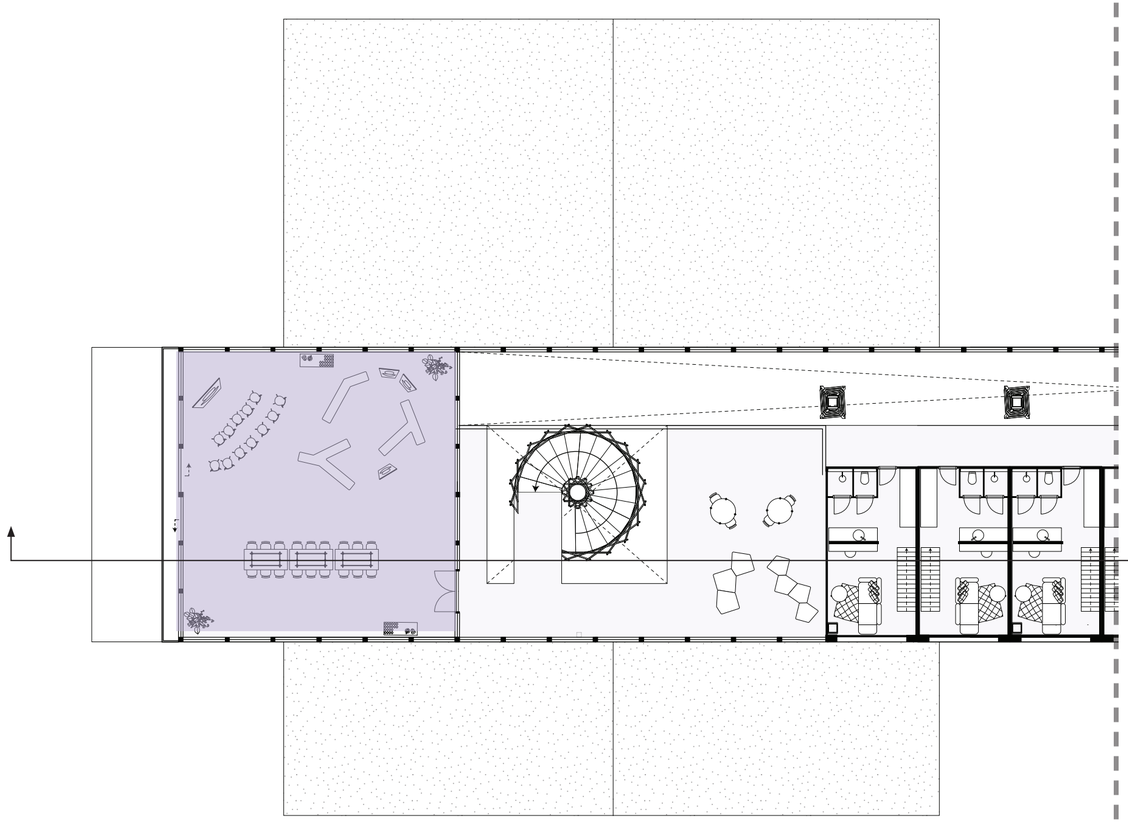


WORKSHOP / MEETING ROOM



2ND FLOOR
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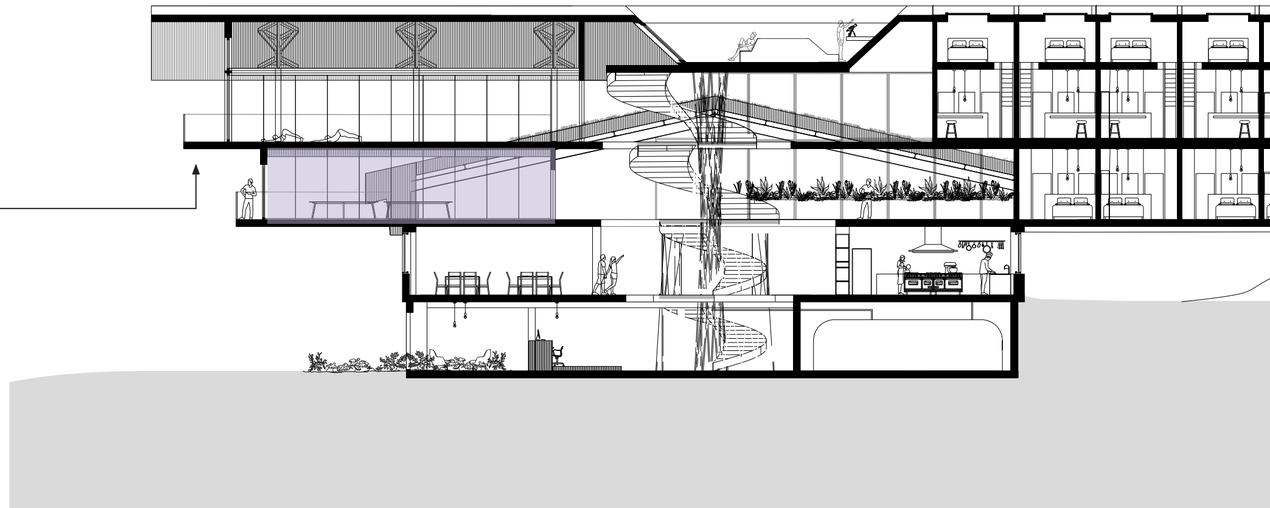
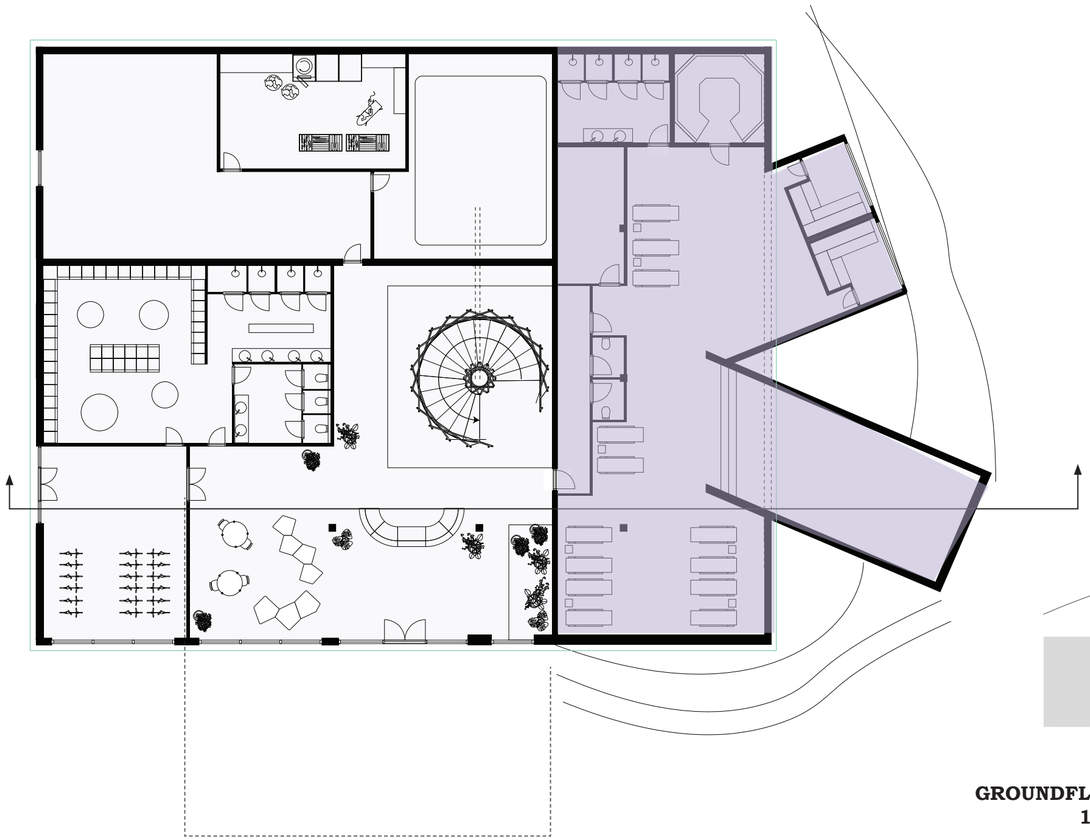


BATHHOUSE



GROUNDFLOOR
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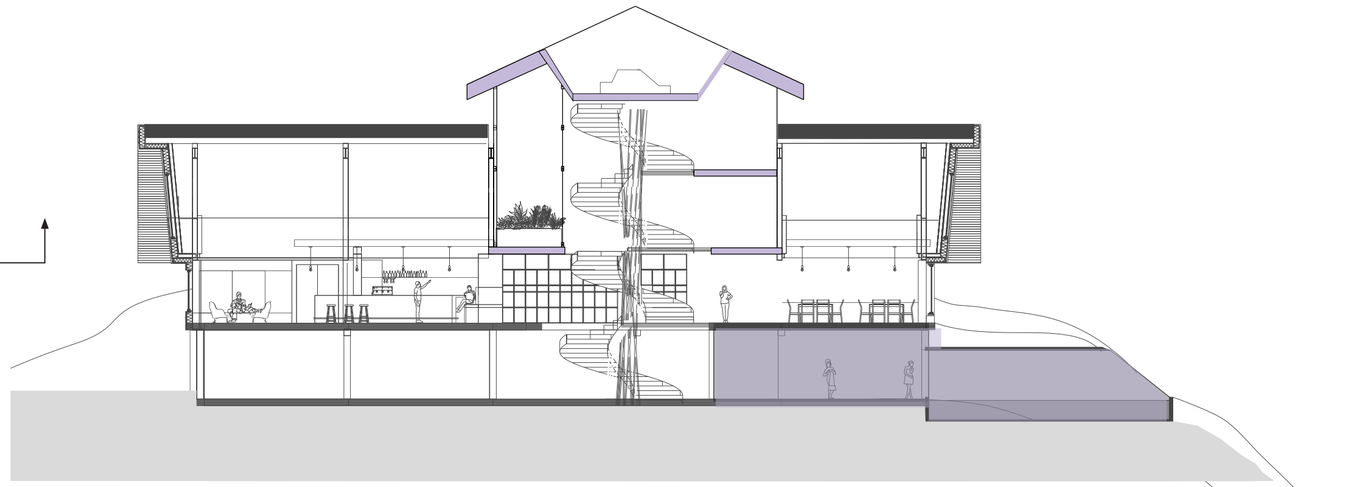

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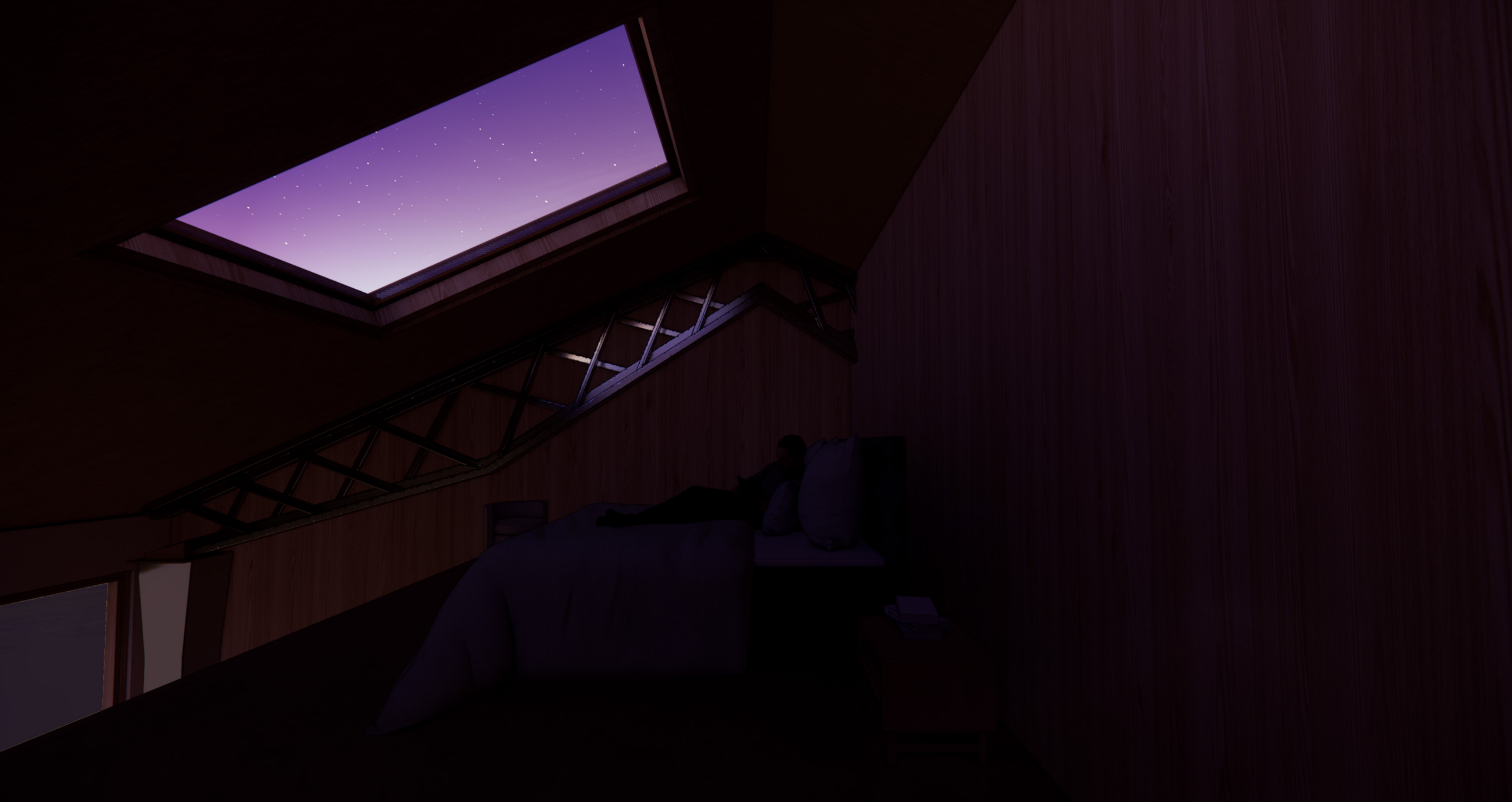


THEMATIC RESEARCH **OBJECTIVE**

Develop/find effective design solutions and/or strategies *to help bridge the Circularity Gap of Austria while aligning with sustainability goals for tourism in the Austrian Alps.*

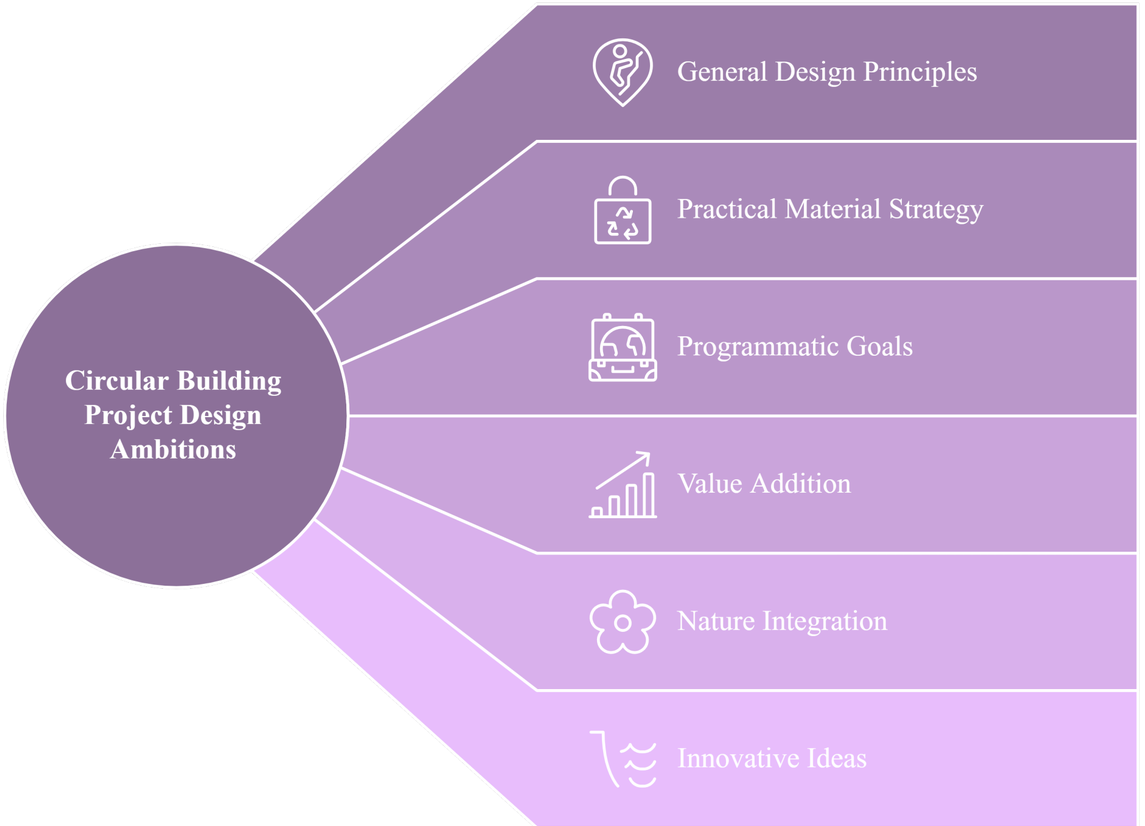
DESIGN QUESTIONS

*How to design a **circular building project** in the Austrian Alps that not only contributes to **sustainable tourism,** but also to **closing the Circularity Gap in Austria**?*

How can the design serve as a **manifestation of circular innovation?**

How can the design **restore the qualities of the mountains**, emphasize them and let people (inhabitants & tourists) **continue to enjoy** them?

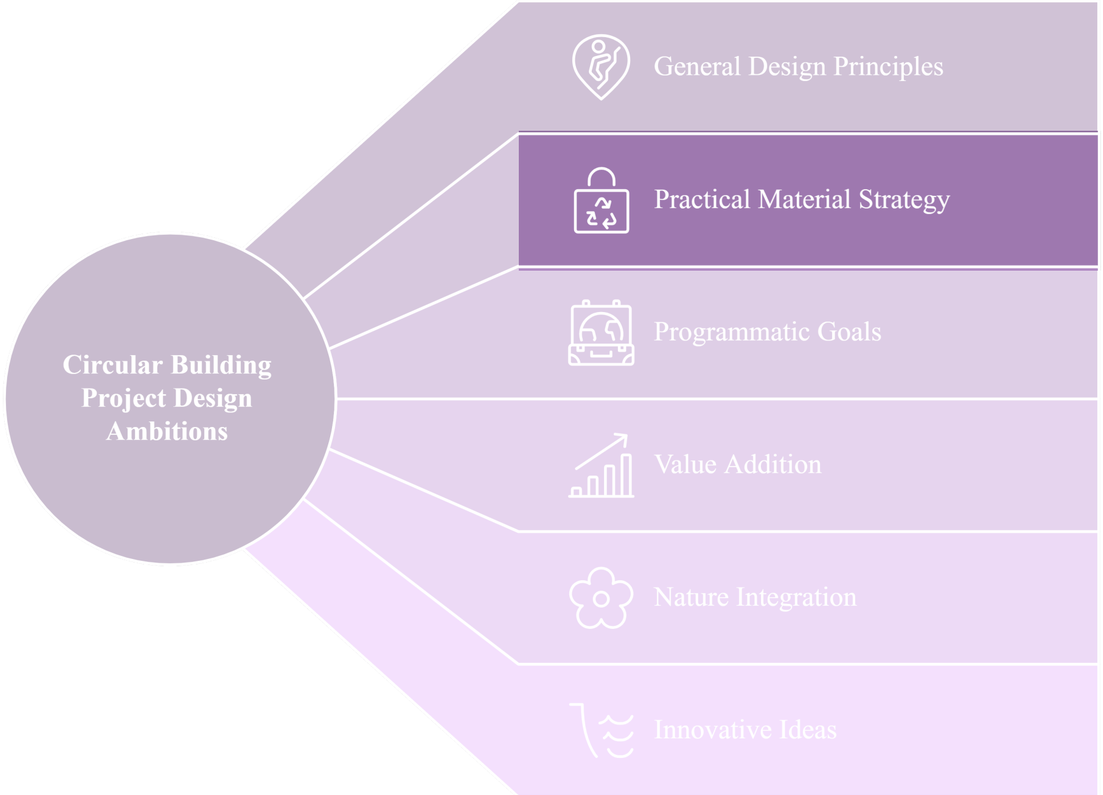
DESIGN AMBITIONS



DESIGN AMBITIONS

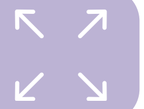
Raw Material Provision: Priorities and Order

1. **Sustainable Secondary Sources**
2. **Sustainable Renewable Sources**
3. **Only the rest from Non-renewable Sources**



DESIGN RULES & STEPS

START: WHAT IS ALREADY THERE?
WHAT ARE THE REGIONAL CE STRATEGIES?

1. 

MAXIMISE STOCK

INVENTORY - POTENTIAL STOCK

2. 

STRUCTURES TO REUSE?

INVENTORY - WHAT CAN BE USED, MATERIALS TO RECLAIM?

CONTRIBUTE TO CLOSING MATERIAL LOOPS

3. 

LOCAL MATERIALS - KEEP WITHIN RANGE

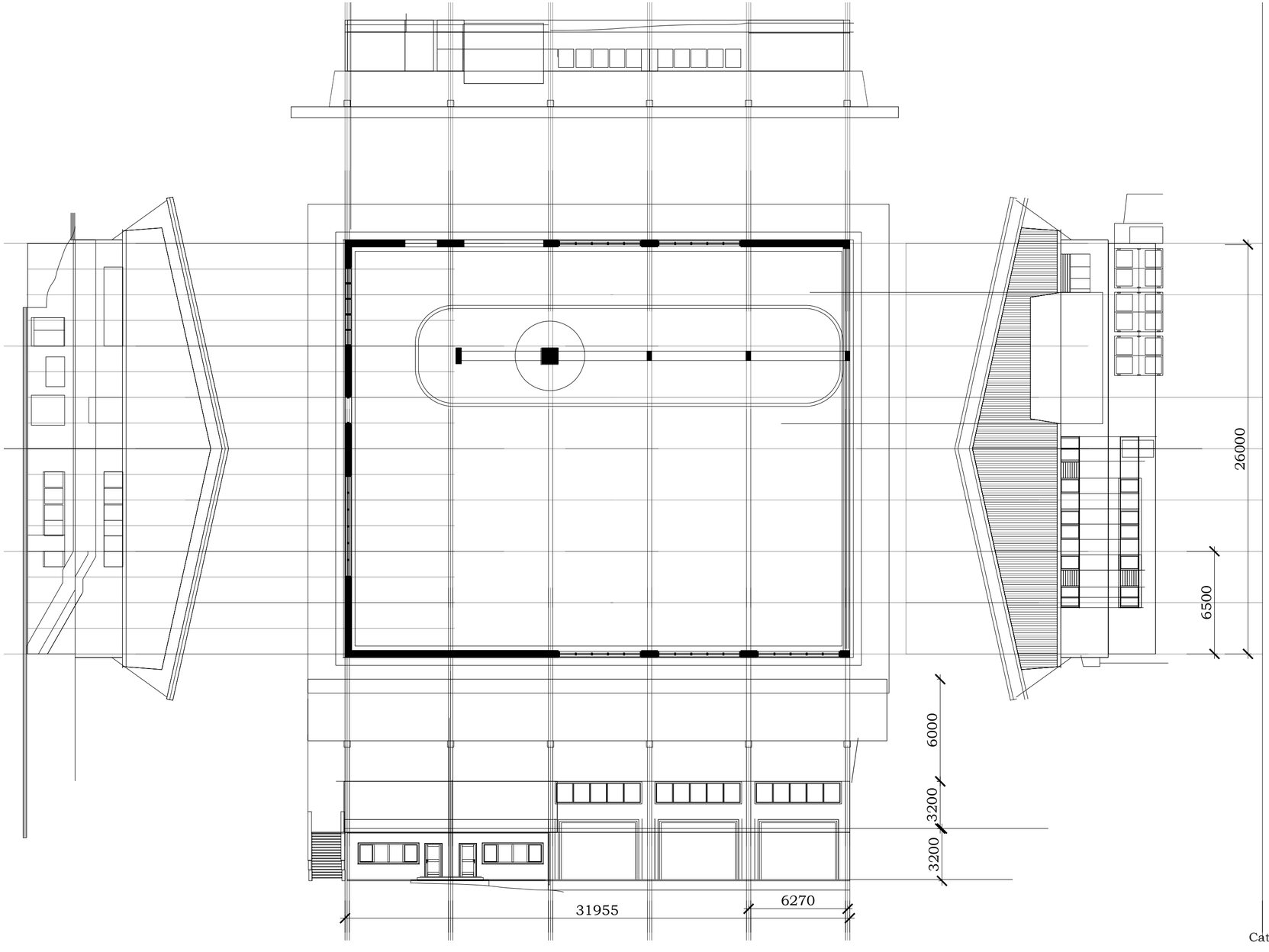
RAMMED EARTH, IF EXCAVATION

CERTIFIED WOOD
BY-PRODUCTS FORESTRY, AGRICULTURE

1.

1.

INVENTORY

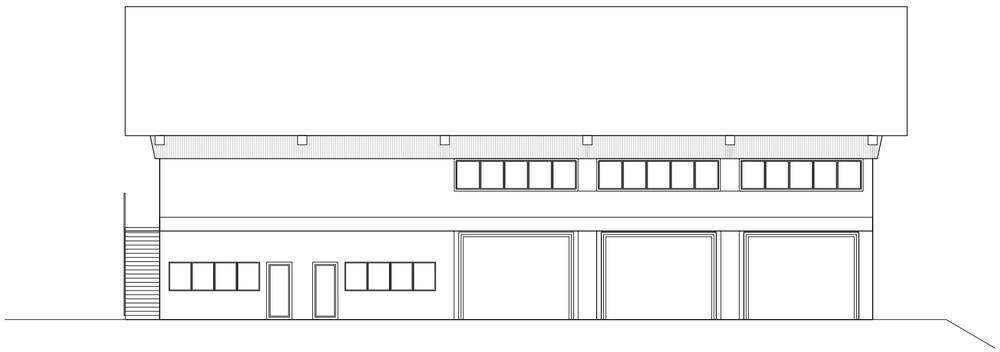


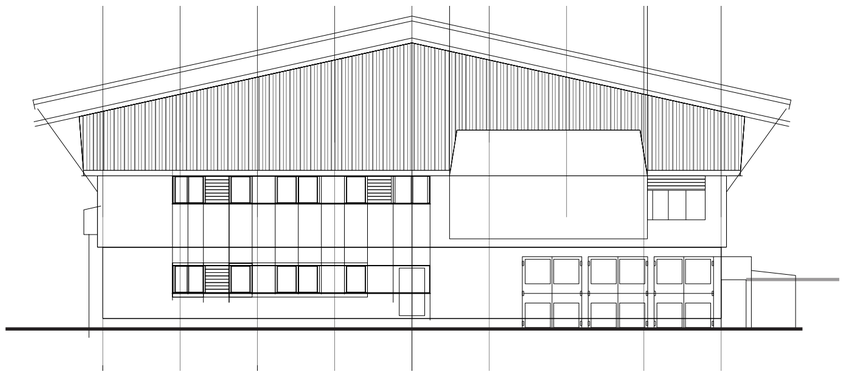
1:200 (90%)

1.

INVENTORY

EXISTING



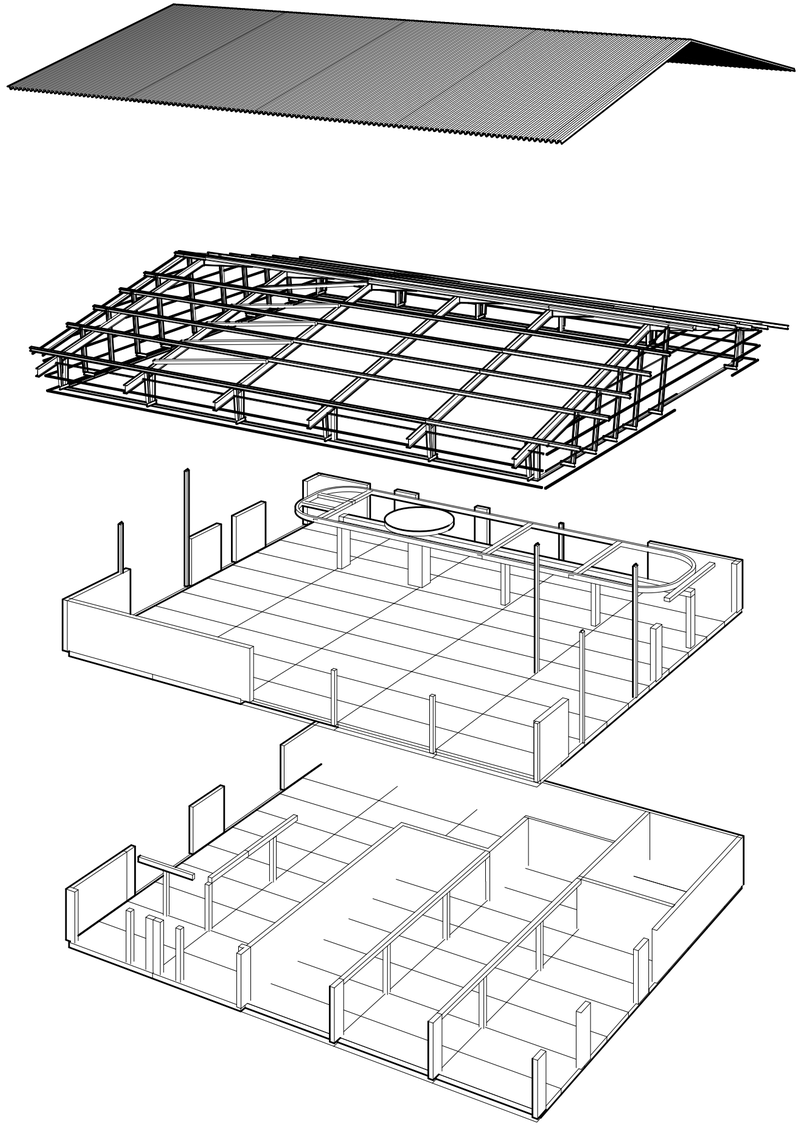


1.

1.

INVENTORY

EXISTING

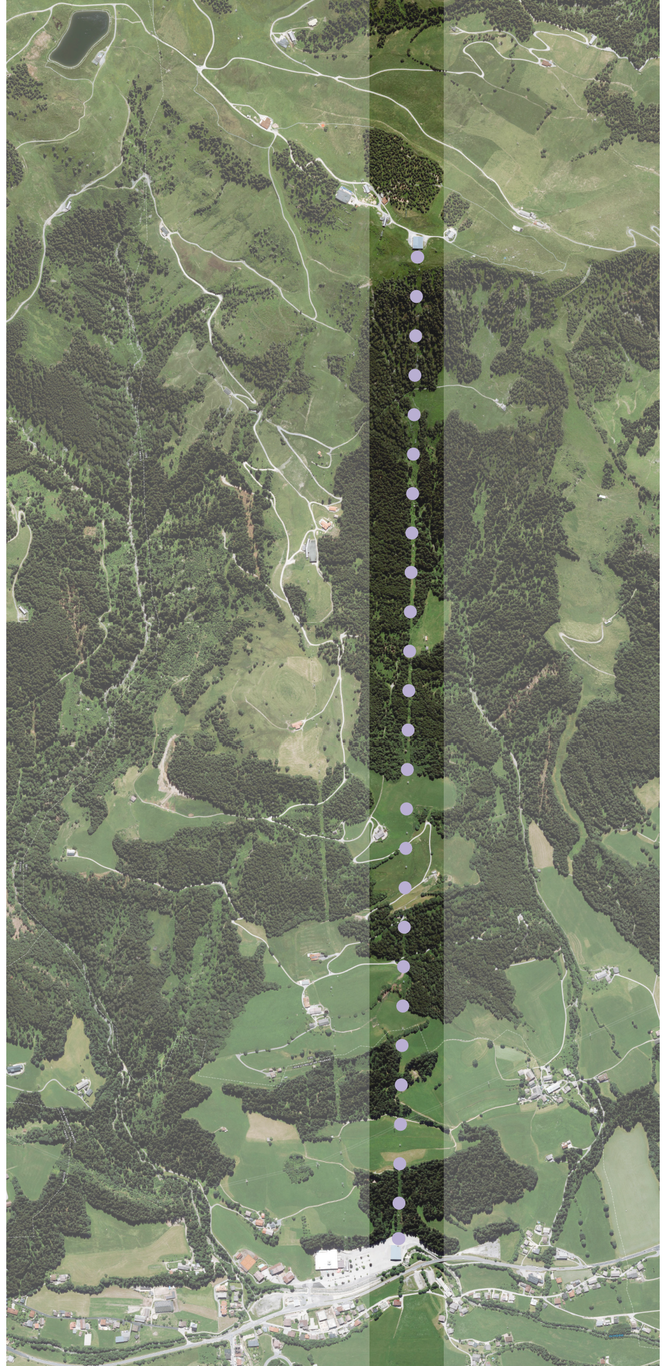


2.

STRUCTURES TO REUSE?

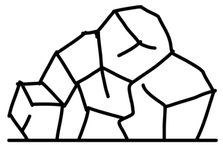
INVENTORY - WHAT CAN BE USED, MATERIALS TO RECLAIM?

CONTRIBUTE TO CLOSING MATERIAL LOOPS

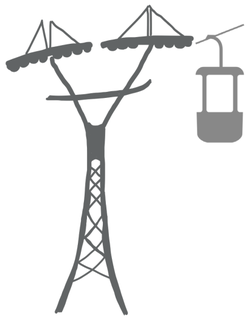


2.

INVENTORY
CONTRIBUTE TO CLOSING MATERIAL LOOPS



ORE, STEEL PRODUCTION



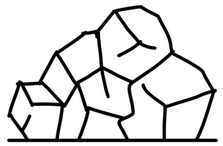
30 YEARS

TRANSPORT - 2ND LIFE

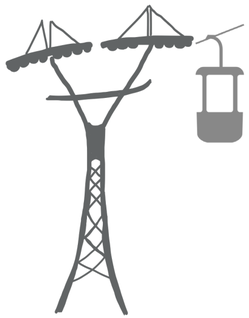
END-OF-LIFE

2.

INVENTORY
CONTRIBUTE TO CLOSING MATERIAL LOOPS



ORE, STEEL PRODUCTION



30 YEARS

TRANSPORT - 2ND LIFE

END-OF-LIFE

SLOW

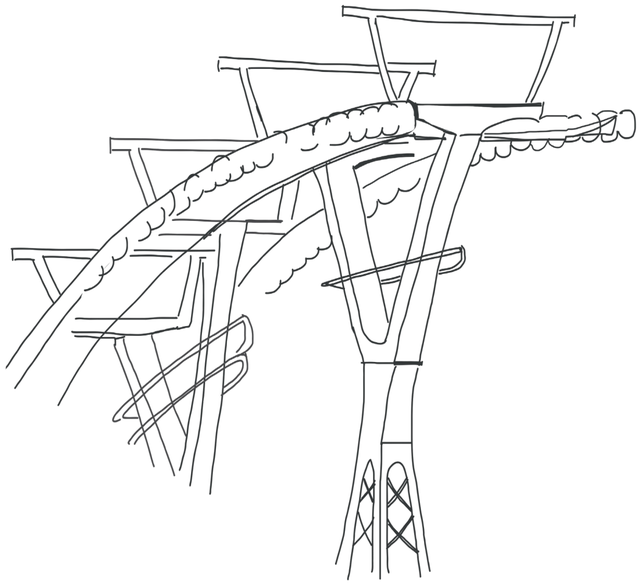
DISSASSEMBLY
NEW USE?

REUSE STRUCTURES

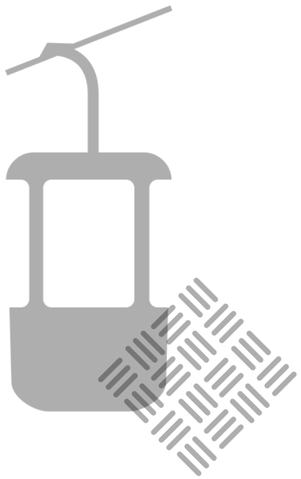
INVENTORY - MP
NO OR LESS TRANSPORT

2.

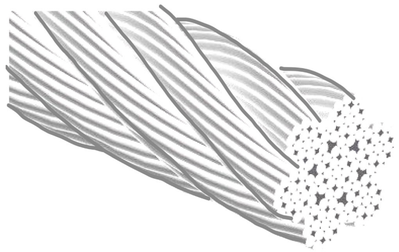
INVENTORY
STEEL - REUSE



STRUCTURE - 25 COLUMNS

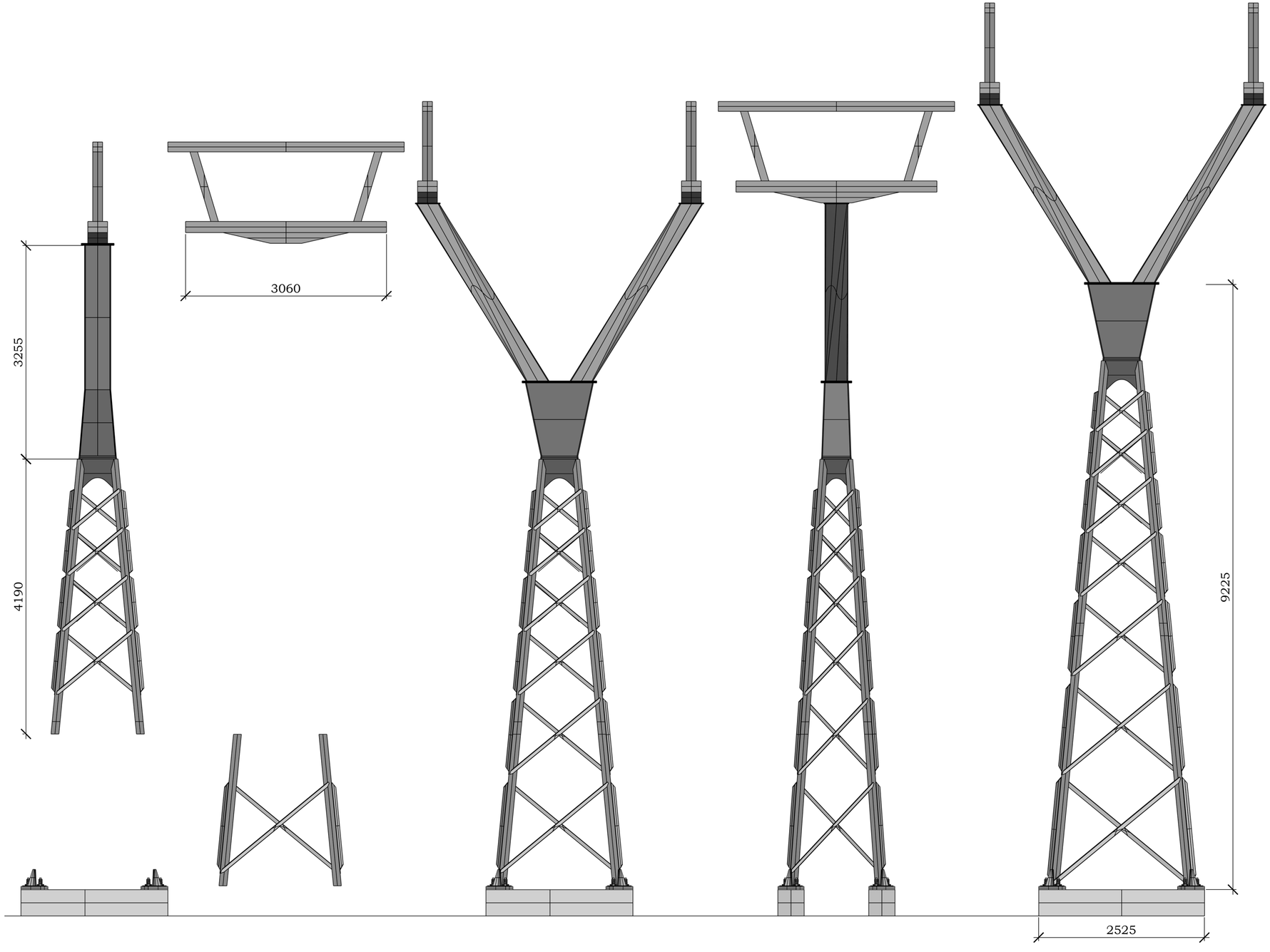


GONDOLA - SHEETS



CABLE - WIRES

2.

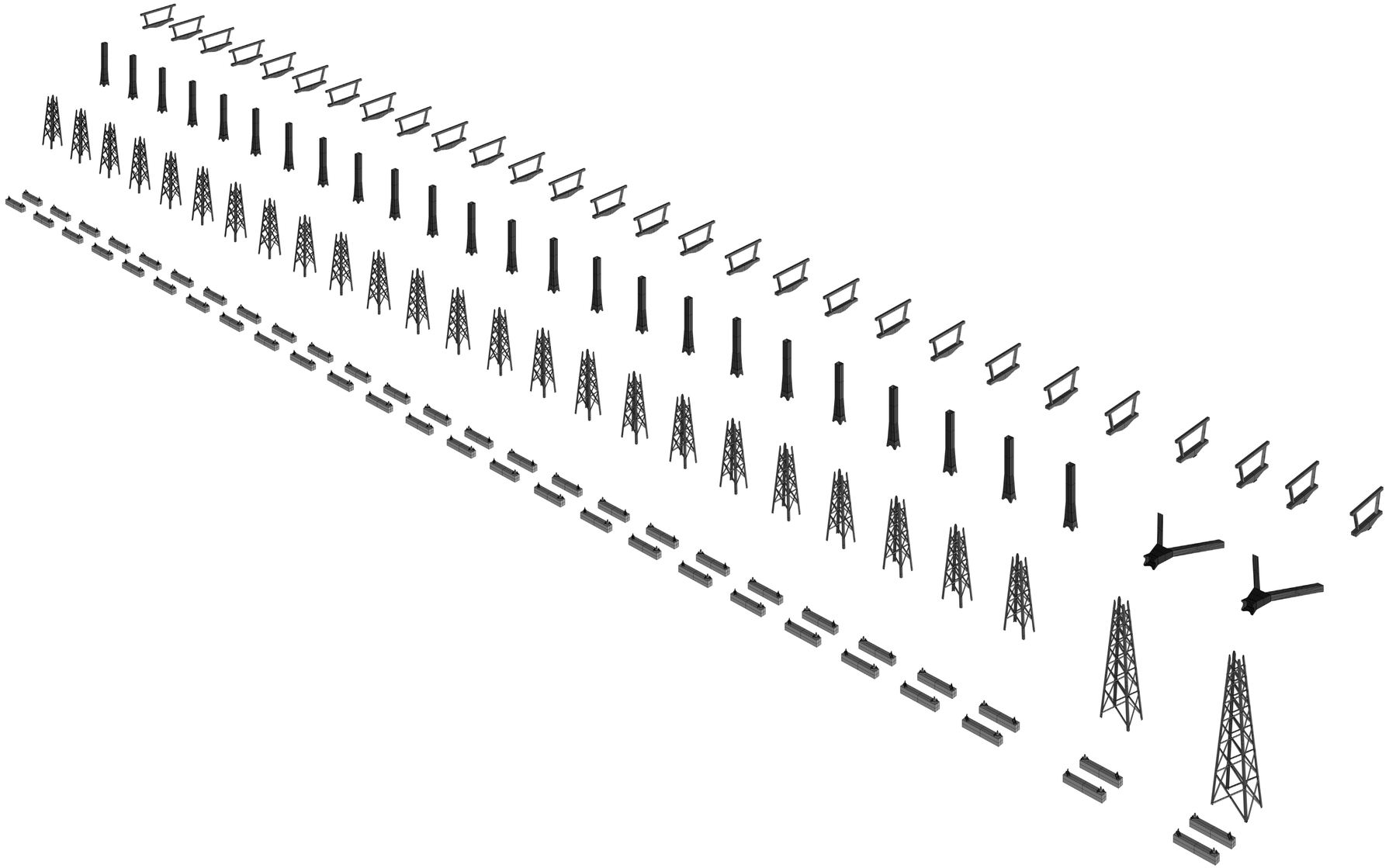


1:50

2.

INVENTORY

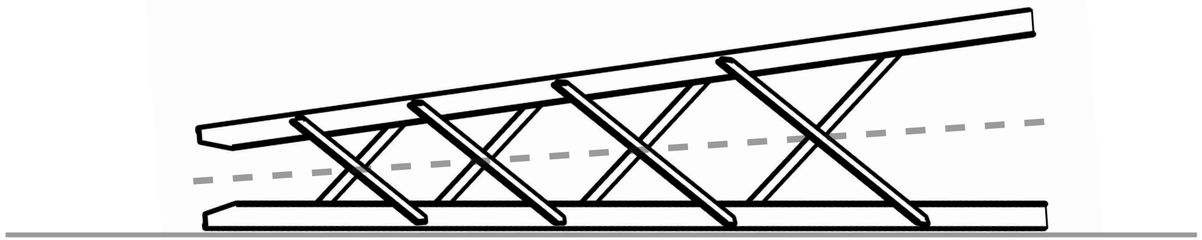
STEEL - REUSE



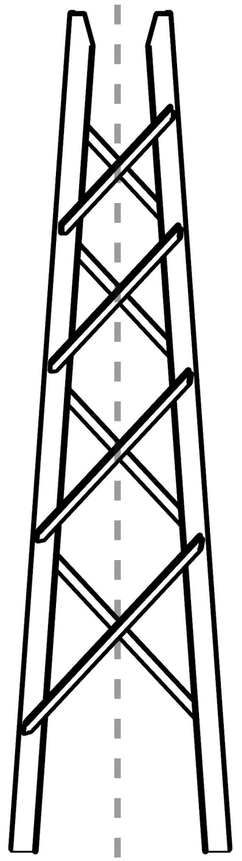

1650m
Scheffau Tirol
Scheffau

2.

DESIGNING WITH RECLAIMED MATERIAL

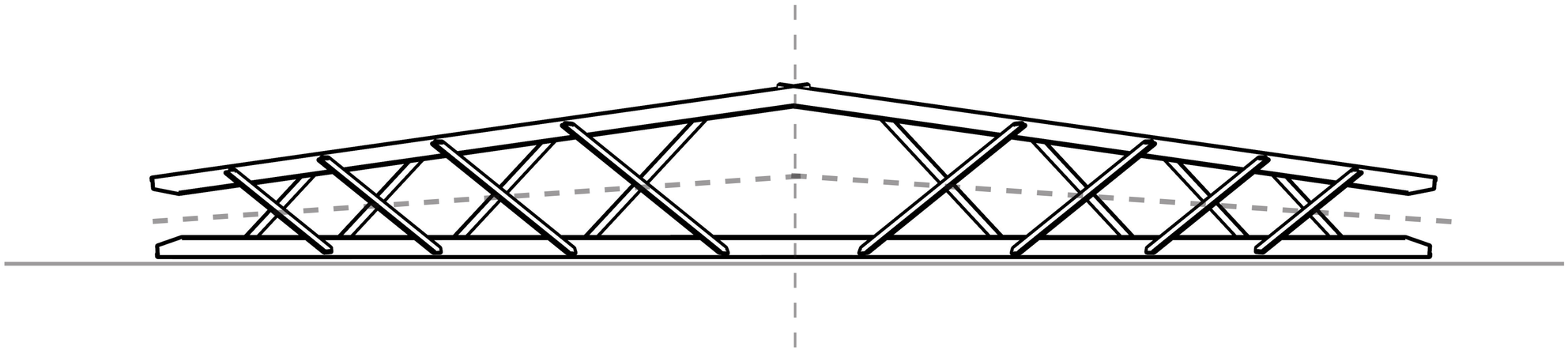


95° Rotation



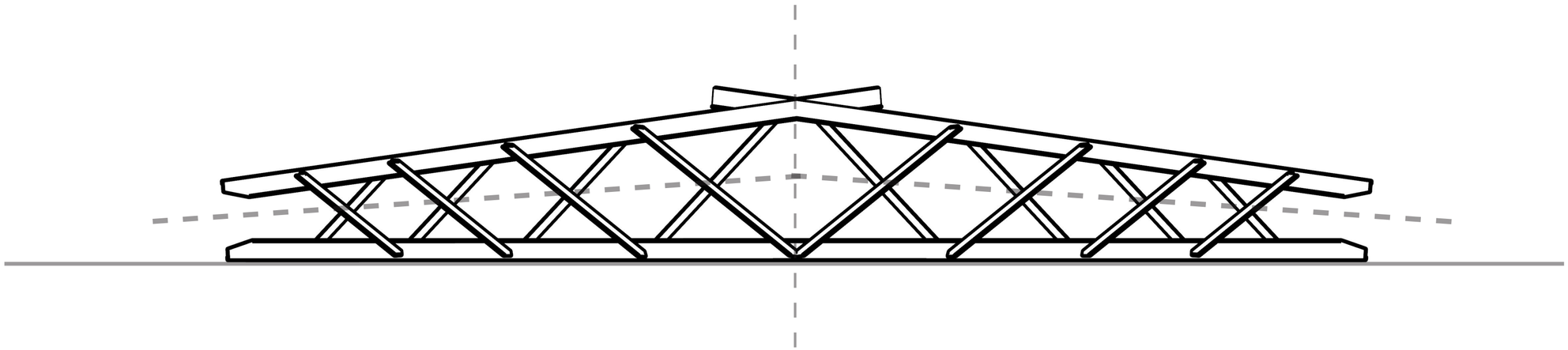
2.

DESIGNING WITH RECLAIMED MATERIAL



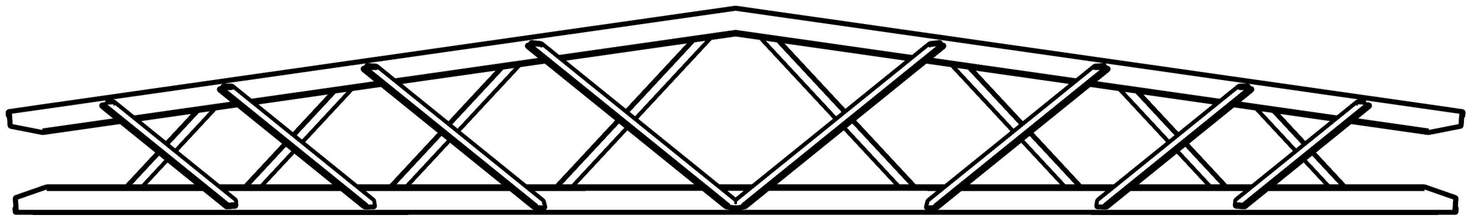
2.

DESIGNING WITH RECLAIMED MATERIAL



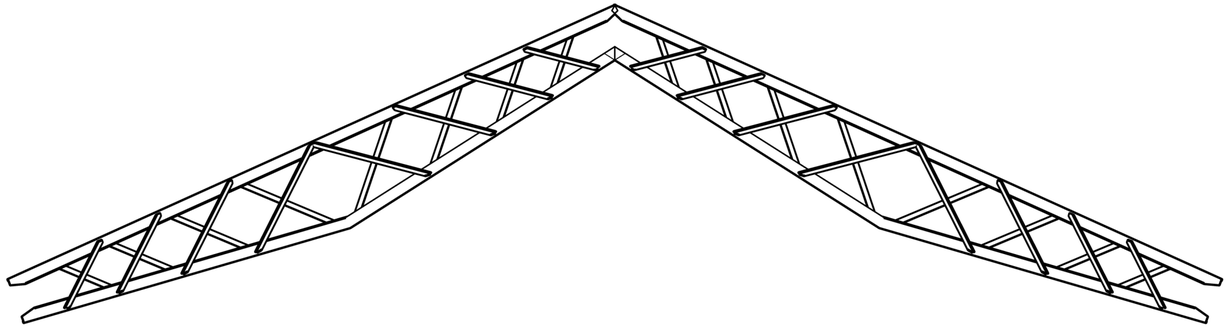
2.

DESIGNING WITH RECLAIMED MATERIAL



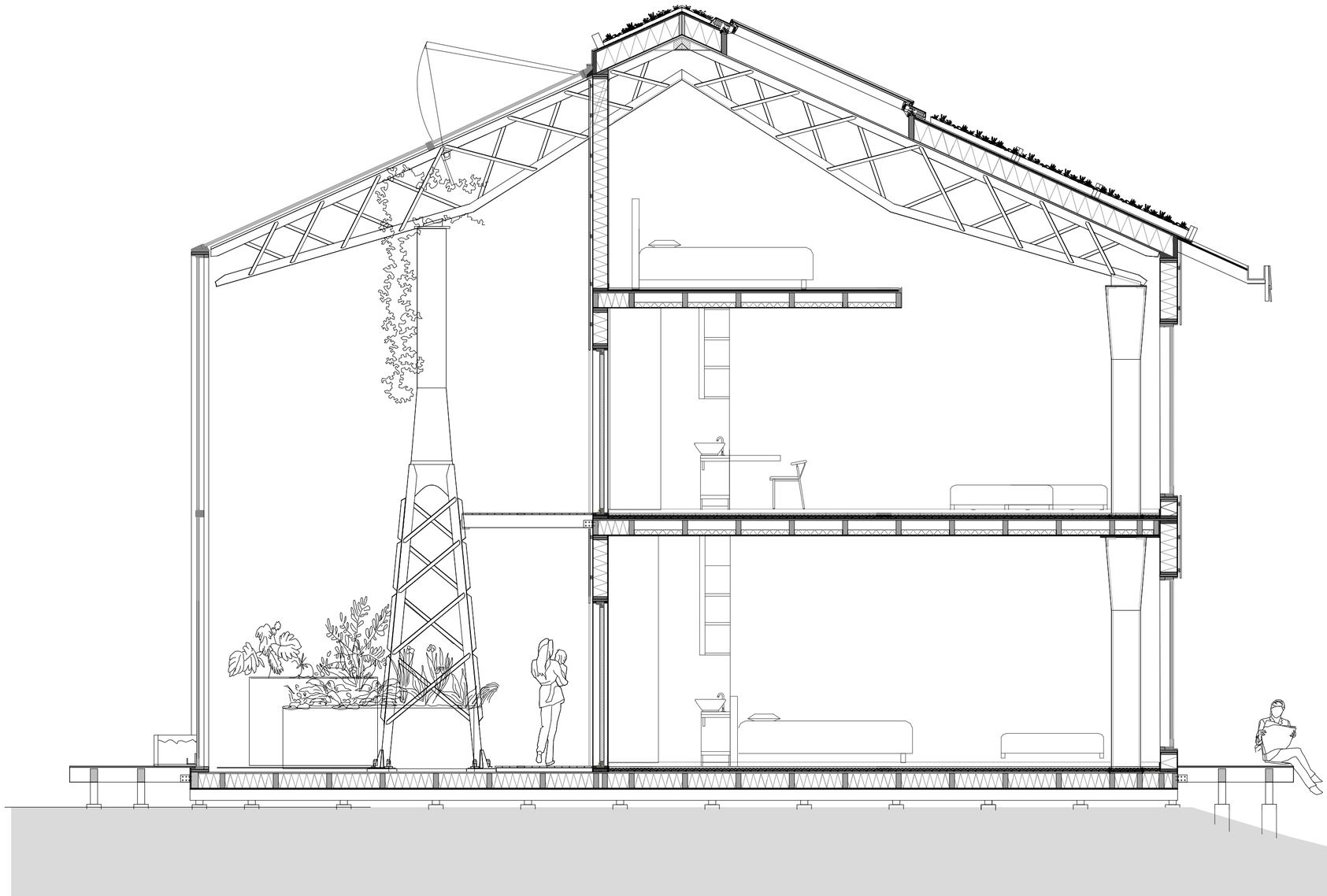
2.

DESIGNING WITH RECLAIMED MATERIAL



2.

DESIGNING WITH RECLAIMED MATERIAL



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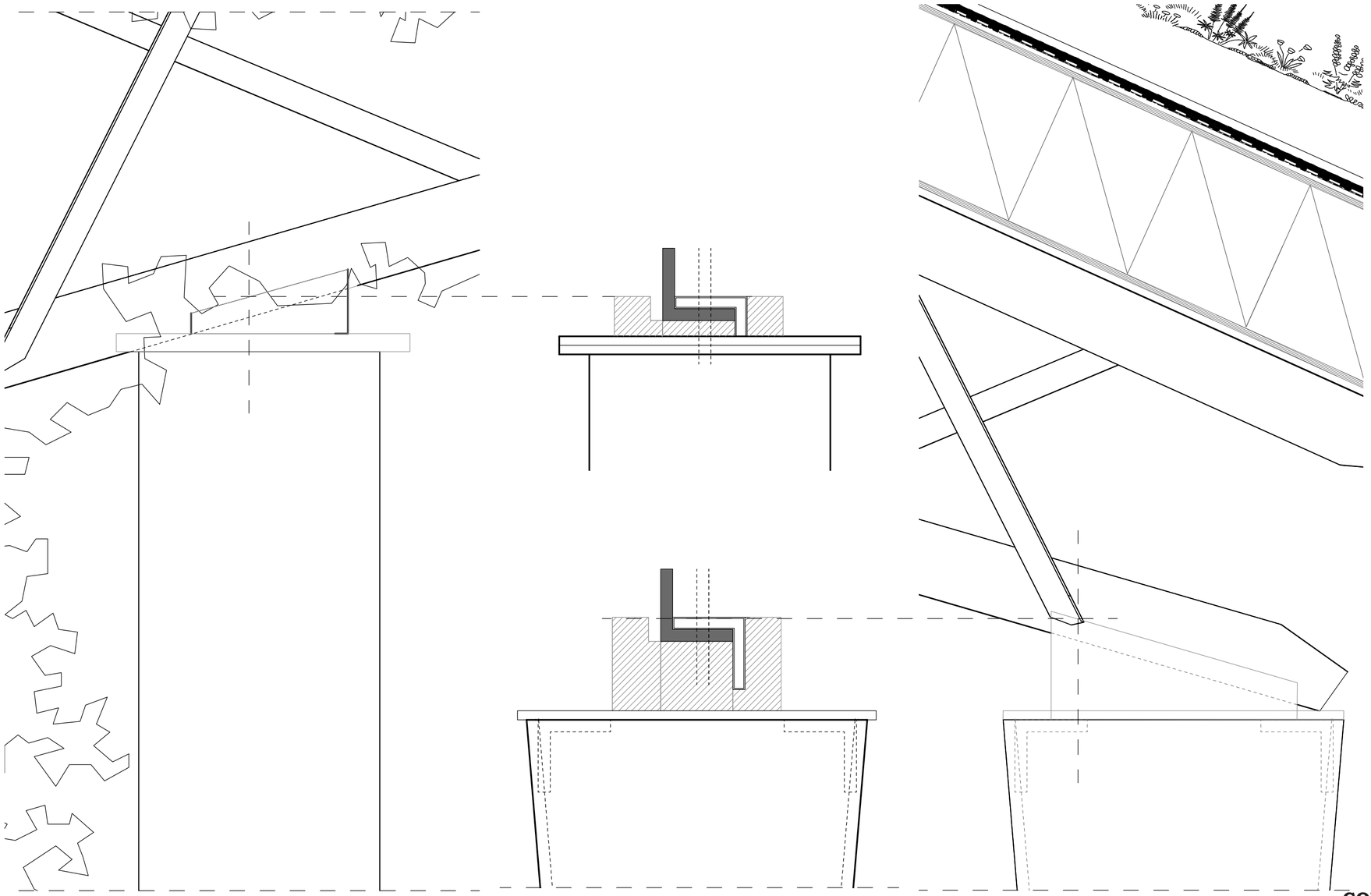
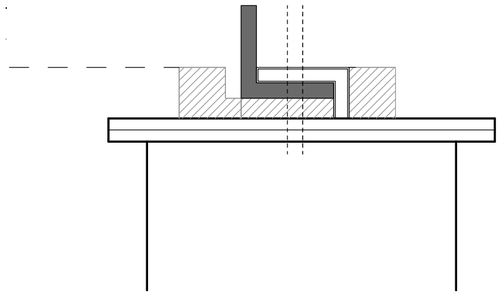
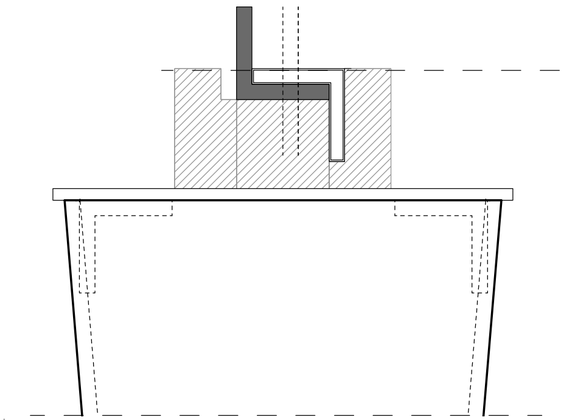
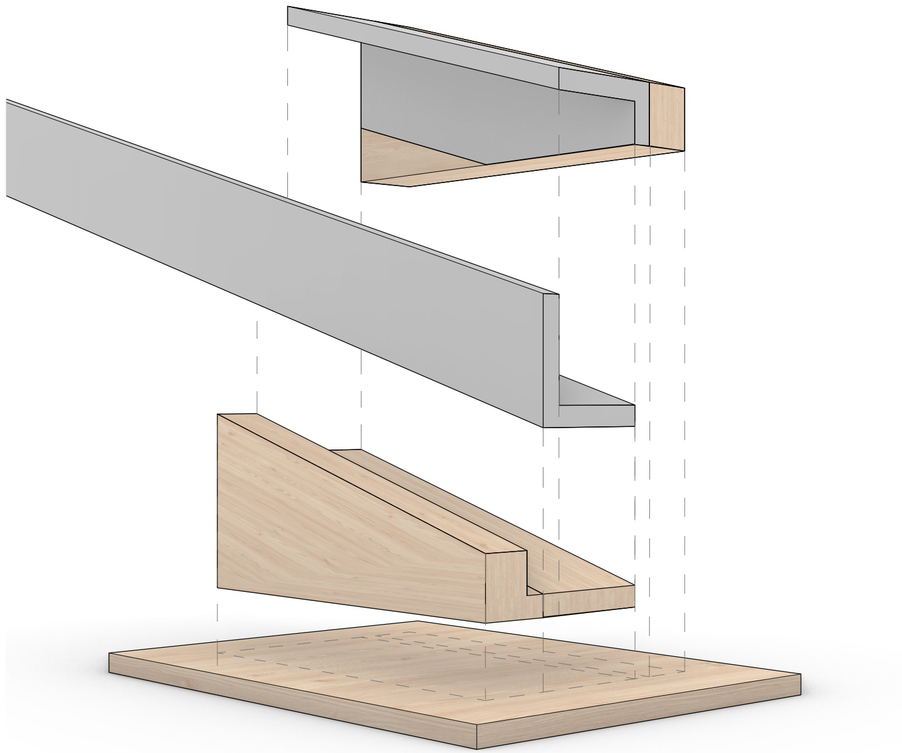


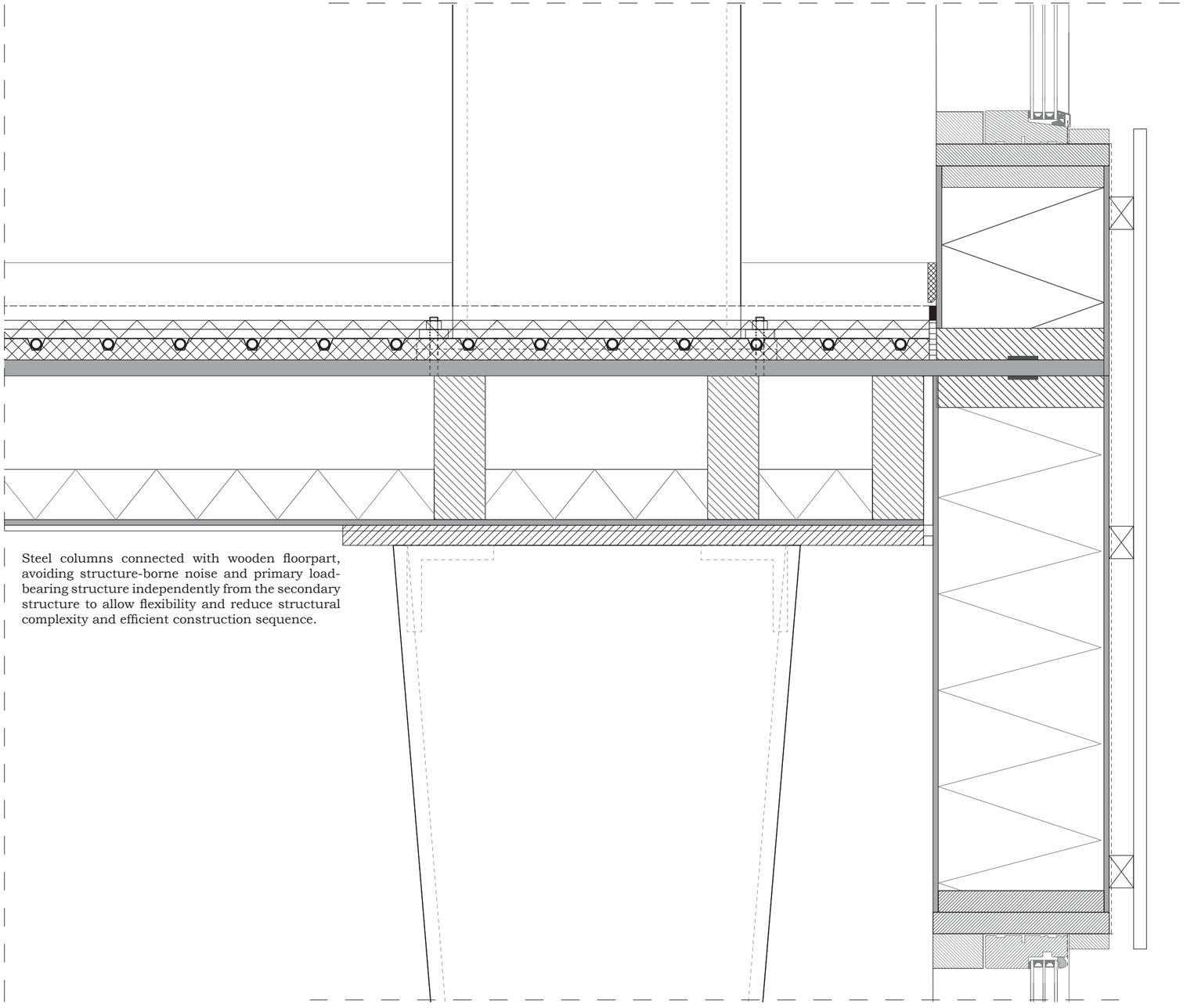
D4 1:5
CONNECTION COLUMNS, TRUSS
WOOD, ANGLE PROFILE







2.

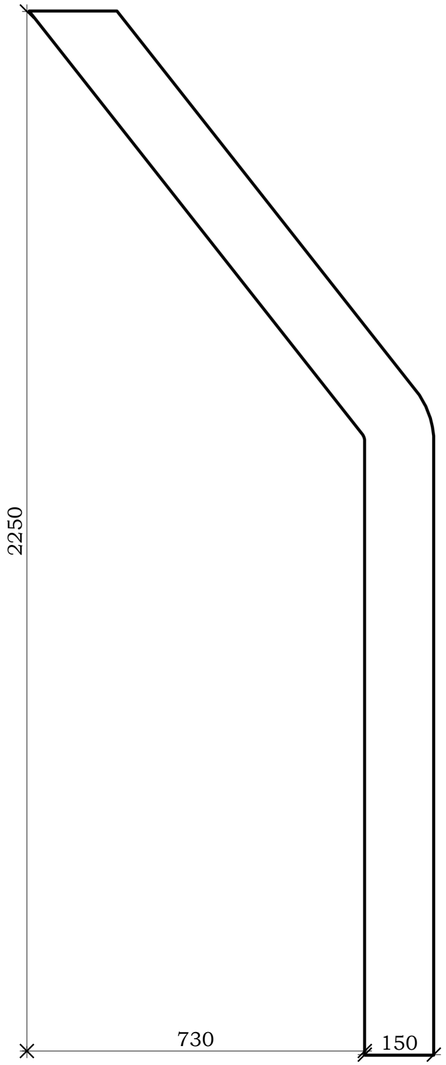


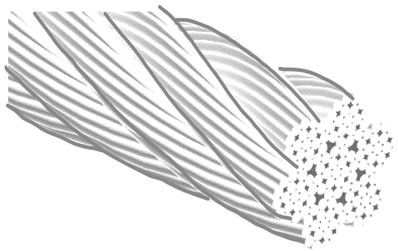
Steel columns connected with wooden floorpart, avoiding structure-borne noise and primary load-bearing structure independently from the secondary structure to allow flexibility and reduce structural complexity and efficient construction sequence.

D6 1:5
CONNECTION CONSTRUCTION, FLOOR, FACADE

2.

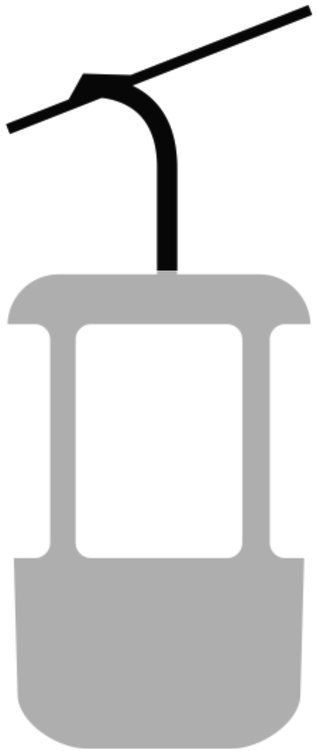
DESIGNING WITH RECLAIMED MATERIAL





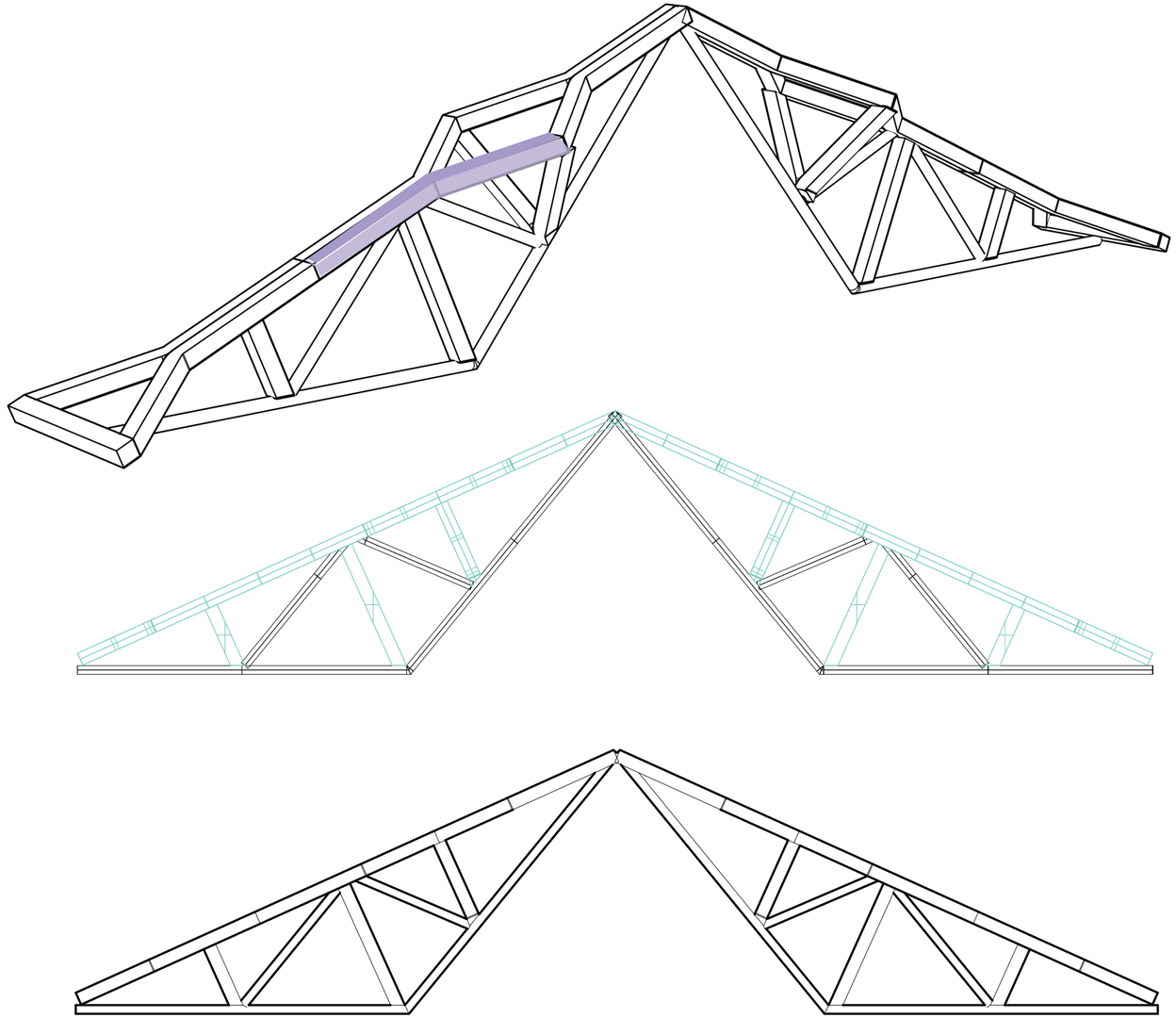
6,5 km CABLE - WIRES

180 Brackets



2.

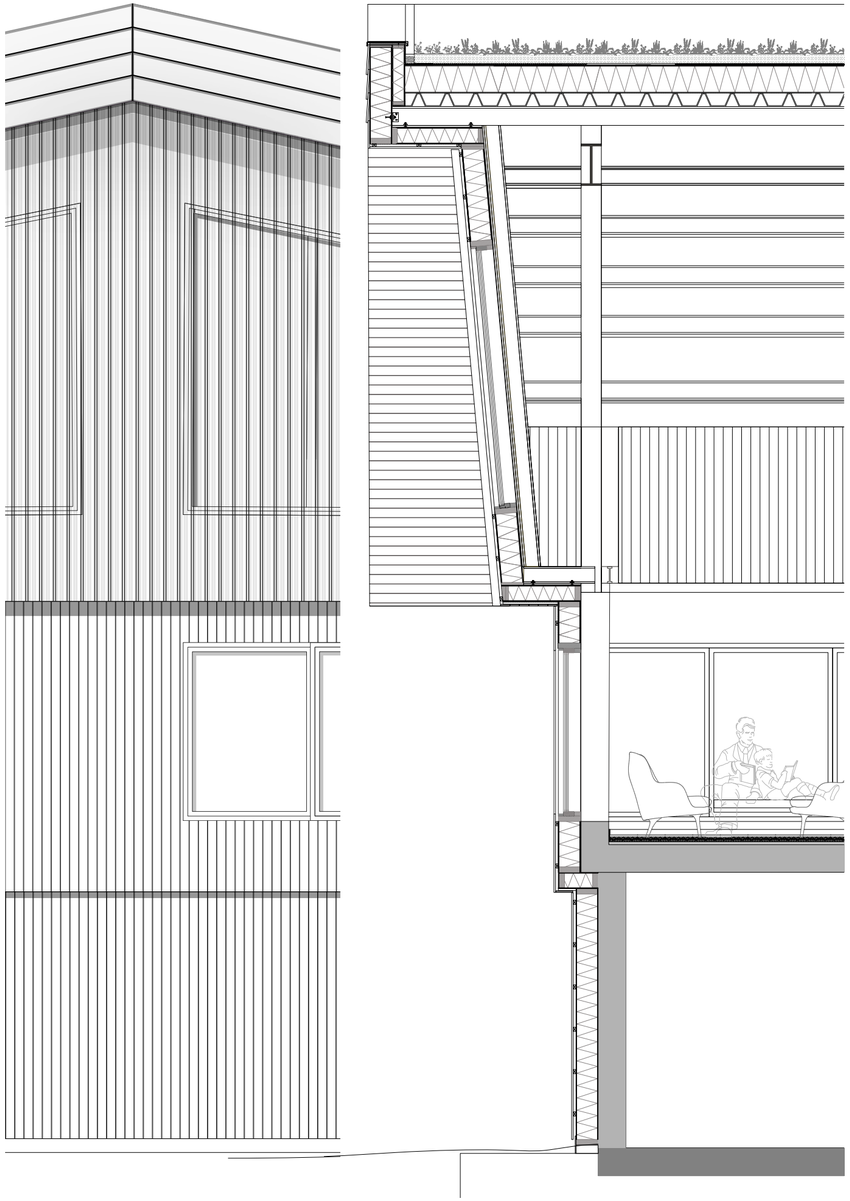
DESIGNING WITH RECLAIMED MATERIAL



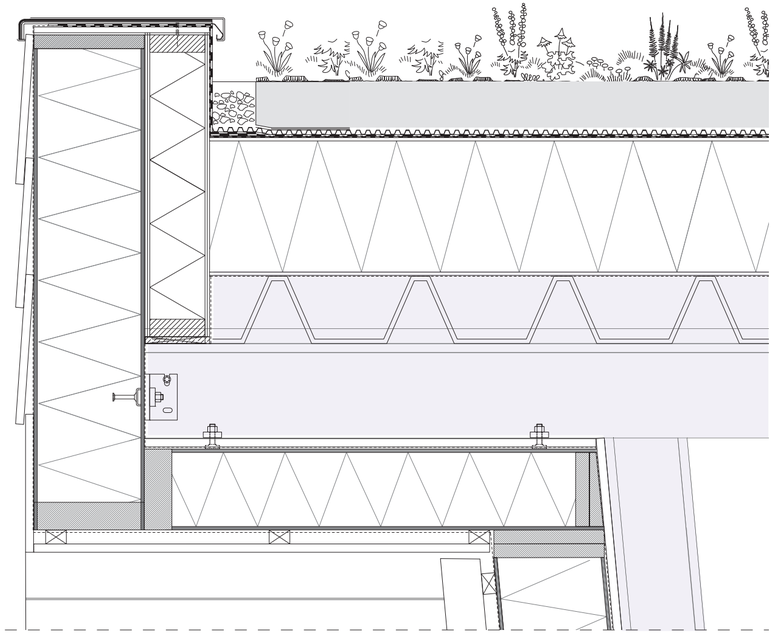
3.

LOCAL SUSTAINABLE RENEWABLE MATERIALS - KEEP WITHIN RANGE

LOCAL SAWER 2 KM, CERTIFIED TIMBER
BY-PRODUCTS FORESTRY, AGRICULTURE: WOOD FIBRE INSULATION



FACADE FRAGMENT
EXISTING RENOVATED
SOUTH 1:20 (40%)



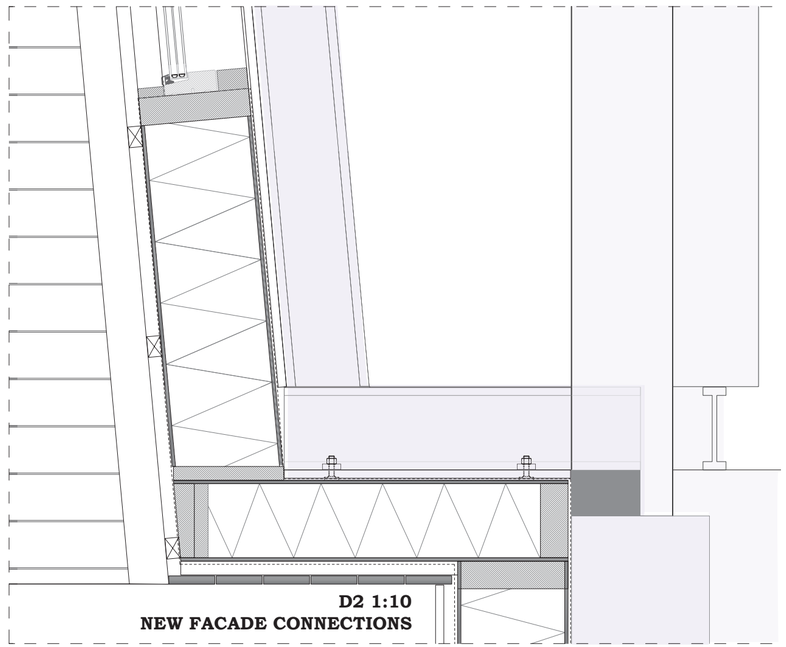
D1 1:10
ROOF SYSTEM AND CONNECTION

300 mm Wood fiber insulation (λ = 0.04 W/mK)
150 mm Extensive vegetation
(substrate + vegetation) (λ= 0.35 W/mK)

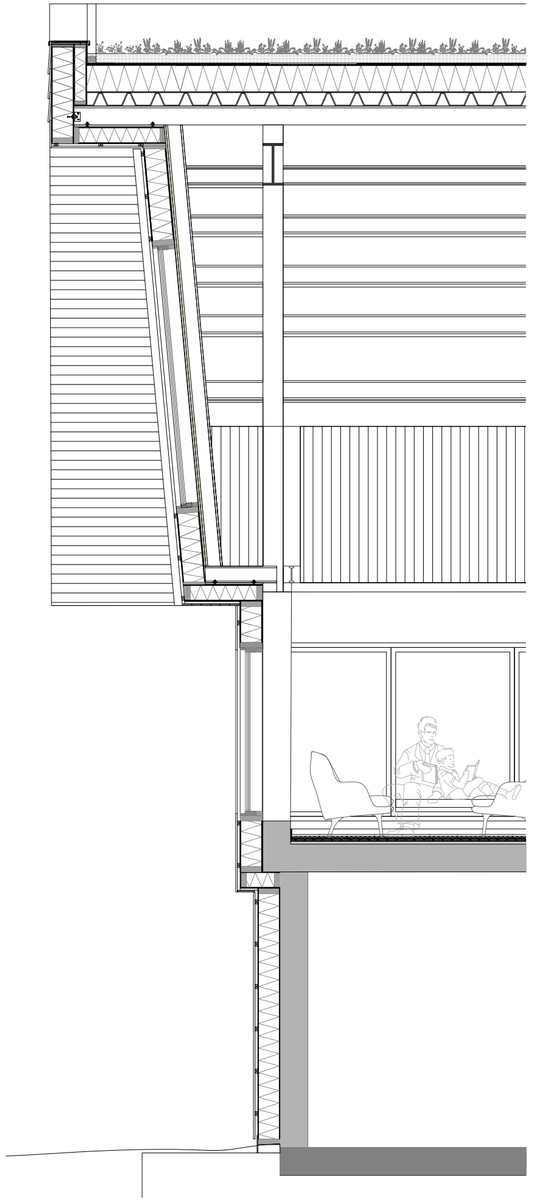
Rc Roof = R wf. + R veg. = 7.93 m² K/W

240 mm Wood fiber insulation (λ = 0.04 W/mK)

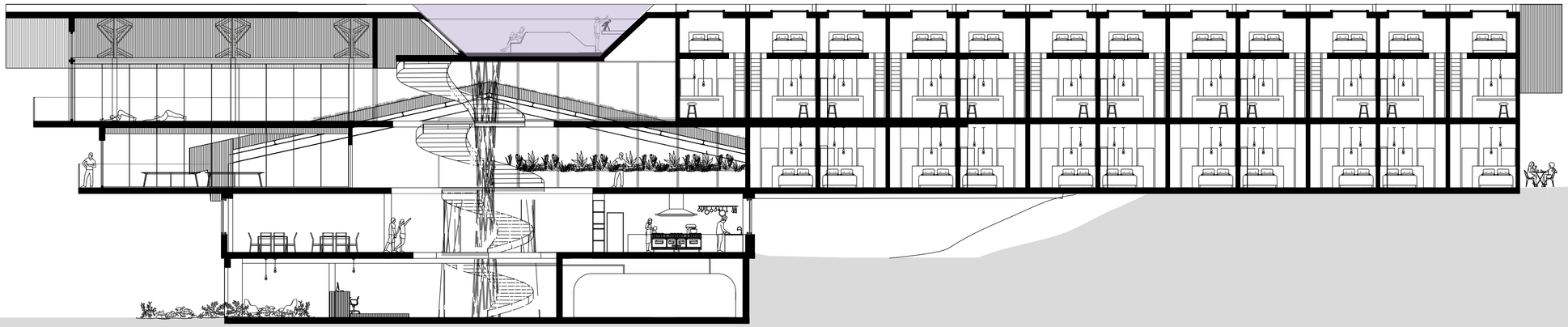
Rc Facade = 0,24/0.04 = 6 m² K/W

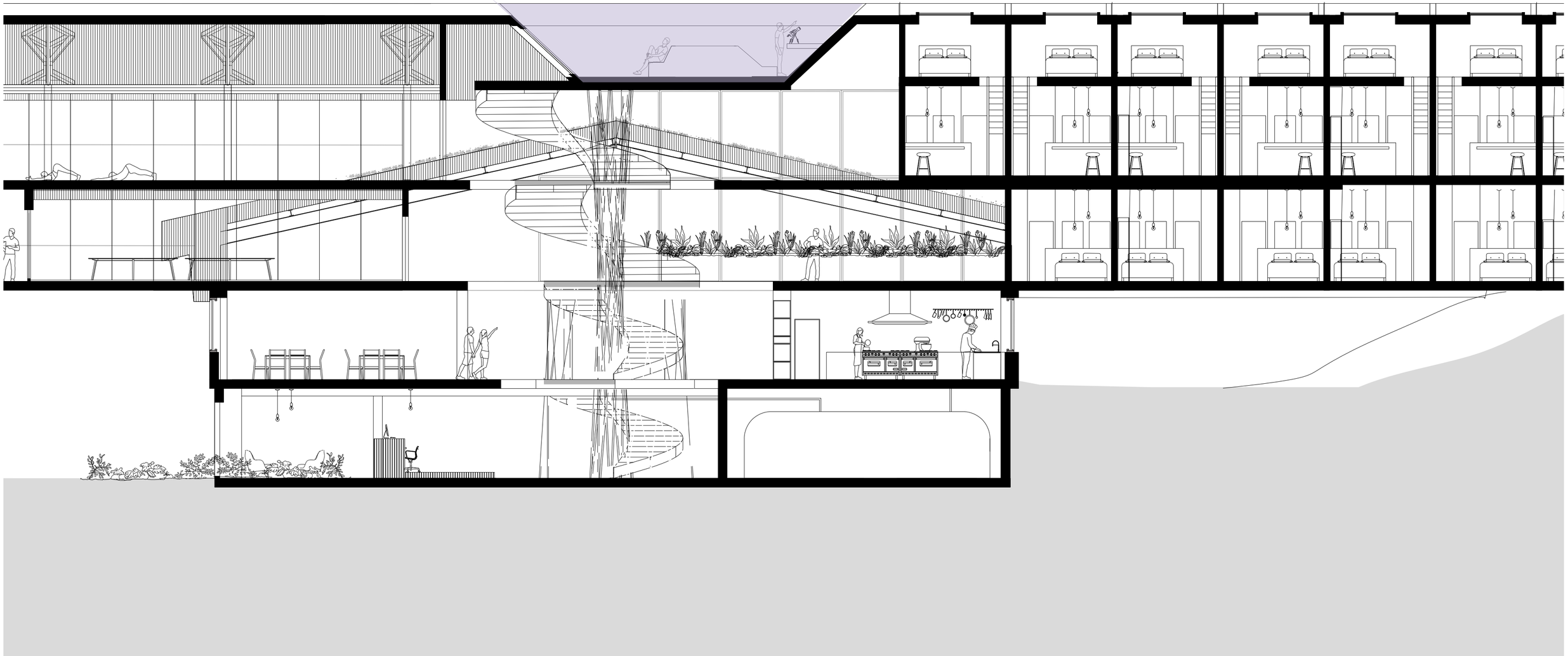


D2 1:10
NEW FACADE CONNECTIONS



FACADE FRAGMENT
EXISTING RENOVATED
SOUTH 1:20 (40%)





...In this way, **STAHLstadl** is designed to act as an example of a new form of **sustainable tourism,** while contributing to **closing material loops.** It emphasises the importance of allowing people **to enjoy and learn about the unique qualities of the Alps** without causing harm, instead giving back to nature through **circular and sustainable strategies.**

STAHLstadl

Sustainable
Transformation
Alpine
Hospitality &
Landscape

Sustainable Alpine Architecture & Tourism:
Reimagining through Circular Strategies

P5 PRESENTATION
Graduation Architectural Engineering
Catherijne Schot
14-01-2025

Questions?