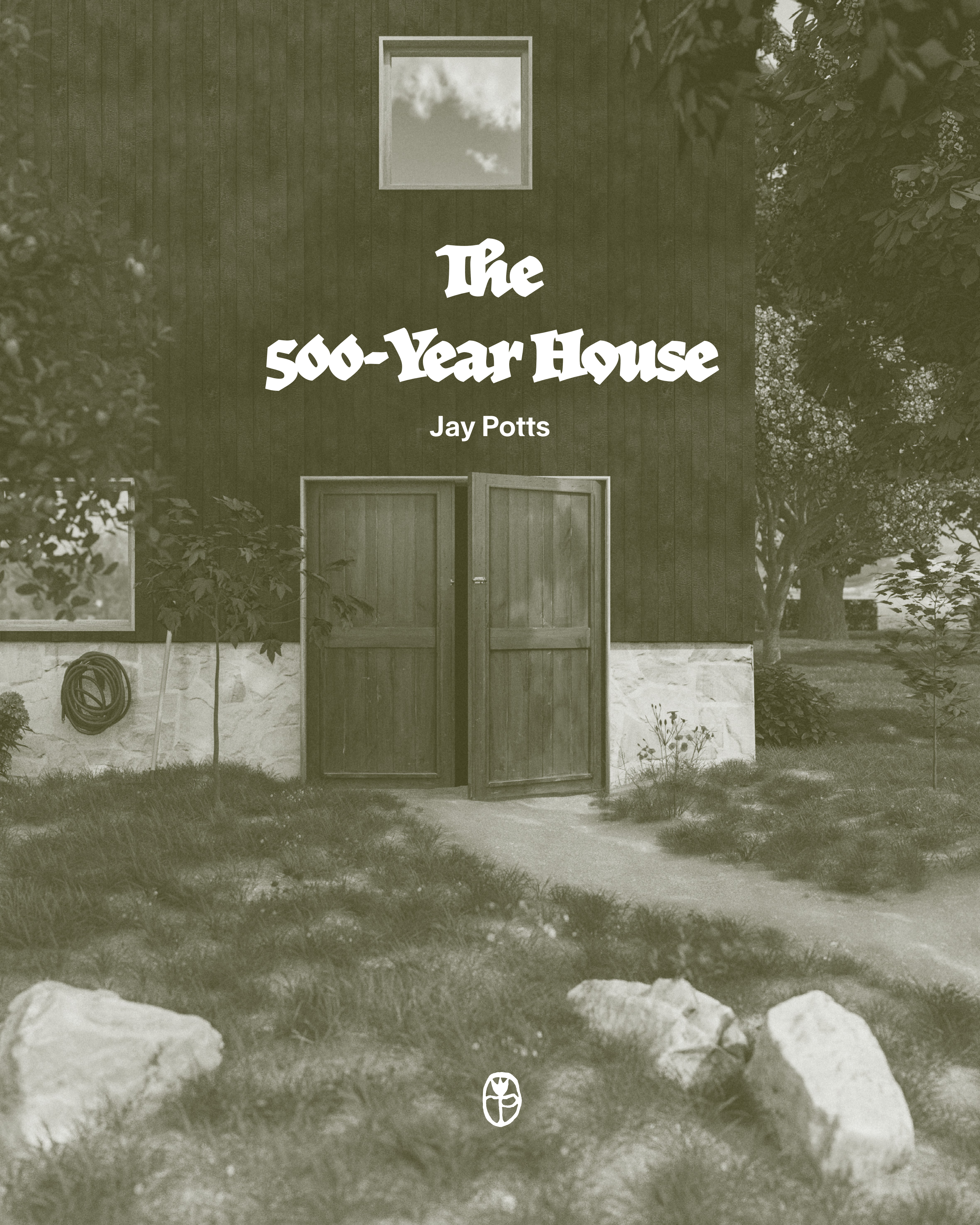

The 500-Year House

Jay Potts

The 500-Year House

Someplace In-Between

During the period of Britain's Great Rebuilding five hundred years ago, for the first time rural communities had the means to build relatively expensive buildings out of permanent materials, and the security of tenure to make these investments worthwhile. Today, multi-billion dollar developer corporations are building homes that live barely one tenth as long as their ancient counterparts. Britain now boasts the poorest quality housing stock in Europe, and the construction industry accounts for over 60% of waste generated in the UK. Are disposable homes by design or merely a bi-product of our throwaway culture? What does it mean to design for longevity above all else, and how can this create resilient homes and communities?

By researching vernacular buildings, their construction techniques, materials, and the culture of care and maintenance that surrounds them, this thesis proposes a new method of rural home building; someplace in-between a romantic notion of the past and the modern desire for affordable, quality homes.

The 500-Year House
Jay Potts
Diploma 1 Thesis
AA School
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Editor's Note

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1.1 Introduction

It's impossible to pinpoint the exact moment in history when the UK lost touch with its traditional building practices. While some scholars point fingers at the modern movement that swept Europe in the 1920s, others trace the demise of the traditional house to Inigo Jones and the introduction of the classical house in the early 17th century.[1] It might be fitting to blame architects for the demise of the traditional house; one often sees a break from tradition as a sort of enlightenment—a move towards better and more sophisticated systems. Besides, the history of architecture is one fraught with architects seeking to self-actualize, to situate themselves above the "primitive," "vernacular," and "unsophisticated" buildings of their fore-bearers. How might it look for architects to praise the genius of amateurs? Of non-pedigreed builders, of farmers swinging hammers? And what fool would dare state that the building arts peaked with the cob wall and thatched roof?

This essay is a call to action. It hopes to reawaken deep-seated architectural knowledge. Knowledge that lies within everyone; not just architects. It advocates for a return to the harmonious building practices of the past to face a future fraught with growing inequality and environmental destruction. I come to you now, humbly a fool; typing away in a wool jumper and wool socks, one cold day in a damp warehouse conversion in East London. I come to you with all the modern amenities, yet unable to run the heating for its high cost, and unable to escape the moist air for lack of proper ventilation. I write and dream of a huge clay hearth and a roaring fire. I imagine myself in an untamed wood with a small creek running nearby; a mystical encounter with a grazing deer; and an explosion of wild calls at sundown. I used to dream of the city and a fresh pair of trainers but now I dream in Wellies. I know I dream not in solitude.

Fig. 1 Boarhunt Hall, reconstructed at the Weald and Downland Museum. Image courtesy of the Museum.

In the past decade, there has been a resurgence of young urbanites seeking refuge in wild and in quasi-agrarian lifestyles. "Tiny-houses," "van-life" and "homesteading" are some of the minimalist lifestyle trends which exploded on social media in the early 2010s. Most recently, the term "cottagecore" has jumped 100x in popularity between November 2019 and November 2020 (Google Trends), suggesting the modern resurgence in simple, subsistence lifestyles has largely been catalyzed by the 2020 pandemic. Photographer Olivia Harris cataloged the slow crawl of Londoners during this period in her publication "Days on Repeat" (fig. 2). Browsing through it's full bleed images, it's hard not to feel nostalgic for this period of simplicity. Of course, for many, this was a time of extreme peril; of job loss, insecurity, and of course illness and death. But the "new normal" gave lots of people their lives back. They suddenly had time to cook, take care of plants and pets, and could spend a whole weekday reclined in a park six feet from their closest friends. What we learned from the pandemic was twofold; it amplified preexisting urban problems (lack of public amenities, cramped housing, etc) and made us aware of what was essential in our lives (connection, leisure time, etc). Now, we've already regressed to the "old normal," but some folks are still holding onto vestiges of the slow life.

So, what does it mean to build a model in England for the slow life today? Well, it might already be on the horizon. Bi-partisan consensus sees developing the greenbelt as a means of solving the housing crisis. The greenbelt, comprising 13% of land in England is a series of rings of open land encompassing large urban cores.[2] It's general purpose to is to check unrestricted urban sprawl

Fig. 2 Image from Harris' "Days on Repeat," documenting pandemic life in East London. © Olivia Harris.

and preserve the historic environment of the countryside.[3] A study in 2021 found that 55% of 18-34 year old Londoners were already considering living elsewhere, with 19% opting to live somewhere greener, such as in the countryside.[4] This demographic also comprises the majority of tenants (68%) in search of new General Needs lets on the social housing; 71% of whom are women.[5] As we look to the future, it is essential to examine what types of urbanity are suitable in this landscape and for this younger population. In the recent past, residential building trends in the countryside have followed their urban counterparts with cheap and fast being the driving tenets. As a standard, houses in the UK are built to last 50-60 years, but many of their component parts have just 10 to 20-year lifespans. Britain is facing problems with its housing stock, which compared to EU averages is older and in poorer condition.[6] There are promises on both sides of the aisle to deliver new homes over the next five years, but much of the rhetoric echoes promises of the low-quality mass housing boom of the post-war period. What remains of this era is shoddy construction, mismanagement, and profit-driven development.[7] This legacy is partially accountable for why 62% of waste in the UK is generated by the construction industry (fig. 11), and we risk perpetuating it well into the future.[8]

The problem here is clear; with the emergence of a new rural population of ex-urbanites who will put increased demand on existing, depleted housing stocks, will it be business as usual for new developments, or can we imagine a different future for rural architecture? What does it mean to establish meaningful communities in these regions and how do we rekindle a relationship with this landscape that will last? If not 50, what does a 500-year home look like?

To do so, we might look to the past to see which models have endured in England, and which have failed. The vernacular homes of everyday Britons will be the starting point, but we will also look towards modern natural homes that take cues from their ancient types. We will draw upon the similarities between amateur building in Britain's past and the contemporary movement of self-building and look towards architecture that emphasizes "sustainability in the form of durability." "Sustainable" means practices that can be carried out indefinitely into the future. At the urban scale, ecovillages offer a model for harmonious integration of housing into the greenbelt. If the vernacular is a model of the sustainable past, then the ecovillage is the contemporary model of the sustainable future. Ultimately, I argue towards sustainable development and a "reawakening of cultural identity"[9] through *genius loci* and the study of the vernacular and the natural house.

Fig. 3 Tindal's Cottage at the Weald and Downland Museum

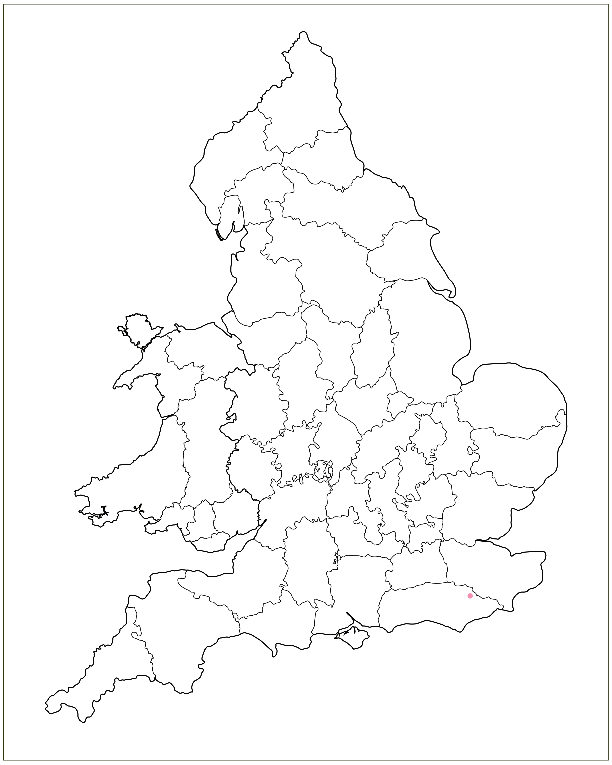

Fig. 4 Original location of Tindal's Cottage in East Sussex

Fig. 5 East and West Elevations.

Fig. 6 North and South Elevations.

1.2 The Vernacular House

Few, if any, vernacular buildings today predate the social revolution of the late 14th century, which saw the demise of the feudal system and the birth of the yeoman farmer. The Black Death, which swept Europe between 1348-1349, decimated Britain's population, leading to a shortage of labour that seeded deep resentments towards the landowners. Lords of the manor began amalgamating strip allocations into large open fields and leasing demesne land to those who had survived the plague. A new class of yeoman farmers "holding land to the value of 40 shillings"[10] were born out of this reorganization, who peppered the English lowlands with Wealden Hall Houses, modeled after the large manor houses of the aristocracy. With thick walls, thatched roofs, and a central room heated by a large hearth, these cottages are well documented, and often constitute the material imagination of the British vernacular, largely because other preceding forms have long been lost. We can conclude that the yeoman cottage (fig. 1) of the 14th century represents the "vernacular threshold;" a term describing the period after which common houses were built to be robust enough to have survived to the present day.[11]

Of course, there are surviving examples of British buildings from before this time—the castles of the 11th century come to mind—but many of these would hardly be considered vernacular. R. W. Brunskill marks the distinction between the "polite" and the "vernacular" as buildings which produce, more than solely utilitarian results. The former are typically designed and constructed by architects, master buildings, or other professionals acting in similar capacities, such as craftsmen like stonemasons and carpenters, whereas the latter have been "designed by the amateur, and probably the intended occupier of the building."[12] Simply, the "polite" and the "vernacular" is the difference between "architecture and mere building." Similarly, Rudofsky describes the vernacular as "non-pedigreed architecture."[13] What happens when the profession wholeheartedly embraces the vernacular? What happens when we formalize it, and 'improve' upon it?

Fig. 7 Craigievar Castle, ca. 1576. The restoration of Scotland's castles to their original colouration is a material expression of cultural heritage. © National Trust for Scotland.

To start, we can see what it already does well. The quality of a vernacular house often comes down to how well it typifies the use of "a good hat, boots, and overcoat." This addage refers to its foundation, roof, and weatherproofing, which vary largely depending on the region in which it was constructed (see 2.2 Mapping the Vernacular House). Today, a "good home" that is well built and well designed is judged on additional criteria, including, energy efficiency, air quality, and lighting, to name a few, but those core princi-

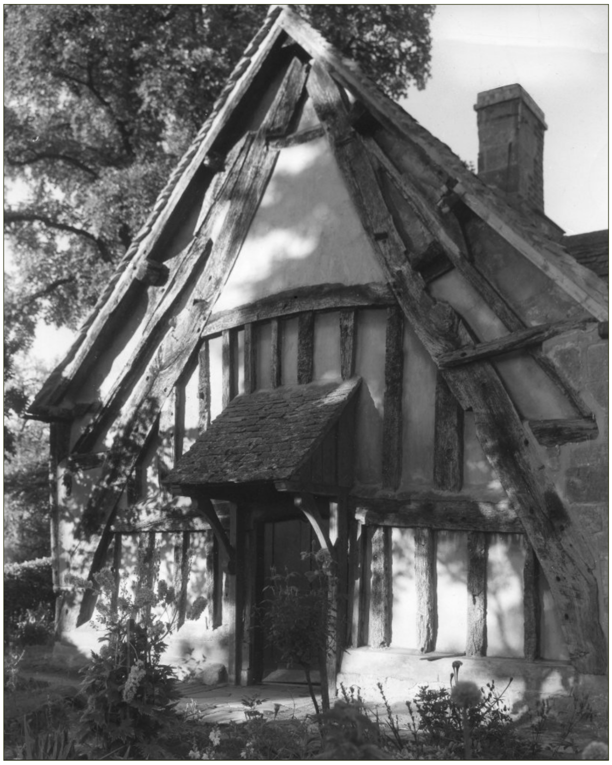

Fig. 8 Ancient Cottage at Didbrook in Gloucestershire.
© RIBA PIX

Fig. 9 Elevation of the Cottage at Didbrook.

ples remain. In this way, the natural house—which I argue is the modern equivalent of the vernacular house—should adopt the very best strategies used in old and new homes. We can treat this model as a beautiful beast; a Frankenstein's monster that combines the strongest constituents available.

This conceit emphasizes the relationship between the vernacular house, the body and the landscape. The house was usually constructed by whoever would eventually occupy it, using whatever materials were locally abundant. In addition to the use of local raw materials, there was a strong culture of reuse, with vernacular homes often incorporating elements from the houses they superseded. A living example of this is Tindall's Cottage (fig. 3-6, full-scale drawings in section 2.1), which has been rebuilt at the Weald and Downland Living Museum. Upon reconstruction, it was discovered that "nearly all of the oak used in the timber frame was re-used from other, earlier, buildings."[14] Similar to building elements, construction techniques were also passed-down, often from father to son. This culminated in buildings that were firmly rooted in landscape, culture, and heritage. A loss of the vernacular tradition thus coincides with a loss of these tenets. This is especially true for timber building in England. A majority of surviving vernacular buildings used sturdy oak crucks felled locally. Today, England imports 80% of the timber used in its homes, most of it softwood from China, Sweden, United States, Germany and Finland.[15]

We know from the Doomsday Book of 1086 that at the time, 15% of England's land area was covered by woodland. Before that, it is estimated that England was 60-70% covered in trees, largely ash and oak.[16] This dropped to 7% by 1300 and 5% by the beginning of the 20th century, largely due to the golden age of ship building in the 18th century and the strain of the first World War. In 1919, the Forestry Commission was created to own and manage state-run forests. As a result, there are surviving ancient woodlands today, and in 2022, Britain's woodland cover rose to 13.3%.[17] While the prospects of large-scale timber building with local trees is a long way off in England, architects might start to imagine how small-scale models of sustainable building and forestry can arise in tandem.

Hooke Park is a prime example of harmony between architecture, building, and landscape. Beyond the computational techniques used to unearth the structural propensity of natural forms, Hooke Park offers a model of hyper-locality. Architectural outcomes are informed by the tools and materials at-hand, and the building labour is sourced from students, who pass on the building and the techniques to the successive cohort. Crucially, Design + Make fuses time-tested practices with modern technology and industrial processes. We can begin to categorize the work of Design + Make as a type of optimized, or techno-vernacular. Self-build on steroids or even, paradoxically, expert DIYing. The recent work by Wyatt Armstrong's "Blade Building" media studies course at the AA exemplifies this new model (fig. 10). It brings the tradition of British cruck construction (fig. 8-9) into the 21st-century imagination. Of course, this is just one example of a new approach that catapults traditional techniques into the modern era. Every year it seems a new mode of building emerges from Hooke Park that does exactly this, all the while reminding the profession that radical and sustainable propositions can be realized and industrialized.

Fig. 10 Pavilion from Armstrong's CMS1 "Blade Building" course. Armstrong is an architectural robotics developer and tutor at Hooke Park.

1.3 The Vernacular vs. the Modern House

We are in desperate need of better models for sustainable building. The stock of today's copy-paste, anonymous housing, built cheaply and without longevity in mind can partially explain why construction, demolition & excavation (CD&E) generates 62% of the UK's waste (fig. 12). Adam Curtis' 1984 film "Inquiry: The Great British Housing Disaster" attributes these poor construction practices to the 1960s council housing boom. However, the problems here stem from an even earlier time. In 1945, a New Towns Committee created government-sponsored corporations tasked with developing new, garden-city revival towns. Between 1946 and 1972 twenty-two new towns were created, most of them satellites to Greater London.[18] A majority of these homes were built with

Fig. 11 Concrete and steel prefab housing in Hillingdon, 1949.
© Hulton Archive/Getty Images via Science Museum Group

pre-cast reinforced concrete (PRC), hailed for requiring less skilled labour and quicker build times (fig. 11). Throughout this period, there was a scarce supply of quality building materials, and the need to construct housing at speed outweighed the priority of durability. As a result, many of these homes were poorly built and by the 21st century had run their serviceable course. The problems associated with prefabricated housing continued into the 1960s, which saw these technologies implemented at the untested scale of high-rise housing.

The Labour Government, which came into power in 1964, hoped to spur productivity in the construction sector by subsidizing factory-built high-rise housing. Sensing a new lucrative market, contractors invested millions in new factories often before a single order was placed. Given the size of their investment, contractors became concerned with finding quick and cheap methods to maximize their returns. In "The Great British Housing Disaster," Gordon Stobbs, Assistant Chief Architect of the Nottingham City Council from 1964-1974, sums up the general approach by contractors as: "get it built as quickly as possible, then think." This often involved the sale of "package deals" where the contractor was sole designer, provider of the materials, and supervisor of the jobs. With little to no external oversight, the contractor had all the power to make time-saving and corner-cutting decisions to maximize profits. As a result, many estates were demolished not 15 years after they were built.

Today, we are still feeling the effects of the poor housing stock in Britian. According to the October 2023 Home Builders Federation (HBF) International Housing Audit, 15% of British homes failed to meet the Decent Homes Standard in 2020.[19] This Standard outlines the minimum requirements for housing, such as: "it is in a reasonable state of repair" and "has reasonably modern facilities and services."[20] Simultaneously, the UK has some of the oldest housing stock in Europe. 78% of British homes were built before 1980 and 38% before 1946, compared to the EU average of 61% and 18% respectively.[21] This is in part due to historically low levels of new house building,[22] a phenomenon that was long overdue by the Labour Government's 1964 call to build 500,000 new homes per year.[23] The UK is also a very unaffordable place to buy or rent a home, with 15.1% of the UK population living in households that are spending more than 40% of their income on housing.[24] With a housing stock that is old, in bad condition, and expensive, it is no wonder why the housing crisis is at the centre of Britain's woes.

Along with poor construction techniques, we

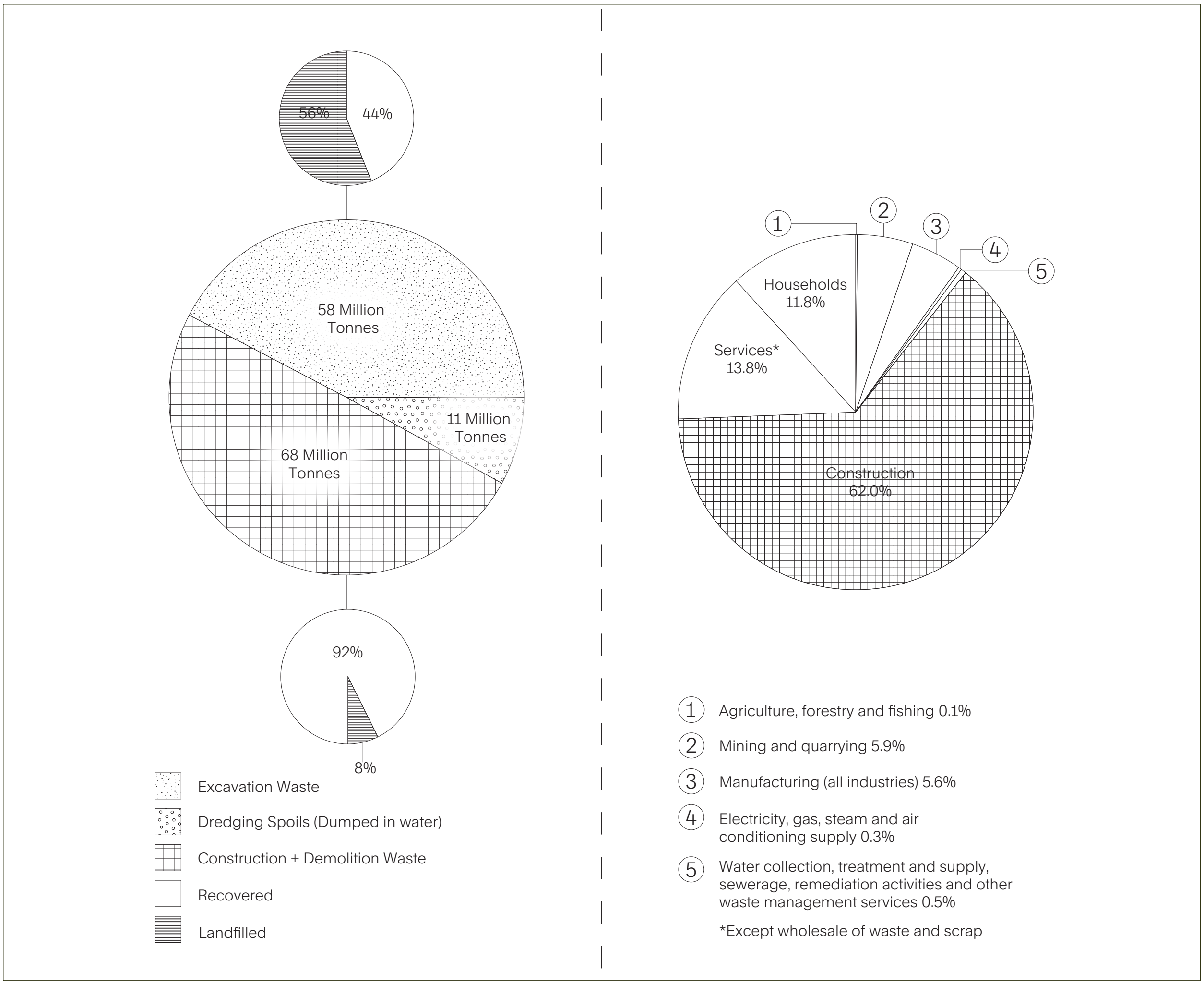

Fig. 12 C,D & E Waste Generated in the UK (left), Total UK Waste (right). GOV.UK 2018: DEFRA

might also blame the commodification of housing for the poor state of Britain's homes. Since 1980, the "right-to-buy" scheme has seen a large number of council houses purchased at a discounted rate by tenants. If they are compelled to sell, this scheme disincentivises local councils to build more affordable housing as it sees their initial investment vanish only a few years after housing is built.[25] Further, the scheme cannot ensure these homes remain in the hands of local tenants, as there is no way to hinder the resale of council houses once they have been lawfully purchased. This has concentrated what should have been non-profit housing into the hands of landlords who now control a radically inflated rental market. As a result, there is now only 2.2 million council homes, down from 6.5 million in 1979, and 4.4 million households rent privately, twice the rate fifteen years ago.[26] The waitlist for council housing in England stands at 1.6 million households, many of them younger people who face shoddy rental accommodations, which can explain their desire to leave urban centres behind.[27]

Fig. 13 A street corner in Shoreditch. A common site in London. Via @scrapspotting on Instagram.

Fig. 14 Image of Right to Repair activists, from the "Waste Age" Exhibition at the Design Museum.

At the same time, our homes often fall victim to our cultural propensity to rapidly consume and dispose of commodities. Obsolescence in design is partially fueling this waste epidemic, and extends to the design of our homes. As a generalization, designers often enable the generation of waste by creating "solutions" to problems that don't exist, then treat their effects with more, ever-complex solutions. As a slight digression, no better, catastrophic, example can be given than geoengineering. To some scientists, the solution to climate change lies in solar radiation management (SRM), which involves the dispersal of sulphuric mist in the stratosphere. Under this scheme, instead of decarbonizing the grid, uninhibited capitalism would be allowed precipitate, until, eventually, the whole-earth system would be unimaginably destabilized through habitat loss, extinction and acidification.[28] On a smaller scale, we can look at housing remodels. Updating homes to meet modern standards of comfort and energy use will often create waste through the use of poor materials and trendy finishes and furnishings. This mean that these updates are seldom future-proof and require re-updating a handful of years down the line. Just look at any street corner in London; I guarantee you'll find traces of melting Swedish particle board (fig. 13).

Concurrently, we can look at the modern house, which today is a complex, technological organism. Since the 1970s energy crisis, homes have become increasingly sealed-off in the name of energy conservation.[29] The *eco-house* and *passivhaus* are today's equivalents; sealed plastic envelopes promising guilt-free consumption of energy-ef-

Fig. 15 The Oast House in Godmersham. © Oast House Archive

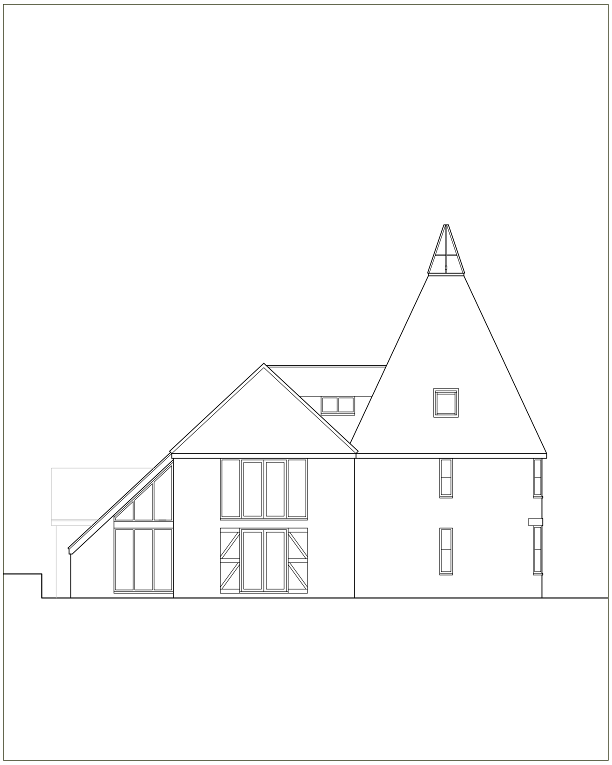

Fig. 16 North Elevation

ficient pleasures. Previous models, such as Sears' "Modern Homes," Monsanto's "House of a Future," and Bucky's "dymaxion house," promised similar "standard-of-living-packages" for the modern era.[30] When we treat the housing envelope as an impermeable membrane and not a "third-skin," it leads to other problems, such as "sick building syndrome,"[31] which are solved by implementing more technology, such as mechanical ventilation. Current building methods mean 15% of Britain's population lives in homes suffering from damp, a leaking roof and rot in frames or floors.[32] In the vernacular house, the indoor environment was constantly refreshed through gaps, and most importantly, the central stack. A constant fire in the large, open fireplace, sent most of the moisture generated from cooking, drying clothes, and boiling kettles up the chimney. Even in the winter, this generated "at least four air changes an hour whilst the fire was in place."[33] Further, during the summer, the large open hearths benefited from a "summer fireplace" where a small fire would be lit to create an updraft to draw fresh air through the home (fig. 17). In other cases, a substantial stack would absorb solar gain on a hot summer day, which would direct air up the stack through convection and passive ventilation.[34]

Similar techniques of ventilation are perhaps most visible in conical industrial and agricultural buildings such as kilns and Oast Houses (fig. 15-16). These funny buildings have dotted the Kentish landscape since as early as the 16th century, and use the venturi effect to draw heat up the chimney and through latticed drying platforms. Today, many have been converted to residences, with an of-

Fig. 17 Inglenook fireplace at Lummus House in brick and timber. Summer fires can be lit in the nooks on the rear wall. © A. Boynton via Flickr.

fice, bedroom, or dining room placed in the oast. Similar conversions have taken place in lighthouses, silos, and even windmills. In any case, the utility of the conical roof has been rendered entirely useless. This is a common affliction among conversions; where once utility and building form coincided, all types of unfitting hybrids are emerging from the desperate need to increase Britain's housing stock. Perhaps it is lack of imagination, or pressures from the market, but one can only dream of the social and political revolution required to reinstate such buildings rather than re-purpose them into housing.

These conversions are stark reminders that British agriculture and manufacturing are in decline. In addition, whole sectors of the white-collar economy are now increasingly threatened by AI, the effects of "work from home," and "cost of living crises." Coincidentally, these challenges have spawned movements like "quiet-quitting" and "digital nomadism," which seek a return to restorative lifestyles and new modes of simple, rural living. While I don't believe these movements will catalyze a complete return to agrarian life, we can speculate on how work and the workforce will change, especially if AI succeeds in giving us boundless leisure time (which I doubt). What would we do with that free time? Would we become anchored in our echo-chambers? Would we retreat to digital pleasure realms? Or, would we find meaning by enriching our local environment? A vernacular revival demands critical takes on how to live harmoniously within our context, and how we might develop models for longevity in world where technological and social revolutions are inevitable.

Fig. 18 Self-building at Walters Way. AA Photo Library

Fig. 19 Walters Way. AA Photo Library

Fig. 20 Cruck trusses at Avon Tithe Barn, ca. 14th century.

Fig. 21 Avon Tithe Barn

Fig. 22 of 1:20 model merging Segal and the vernacular.

Fig. 23 Exterior of 1:20 model

Design for harmony with the planet	Design for peace for the spirit	Design for health of the body
-Site, orient, and shelter the home to make best and conserving use of renewable resources. Use the sun, wind, and water for all or most of your energy needs and rely less on supplementary, nonrenewable energy. -Use "green" materials and products - nontoxic, nonpolluting, sustainable, and renewable, produced with low energy and low environmental and social costs, and biodegradable or easily reused and recycled. -Design the house to be "intelligent" in its use of resources and complement natural mechanisms, if necessary with efficient control systems to regulate energy, heating, cooling, water, airflow, and lighting. -Integrate the house with the local ecosystem, by planting indigenous tree and flower species. Compost organic -Wastes, garden organically, and use natural pest control - no pesticides. Recycle "greywater" and use low-flush or waterless toilets. Collect, store, and use rainwater. -Design systems to prevent export of pollution to the air, water, and soil.	-Make the home harmonious with its environment - blending in with the community, the building styles, scale, and materials around it. -Participate with others at every stage, using the personal ideas and skills of all in order to seek a holistic, living design. -Use proportions, forms, and shapes that are harmonious, creating beauty and tranquillity. -Use colours and textures of natural materials and natural dyes, paints, and stains to create a personal and therapeutic colour environment. -Site and design the house to be life enhancing, and increase the wellbeing or the vital life force, *ch'i*, of its occupants. -Connect the home with Gaia and the natural world and the rhythms and cycles of the Earth, its seasons, and its days. -Make the home a healing environment in which the mind and spirit can be free and flourish.	-Create a healthy indoor climate by allowing the house to "breathe", and use natural materials and processes to regulate temperature, humidity, and air flow and quality. -Site the home away from harmful EM radiation from power lines and also away from negative ground radiation. Design to prevent the build-up of static and EMF from domestic equipment, and to avoid interference with beneficial cosmic and terrestrial radiation. -Provide safe and healthy air and water, free from pollutants (radon especially), with good humidity, negative-ion balance and pleasant fragrance from herbs, materials, and polishes. Use natural air flow and ventilation. -Create a quiet home, protected and insulated from external and internal noise, and a pleasant, sound-healthy environment. -Design to allow sunlight and daylight to penetrate, and thus rely less on artificial lighting.

Fig. 24 The Gaia House Charter by Gaia Architects.

1.4 The Natural and the Self-Build House

The vernacular house reminds us that we know how to build to last. It is timeless, handmade, ecological, and meaningful to the people who helped build it. In this light, the modern house with its bleak, analytical machinism is the antithesis of the vernacular house. Today, the natural house is what we might call the “modern vernacular,” but there are some important distinctions. Modern applications of the vernacular are often heavily aestheticized. Developers might adapt “vernacular forms” to appease local character guidelines, while disregarding crucial vernacular strategies like building with local and natural materials. An aestheticized vernacular house might blend contemporary building practices—mineral wool insulation and polyurethane vapour barriers—with exterior applications that mimic the vernacular, such as cement instead of lime plaster, and brick veneer. Often, the passivhaus or the eco-house takes on these qualities. In contrast, the natural house has certain modern comforts, but relies mostly on ancient knowledge of materials and processes.

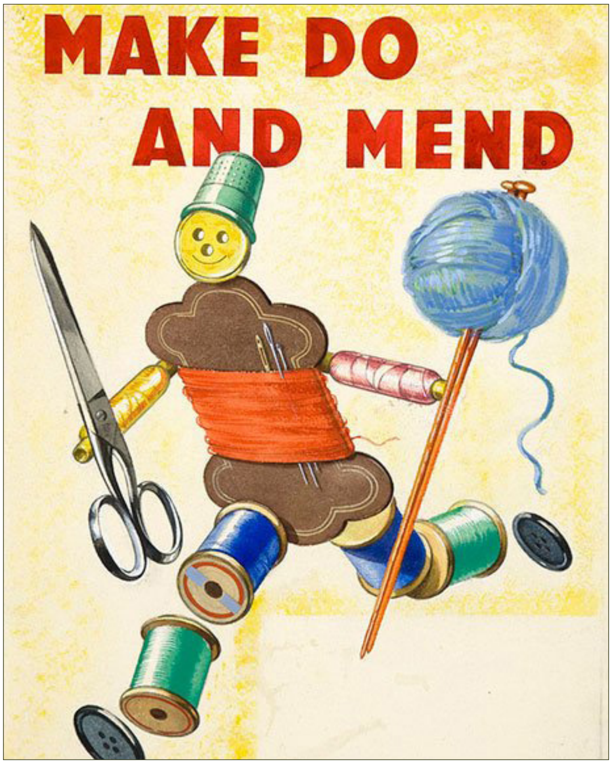

Fig. 25 "Make Do and Mend" poster from the Ministry of Information, 1939-1945

Fig. 26 Villa Verde Project by ELEMENTAL, 2013. Image courtesy of the Pritzker Prize in Architecture, 2016.

When I talk about the natural house, I am really referencing the principles set out in the Gaia House Charter (fig. 24). Founded in 1984 by Howard Lidell, Gaia Architects (now Gaia Group) pioneered sustainable development and "green architecture" in the UK. In short, the charter propounds design for harmony with the planet, peace for the spirit, and health of the body.[35] Within these sections are specific actions, such as "integrate the house with the local ecosystem," "participate with others at every stage," and "allow the house to breathe."[36] These same strategies can be widely applied to vernacular houses. If we combined vernacular and natural house strategies, we could arrive at some additional points that might include:

1. Design for longevity. Understand life cycles of building materials and components; how best to apply them and source them when they need repair or replacing. People and lifestyles change; allow the building to remain light and evolve over time. Technological elements should be modular so they can be swapped and upgraded. Be critical of trends and try to design for timelessness

2. Design for maintenance. Building upkeep and repair should be considered from the project's outset. Strategies such as sacrificial elements, modular structural components, demountable joints, and standardized parts should be considered. Keep key elements such as structure, cladding, and roofing separate to facilitate the interchange of components. The budget should include maintenance costs and an upkeep plan for at least one generation. Above all, the design should be simple enough to understand and alter

so the occupants can easily undertake repairs without needing specialists.

Point 2 brings up an important parallel between the vernacular and the DIY/self-build movement which spurred from WW2 self-reliance. During this period, the Ministry of Information, which formed the day after Britain's declaration of war, created posters like "make do and mend" (fig. 25) in the face of material scarcity. In 1962, the BBC's "Bucknell's House" helped bring home improvement to the masses. Concurrently, counter-culture movements like free love painted DIY as a tool for social revolution.

In the 1970s, self-build developed again out of necessity, this time in response to the oil crisis of 1973 and ensuing recession. In 1976, Walter Segal's systems approach was published in a special edition of *Architectural Design* that spurred a British movement of self-builders that continues to this day. This pioneering method introduced "sweat equity" into the affordable housing scheme. Residents built seven single-storey houses at Segal's Close in Lewisham, resulting in homes 25-40% cheaper than comparable London housing costs.[37] This was made possible through a successful partnership with the local council, and further resulted in the Walter's Way development of 13 homes just a mile's walk from Segal's Close (fig. 18-19).

Whereas material scarcity informed self-build of the post-war period, today we might reflect upon how a society of abundance has generated "a lack of being" through the "acceleration of contemporary life."[38] Many self-builders, off-grid homesteaders and even "survivalists" share a desire to become "agent[s] of [their] own transcendence."[39] To them, this begins by seeing "dwelling as an act rather than an object."[40] In this way, the farmers and yeomen who built their cottages 700 years ago, and the self-builders of today share an intimate knowledge of their home and its processes. They see themselves as part of the building ecology and seek to repair, update, and care for their homes. In the same light, modern DIY is generally open access (WikiHouse, U-Build, for example) and freely exchanged between enthusiasts in acts of communal support and mutual aid. This strengthens social bonds and affects waste relations as handmade and repaired objects and buildings are less likely to be disposed of due to embodied sweat equity.

Perhaps the most notable use of self-build in the past decade is Alejandro Aravena's Villa Verde project, cited by the 2016 Pritzker Prize (fig. 26). The driving factor of this forestry workers housing project was the budget of 700 US$/m2 (including cost of land). Working within these constraints, ELEMENTAL decided to build "half a good house" rather than a "whole bad house" for the workers. Ironically, we are left with a cruel *double entendre* whereby "have a house" became "half a house." The built reality highlights this contradiction, with houses that are neither half nor whole, but seemingly unfinished. The general critique is simple: where is the architect for the other half?

The Segal approach might have offered a solution through a directed self-build system to take after the contracted start. This would have enabled the resident builders to follow a system; one which might optimize material use and offer various strategies for different budgets. If we consider this application in the UK, by combining the two approaches, we might arrive at a cooperative model where the council provides the land and the framework, the architect provides their expertise, and the resident provides their labour. Crucially, the council has a stake in the project because their initial investment would be lower than council housing with right-to-buy, the architect has stake because

Fig. 27 Houses at the Findhorn Ecovillage. © IrenicRhondavia Flickr.

Fig. 28 Gardens among housing at Findhord. © PunkToad via Flickr.

they operate as a design and construction consultant throughout the build and maintenance scheme, and the residents have a stake because their inputs (labour, material costs, etc) help finance their mortgage.

Segal's method inspired projects all over Britain, even after his death in 1985. Although Segal actively denounced ideological architecture (he instead believed architecture should first be practical), the Diggers cooperative in Brighton (ca. 1990) reminds us that self-build is always political. The name "Diggers" is a term used to refer to the "True Levellers;" a dissident group of agrarian socialists who cultivated common land in the mid-17th century. They sought to establish a communistic utopia derived from the ecological bond between humans and nature. Ultimately, the vernacular house, the natural house, and the self-build house offer paradigms for a future where we are more connected with our context. A future built on the interrelationship between us, our homes, and our environment.

1.5 The Vernacular as Permaculture

In 2021, the House of Commons Housing, Communities and Local Government Committee called for a review of the "purpose of the greenbelt," citing concerns that it restricts urban development and is assisting in the housing shortage.[41] This is in-part reflected in the National Planning and Policy Framework (NPPF), which states the fundamental aim of the greenbelt is to "check the unrestricted sprawl of large built-up areas."[42] As noted earlier, the "untapped potential" of developing agricultural land is not to blame for the housing shortage, rather it is ill-built, profit-driven development. In late 2023, Tony Juniper, chair of Natural England, proposed developing the green belt as the solution to the housing crisis.[43] This sentiment is echoed in Kier Starmer's Labour Party bid to build 300,000 new homes per year if elected in the 2024-2025 general election, which includes releasing lower-quality greenbelt land for development.[44] This same target of 300,000 new houses per year is the amount promised in 2019 by the Conservative government, who have failed to meet their pledge by around 65,000 houses per year.[45] Even more concerning is the lacking provisions for social housing. At present, the government's affordable homes commitment for 2021-2026 is a mere 180,000 new homes.[46] As noted by the housing charity Shelter: "there is no point in building 300,000 homes a year if the vast majority are overpriced flats and houses that people on average or lower incomes can't afford."[47]

It seems the same "numbers-game" rhetoric of the 1960s is again rearing its ugly head. Today, we run the risk of repeating the "build now, think later" approach to meet the demands of housing, rather than thinking long-term about the effects of hasty development. At the same time, we are failing to address the 1.6 million people waitlisted for affordable housing who are most vulnerable to inflated costs of living and rising house prices. Rather than overhaul the NPPF, is there a way to deliver high quality social housing, while amplifying the value of the greenbelt? If we acknowledge the lessons gleaned from vernacular and natural house building, can we imagine a model of planning for 500-year urbanity? For concision, this thesis will not address all possible solutions. However, one which shows considerable promise is the "ecovillage," an agricultural co-housing typology.

Based on the 1991 Gaia Trust global survey carried out by Diane and Robert Gilman, an ecovillage can be defined as "a human scale, full-featured settlement, in which human activities are harmlessly integrated into the natural world, in a way that is supportive of healthy human development and can be successfully continued into the indefinite future."[48] This definition was based on examples of preexisting ecological co-housing projects around the world, including the Findhorn Ecovillage (fig. 27-28) in Scotland which remains the largest intentional community in the UK. "Intentional community" means residents have a high degree of social cohesion and shared values and work together on shared goals. Established in the 1960s, Findhorn has grown into a community of more than 500 people who share ideas around sustainability, social unity and spiritual connection to the land. In essence, the community is a social laboratory investigating alternative and innovative solutions for a sustainable future. This includes harvesting of wind and solar power, biological sewage treatment, and ecological home prototyping. They also have a car-sharing system rather than individual car ownership. At the same time, they grow organic produce for the area and champion local and ethical business practices. Today, it is the centre of the Global Ecovillage Network (GEN) which comprises 10,000 communities from around the world.

If the bi-partisan consensus around building on the greenbelt remains popular in the coming years, adopting ecovillage principles can curb the negative impacts of development. If we probe the NPPF, there are already indications of the potential of building ecovillages on the greenbelt. Specifically, paragraphs 154 and 155 highlight constructions that are "not inappropriate" for the greenbelt. "Buildings for agriculture and forestry," "limited affordable housing for local community needs," and "development brought forward under a Community Right to Build Order or Neighbourhood Development Order" are deemed appropriate, given they maintain the openness of greenbelt land.[49] As per the last point, the Localism Act of 2011 has increased access to community-led housing through Right to Build, highlighting the viability of intentional communities.

The ecovillage typology has the potential work at the scale of mass social housing in Britain because it delivers high quality housing while enriching the social welfare and ecology and of its immediate context. As explored earlier, the limiting factor of social housing development today is cost. Materially, vernacular/natural house construction is very cheap, but relies on a huge number of labour hours. Self-build offers a way to reduce the cost of housing for the council and the residents, and empowers the occupants by building communal bonds through mutual aid. We have already seen the success of partially council-funded and sweat-equity subsidized housing at Segal's Close and Walter's Way. Sweat equity could, for instance, help the 15.1% of the population who already spend 40% of their income on housing. For example, if that 40% was spent through labour hours of construction, the residents would be able to keep those labour hours rather than selling them to a landlord in the form of rent. 40% of your labour hours equates to two days of the work week. In theory, working 3 days in stable, part-time employment and 2 days on construction per week, would allow those workers to retain that 40% in the form of home-ownership. In this way, over the course of construction, the residents would be able to pay off their mortgage using their own labour, and build generational wealth.

Findhorn is just one example of a UK-based ecovillage, and has inspired other developments such as the Centre for Alternative Technology in Wales and LILAC co-housing in Leeds. Because environmentalism is a core principle in these communities, it's architecture often reflects a sensitivity of place. At Findhorn, the earliest settlements were constructed from re-used whiskey barrels and other recycled materials. LILAC co-housing uses lime-plastered straw bale construction, and includes allotments for residents and community members to grow produce. Agriculture is central to these co-housing projects because it fosters community through mutual aid and can help subsidize grocery bills. Careful soil maintenance and growing a mix of annual and perennial crops can also create much-need habitats for animals and bugs in the otherwise mono-cropped pasture land covering the majority of the greenbelt. In the case of overgrazed, brownfield or so-called "low-value greenbelt," permaculture gardening, which is core to ecovillages, can actually remediate soil biology.[50]

Permaculture is shorthand for permanent or perennial agriculture. It was founded in Australia by Bill Mollison and David Holmgren, based on techniques of natural farming developed in Japan by Masanobu Fukuoka. In essence, this farming technique is based on ecosystems planning. After initial seeding, it requires very little maintenance and inputs such as watering and fertilizer. If formalized into planning, permaculture cultivation would retain access to open green space alongside housing development in the greenbelt. Light, daily gardening has also been shown to promote healthy, long lives, as shown in Netflix's hit show "Blue Zones" released in 2023. Similar to the revival of vernacular building techniques, permaculture farming stems from a modern desire to replicate forms of sustainable land stewardship. In this way, we can expand the definition of permaculture to mean "permanent building culture" to acknowledge the enduring harmony of historic buildings in Britain's landscape.

1.6 Conclusion

To conclude, this dissertation cannot claim to solve the housing crisis. It merely offers a model for the sustainable development of social housing should the UK government seek to expand cities into the greenbelt. Already, cities are proving too expensive for younger people who are most susceptible to rising costs of living, and many of them are already considering moving to the countryside to live more simply. A model for this new urbanity is offered by ecovillages, which already have a long history in the UK. This could involve the creation of medium-density housing constructed with vernacular and natural house techniques, set in a permaculture landscape. Housing would be built on the guiding principle of longevity, rather than speed, in order to avoid the poor quality housing associated with the explosion of mass social housing in the 1960s. Self-build and permaculture gardening would foster strong communal bonds in these settlements through mutual aid. At present, National Planning Policy hints at the potential for this form of development, but additional laws would likely be necessitated.

A general critique of this plan involves the comparison with the *Garden Cities of Tomorrow* brought forward by Ebenezer Howard in the 1902, which inspired the first greenbelt guidance under the NPPF in 1955.[51] The Garden City Movement led to the creation of around 20 post-war satellite towns, that suffer the same blights as North-American suburbs, such as increased car dependency and low-density urban sprawl. Garden Cities differ from the proposal in this dissertation in that these new ecovillages would be built on the periphery of existing settlements, blending the boundaries between the urban cores and surrounding greenbelts. The financial model for these new ecovillages involves commitments from both local councils and residents who can contribute their sweat equity to subsidize the costs of development, and ensure access to affordable housing through community land trusts.

Another critique would be comparing this model to land use in medieval serfdoms. Here, peasants would live and work on the land they toil. Ironically, a popular sentiment in modern economics is that we are already living in a sort of “technofeudal” society. Yianis Varoufakis argues cloud services, such as Amazon and iCloud, are charging rent for what is essentially privately-owned use of public infrastructure. Further, landlords, who control the unregulated rental market in England are free to fix rental prices to keep renters from accumulating savings to purchase their own property. Private equity firms are also buying up single-family homes to inflate housing costs for ordinary citizens. Ecovillages offer a way out of these rental serfdoms because the residents would own the land upon which they would cultivate and live. Further, living here would not be contingent upon surplus value generated from agricultural activity. Permaculture gardening would simply offer a balanced, “slow-life” for the residents.

Ultimately, the ecovillage model presents an urban plan where space which is normally given over to cars is kept productive and green. If we can achieve a medium-density of housing among agricultural land which maintains the traditional use of greenbelts while striving to reach the government’s social housing goals, it is not impossible to imagine how similar planning principles can be implemented around the country. Planning for 500 years, rather than 50 years into the future, is a way to establish sustainable modes of dwelling for present and future generations.

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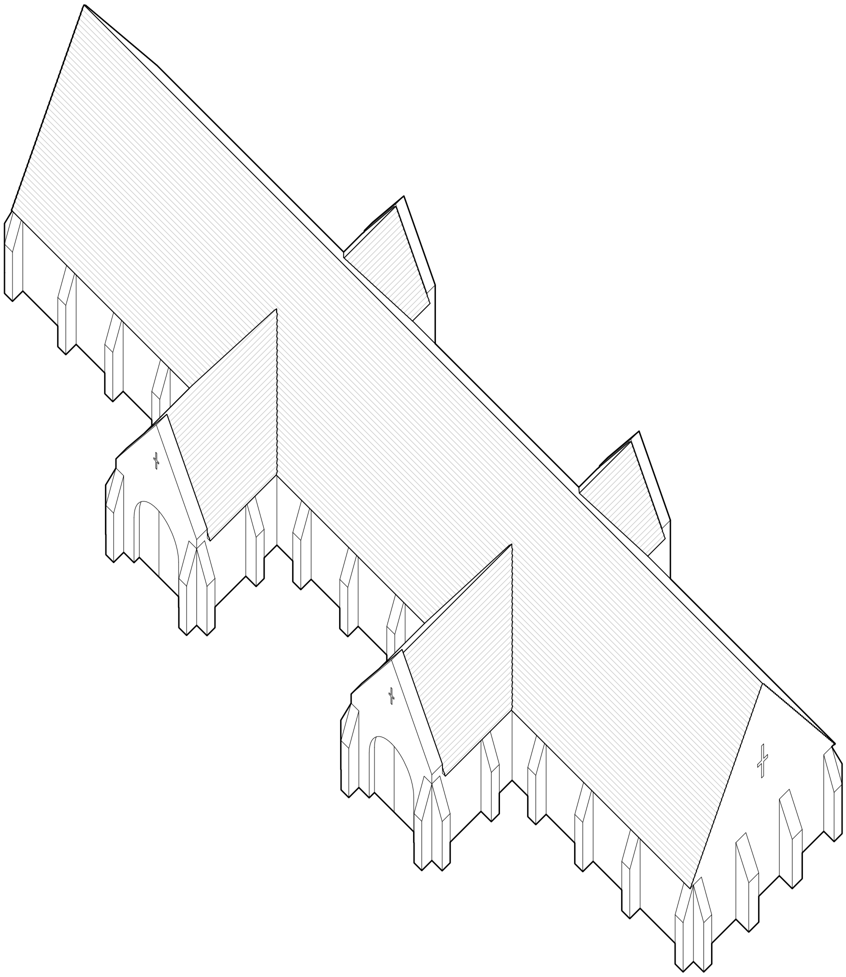
Old postcard depicting the Bradford-on-Avon Tithe Barn.

Index

2.1 Full-Size Case Study Drawings

For reference, full-scale drawings of the case studies used throughout the paper are included in this index along with additional drawings not previously shown.

Project Title **Bradford-on-Avon Tithe Barn Case Study** Author Jay Potts	Client AA School Project Start Date 2023.11.09 Project End Date 202X.XX.XX	Drawing Title **Location Map** Issue Date 2023.11.10	Paper Size: A4 Scale: N/A Drawing No. **A-401** *Image Attributions: RIBA PIX*



Project Title

Bradford-on-Avon Tithe Barn Case Study

Address

Barton Farm Country Park, Pound Lane, Bradford-on-Avon, BA15 1LF

Client

AA School of Architecture

Project Start Date

2023.11.08

Project End Date

202X.XX.XX

Notes

-The Great barn at Bradford-on-Avon dating from the 1330s
-By 1914 it was no longer required for the manor form, but listed under Historic England
-Repairs began in the 1950s, including faithful restorations to the roof carried out by craftsmen still in traditional carpentry and joinery
-Limestone walls, quarried nearby, with deep external butresses
-Roof uses cruck contruction for the primary trusses, but varies in construction based on the available timbers
-Roof is covered in stone slate
-51m long and 9.5m wide

Modifications

Drawing Title

Axonometric

Paper Size

A4

Scale

1:300

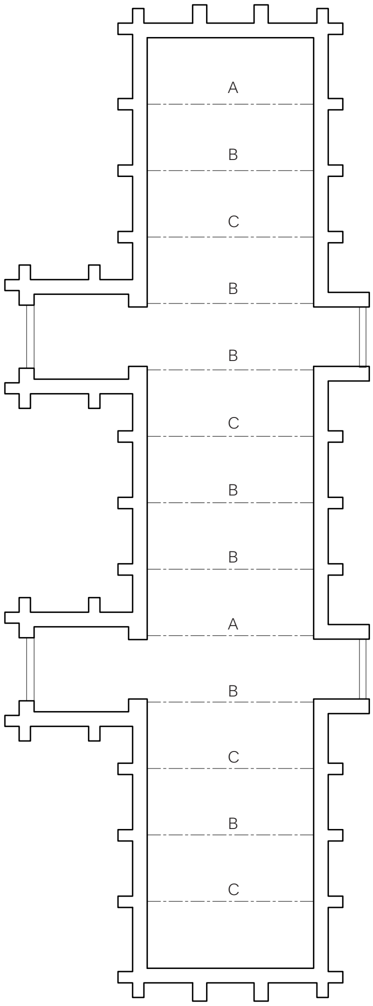
Drawing No.

A-901

Issue Date

2023.11.10

POTTS INDUSTRIES



Project Title	Client	Drawing Title	Paper Size	Scale
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Author	Project Start Date		Drawing No.	North
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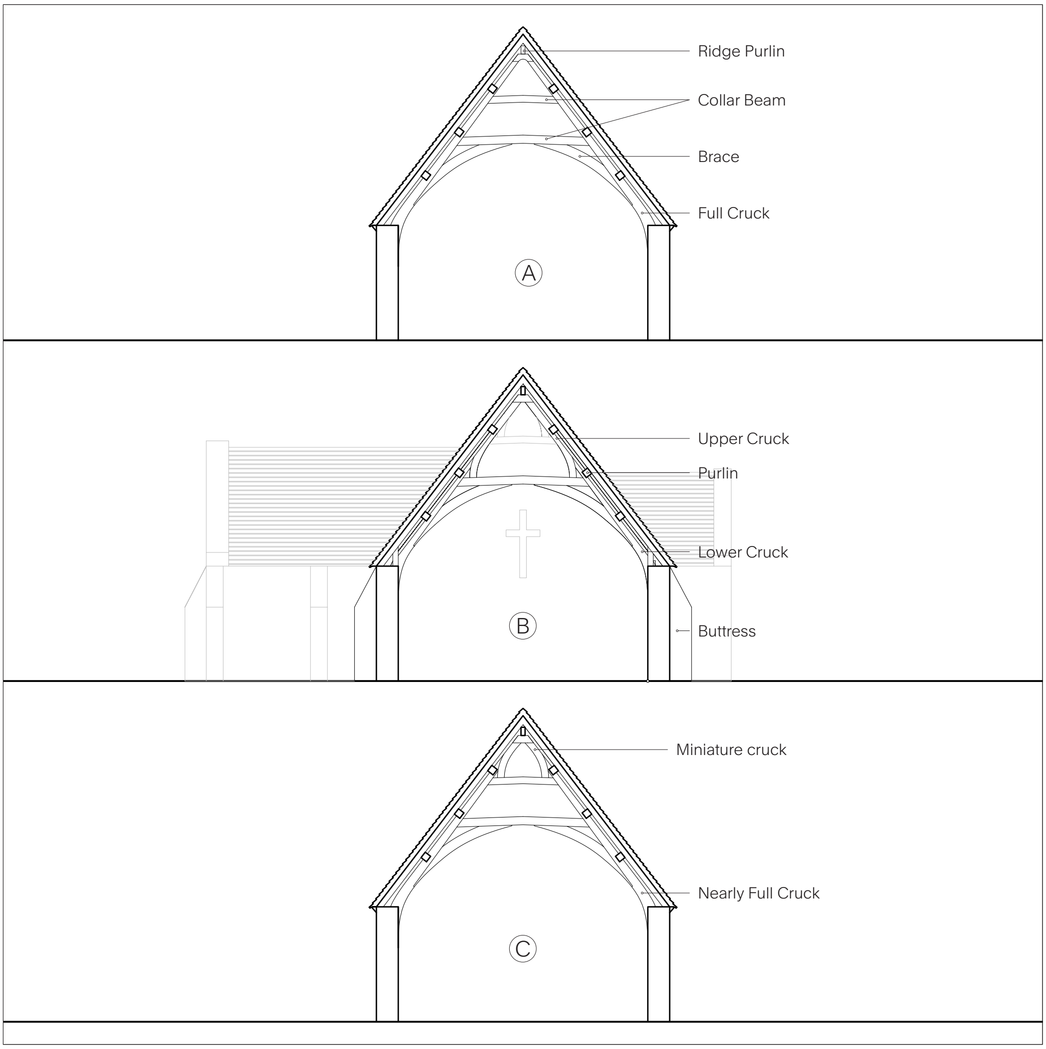
	Project End Date	Issue Date		
	202X.XX.XX	2023.11.10		



Project Title

Bradford-on-Avon Tithe Barn Case Study

Address

Barton Farm Country Park, Pound Lane, Bradford-on-Avon, BA15 1LF

Client

AA School of Architecture

Project Start Date

2023.11.08

Project End Date

202X.XX.XX

Notes

-A: full crucks, rising the whole height of the roof and meeting at the apex, with two tiers of collar beams to brace them apart, the lower collar being braced
-B: two-tier crucks, where the lower crucks rise to just above the level of the lower collar; above this is an upper tier of crucks, braced by the upper collar
-C: nearly full crucks, rising to the level of the upper collar, above which there is a miniature upper tier of crucks.

Modifications

Drawing Title

Latitudinal Sections Showing Principal Trusses

Paper Size

A4

Scale

1:200

Drawing No.

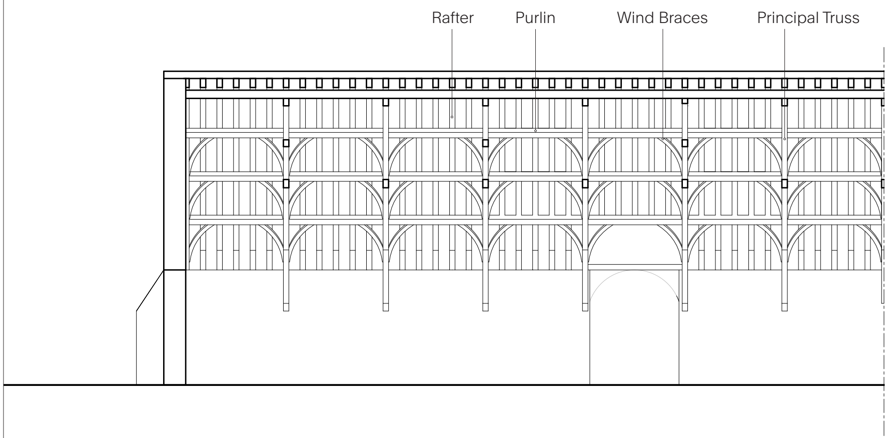
A-201

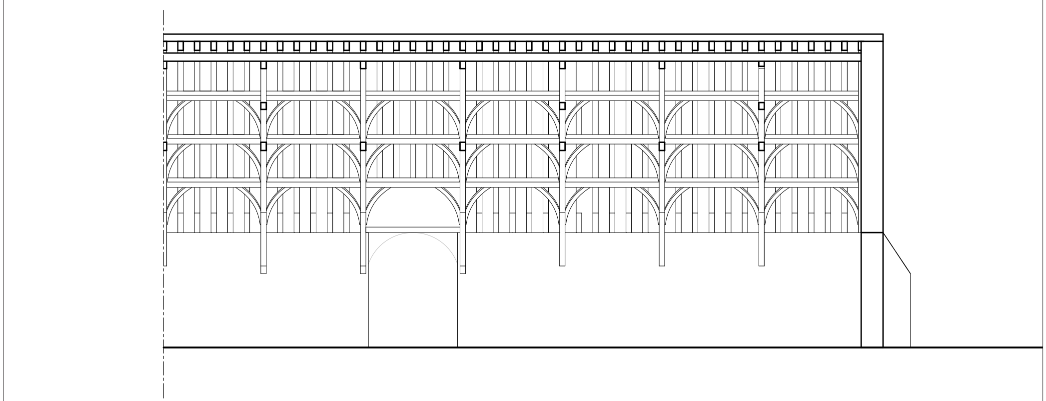
Issue Date

2023.11.10

1:200

POTTS INDUSTRIES





Project Title

Bradford-on-Avon Tithe Barn Case Study

Author

Jay Potts

Client

AA School

Project Start Date

2023.11.09

Project End Date

202X.XX.XX

Drawing Title

Longitudinal Section Through Ridge Line

Issue Date

2023.11.10

Paper Size

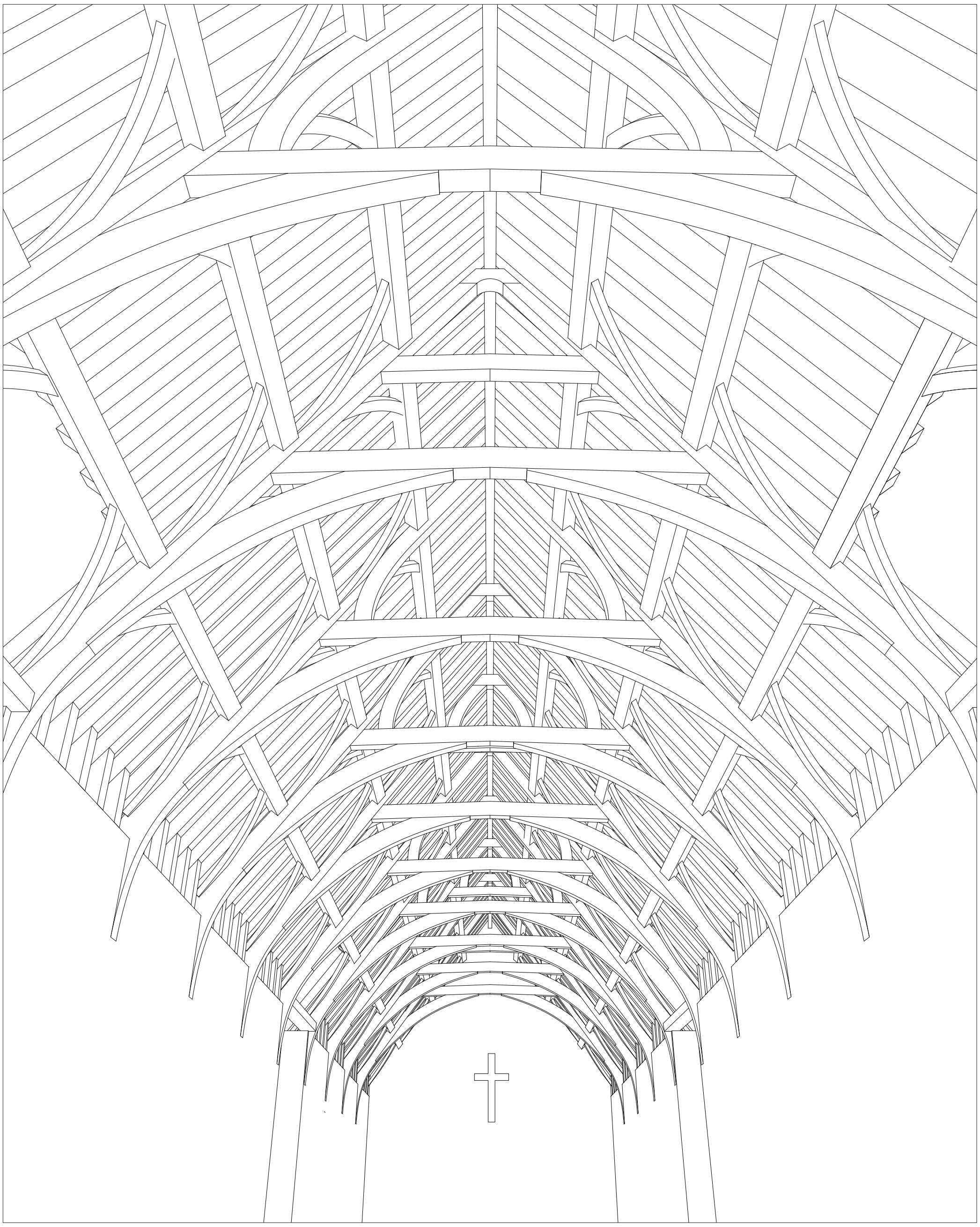
A4

Scale

1:200

Drawing No.

A-202



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Author	Project Start Date		Drawing No.	
Jay Potts	2023.11.09		**A-002**	
	Project End Date	Issue Date		
	202X.XX.XX	2023.11.10		

Project Title
The Oast House

Author
Jay Potts

Client
AA School
Project Start Date
2023.11.30
Project End Date
202X.XX.XX

Drawing Title
Location Map

Issue Date

Paper Size
A4
Scale
N/A
Drawing No.
A-401

Project Title

The Oast House

Address

The Oast House, Pope Street, Godmersham, Canterbury, Kent CT4 7DL

Client

AA School of Architecture

Project Start Date

2023.11.30

Project End Date

202X.XX.XX

Notes

Modifications

Drawing Title

North Elevation

Paper Size

A4

Scale

1:100

Drawing No.

A-201

Issue Date

2023.11.30

POTTS INDUSTRIES

Project Title

The Oast House

Address

The Oast House, Pope Street, Godmersham, Canterbury, Kent CT4 7DL

Client

AA School of Architecture

Project Start Date

2023.11.30

Project End Date

202X.XX.XX

Notes

Modifications

Drawing Title

North Elevation

Paper Size

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Scale

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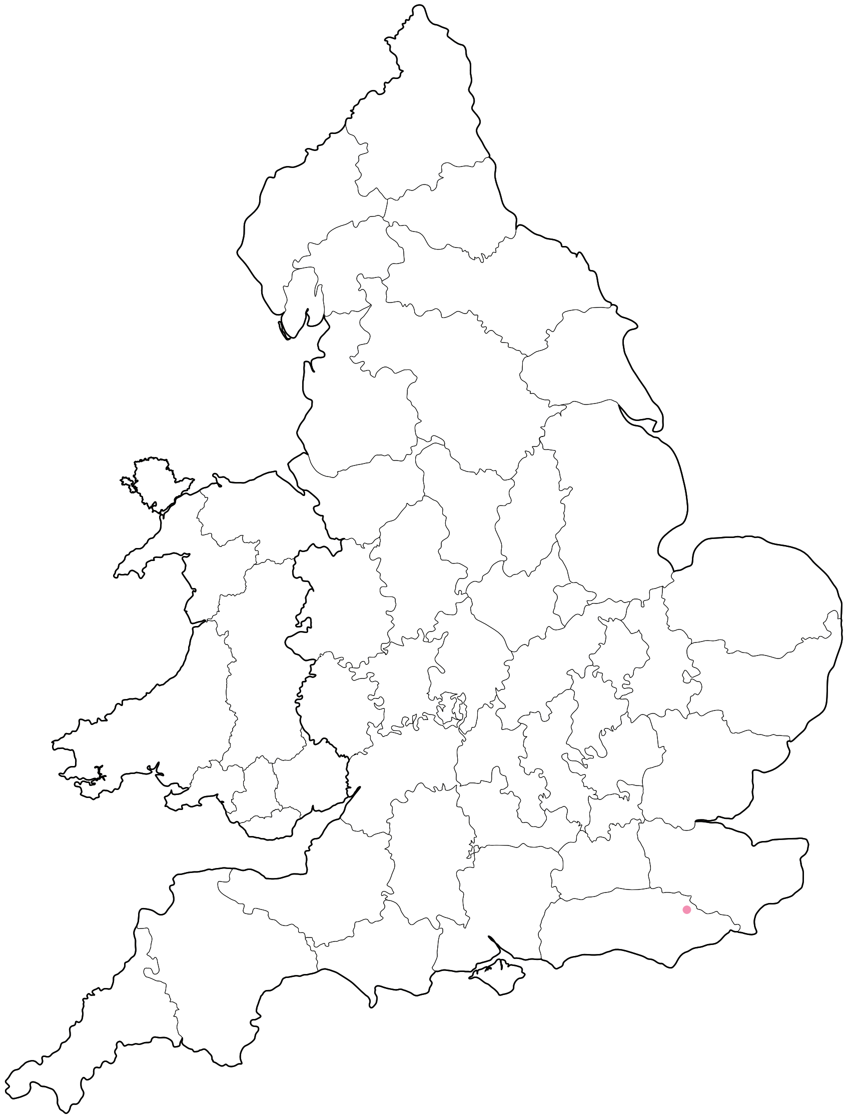
Drawing No.

A-201

Issue Date

2023.11.30

POTTS INDUSTRIES



Project Title	Client	Drawing Title	Paper Size / Scale
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Author: Jay Potts	Project Start Date: 2023.11.09	Issue Date: 2023.11.17	Drawing No. **A-401**
	Project End Date: 202X.XX.XX		*Image Attributions: RIBA PIX*

Project Title
Tindall’s Cottage Case Study

Author
Jay Potts

Client
AA School
Project Start Date
2023.11.09
Project End Date
202X.XX.XX

Drawing Title
East and West Elevations

Issue Date
2023.11.17

Paper Size
A4
Scale
1:200
Drawing No.
A-201

Project Title
Tindall's Cottage Case Study

Author
Jay Potts

Client
AA School

Project Start Date
2023.11.09

Project End Date
202X.XX.XX

Drawing Title
North and South Elevations

Issue Date
2023.11.17

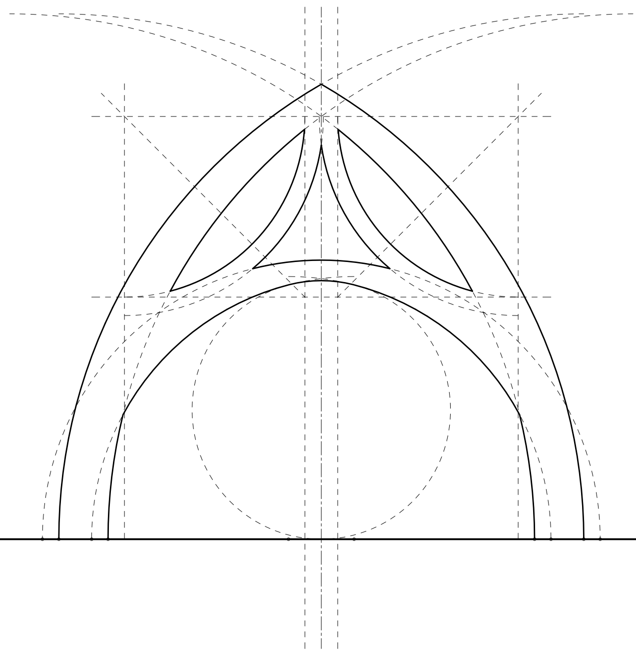
Paper Size
A4

Scale
1:200

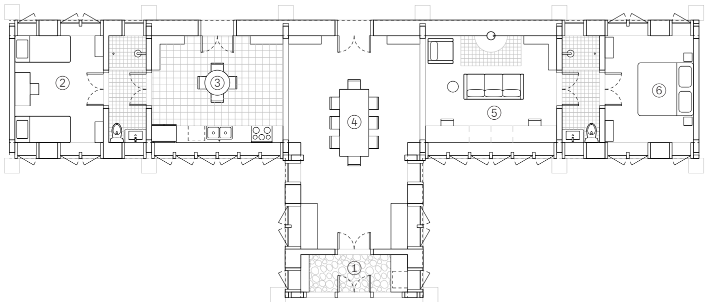
Drawing No.
A-202

2.2 Vernacular House Model

A test model exploring how a Hall House from the Weald district could be built using the Walter Segal self-build method. The result is an architectural chimera.



Project Title **The 500-Year House** Author Jay Potts	Client AA School Project Start Date 2023.09.30 Project End Date 202X.XX.XX	Drawing Title **Principal Cruck Truss Diagram** Issue Date 2023.11.17	Paper Size: A4 Scale: 1:30 Drawing No. **A-001** *Image Attributions:*



Project Title
The 500-Year House

Location
TBD

Address

Client
AA School of Architecture

Notes
Cut at 1000mm above grade

1. Mudroom/storage
2. Bedroom + bath-room
3. Kitchen
4. Dining
5. Living/study
6. Bedroom + bath-room

Drawing Title
Ground Floor Plan - Populated

Paper Size
A3

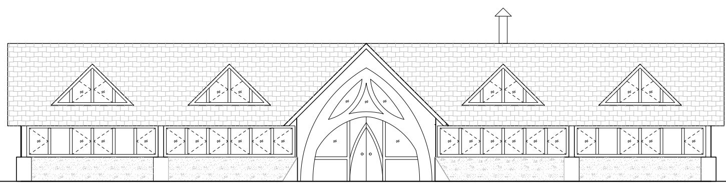
North

Scale
1:100

Drawing No.
A-102

Issue Date
2023.11.17

POTTS INDUSTRIES



Project Title
The 500-Year House

Location
TBD

Address

Client
AA School of Architecture

Notes
North elevation - lots of glazing for passive heating

Drawing Title
South Elevation

Paper Size
A3

Scale
1:100

Drawing No.
A-102

Issue Date
2023.11.17

POTTS INDUSTRIES

Side view of model, showing cruck-framed gable end in glulam.

Detail of masonry plinth.

Slate tile roof.

Interior of foyer.

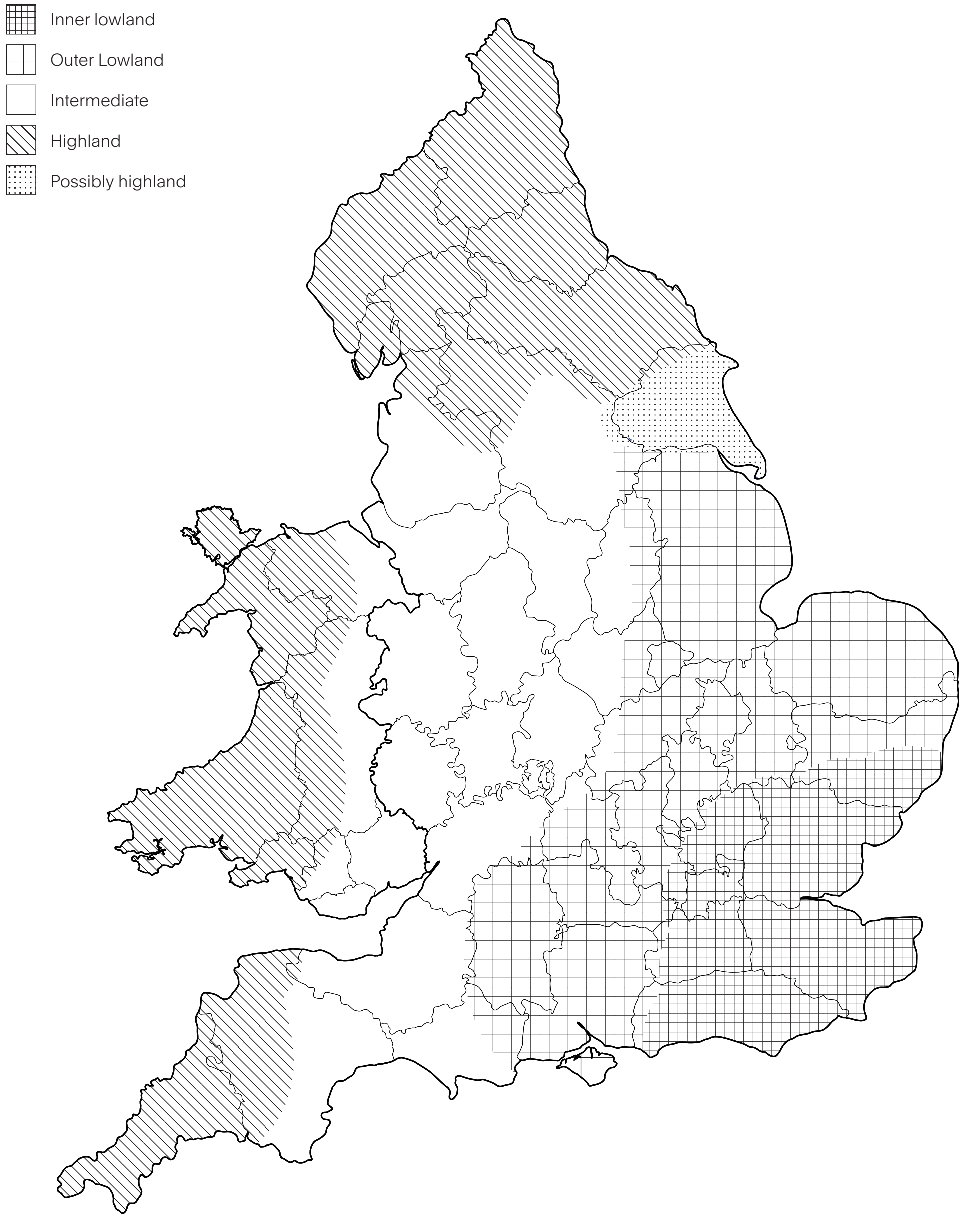


Fig. 1 Lowland and Highland Building Regions

2.3 Mapping the Vernacular House

The following maps of the distribution of vernacular buildings in England and Wales are based on the findings of R. W. Brunskill (1987). By mapping the distribution of building materials used in the vernacular, we can start to visualize how buildings relate to their context, and which techniques can begin to express the "British vernacular." As a guide, these maps can be used to determine which materials are suitable for applications in various local contexts.

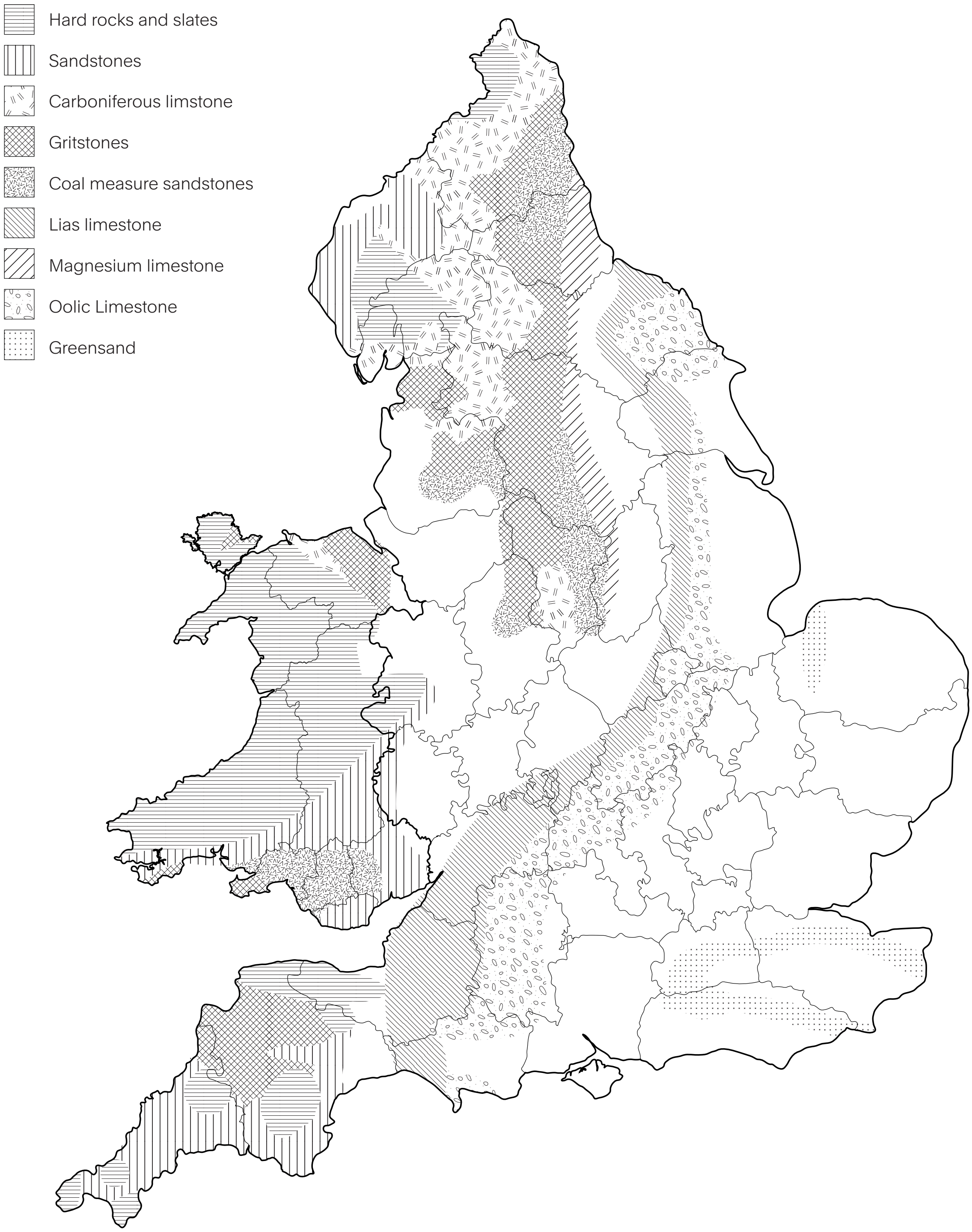


Fig. 2 Walling Materials: Stone

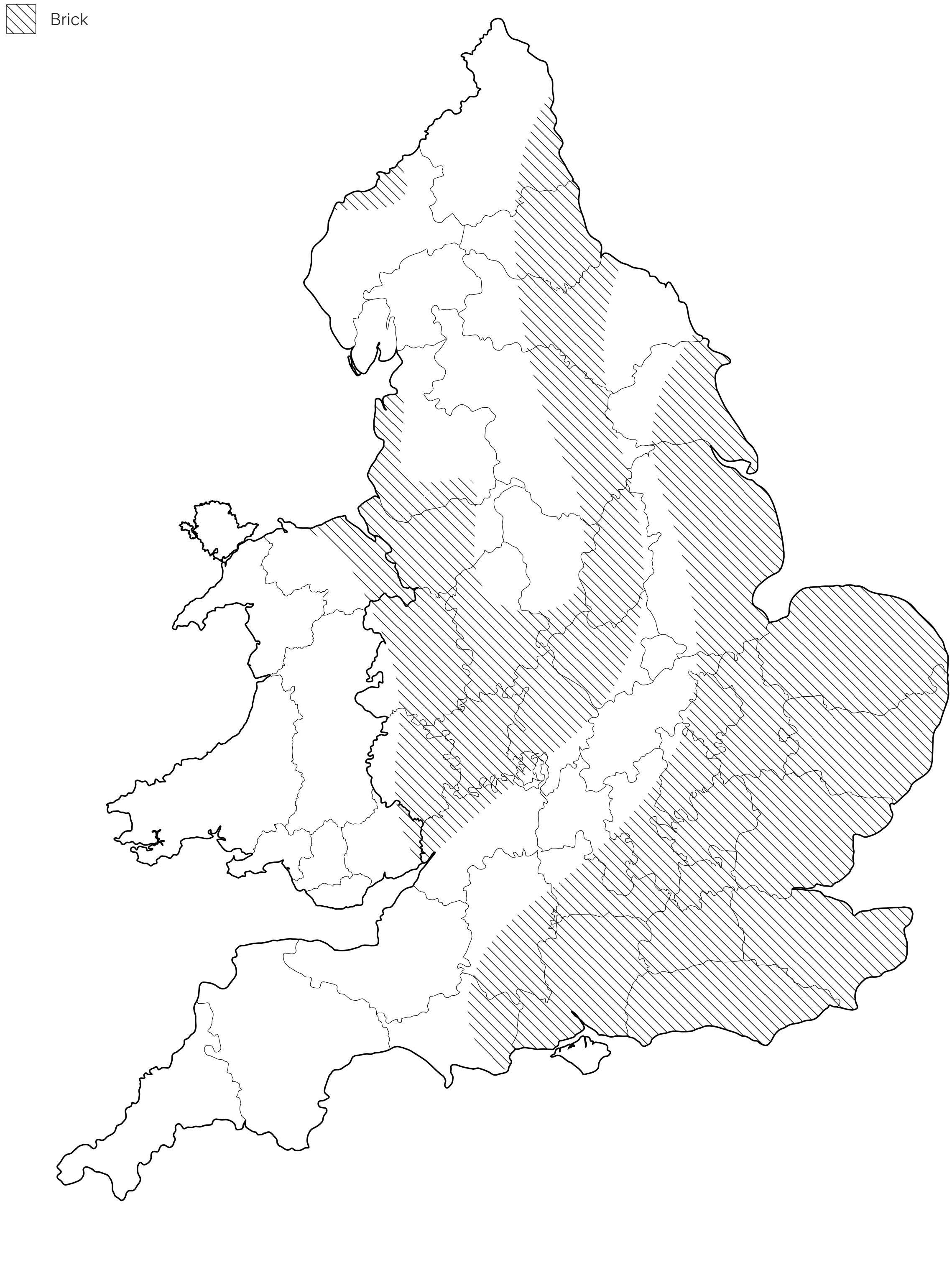


Fig. 3 Walling Materials: Brick

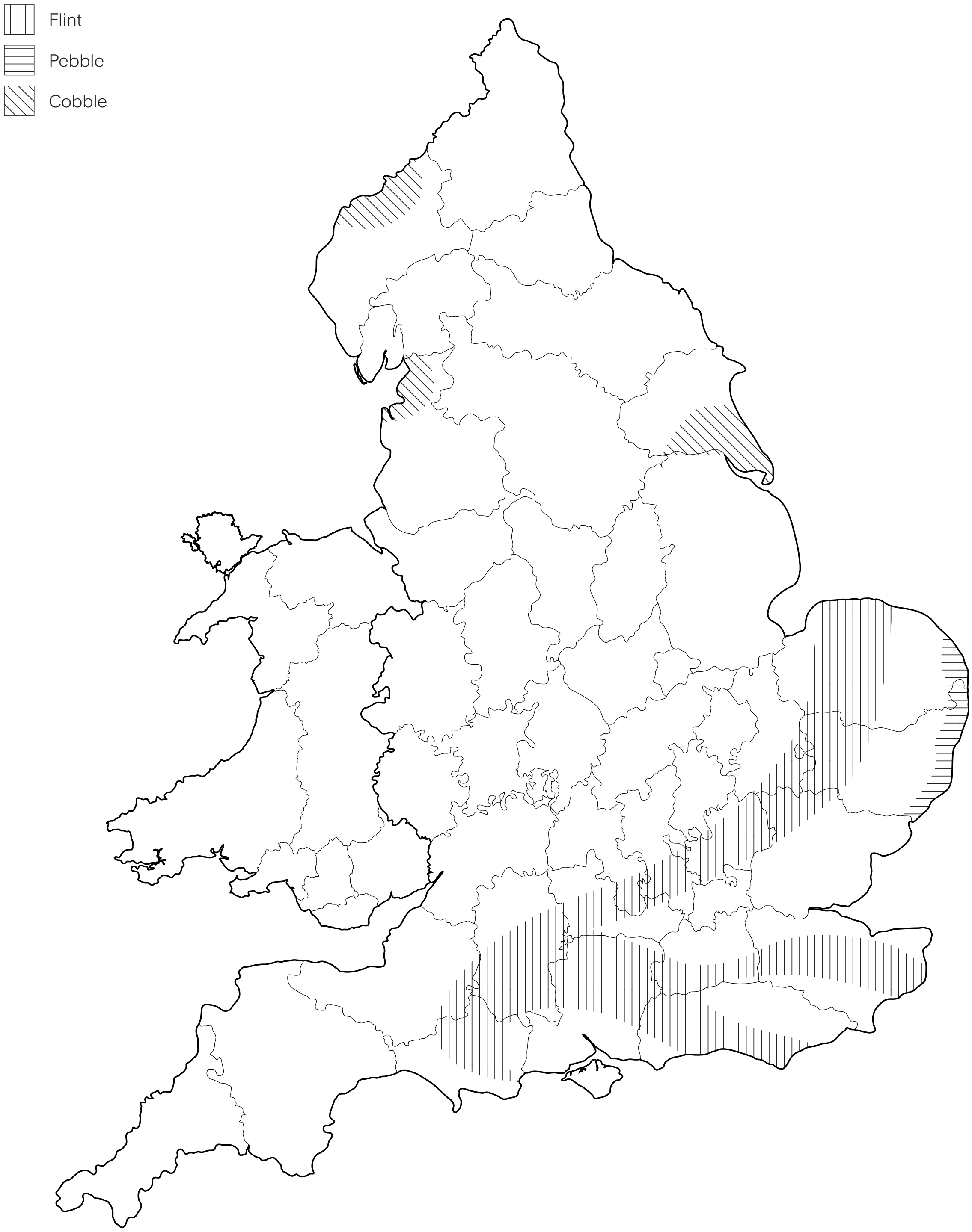


Fig.4 Walling Materials: Flint, pebble, and cobble

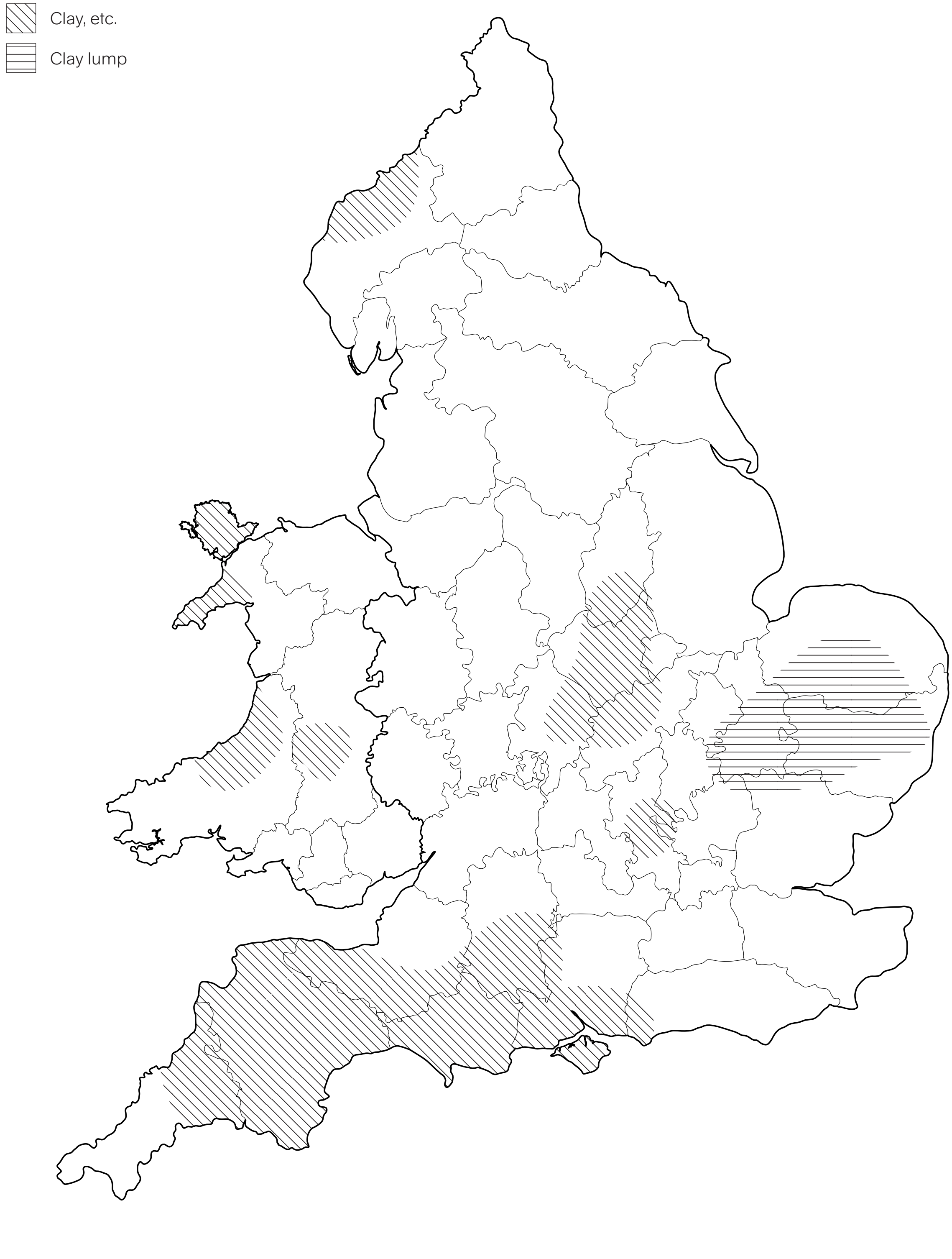


Fig. 5 Walling Materials: Clay, clay lump

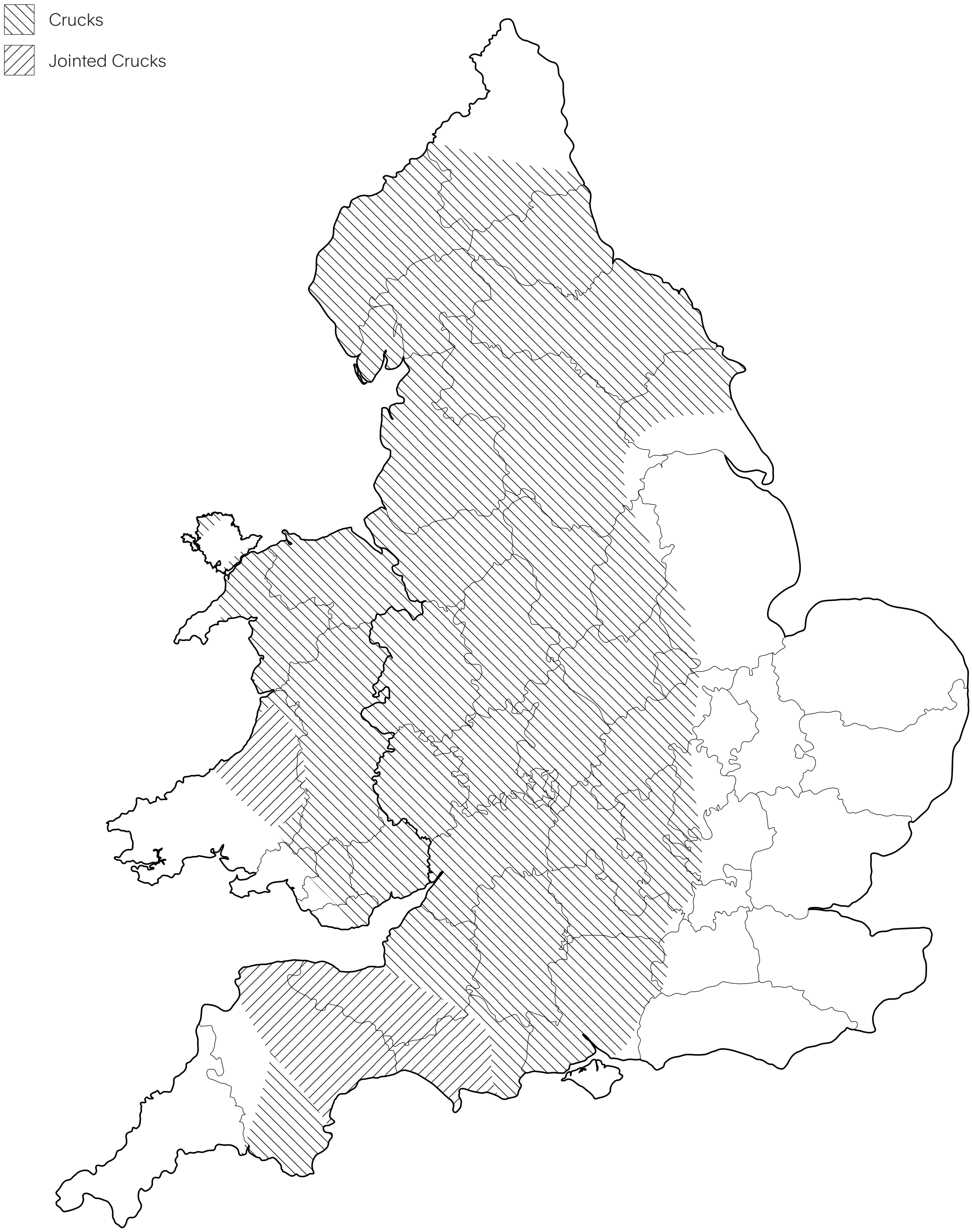


Fig. 6 Timber Frame: Cruck Construction

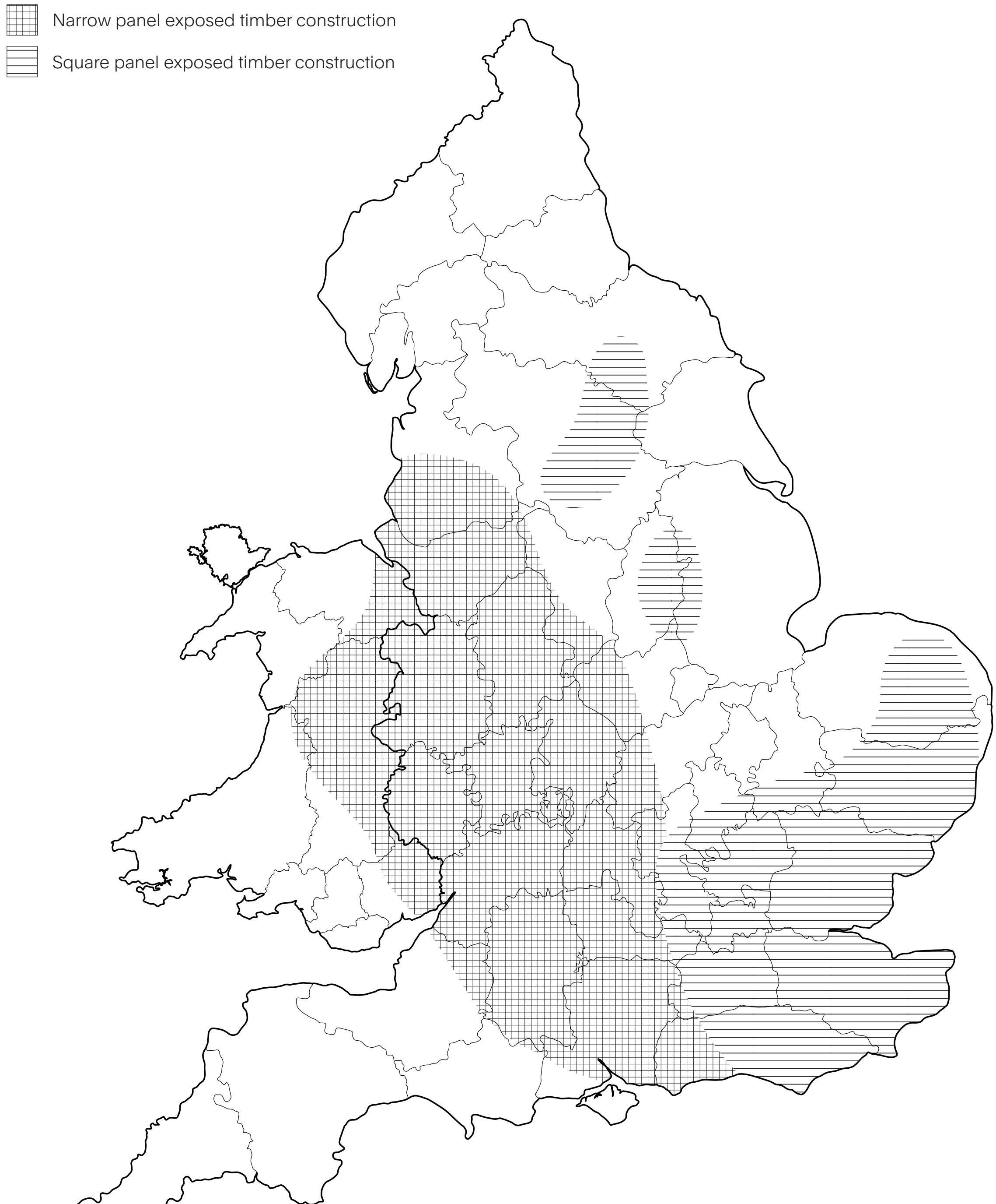


Fig. 7 Timber Walling: Exposed Timber Frame

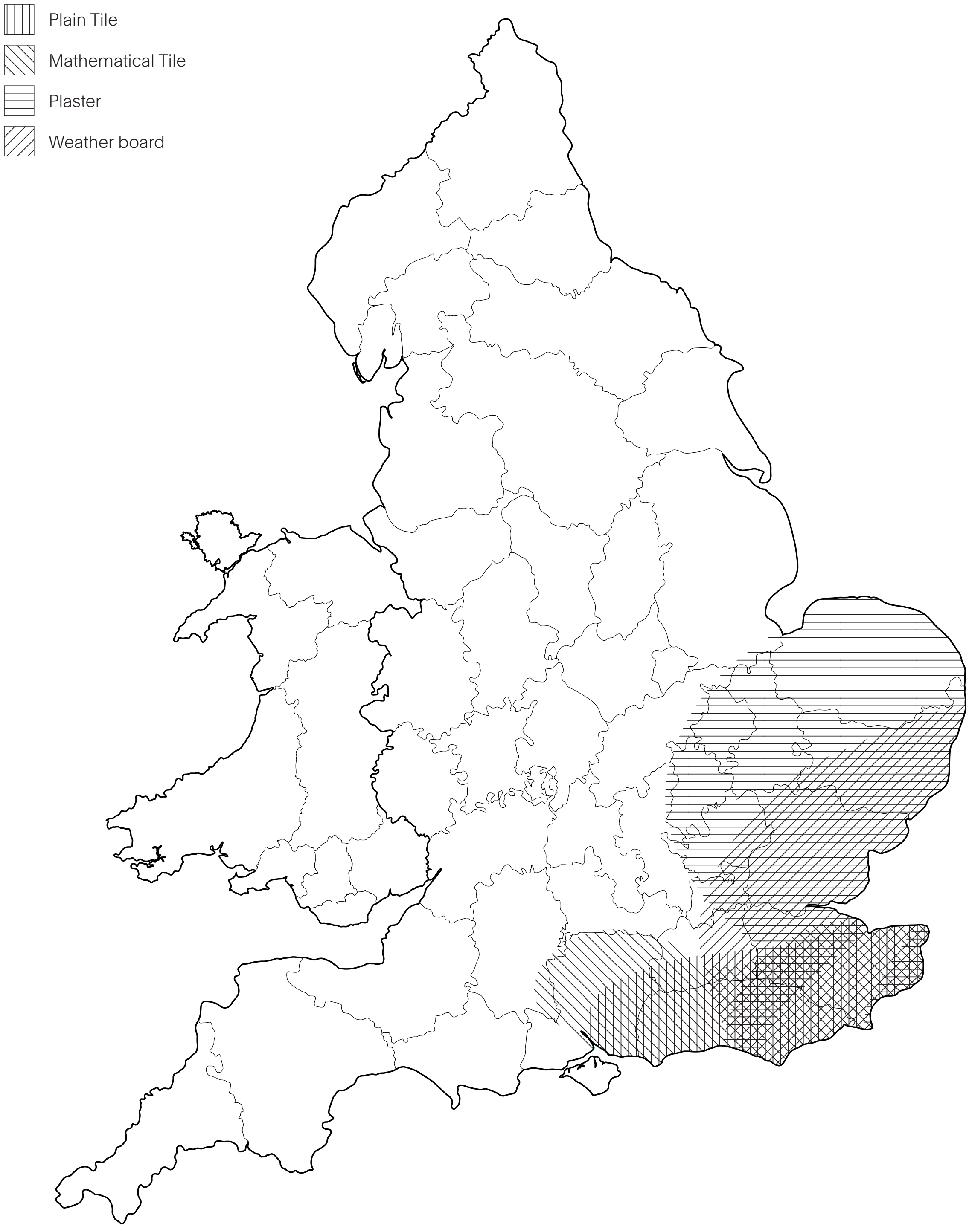


Fig. 8 Timber Walling: Cladding Materials

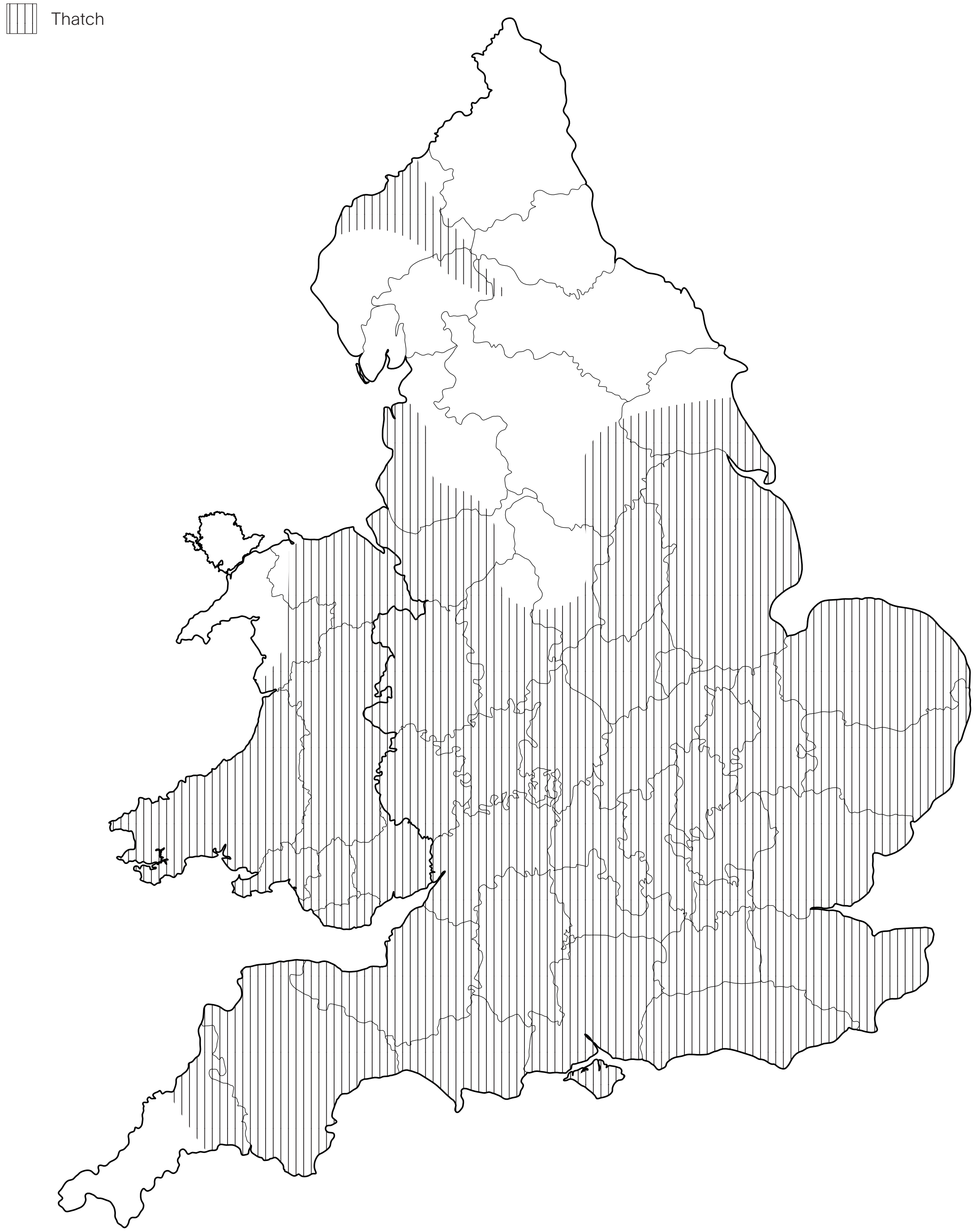


Fig. 9 Roofing Materials: Thatch

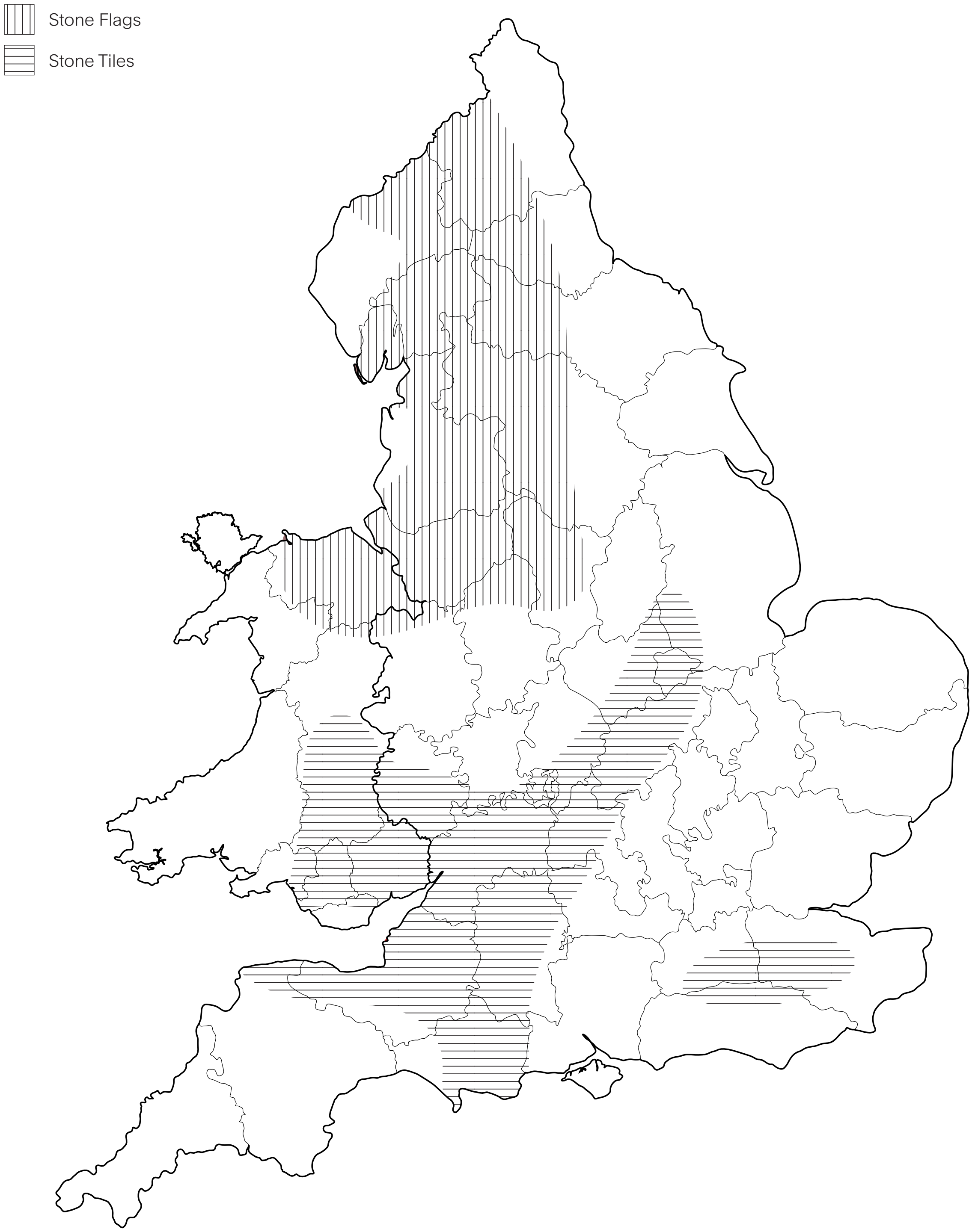


Fig. 10 Roofing Materials: Stone Flags and Stone Tiles

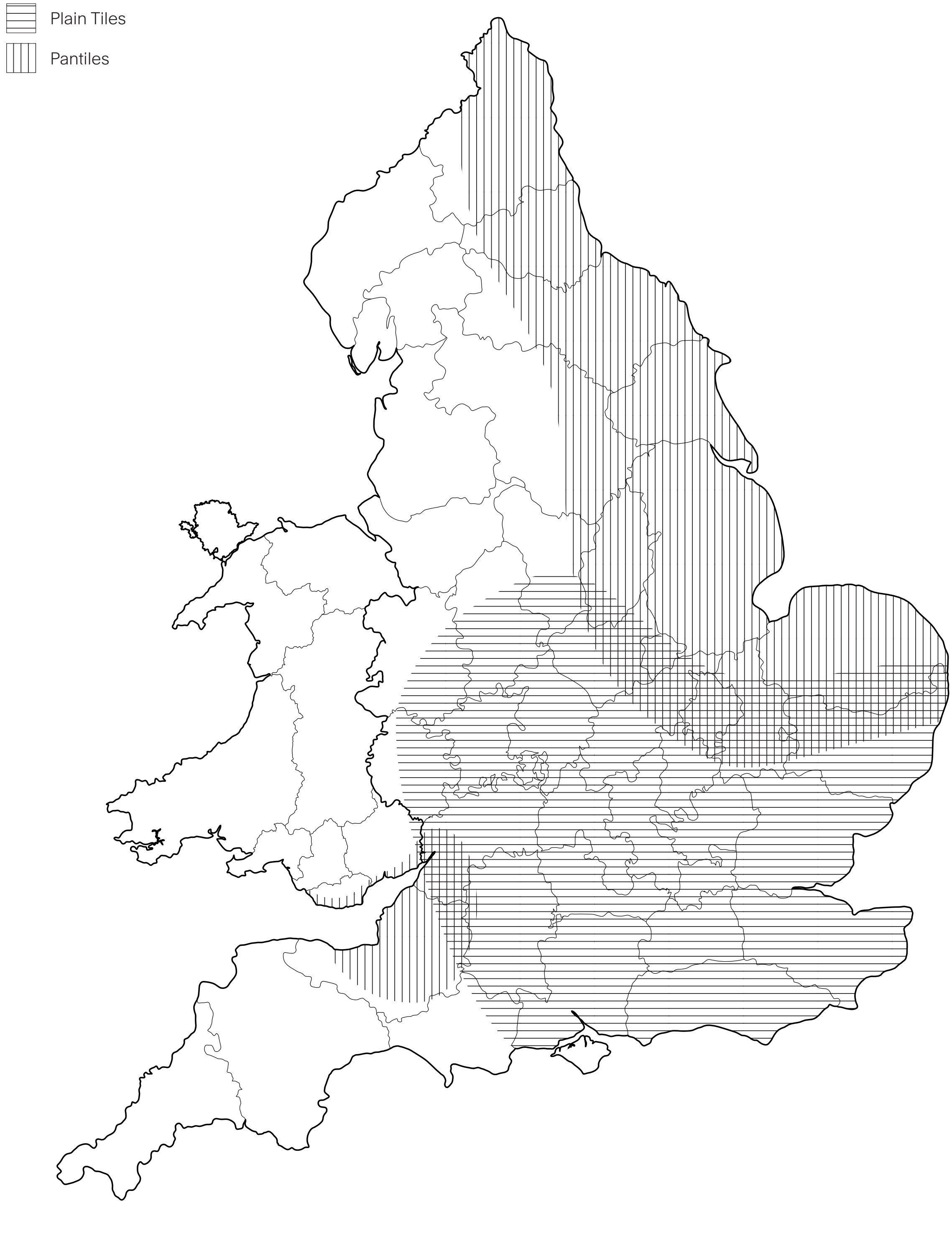


Fig. 11 Roofing Materials: Plain Tiles and Pantiles

Part II
The Proposal

The Site

3.1 Site Selection

The 500-year house is firstly a strategic approach. Because of this, it is site-less, or can function on various sites so long as they satisfy a few criteria. The first criteria is regional location. The 500-year house should first be located in a mainly rural district in England, within 1-2 hours of a major city. The reasons are twofold. Firstly, it needs to be sited near a major city in order to attract young residents who still wish to maintain their relationships within the city, but want to lead slower lives in the countryside. Secondly, land use around the 500-year house would be dominantly for forestry and agricultural activities, so should seamlessly integrate into a rural context. To determine a suitable region, we can look to the Rural-Urban Classification of Authority Districts (RUCLAD) map of England. For the purpose of this thesis, the starting city centre is London. The nearest mainly rural district to London is the Uttlesford District, to the north of the city in Essex.

Within the rural district, we should next identify strategic settlements. These are places identified by local councils as sites for future expansion. In the case of the Uttlesford District, this would refer to the Saffron Walden Parish, a strategic settlement where the council is hoping to build 1280 new homes by the year 2041. Saffron Walden is a medieval village with building remains dating back to the 11th century. Around the 16th or 17th century, the saffron crocus was grown in abundance due to favourable soil conditions, giving the town its name. The town today is best known for its markets, which attract visitors from all over southeast England. The Local Plan, drafted in 2023, has identified land to the southeast of the village for new housing (fig. 1). In this area, housing provisions have been recommended, but there is no mention of agricultural acitivities, which constitute the historic use of the site. This

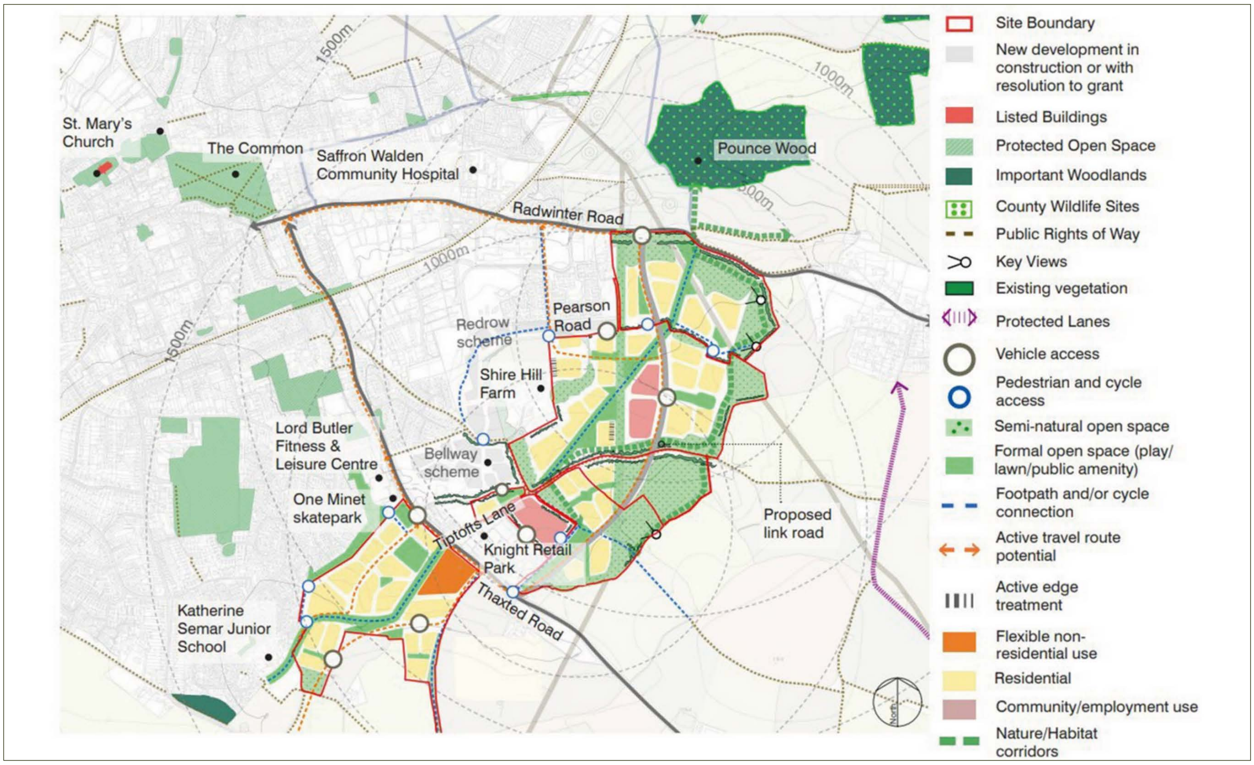


Fig. 1 Proposed strategic allocations at Saffron Walden. Via the 2023 North Uttlesford Local Plan.

ommission comes in spite of the local plan seeking "development which achieves high quality design, conserving the historic environment and landscape setting of the settlements." This comes as no surprise, as there is a clear division between what the council is putting forward, and what is actually getting done in the town.

The development strategies in this area in the recent past have largely been developer-driven, resulting in sprawling subdivisions. This is because the green-belt land abutting Saffron Walden is often no longer used for agriculture due to shifting economic activities and depleted soil quality, and can be developed quite inexpensively. As previously mentioned, this land is what politicians are calling "low-value greenbelt land." Because of this rhetoric, it's use can be justifiably switched from agriculture to housing. However, this strategy shouldn't be the only way forward. Despite appearing unproductive, these types of agricultural sites can be ecologically strategic for multiple reasons. Firstly, they are important for the water table. Green lands are essential catchment basins, and can help reduce overland run-off through infiltration. Paving, which would be laid for housing development, can only do further damage to this landscape because it is non-porous. Secondly, while overgrazed farmland is not explicitly biologically diverse, remediation of these landscapes through replanting or rewilding can restore the soil biology and create new habitats. Various planting strategies, such as permaculture gardening, can rebuild root and nutrient networks while remaining productive for human use and consumption. As a result, this thesis proposes the cross-sectional development of "low-value greenbelt land" through mixed-use housing, agriculture and forestry.

3.2 Site Use

Land use on the site of the 500-year house would be part housing, and part agriculture and forestry. As a result, the lot area should large enough to support these activities, but small enough to remain productive. There is a negative correlation between farm size and yield, with the optimum farm size being less than one hectare. This size is considered a "smallholding." Smallholdings are significantly more productive, per hectare, than large farms because they have diverse land use. This results in a polyculture, rather than a monoculture. A monoculture requires huge inputs (fertilizer, pesticides, antibiotics, etc.) because soil nutrients are yearly depleted. In contrast, polycuture holdings naturally replenish the soil through seasonal crop rotations and can be naturally pest resistant by creating resilient ecosystems for predators. Based on this, the 500-year house should be sited on land no greater than one hectare.

Holdings of this size in Saffron Walden are abundant, but a few key sites are chosen. Sections of land around the Shire Hill Farm are already slated for redevelopment as subdivisions (see pages 70-77), but there remains large tracts of land with no currently approved planning permission. Specifically, land to the East of the Bellway Homes development is chosen. Hopefully, by preserving the agriculture use of this land while providing housing, it can create a mini greenbelt around the neighbouring subdivisions to reduce urban sprawl. While this land is larger than one hectare, only a small portion of this land would be immediately developed by the 500-year house proposal. The "eco-village" that should spring up around it is meant to expand over the years, as did Findhorn, which is the main inspiration for this development. While also retaining historic land use, reintroducing tree cover is essential for mitigating the effects of climate change.

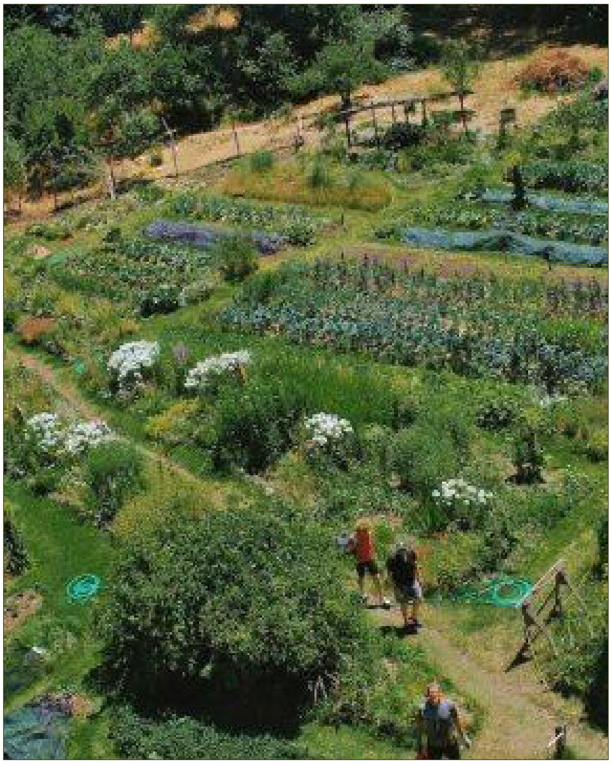
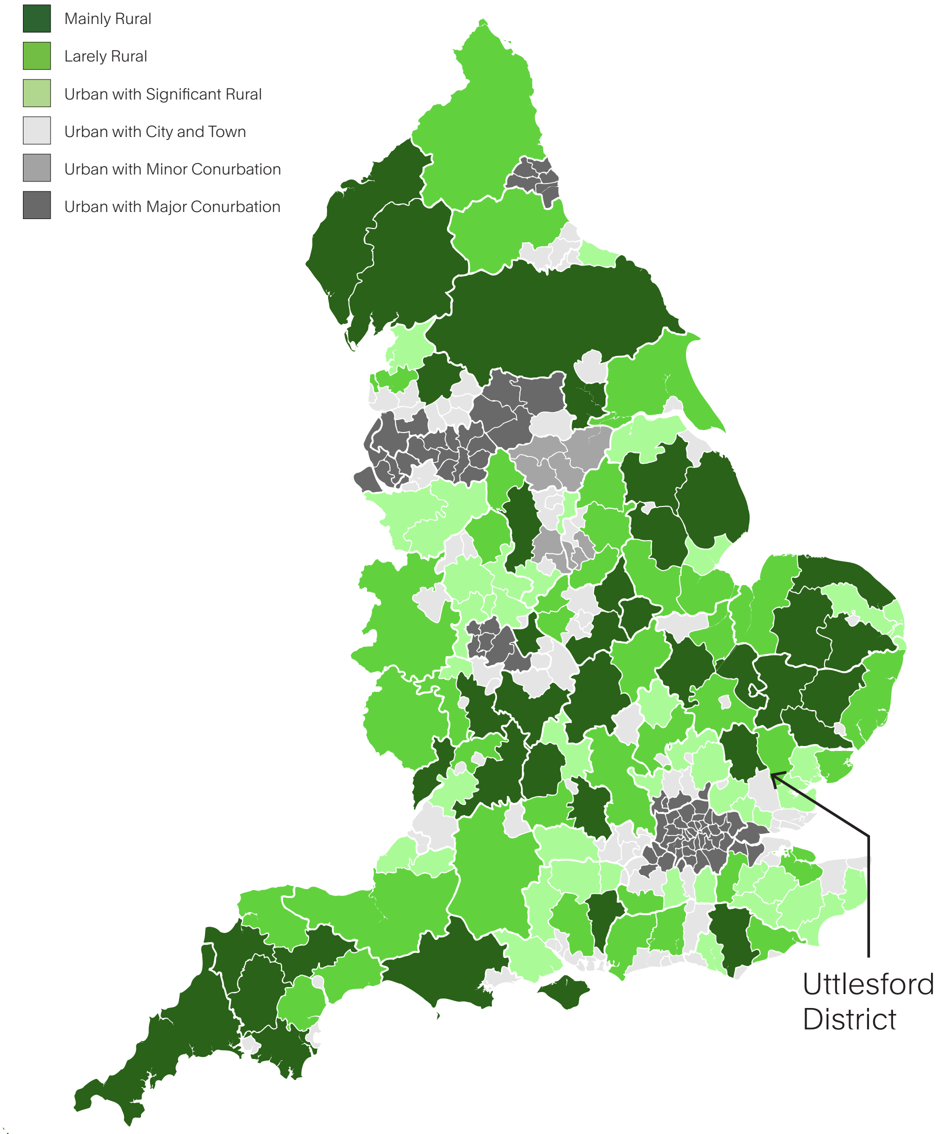


Fig. 2 Permaculture garden at the Occidental Arts and Ecology Centre. Image courtesy of the OAEC.

Half-Earth Socialism recommends returning half of the earth's land to wilderness, primarily through the conversion of pasture land. While not explicitly wild, a mix of perennial tree crops (70%) and seasonal crops (30%), as suggested in *Permaculture One* can act as a productive alternative. In addition, a few grazing animals would be retained on site to aid in pest control, and to be used as natural lawn mowers and to fertilize the land.

3.3 Mapping the Site

The following maps locate Saffron Walden within the North Uttlesford District, and showcase the sites suitable for the 500-year house development.



Project Title **500-Year House Site Studies** Author Jay Potts	Client AA School Project Start Date 2023.10.25 Project End Date 202X.XX.XX	Drawing Title **RUCLAD of English Districts** Issue Date 2023.12.01	Paper Size: A4 Scale: N/A Drawing No. **A-001** *Image Attributions:*

Project Title
500-Year House Site Studies

Author
Jay Potts

Client
AA School

Project Start Date
2023.10.25

Project End Date
202X.XX.XX

Drawing Title
Uttlesford Electoral Map 2023

Issue Date
2024.08.18

Paper Size
A4

Scale
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A-002

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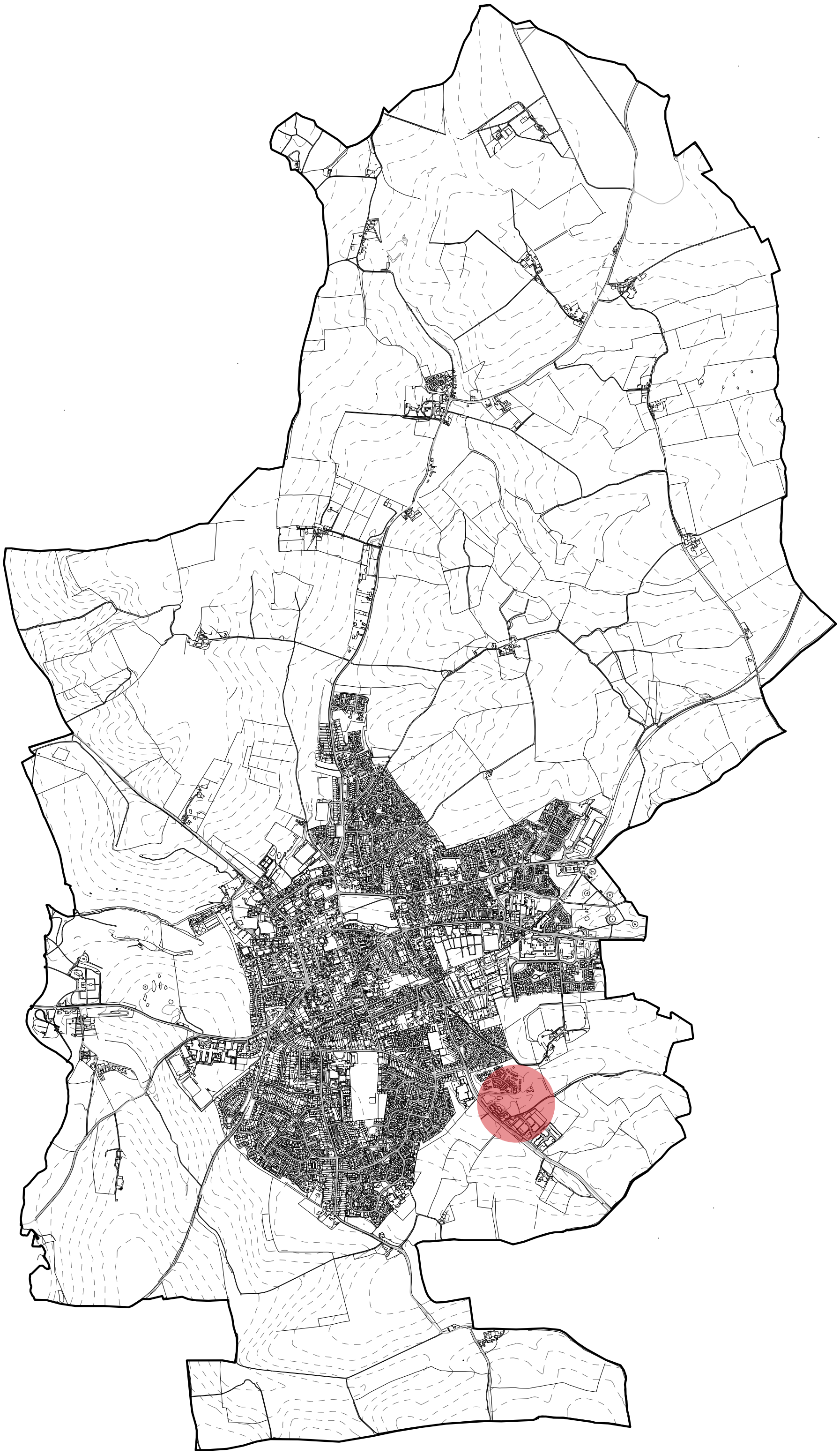


Saffron Walden Parish Plan, site location in red.

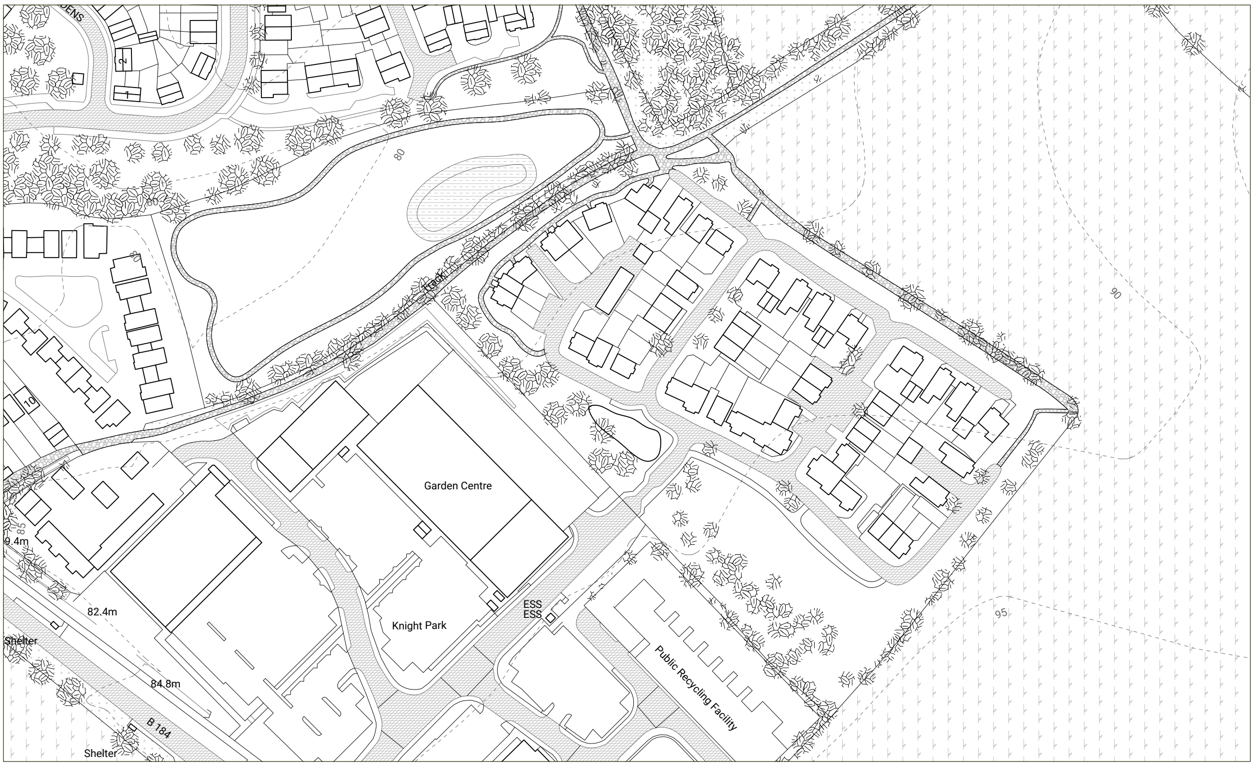
Land to the South-East of Saffron Walden, identified as a location for the development of 1280 homes in the next 20 years. The land is characterized as "lowa-value greenbelt," suitable for redevelopment. This map shows the site's present condition with the Bellway development underway.


Wild Hedges
Track
Turnip Hall Farm
LEVERETT WAY
GRIFFIN PLACE
EDDYSTONE AVENUE
MYHILL CLOSE
PORTSMOUTH CLOSE
FAIRFAX DRIVE
SATIVUS CLOSE
WALLACE ROAD
PEARSON ROAD
Track
Track
Shire Hill Farm
Hylands
Wheel Hall
Public Recycling facility

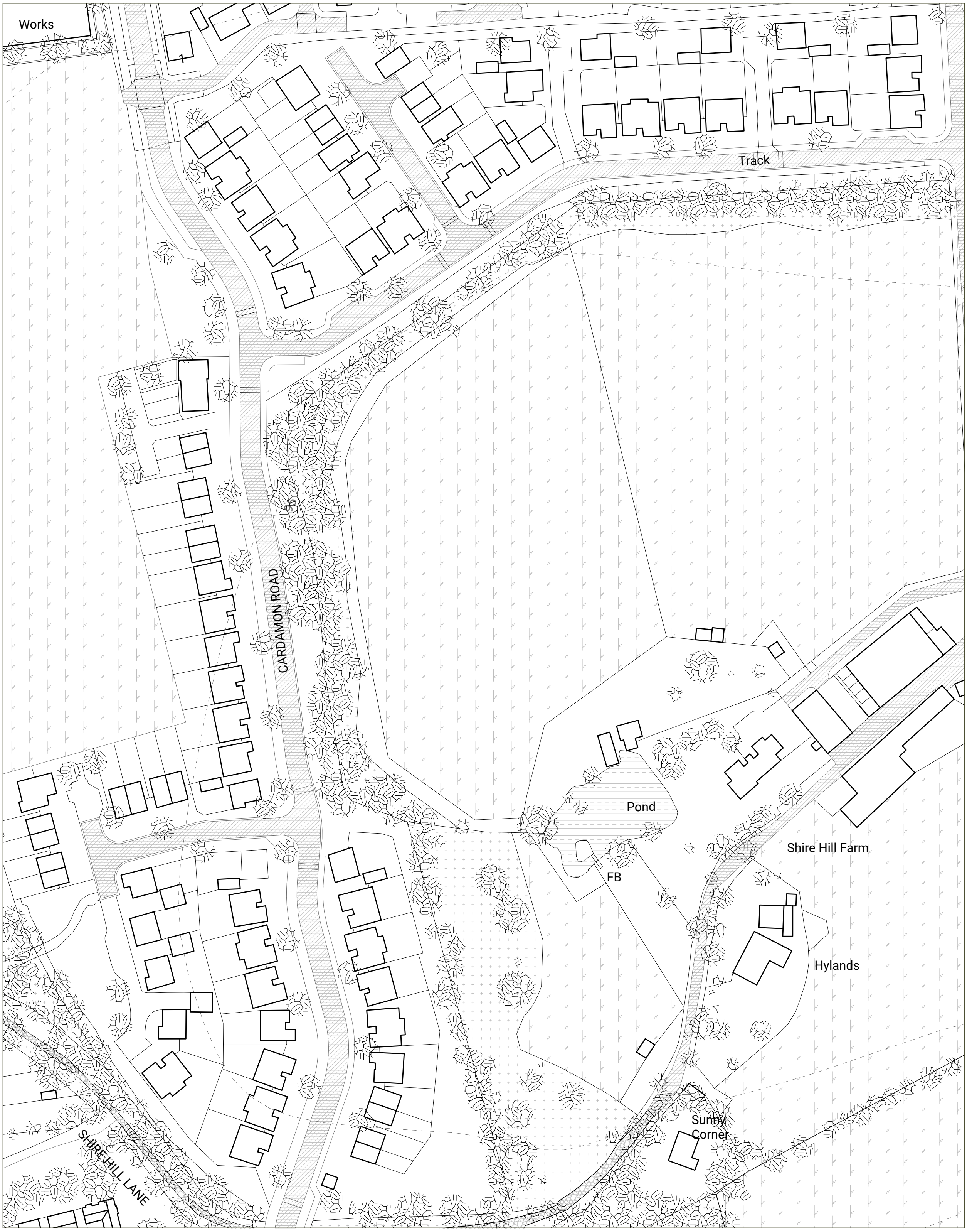

Warehouse
Works
Factory
Depot
Dencora Park
St Andrews House
Carlton Place
Carlton House
Angus House
Business and Technology Centre
Nursery School
Balancing Pond
Play Area
Seversend Drive
Griffin Place
Sativus Close
Track
Turnip Hall Farm
Shire Hill Farm
Hylands
Pond
Tennis Courts
Cardamon Road
Skateboard Bowl
Garden Centre
Knight Park
Public Recycling Facility
Hotel

This map shows the developments that wave been approved for planning. The trend is clear; the once historic farmland will be transformed into sprawling suburbs.

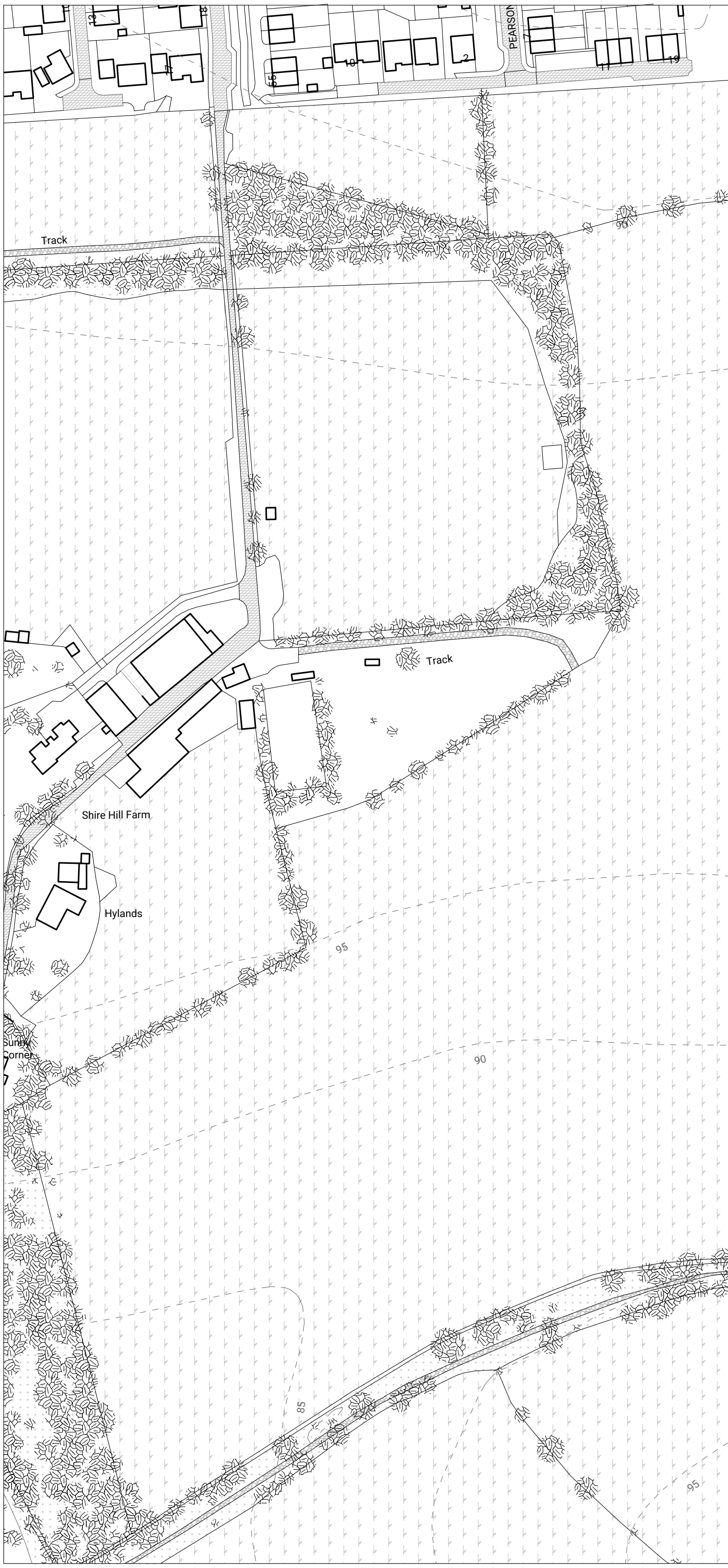
The Bellway Homes redevelopment of the "brownfield site" of the Old Cement Kilns. Planning application ref: UTT/18/0824/OP



Site south of Bellway approved for the erection of 55 dwellings by Kier Group. Planning application ref: UTT/23/3112/PINS



Proposal by Redrow Homes to develop 100 dwellings on Shire Hill Farm. Planning application ref: UTT/21/3565/DFO.



Land to the East of Bellway. There are no current development proposals on this land, as it is still owned and operated by Engelmann Farms ltd. Potential to turn this "low-value greenbelt" land into a highly productive ecovillage.


95
95
100
105
100
95
Track
Path (um)
100

3.4 Site Survey

Medieval character of Saffron Walden.

Drab, copy-paste developer housing on the Bellway site.

Charming house with tinted limewash.

Colourful, timber-framed historic homes.

Historic market in town centre.

Flint and brick walling found throughout Saffron Walden.

Boring streets, lots of paving, few trees.

Lots of houses for sale.

Entrance to the neighbourhood felt like a car dealership.

Empty house. Lots were empty.

CMU construction with brick cladding.

Lots of houses for sale.

Southern edge of Bellway.

Looking towards the Old Cement Kilns site.

Site of the Old Cement Kilns

6m tall escarpment left over from mining operations.

Water running between Bellway and open land.

Open land to the South of Bellway.

Shire Hill Farm property. Site of Redrow Development.

Looking South-East.

Looking North-West.

Looking West.

Land South-East of the Bellway.

Land South of the Bellway.

Public footpath South of the Bellway.

Public footpath between Bellway and Shire Hill Farm.

Part III
The House

Timber Framing

4.1 Introduction to Timber Framing

The timber frame is the bones of this technical thesis. Based on previous research, there existed two building systems that were key to the longevity of ancient vernacular homes: mass construction and frame construction. With mass construction, the loads of the roof and upper floors were carried through thick walls down through the foundations. With frame construction, these same loads were carried through a frame and distributed across the foundations. In some instances, such as with the Bradford-on-Avon Tithe Barn (pg. 34-40), a combination of mass, stone walling and timber cruck frames were used. Both systems have their merit, and continue to be used today throughout the UK. However, this section will focus specifically on timber frame construction because of its modularity, demountability, re-usability and quick build time.

Firstly, it's important to note why the popularity of timber frames have diminished over the years. The UK still builds in wood, but we have transitioned from large, robust timber frames to stick (stud), platform, and balloon framing, which originated in America in the late 19th century. Some attribute this shift to the depletion of stocks of suitable timber, notably oak, which were used up during the UK's ship building boom that lasted until the early 20th century. Oak, being a hardwood, takes much longer to mature that softwoods such as pine and larch. It is typical to wait between 40-80 years before harvesting an oak for its lumber, whereas a spruce or pine, for example, could reach harvestable size in about half that time. Others attribute this decline to a lack of skilled carpenters able to cut and join a timber frame. It seems a combination of market factors has lead to the decline of timber framing, and not necessarily its innate qualities. In fact, there are considerable advantages to timber frame construc-

Fig. 1 Timber framed house in Workingham during restoration. Via RIBAPix, reference RIBA116120.

tion over stick frame construction that can be further harnessed through modern developments in engineered timber, such as glulam, dowel-lam, and cross-lam, as well as manufacturing advancements in machine automation and robotics.

One of the main advantages of timber framing today is that it uses considerably fewer individual timber sections than a stick frame. This means that the total volume of timber used is much lower, and therefore produces less waste in the form of offcuts and has an overall reduced environmental footprint since less trees are felled. Timber frames are often better fire-rated since there is less surface area of wood, and the larger members will char instead of burning up entirely. While in the past, it might have been quicker to assemble a stick frame because it requires no complex, hand-cut joinery, today, the production of individual columns and beams for a timber frame can be completely automated. While some manual labour is still required, CNCs and industrial planers can process wood and joints in a fraction of the time taken by even modern carpenters armed with electric hand tools. Also, there is a higher capacity for individual timber members to be reused over its stick-framed counterparts. Timber frames today use either joined or bolted connections, meaning they can be taken apart. In contrast, stick framing requires a huge number of nails and screws, which makes the reuse of lumber more difficult. As previously mentioned, it is also much easier to erect a timber frame on-site. Individual members can be prefabricated, and then lifted into place. A timber framed building can be erected in a few days, wheres a stick frame can often take weeks to build. Finally, timber frames are better at absorbing wind, rain, and seismic loads because of their ability to flex, which can explain their robustness over the years.

Of course, there still exist benefits to stick framing over timber framing. It is often cheaper to build a stick frame, and more carpenters today know stick framing over timber framing. Softwood timber lengths are also more abundant, and often you have to go through a specialist merchant to find larger timber sections for a timber frame. Also, if the building envelope is not properly weather sealed, timber frames can rot when exposed to water. Finally, glulam beams use oil-based glues, which have high-embodied carbon and do not biodegrade. Still, the criteria for a choosing a framing method for this thesis are: longevity, re-useability, and modularity which makes timber framing, be it in solid wood or engineered timber, the best choice of the two.

This thesis attempts to address the chal-

Fig. 2 Concrete masonry unit (CMU) and stick frame construction in Saffron Walden.

lenges associated with timber frames. Firstly, "cheap" is often a function of labour time and material costs. If we consider constructing a huge number of homes using standard timber frame sections, then cost can be drastically reduced through mass-production. Modern glue-laminated timber members cost significantly more if they exceed 6m in length. This is because the lamellas require finger-jointing to achieve these longer spans. Also, transport costs can be higher because they would exceed the standard truck-bed and shipping container length of 20ft/6m. As explained to me during a visit to the Versowood factory in Finland, some markets, such as the Japanese market, prefer 3m, 4m, and 5m glulam lengths because of their lower cost. Further, if the glulam members aren't exposed to water, they should be able to last hundreds of years. In the proceeding pages, I look into different methods at producing engineered timber and look for methods of joining timber frames that require no steel. The benefits of reducing the amount of steel used in glulam is twofold. Firstly, steel has high embodied carbon, so if we can reduce the amount of steel, we reduced can reduce carbon emissions of the construction. Secondly, wood expands and contracts during different climatic conditions, whereas steel does not. Wood-wood joints can expand and contract in relation to one another, strengthening the connection over time, whereas wood-steel joints can crack the wood. We know from looking at vernacular buildings that wood-wood joints can last a very long time (they often use mortise and tenon joints; see section 4.5), and can even be taken apart multiple times without compromising the integrity of the joints (Tindall's Cottage being a prime example). This thesis attempts to modernize these joining methods.

4.2 UK Timber Production

At present, the UK imports 80% of it's timber (mostly softwood) used in construction. While timber is hailed as a sustainable material, embodied shipping miles can drastically reduce their environmental benefit. Most of the UK's domestic softwood timber comes from Scotland, the majority of which are felled on private estates, and processed by large sawmills. At present, the delivery of hardwood to sawmills across the UK has dropped to almost negligible levels, with most felled hardwood being used as fuelwood/firewood. The primary market served by softwood sawmills is decking and fencing, with firewood being a close second. The construction sector is only the 3rd most served market, which is concurrent with reports that most of these sawmills do not undertake timber grading. In fact, only 40% undertake visual grading, few conduct machine grading and none do acoustic grading. This can explain why the vast majority of timber used in construction

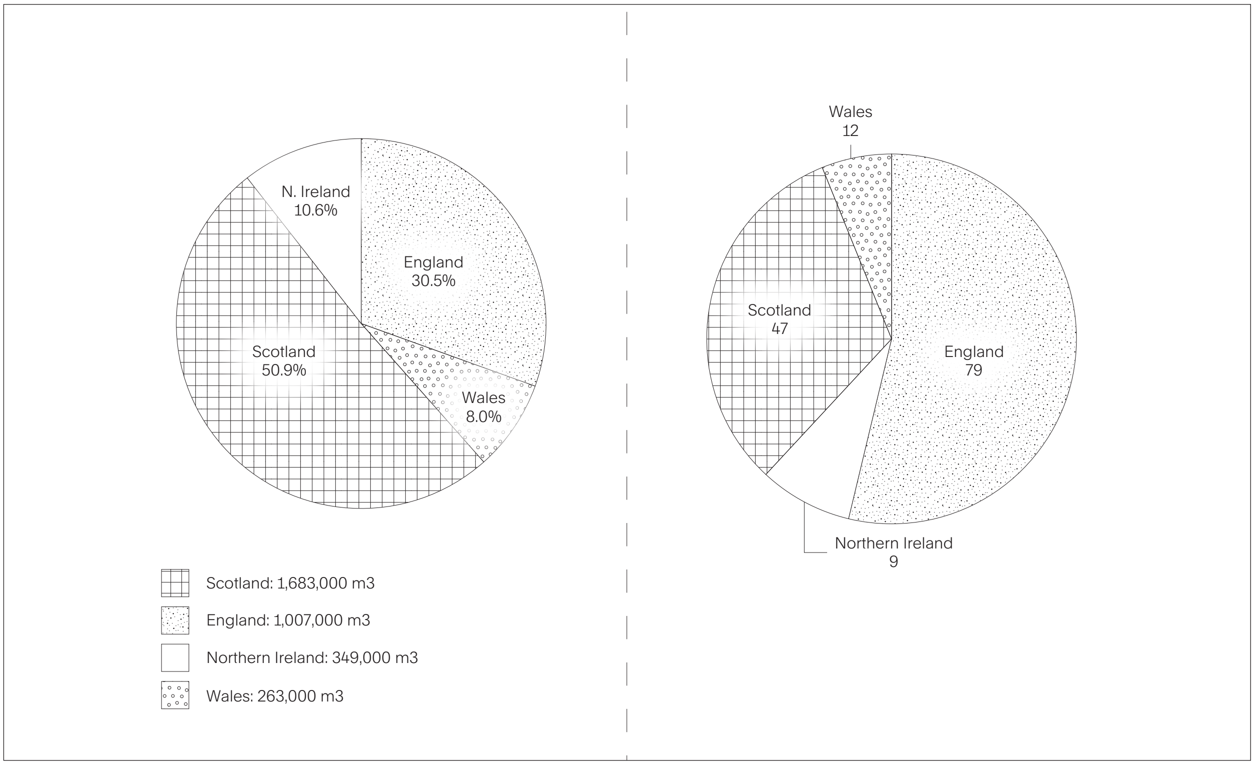


Fig. 3 Share of softwood production in the UK (left) and total number of sawmills in the UK (right). © 4c Engineering 2022.

is imported. Generally, this can be attributed to climatic growing conditions. Due to the UK's mild winters, softwoods grow continuously year-round. In contrast, in countries like Finland, the growth rate of trees slows during the winter, leading to tighter growth rings and therefore higher quality lumber. This can explain why the UK virtually produces no C30 lumber, and must import this higher grade.

In keeping with the aims of reducing embodied carbon, this thesis proposes the production of domestic glulam beams using C30 imported softwood tension lamellas for only the top and bottom laminations, with lower-grade C24 domestically-produced wood for the core lamellas (see page 146). This practice is already undertaken in other European countries, such as Germany, who use lower-grade domestic timber and imported C30 lamellas from Scandinavia to achieve up to GL30c beams (only GL30h+ can be achieved with 100% C30 lamellas). The aim of this thesis is to use around 80% domestic timber in these glulam members, and to begin reducing the UK's dependency on imported construction-grade softwood.

One of the main challenges with bolstering domestic yields of softwood timber is the risk to forest ecology. It is common to see timber farms replace mixed forests for the sake of increasing harvest yields. The modern industrialization of the forestry sector planted huge amounts of monocrops from 1919 onwards to rebuild timber stocks, but this is no replacement for ancient and well-managed woodlands. It is still common to observe clear-cutting and replanting of a single species of tree on tree farms used in glulam production, which destroys native ecologies and reduces biodiversity. To combat this, it is important to manage forests with diverse and resilient species and to selectively harvest, rather than clear cut. While this thesis will not focus on forest management, I am aware of and grateful for the ongoing research at Hooke Park which tackles exactly this.

4.3 Glulam Carbon Emissions

According to the UN, the building industry accounts for 37% CO^2 emissions. Reducing emissions in all areas of construction, including what could be considered "green" construction, is essential. A study by Oh *et al* found that glulam beams emit 75% less carbon emissions that comparative structural members of concrete and steel. The majority of glulam's embodied carbon (256 $kgCO_2e/m^3$) comes from its manufacturing processes (143.6 $kgCO_2e/m^3$) and from the resins and glues used (28.3 $kgCO_2e/m^3$). However, these emissions are compounded when we consider how glulam is processed at the end of it's serviceable life. While glulam can be reused without reprocessing, if it is landfilled, or down-cycled and burned, it can release much of the emissions sequestered during growing. As wood decomposes in a landfill, it emits carbon dioxide and methane, and when burned it also emits CO^2 and CO. As a result, the best way to reduce the carbon emissions of glulam is to extended its serviceable life. We have some surviving examples of glulam beams from the 19th century. With today's improved manufacturing techniques, there's not reason to believe a that well protected member could live 500 years and perhaps even longer.

At the same time, this thesis looked at alternative lamination methods to reduce carbon dioxide emissions. Historically, glues have been derived from plant, milk and animal sources. These have comparatively low adhesion and are less resistant to rot and pests than chemically derived glues. Formaldehyde used to be the most common chemically-derived glue used in glulam, but emit stoxic vapours and release toxic fumes when burned. Some fabricators have switched to polyurethane glues, which are still petrochemical products, but are less harmful. Recently, engineered timber companies have been producing and selling glue-free laminated products. For instance, Beck fastening, an Austria company, has created a wooden nail system that can create 100% wood composite beams. This works by shooting wood nails through a modified pneumatic nail gun into wood at high speeds, which heats up the lignin and bonds the wood boards to the nail. This is proposed as an alternative to dowel laminating, which requires pre-drilling before inserting the dowels. Both nail-lam and dowel-lam are best used in cross-laminated timber panels, but this thesis experimented with using dowel-lam timber beams and columns.

A few tests were carried out with dowel-laminating timber beams at a scale of 1:5 (due to machine size constraints at the AA). Because of the low adhesion between boards, lamellas could only be laid up with parallel to the direction of the load, in contrast to glulam which is laid up perpendicular to the load direction. As a result, you cannot achieve substantial depth with dowel-lam beams, because the width of planed timber becomes the limiting factor (planed timber rarely exceeds 225mm in width, which would be the maximum depth if used in dowel-lam). In contrast, glulam can achieve much larger spans because lamellas can be continually laid up on top of each other to achieve deeper beams, and operate as one homogeneous entity due to the glue, which often has higher bond strength than the wood fibres. For this reason, this thesis chose not to pursue dowel-laminated beams and columns. Experiments into the matter are laid out on the proceeding sections.

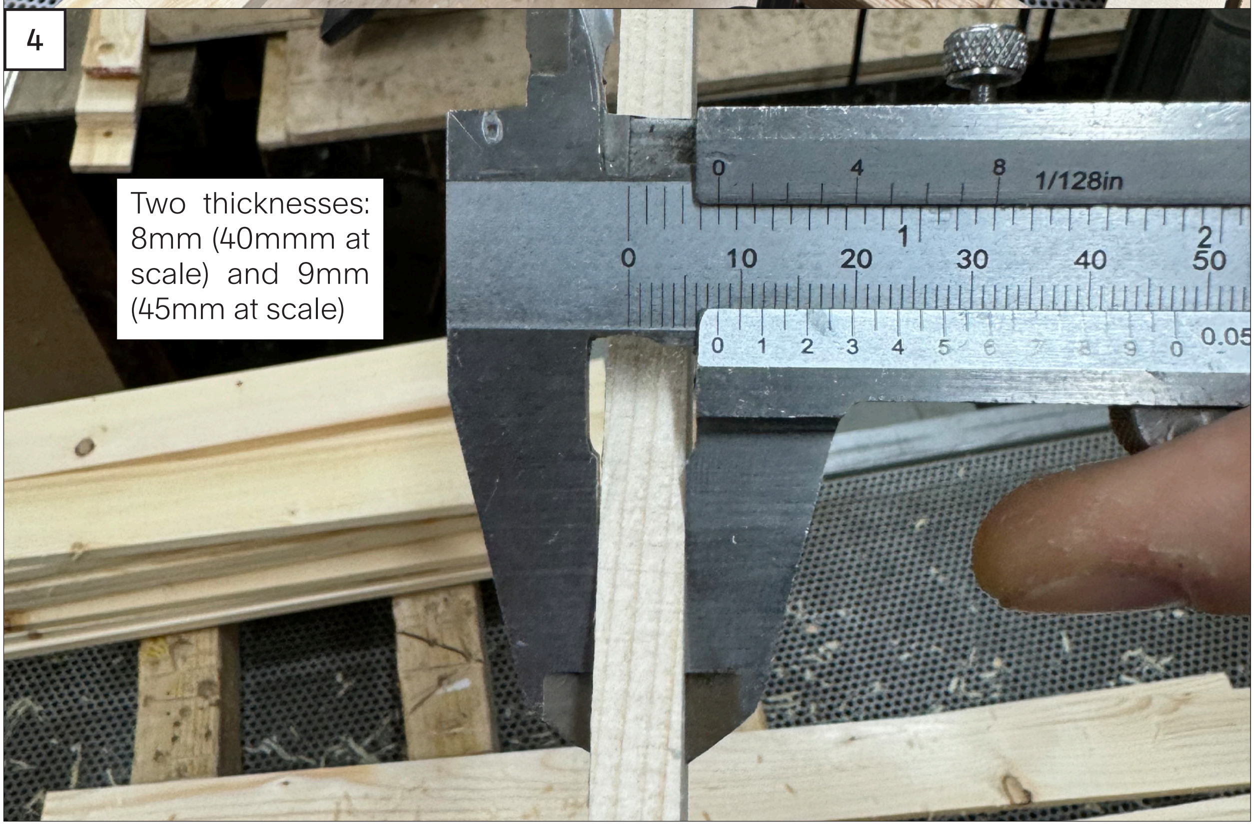
Fig. 4 Lamellas waiting to be glued up at the Versowood factory in Finland. Factory roof is made from glulam.

1 | 4.4 Making a Glulam Beam (GLT)

2

3

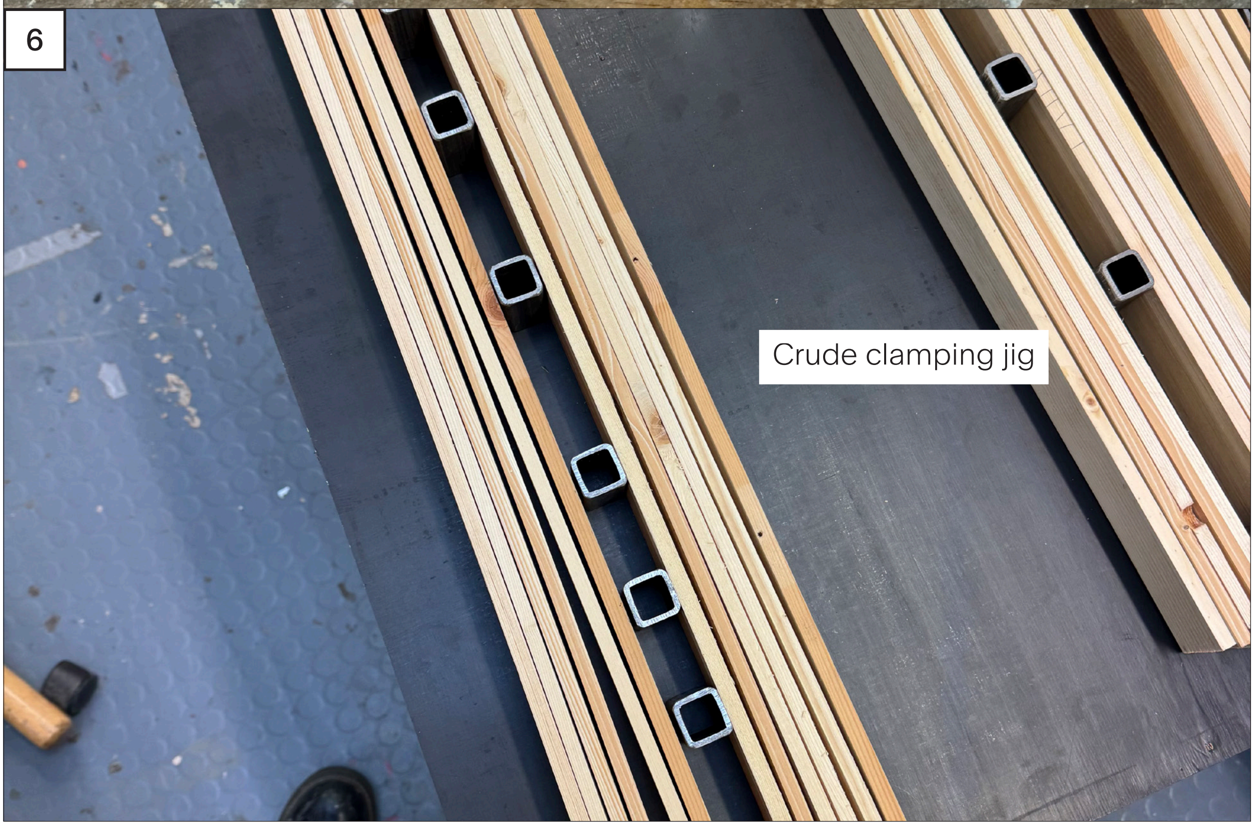
Planing lamellas to final size



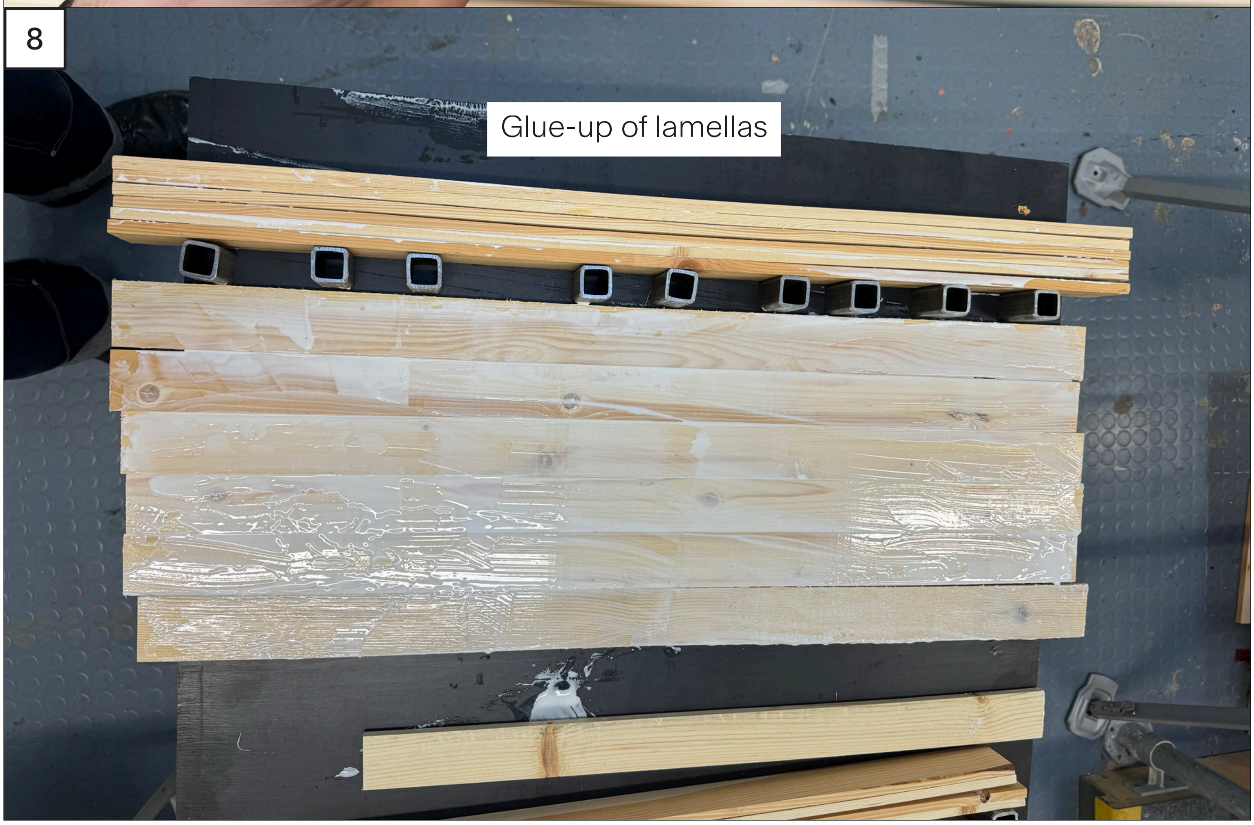
4

Two thicknesses: 8mm (40mmm at scale) and 9mm (45mm at scale)

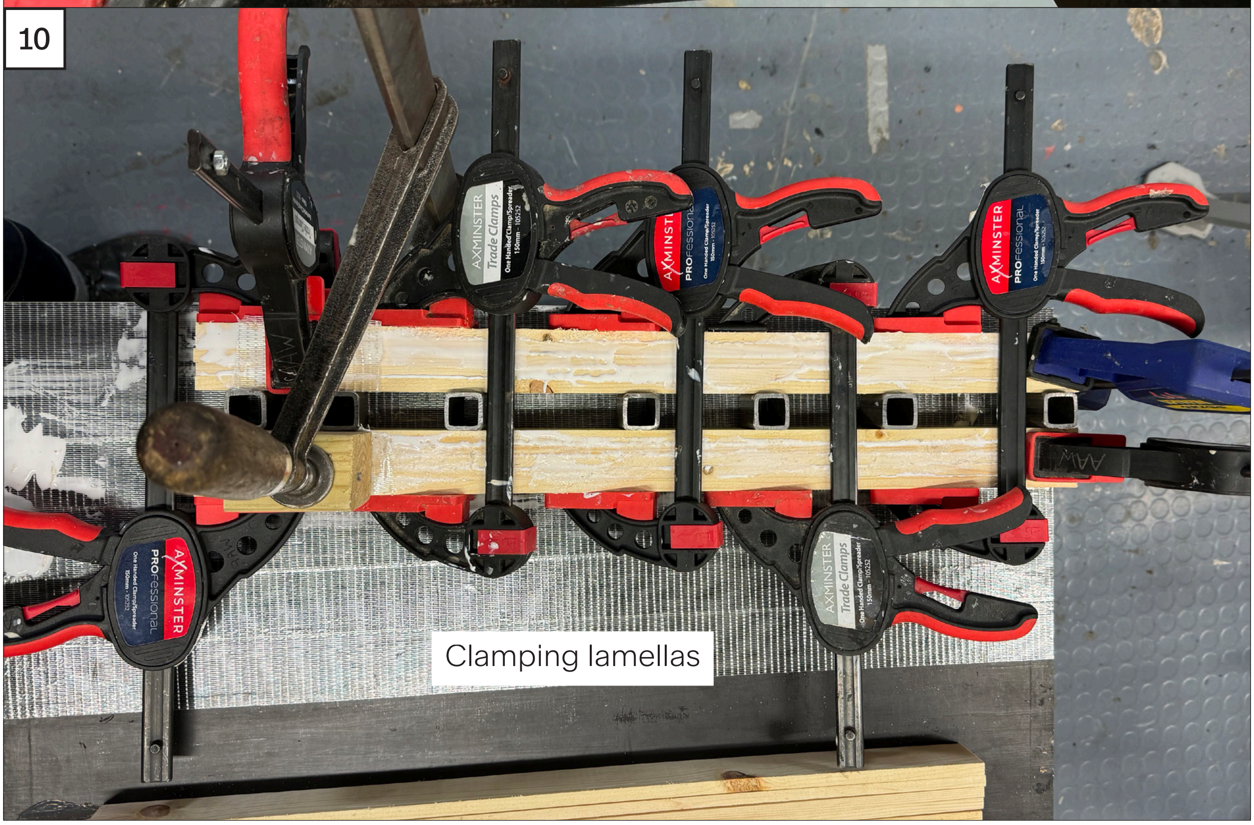

5
9mm outer lamellas
Laying-up the lamellas
8mm inner lamellas

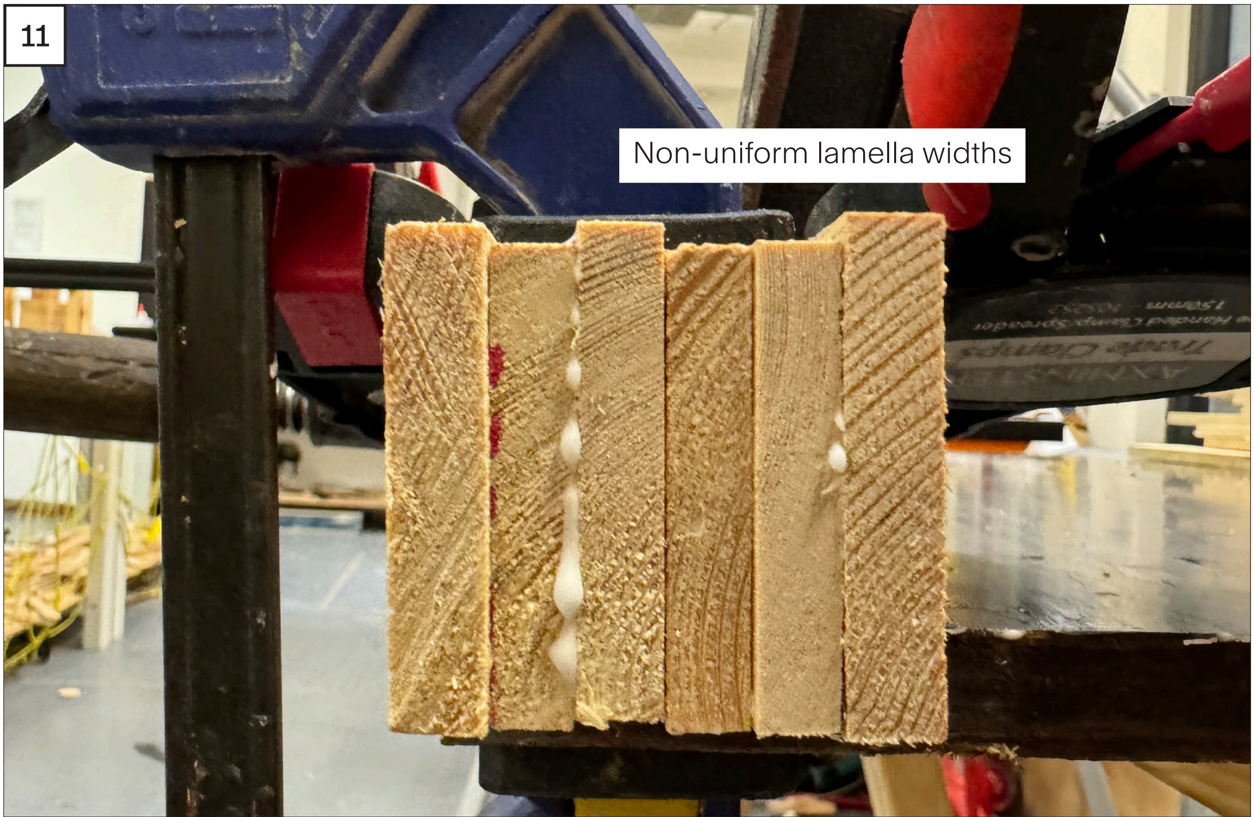

6
Crude clamping jig

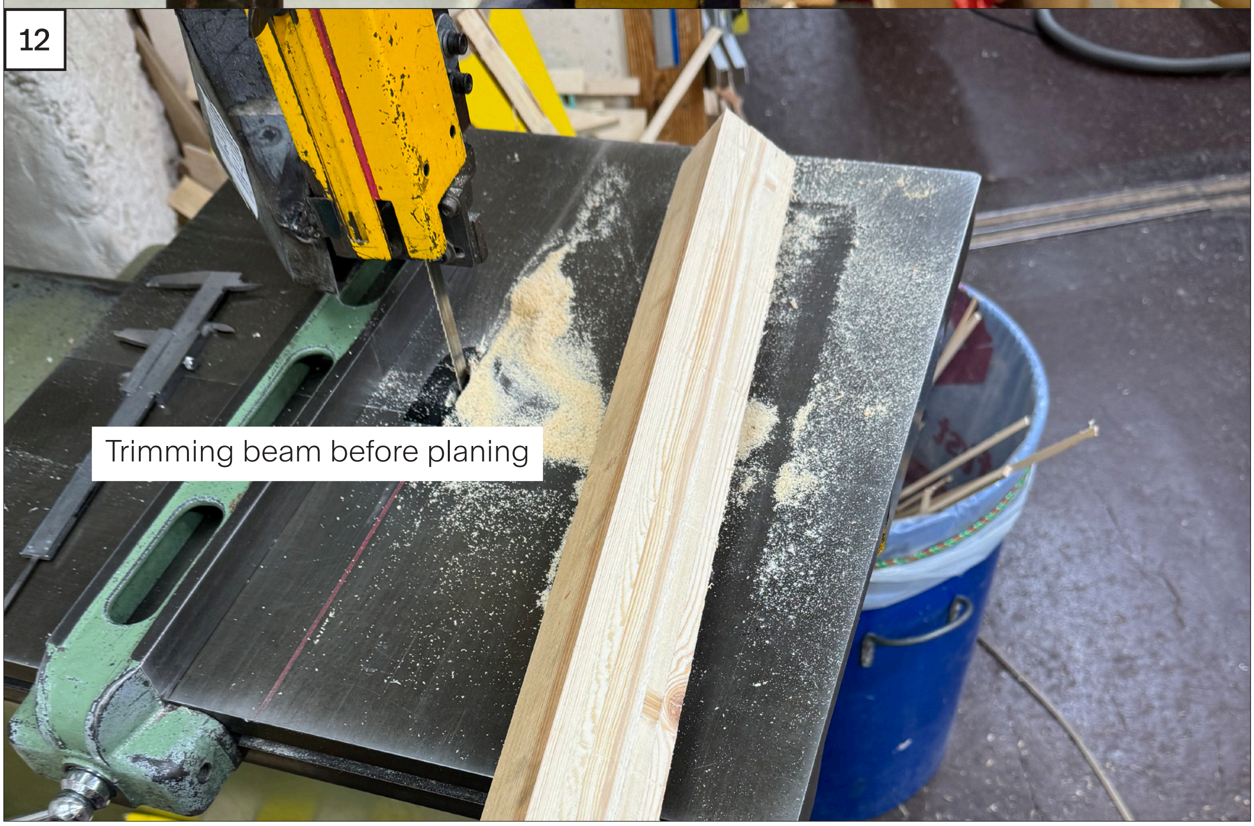

7
Spacers from scrap steel sections


8
Glue-up of lamellas

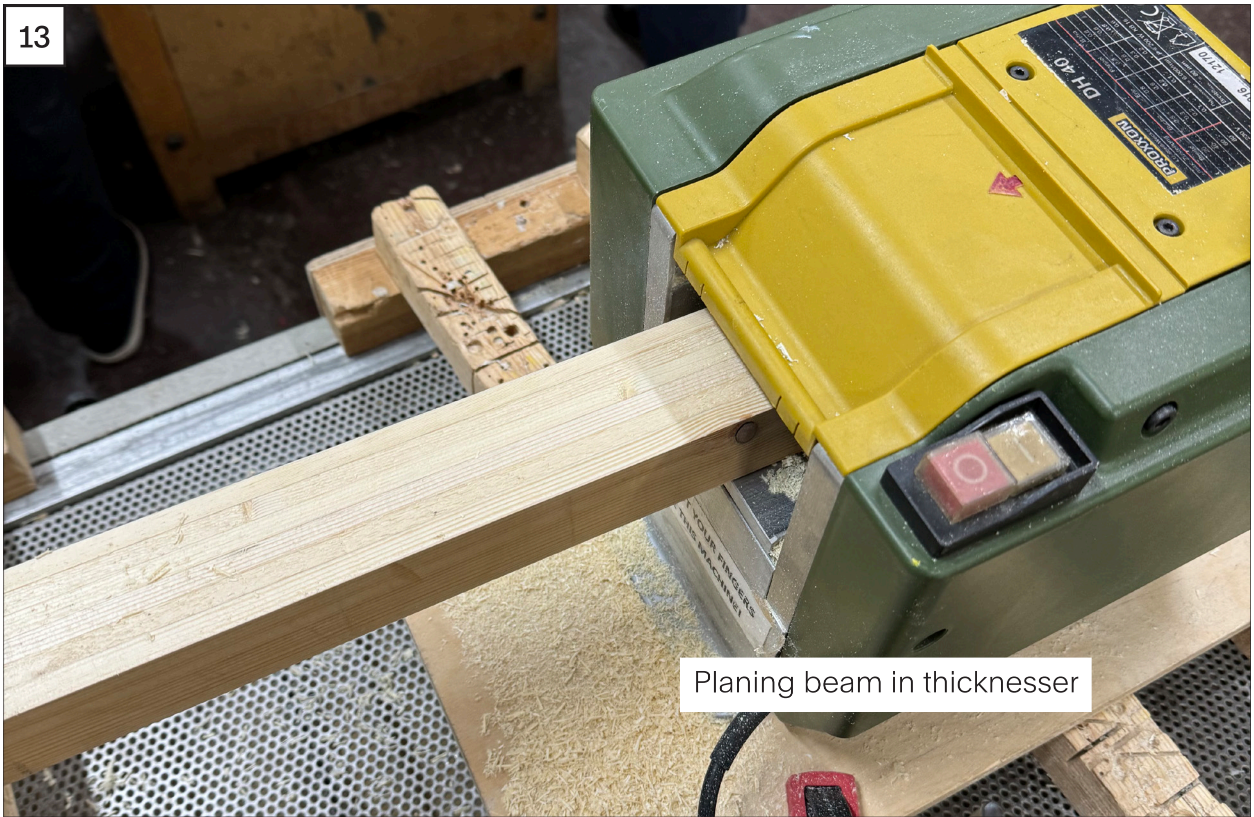

9
Clamping lamellas


10
Clamping lamellas


11
Non-uniform lamella widths


12
Trimming beam before planing

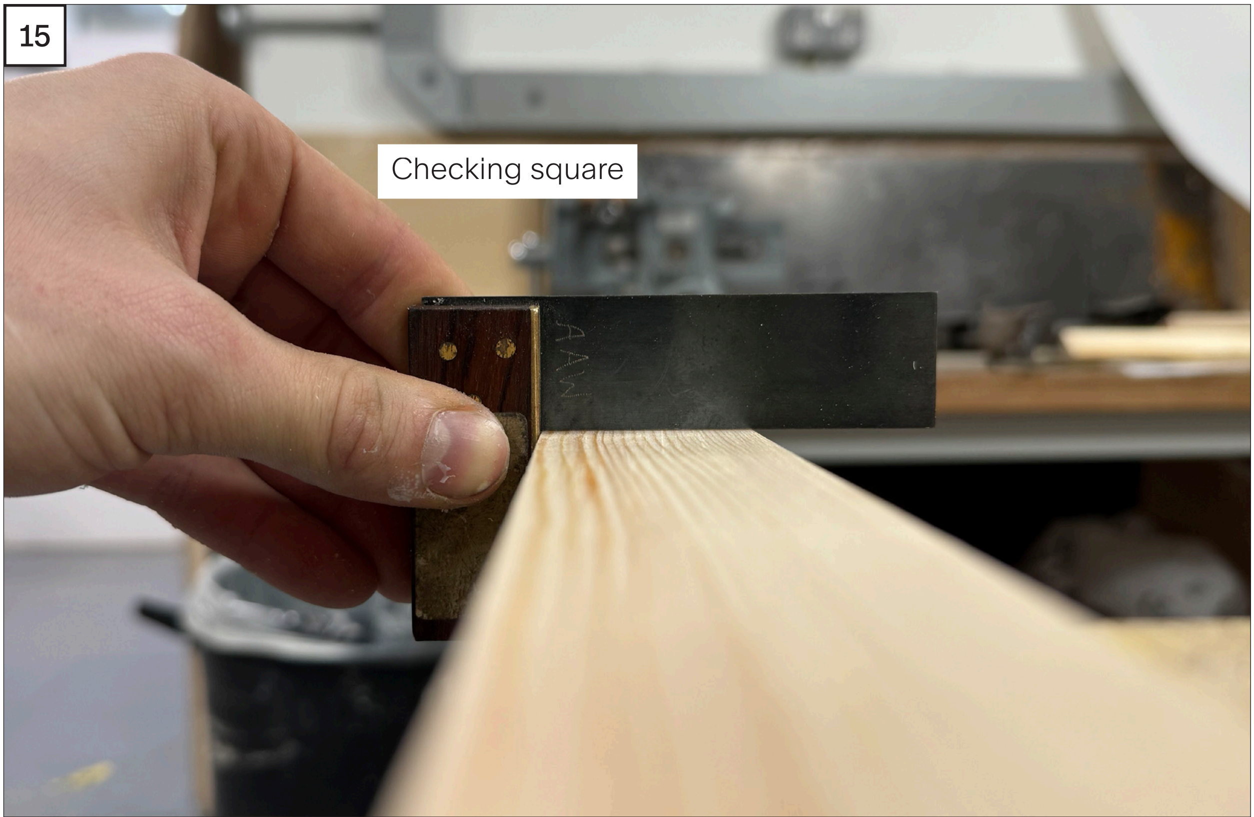
13

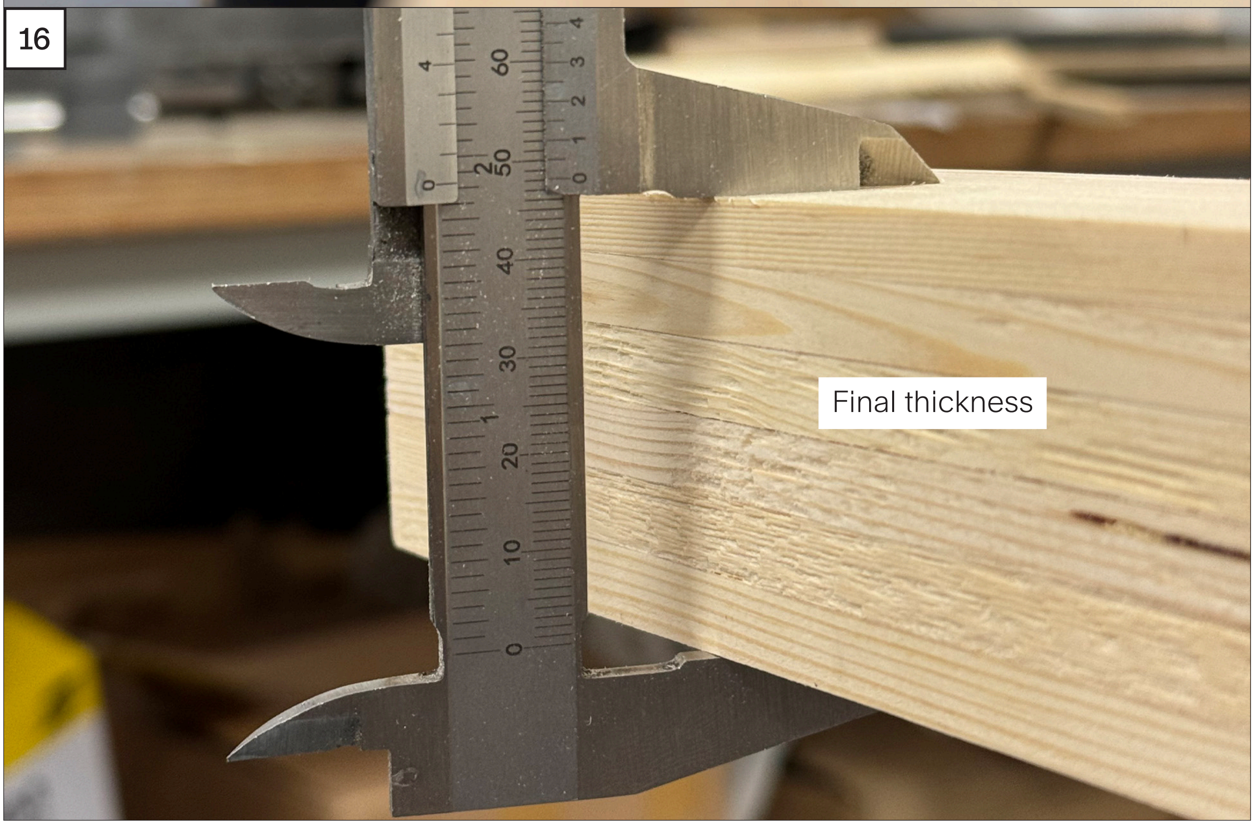


Planing beam in thicknesser

14

Manual planing width (doesn't fit in thicknesser)


15
Checking square

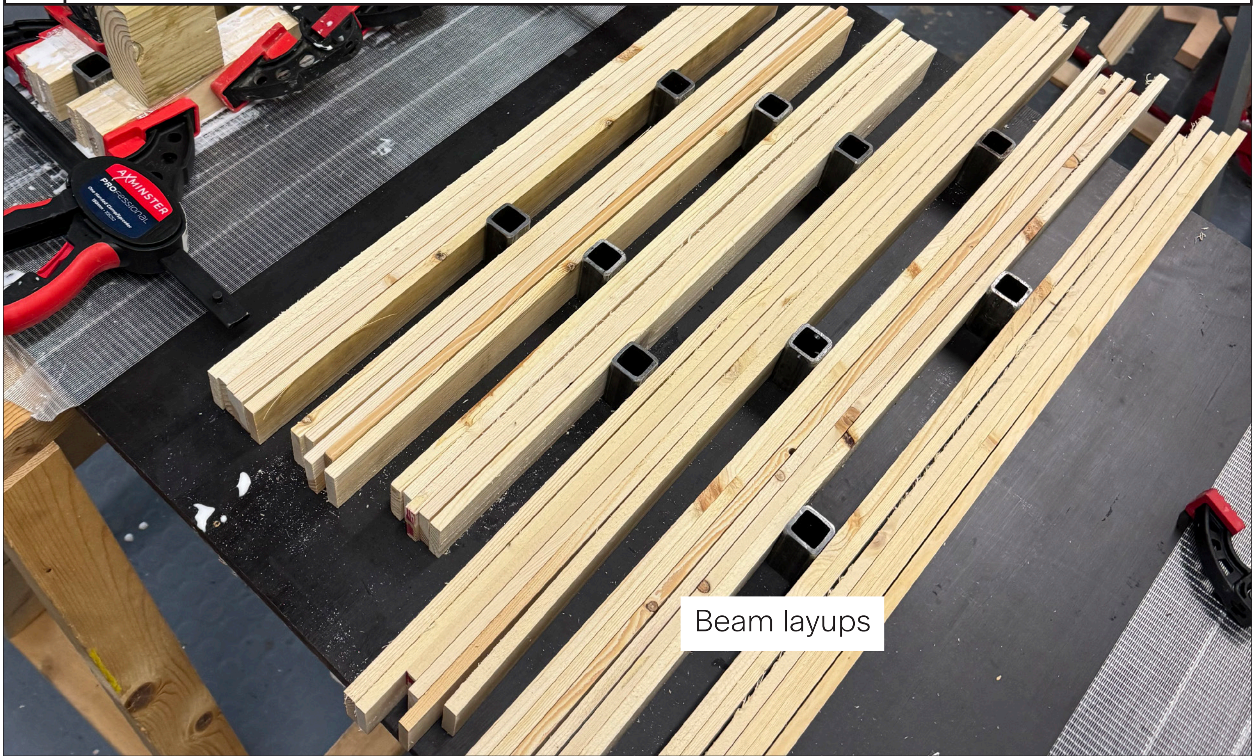

16
Final thickness

Finished Glulam specimens.

Finished Glulam specimens.

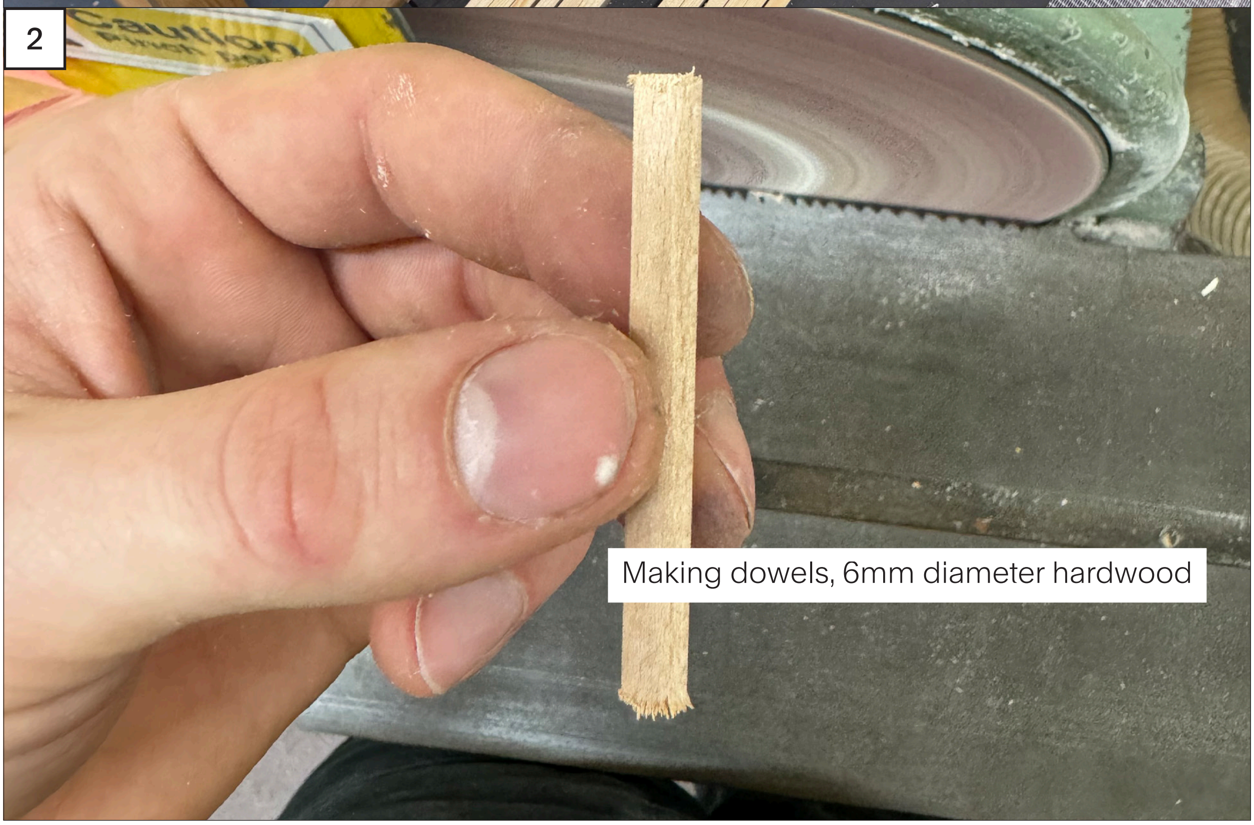
1

4.5 Making a Dowelam Beam (DLT)



Beam layups

2

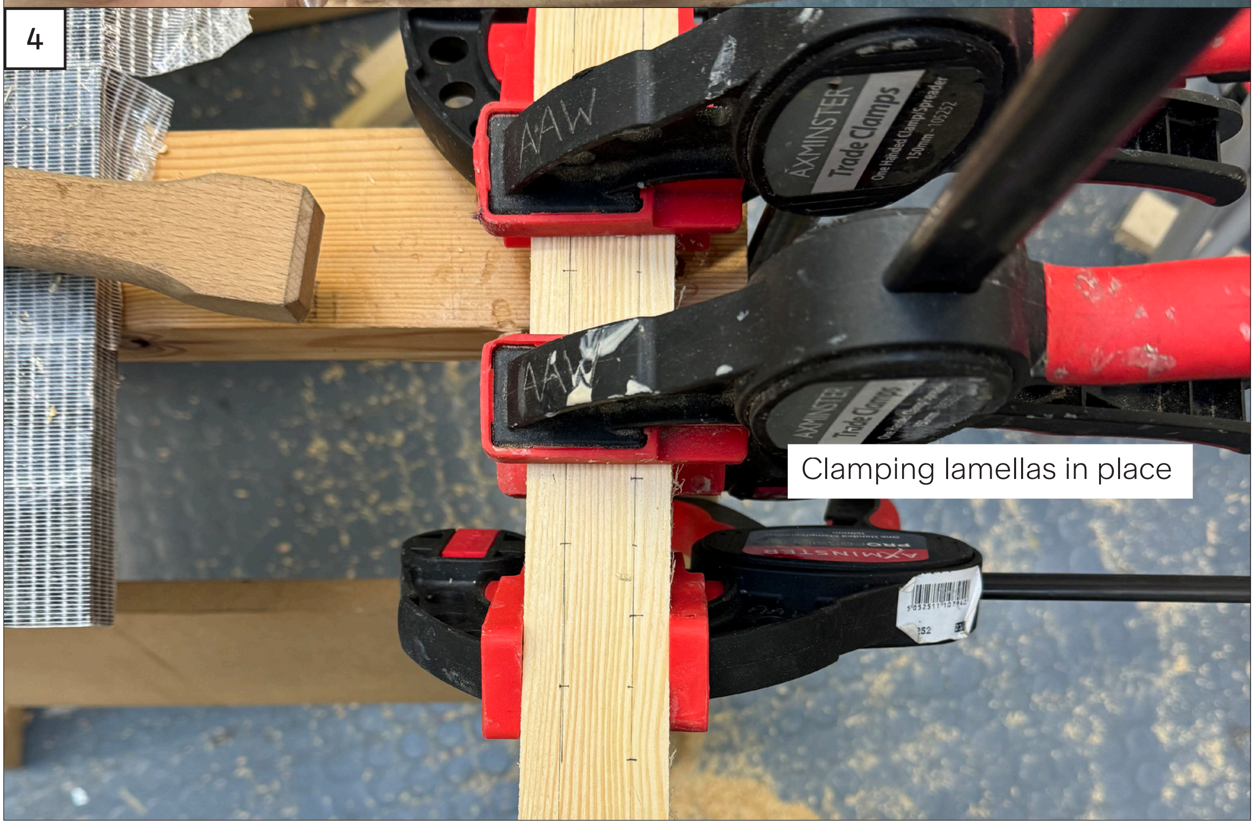


Making dowels, 6mm diameter hardwood

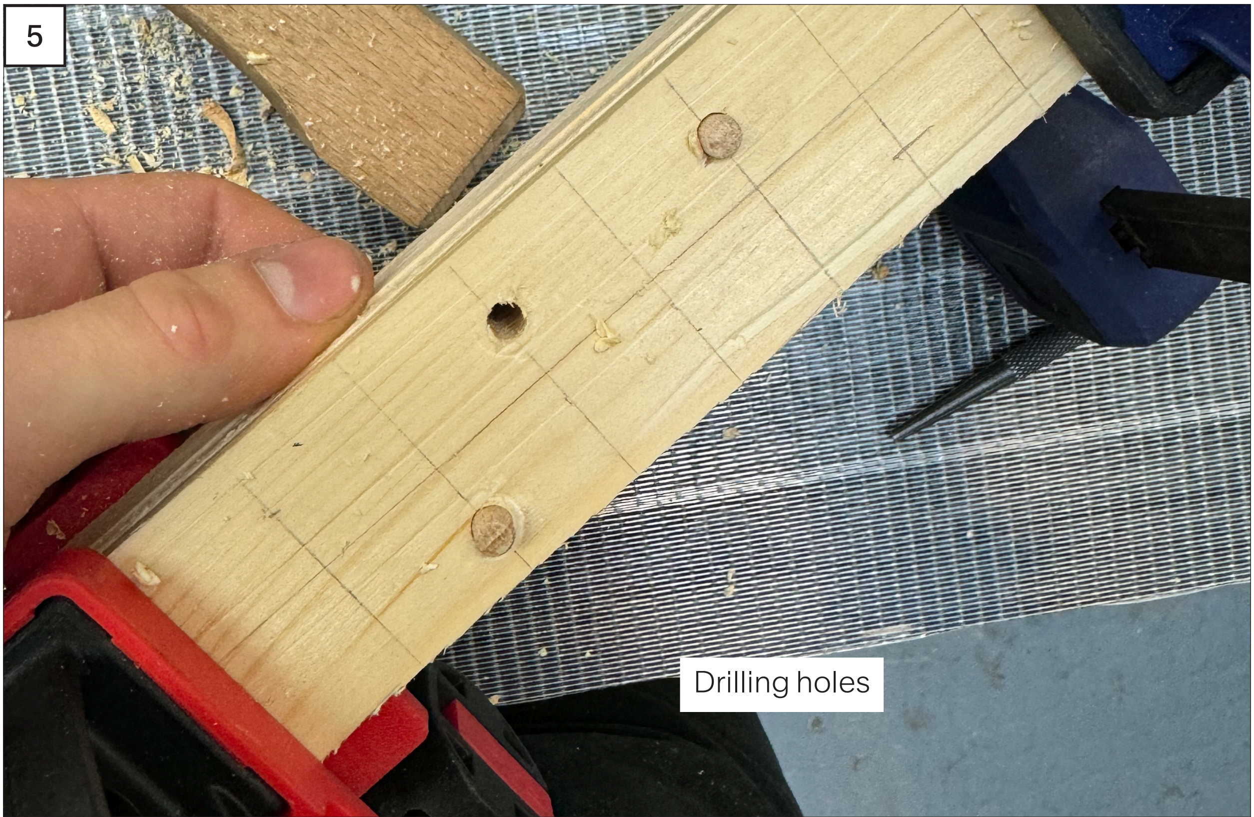
3

Finished dowels

4



Clamping lamellas in place



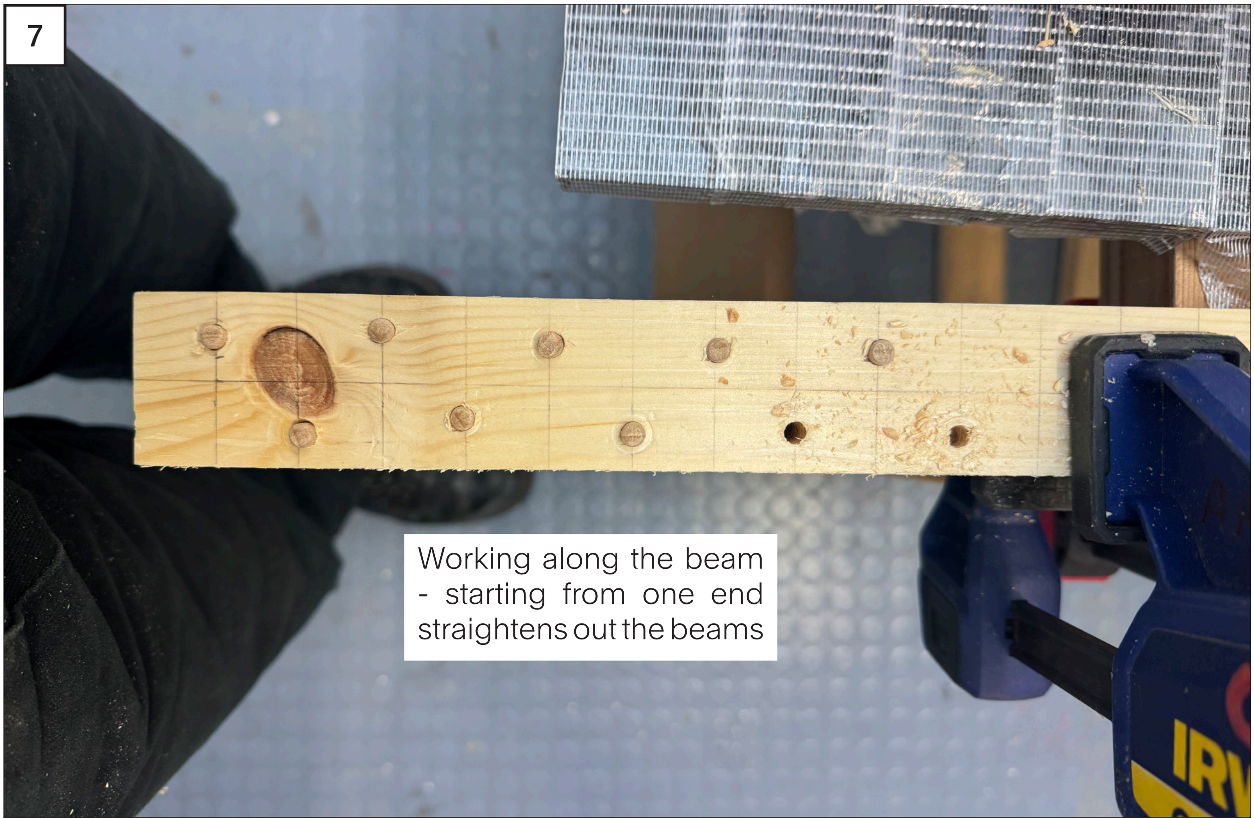
5

Drilling holes

6

Hammering dowels in the holes with wooden mallet

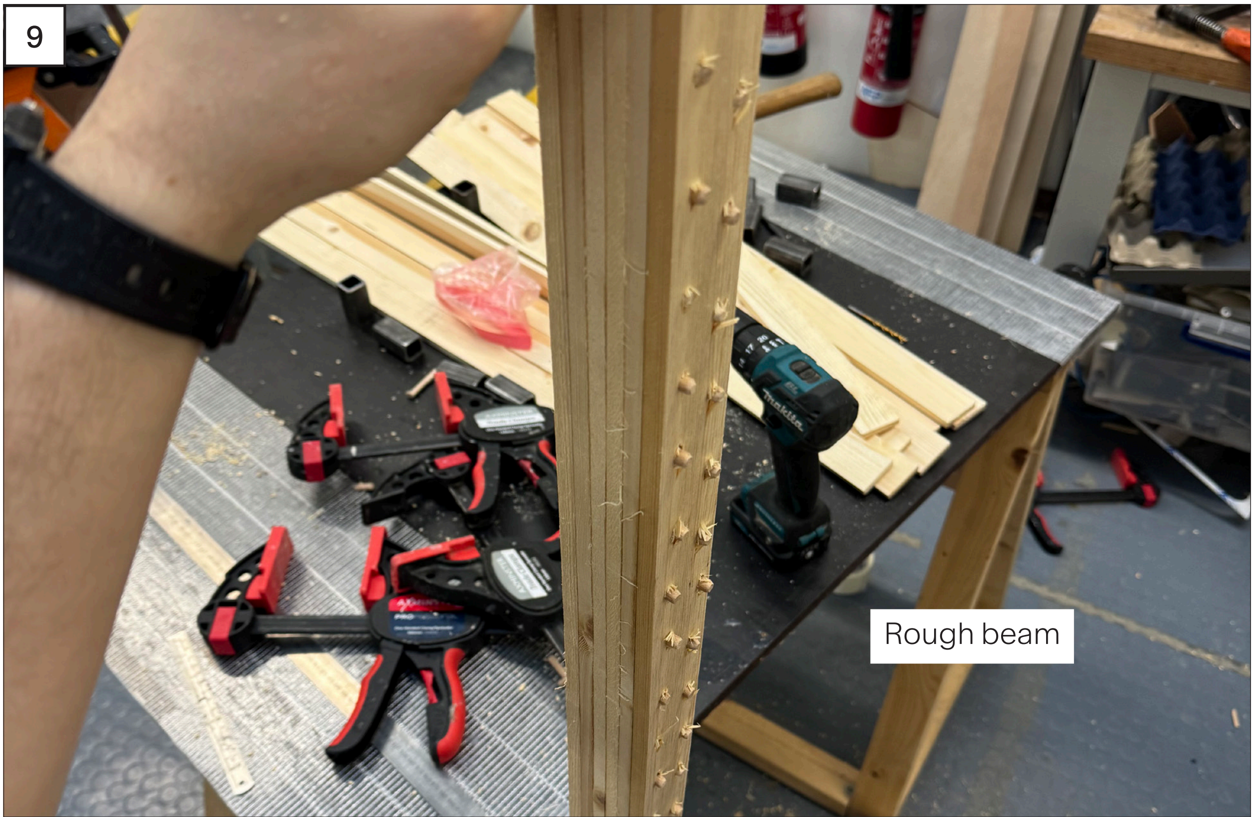
7

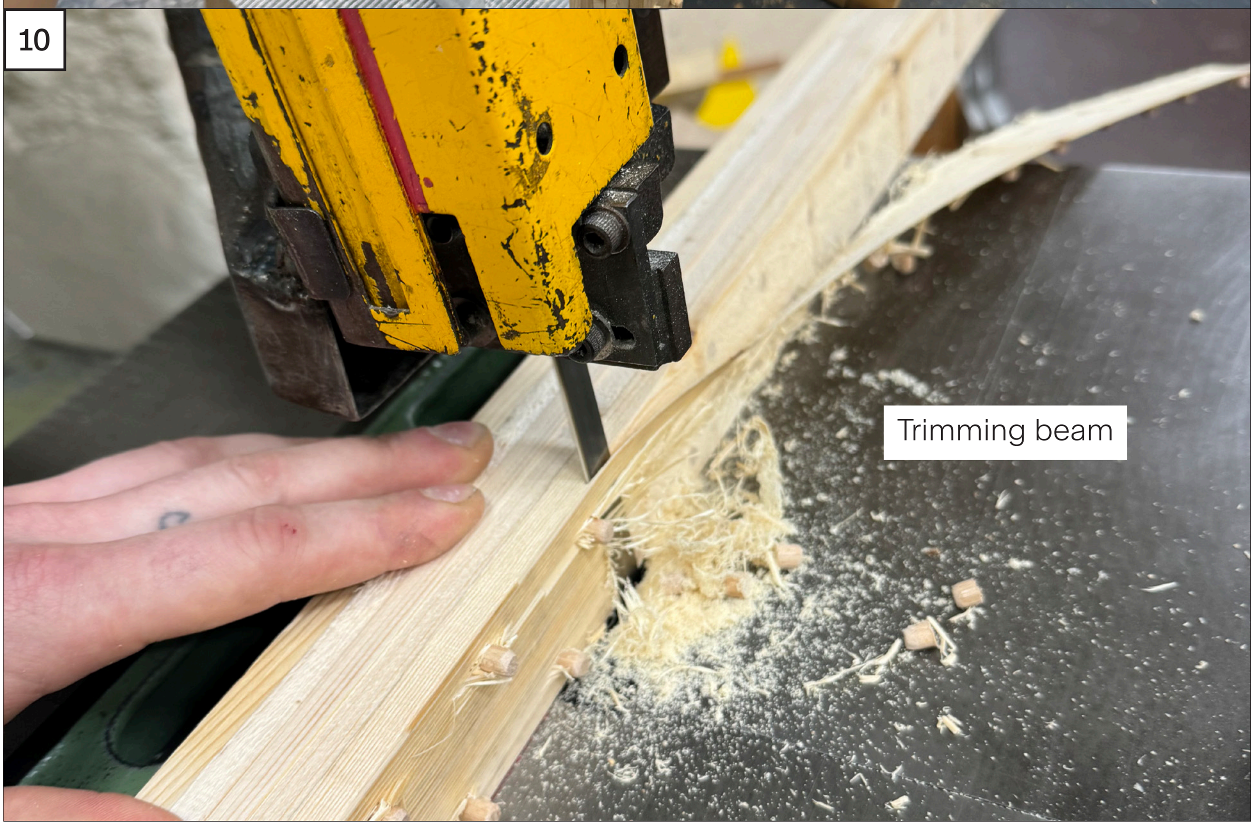


Working along the beam - starting from one end straightens out the beams

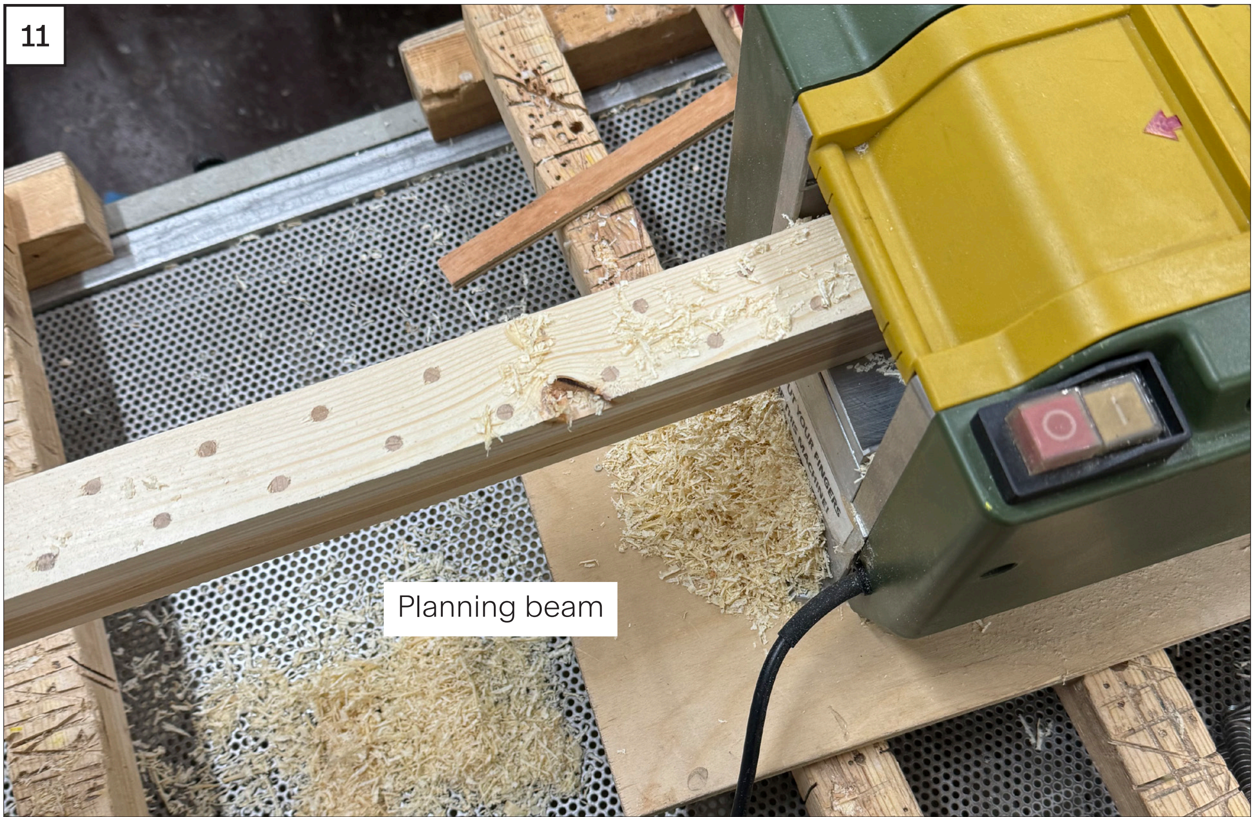
8

The bows in the lamellas help lock the dowels in place, after they are clamped straight and inserted


9
Rough beam

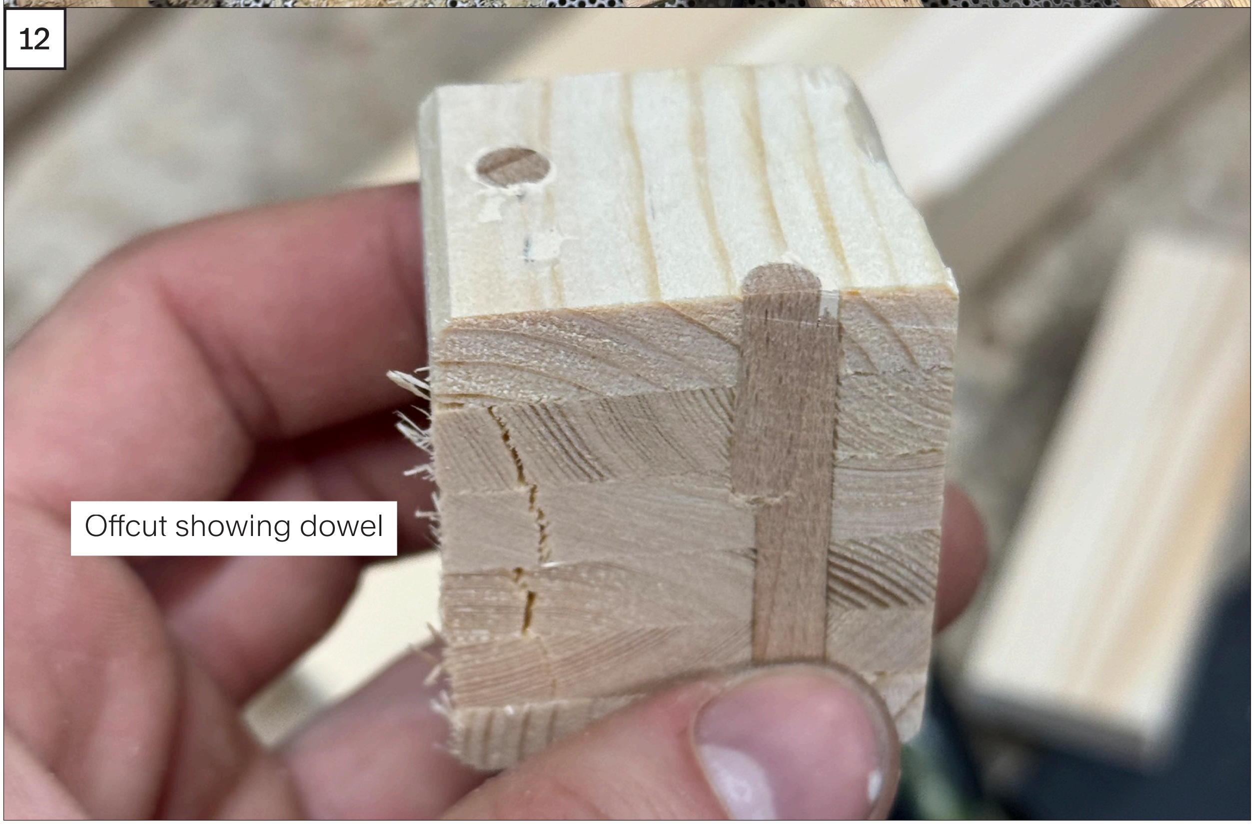

10
Trimming beam

11



Planning beam

12



Offcut showing dowel

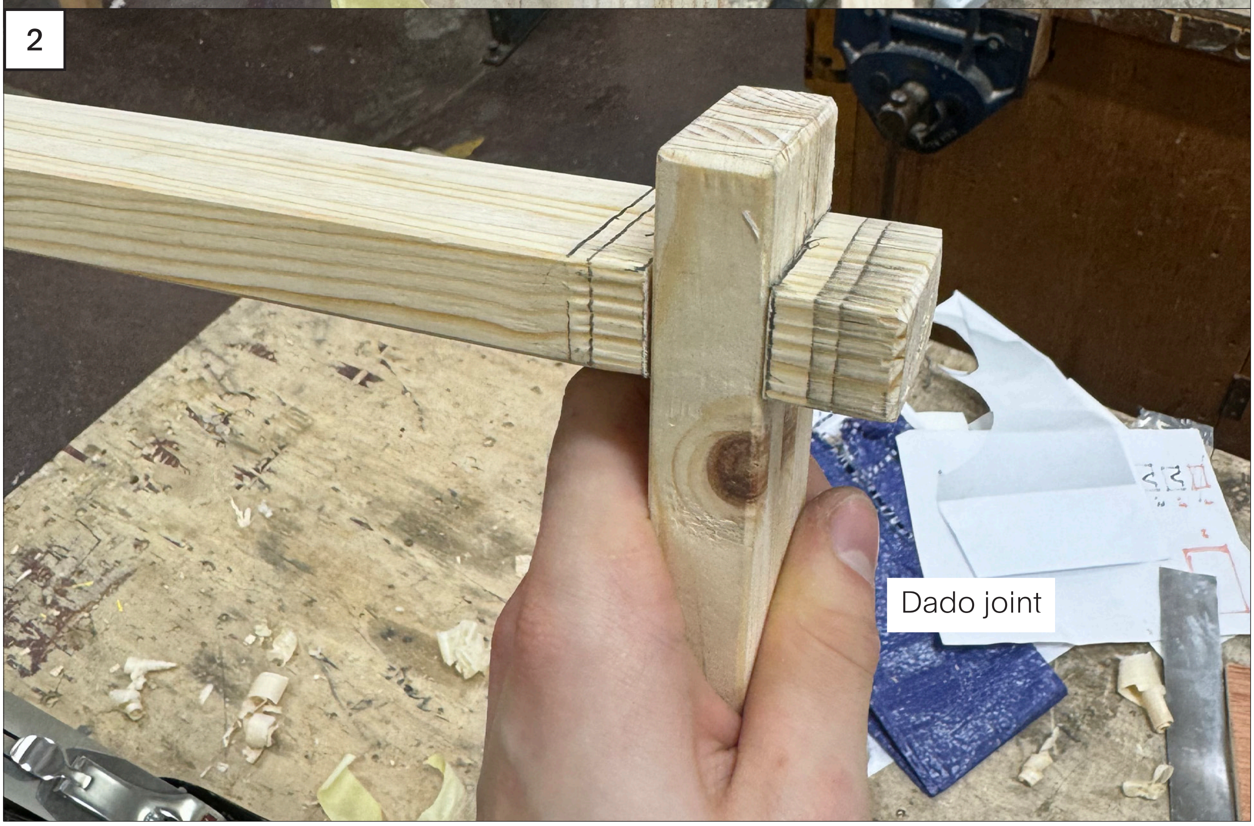
Finished Dowelam specimens.

Finished Dowelam specimens.

1	4.6 Experiments in the Timber Joinery


Making a dado joint

2


Dado joint

Dado joint + through-tennon with wedge

1

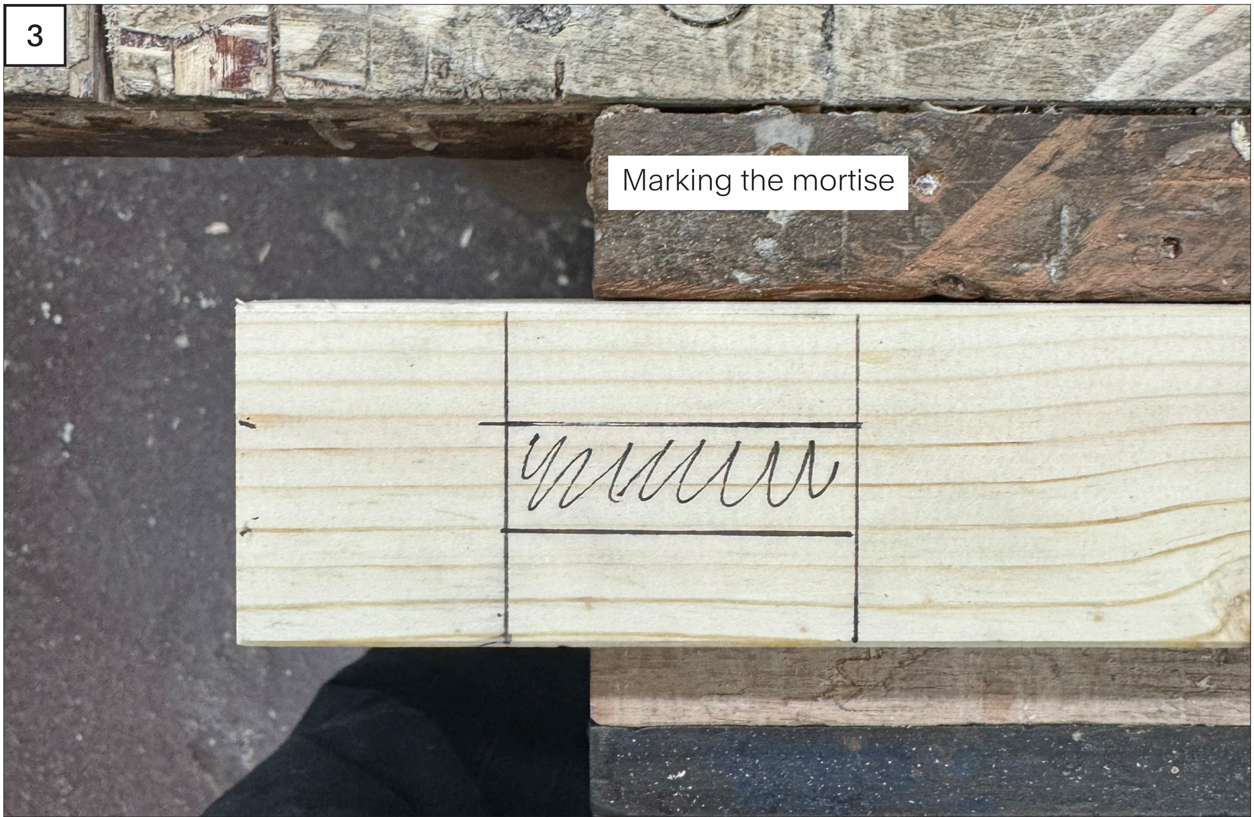
4.7 Mortise and Tenon Joint

Making a mortise and tenon joint

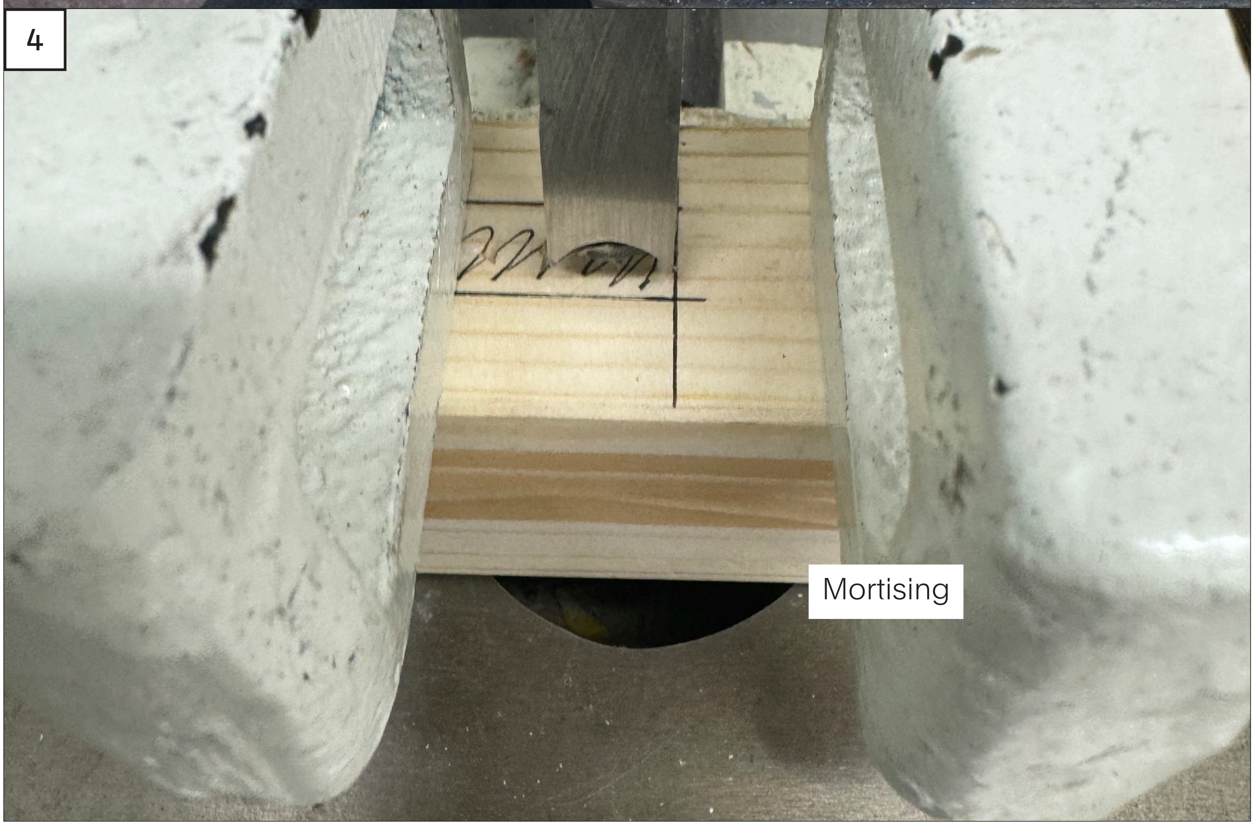
2

Cutting the tenon

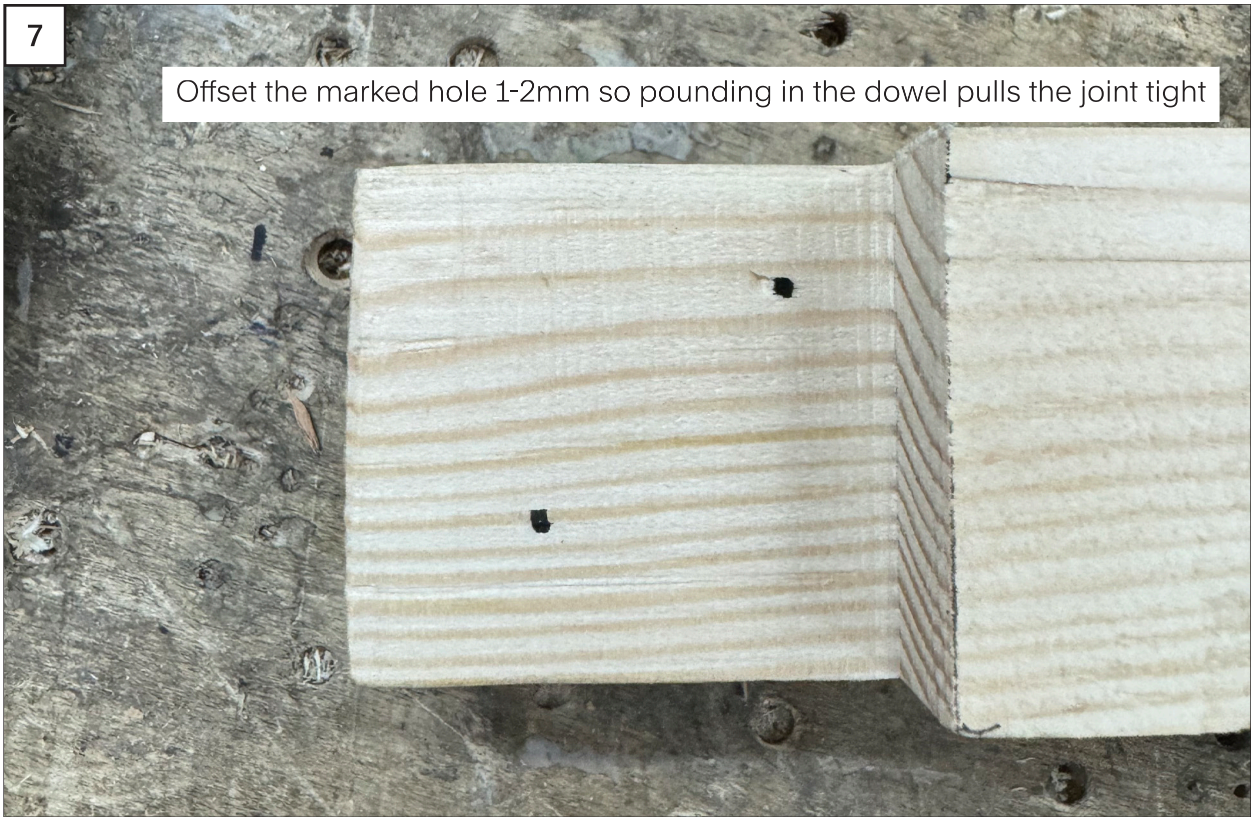
3

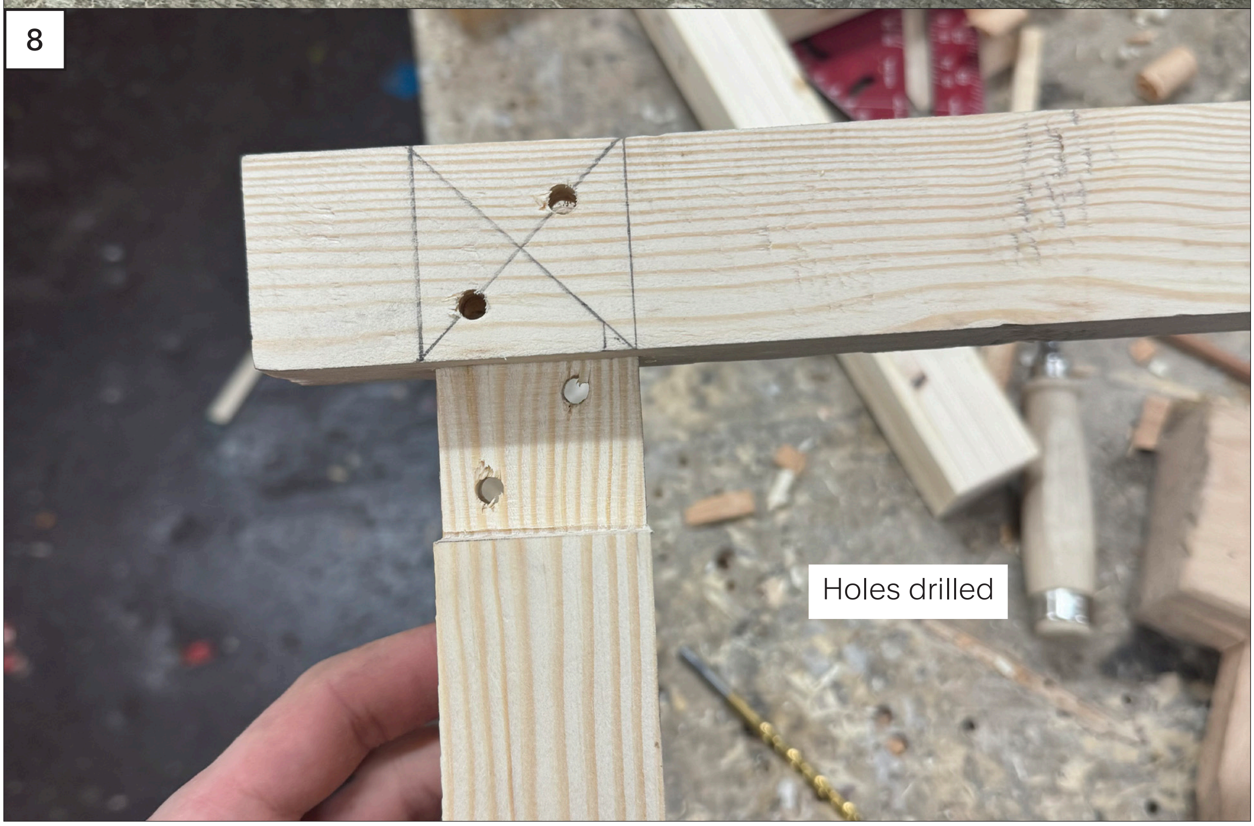


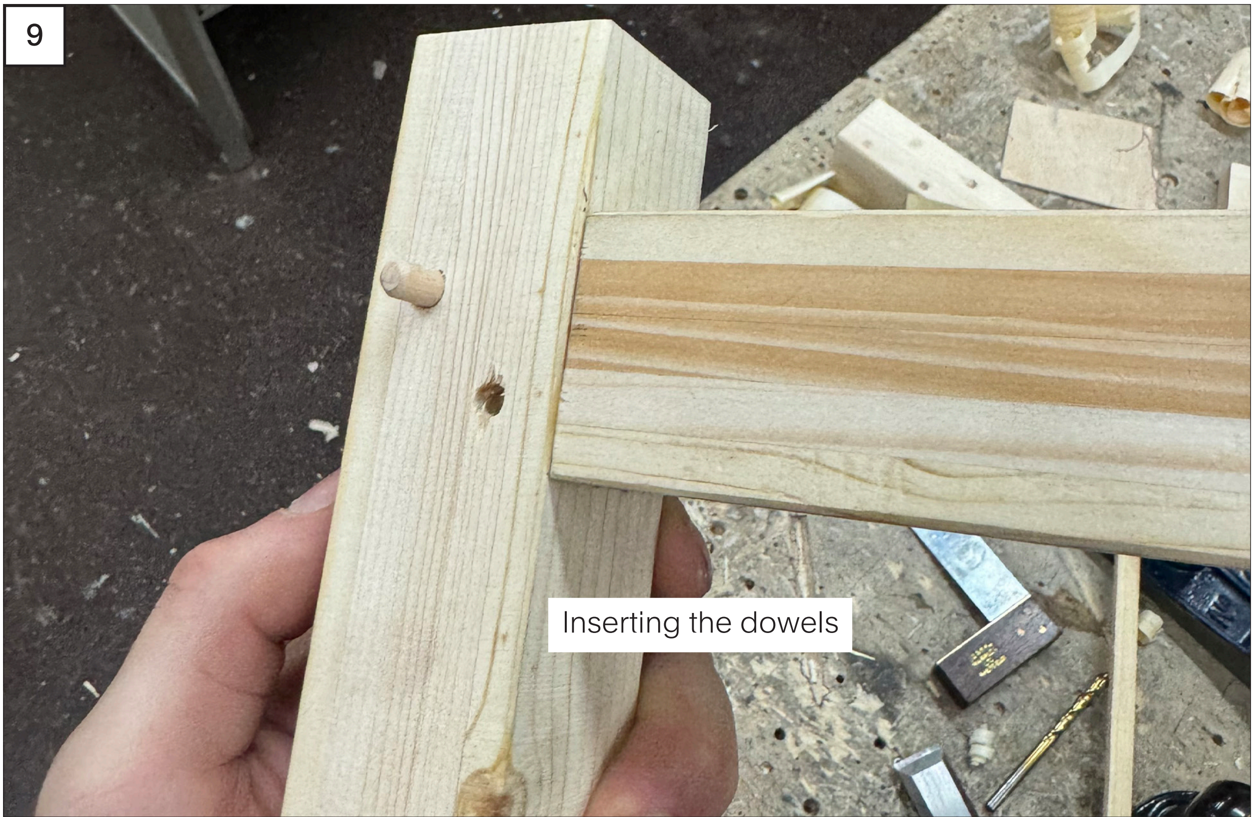
4



Fitting the joint, marking the dowel holes on the tenon


7
Offset the marked hole 1-2mm so pounding in the dowel pulls the joint tight


8
Holes drilled



9

Inserting the dowels

10

Trimming the dowels

Finished mortise and tenon joint with Glulam.

Finished mortise and tenon joint with timber.

Finished mortise and tenon joint with timber.

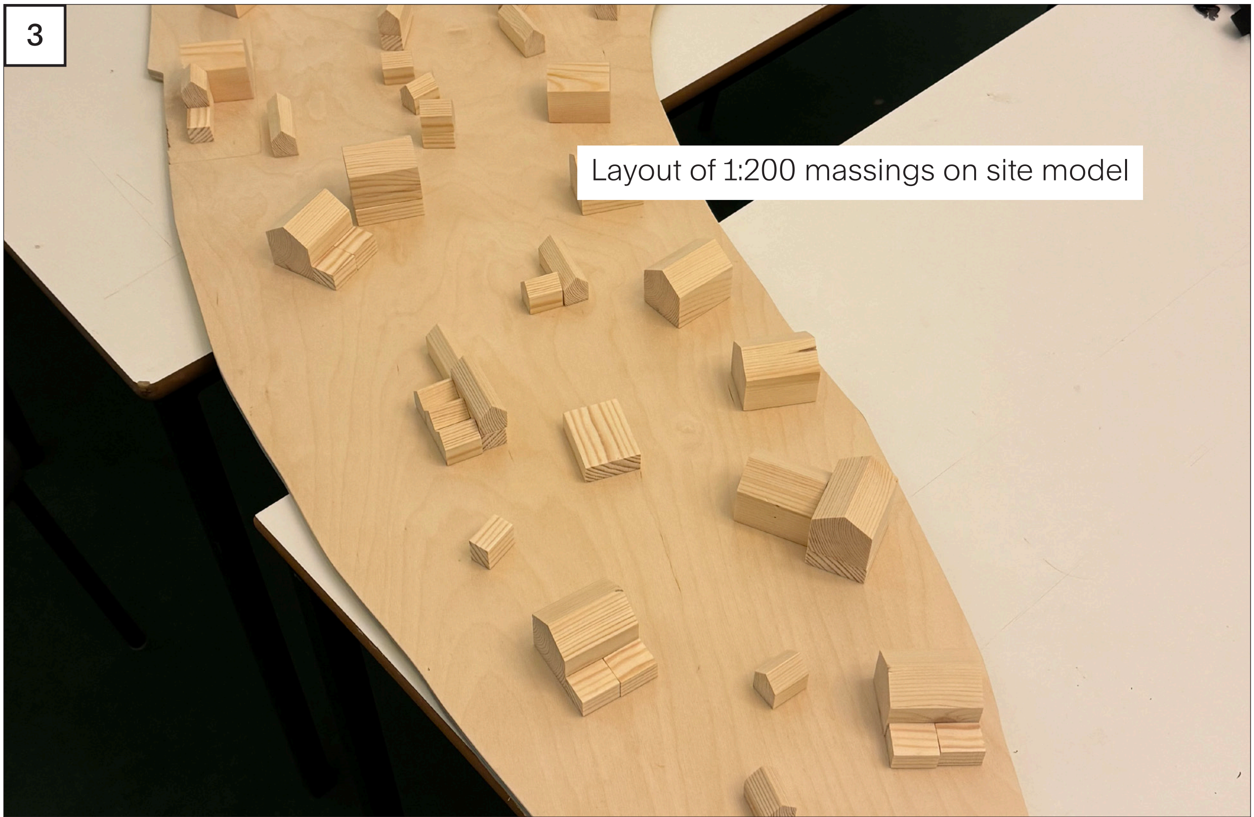
1

4.8 Making a Timber Frame

Sketch massing models

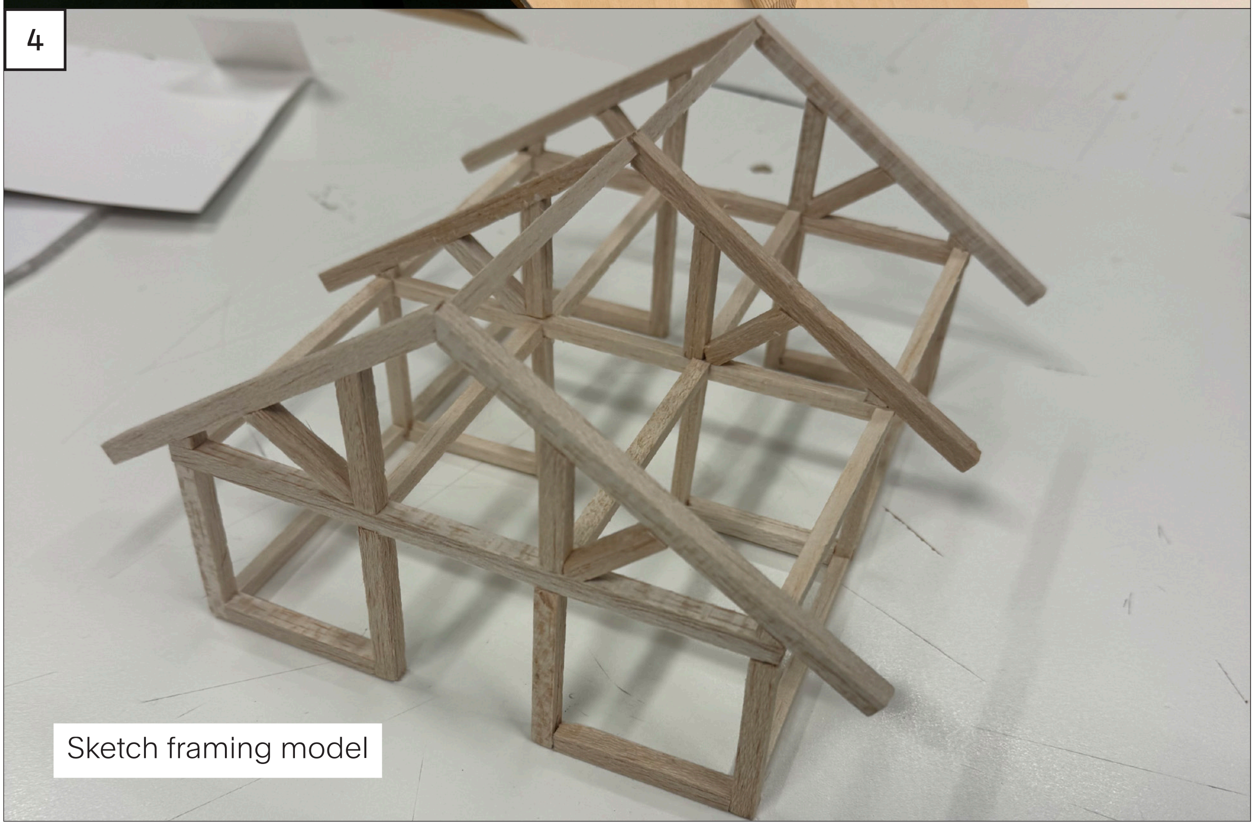
2

1:200 massings in timber



3

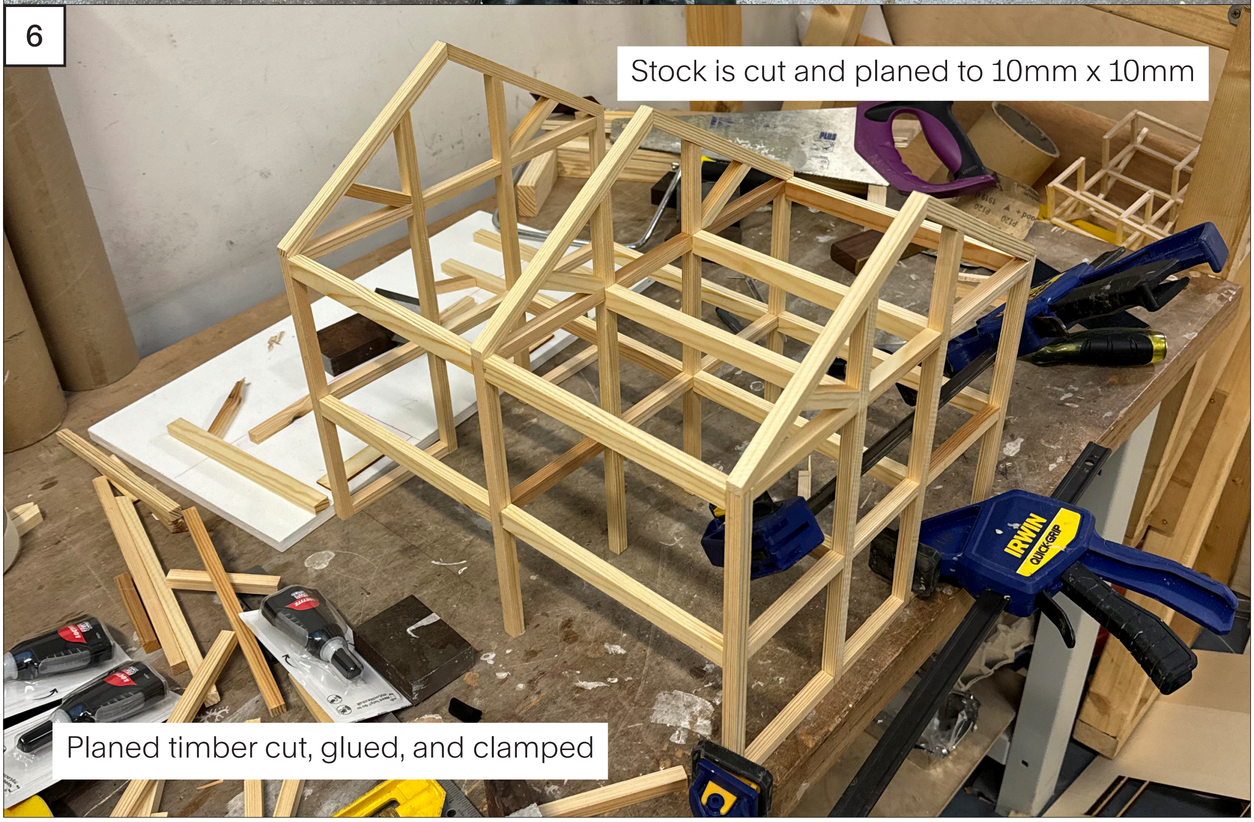
Layout of 1:200 massings on site model



4

Sketch framing model

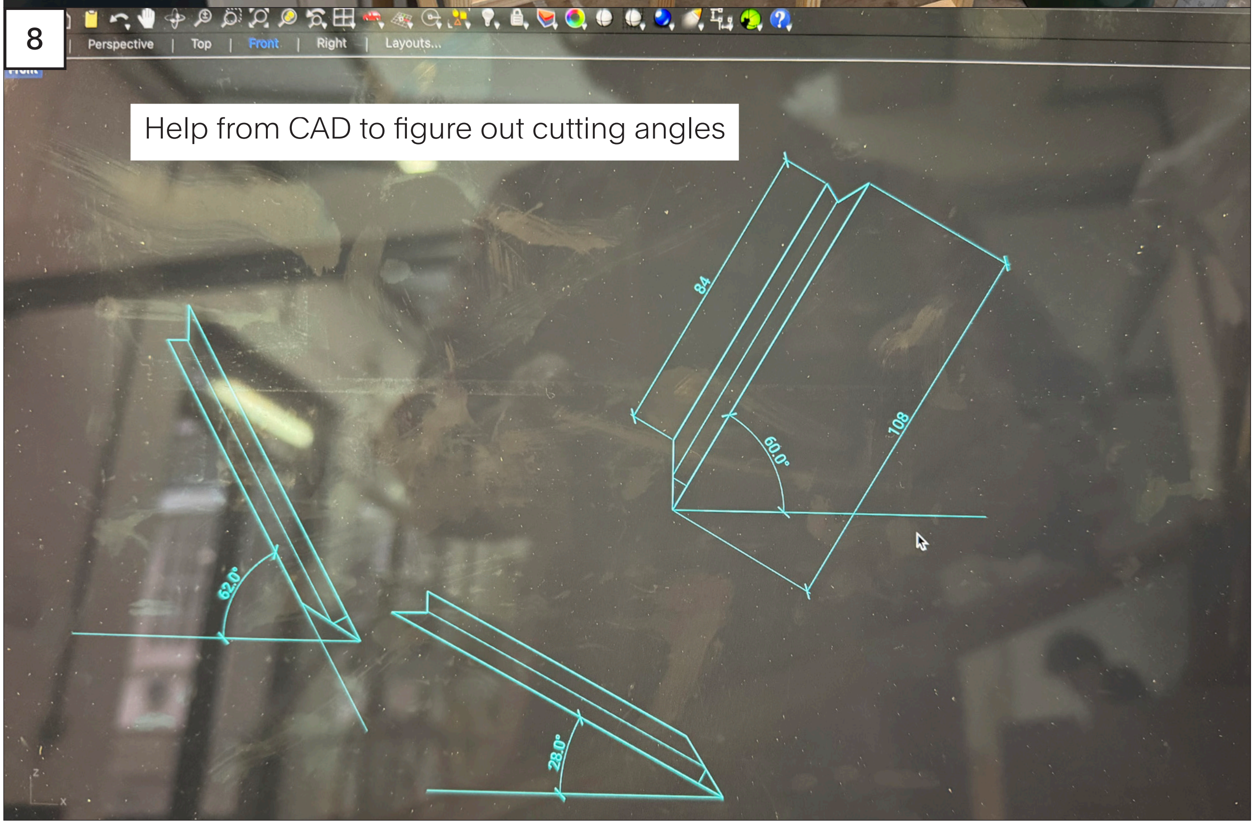

5
Salvaged stock


6
Stock is cut and planed to 10mm x 10mm
IRWIN
QUICK GRIP
Planed timber cut, glued, and clamped

7

Figuring out eaves with foamcore

8



Help from CAD to figure out cutting angles

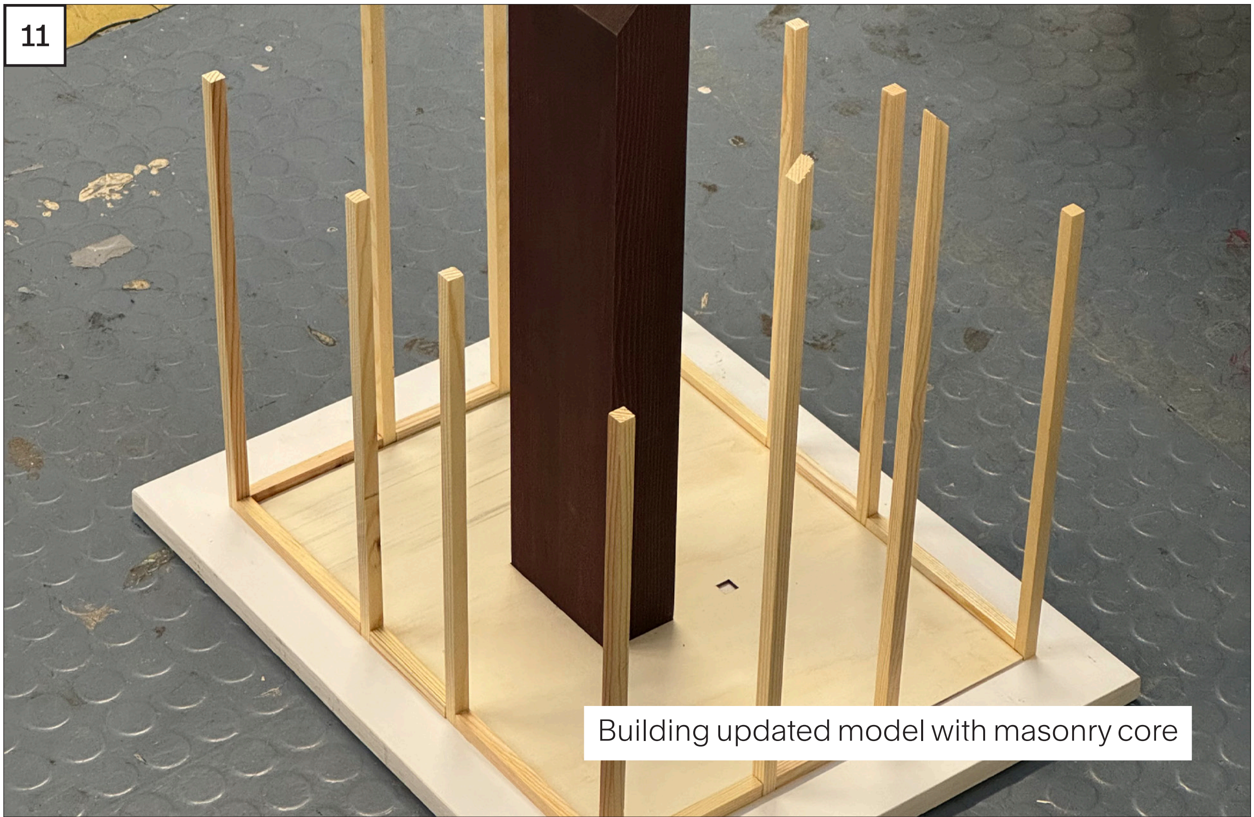
9

Assembling model

10

1:20 Model with eaves

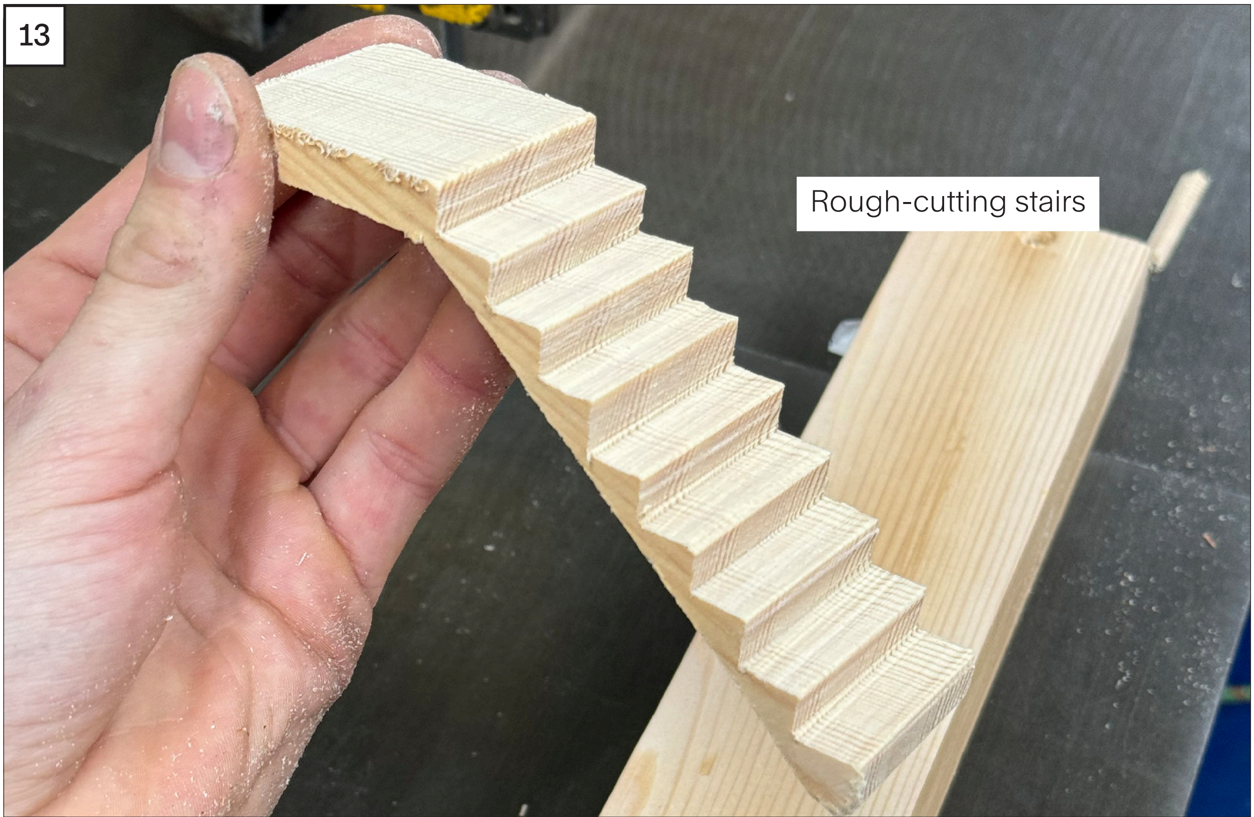
11



Building updated model with masonry core

12

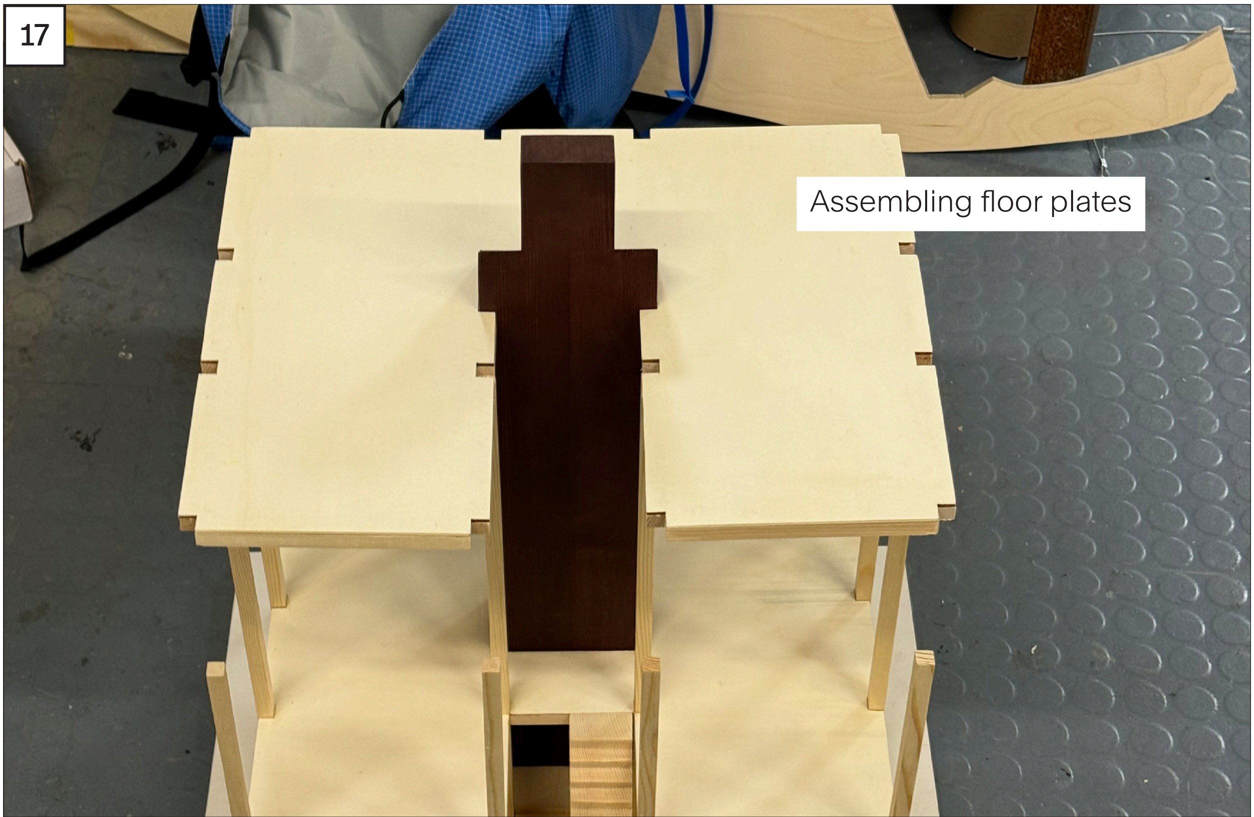
Floor plates, 10x10mm timber to 3mm plywood


13
Rough-cutting stairs

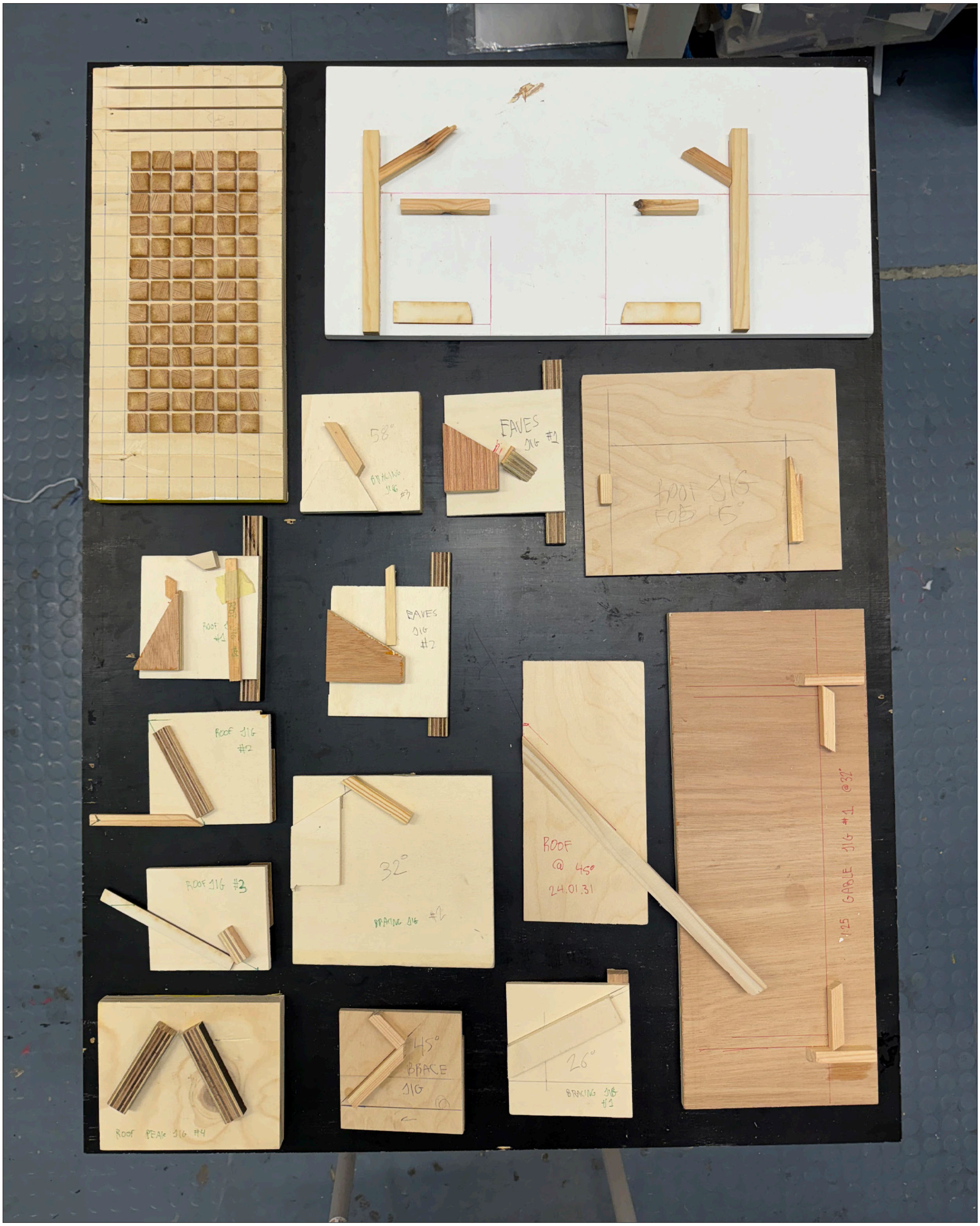

14
Hand-finishing stairs

Sanded stairs

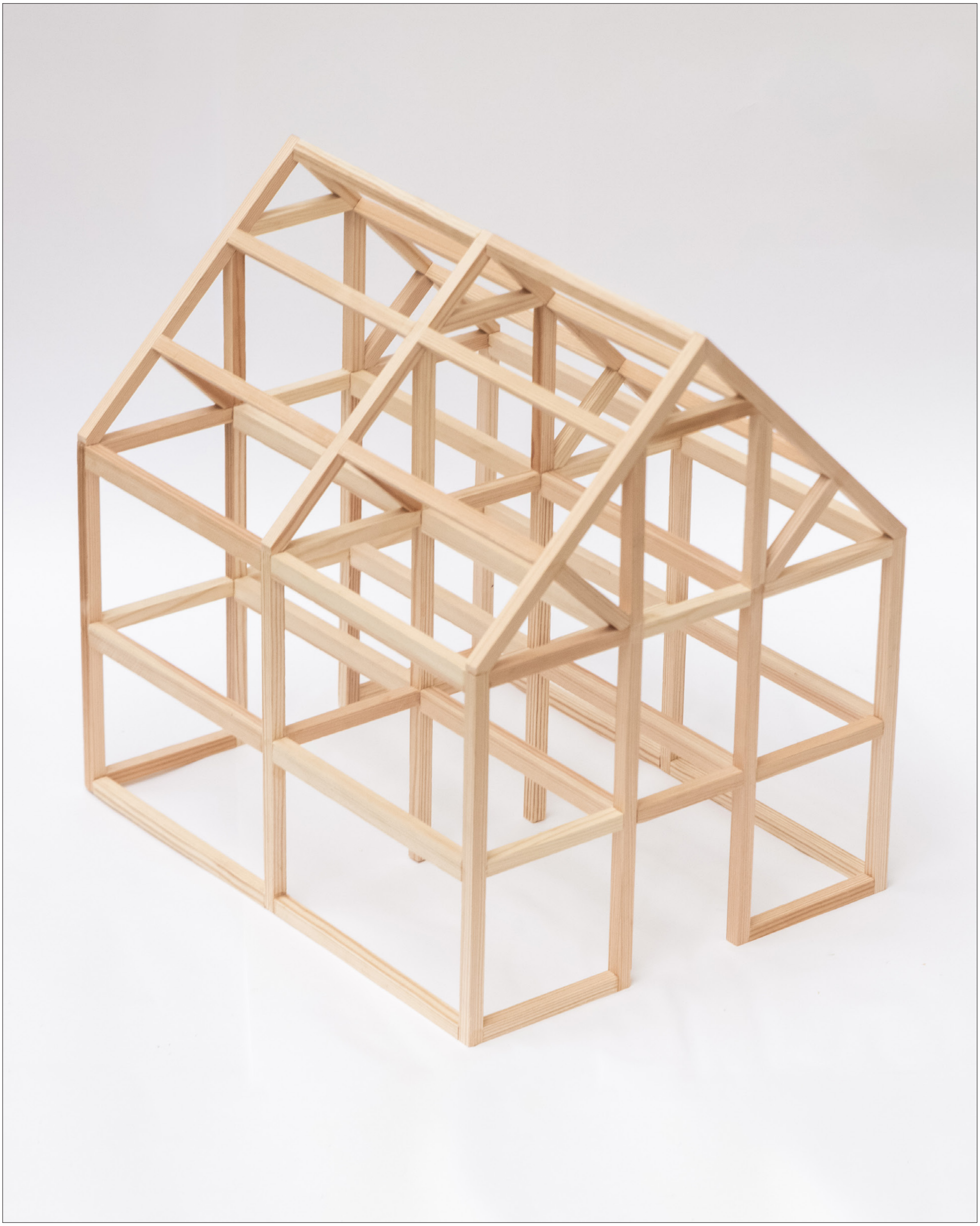
Gluing stairs with weights and spacers


17
Assembling floor plates


18
Finished models

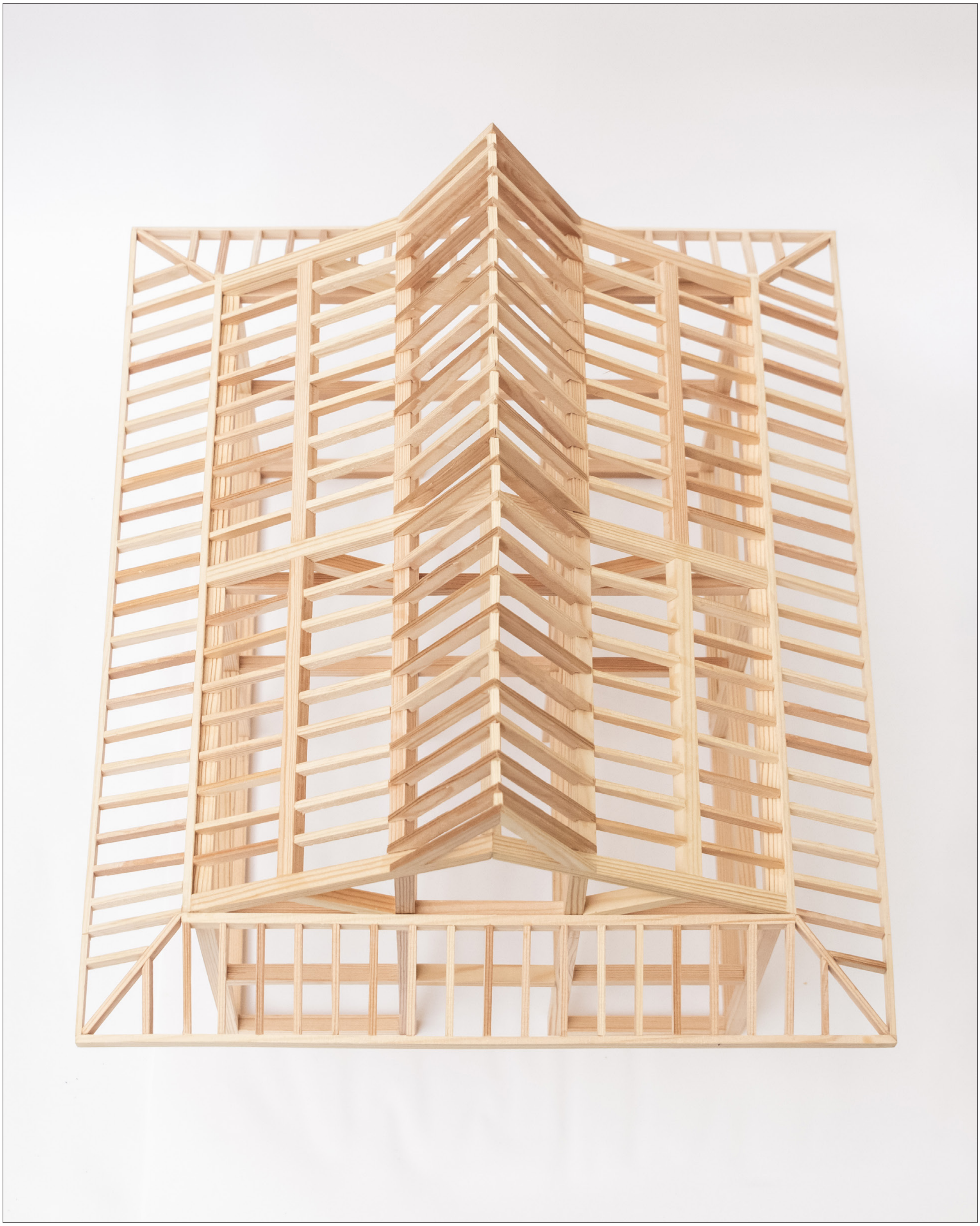


The various jigs used to make the 1:20 models. Some jigs used in assembly, most used with the bandsaw.



Simple 1:20 timber frame study.

Framing model at 1:20 showing eaves.



Eaves model from above.

Detail of eaves and roof framing.

Interior of model showing timber frame.

Framing model at 1:20 with masonry core in dark-brown wood.

Timber stairs.

Timber stairs.

Timber stairs.

Masonry core.

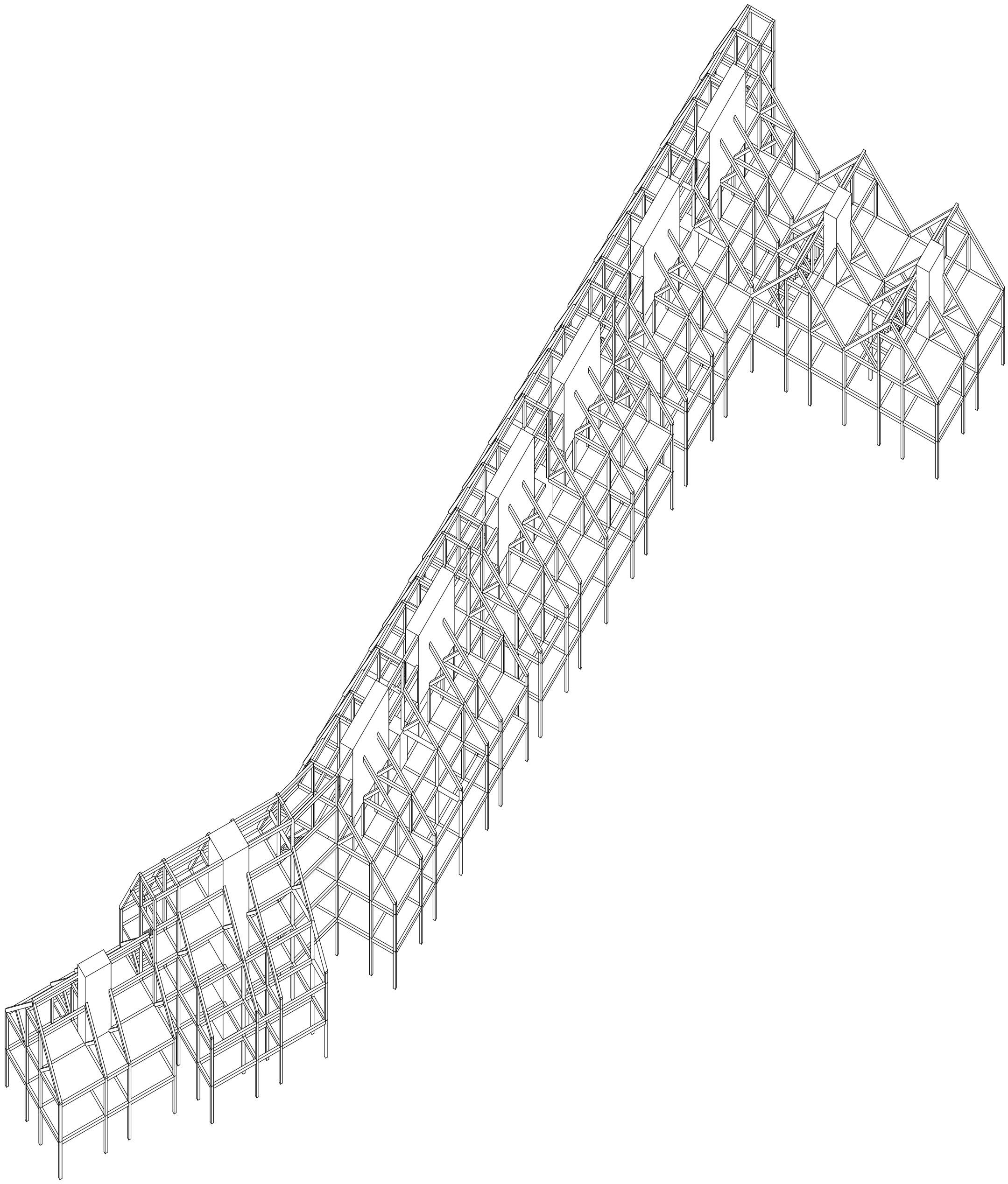
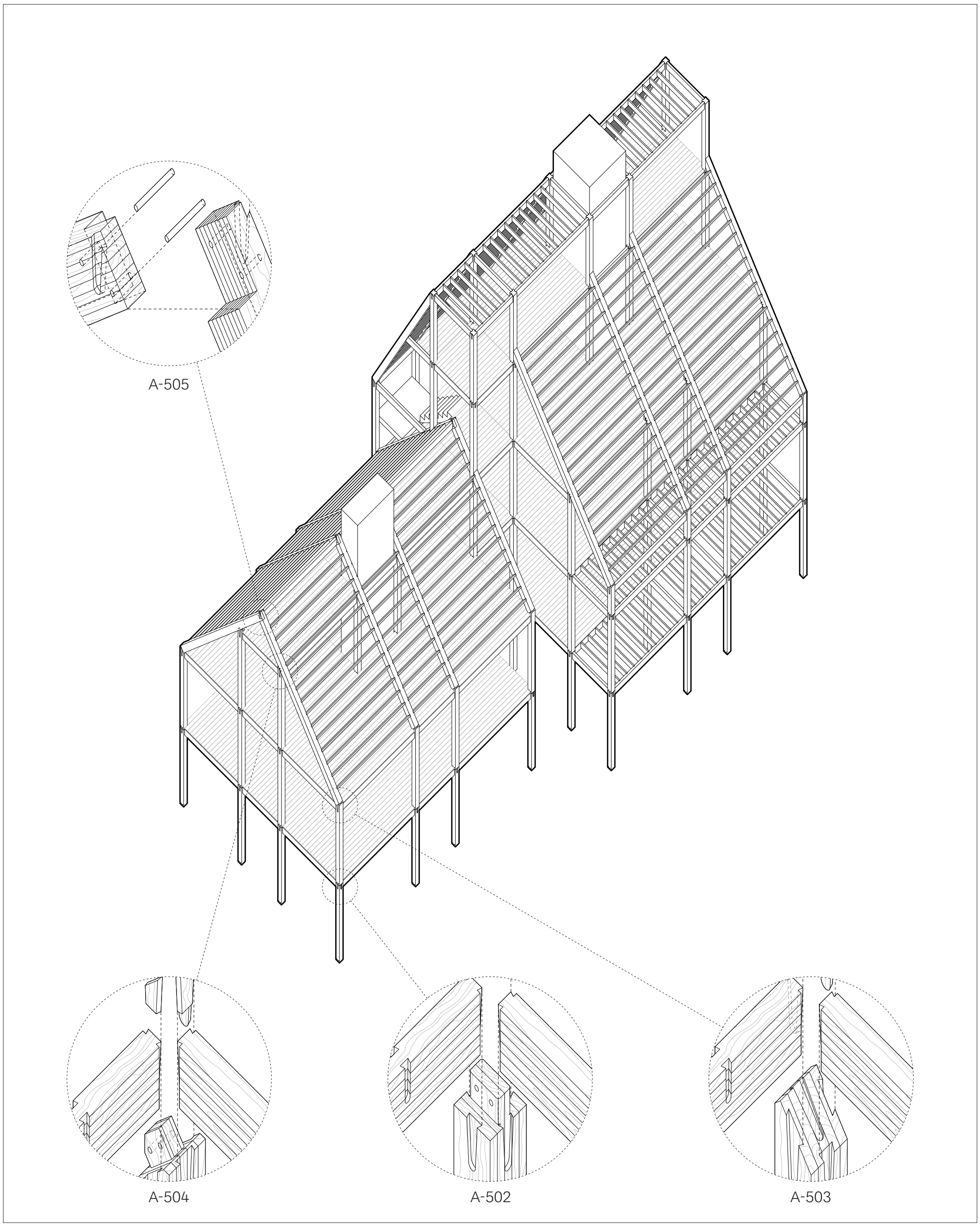


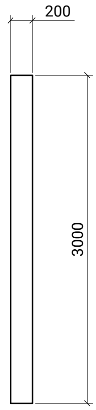
Diagram of proposed longhouse. Communal spaces are on the left, housing on the right.

4.9 Drawing the Timber Frame

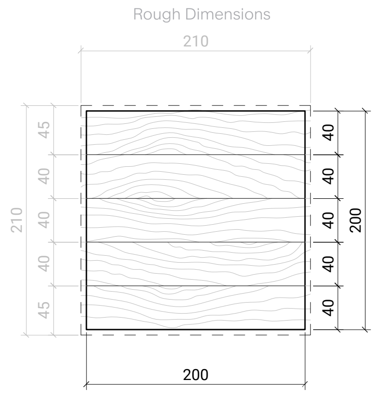
Modern Gulam buildings use steel joints that don't expand and contract with the wood. Learning from the lessons of building at 1:5 and 1:20, the proposal uses a timber frame with Glulam columns and beams that interlock with dovetail and mortise and tenon joints. These wood-wood joints echo the vernacular techniques used in buildings throughout Britain that have survived hundreds of years. The modern joinery outlined on the following pages can be achieved using a router, CNC, or robotic arm.



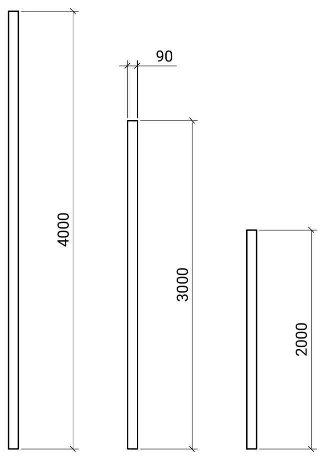
Project Title	Notes	Drawing Title	Paper Size	Scale
The 500-Year House		**Framing Diagram of Communal Buildings**	A4	1:200
Author		Issue Date	Drawing No.	
Jay Potts			**A-901**	



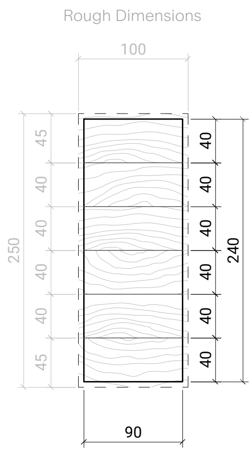
Nominal Column Lengths



Planed Final Dimensions: 200 x 200mm
Target Strength: GL28c, with high-grade (C30) Scandanavian SPF lamellas (45mm) at top an bottom, and lower-grade (C24) british SPF lamellas (40mm) in between.



Nominal Beam Lengths



Planed Final Dimensions: 90 x 240mm
Target Strength: GL28c, with high-grade (C30) Scandanavian SPF lamellas (45mm) at top an bottom, and lower-grade (C24) british SPF lamellas (40mm) in between.

Project Title
The 500-Year House

Author
Jay Potts

Notes

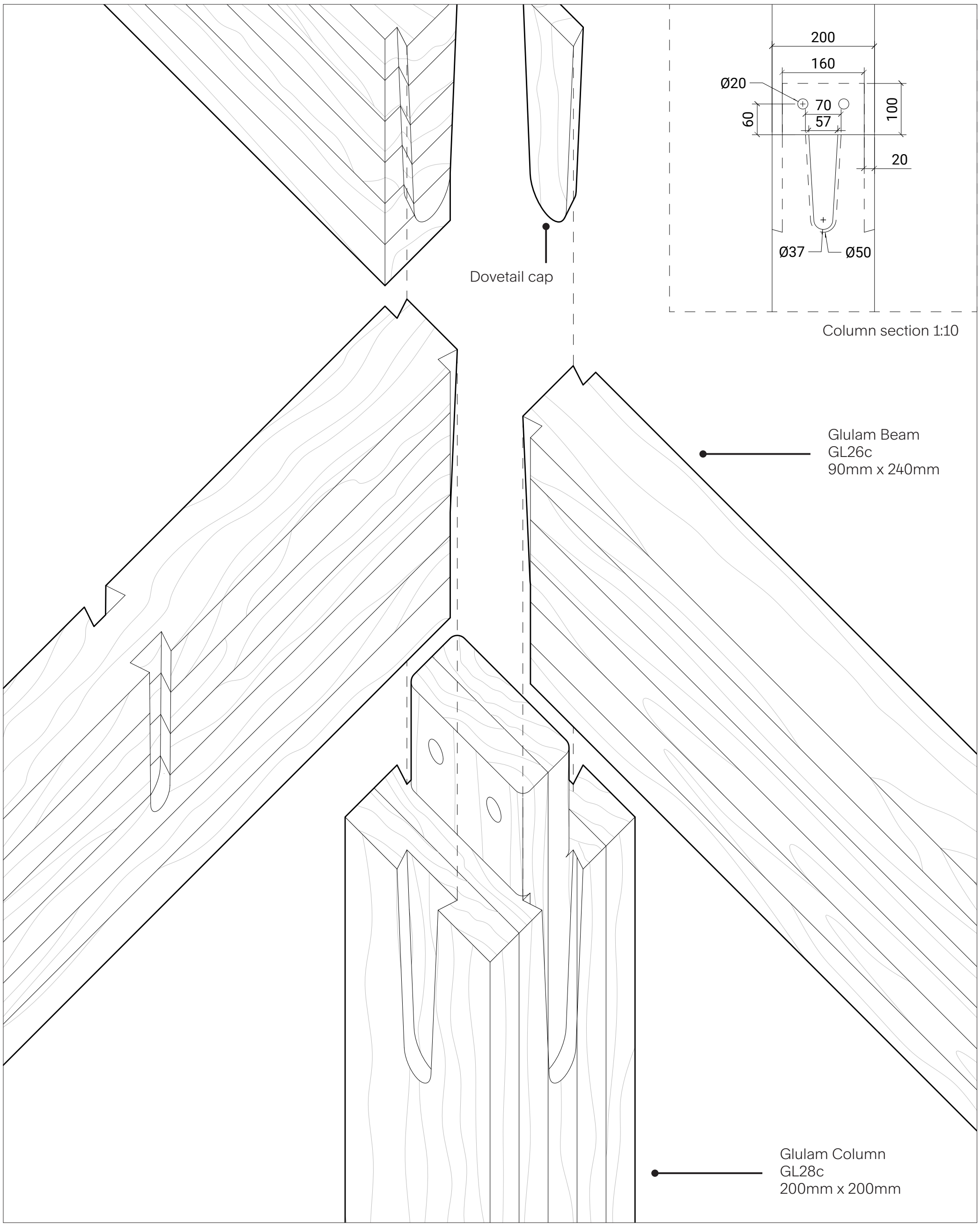
Drawing Title
Glulam Column and Beam Sections

Issue Date
2024.02.29

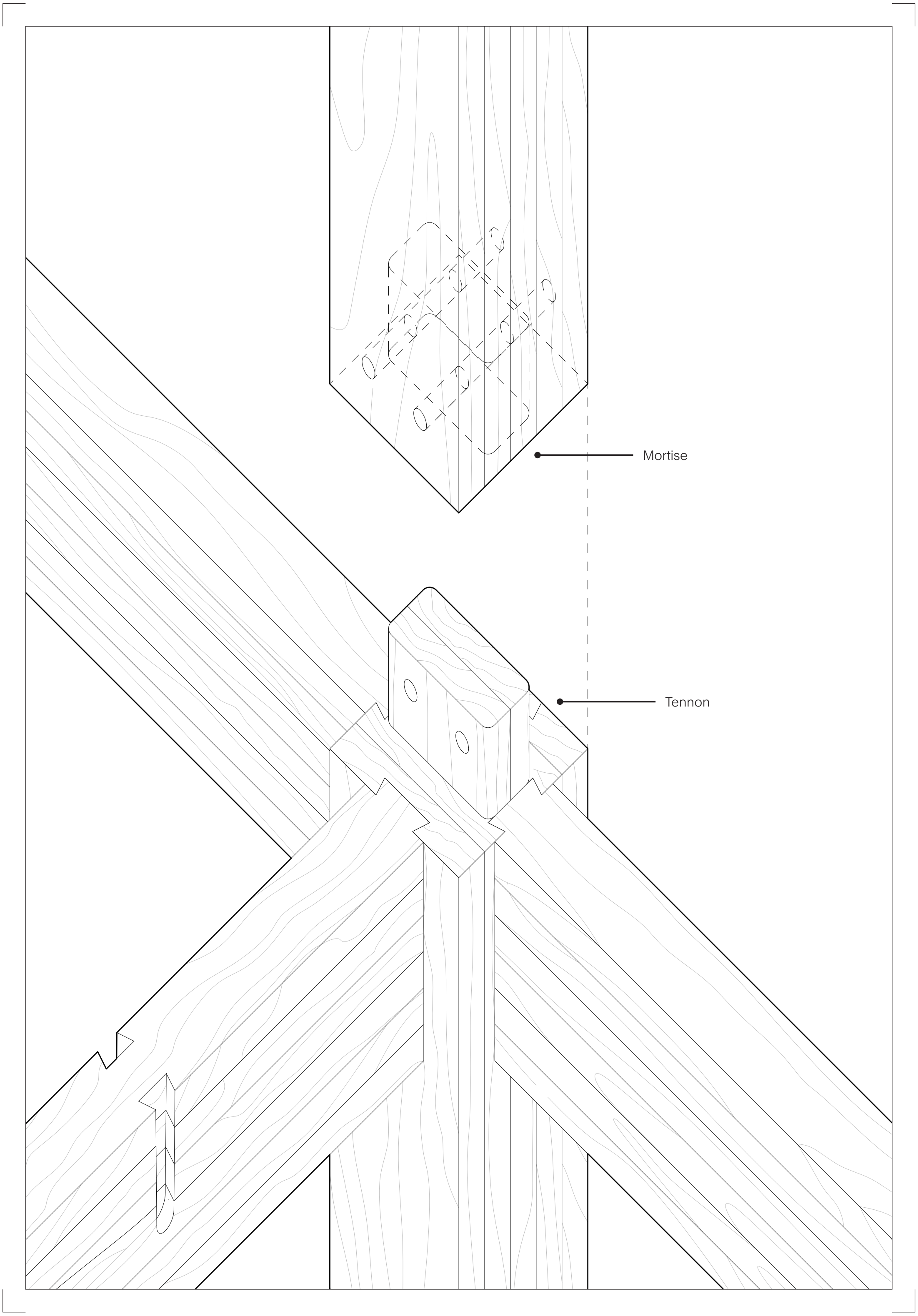
Paper Size
A4

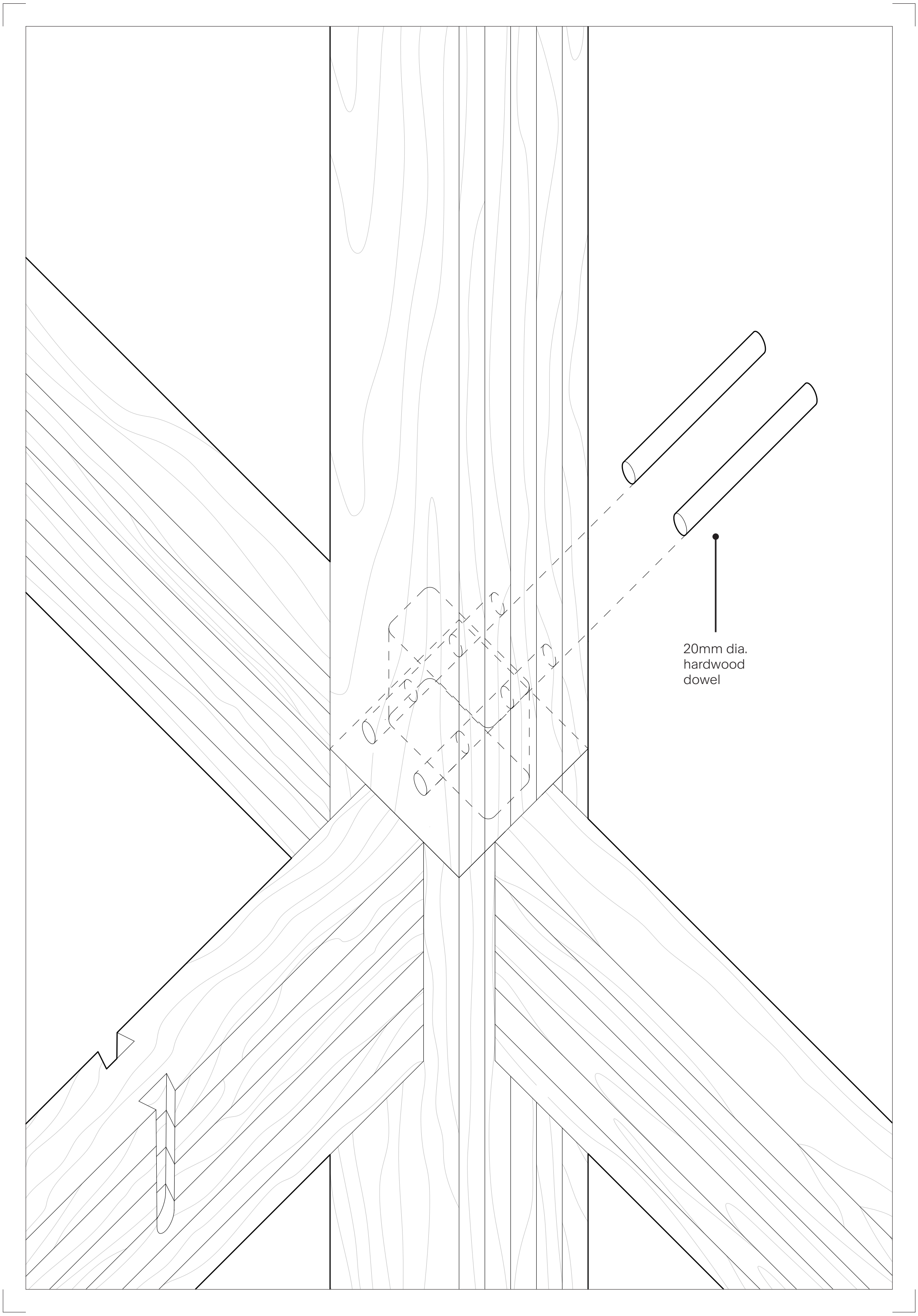
Scale
N/A

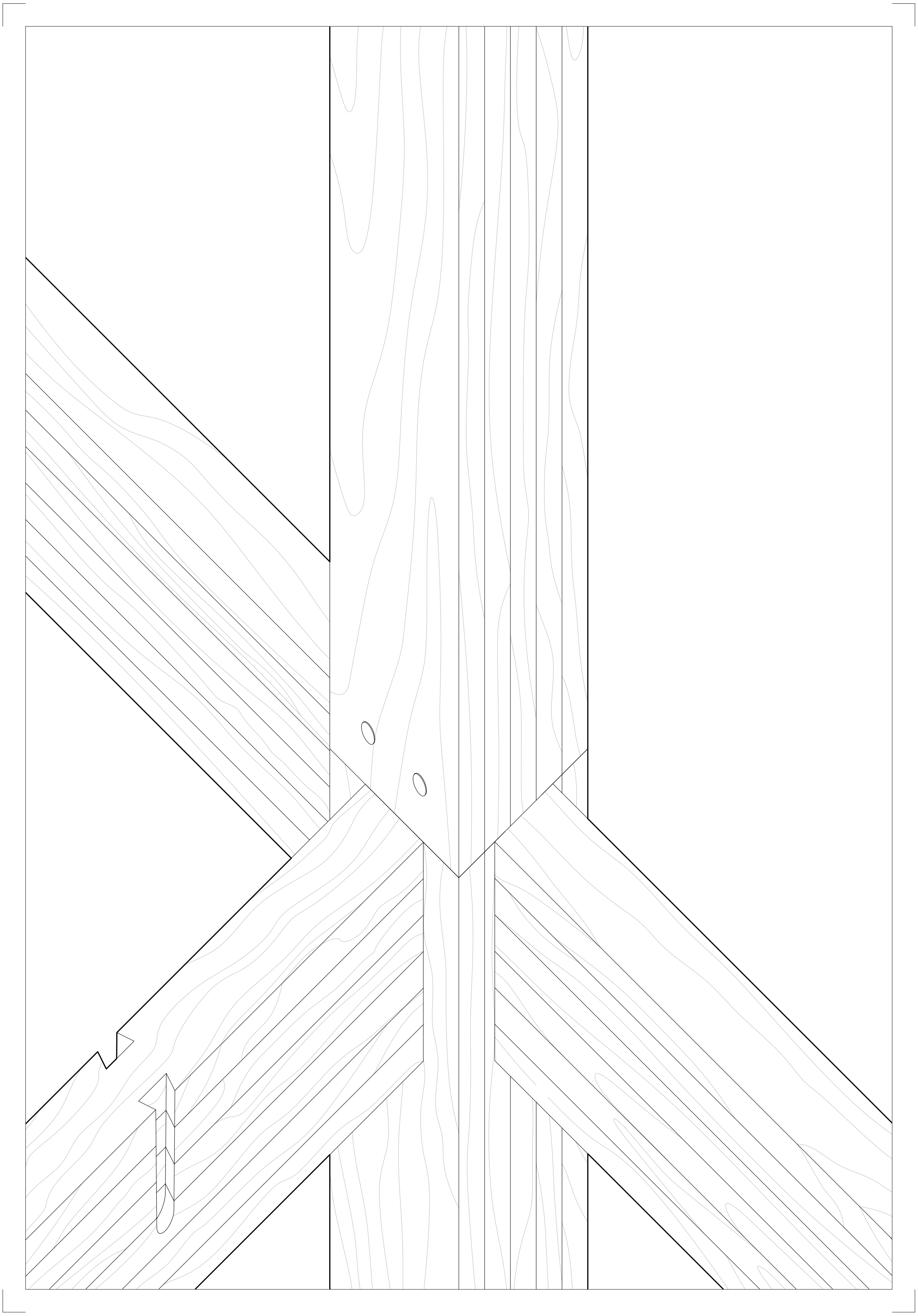
Drawing No.
A-501

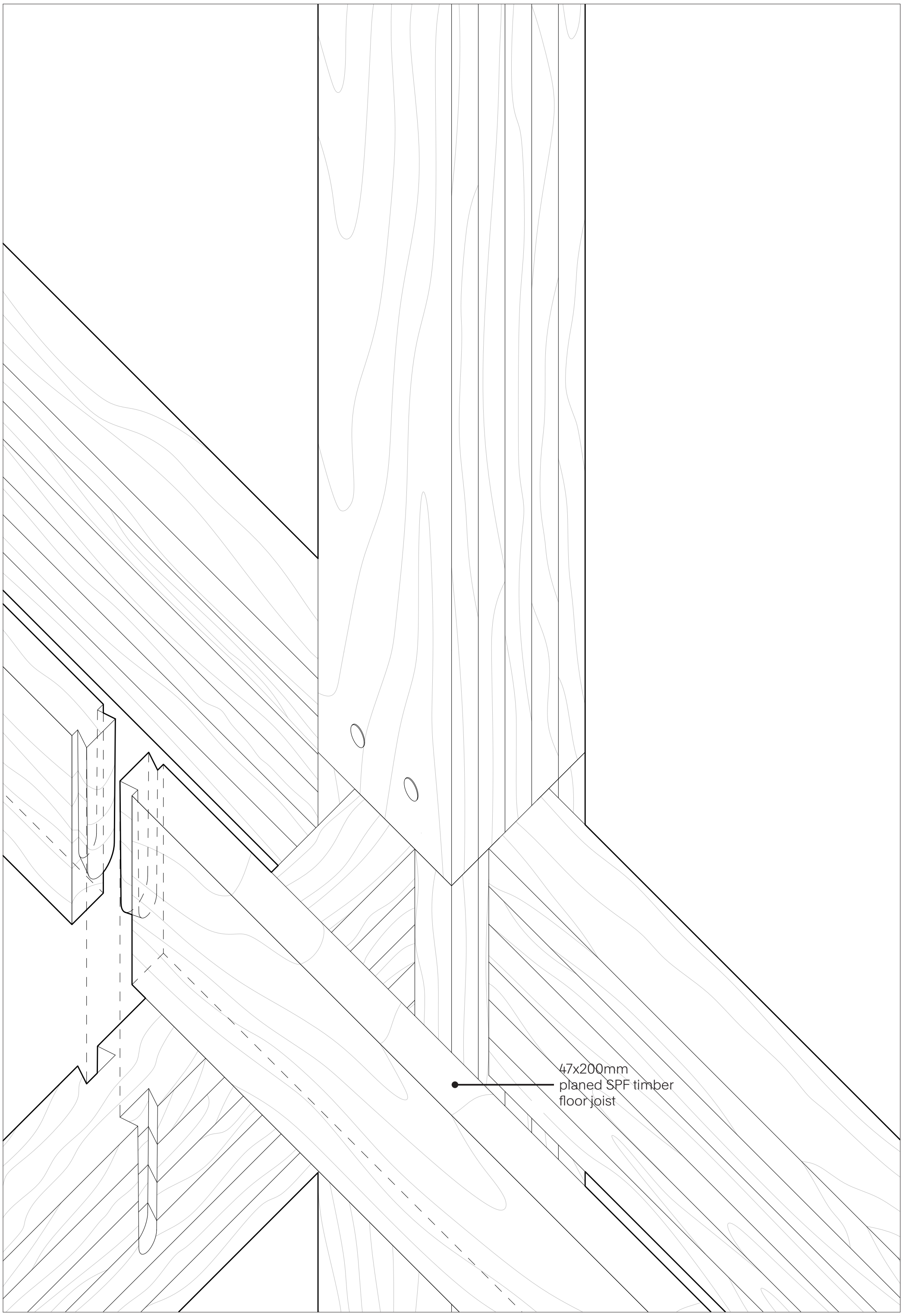


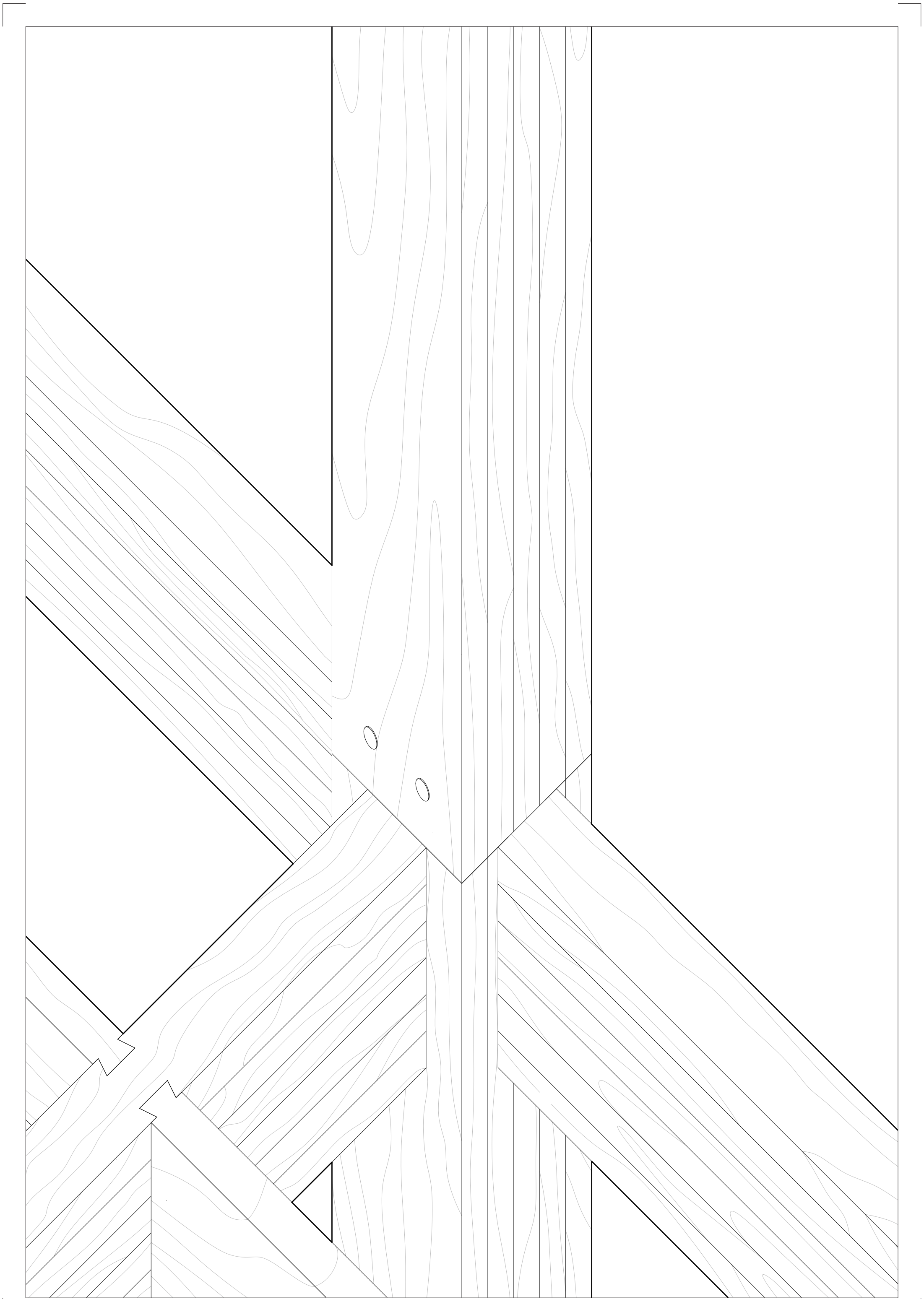
Project Title	Notes	Drawing Title	Paper Size	Scale
The 500-Year House		**Column-Beam Connection Detail**	A4	1:5
Author		Issue Date	Drawing No.	
Jay Potts		2024.02.29	**A-502**	

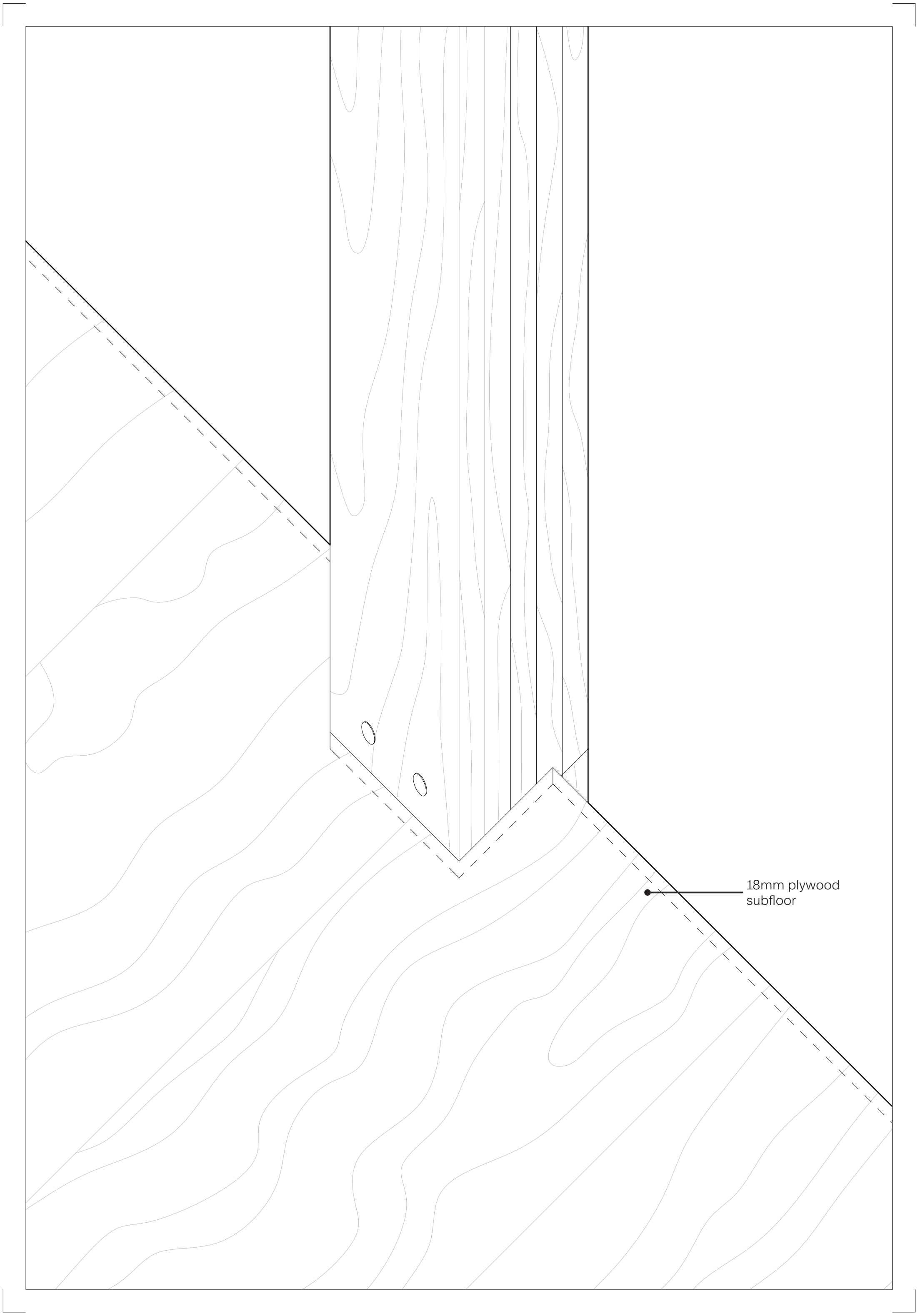

Mortise
Tennon

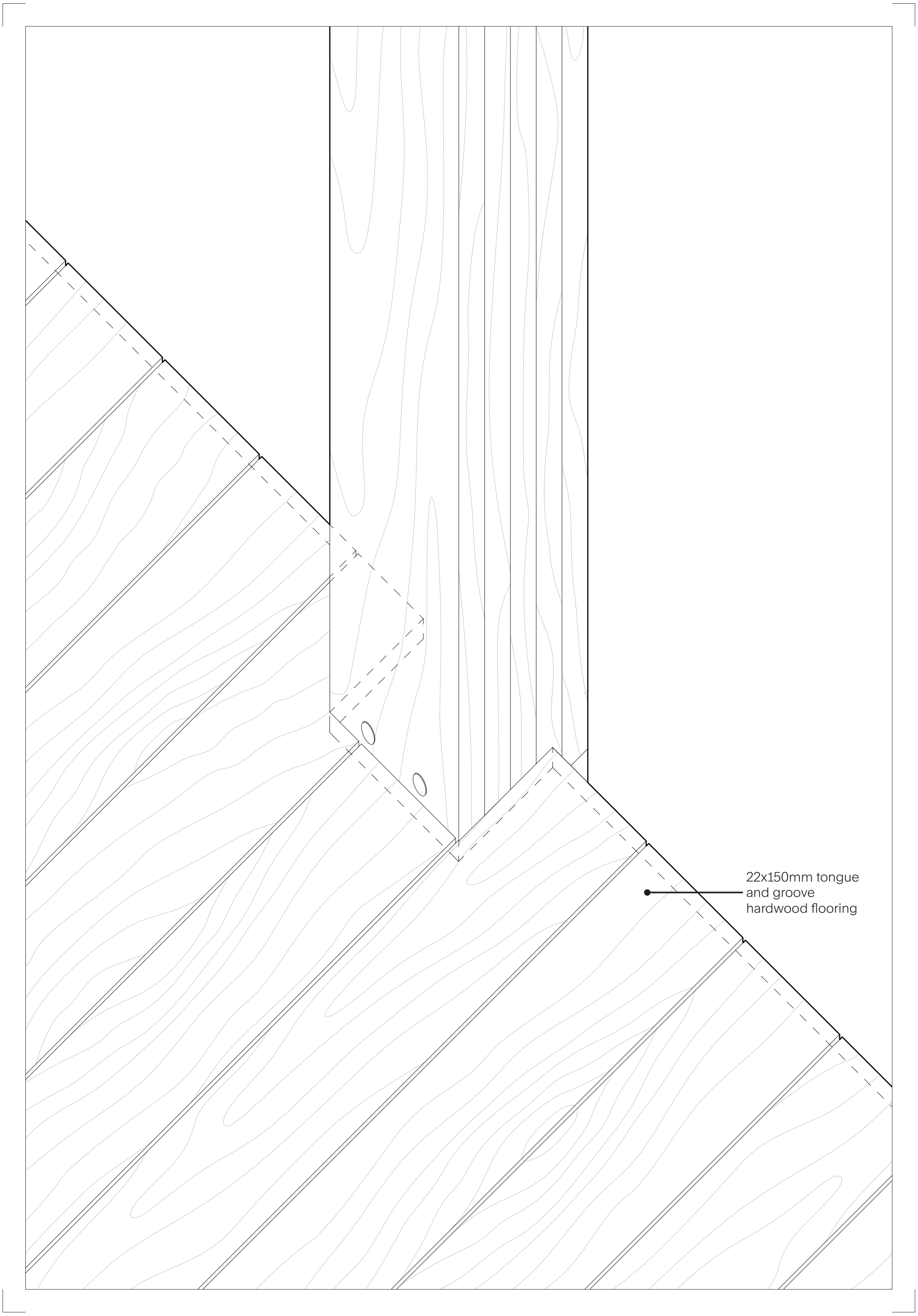

20mm dia.
hardwood
dowel

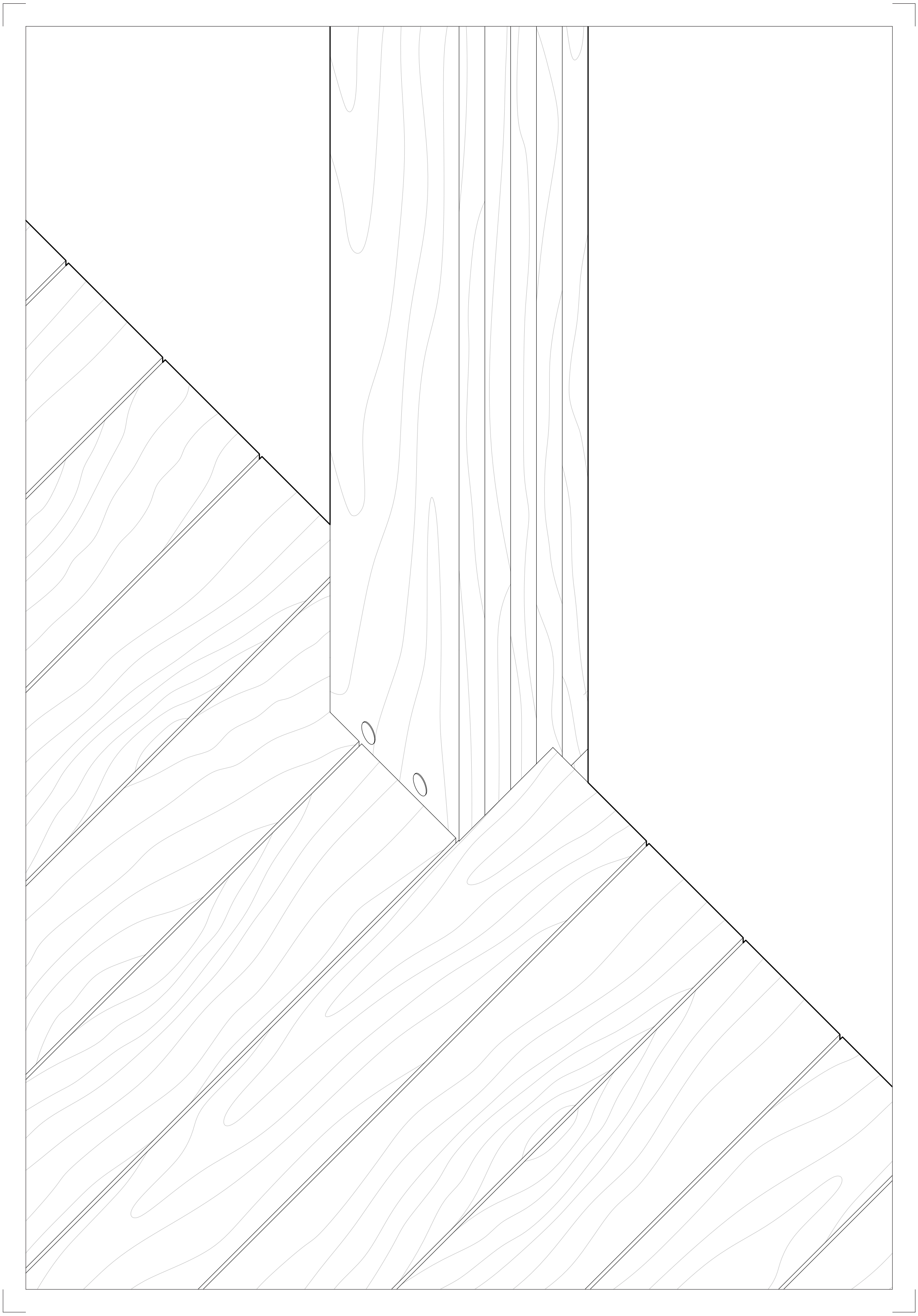


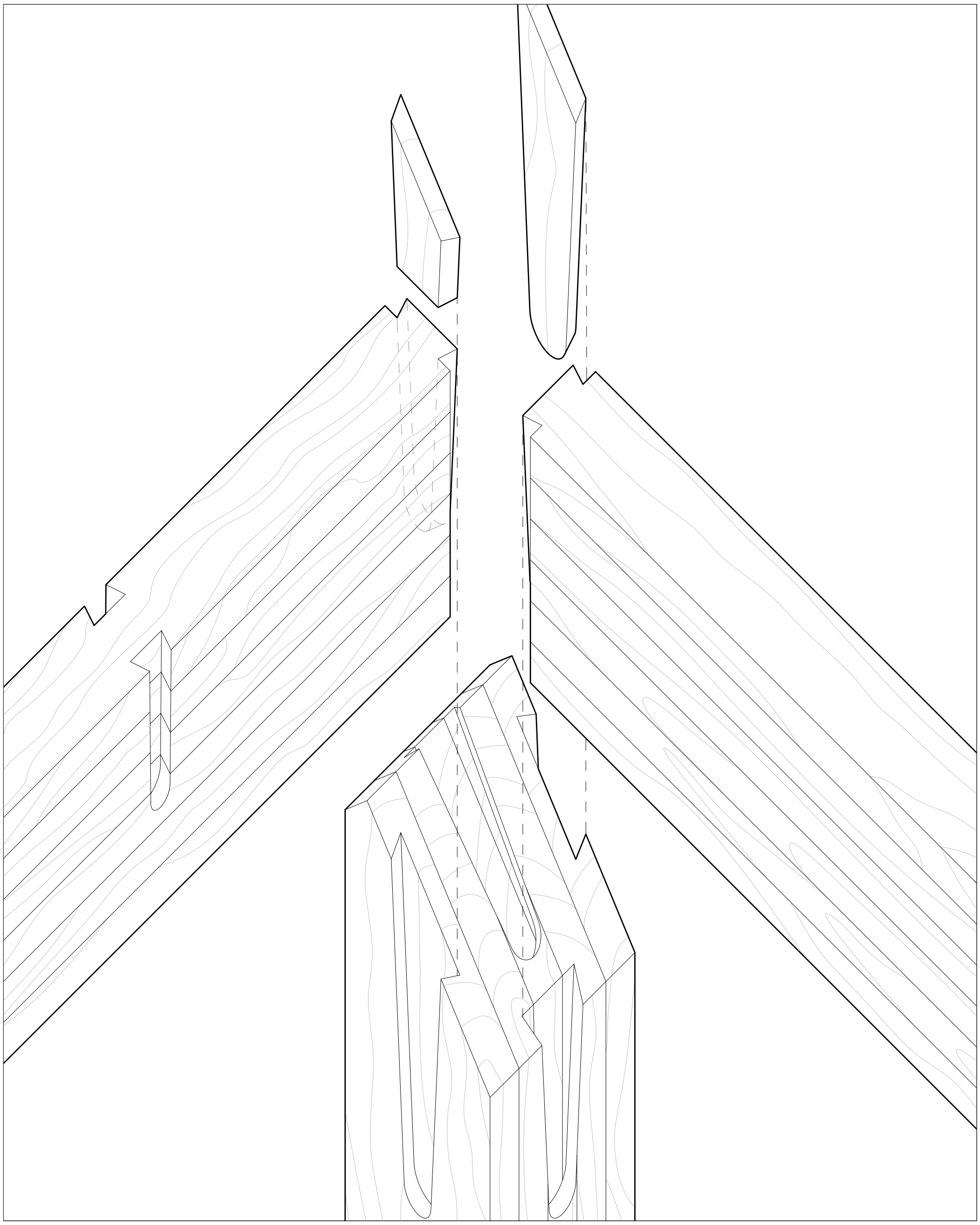

47x200mm
planed SPF timber
floor joist




18mm plywood
subfloor


22x150mm tongue
and groove
hardwood flooring





Project Title
The 500-Year House

Author
Jay Potts

Notes

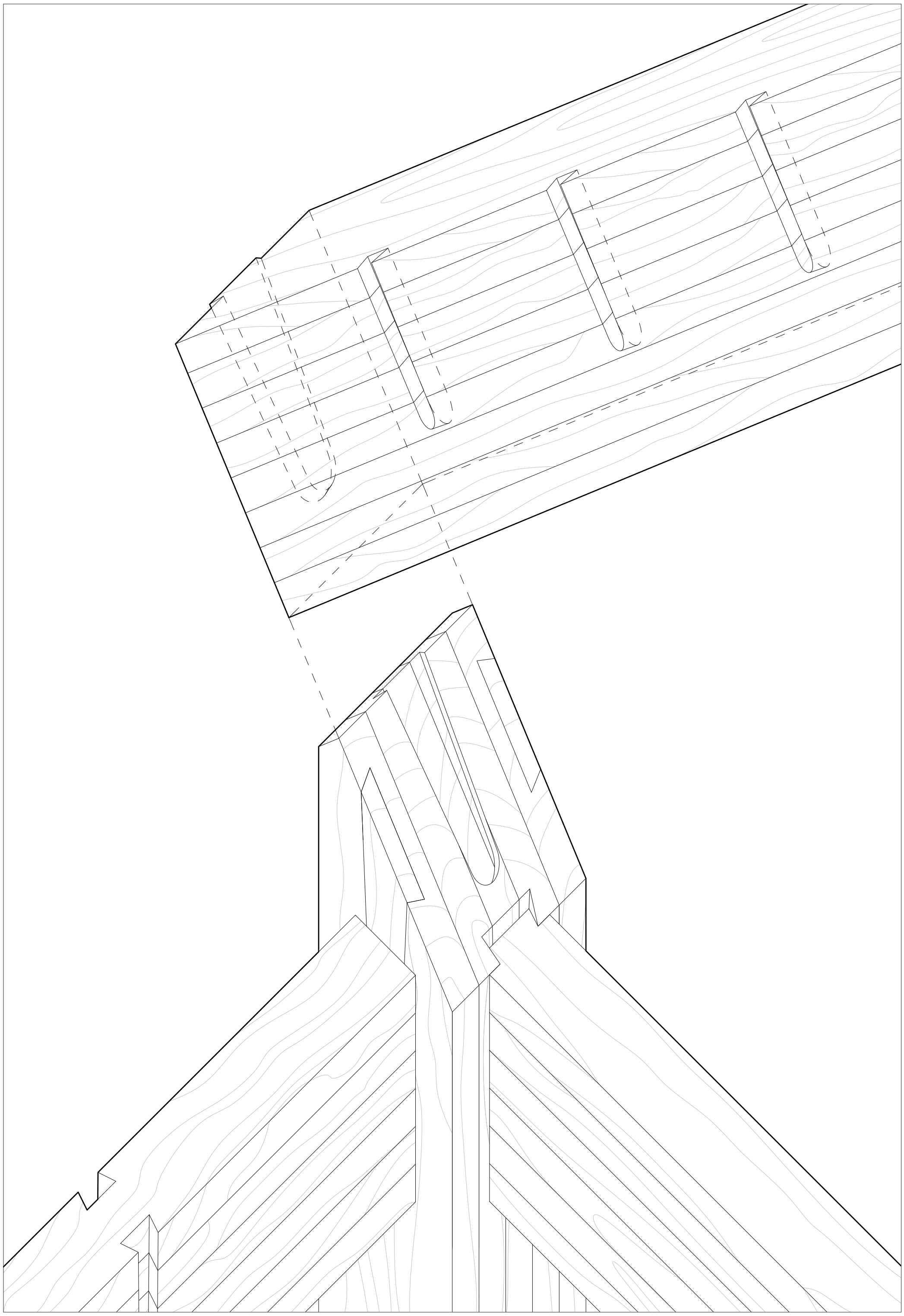
Drawing Title
Column-Rafter Connection Detail

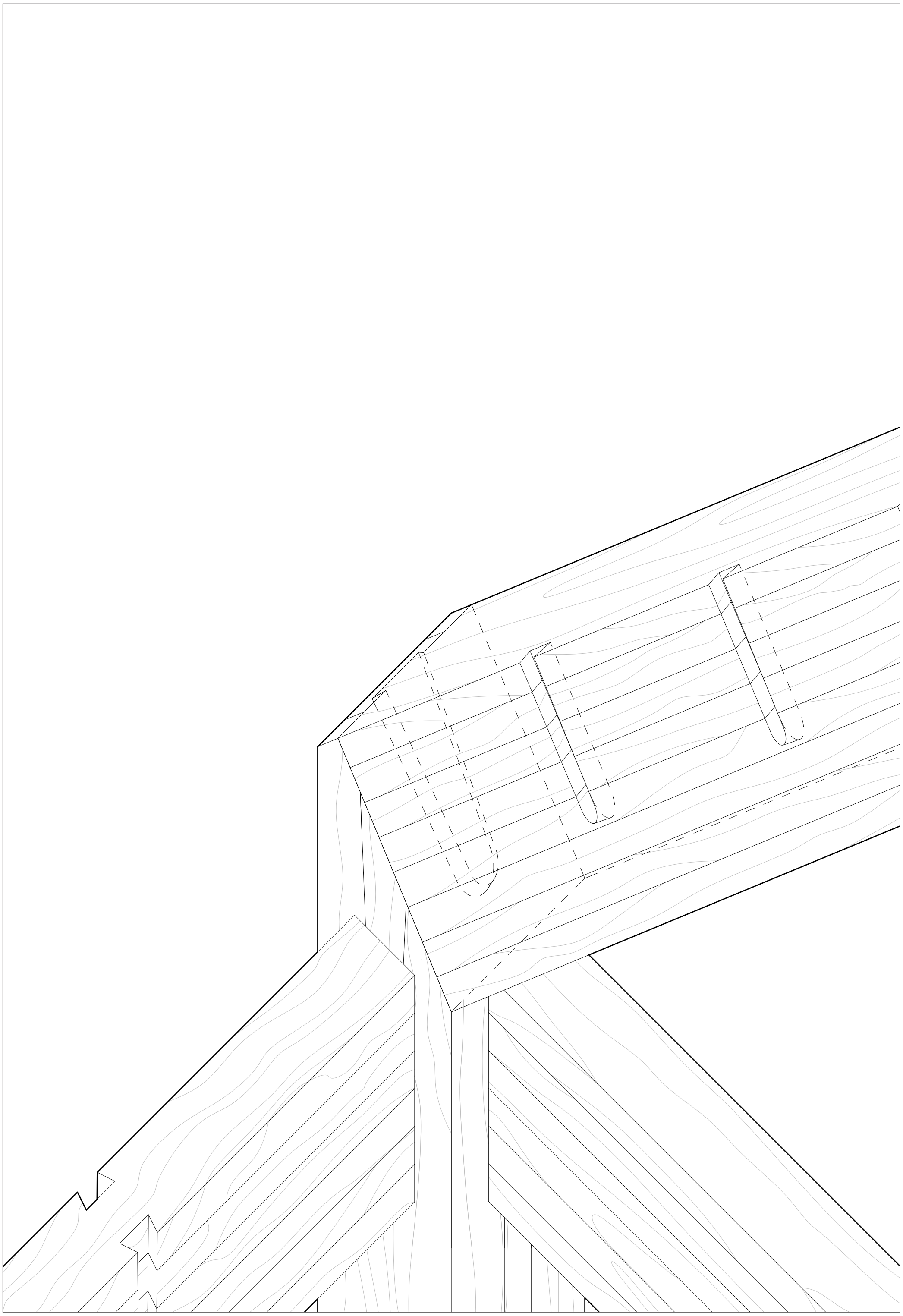
Issue Date
2024.02.29

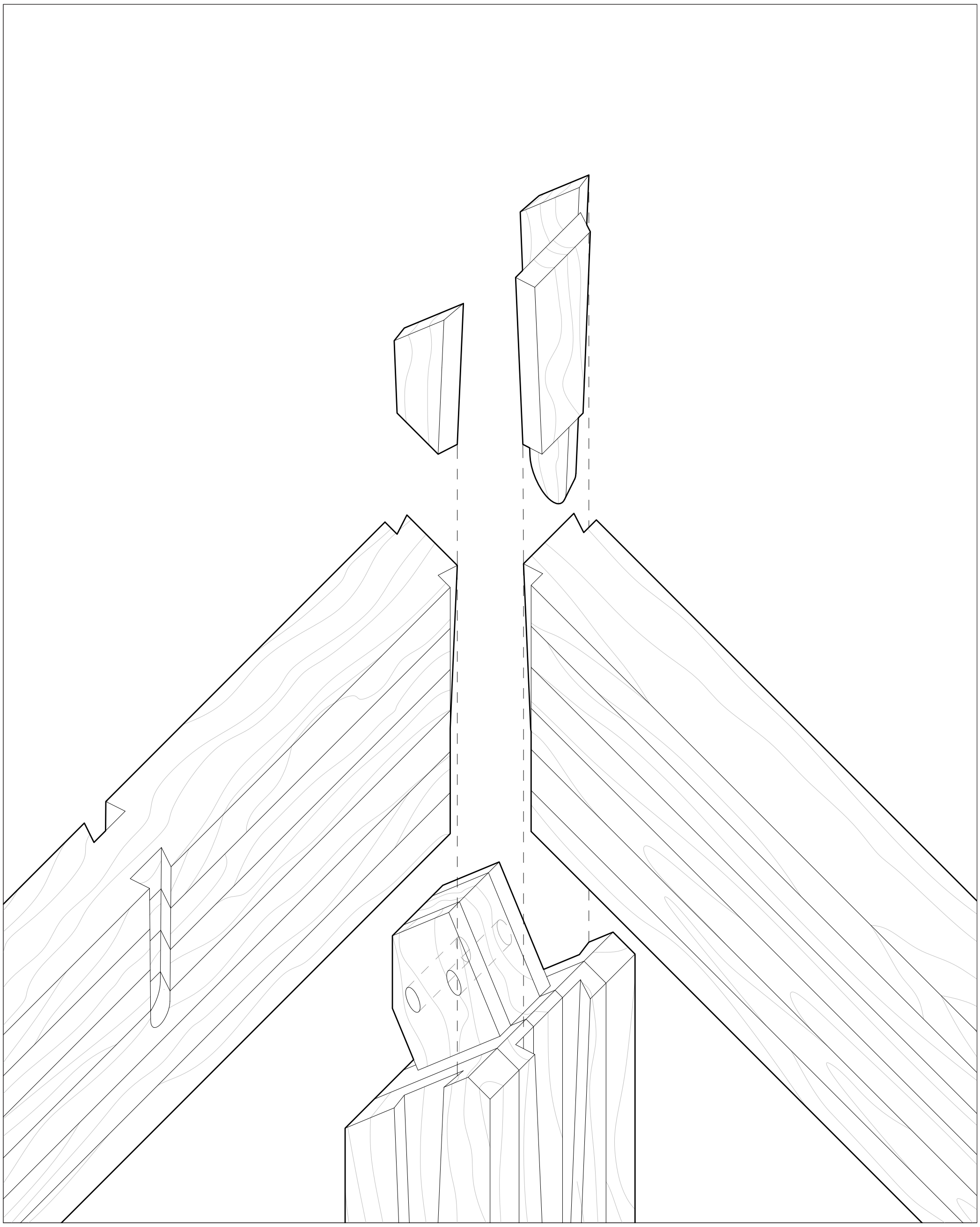
Paper Size
A4

Scale
1:5

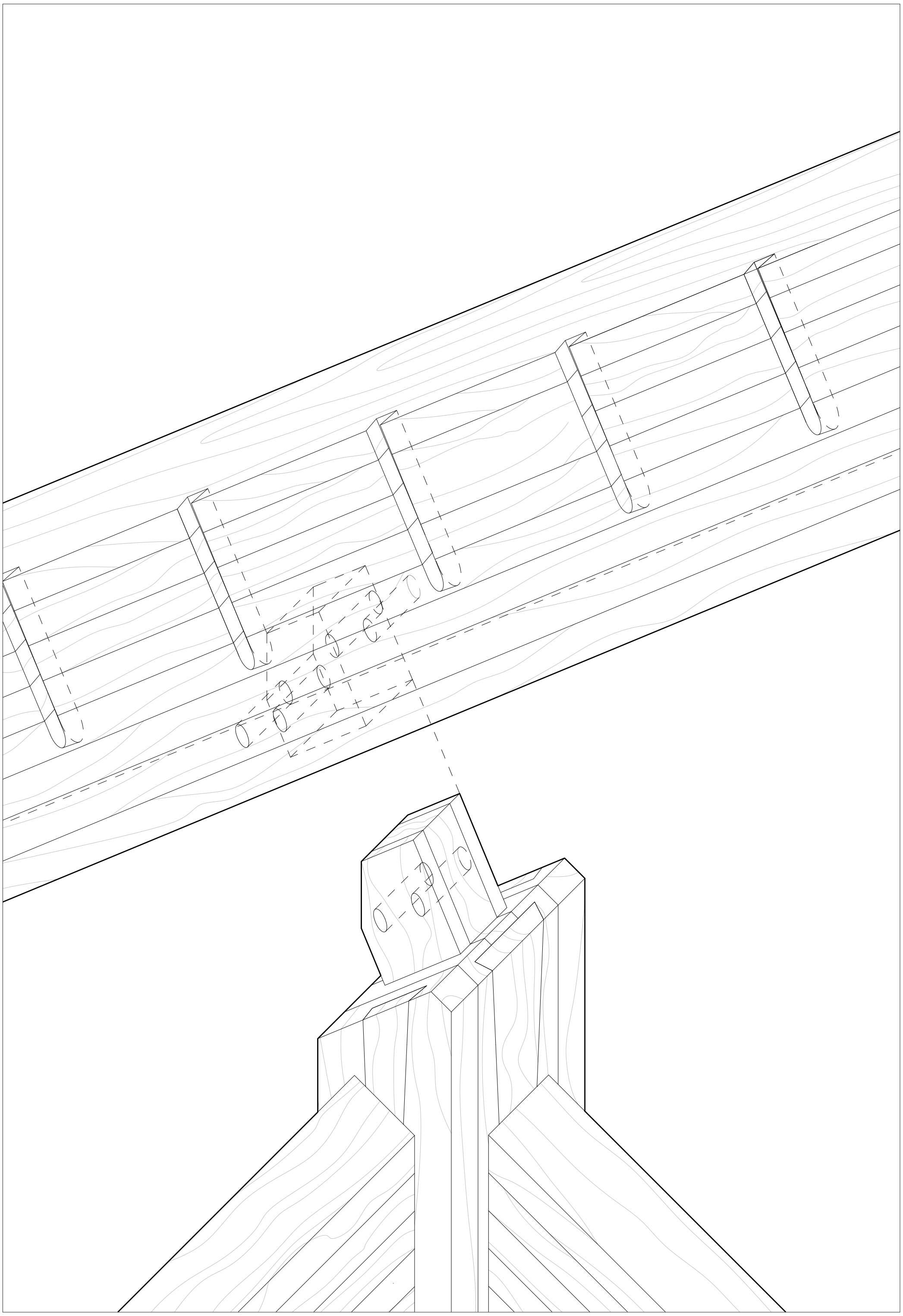
Drawing No.
A-503

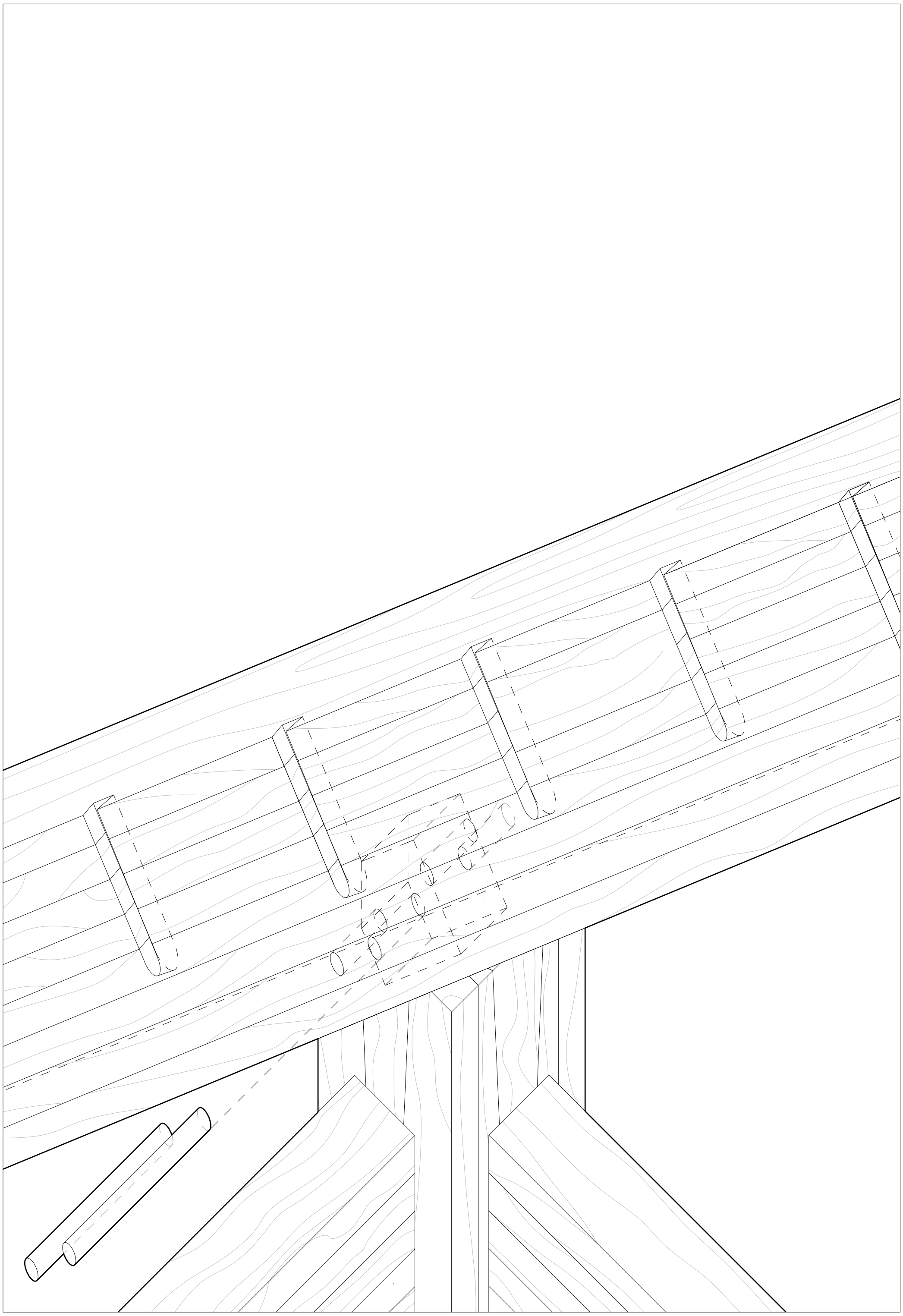


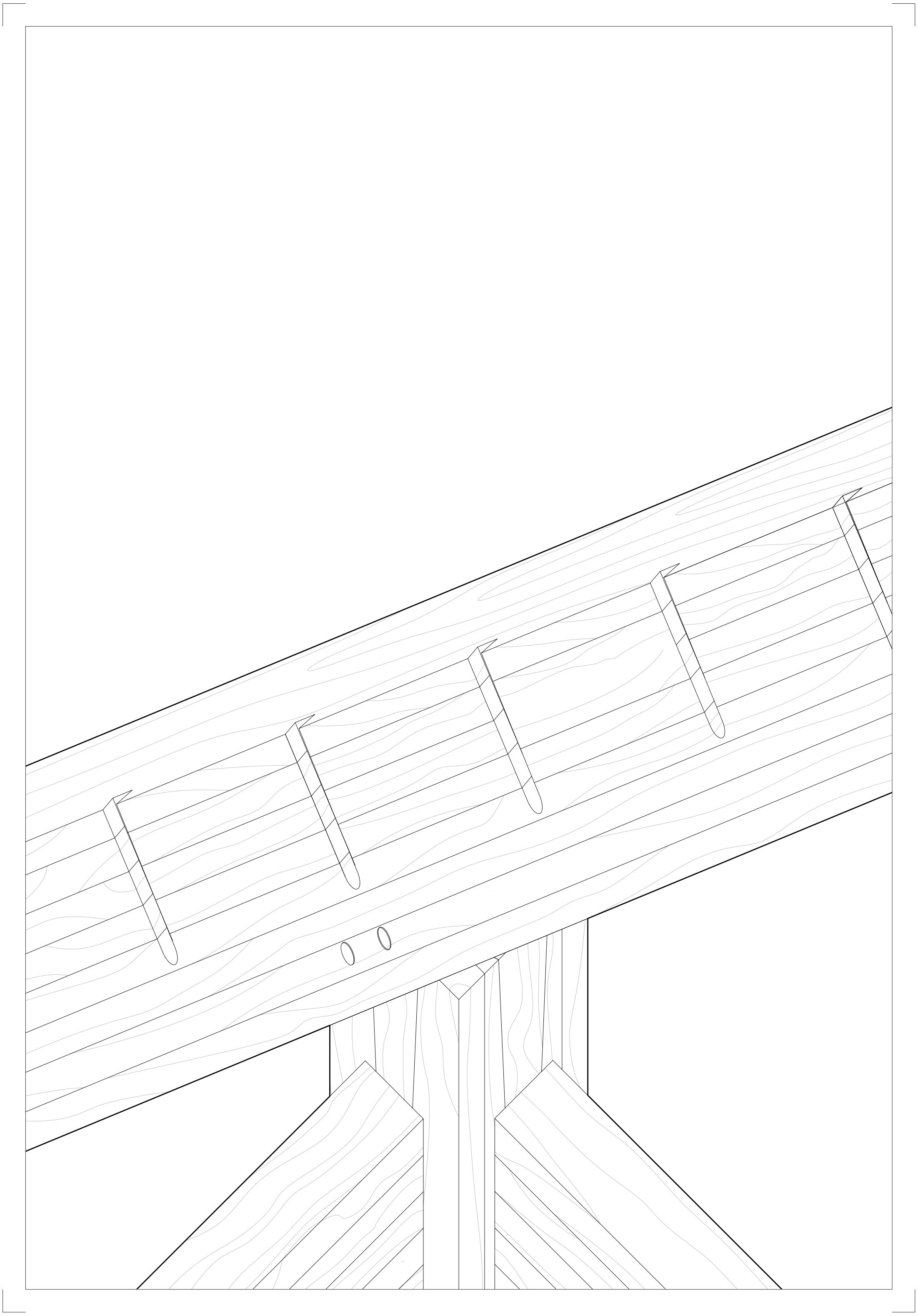


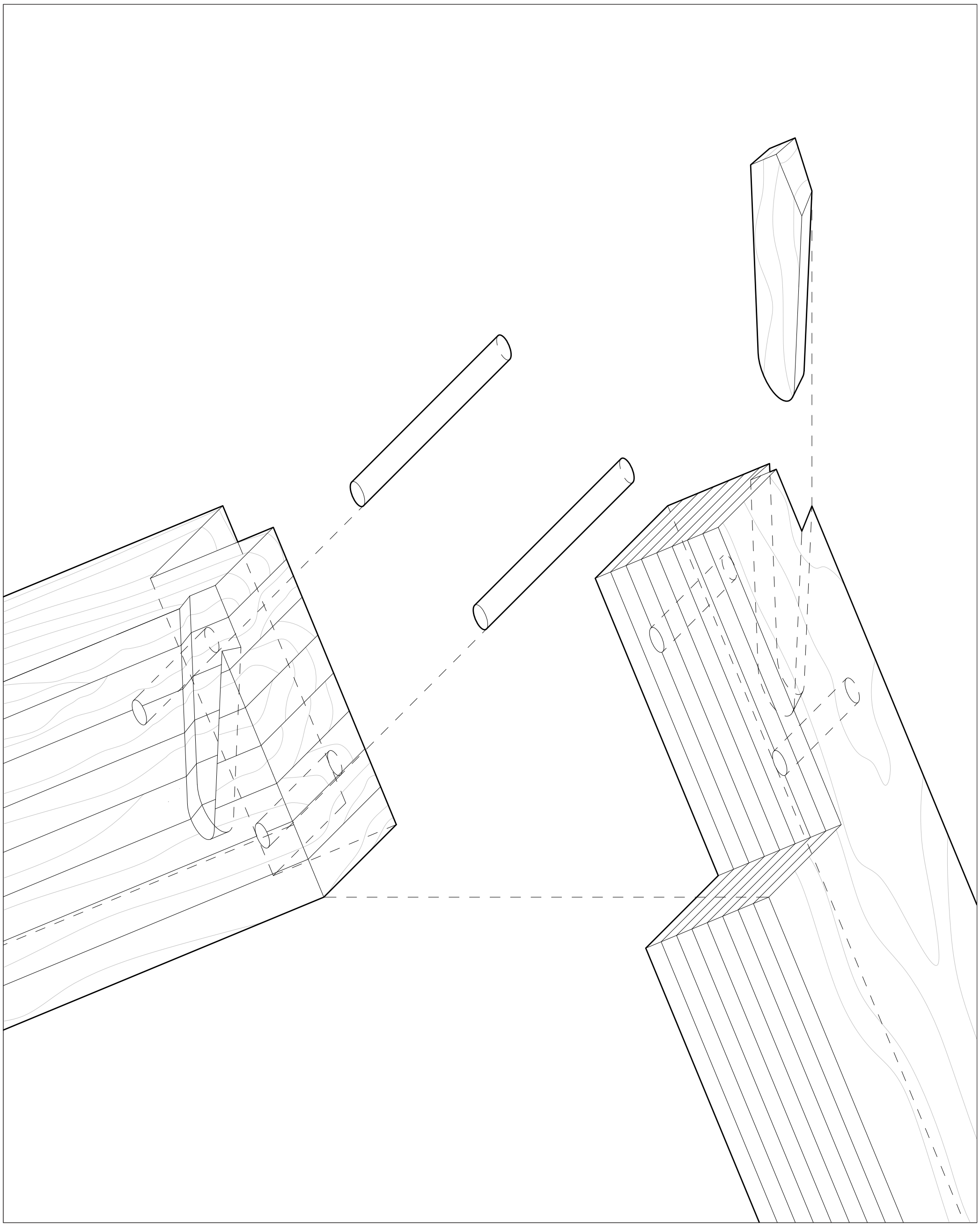


Project Title **The 500-Year House** Author Jay Potts	Notes	Drawing Title **Column-Rafter Connection Detail** Issue Date 2024.02.29	Paper Size: A4 Scale: 1:5 Drawing No. **A-504**

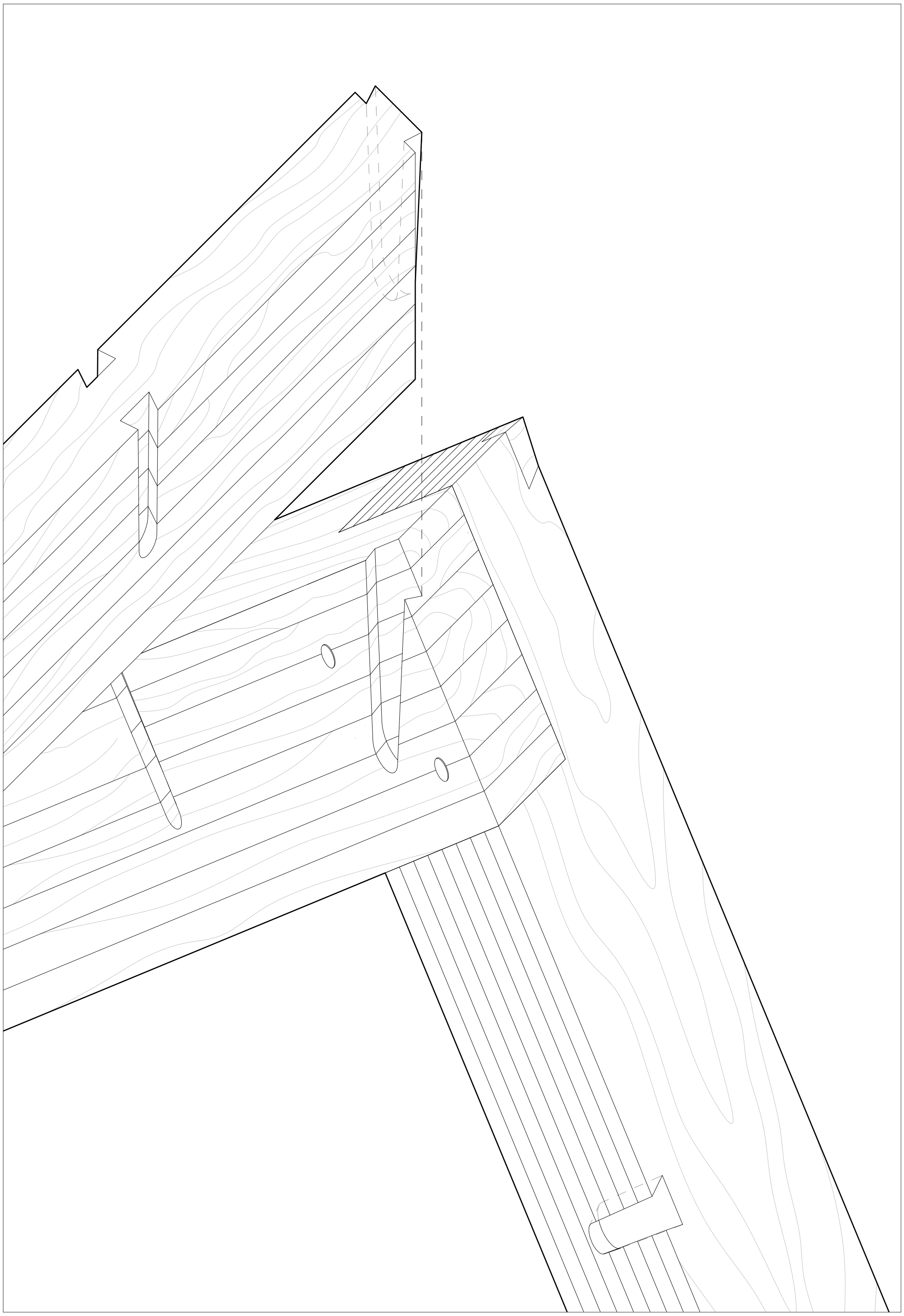


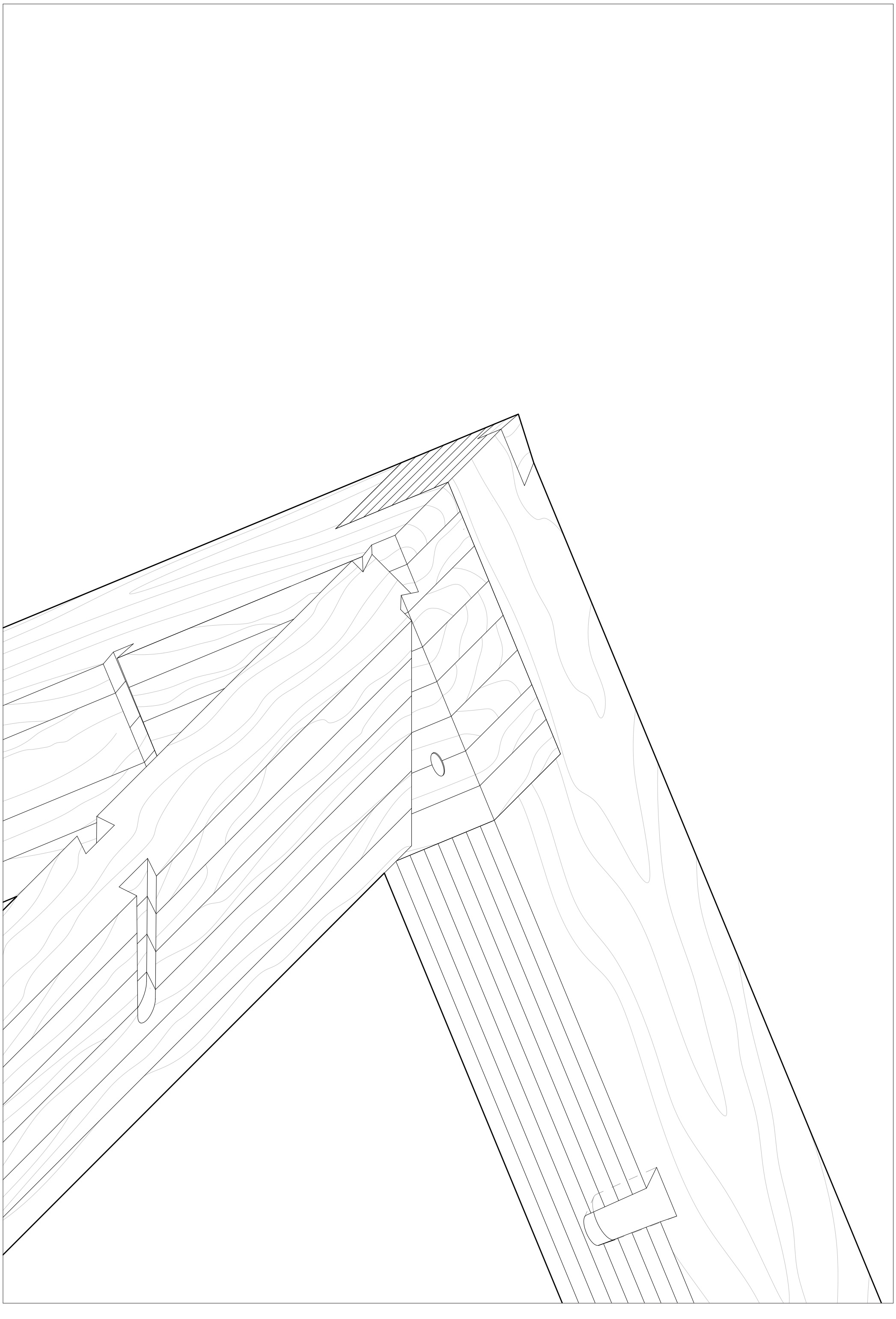






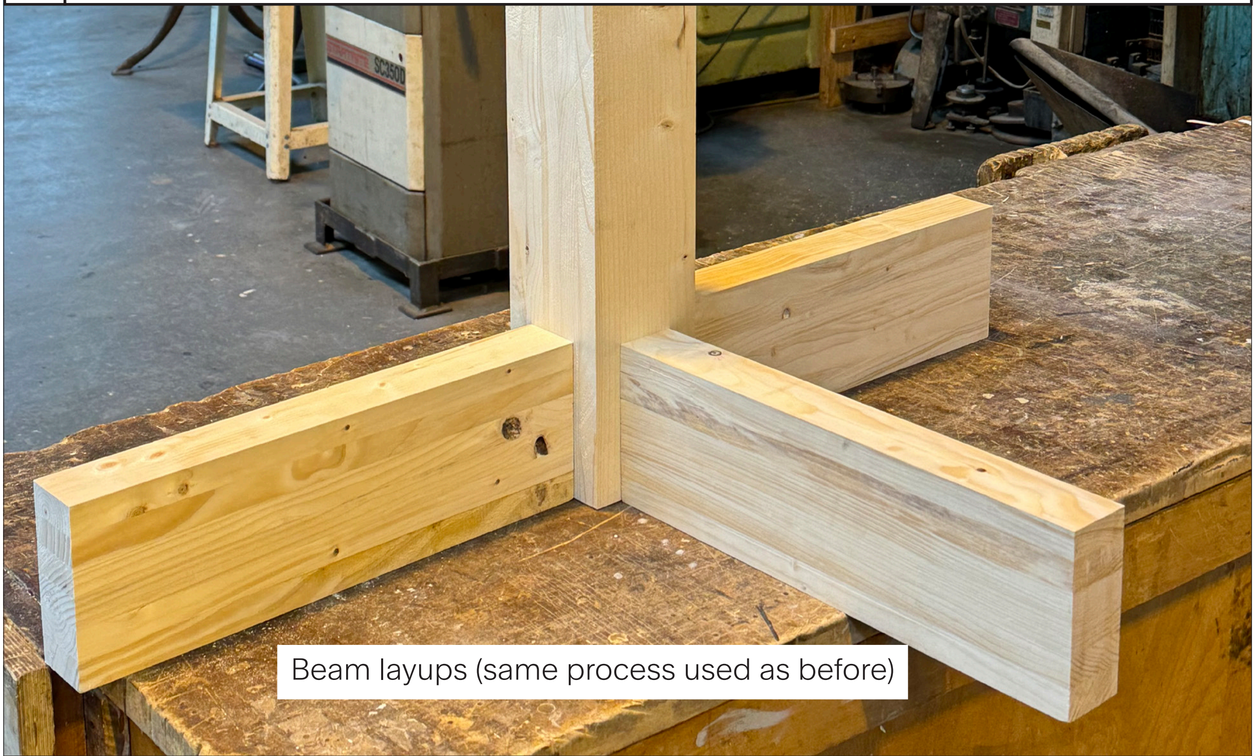
Project Title	Notes	Drawing Title	Paper Size / Scale
The 500-Year House Author Jay Potts		**Rafter-Rafter Connection Detail** Issue Date 2024.02.29	Paper Size: A4 Scale: 1:5 Drawing No. **A-505**





1

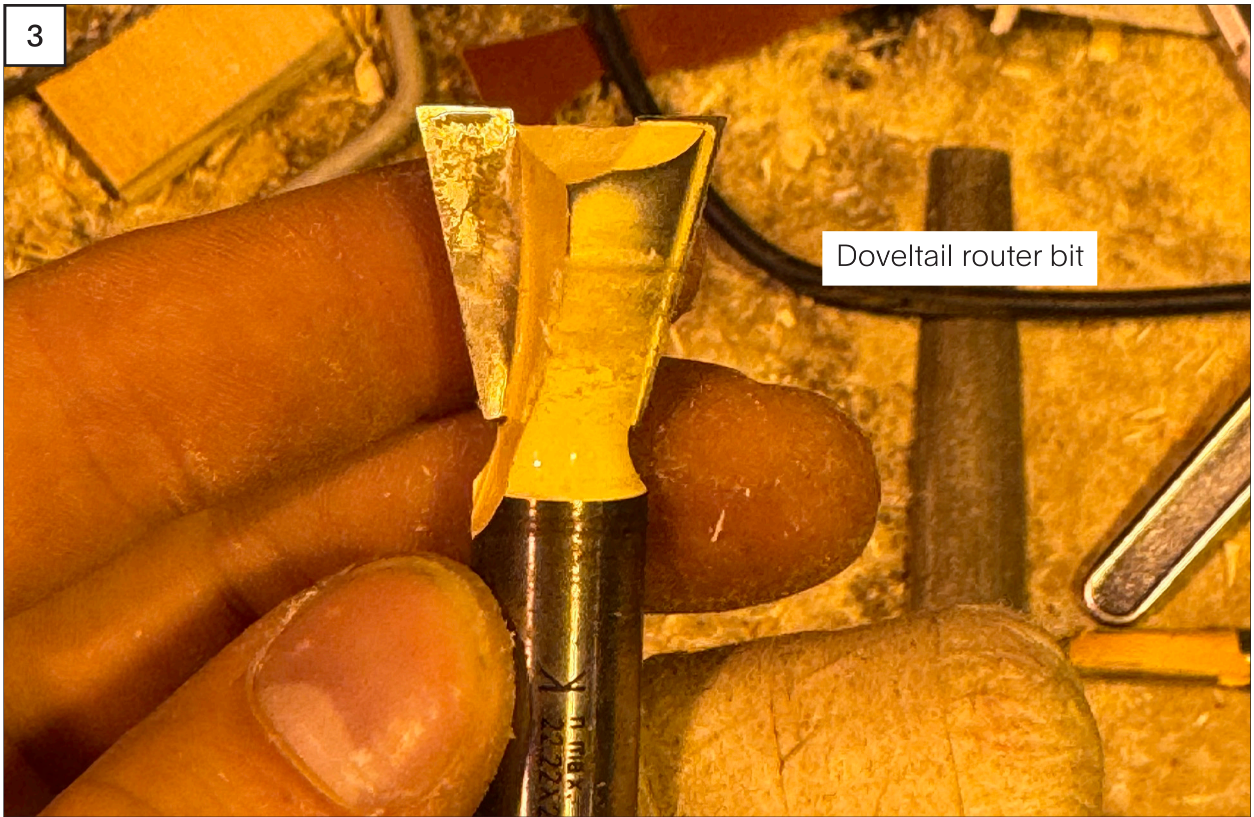
4.10 Timber Connection Model



Beam layups (same process used as before)

2

Router jig for female connection


3
Doveltail router bit

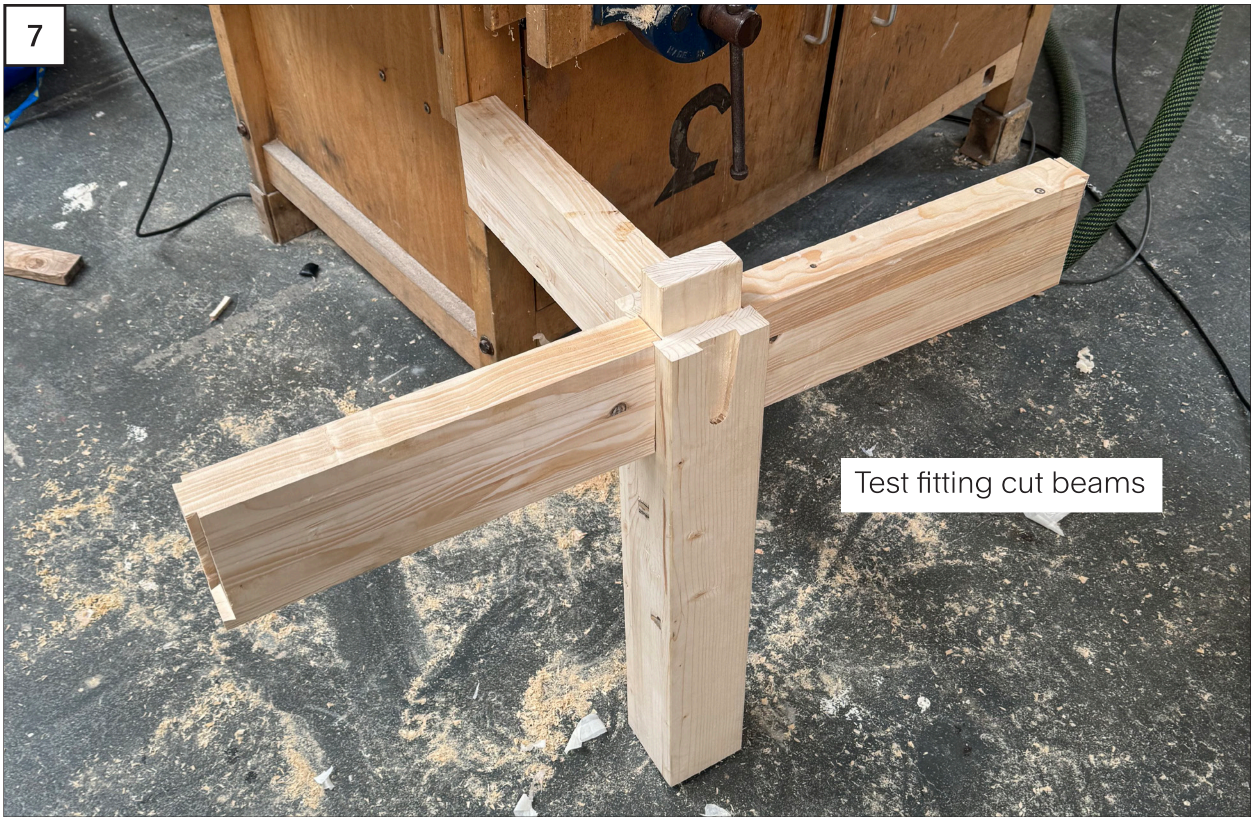

4
Finished routed profile

5

Tenon cut and chamfered

6

Jig to cut beam ends
(male connection)



7

Test fitting cut beams

8

Drilling hole in tenon and mortise (in background)

Connection model in pine at a scale of 1:2.

The hole for the pin in the tenon is 1.5mm lower than the hole in the mortise, so the joint tightens as the pin is hammered in.

Knots have been filled in with wood putty per manufacturing specifications.

End grain showing lamellas.

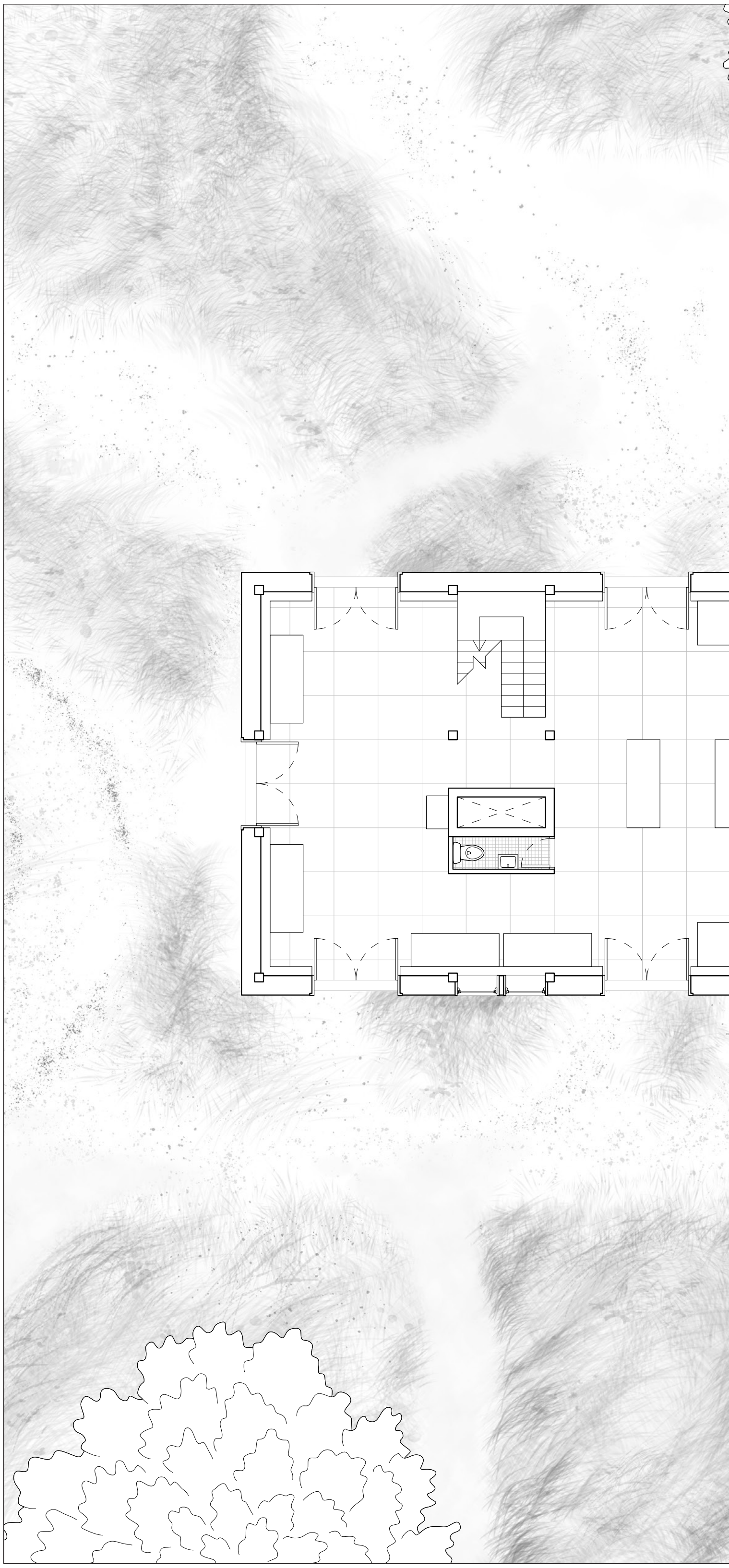
Above: Render of a workshop inside the longhouse.

Opposite: Ground-floor residential winter garden.

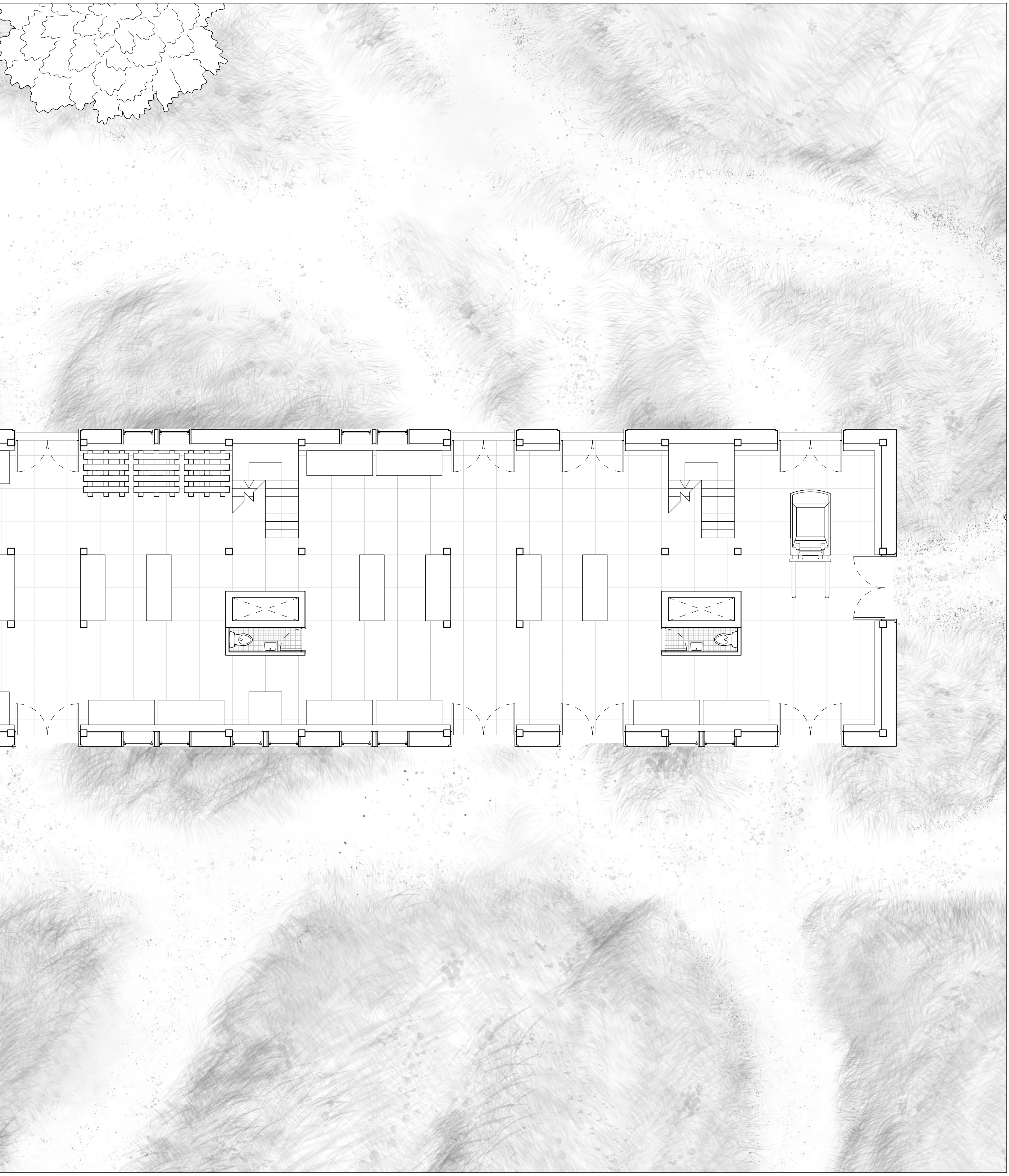
4.11 Iterations of the Timber Frame

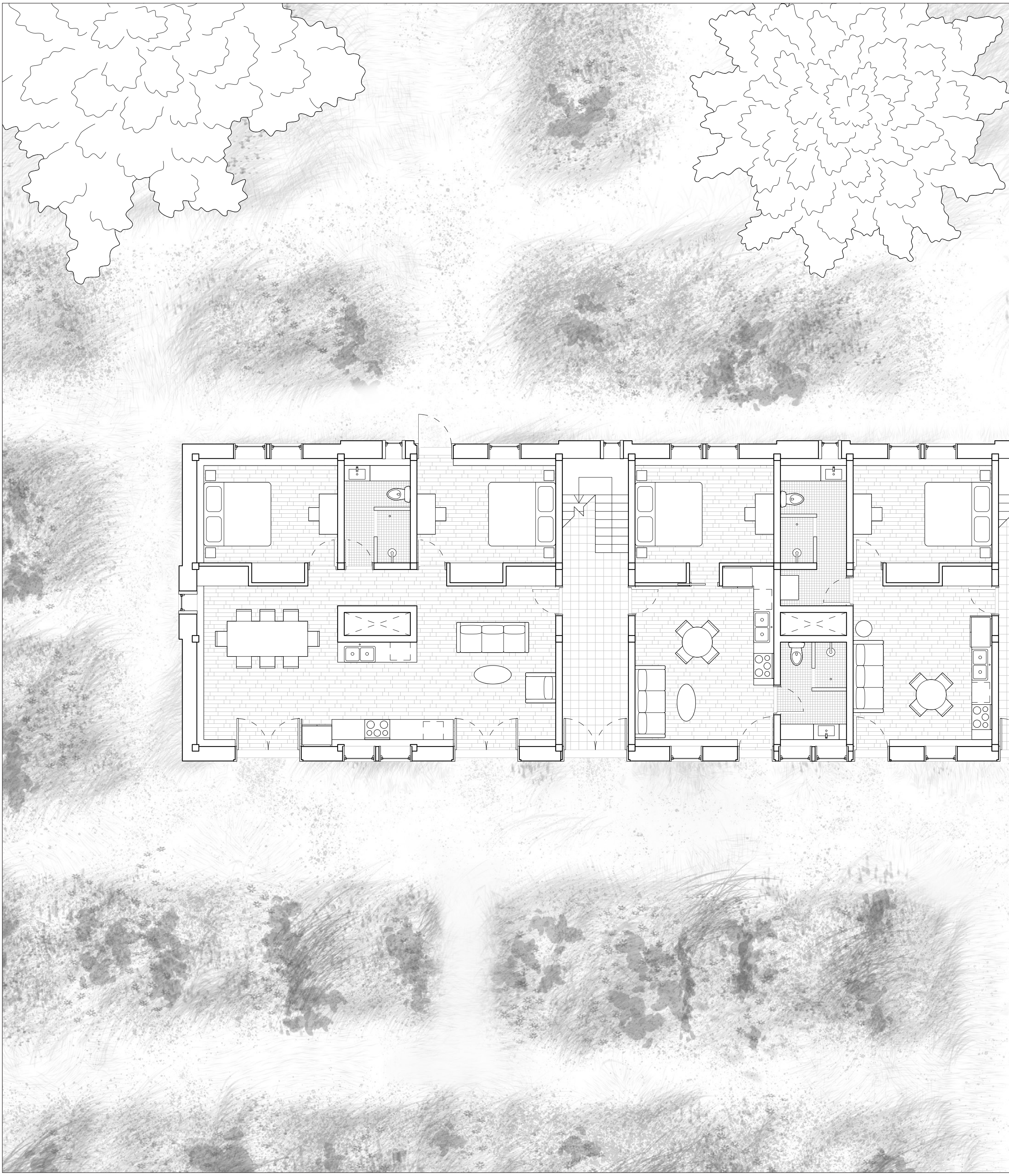
The use of a modular timber frame allows various programmes to fit inside the long-house envelope. This allows the use of the space to transition as the needs of the residents change. In the early stages of the site's redevelopment, the longhouse would host a workshop from which the residents would be able to construct the other buildings on the site. Later on, this workspace might change into housing or another community ammenity. The following plans showcase various spatial arrangements of the longhouse.

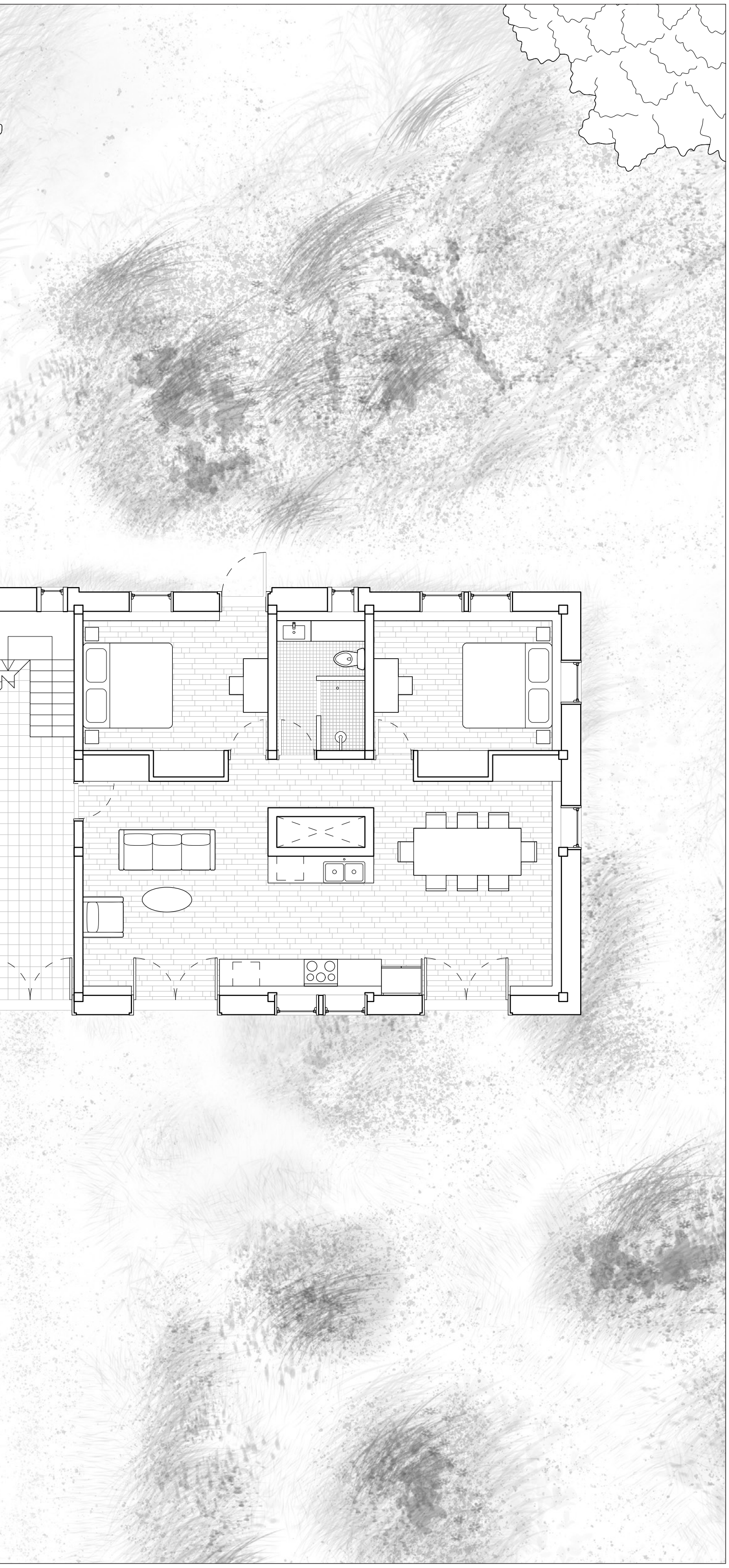

WELCOME



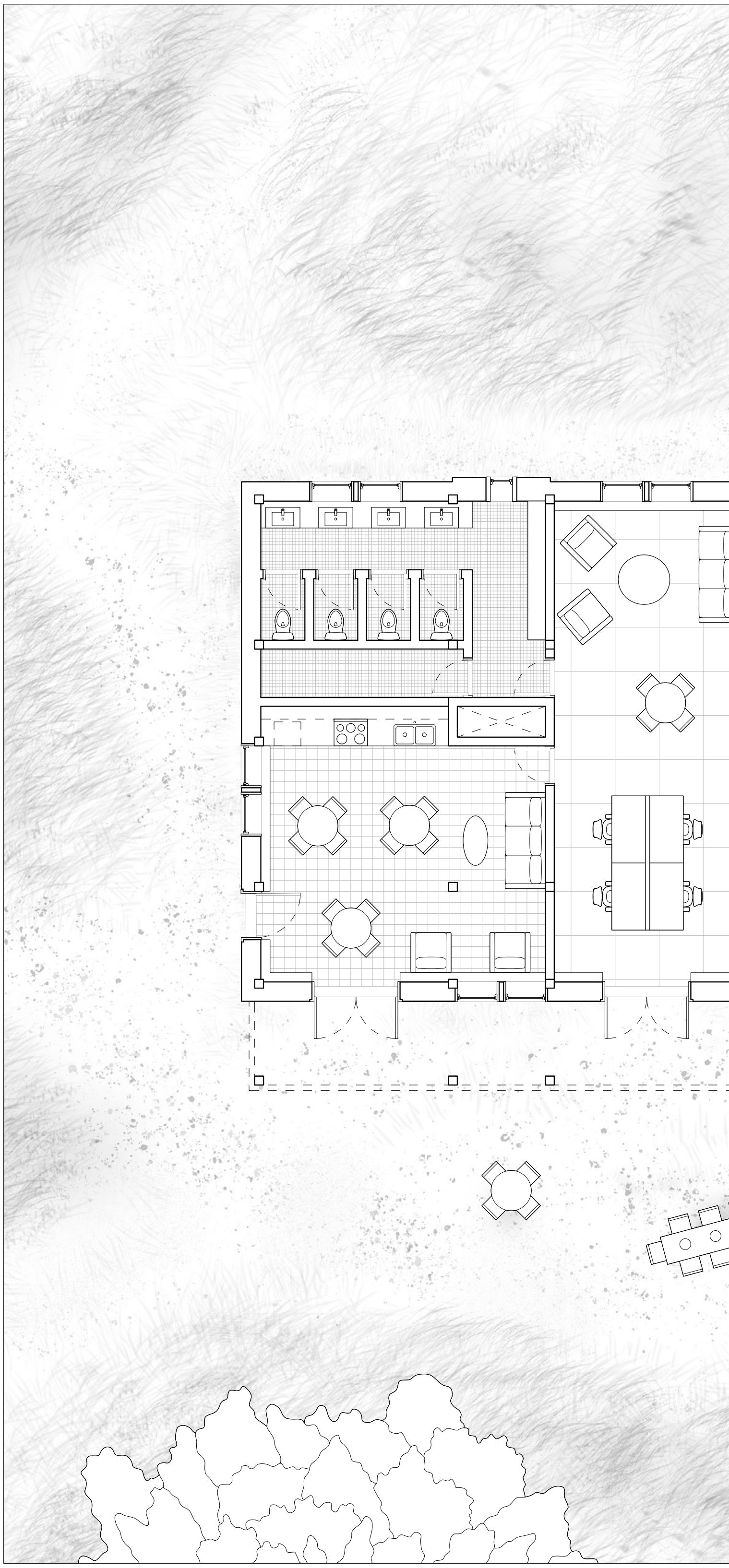
Ground floor of the longhouse as a workshop space. Workshop spaces would include woodworking, metalworking, sculpture, and the upper floors could be used for painting, drawing, and ceramics.



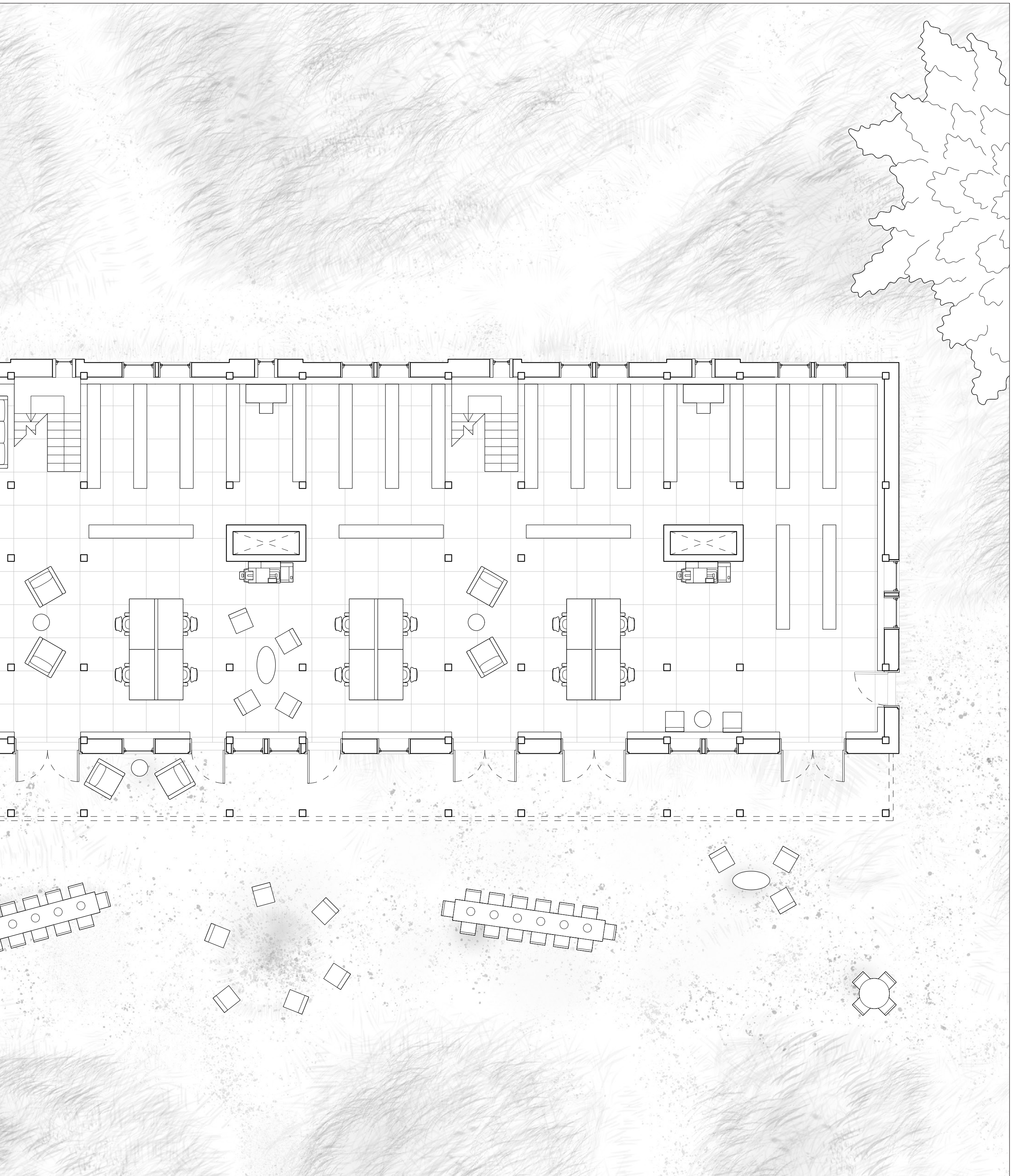




Longhouse residential first floor plan with adjacent allotments. A mix of 1, 2, 3, 4 bedroom apartments.



A longhouse with community spaces including co-working space, a library, and resource facilities.



Walling and Cladding

5.1 Introduction to Walling and Cladding

While timber frames today are often wrapped in structurally insulated panels (SIPs), ancient timber framing was almost always infilled. One of the most common materials found as the walling infill between timber frames was wattle and daub. Staves with an pointed end would be fitted into channels augured into the timber, then withies would be woven through the staves, creating a screen resembling a wicker basket. Then, a mixture of clay, dung, straw and hair would be applied to the wattle, before being coated in a layer of plaster. If the spans between timber members were too great, sometimes the huge build up of daub would essentially act as a reinforced mud wall. Otherwise brick, stone, or larger wood sticks would replace the use of a wattle. However, once plastered over, they would appear indistinguishable.

The major downside to wattle and daub was durability. Panels were often thin and fragile, and offered little protection against weathering. As a result, they required constant re-plastering. Overtime, the plaster could build up to create a very durable overcoat, but if left unattended, it could crack and leak. To combat this, cladding in terra cotta and wood was affixed to the exterior walls. Various types of clay tiles were used, from plain tiles to mathematical tiles. In some cases, slate would be used. Weatherboarding in wood (elm or oak) was popular for farm buildings and churches from the late 16th century, but was not used in domestic contexts in England until the end of the 18th century.

5.2 Mass Walling

In contrast to timber framing, another building techniques crucial to the longevity of the vernacular home was mass walling. There are two main types of mass walls used: stone walls and mud/earth walls. Both were a result

Fig. 1 15th century timber-framed barn with thatched roof, wattle and daub infill, and wood weatherboarding in Wendens Ambo, Essex. Via RIBAPix, reference RIBA42020.

of what was readily available to the builder. Over time, brick became the dominant walling material in England, due to industrial processes that lowered its cost for the average builder. Today, the use of brick is often merely superficial, and is used as cladding rather than in load-bearing mass walls.

Before fired clay bricks, adobe clay blocks were used, and in the south-east of England, clay lump was used. More common, however, was the use of cob walls. These walls would be built in layers on top of a study underpin course, either with or without form work, using a mixture of earth or clay, water, and straw. Sometimes pebbles and chalk were added to increase stability. These materials were generally excavated on the building site, making them very popular among vernacular builders. Later, rammed earth or *pisé de terre* would improve upon the cob wall, but would only be first used in England in the late 18th century (fig. 2).

The map on page 54 shows the various types of stone used in vernacular buildings, and coincides with locally and regionally available rock types. Unless a quarry was located nearby, stone used in construction was often obtained from clearing farm land. Building in stone was quite challenging before cheaply available lime and cement-based mortars, and of course before the use of modern machinery. In order to keep walls plumb, stone buildings were often modest in size and kept to one storey tall. Generally, larger stones were used at the base of walls, sometimes in combination with a wood sill plate to keep walls from bowing outwards, and smaller stones would be stacked on top.

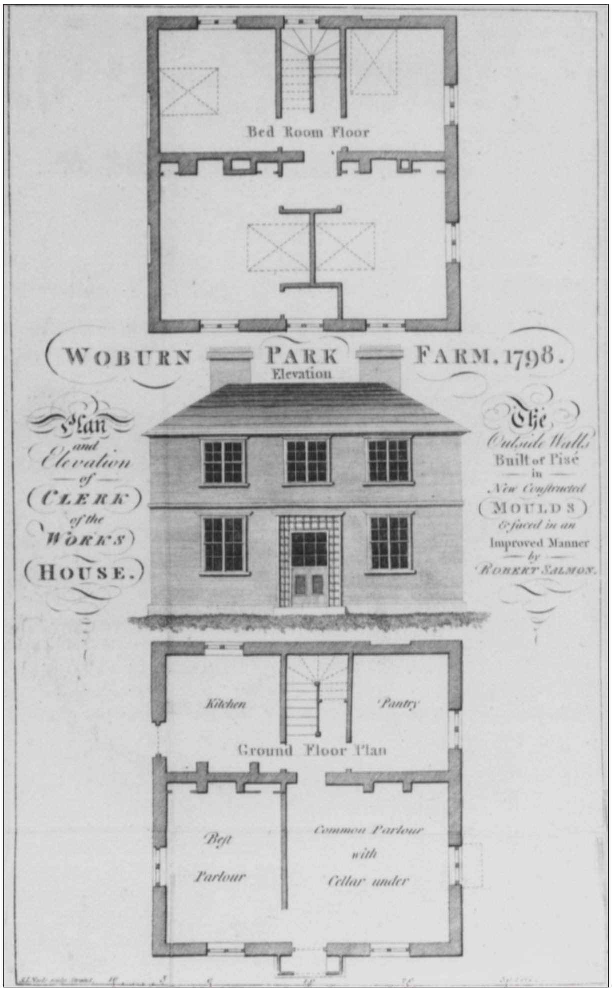


Fig. 3 House of Robert Salmon built in rammed earth at Woburn Park, the estate of the Duke of Bedford, in 1798. Photo via the British Library, London.

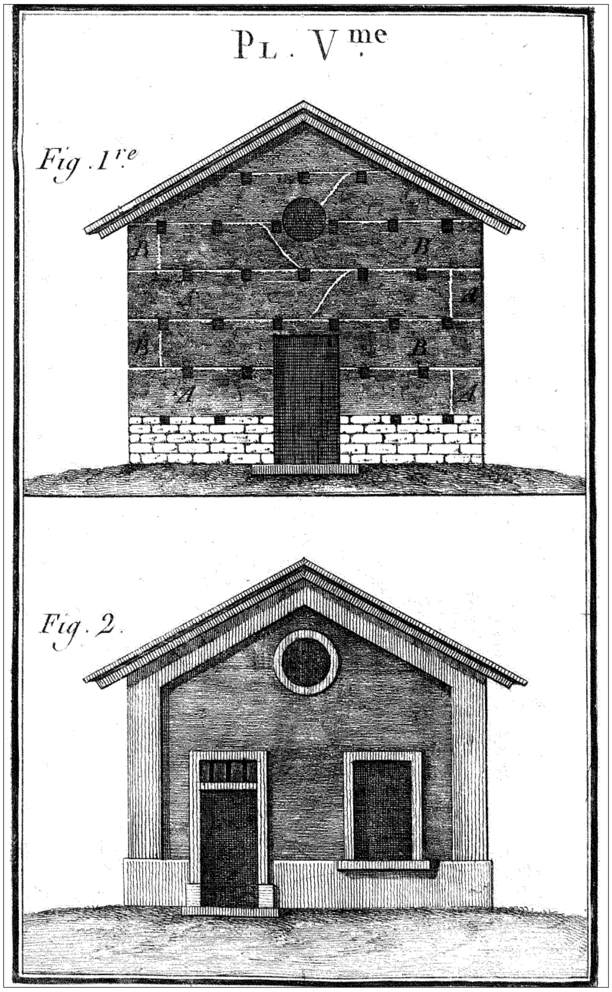
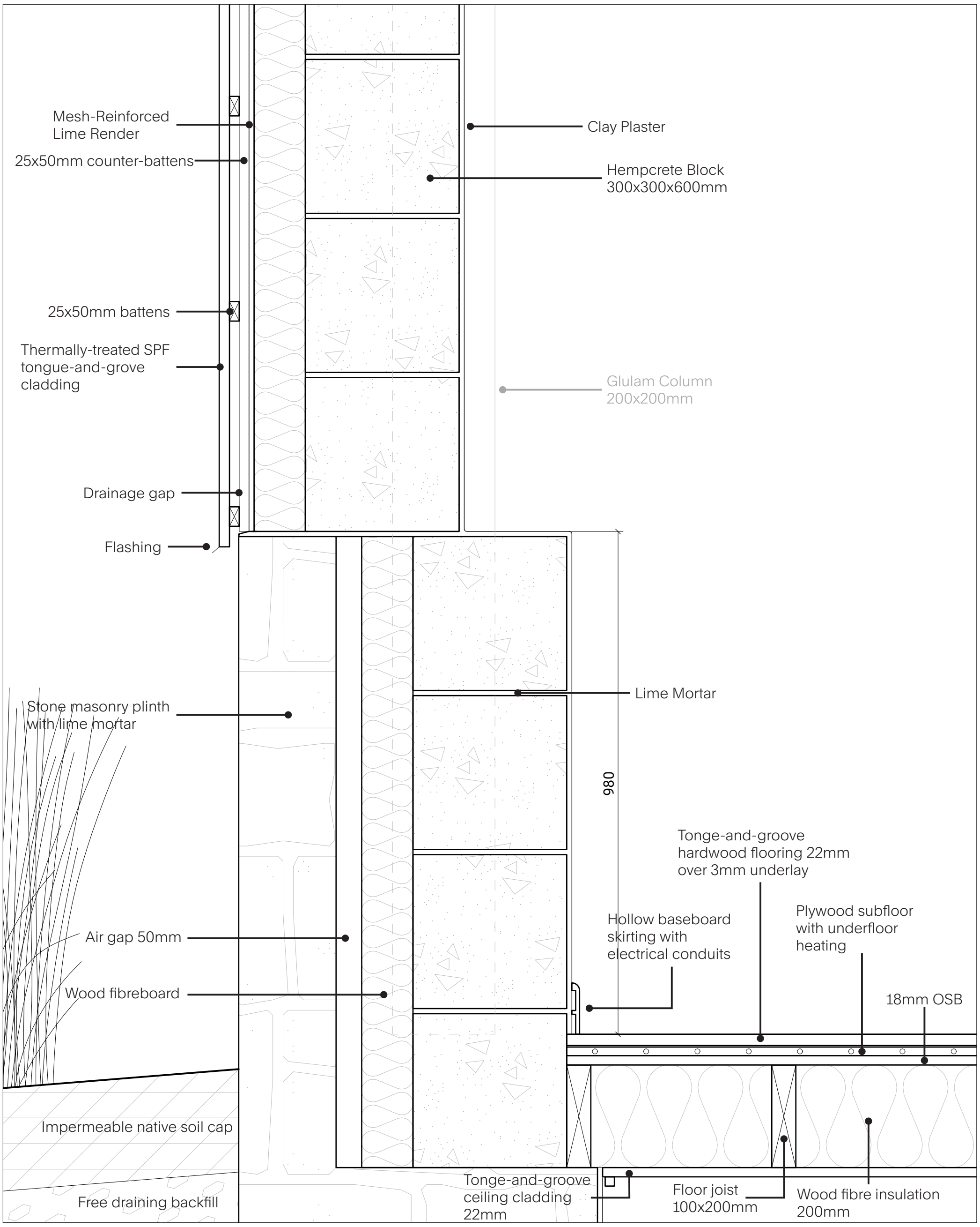


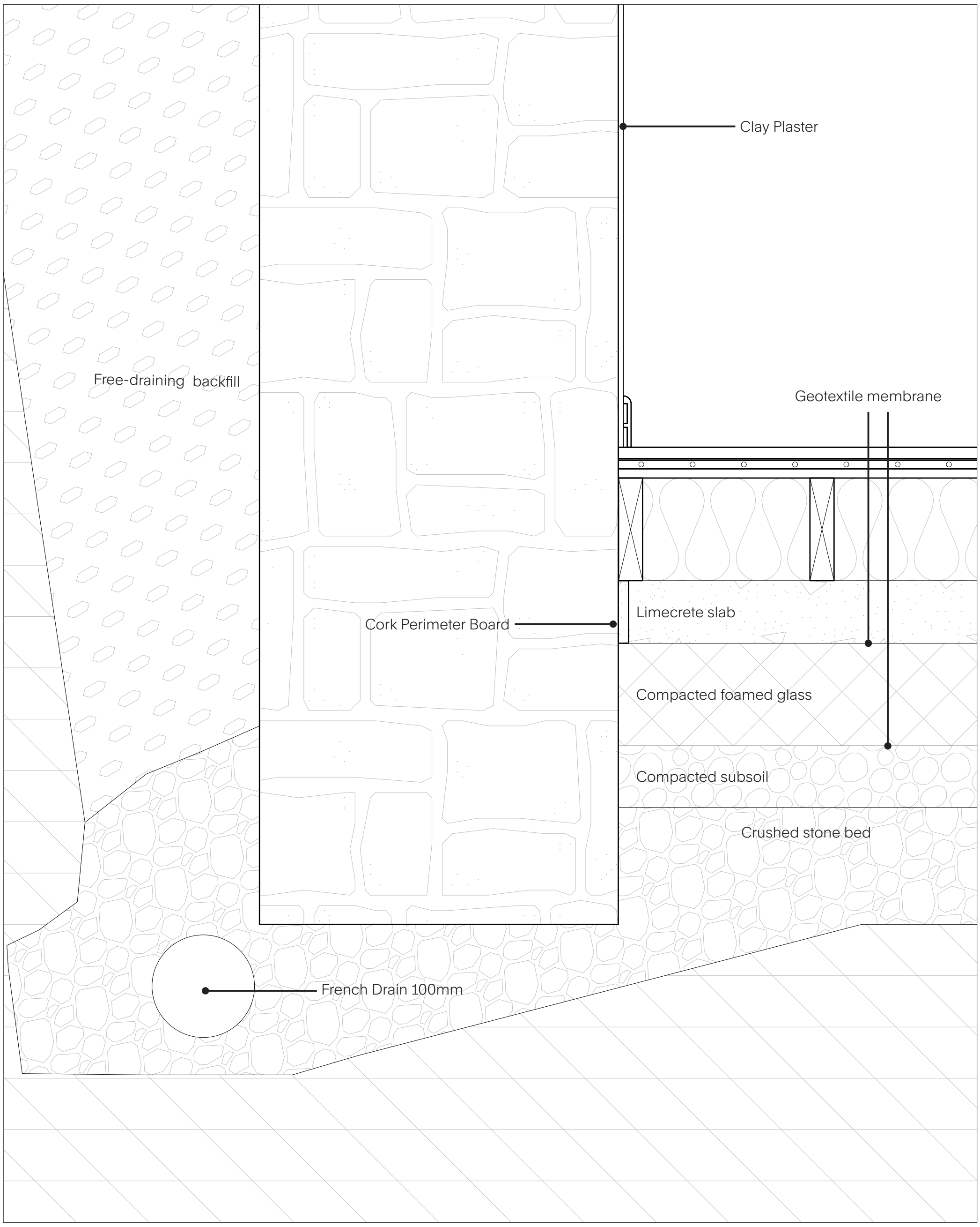
Fig. 4 House in Rammed Earth from École D'architecture Rurale by François Cointeraux. Image via Wikimedia Commons.

5.3 Modern Ancient Materials

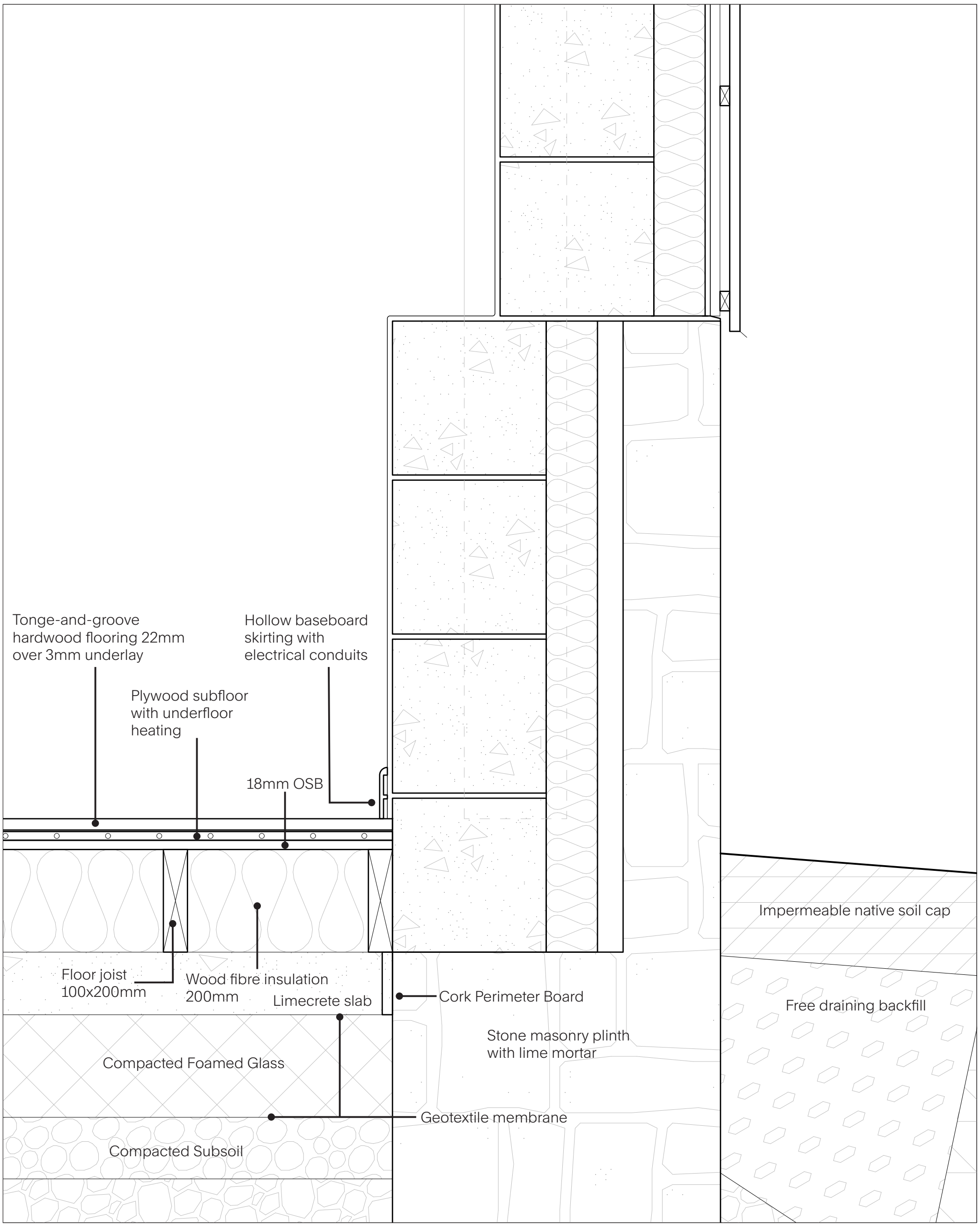
A combination of timber framing and mass-walling was used in this thesis after considering all the research gathered. A wall-build up exhibiting good weatherproofing and a high thermal mass was chosen in anticipation of the extreme changes to climatic conditions in Britain of the next 500 years. Thick walls reduce direct sunlight exposure and maintain ambient indoor temperatures. All the materials are naturally derived to reduce the building's overall carbon footprint and to demonstrate that a high-performance, breathable building envelope can be built with locally-sourced materials. The stone foundations and 1m tall plastered stone plinth ensure a steady base, and the hempcrete blocks allow the timber-frame infill to be built out more easily and with higher insulation and breathability properties than masonry construction. Clay plaster is used as an interior wall finish because it is highly hygroscopic and controls air humidity. A limecrete slab was chosen because it is more flexible, breathable, and recyclable than concrete. Finally, this thesis has imported *shou sugi ban* from Japan—an 18th century technique of weatherproofing wood through charring—to double the lifespan of the wood cladding.



Project Title	Notes	Drawing Title	Paper Size / Scale
The 500-Year House	-UBAKUS simulator data for upper wall build-up shows u-value of 0.144 W/(m^{2}K)	**Stone Plinth Section**	A4 / 1:10
Author: Jay Potts	-Stone plinth build-up u-value of 0,144 W/(m^{2}K)	Issue Date: 2024.02.29	Drawing No. **A-506**



Project Title **The 500-Year House** Author Jay Potts	Notes	Drawing Title **Foundation Detail** Issue Date 2024.02.29	Paper Size: A4 Scale: 1:10 Drawing No. **A-507**

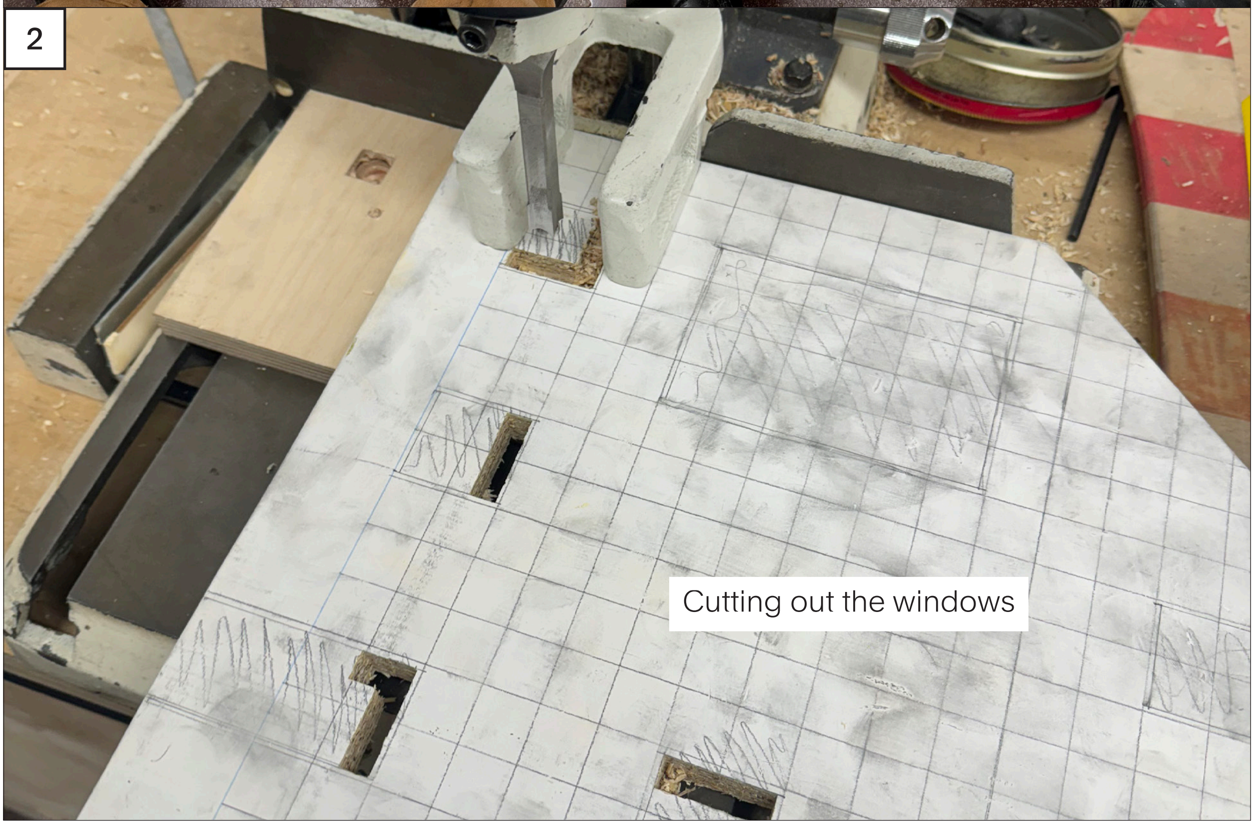


Project Title	Notes	Drawing Title	Paper Size / Scale
The 500-Year House		**Subfloor Heating Detail**	A4 / 1:10
Author: Jay Potts		Issue Date: 2024.02.29	Drawing No.: **A-508**

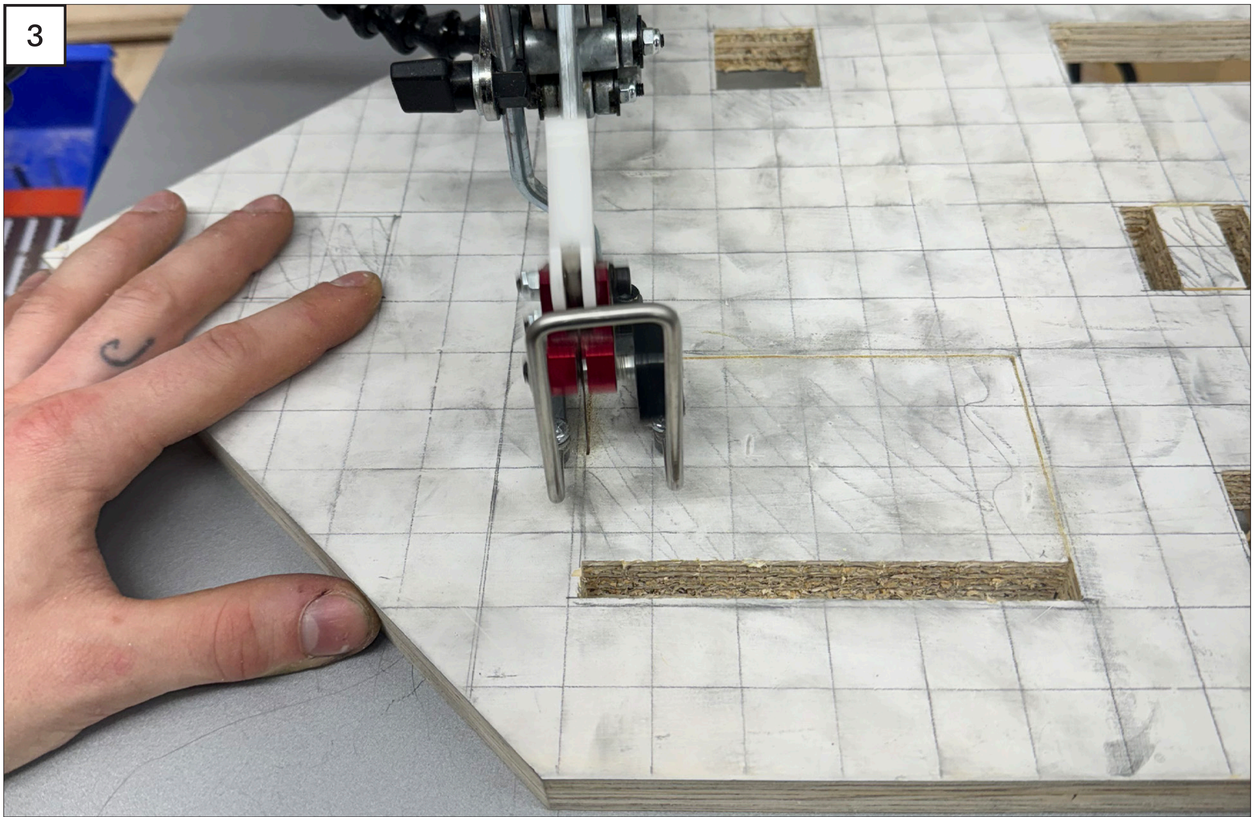
1 5.5 Making a Timber Facade

Testing window layouts with scrap wood

2



Cutting out the windows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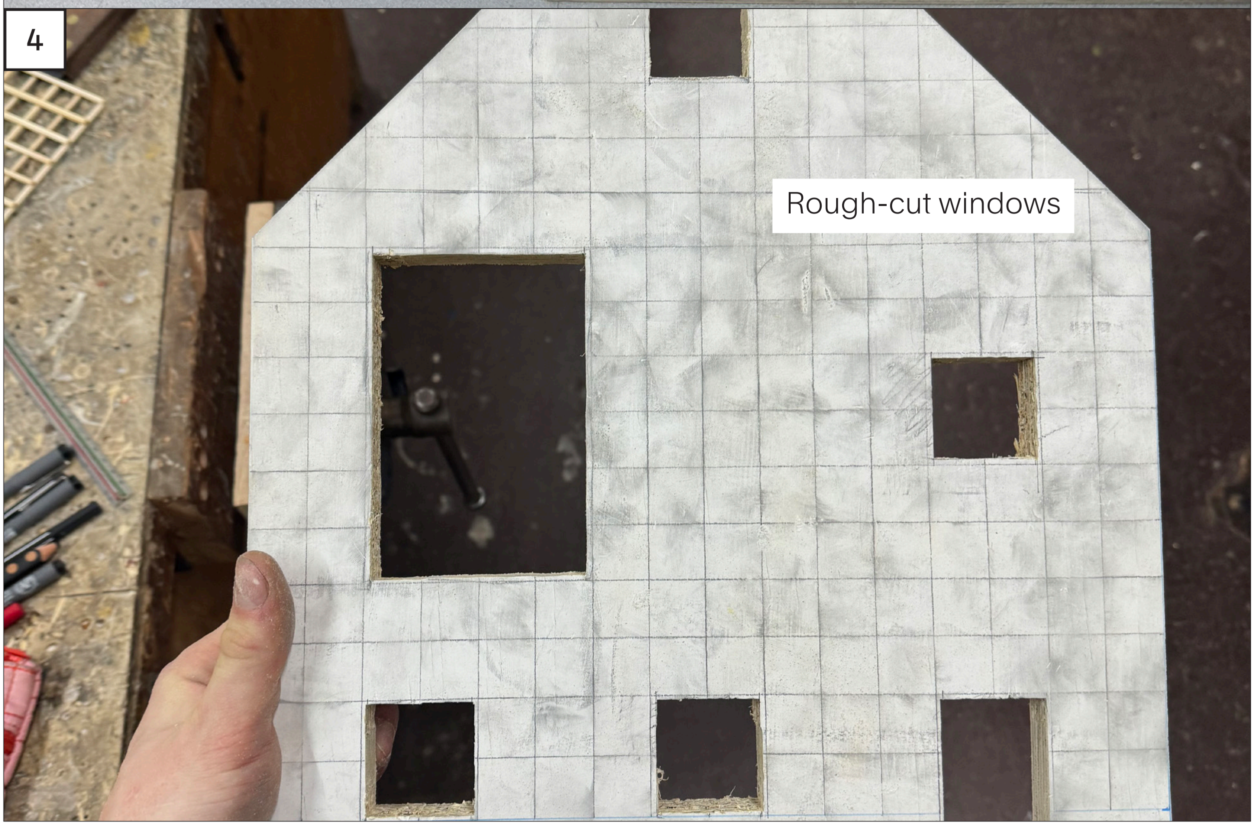
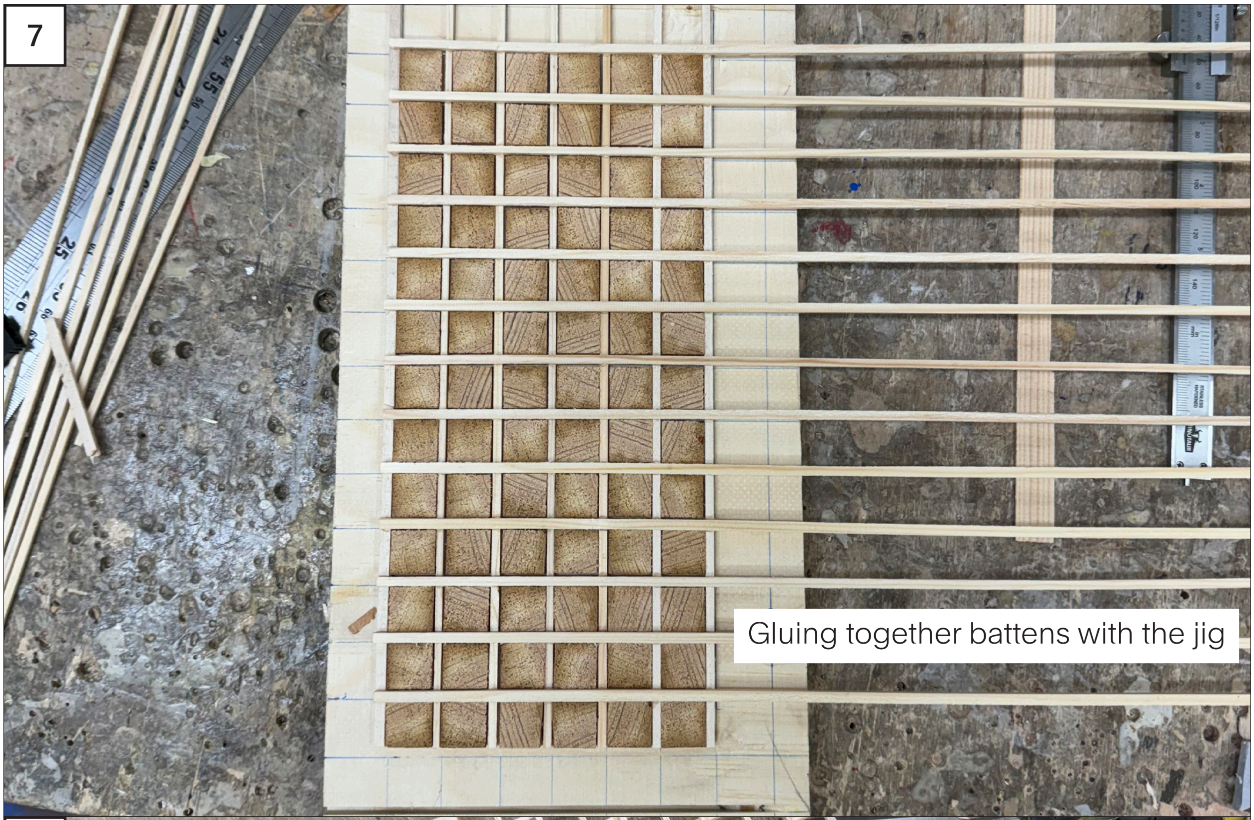

4
Rough-cut windows

5

Making a jig for batten assembly

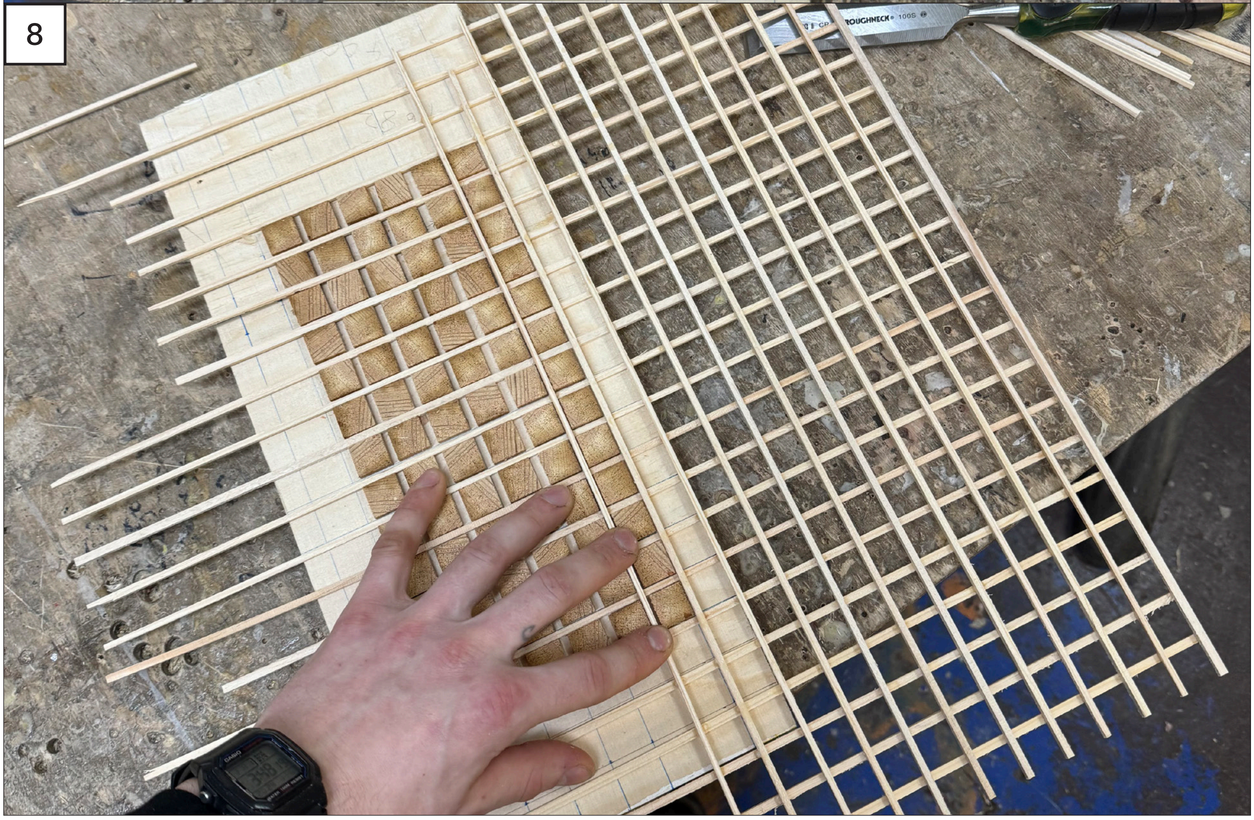
6

7



Gluing together battens with the jig

8



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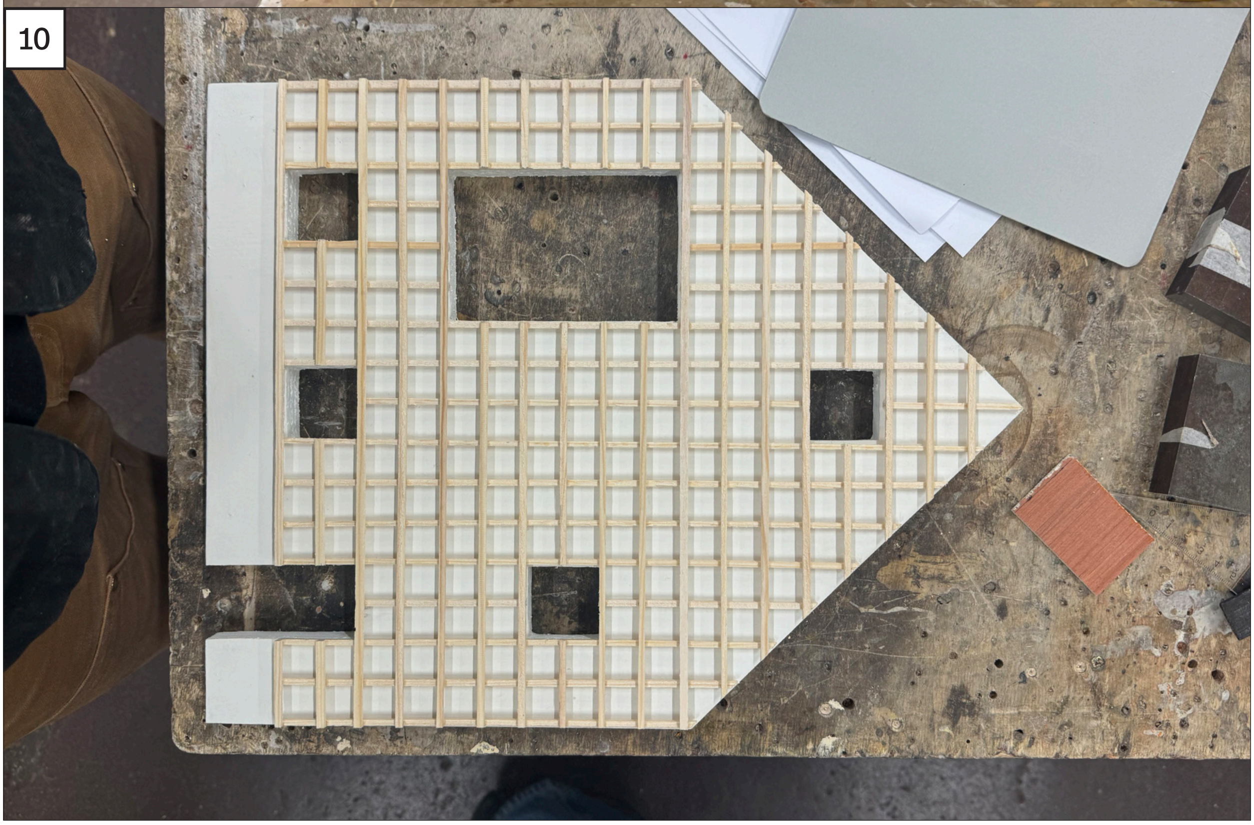
Trimming batten assembly to fit facade

10



11

Charring test on timber shingles

12

Gluing on timber shingles

13

Rough timber shingles

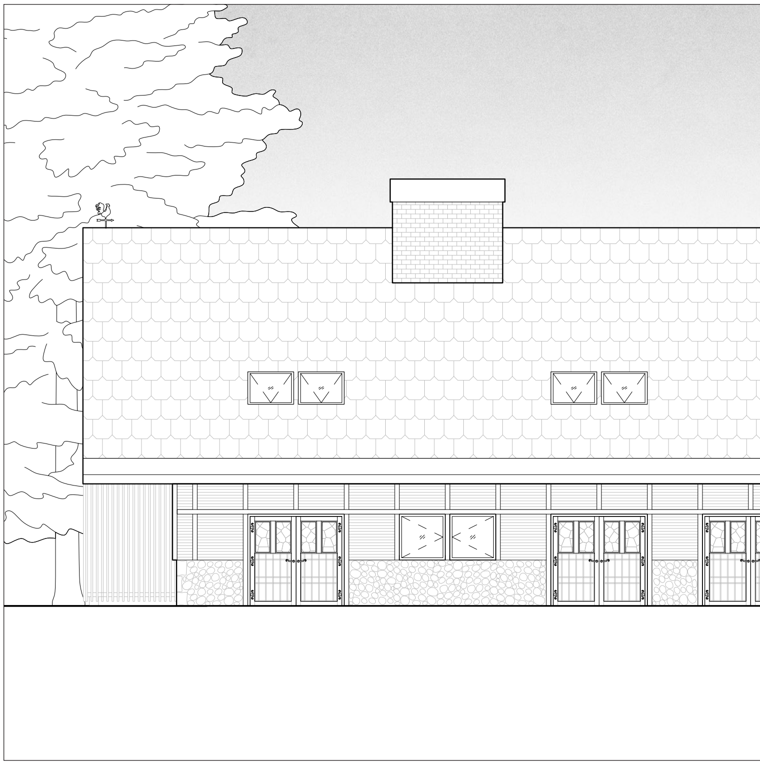
14

Charring, trimming shingles, adding cedar sills

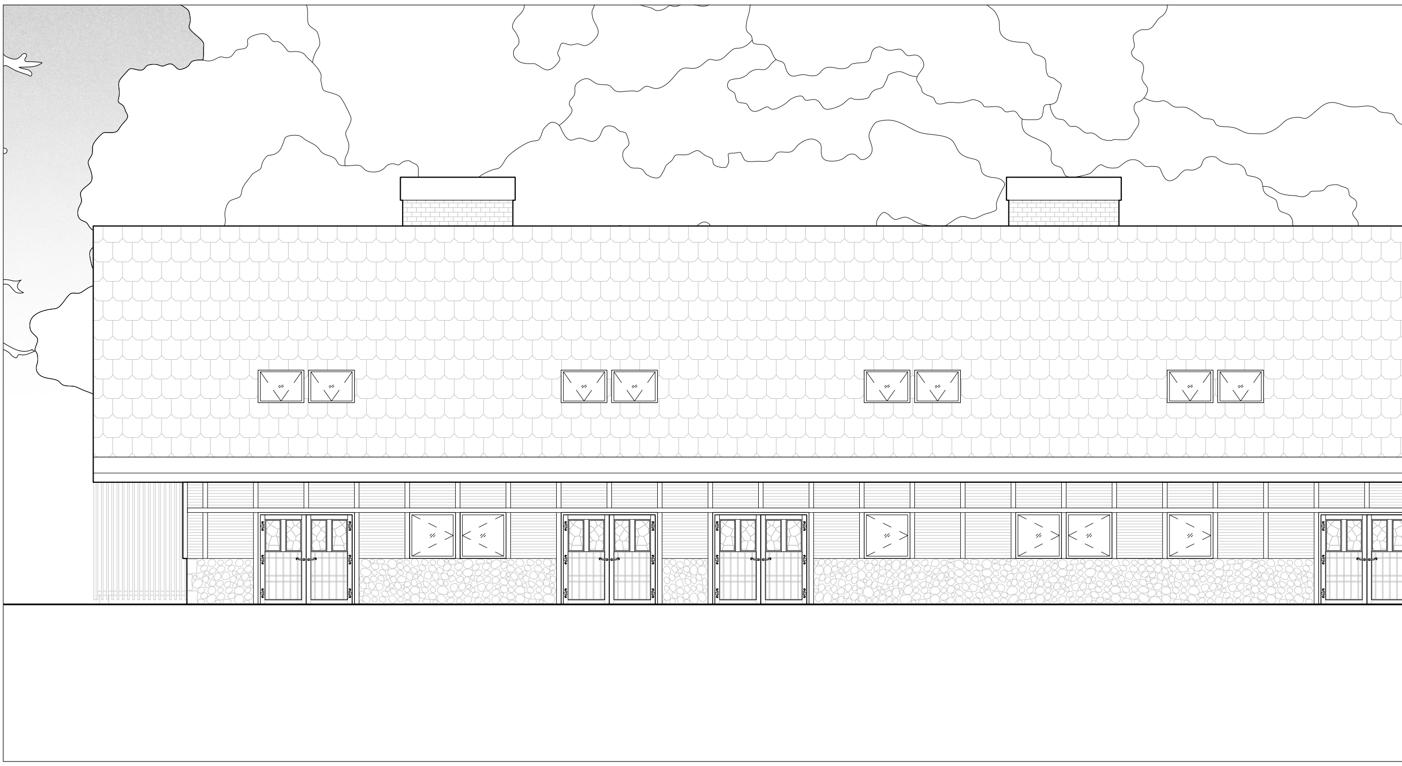
Finished facade model.

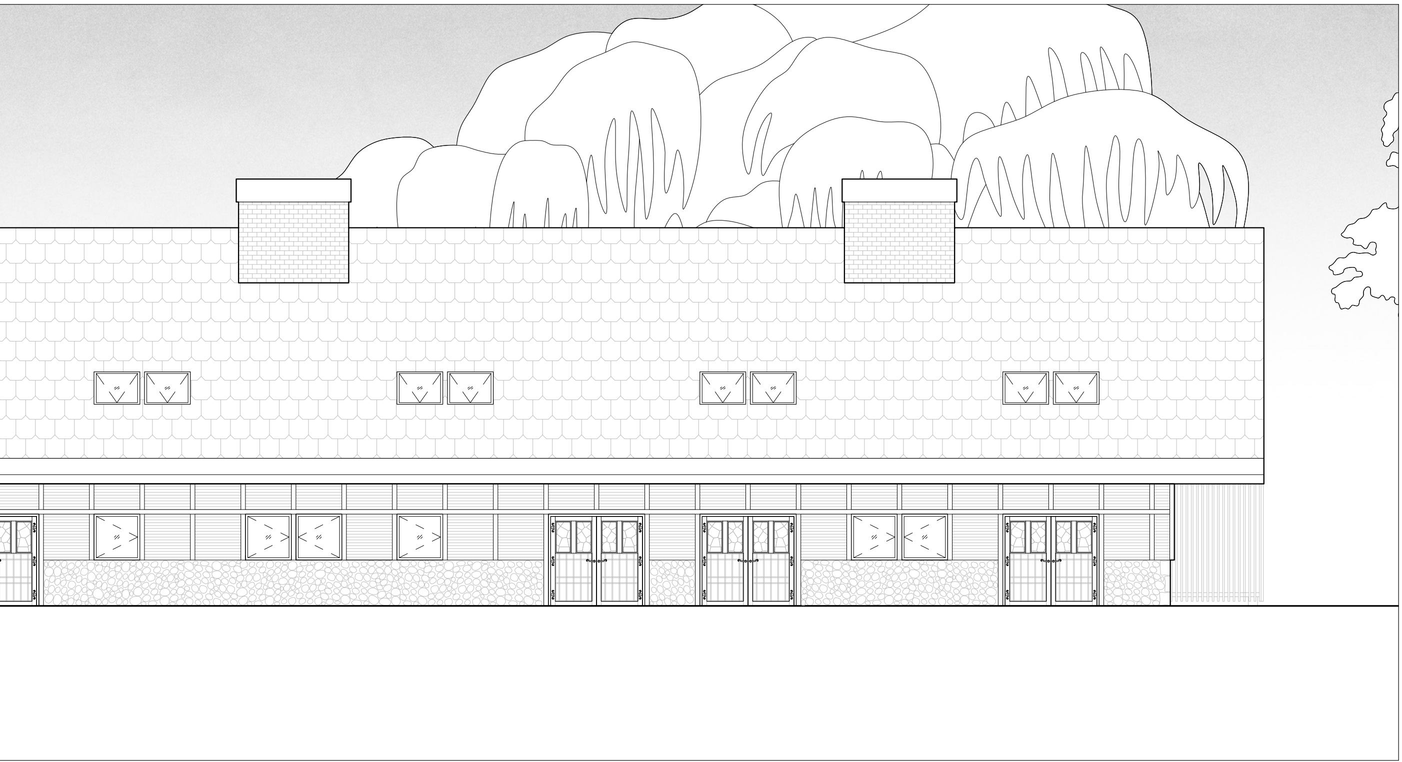
5.6 Elevational Permutations

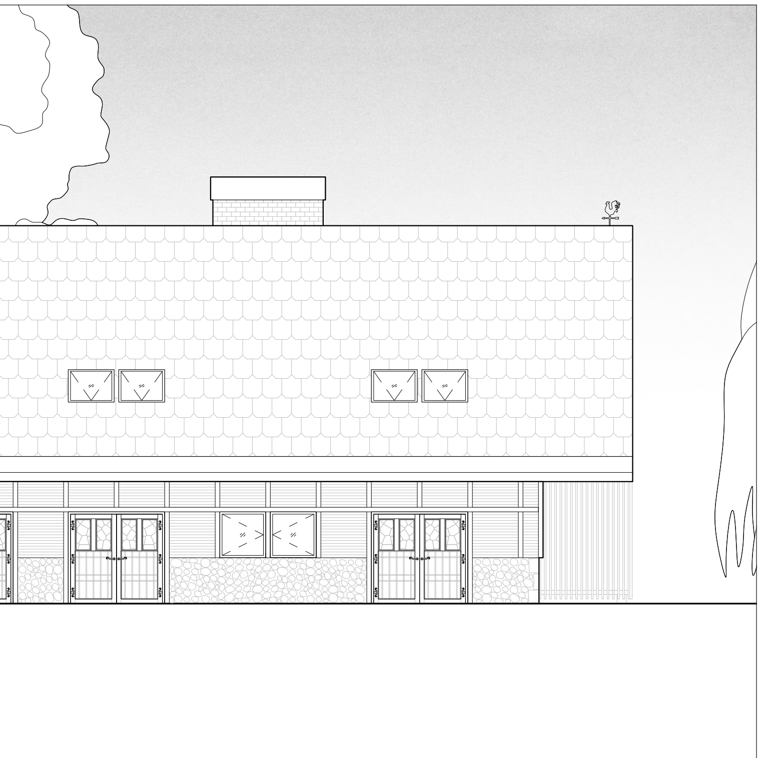
The modular timber frame frees the facade from load-bearing capacity. This means the facade can adapt to the use of local materials and thus express a local vernacular. The following elevational permutations express the local Essex vernacular with flint walling and wood and slate shingles.



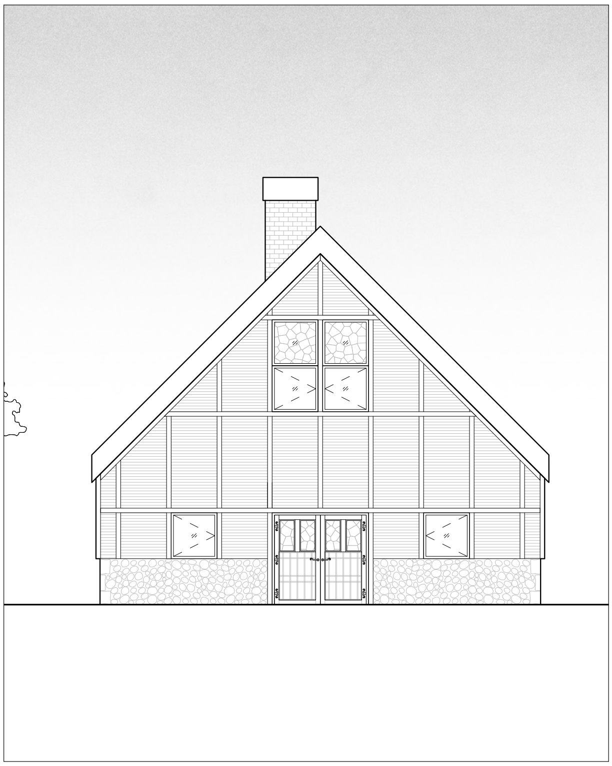
A permutation of a 2-Storey Longhouse, broad elevation.



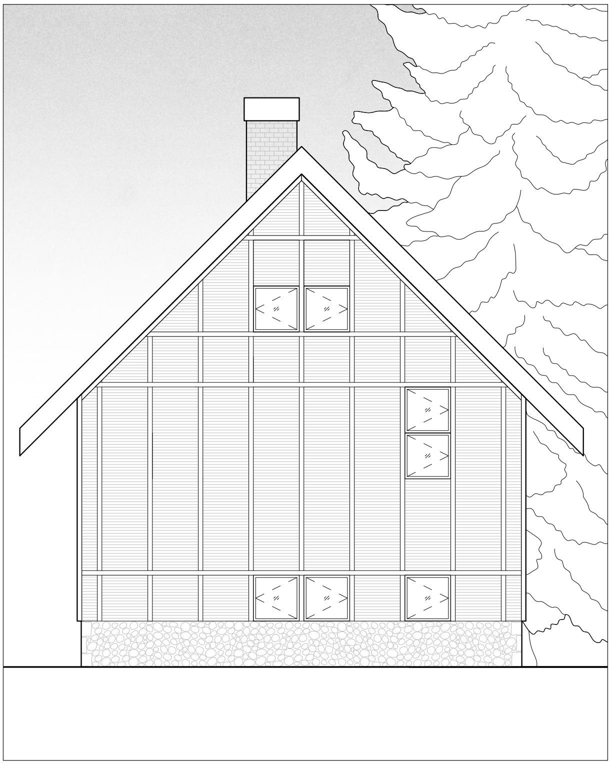




Broad rear elevation iteration.

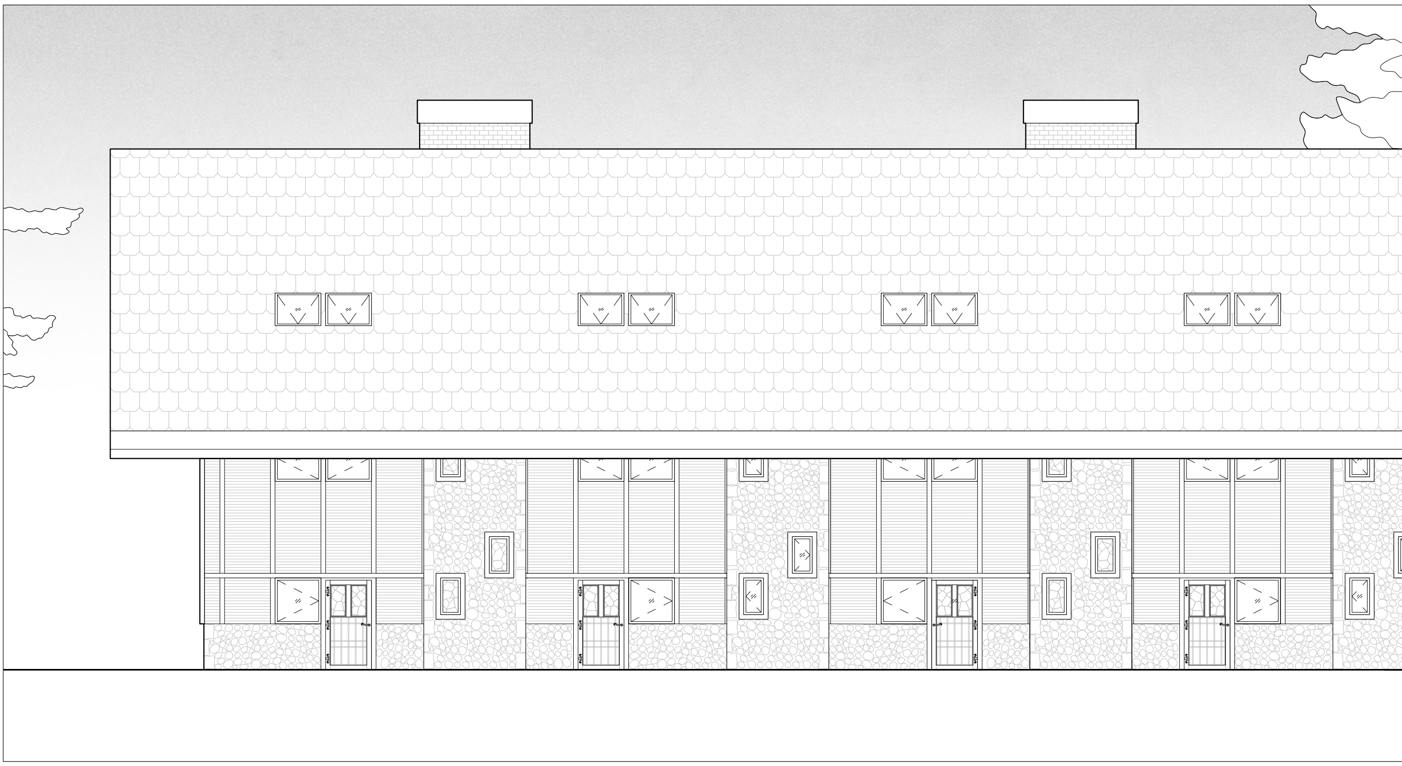


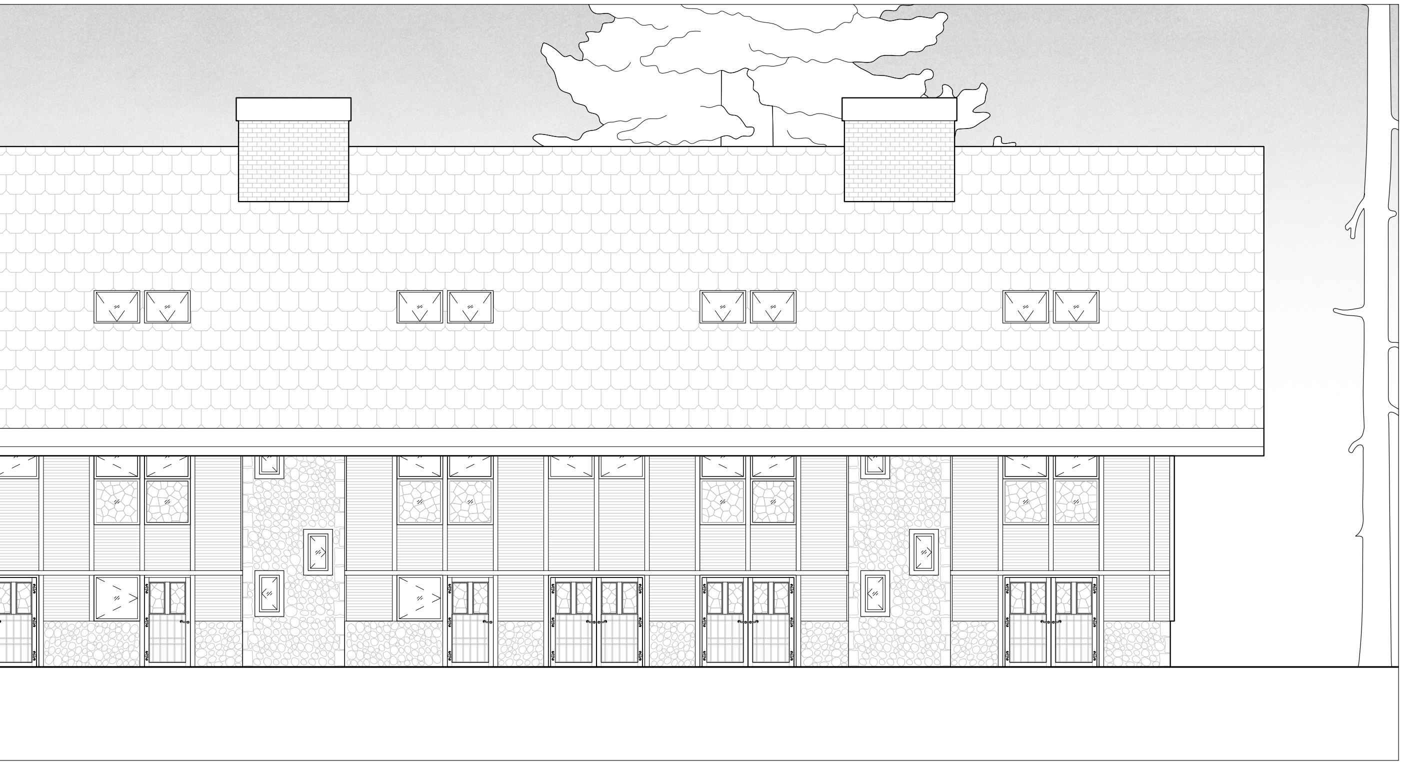
Gable end elevation.

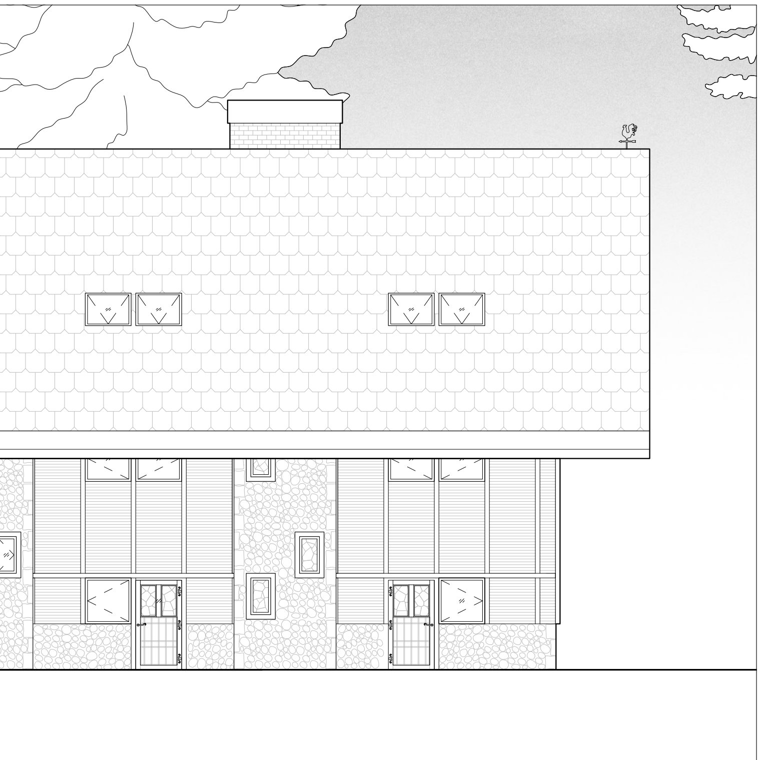


Elevational permutations of a 3-storey Longhouse.

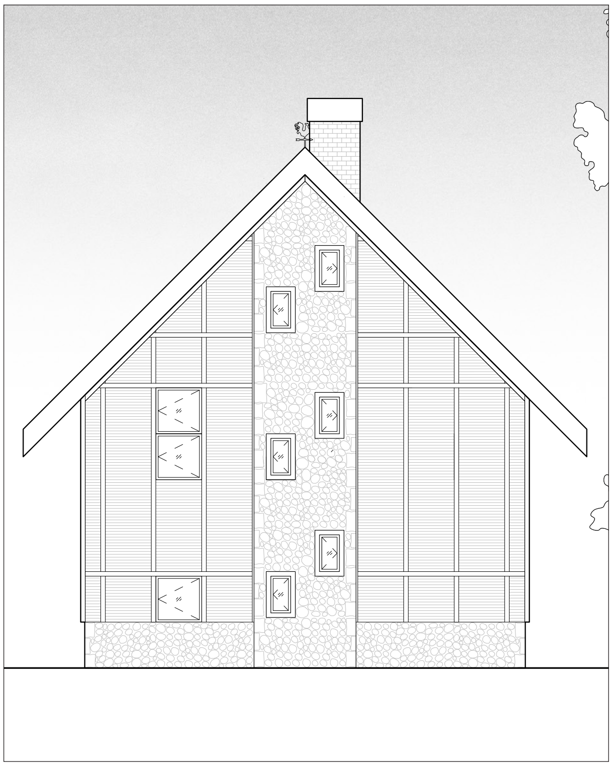
Broad front elevation iteration.





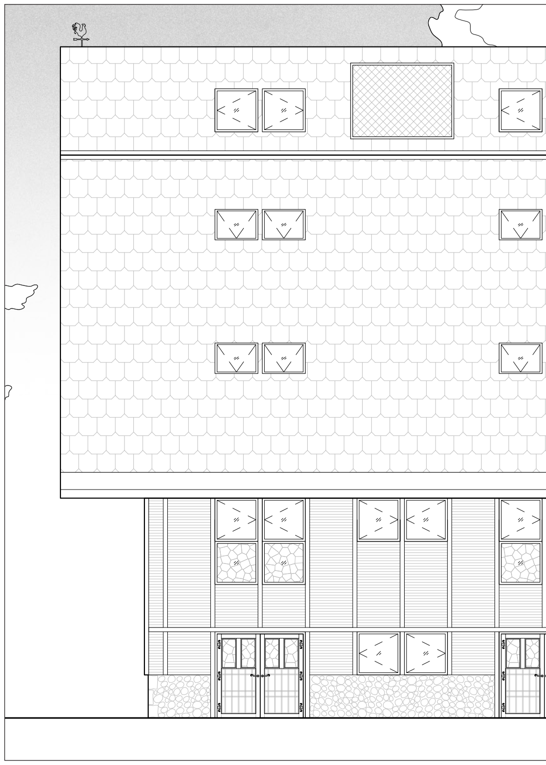


Broad rear elevation iteration.

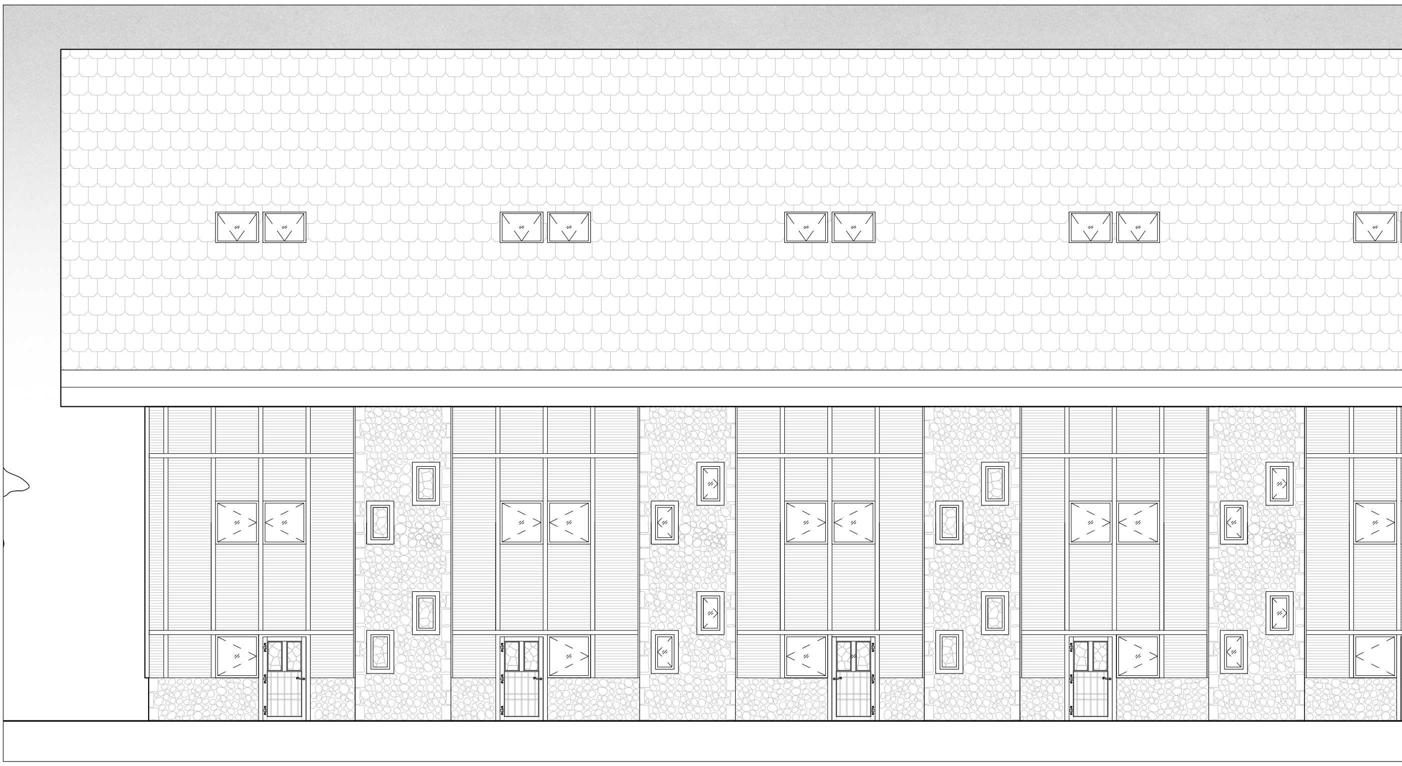


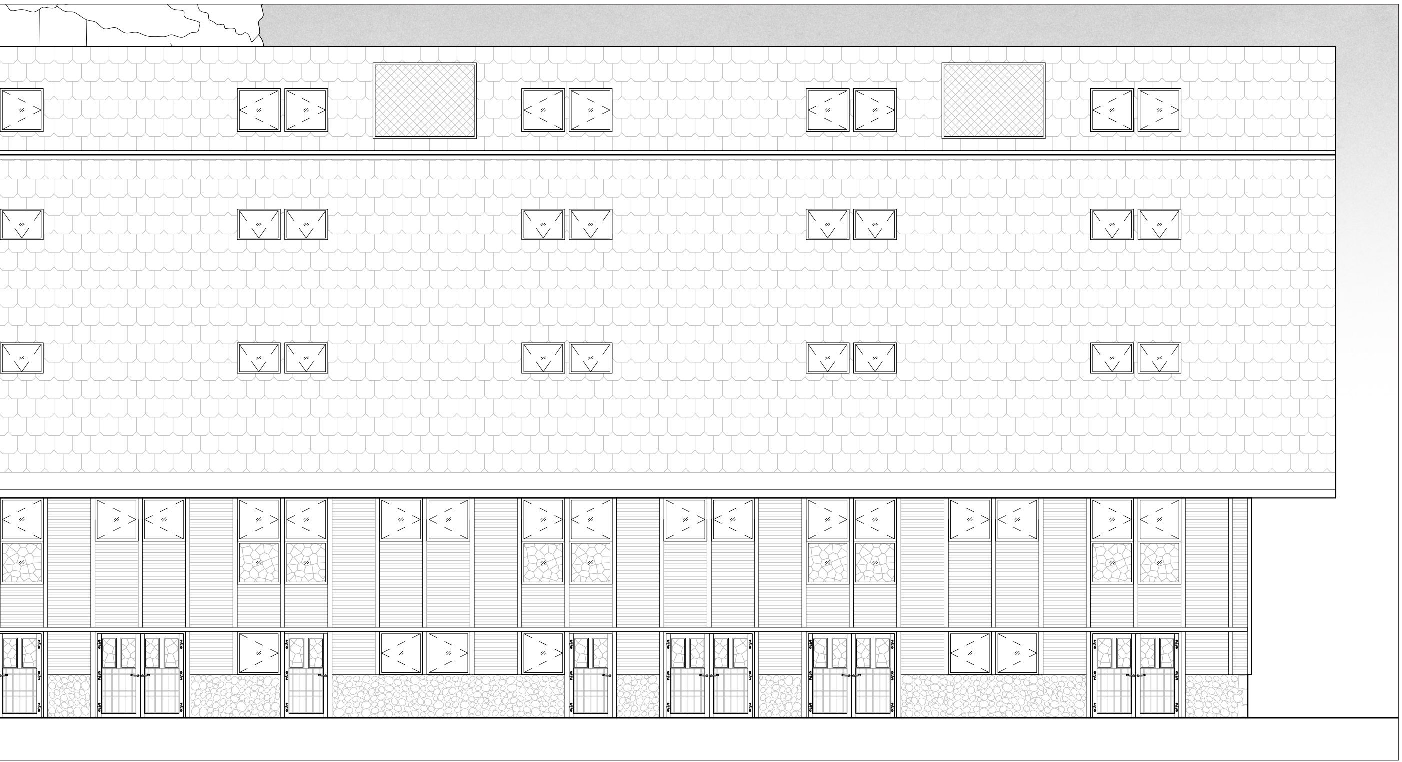
Opposite gable end elevation.

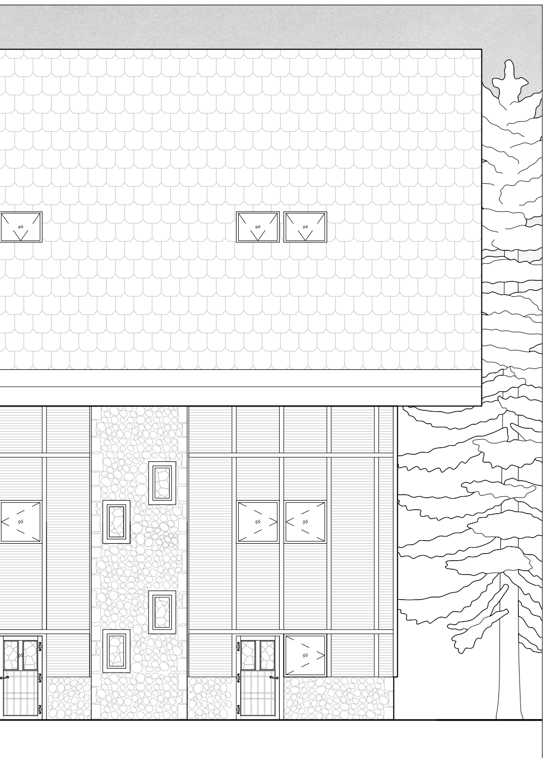
Elevational permutations of a 4-storey Longhouse.



Broad front elevation iteration.







Broad rear elevation iteration.

Opposite gable end elevation.

Roofing

6.1 Thatched Roof

Before tiles, thatch was the universal roofing material in the country. Thatch, in the form of reed, straw, and heather, was widely available, cheap, and light enough to be fitted to even poorly built mud or chalk walls. Today, thatch is used as a legacy material in many ancient buildings, but the profession of thatching has largely died out due to cheaper and more durable modern roofing options. Today, thatch is almost always installed to meet heritage guidelines and is rarely applied to new-builds. While the appeal of thatch is still felt throughout England, it has fallen out of favour for a number of reasons. Firstly, thatching is extremely labour intensive and relies on specialist thatchers in a relatively uncompetitive market, leading to high installation costs. Because of it's natural, fibrous quality, the lifespan of a thatched roof is around 30 years due to decay by weathering. Animals can also nest in the roof leading to further degradation. Thatch is also highly flammable, and was often replaced by tiles to avoid this hazard. However, thatch is an unparalleled insulator compared to other vernacular roof types, which might explain its enduring and widespread appeal amongst vernacular builders.

6.2 Tiled Roof

In contrast to the widespread use of thatched roofing, roof tiles made of stone and slate were often only used in areas with an abundance of the materials. Due to their weight, these tiles seldom traveled long distances until the expansion of England's rail networks in the 19th century, when Welsh slate proliferated the country. Slate has numerous advantages, from being lightweight, durable, and highly water-resistant. Due to their density, they don't readily allow water vapour to escape, and can often cause damp if their underside is not properly ventilated. Further,

Fig. 1 Thatched roof and cob wall in Milton Abbas, Dorset. © Blackmore Vale Magazine/Reach

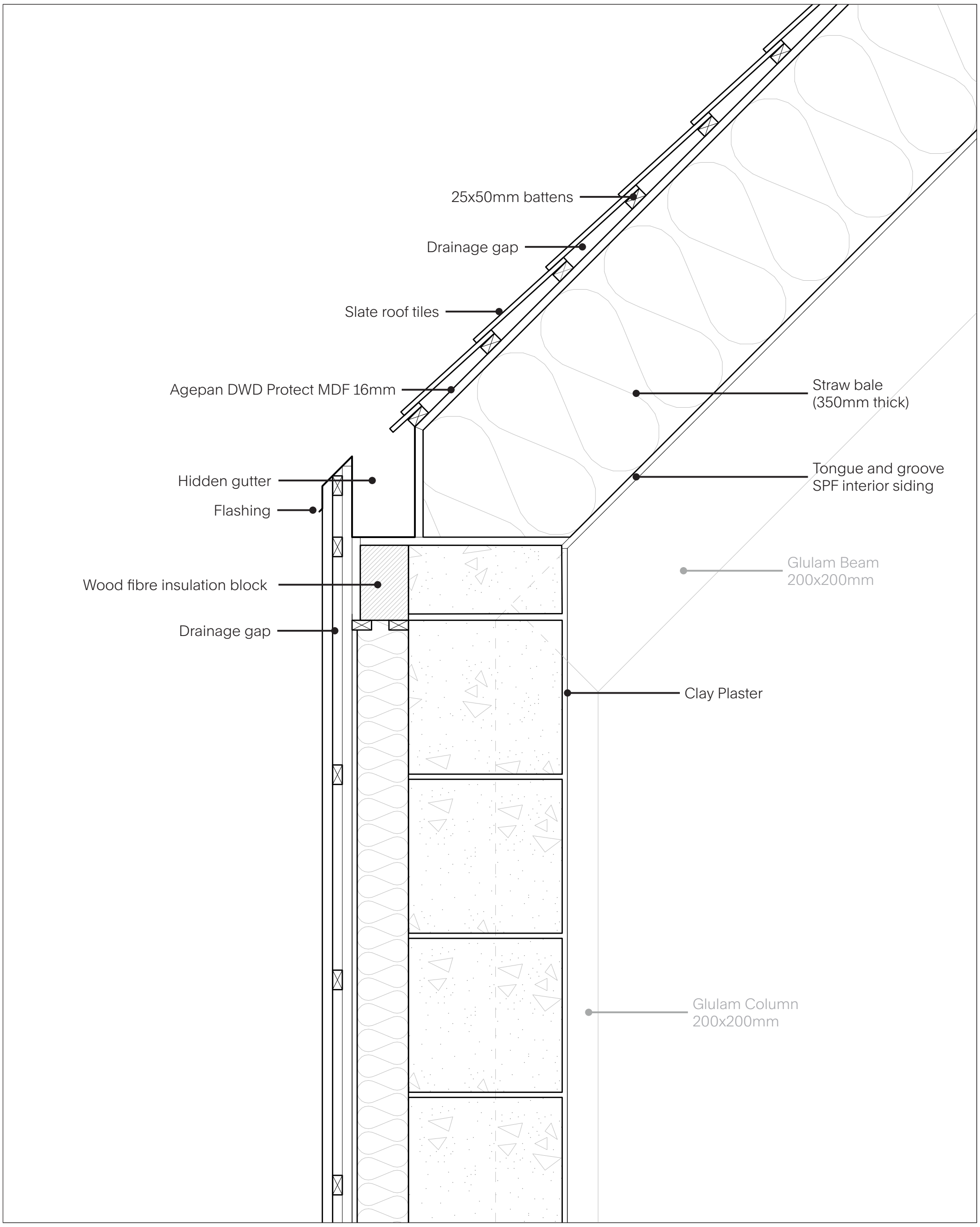
Fig. 2 Great Coxwell Barn, the last surviving building of a 13th century grange in Oxfordshire, with Costwold slate roof. Via RIBApix, reference RIBA89828

slate roofs require little maintenance over time, except the odd tile replacement. With the advent of pressure washers, build-ups of organic material, like moss and lichen, on the tiles be easily washed away.

The same goes for terra cotta roof tiles that developed alongside standard brick making. Fired clay tiles are water and fire resistant, making them an ideal choice when stone and slate tiles were not available. However, clay tiles are more fragile and risk breaking. The first available clay roof tile was the plain tile, which was standardized in 1477, and measured 10.5 x 6.5 x 0.5 inches. The pantile came later, having been imported from Holland towards the end of the 17th century. Unlike plain tiles, pantiles overlap at the top and side of each tile, making them more resistant to weathering and water ingress.

6.3 Proposed Roof

Combining the insulation properties of thatch with the weather proofing of slate, this thesis arrived at the proposed build-up on page 194. The main insulator is straw bale, which is increasing in popularity in Britain for being cheap, lightweight and nontoxic. Moisture can cause straw to rot, so a vapour-open and rainproof MDF board by Agepan is used to protect the straw while allowing it to breathe. Slate tiles are affixed to the Agepan board with wooden battens that also ventilate the underside of the tiles. A hidden gutter gives the whole building a contemporary feel while protecting the cladding. The roof is built up on top of the roof joists so that the glulam members are visible from the inside. Interior finishes can vary from tongue and groove boards to drywall.



Project Title	Notes	Drawing Title	Paper Size / Scale
The 500-Year House	-UBAKUS simulator data for roof build-up shows u-value of 0.109 W/(m^{2}K) -Straw bale and Agepan DWD protect help keep the roof vapour-open	**Roof Detail**	A4 / 1:10
Author: **Jay Potts**		Issue Date: **2024.02.29**	Drawing No. **A-509**

Render: Looking forward to look back at the first longhouse.

6.4 Final Model

A final model at 1:50 was built to explore the construction of the longhouse. The model is both conceptual and practical. It is a snapshot in time, showing multiple stages of the longhouse's construction. At the same time, it shows the spatial qualities of the modular timber frame and its basic organization. The model is constructed out of wood, steel, perspex and acetate. The facade is different from the elevational permutations explored in section 5.6, but maintains the same section as the elevations on pages 204-205.

Far end of the final model showing early stages of the construction of the longhouse.

Final longhouse model at 1:50.

Frosted perspex is used in place of the glass blocks for the ground-floor winter gardens.

Colour is used to break up the facade and deferential between the various apartments.

A tree and pond in steel.

Glass blocks are used throughout the longhouse and bring light into the main stairwells while providing privacy.

Maintenance

7.1 Introduction to Maintenance

A building could not survive on it's own. The key to longevity is maintenance. In the past, maintenance was a regular part of the lives of those who occupied vernacular houses. House work was an extension of their subsistence lifestyles, and they knew intimately how to fix just about everything in their homes. This permitted the use of materials such as lime renders, which require regular maintenance, and can explain why despite its benefits, it has been largely phased out of house building. Today, we are working more on average than our medieval counterparts. In Hungary, for example, peasants worked far fewer hours and would spend a good portion of the day decorating their objects. These objects were functionally useful, and the ornamentation was meant to inspire joy when using them. Work was also seasonal, and following the harvest, they would divert their efforts to ameliorating their homes. Even in the poorest dwellings, you can see richly painted walls and intricate wood carvings.

Today, the nature of work has changed from toiling fields to slouching behind screens, but still; to add additional domestic labour on top of our full-time occupations leaves no room to enjoy the fruits of our labour. Whether it be lack of time, or sheer inability to rise to the occasion for lack of skill and motivation, modern buildings receive far less love and maintenance than their predecessors. As a result, things tend to fail quicker and more frequently. Because of this shift, we start to perceive our buildings as disposable and build them to fail. This short-term thinking has no place in a world plagued by environmental catastrophes. Something has to give; either we switch our habits or find new ways to build and take care of our homes. This thesis proposes the following. Firstly, new buildings will be designed with a maintenance schedule for at least one generation.

Fig. 1 Richly decorated interior at the Károly Viski Living Museum. Image © John Willis via Flickr.

The up-front costs of the project will include maintenance expenditures, which will be held in trust by the residents' organization. Secondly, a specific period of the year, ideally late summer, will be dedicated to building maintenance. In the spirit of *kaláka,* this period will take place as a festival, and the community will come together to celebrate the building and work together to maintain it. Finally, the community will elect a resident to be head of maintenance, whose duty it is to keep track of and make minor repairs to the building throughout the year. Elections will take place annually, in order to keep this representative accountable. This position will be remunerated and paid for from the residents' organization fund. Space within the building should also be allocated to store maintenance materials, and a workshop with tools held in common.

7.2 Schedule of Maintenance

Not all the elements of a building will last forever. It is important to understand the longevity of individual components and allow them to be easily replaced at their end of life. By building modularly, these elements can be quickly swapped out. Further, by building with natural materials, any replaced or damaged element can be recycled or composted, creating a closed-loop reuse system on the estate. It is difficult to estimate the lifespan of a building component. This primarily comes down to how well the component was built and installed, and how frequently maintenance is undertaken. This thesis has attempted to estimate the life-cycle of specific elements based on various sources, and how frequently they should be serviced and/or replaced. In general, the "bones" of

Fig. 2 Adobe building in Morocco. Many Moroccans still build their homes with adobe due to its thermal mass. This trip also inspired the use of lime-based Tadelakt plaster in this thesis.

Fig. 3 1:50 Model of the 500-Year House. The Masonry stack (brown) concentrates all the electrical and plumbing, and provides easy access to wires and pipes.

the house are what determine its longevity. This includes the timber frame, stone foundations and mansory core. For this thesis, it is assumed they will last 500 years.

There are tools such as the BCIS Life Cycle Evaluator that can estimate costs of construction and maintenance over a building's life, but there will always be unexpected costs of maintenance. Instead of trying to predict specific cost, this thesis proposes a 10% premium on top of the total project cost to account for long-term maintenance. Since it is assumed that the residents will be carrying our repairs, this premium would only need to go towards the purchase of materials, the rental of equipment, and in rare instances for hiring a specialist. These funds would be held in common and could be kept in a low-interest savings account in order to compound over time and account for rising prices due to inflation.

On the proceeding pages you will find an outline of some of the building components, what maintenance is required, how often the maintenance should be carried out, and the amount of time before the element would need to be replaced. The items that would require replacing the most frequently are the appliances. Because of this, the electrical system is entirely modular and there are no built-in fixtures or appliances. This is possible with a hollow baseboard that is routed for electrical cables and fitted with sockets. All the lights are either floor lamps or pendant laps that can be plugged in or out of the baseboard. Also, all the plumbing is located in the central masonry stack to make regular maintenance easier.

Building Section	Component	Maintenance Activity	Maintenance Frequency (Y)	Predicted Longevity (Y)
Foundation	Masonry stone foundation	Check for cracks, deformation	10	500+
	Backfill	Monitor backfill infiltration	10	500+
	French drain	De-clogging	1 p/y	30-50
	Limecrete Slab	Checking for cracks	10	100+
	Compacted Foamed Glass	N/A	N/A	500+
	Compacted subsoil	N/A	N/A	500+
	Subfloor Insulation	Check for rot and pests	10	100+
	Clay Plaster	Check for cracks, re-apply plaster	Reg.	50+
Floor	Floor joists	Monitoring deflection, cracks and rot. Staining as needed.	Reg.	200+
	Wood Fibre Insulation	Check for rot and pests	10	100+
	Plywood Subfloor	Check for rot	10	100
	Hardwood Flooring	Sweeping, mopping.	1 p/m	100+
	Subfloor heating	System inspection, air bleeding	1 p/y	50+
Wall	Masonry Stone plinth	Check for cracks, deformation	10	500+
	Lime Mortar	Re-pointing of lime mortar	100	500+
	Lime Render	Check for cracks, reapply lime render	25	100+
	Timber cladding	Re-charring, replacing broken boards	10-15	40-60
	Wood Fibre Board Insulation	Check for rot	10	100+
	Hempcrete Blocks	Re-plaster hemp	100	300+
	Clay Plaster	Check for cracks, re-apply plaster	Reg.	50+
	Wood Doors (Interior)	Staining/sealing	25	100+
	Wood Door Frames (Interior)	Staining/sealing	25	100+
	Metal Door Handles (Interior)	Oil/lubricating, clearing dirt	10	25+

	Wood Doors (Exterior)	Staining/sealing	10-15	50+
	Wood Door Frames (Exterior)	Staining/sealing	10-15	50+
	Metal Door Handles (Exterior)	Oil/lubricating, clearing dirt	5	25+
	Wood window frames	Staining/sealing	2-3	100+
	Glass Panes	Checking for cracks, replacing panes	Reg.	100+
	Window Mechanisms	Oil/lubricating, clearing dirt	5	25+
	Wood cabinets/millwork, and built-ins	Staining/sealing	25	100+
	Bathroom Cabinets	Staining/sealing	10-15	50+
	Kitchen Cabinets	Staining/sealing	10-15	50+
Frame	Glulam Columns	Monitoring deflection, cracks and rot. Staining as needed.	Reg.	500+
	Glulam Beams	Monitoring deflection, cracks and rot. Staining as needed.	Reg.	500+
	Hardwood Dowels	Checking for rot, cracks, loosening.	Reg.	500+
	Masonry core	Monitoring bowing/deformation, cracking. Re-plastering as needed.	Reg.	500+
	Wall tiles	Check for cracking, replace broken tiles.	Reg.	70+
	Hardwood stairs	Check for cracks, refasten loose boards, stain.	25	300+
Systems and Appliances	Electrical baseboard skirting	Check for conductivity, fix connection issues	Reg.	10-20
	Radiant heating and cooling in core	System inspection, air bleeding	1 p/y	40-50
	Plumbing in core (copper pipes)	Clearing blocks, build-ups, ensure good flow	1 p/y	50-70
	Copper waste pipe	Clearing blocks, build-ups, ensure good flow	1 p/y	100+
	LED Lights	Check brightness, function	Reg.	5
	Light fixtures (corded to baseboard- no built-ins)	Check brightness, function	5	30-40
	Service Panel	Check fuses, replace as needed	2-3	50-60
	Copper wires	Check conductivity	5	100+
	Toilet	Replace tank components	5	100+
	Shower	Clear blockages, fix leaks	1 p/y	50+
	Faucets	Clear blockages, fix leaks	1 p/y	15-20
	Gas Oven	Check for leaks, deep clean	1 p/y	15-20
	Refrigerator	Check for leaks, deep clean and defrost	1 p/y	5-15

	Freezer	Check for leaks, deep clean and defrost	1 p/y	10-20
	Dishwasher	Clean filters, clear blockages	1 p/y	5-15
	Washing Machine	Functions, replace battery	1 p/y	5-15
	Smoke/Heat detectors	Functions, replace battery	1 p/m	10
	Boiler	Fix water and gas leaks	1 p/y	40-50
	Heat pump	Top-up refrigerant, measure airflow	1 p/y	10-15
	Heat Exchanger	Flush heat exchanger	2 p/y	10-15
	Thermostats	Clean contact points, check battery	1 p/y	20-30
Roof	Slate roof tiles	Replace broken roof tiles, check for leaks.	10	100+
	Copper downspouts, gutters and flashing	De-clogging	1 p/y	50+
	Straw bale insulation	Check for rot and pests	5	100+
	Agepan DWD protect	Check for degradation, air permeability	5	50-100
	Interior siding (Plasterboard)	Patch holes, repaint	10	75+
	Interior Siding (Wood paneling)	Staining/sealing	10	50+

Fig. 4 A worker's guild would form out of the construction of the longhouses in order to maintain a standard of building, a code of ethics, and pass down building and maintenance techniques to successive generations.

Community Proposal

8.1 Building and Programme List

The proposed community can be broken down into a series of programmes, centred around social, residential, employment, education, and social uses. Feeding these programmes are various types of infrastructure and emergency services. The list of programmes includes the following:

1. Housing

The main housing typology is of course the longhouse, which would have various embedded typologies, such as apartments, townhouses, or shared housing units to accommodate different family sizes and preferences. In addition, there would be larger lodges for communal living, which could support students and also the elderly, who might require live-in nurses. Finally, guest cabins and lodges could accommodate visiting groups, as well as paid and volunteer labourers such as WWOOFers.

2. Community Buildings

Various types of community buildings could include the following: town hall, gymnasium, daycare, events space and mess hall for community dining, community kitchen, stargazing and observation pods, and more.

3. Gardening, Orchards, and Forestry

Alongside a large community farm and smaller community allotments for growing seasonal fruits and vegetables, there would also be nuts and fruit forests, hardwood and softwood mixed forest, and a fungi farm and herbal medicine garden. Various out-buildings would services these gardens, such as garden sheds, greenhouses, raised beds, composting and mulch areas, nurseries and a natural pond to naturally control ground water levels and help with passive irrigation.

4. Animal Enclosures

A small pasture would keep goats and sheep and a chicken coop with an enclosure for geese. Geese and chickens help with natural pest control and give eggs, and sheep and goats would help to graze the landscape and provide wool and milk. These animals would not be bread for meat and would instead be treated like pets.

5. Environmental Conservation Areas

These areas would be untouched for productive harvesting and would allow nature to return to the former pasture land.

6. Education and Resource Centres

Lecture hall with classrooms to give workshops and seminars on green building, permaculture gardening, circular economies, and more. A community library with books, magazines, videos, and online resources, as well as shared amenities such as computers and printers. An employment hub, and co-working spaces with for-hire desks could also be included.

7. Recreational Areas and Social Spaces

This would include mixed-use outdoor green space for outdoor dining with a fire pit, pizza oven/barbecue, picnic area, playground, walking, running and biking trails, and outdoor sports facilities.

8. Businesses and Amenities

Café and restaurant that serves the community and outside guests, a cooperative market where residents can buy, sell and trade surplus produce, homemade goods, artisan products, and used items such as furniture. On weekends, this could turn into a flea market and attract visitors would already flock to Saffron Walden for its rich markets. Also, there would be a small office park for sustainable businesses.

9. Workshop Spaces

Workshops could serve residents and visiting groups and would include a wood workshop, wood storage and outside carving centre, metal workshop, sculpture/painting/ceramics studio, park maintenance workshop, and a DIY workshop for repair of appliances and bikes. Tools would be jointly own by the community and there would be a tool library where residents could sign-out tools to use off-site.

10. Wellness Centre

This space would run alongside the fungi/herbal garden and could have a small practice for family medicine. Other facilities here could include yoga, meditation, massages, and mental health councillors.

11. Transportation Hub

Parking for guests, car-shares, bike lockers, electric vehicle charging stations, and public transport links. These would be linked to the solar panels on top of the buildings.

12. Waste Management Centre

Systems for recycling, garbage, composting, rainwater and grey water processing, biomass boiler, and storage of unused materials for later processing and upcycling.

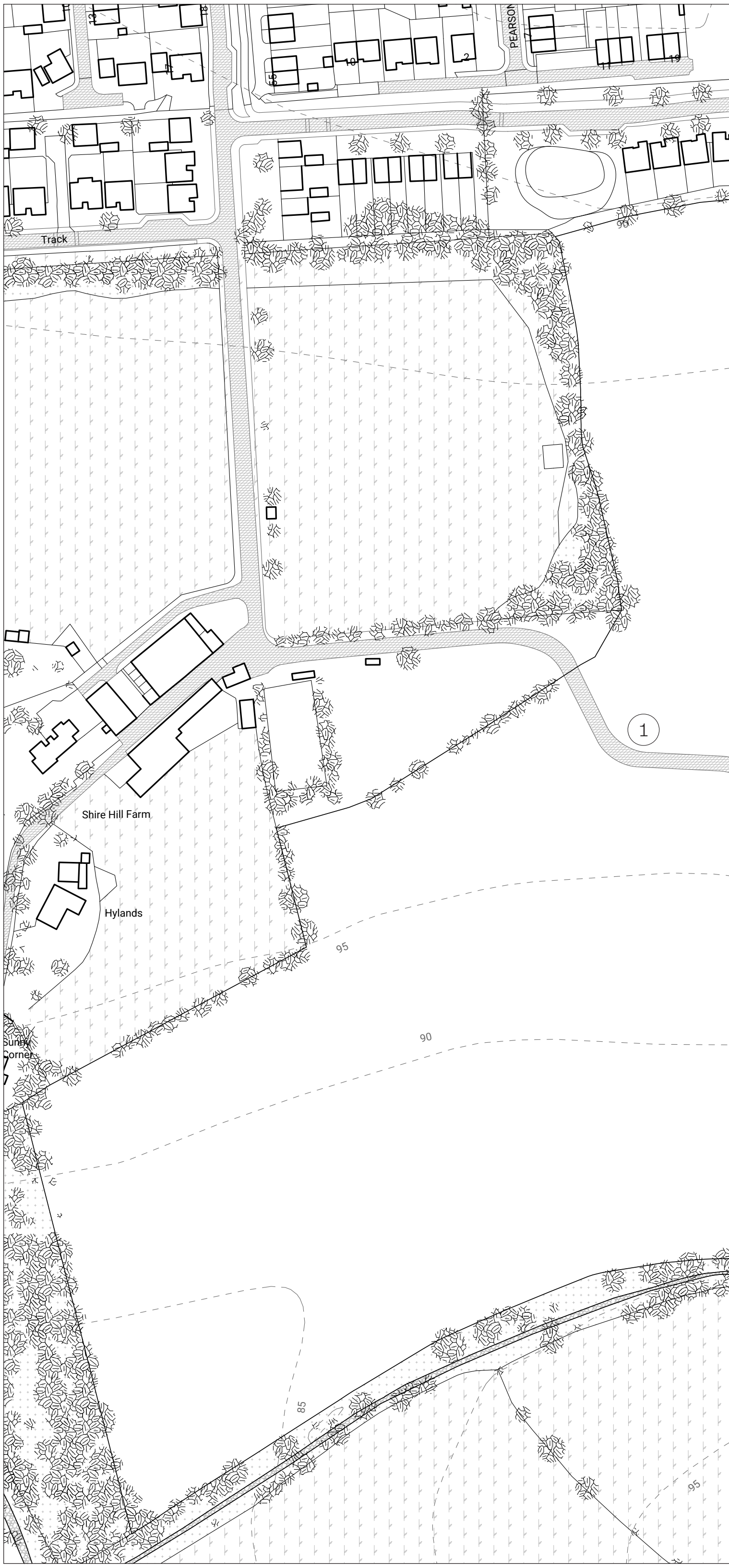
13. Emergency Services

Access to fire, medical, and security. Community liaison and support officers instead of cops, and volunteer fire-fighters would live on-site. Emergency signals and congregation points would also be implemented.

8.2 Site Development

Phase 1 of Development:

1. Access Road
2. Barn and Workshop

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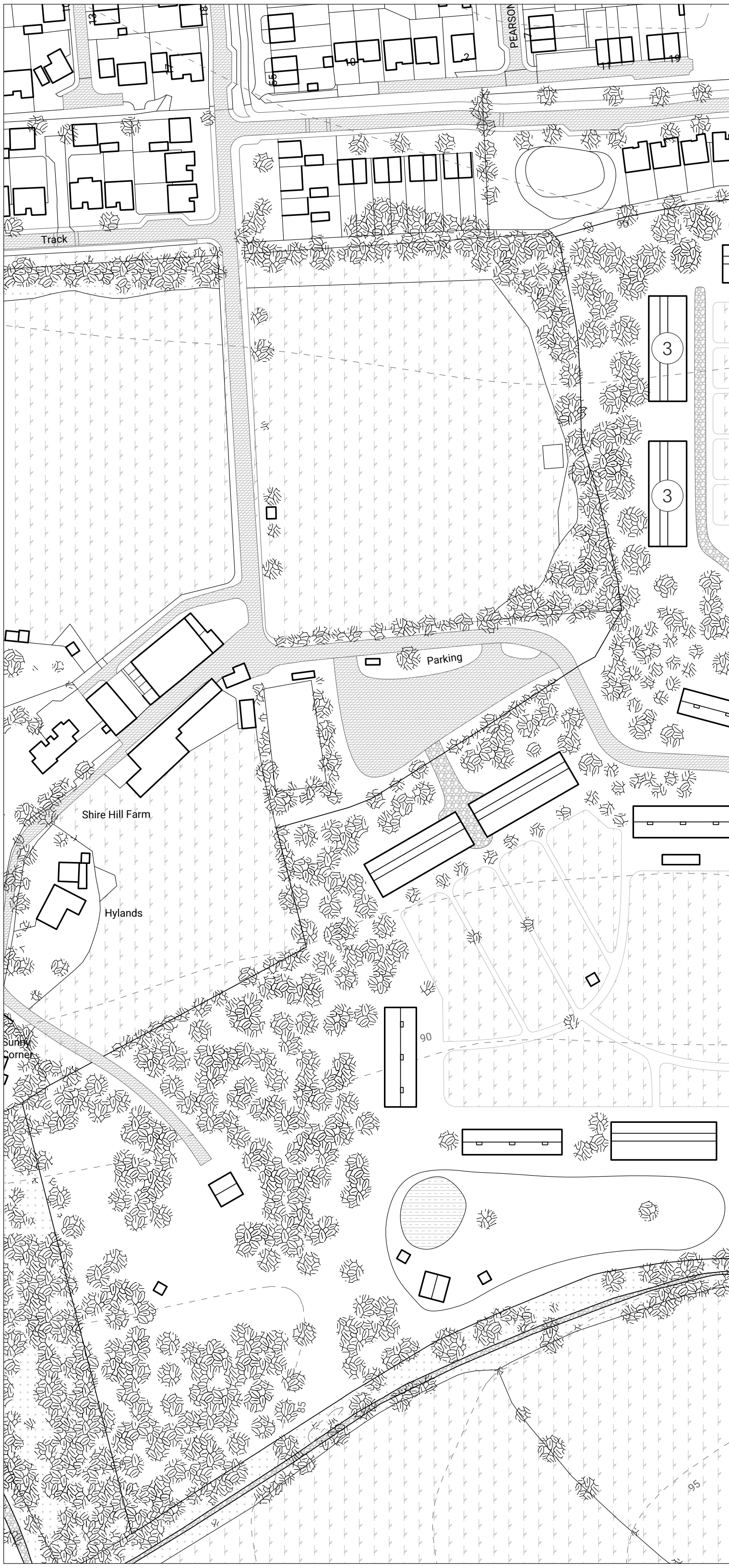
Phase 2 of Development:

1. Parking/Waste centre
2. Market/Swap Shop
3. Town Hall/Fire Hall
4. Longhouse
5. Gymnasium, community kitchen, daycare, community office
6. Guest longhouse
7. Forest and Forester’s Hut
8. Allotments
9. Pasture/Enclosures
10. Duck pond
11. Fruits/nuts orchard
12. Herb/fungi garden/wellness centre

Phase 3 of Development:

1. Forest school and conservation
2. Restaurant, cafe, sustainable businesses
3. Longhouses
4. Allotments
5. Outdoor dining
6. Library, co-working, lecture hall, class-rooms
7. Sports pitch
8. Climbing gym
9. Orchard
10. Animal enclosures

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