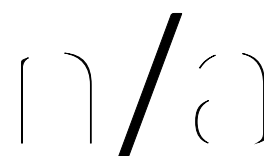


THE HEMP HOUSE – DETAIL CATALOGUE

SELECTED CONSTRUCTION DETAILS AND SPECIFICATIONS

Prepared by nikolova/aarsø for
UCE - UddannelsesCenter Sydøstdanmark Lolland-Falster





UCE  UddannelsesCenter
Syddanmark

www.uce.dk

UCE – UddannelsesCenter Syddanmark (formerly UCE) has played a central role in the realisation of the Hemp House. As the host institution for the building, UCE has provided a setting for learning, experimentation and the dissemination of knowledge about bio-based construction.

During the construction phase, UCE hosted a large-scale on-site workshop in which the building's walls were constructed using in-situ hemp-lime. The workshop was facilitated by Sergiy Kovalenkov, CEO of Hempire, and brought together construction professionals, students and teaching staff in a hands-on building process focused on exploring new materials and construction methods. Students and teachers from UCE actively participated in the construction, gaining direct practical experience with bio-based building solutions.

Today, The Hemp House continues to serve as a built example of bio-based construction and forms part of UCE's ongoing efforts to integrate sustainable materials and construction methods into education and practice. The project demonstrates how education, innovation and craftsmanship can be brought together in the development of new value chains for bio-based materials.

CONTENTS

INTRODUCTION	4
DETAIL OVERVIEW	5
BIO-BASED GROUND FLOOR SLAB	6
LIGHTWEIGHT EXTERNAL WALL WITH HEMP FIBRE	8
IN-SITU EXTERNAL WALL WITH HEMP-LIME	10
HEMP WOOD WINDOW IN LIGHTWEIGHT EXTERNAL WALL	12
HEMP WOOD WINDOW IN IN-SITU EXTERNAL WALL	14
PARTITION WALL WITH HEMP FIBRE	16
EAVES WITH HEMP COMPOSITE TILES	18
MATERIALS AND ALTERNATIVES	20
PROJECT PARTNERS	21
CONTACT INFORMATION	22

INTRODUCTION

About the Hemp House:

The Hemp House is a forward-looking building project that explores and demonstrates the potential of hemp-based materials in contemporary construction. Designed by nikolova/aarsø and commissioned by Guldborgsund Municipality, the project is located at UddannelsesCenter Sydøstdanmark Lolland-Falster (UCE), Merkur Plads 1, Nykøbing Falster. The building serves as a living laboratory for hemp-based materials and construction systems, with the aim of expanding the possibilities for the use of hemp in the built environment. The Hemp House is a state-of-the-art project demonstrating how bio-based materials can be integrated throughout a building – from the structural system to the façade and roof.

Purpose of the document:

This technical documentation has been prepared for UCE to provide inspiration and guidance on the design and construction of building assemblies incorporating a high proportion of hemp-based materials. The document is intended as a practical educational resource, providing specific examples of how hemp can be applied across different building elements.

Target audience:

This document is intended for:

- **Vocational construction students and apprentices** seeking to learn about new and sustainable building materials.
- **Students of architecture and structural engineering** seeking inspiration for innovative and climate-conscious building projects.
- **Practising craftspeople and consultants** seeking to broaden their knowledge of bio-based building materials.
- **Others with an interest in bio-based construction**, particularly the use of hemp as a sustainable alternative to conventional building materials.

Key principles:

The Hemp House is based on the following principles:

- **Sustainability:** Hemp is a rapidly renewable material that absorbs CO₂ during growth and can replace conventional, resource-intensive building materials.
- **Vapour permeability:** Hemp-based materials contribute to a healthy indoor environment by helping to regulate moisture and allowing building assemblies to remain vapour-permeable.
- **Circularity:** The materials are suitable for reuse and can be recycled, repurposed or composted at the end of the building's service life.
- **Innovation:** The project explores new applications for hemp, including experimental materials such as hemp wood and hemp composites.

Intruduction to construction details:

The document provides technical descriptions of the following building assemblies:

- **Ground floor slab** with hemp-based insulation solutions.
- **External walls** incorporating hemp-lime and hemp fibre insulation.
- **Partition walls** incorporating hemp-based boards and insulation.
- **Eaves** with integrated drainage and weatherproofing solutions.
- **Windows** with hemp-based frames and sealing solutions.

Each detail is presented step by step, with particular emphasis on material selection, installation and junction detailing, allowing the solutions to be adapted and applied to other projects.

This document has been developed for UCE as a living educational resource that can be continuously updated as new knowledge and experience emerge from The Hemp House. It is intended to inspire and support the transition towards more sustainable, bio-based construction.



DETAIL OVERVIEW

Location of details in The Hemp House

The accompanying diagrams show The Hemp House, with the individual construction details described in the technical guidance documents indicated.

The markings indicate the locations of:

- Ground floor slab
- External walls
- Partition walls
- Eaves
- Windows

The diagrams provide a clear overview of where the various construction details are located within the building. This makes it easy to relate the technical descriptions to the building's actual construction and to understand how the individual elements form part of the overall building.

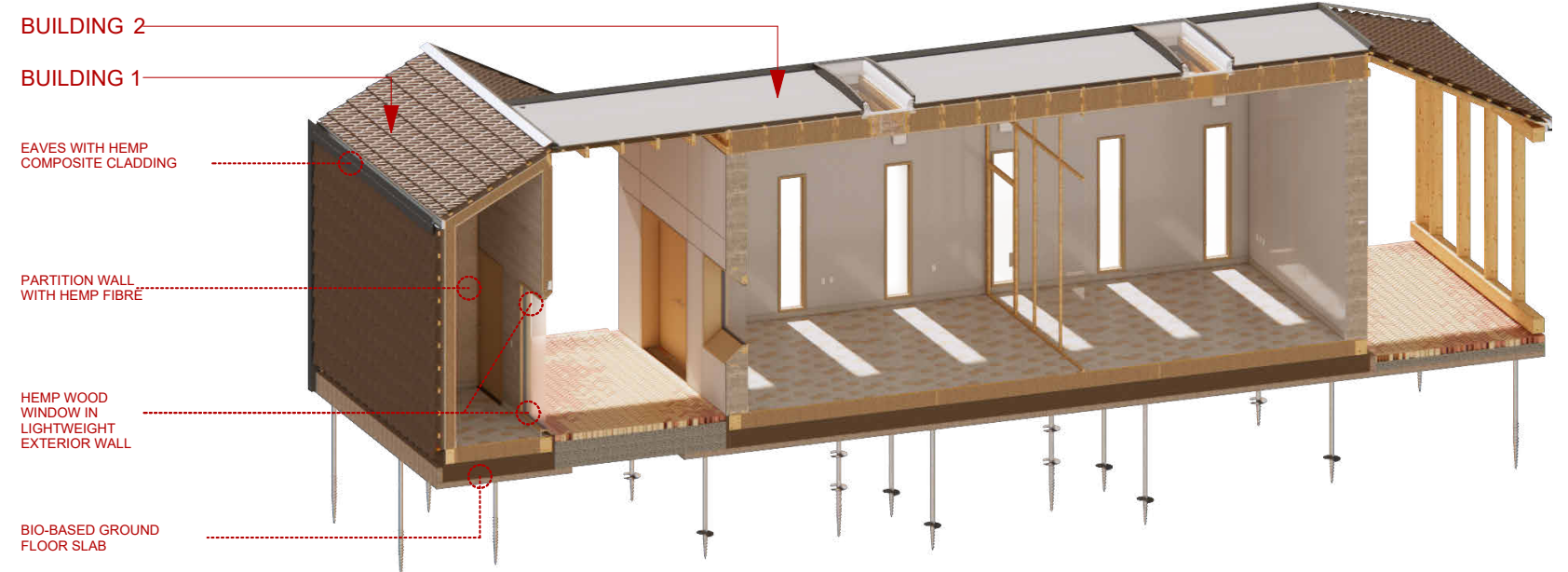
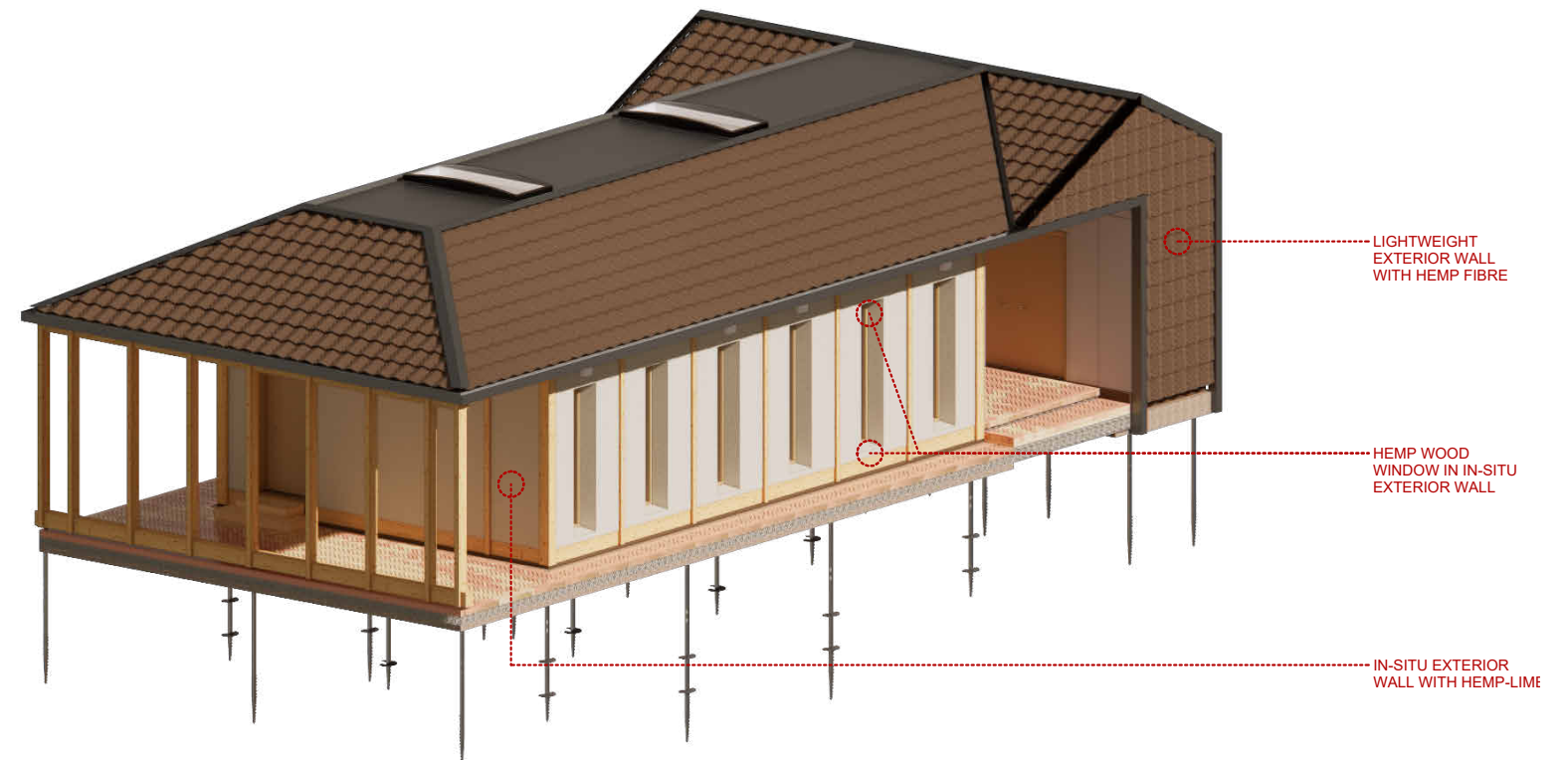
The Hemp House – two different building construction systems under one roof:

BUILDING 1 – Lightweight external wall with hemp insulation for storage/industrial buildings.

- Based on an established commercial building system
- Demonstrates how sustainable materials can be incorporated without changing the construction system
- Serves as a realistic prototype

BUILDING 2 – Hemp-lime external wall construction designed for heated buildings/residential use.

- The construction is vapour-permeable
- Moisture is managed by the materials themselves
- The alkaline properties of lime inhibit mould growth



BIO-BASED GROUND FLOOR SLAB

About the detail

The detail presents a fully bio-based ground floor slab that integrates screw foundations with a lowered construction to avoid the need for accessibility ramps. This solution demonstrates how even complex ground floor slabs can be constructed using bio-based materials without compromising functionality or structural integrity. The choice of materials is based on an analysis of the environmental conditions to which each component is exposed—either below or above ground level. This ensures that the construction is both sustainable and technically optimised for the specific requirements of a ground floor slab.

Materials used

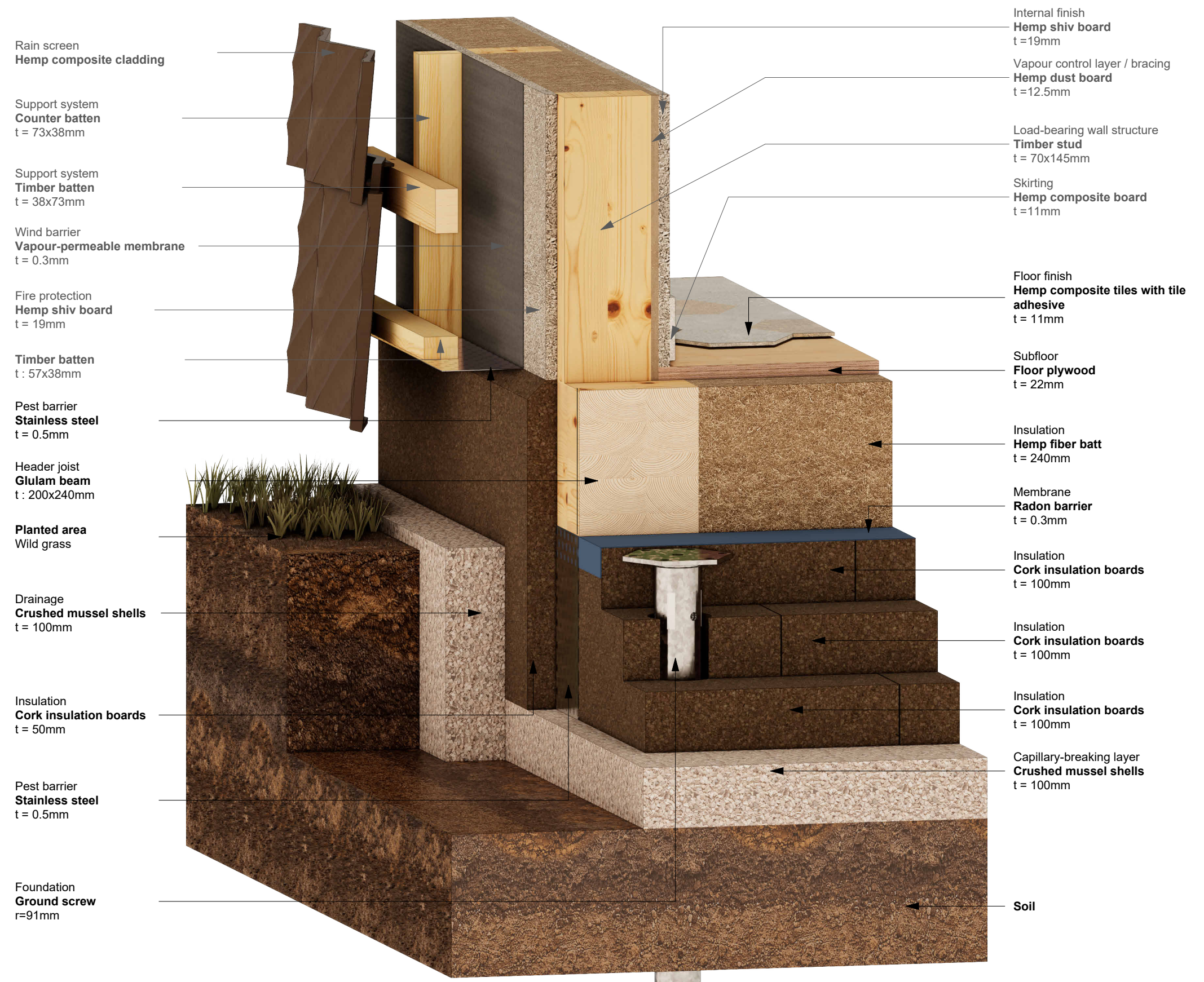
The ground floor slab consists of several layers selected for their environmental and technical properties:

- Below ground level, a levelling layer of gravel is installed, followed by a 100 mm layer of crushed mussel shells, which acts as a capillary-breaking layer. This is followed by 300 mm of cork insulation, a hydrophobic material with high resistance to degradation.
- A radon and moisture barrier is placed above the cork insulation to protect against moisture and harmful gases. The insulation consists of hemp fibre batts, combining breathability with effective thermal insulation.
- The plinth is constructed from cork and protected by a vertical layer of crushed mussel shells, which acts as a barrier against soil bacteria and as perimeter drainage.
- A glulam beam is placed on top of the screw foundation, with integrated structural timber floor joists. The floor is finished with a plywood board and hemp bio-composite tiles, forming a waterproof and durable floor.

Potential of hemp-based materials

Industrial hemp is used in the construction as insulation in the form of hemp fibre batts and as a component of the custom-made hemp bio-composite tiles. These materials utilise the natural properties of hemp and reduce the need for petroleum-based alternatives.

Although the use of hemp in the ground floor slab is limited, it represents an important step towards a fully climate-responsible solution. The combination of cork and mussel shells enables the complete elimination of conventional materials such as concrete and foam insulation, opening up new possibilities for sustainable construction practices.



Dimensions and u-value:

Con. Dim.: 672 mm

Ins. Dim.: 540 mm

U-value: 0,08 W/(m²·K)

Installation instructions

Preparation and substrate

Screw foundations:

- Ensure the screw foundations are correctly positioned and aligned with the project specifications.

Compacted gravel layer:

- Install a compacted gravel layer as a base to ensure stability and drainage.
- Ensure the gravel layer is level and well compacted.

Mussel shells:

- Install a 100 mm layer of mussel shells, evenly distributed over the gravel layer and around the screw foundations.
- Do not compact the mussel shells, as the air voids are essential to their capillary-breaking function.

Construction and insulation

Cork insulation:

- Install 300 mm of cork insulation in staggered layers to minimise thermal bridging.
- Cut the cork insulation to fit precisely around the screw foundations.

Moisture and radon barrier:

- Install a moisture and radon barrier over the cork insulation to protect against moisture and radon ingress.

Hemp fibre insulation:

- Install hemp fibre insulation between the timber structural elements to ensure optimal thermal insulation.
- Ensure that the insulation fits tightly, with no gaps.

Floor plywood:

- Install floor plywood over the timber structure as a load-bearing layer.
- Secure the plywood boards with screws for stability.

Floor tiles:

- Install hemp bio-composite tiles with a suitable grout to ensure a stable and watertight surface.
- Ensure that the tiles are evenly spaced and level before fixing.

Moisture protection:

- Protect the construction from precipitation and moisture during construction.
- Allow the construction to dry thoroughly before applying the final finish.
- Bio-based materials are organic and must therefore be stored dry and securely on site, including before installation.

EXTERIOR

Hemp composite cladding

Timber batten

t : 38x73mm

RtF : D,s2,d0

Counter batten

t : 73x38mm

RtF : D,s2,d0

Traspir evo uv 210

t : 1mm

RtF : B,s1,d2

Z : 100

Hemp shiv board

t : 19mm

RtF : B,s1,d0

Z : 5,2

Fixing with screw and washer

Mouse mesh

t : 0.5mm

Timber batten

t : 57x38mm

RtF : D,s2,d0

Glulam beam

t : 200x240mm

RtF : D,s2,d0

Planted area

Wild grass

Crushed mussel shells

t : 100mm

RtF : A

Z : 5

Cork insulation boards

t : 50mm

RtF : E

Z : 15

Mouse mesh

t : 0.5mm

Ground screw

r : 91mm

RtF : A

INTERIOR

Hemp shiv board

t : 19mm

RtF : B,s1,d0

Z : 5,2

Hemp dust board

t : 12.5mm

RtF : B,s2,d0

Z : 35,2

Hemp fibre batt

t : 145mm

RtF : D,s1,d0

Z : 0,96

Hemp composite board

t : 11mm

Hemp composite tiles

t : 9mm

Tile adhesive

t:2mm

Floor plywood

t : 22mm

RtF : D-s2, d0

Hemp fibre batt

t : 240mm

RtF : D,s1,d0

Z : 0,58

Radon barrier

t : 0.3mm

Cork insulation boards

t : 300mm

RtF : E

Z : 7,5

Crushed mussel shells

t : 100mm

RtF : A

Z : 5

LIGHTWEIGHT EXTERNAL WALL WITH HEMP FIBRE

About the detail

The external wall construction is designed for storage and industrial buildings where insulation requirements are limited—typically for buildings heated to a maximum of 15°C or simply maintained above freezing. The solution demonstrates how stringent fire safety requirements can be met using hemp-based materials, particularly in relation to the internal lining and wind barrier.

Materials used

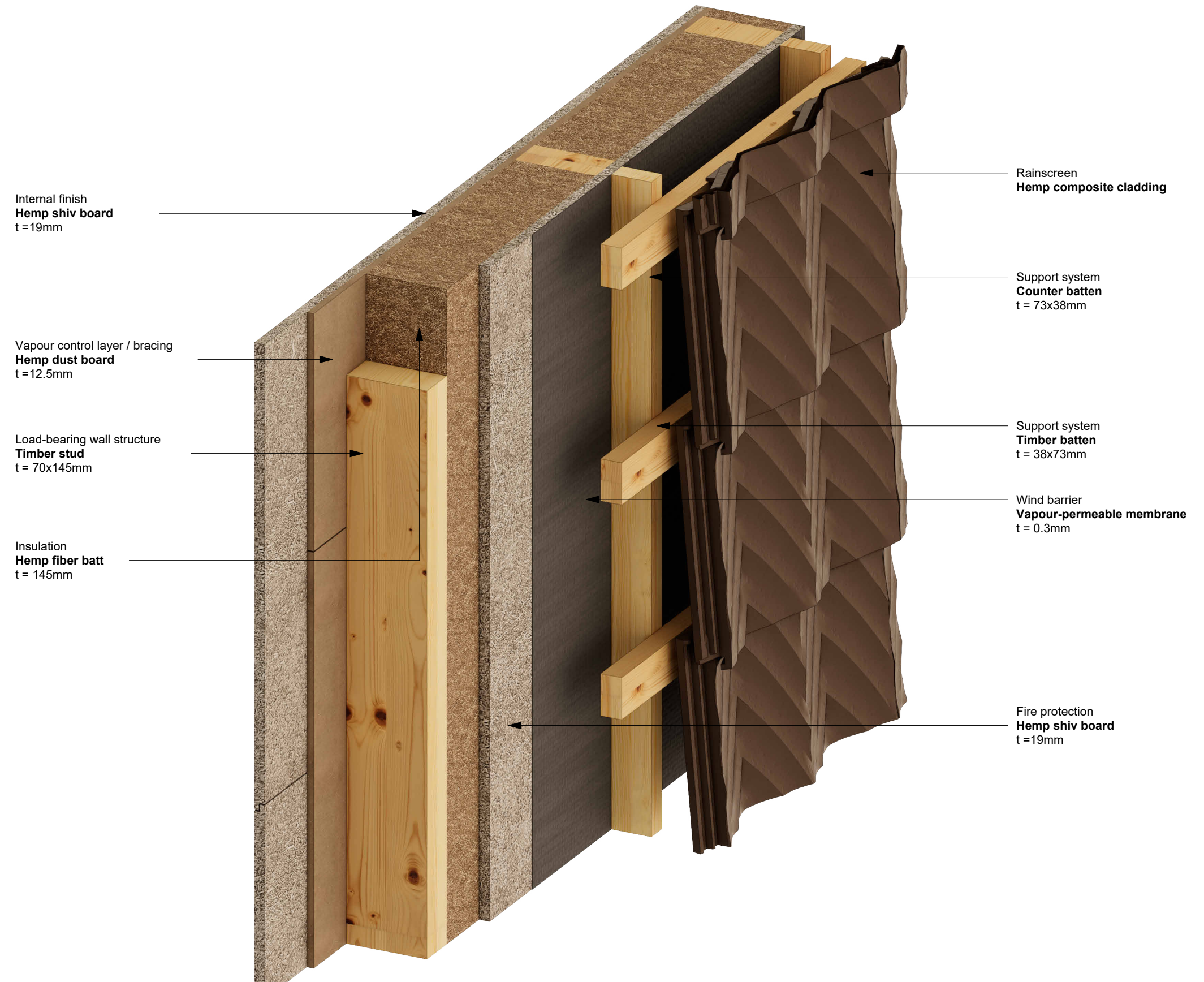
The construction consists of several functional layers:

- The internal lining consists of a compressed hemp shiv board with a mineral binder, achieving reaction-to-fire class B-s1,d0 and lining class K1 10—a requirement for pre-accepted solutions.
- The vapour control layer and structural bracing are provided by a high-strength hemp dust board, ensuring stability and moisture regulation.
- The insulation between the timber frame elements consists of hemp fibre batts, providing the required thermal performance.
- The external sheathing consists of the same type of hemp shiv board with a mineral binder, protected by a vapour-permeable, wind- and watertight membrane. Together, these layers form the wind barrier of the construction.
- The façade consists of specially designed hemp bio-composite tiles made from fine hemp fibres in a 100% bio-based soy resin. The tiles are installed on a traditional and robust system of timber counter battens and spacer battens.

Potential of hemp-based materials

Almost all components—except for the timber structures and the membrane—are based on industrial hemp. Hemp shiv boards, hemp fibre insulation and bio-composite tiles demonstrate how hemp can be used from structural elements through to finishing surfaces. Even hemp dust is reused in structural sheathing boards, highlighting the versatility of the material.

The fine hemp fibres used in the façade's bio-composite tiles enable a robust, watertight and aesthetically refined finish, demonstrating the potential of hemp as a sustainable and versatile material in contemporary construction.



Dimensions and u-value:

Con. Dim.: 307 mm

Ins. Dim.: 145 mm

U-value: 0,27 W/(m².K)

Installation instructions

Timber structure:

- Construct a stable timber frame with studs spaced at a maximum of 600 mm centre-to-centre to ensure stability and provide space for insulation.

External sheathing:

- Install hemp shiv boards as external sheathing on the timber frame with screws or staples, ensuring tightness.

Vapour-permeable membrane:

- Install a vapour-permeable, wind- and watertight membrane on the outside of the hemp shiv boards.
- The membrane must protect the construction against wind and weather while allowing it to remain vapour-permeable.

Counter battens:

- Fix counter battens to the outside of the membrane to provide stable and durable support for the façade.

Internal insulation:

- Install hemp fibre insulation tightly between the timber studs.
- Ensure that the insulation is evenly distributed and free of gaps to prevent thermal bridging.

Vapour control layer and bracing:

- Install hemp dust boards as a vapour control layer and structural bracing.
- Ensure that the boards are tightly fitted and that all joints are taped, bonded or sealed to ensure that the layer functions continuously as a vapour control layer.

Internal lining:

- Install hemp shiv boards as internal lining and fix them to the timber structure using screws or staples.

Completion of the building envelope:

- The building envelope is now complete, and the construction is protected against wind and water.

Façade:

- Fix the hemp bio-composite tiles to the spacer battens with the correct overlap to ensure a watertight and durable façade.

Internal finish:

Apply lime or clay plaster to the internal hemp shiv board to achieve a smooth and aesthetically refined surface.

Moisture protection:

Protect the construction against precipitation and moisture during construction.

EXTERIOR

Hemp composite cladding

Counter batten
t : 38x73mm
RtF : D,s2,d0

Timber batten
t : 73x38mm
RtF : D,s2,d0

Traspir evo uv 210
t : 1mm
RtF : B,s1,d2
Z : 100

Hemp shiv board
t : 19mm
RtF : B,s1,d0
Z : 5,2

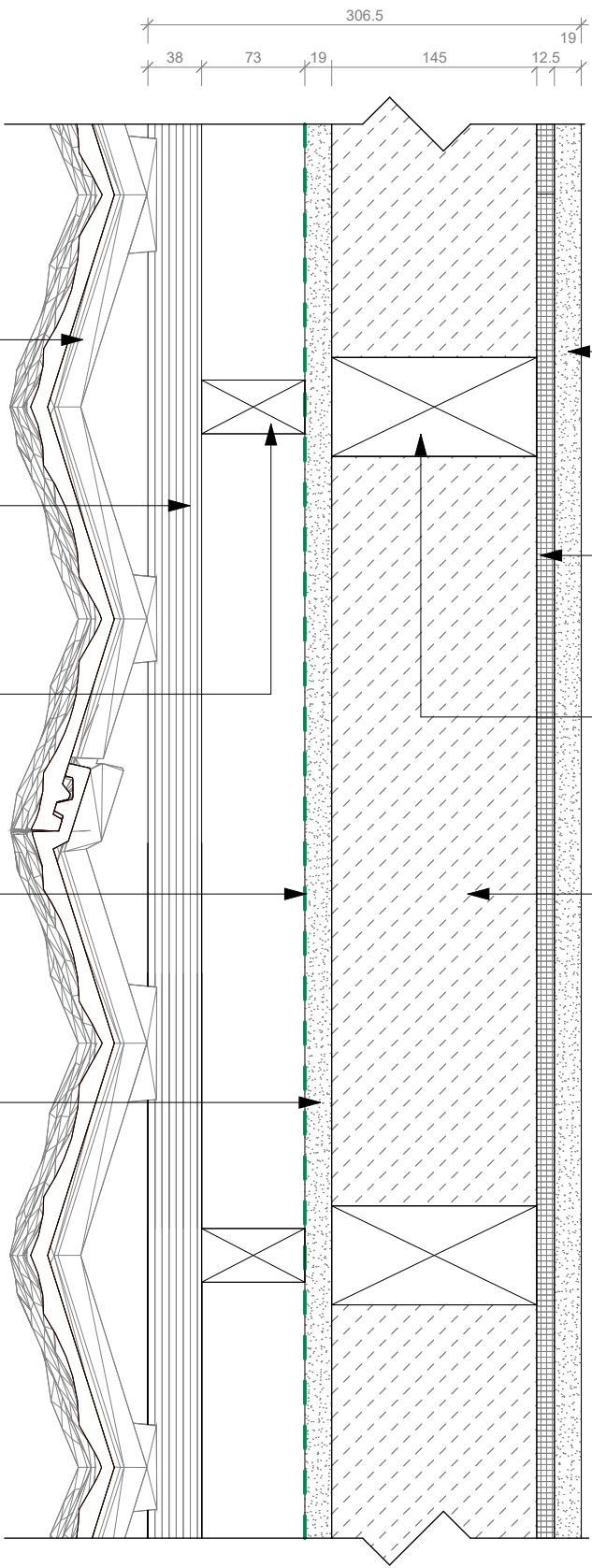
INTERIOR

Hemp shiv board
t : 19mm
RtF : B,s1,d0
Z : 5,2

Hemp dust board
t : 12.5mm
RtF : B,s2,d0
Z : 35,2

Timber stud
t : 70x145mm (c-c 600mm)
RtF : D,s2,d0

Hemp fibre batt
t : 145mm
RtF : D,s1,d0
Z : 0,96



IN SITU EXTERNAL WALL WITH HEMP-LIME

About the detail

The external wall construction is designed for heated buildings, such as residential buildings, and is characterised by its simplicity, as it consists primarily of hemp-lime—a material often incorrectly referred to as “hemp-crete”. Hemp-lime is not concrete, but a self-supporting insulation material that can be rendered directly.

In this project, the hemp-lime is cast in situ, allowing the material to be compacted more densely at the outer surfaces and around the timber structure, while the core remains porous. This technique improves the thermal insulation performance compared with prefabricated blocks, where the entire cross-section is uniformly compacted.

Materials used

The construction consists of:

- Internal finish: Lime plaster with exposed hemp shiv, improving the insulation and highlighting the material's aesthetic qualities.
- Structure: Solid glulam with vertical timber battens serving as formwork for the hemp-lime.
- Insulation: The entire wall, excluding the plaster, is constructed from hemp-lime—a mixture of hemp shiv and lime, mechanically mixed on site.
- External finish: Traditional lime plaster without cement, providing protection against wind, water and sunlight.

Potential of hemp-based materials

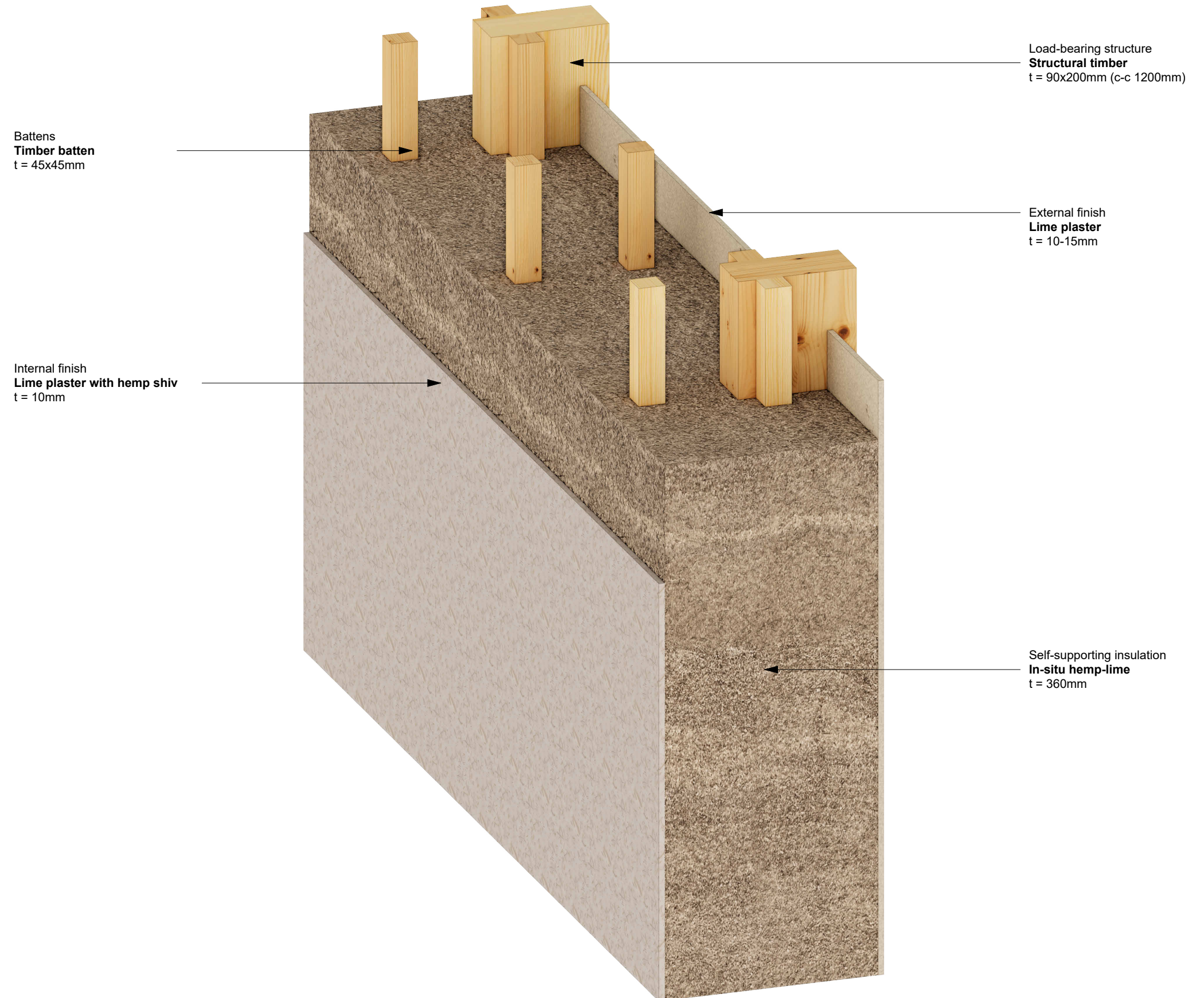
The construction utilises hemp shiv combined with lime, providing several benefits:

Fire resistance: Achieves reaction-to-fire class B-s1,d0 and can meet requirements such as EI30 even in thin walls (down to 70 mm).

Moisture regulation: Vapour-permeable and capable of absorbing moisture, helping to stabilise the indoor climate.

Mould resistance: The alkaline properties of lime provide high resistance to mould growth.

This example demonstrates how hemp-lime can provide a sustainable, fire-resistant and climate-stabilising solution for contemporary construction.



Dimensions and u-value:

Con. Dim.: 380 mm

Ins. Dim.: 360 mm

U-value: 0,19 W/(m².K)

Installation instructions

Formwork:

- Install vertical battens on each side of the glulam structure to keep it free from screw holes from the formwork.
- Install additional battens as shown in the drawing to ensure stability and correct fixing of the formwork.
- Fix OSB boards to the battens as formwork.
- Position the boards at the required distance to form the cavity for the in-situ casting.
- Ensure that the formwork is stable and tight enough to withstand the pressure of the wet hemp-lime mixture.

Hemp-lime mixture:

- Mix the hemp shiv and lime binder on site in a forced-action mixer to achieve a homogeneous mixture with the correct consistency.
- The mixture must have an appropriate moisture content to allow proper compaction and optimal filling of the cavity.

Casting the hemp-lime:

- Cast the hemp-lime mixture into the cavity between the OSB boards in layers.
- Compact the outer surfaces and around the glulam structure and battens to increase density and strength, while keeping the core porous for improved insulation.
- Once a layer reaches the top of the formwork, remove the OSB boards and move them upwards to cast the next layer on top of the previous one.

Drying:

- Ensure continuous ventilation around the cast hemp-lime to promote even drying.
- Avoid stagnant air, as this may delay the drying process and affect the quality of the material.

Internal plaster:

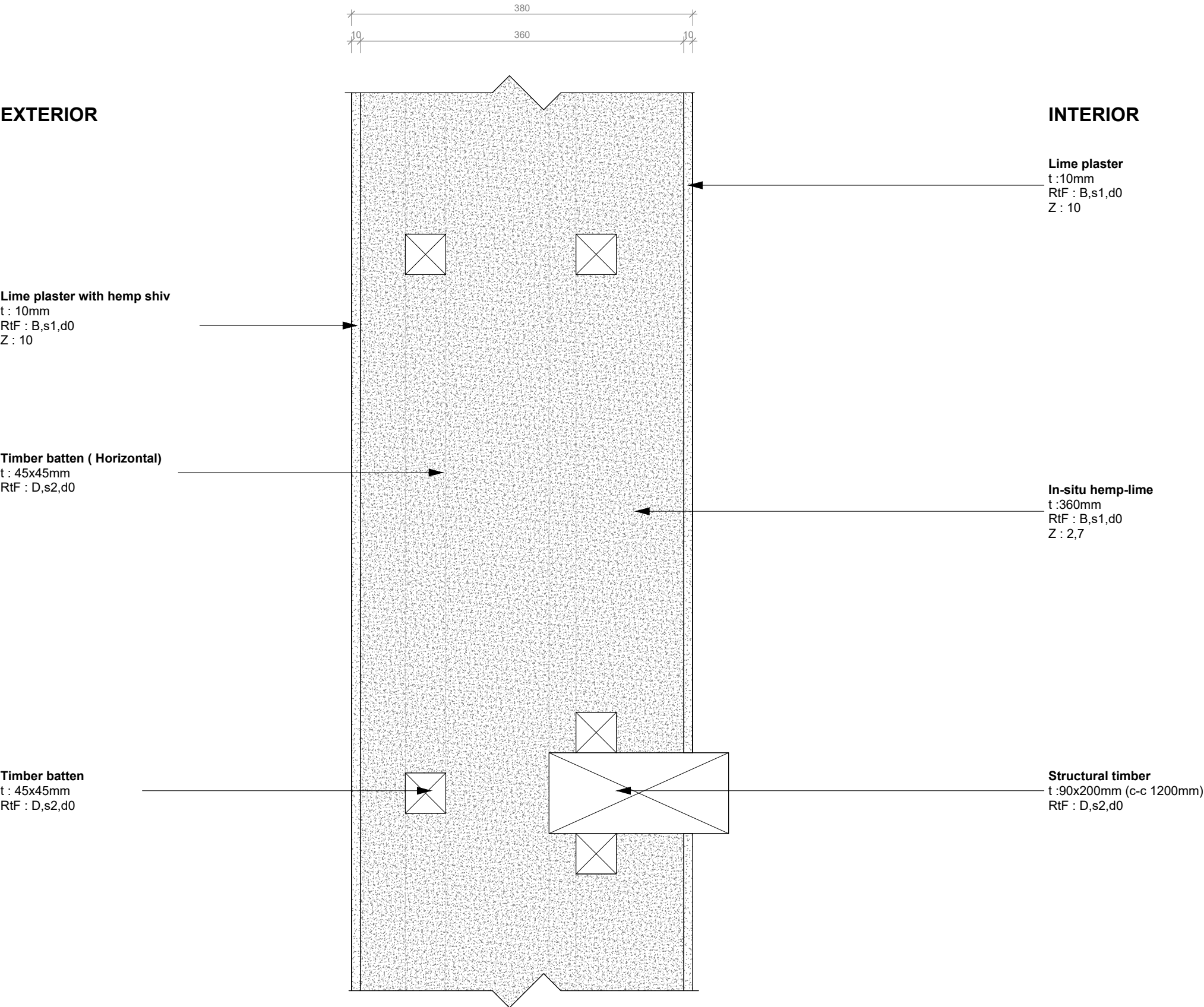
- Apply lime plaster with exposed hemp shiv as the internal finish once the hemp-lime is fully dry.
- Apply the plaster evenly and allow it to dry properly to highlight the material's aesthetic qualities and improve insulation.

External plaster:

- Apply traditional cement-free lime plaster as the external finish.
- Apply the plaster evenly to provide protection against wind and water.
- Allow the plaster to dry thoroughly and cure properly.

Note:

Bio-based materials are organic and must therefore be stored in dry and secure conditions on site, including before they are incorporated into the construction.



HEMP WOOD WINDOW IN LIGHTWEIGHT EXTERNAL WALL

About the detail

The detail shows the installation and sealing of a window in a lightweight external wall with hemp fibre insulation. In The Hemp House, the focus is on demonstrating hemp-based solutions, and here the window frame, glazing beads and reveals are made from hemp wood—an experimental material produced from whole hemp plants which, after retting, are treated with a soy-based resin and pressed into a solid, timber-like product.

Although hemp wood is not yet a fully developed product on the market, the detail illustrates how it can be integrated into a lightweight external wall. The window is installed using frame screws in all frame members to prevent splitting, while sealing is provided by tarred oakum, joint tape and hemp fibre insulation to achieve optimal thermal insulation and durability.

Materials used

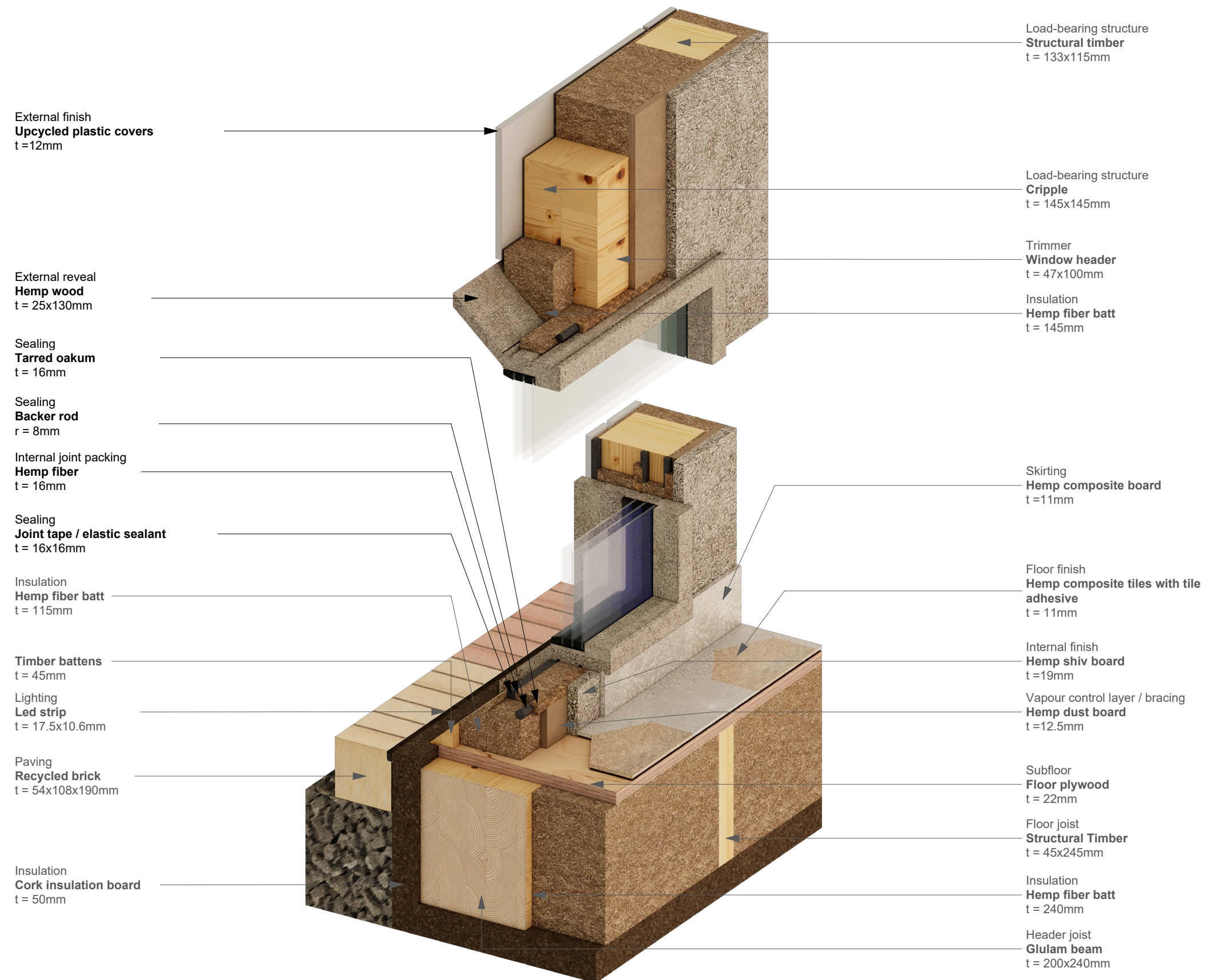
The window construction includes:

- Window frame: Solid hemp wood with precisely routed grooves for glazing. The joints are executed using traditional timber craftsmanship to ensure stability and a long service life.
- Sealing: Tarred oakum, joint tape and hemp fibre insulation provide both airtightness and effective thermal insulation around the window frame.
- Reveals: Angled hemp wood boards, pigmented red and lacquered to highlight the material's natural texture and protect it against moisture and weathering.

Potential of hemp-based materials

Hemp wood shows significant potential as a sustainable alternative to conventional timber. Under optimal conditions, hemp can be harvested 1–2 times a year, unlike trees, which require 20–30 years of growth. This makes hemp an effective CO₂ store, capable of rapidly sequestering significant quantities of CO₂ from the atmosphere.

The development of hemp wood could reduce dependence on imported timber and enable local production, even in areas with limited forest cover. This contributes to more sustainable construction practices by freeing up forest areas for other purposes, such as nature conservation or recreational use.



Dimensions and u-value:

Con. Dim.: 307 mm

Ins. Dim.: 145 mm

U-value: 0,27 W/(m².K)

Installation instructions

Initial note:

This detail is designed for a fully covered external wall that is not exposed to rain. It is important to note that the materials and installation are adapted to this specific context.

Preparation of the opening:

- Ensure that the opening in the external wall is accurately measured and adapted to the window dimensions.

Positioning and packing the window:

- Position the window in the opening and pack it so that it is correctly aligned with equal clearance to the surrounding construction.

Installation of the window frame:

- Pre-drill holes in the hemp wood to prevent splitting when installing the frame screws.
- All frame members must be fixed to distribute the load as evenly as possible across the entire frame.
- Tighten the frame screws, finishing by hand to ensure precise control and prevent the hemp wood from splitting.
- Countersink the frame screws and finish with hemp wood plugs for a clean and durable appearance.

Window sealing:

- Insert joint tape between the external side of the construction and the frame.
- Seal externally with tarred oakum.
- Insulate between the frame and the construction with hemp fibre insulation.
- Finish internally with joint tape and tarred oakum.

Installation of reveals:

- Fix angled hemp wood boards as reveals around the window.
- Fix the reveals to the frame and the surrounding construction.
- The lacquer finish can be touched up afterwards if there are scratches or visible screw holes.

Note:

- It is important to emphasise that hemp wood is still a material under development. Its use for window frames is therefore experimental and not a standard application of the material. Particular care must therefore be taken during installation and when sealing the material against water and moisture ingress. Bio-based materials are organic and must therefore be stored in dry and secure conditions on site, including before they are incorporated into the construction.

EXTERIOR

Upcycled Id-covers(plastic)

t : 12mm

RtF : Bfl,S1

Ventilated cavity

t : 5mm

Screw with sealing washer

Spacer washer

Hemp fibre batt

t : 98mm

RtF : D,s1,d0

Z : 1,20

EXTERIOR

Joint tape / elastic sealant

t : 16mm

Hemp fibre batt

t : 115mm

RtF : D,s1,d0

Z : 1,20

Timber batten

t : 45mm

RtF : D,s2,d0

Floor plywood

t : 22 mm

RtF : D,s2,d0

LED strip

t : 17.5x10.6mm

Paving

Recycled brick

t : 54x108x190mm

INTERIOR

Hemp shiv board

t : 19mm

RtF : B,s1,d0

Z : 5,2

Hemp dust board

t : 12.5mm

RtF : B,s2,d0

Z : 35,2

Structural timber

t : 145x145mm

RtF : D,s2,d0

Window header

t : 47x100mm

RtF : D,s2,d0

Tarred oakum

t : 16mm

Backer rod

r : 8mm

Hemp fibre

t : 16mm

INTERIOR

Hemp fibre

t : 16mm

Tarred oakum

t : 16mm

Hemp composite board

t : 11mm

Hemp shiv board

t : 19mm

RtF : B,s1,d0

Z : 5,2

Hemp dust board

t : 12.5mm

RtF : B,s2,d0

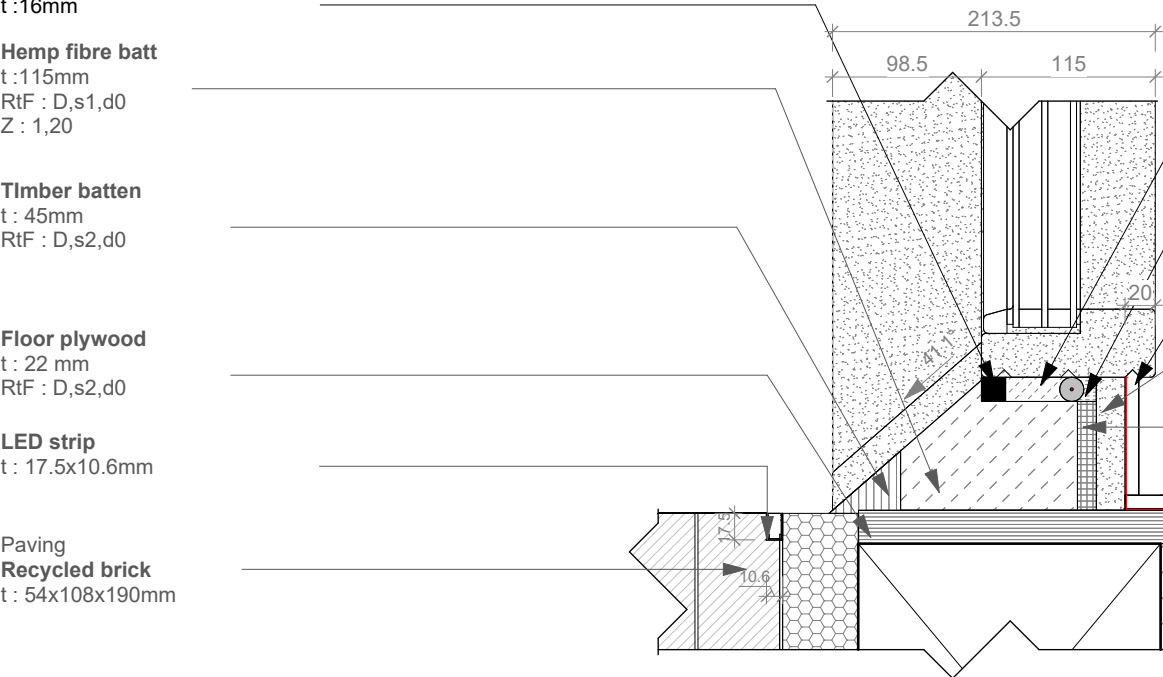
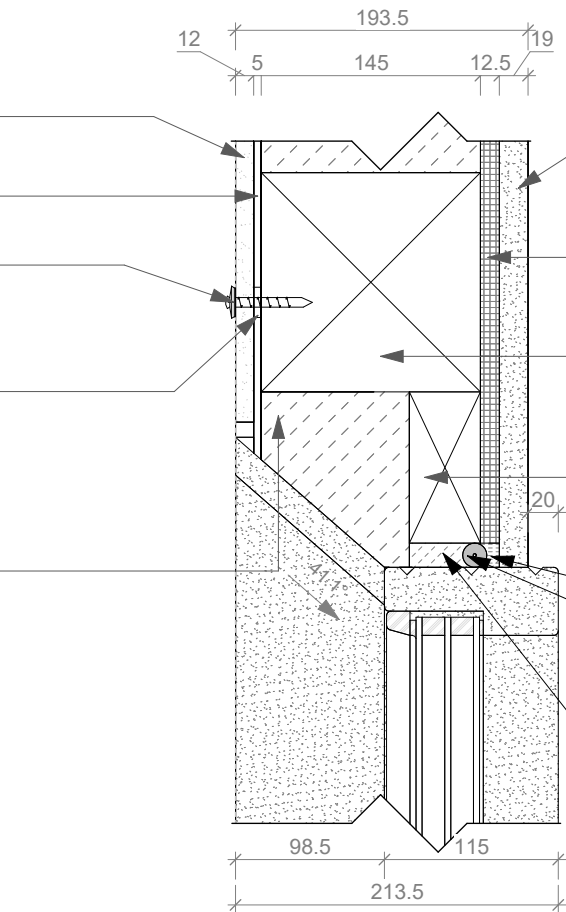
Z : 35,2

Hemp composite tile

t : 9mm

Tile adhesive

t : 2mm



HEMP WOOD WINDOW IN IN SITU EXTERNAL WALL

About the detail

The detail shows the installation and sealing of a window in an external wall constructed from hemp-lime, with a focus on integrating the window solution into a self-supporting, bio-based construction. The window is of the same type as previously described, but here the external reveals are formed as in-situ cast hemp-lime elements and finished with traditional lime plaster.

The solution demonstrates how windows can be installed in a hemp-lime wall, making full use of the material's self-supporting properties and vapour permeability. The sealing around the window is carefully executed to ensure both moisture protection and the preservation of the construction's breathability.

Materials used

The window construction and integration include:

Window frame: Solid hemp wood with routed grooves for glazing, fixed to the surrounding timber structure with frame screws to prevent splitting.

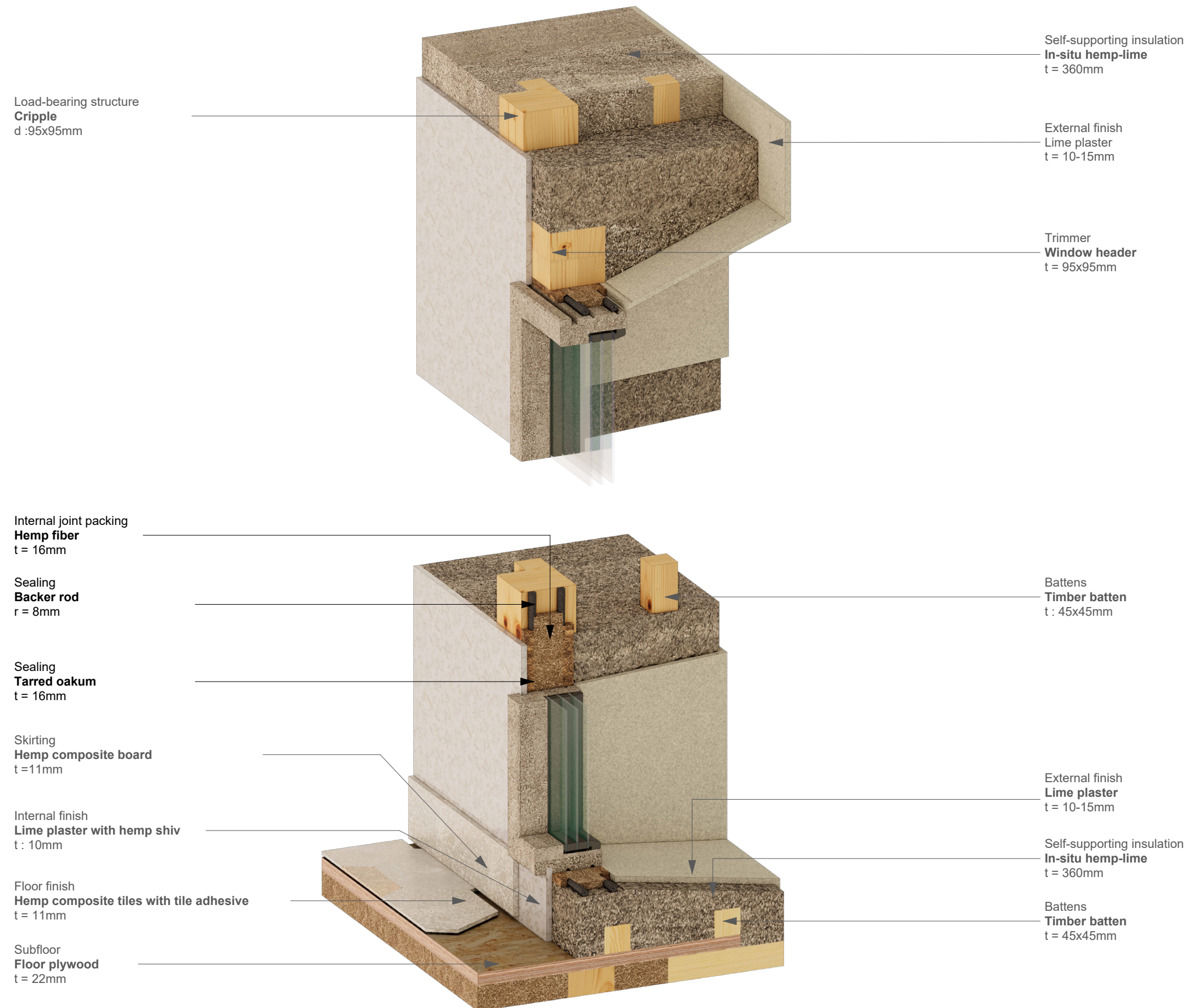
Sealing: Tarred oakum and joint tape provide sealing around the window frame, while hemp fibre insulation is incorporated to maintain thermal performance.

External reveals: In-situ cast hemp-lime reveals, finished with lime plaster to provide protection against weathering while preserving the material's natural appearance. The reveals are shaped to ensure effective drainage and harmonious integration with the wall.

Potential of hemp-based materials

In this solution, hemp-lime is used for both the wall construction and the reveals, highlighting the material's versatility. The self-supporting properties of hemp-lime and its ability to regulate moisture make it ideal for window integration, where both durability and indoor climate are prioritised.

The hemp wood window frame once again demonstrates how hemp can replace conventional materials such as timber, while the in-situ casting of hemp-lime enables customised solutions that optimise both aesthetics and functionality. This combination of materials demonstrates how bio-based solutions can provide both technical robustness and sustainability in contemporary construction.



Dimensions and u-value:

Con. Dim.: 380 mm

Ins. Dim.: 360 mm

U-value: 0,19 W/(m².K)

Installation instructions

Initial note:

This detail is designed for a hemp-lime wall exposed to driving rain. It is therefore essential that all sealing and surface treatments are carried out thoroughly to ensure durability and resistance to moisture.

Preparation of the opening:

- Ensure the opening in the hemp-lime wall is accurately measured and fits the window dimensions.
- Ensure the opening is stable and ready for installation.

Positioning and packing the window:

- Position the window in the opening and pack it so that it is correctly aligned with equal clearance to the surrounding construction.

Installation of the window frame:

- Pre-drill holes in the hemp wood to prevent splitting when installing the frame screws.
- Tighten the frame screws, finishing by hand to ensure precise control.
- Countersink the frame screws and finish with hemp wood plugs for a clean and durable appearance.
- Thoroughly seal the hemp wood with a suitable lacquer or oil to protect against moisture and driving rain.

Window sealing:

- Insert joint tape between the hemp-lime wall exterior and the frame to ensure a tight connection.
- Seal externally with tarred oakum, ensuring that all joints are completely sealed.
- Insulate between the frame and hemp-lime wall with hemp fibre to maintain thermal performance.
- Finish internally with joint tape and tarred oakum to ensure complete sealing.

In-situ cast reveals:

- The reveals around the window are cast in situ using hemp-lime.
- Form the reveals to ensure effective drainage and harmonious integration with the wall.
- Ensure that the reveals are sloped to direct water away from the window.
- Allow the reveals to dry thoroughly before finishing with lime plaster.

Lime plaster finish:

- Apply lime plaster to the in-situ cast reveals to achieve a smooth and durable surface.
- Allow the plaster to dry thoroughly and cure properly to provide protection against weathering.
- Apply an additional protective layer of lime plaster or a suitable surface treatment to increase resistance to driving rain.

EXTERIOR

Timber stud
t : 90x200mm (c-c 1200mm,
RtF : D,s2,d0

Lime plaster
t : 10mm
RtF : B,s1,d0
Z : 10

Tarred oakum
t : 12.5mm

Backer rod
r : 6mm

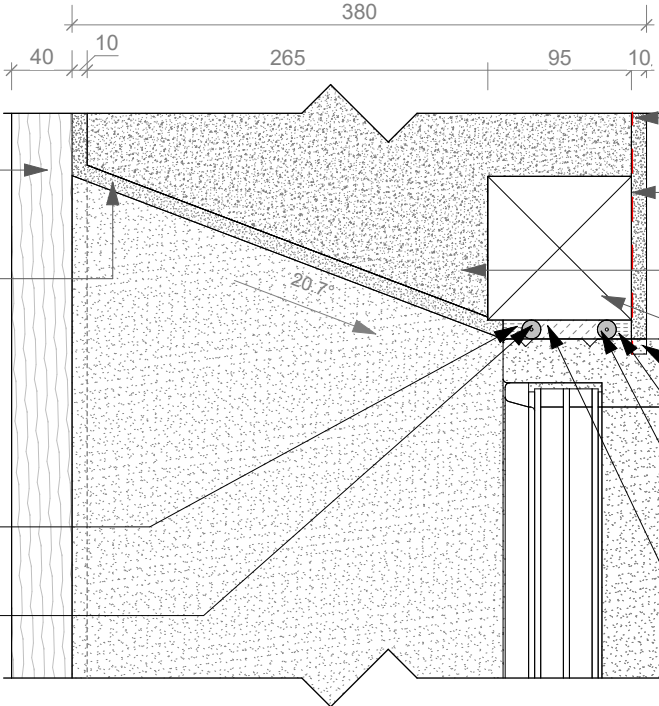
EXTERIOR

Timber stud
t : 90x200mm (c-c 1200mm,
RtF : D,s2,d0

Lime plaster
t : 10mm
RtF : B,s1,d0
Z : 10

Timber batten
t : 45x45mm
RtF : D,s2,d0

Tarred oakum
t : 12.5mm



INTERIOR

Lime plaster with hemp shiv
t : 10mm
RtF : B,s1,d0
Z : 10

Reinforcement mesh
t : 0.5mm

In-situ hemp-lime
t : 360mm
RtF : B,s1,d0
Z : 2,7

Window header
t : 95x95mm
RtF : D,s2,d0

Groove in window frame
t : 10x10mm

Tarred oakum
t : 12.5mm

Backer rod
r : 6mm

Hemp fiber
t : 12.5mm

INTERIOR

Backer rod
r : 6mm

Tarred oakum
t : 12.5mm

Lime plaster with hemp shiv
t : 10mm
RtF : B,s1,d0
Z : 10

Groove in window frame
t : 10x10mm

Hemp composite board
t : 11mm

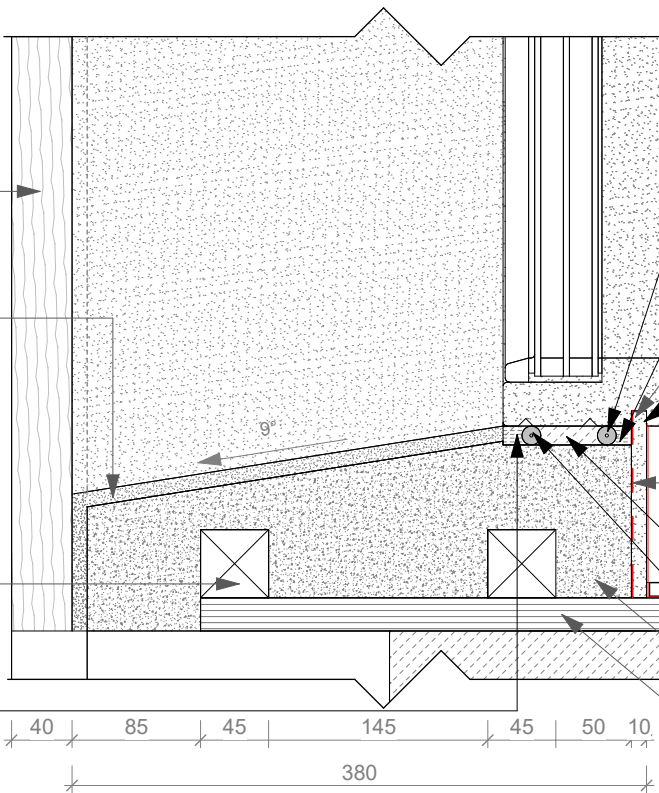
Reinforcement mesh
t : 0.5mm

Hemp fibre
t : 12.5mm

Backer rod
r : 6mm

In-situ hemp-lime
t : 360mm
RtF : B,s1,d0
Z : 2,7

Floor plywood
t : 22mm
RtF : D,s2,d0



PARTITION WALL WITH HEMP FIBRE

About the detail

This detail presents a lightweight partition wall that serves as a fully hemp-based alternative to conventional solutions using plasterboard, mineral wool and steel studs. The partition wall is constructed entirely from hemp-based materials—except for the timber frame—and demonstrates how these materials can be integrated into contemporary construction.

The detail also shows how the partition wall connects to the subfloor via a bottom plate, and how the project's floor tile material can also be used for skirting boards. This highlights how hemp-based solutions can replace conventional materials throughout a building—even in details such as finishes and surfaces.

Materials used

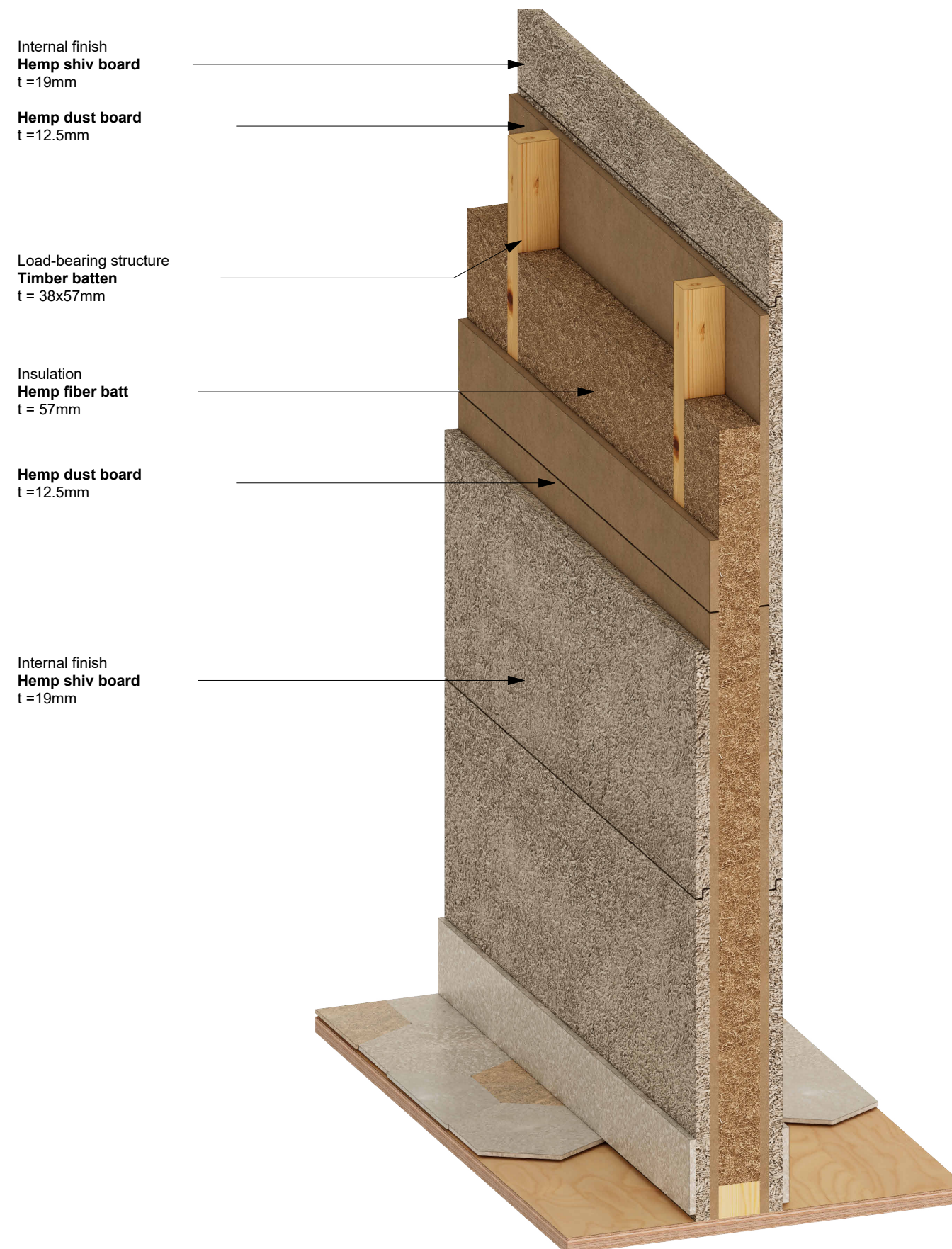
The partition wall is built up in layers from one side to the other:

- Lining: Hemp shiv boards on both sides, which can be finished with either clay or lime plaster/filler to achieve a smooth and aesthetically refined surface.
- Core materials: A hemp dust board provides bracing and acts as a vapour control layer, while hemp fibre insulation provides effective acoustic and thermal insulation.
- Finishing: The floor consists of floor plywood with hemp bio-composite tiles laid on top, while the skirting boards are made from the same tile material to create a consistent and sustainable finish.

Potential of hemp-based materials

This partition wall demonstrates significant potential for replacing conventional solutions in virtually all types of construction. The benefits include:

- CO₂ savings: Hemp-based materials store CO₂ rather than emitting it, as is the case with conventional materials such as plasterboard and mineral wool.
- Improved indoor climate: The materials are vapour-permeable and can regulate moisture, creating a healthier and more stable indoor climate.
- Low risk and easy implementation: Partition walls are protected from wind, water and sunlight, making them an ideal starting point for hemp-based solutions. The construction industry can therefore experiment with new materials at relatively low risk before moving on to hemp-based solutions for the building envelope.



Dimensions and u-value:

Con. Dim.: 120 mm

Ins. Dim.: 120 mm

U-value: --- $W/(m^2.K)$

Installation instructions

Initial note:

This partition wall is a fully hemp-based alternative to traditional solutions using plasterboard, mineral wool and steel studs. The partition wall incorporates hemp-based materials in all layers—except for the timber frame.

Partition wall construction

Bottom plate and timber frame:

- Fix a timber plate to the subfloor and ceiling to ensure stability.
- Install the timber studs vertically between the top and bottom plates and ensure they are level to form the main structure.

Core materials:

- Install a hemp dust board on one side of the timber frame to provide structural bracing.
- Install hemp fibre insulation between the timber studs, ensuring it fills the entire cavity.
- Install a hemp dust board on the open side to complete the core.
- If the partition wall is to function as a vapour control layer, tape the joints and seal the junctions with the floor and ceiling.

Lining:

- Fix hemp shiv boards to both sides of the partition wall over the hemp dust boards.
- Ensure the boards are tightly fitted and fixed to the timber frame with screws.

Surface finish:

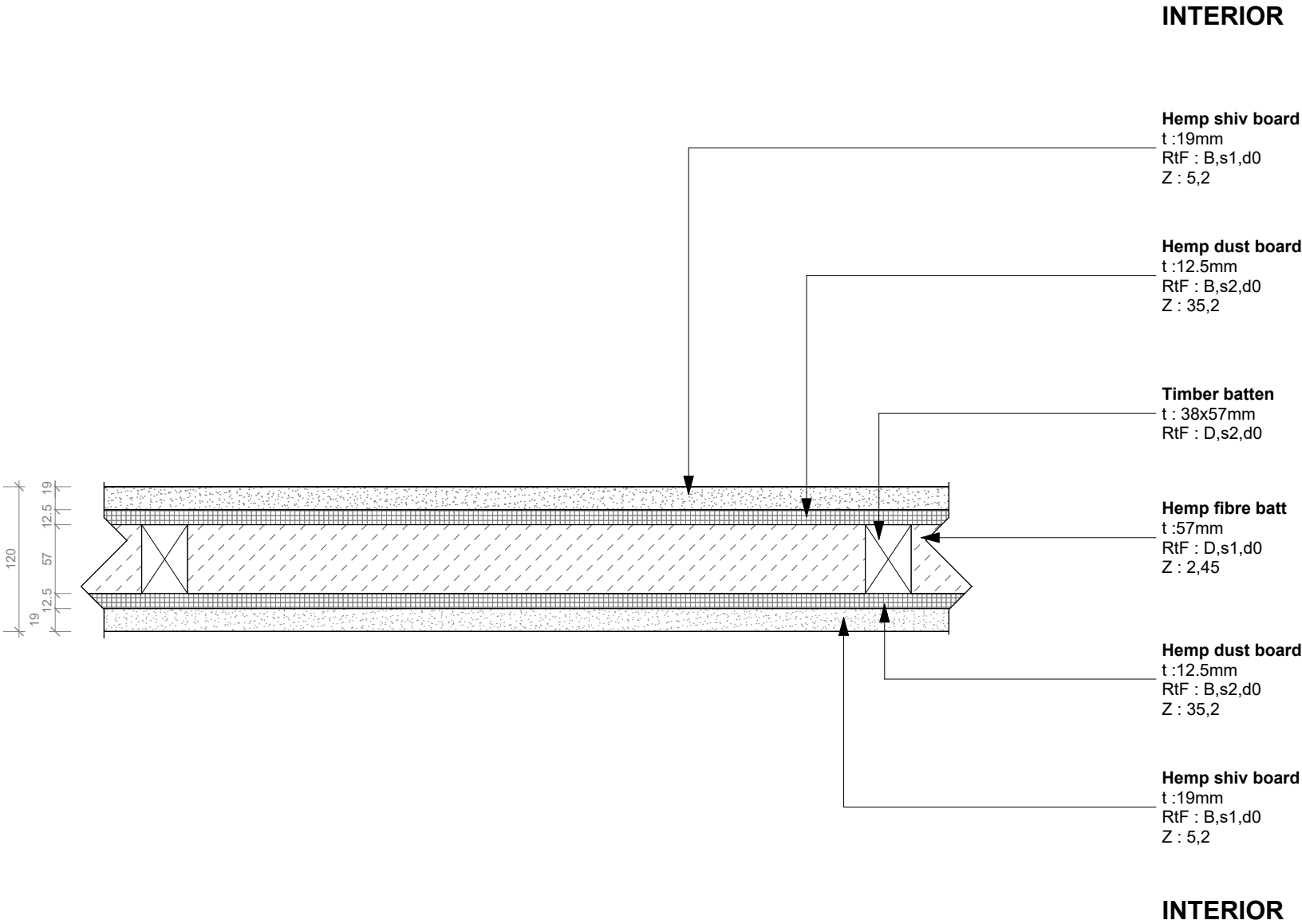
- Apply clay or lime plaster/filler to the hemp shiv boards to achieve a smooth and aesthetically refined surface.
- Allow the plaster to dry thoroughly before any further finishing.

Skirting board:

- The hemp composite skirting board can be bonded directly to the hemp shiv board or installed after plastering.

Note:

Bio-based materials are organic and must therefore be stored in dry and secure conditions on site, including before they are incorporated into the construction.



EAVES WITH HEMP COMPOSITE TILES

About the detail

This eaves detail is designed for buildings heated to a maximum of 15°C, with the insulation adapted accordingly. The external wall and roof share an identical construction system, simplifying construction and ensuring correct junctions at the corners. Hemp is a key material in both the roof and wall, and even the roof and façade cladding are the same with only minor differences in the support system. The multifunctional role of the hemp shiv board is clearly demonstrated here, as it serves as the internal lining for both the wall and ceiling, as well as forming part of the wind barrier and rigid roof underlay. The detail is designed for buildings without roof overhangs, with the gutter concealed behind a front profile while remaining easily accessible for maintenance. The roof underlay is raised at the eaves to allow direct drainage into the gutter.

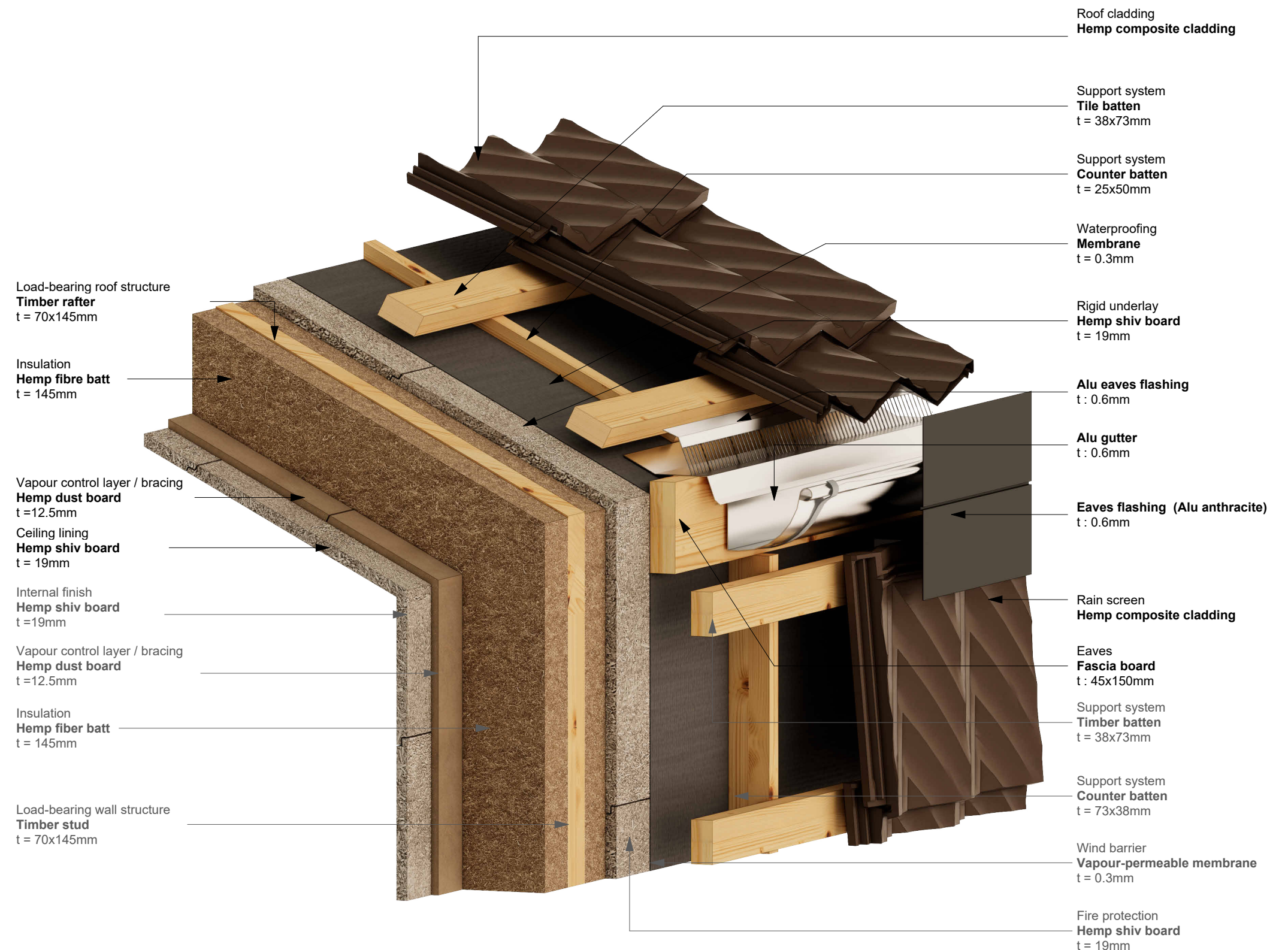
Materials used

The materials are the same for both the wall and roof and consist of the following layers, from inside to outside:

- Internal lining: Hemp shiv board
- Vapour control layer and bracing: Hemp dust board
- Insulation: Hemp fibre insulation between timber structural elements
- Additional sheathing: Hemp shiv board
- Membrane: Vapour-permeable membrane providing wind and water protection
- Support system: Timber counter battens and spacer battens
- Roof and façade cladding: Hemp composite tiles
- Finishing: Aluminium bird guard, drip edge, aluminium gutter and black-painted aluminium front profile

Potential of hemp-based materials

This detail demonstrates how hemp-based construction can achieve a modern and clean architectural expression, showing that the possibilities of bio-based construction are not limited. It demonstrates the potential of hemp to replace conventional materials throughout the building. The detail also highlights how simple and easy-to-construct building systems already exist and can readily be adapted to any design. This opens up opportunities for sustainable and versatile construction practices that combine functionality with aesthetics.



Dimensions and u-value:

Con. Dim.: 269 mm

Ins. Dim.: 145 mm

U-value: 0,27 W/(m².K)

Installation instructions

Roof construction (outside-to-inside principle)

External sheathing (roof and wall):

- Install hemp shiv boards as external sheathing on the timber structure.
- Ensure tight joints and fix the boards with screws or staples.

Vapour-permeable membrane:

- Install a vapour-permeable, wind- and watertight membrane on the outside of the hemp shiv boards.
- Extend the wall membrane beneath the roof membrane to prevent roof drainage from penetrating between the membrane and board.

Counter battens and spacer battens:

- Fix timber counter battens and spacer battens to the outside of the membrane.
- Ensure the battens are level and securely fixed to provide a solid base for the roof and façade cladding.

Fascia board and eaves:

- Install the fascia board at the required height to achieve the desired elevation of the roof underlay.
- Install the aluminium eaves flashing, bird guard and gutter on the fascia board.
- Ensure all components are correctly installed and watertight.

Roof and façade cladding:

- Install hemp composite tiles as roof and façade cladding on the counter battens.
- Ensure correct overlap and fixing to provide a watertight and durable finish.

Front profile:

- Install the black-painted aluminium front profile after the tiles have been installed and checked.
- Ensure the front profile is correctly installed and watertight.

Insulation, vapour control layer and internal lining:

- The installation of the insulation, vapour control layer and internal lining follows the same principles described in the external wall detail.

Completion of the building envelope:

The building envelope is now complete, and the construction is protected against wind and water.

Note:

Bio-based materials are organic and must therefore be stored in dry and secure conditions on site, including before they are incorporated into the construction.

EXTERIOR

Traspir evo uv 210
t : 1mm
RtF : B,s1,d0
Z : 100

Alu eaves flashing
t : 0.6mm

Alu gutter
t : 0.6mm

Eaves flashing (Alu anthracite)
t : 0.6mm

Fascia board
t : 45x150mm
RtF : D,s2,d0

Hemp composite cladding

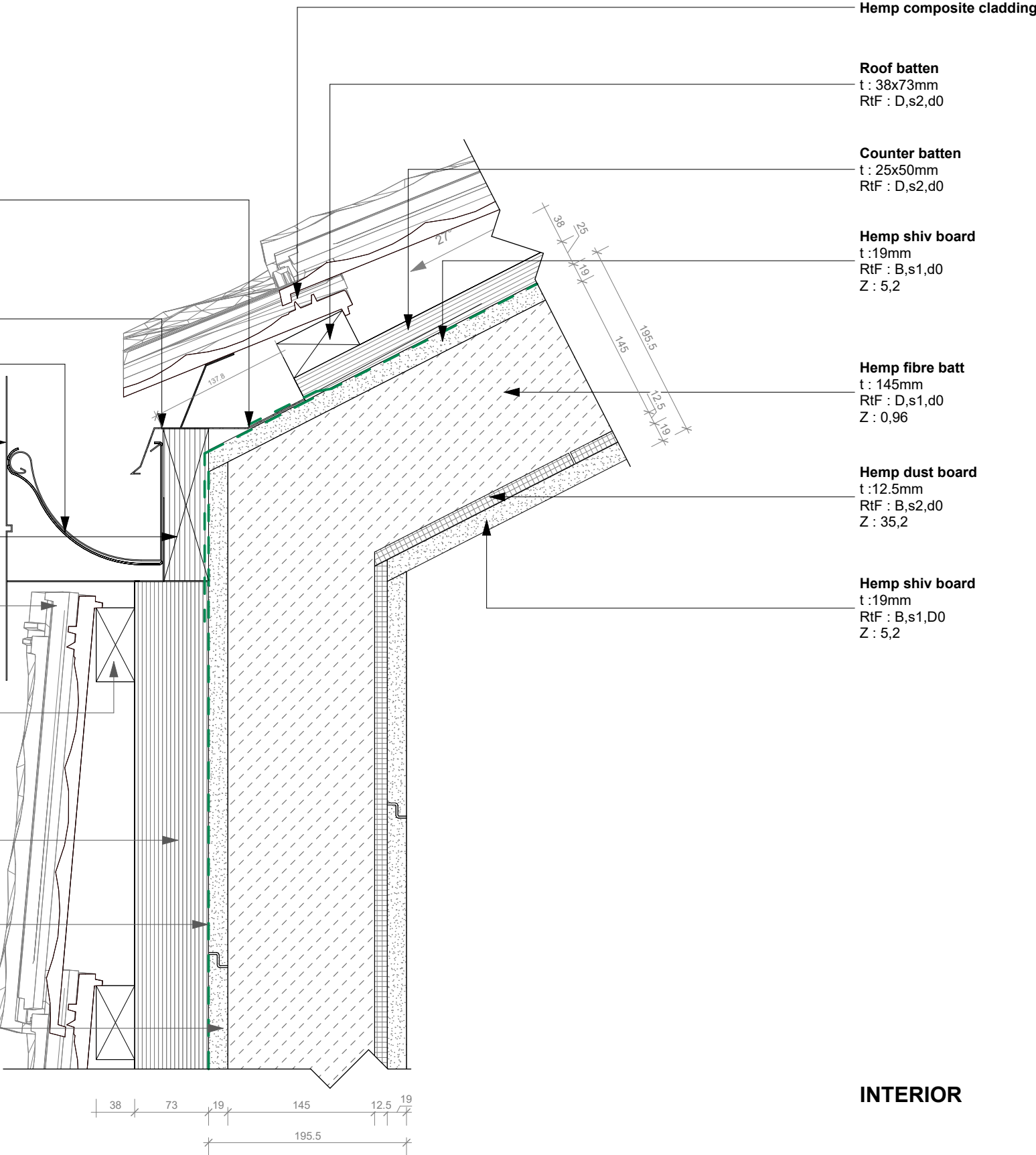
Timber batten
t : 38x73mm
RtF : D,s2,d0

Counter batten
t : 73x38mm
RtF : D,s2,d0

Traspir evo uv 210
t : 1mm
RtF : B,s1,d2
Z : 100

Hemp shiv board
t : 19mm
RtF : B,s1,d0
Z : 5,2

EXTERIOR



INTERIOR

MATERIALS AND ALTERNATIVES

Material overview for The Hemp House

This page provides a detailed overview of the products used in The Hemp House, including information on manufacturers and possible alternatives for each material. The overview has been prepared to provide inspiration and guidance for material selection in similar projects.

The overview can be used to:

- Identify the specific products used in the project.
- Find alternatives to the materials used if they are unavailable or need to be replaced.
- Compare the properties and performance of different materials.

Important considerations when substituting materials:

When replacing a material within a construction, it is essential to ensure that the alternative material has the necessary properties to maintain the function and safety of the construction. These include:

- **Lambda-value (λ):** The thermal conductivity of the material, which affects its thermal insulation performance.
- **Strength:** The material's ability to withstand loads and maintain its structural properties.
- **Tightness:** The material's ability to resist air and water penetration.
- **Fire classification:** The material's fire performance and classification in accordance with applicable standards.
- **Vapour permeability:** The material's ability to allow moisture transport, which is important for the indoor climate.

It is important to ensure that, following any material substitutions, the overall construction continues to comply with Danish building legislation and the technical requirements applicable to the building's use and location.

The overview is intended as a practical tool to support the decision-making process when selecting materials and to ensure that the chosen solutions are technically sound, sustainable and legally compliant.

Material function:	Product:	Manufacturer:	Possible alternatives:	Important considerations with alternatives:
Structural bracing and vapour control layer	Hemp dust board EPD: No RtF: D-s1,d0	SAM Panels	OSB 3/4 - other high-density building boards	The board serves both as structural bracing and as a vapour control layer. Alternatives must have the necessary structural properties and airtightness compatible with the vapour-permeable construction.
Insulation (lightweight)	Hemp fibre batt EPD: Yes RtF: D-s1,d0	Ekolution	Bio-based insulation batts made from hemp, wood, grass or jute.	Bio-based insulation materials may be used freely, provided that their varying lambda values and fire classifications are taken into account. If insulation with reaction to fire class E is used, it must be covered by a K1 10, B-s1,d0 on all sides.
Insulation (in situ)	Hemp-lime EPD: No RtF: B-s1,d0	Hempire	Hemp shiv can be replaced with chopped straw, wood chips, miscanthus or other finely divided biomass.	Hemp-lime, or hempcrete, is a well-tested and widely used product. If the biomass is replaced, the wall's properties in terms of moisture transport and lambda value will change and must therefore be documented.
Ground insulation	Expanded cork EPD: Yes RtF: D-s1,d0	Amorim	No known bio-based alternatives are available.	Cork has the unique property of being hydrophobic and water-repellent, unlike any other known bio-based material, which would otherwise absorb water. It is therefore not recommended to use alternatives to cork where the insulation is exposed to the surrounding ground, as in The Hemp House.
Internal lining	Hemp shiv board EPD: No RtF: B-s1,d0	Materials We Like	Where K1 10, B-s1,d0 is required for a specific project, no known bio-based alternatives are available.	For internal linings, pre-accepted solutions often require a classification of K1 10, B-s1,d0. The only known alternatives are non-bio-based conventional products such as plaster-board or fibre gypsum board.
Wind barrier membrane with fire protection behind	Vapour-permeable membrane + hemp shiv board Membrane: EPD: Yes RtF: B-s1,d0	Rothoblaas og Materials We Like	Where K1 10, B-s1,d0 is required for a specific project, no known bio-based alternatives are available. Otherwise, a wood-fibre-based wind barrier may be used.	For external sheathing serving as a wind barrier, pre-accepted solutions often require a classification of K1 10, B-s1,d0. The only known alternatives are non-bio-based conventional products such as wind gypsum boards or cement-based boards. If B-s1,d0 is not required, wood-fibre-based wind barrier boards may be used; however, the insulation used must then have a minimum classification of D-s2,d2.
Rigid roof underlay	Vapour-permeable membrane + hemp shiv board Membrane: EPD: Yes RtF: B-s1,d0	Rothoblaas og Materials We Like	There are many bio-based rigid roof underlay boards made from wood fibre or compressed straw.	If wood-fibre- or straw-based rigid roof underlay boards are used, it should be noted that they are generally classified as E and are therefore highly combustible. These may be used in pre-accepted solutions. Depending on the roof covering used, its classification may require the rigid roof underlay beneath it to have a density these alternatives cannot meet.
Roof and façade cladding	Hemp composite tiles EPD: Yes RtF: D-s1,d0	NPSP og nikolova/aarsø	Alternatives for roof and façade cladding include various timber cladding solutions, such as timber shingles, boards, etc., or thatched solutions.	Roof coverings must be classified as BROOF(t2) in accordance with the pre-accepted solutions. Always ensure that the manufacturer has documentation confirming this. Thatched alternatives are not classified as BROOF(t2), and therefore place greater requirements on the roof underlay and roof structure, which must be complied with.

THANKS TO THE PARTNERS AND FOUNDATIONS FOR BUILDING AND CO-FUNDING THE HEMP HOUSE



A sincere and heartfelt thank you to all partners and foundations who have contributed to the realisation of The Hemp House. Your commitment, professional contributions and financial support have made it possible to create an ambitious demonstration and knowledge-sharing project in which bio-based building materials have been tested in practice and made accessible to the entire construction industry.

Thanks to your contributions, The Hemp House now serves as an open learning environment where experience is shared, materials are tested, and new solutions are transformed from ideas into reality. The project demonstrates that the green transition in construction is not only about visions, but also about collaboration, courage and the willingness to take the next step.

The baton is now passed on to clients, consultants, craftspeople, manufacturers, educational institutions and decision-makers who can help bring bio-based building materials into everyday construction. Expanding the practical use of these materials is essential if we are to build healthy buildings for people, reduce the climate impact of construction and promote more responsible use of resources. The Hemp House is a starting point. The next steps and the real change will be shaped by those who choose to build on the experience gained.

On behalf of Building Based on Bio Based and the local partners

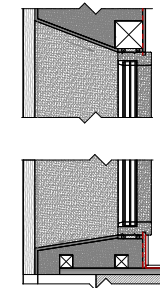
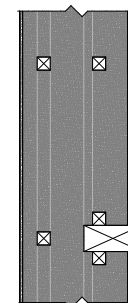
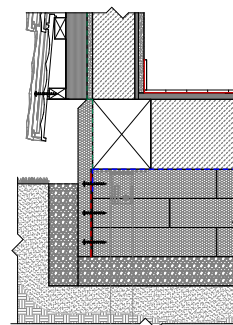
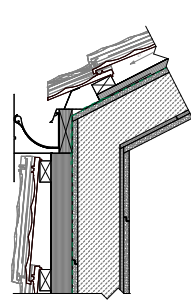
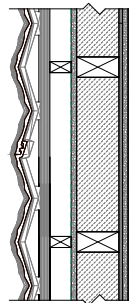
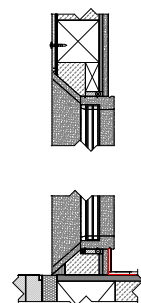


**Interreg
North Sea**



**Co-funded by
the European Union**

BBOBB



nikolova/aarsø ApS
FALKONER ALLÉ 47, 1.TV.
2000 FREDERIKSBERG- DENMARK

info@aboutna.com
+45 61 45 32 13

aboutna.com