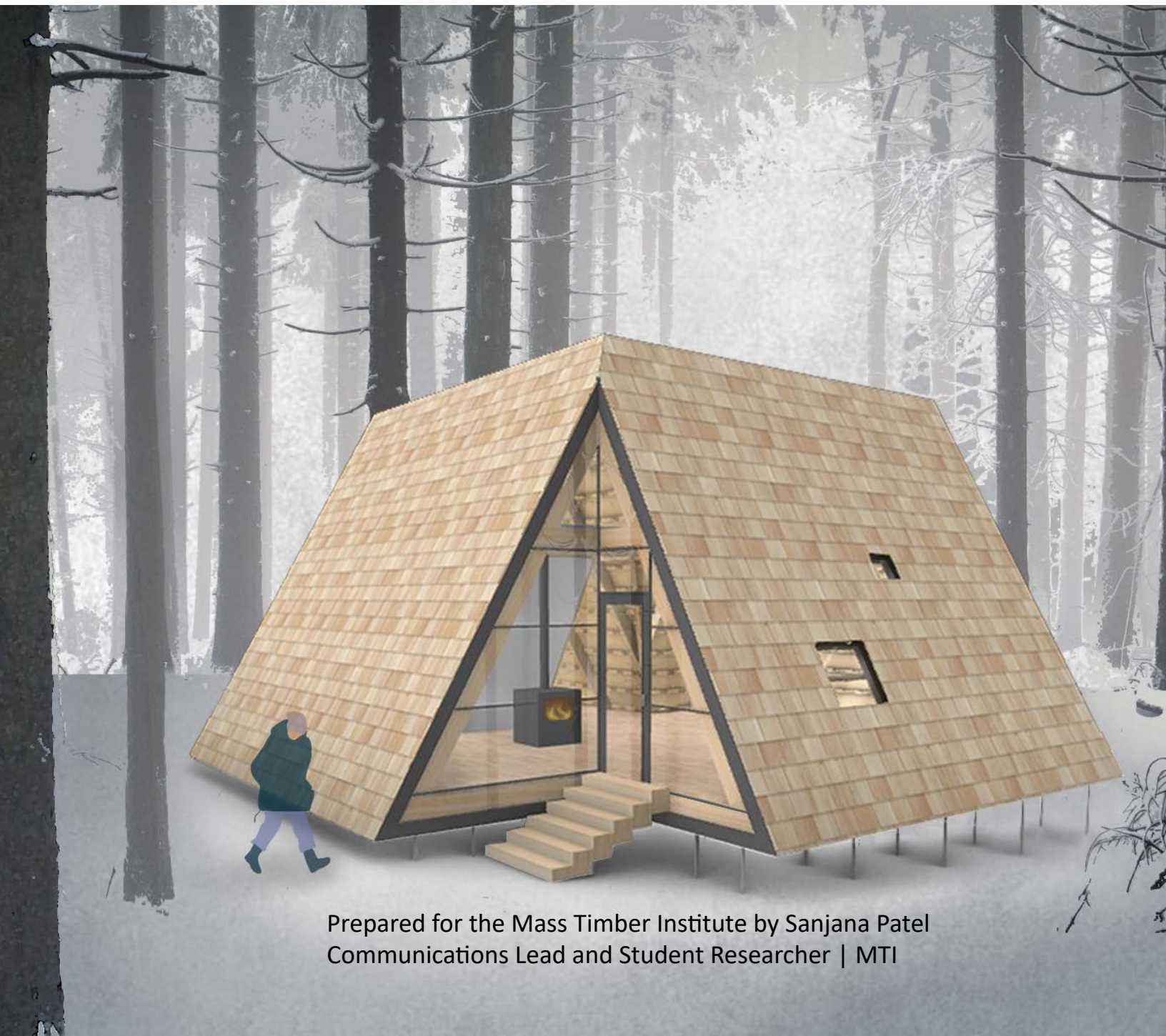


Nest Reconfigurable LVL Structures for Northern Indigenous People

Housing and Hunting Cabin Design for Whitefeather Forest
Community Resource Management Authority

August 13th 2021



Prepared for the Mass Timber Institute by Sanjana Patel
Communications Lead and Student Researcher | MTI

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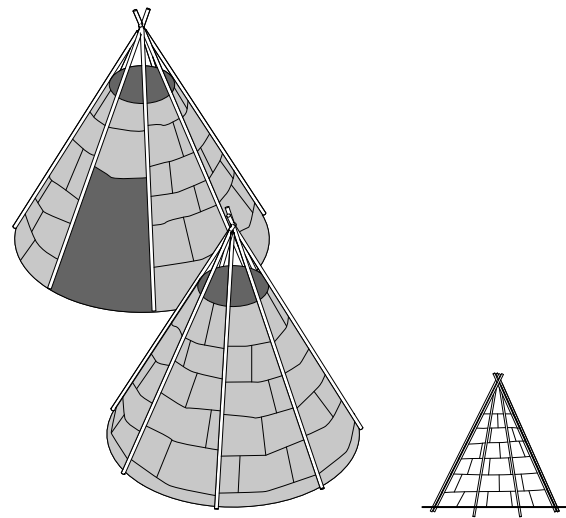
Acknowledgements

I would like to thank Anne Koven and Emmett Snyder at the Mass Timber Institute for overseeing the development of this project, providing insights on forest products and Whitefeather Forest resources, and facilitating connections to industry experts. I'm extremely grateful to Andrew Chapeskie from the WFCRMA for sharing knowledge on Pikangikum's cultural landscape and on First Nations housing regulations, as well as contributing detailed comments on the research. Thank you also to Harriet Burdett-Moulton for taking the time to comment on the design.

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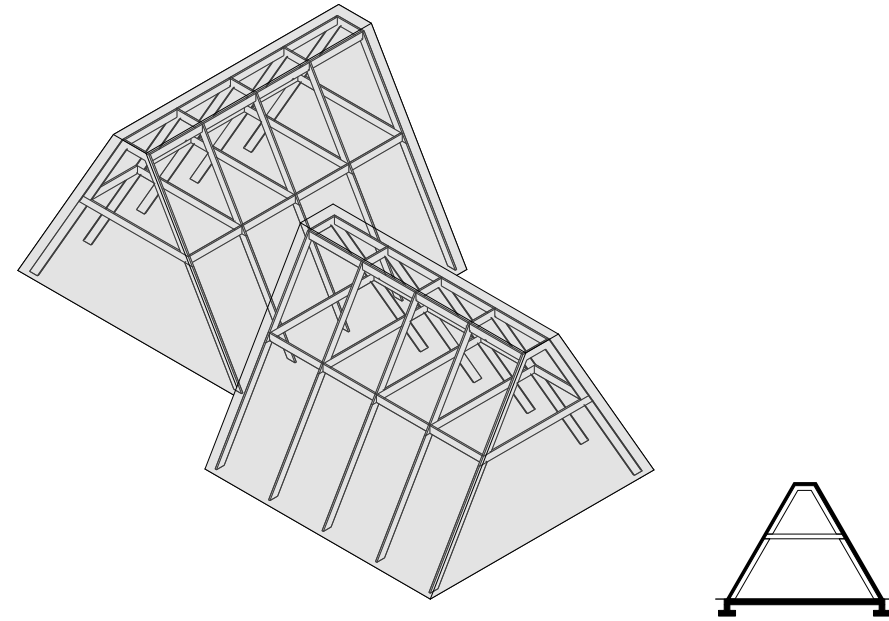
About

Nest is a home designed for Pikangikum residents in Northern Ontario, assembled as a kit of parts that can be configured by the user. Its layered triangular form is inspired by the merging of two conical wigwams¹. At the intersection, there is a communal space representing the hearth around which different generations of the same family come together. The shingled, modular envelope system makes up diagonal planes that become both roof and wall, recalling the construction method of early wigwams which used spruce boughs traditionally and then incorporated canvas after colonial settlement. The section can be extended in two directions. In its most compact form, it is a hunting cabin for a small family. In its largest form, a house for 8 people. The structure is made up of modules that can be assembled by teams of people without heavy machinery. LVL beams and columns are machined to snap together and are 3.5m at longest so that they can be lifted. Using this form of assembly, the house can be reconfigured to expand or shrink easily as per a family's needs.



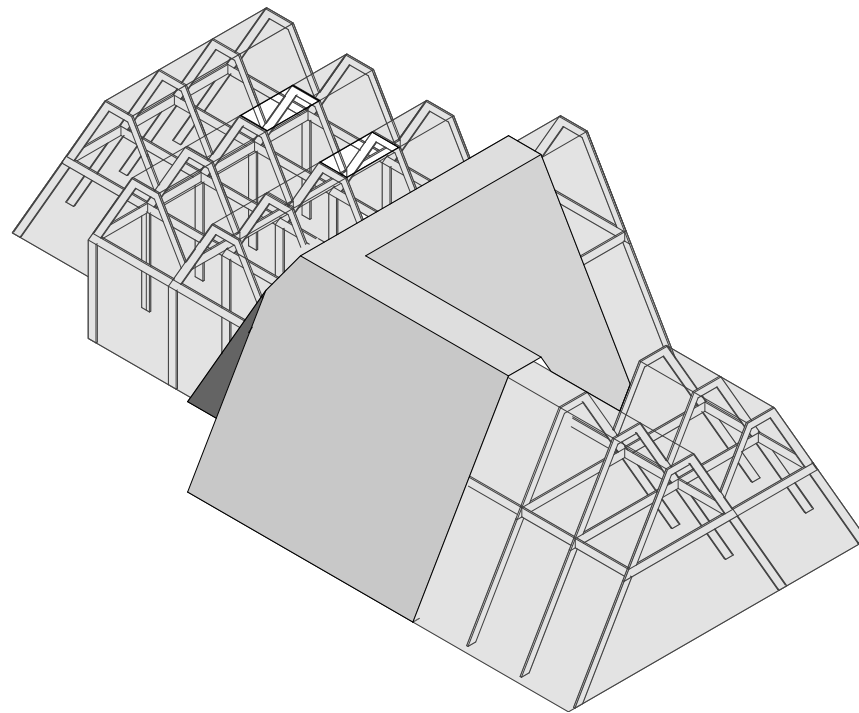
CONICAL WIGWAM

One family in each structure. Each hosts a fire in the center.



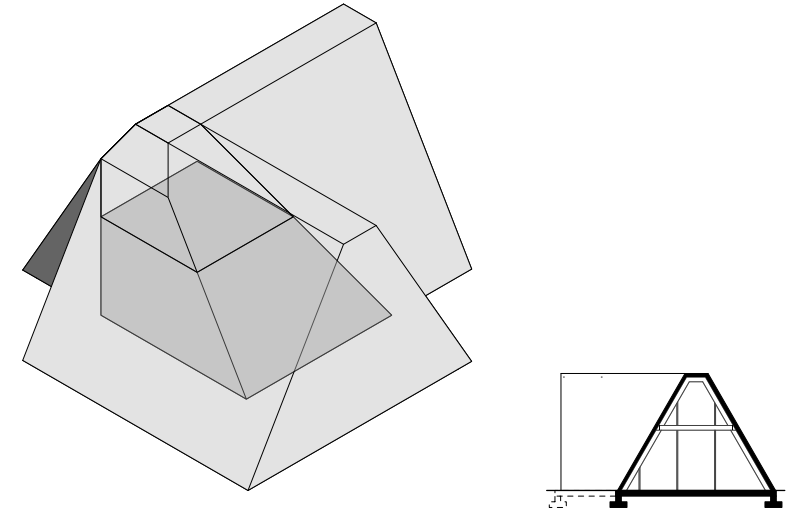
1. CREATE TWO VOLUMES

Using a modular structure based on the section of the wigwam.



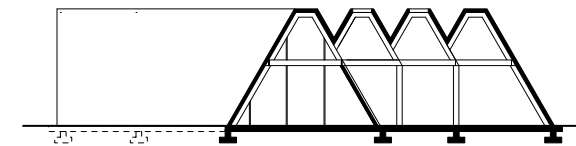
2. MERGE

This is the cabin. Intersection establishes new center - a hearth/ gathering space on the bottom half.



3. EXPAND FROM CENTER

This forms a permanent multigenerational home. Expansion modules resemble nested trapezoid volumes. Optional skylights introduced.



Material Source Map



Research Context

The focus on designing new housing in Pikangikum and hunting cabins in the Whitefeather Forest emerged from two contexts: the shortage of housing stock and the development of the Whitefeather Forest Initiative. A community of about 4000 strong, Pikangikum needs new housing as the government mandated housing becomes overcrowded, wears out, and is in short supply.² At the same time, Pikangikum is the only First Nations in Ontario with a Sustainable Forest License (SFL) (a process that began in 1996 with the first license issued in 2013) and is implementing the Whitefeather Forest Initiative to pursue Indigenous commercial forestry, setting up a path for economic renewal.³ The goal of this research is to use forest resources in a way that adds value back to the community, an opportunity for which mass timber has great potential. In a paper on Whitefeather forest resources, Feiran Xu found that the trees in Whitefeather’s forest – which are predominantly small diameter black spruce – could be used to produce high value laminated veneer lumber (LVL) instead of being pulped, which is the conventional industry product.⁴ In small diameter timber stands, LVL was found to yield a greater economic return to wood than market pulp, \$3.84/ft³ to \$3.60/ft³ respectively.⁵ It has also been shown that the costs of ‘light footprint’ harvesting and the cost of manufacturing wood increases in small diameter stands.⁶ Due to its low value, producing pulp is more likely to require intense harvesting of a high volume of trees to be economically feasible, potentially resulting in increased environmental impacts such as soil compaction, that do not align with the ‘Light Footprint’ forestry approach directed by the Elders of the First Nation. Meanwhile, LVL has a higher return to wood value, making it more conducive to a ‘light footprint’ approach to harvesting than pulp. This project begins with a material that could become meaningful to Pikangikum people and asks: if LVL were produced in a local facility, how could it be used to produce culturally relevant, sustainable, and economical housing in addition to serving broader markets? In Pikangikum, spending extended periods of time living off the land is common practice⁷, and the definition of “housing” could be expanded to represent permanent homes or temporary hunting cabins.

Designing housing for Indigenous communities has been examined by a number of Indigenous architects. Although each First Nation is unique in their culture and housing needs, some considerations taken in the following precedents such as building resilient structures, reflecting cultural identity, and designing spaces for living off the land are applicable to Pikangikum as well. In the design of Cardinal House for Elsipogtog First Nation, eminent architect Douglas Cardinal addressed issues of creating housing that was affordable and built to last. The house deployed a cost-saving prefabricated CLT structure that would not trap moisture and deteriorate with mold as drywall does.⁸ The Indigenous Hub project by Stantec and Two Row Architect expresses cultural identity by referencing traditional craft such as basket weaving and woven blankets in the interpretation of the building materials. Brick, steel, and wood are transformed into culturally relevant symbols through patterning and perforation.⁹ Formline Architecture addressed the programmatic implications of living off the land in their prototype for housing in Deline, Northwest Territories. The prototype included outdoor cooking space, storage space for wild meat and seasonal clothing, and space for individualized mechanical equipment such as a water holding tank and septic tank.¹⁰ The design for Pikangikum takes cues from these precedents with a prefabricated wooden structure, references to customary construction craft, and accommodating a program for living off the land.

Right: Materials for construction such as LVL, wood fibre insulation, and iron ore for steel may need to be sourced far from Pikangikum. This map locates manufacturers for such materials. Producing LVL locally could reduce expensive transportation requirements for a major component of a building: the structure.

Prefabricated and Historical Housing

Comparing contemporary prefabricated housing solutions for other First Nations communities and historical housing precedents in Pikangikum can offer insight into a new type of prefabricated housing for Pikangikum people. The Cardinal house demonstrates a method to create an energy efficient wall assembly, where the insulation is continuous above the structure and prevents thermal bridging. The wigwam demonstrates that the fire occupies an important place in the center of the plan. Gathering, sleeping, and cooking is ordered around the center. The coverings of the wigwam offer an insight into portable construction methods. Coverings acted as small modules and would travel with people as they relocated camp to be reused in a new structure.

Earlier homes such as the wigwam and the log house (which was introduced by settlers and later adapted in Pikangikum) used smaller modules for easy constructability while more contemporary options moved towards a reliance on the crane. This enabled more complex material assemblies and rapid construction but shifted construction to being an activity that requires specialized heavy machinery – not a realistic option for a remote community.

Learning from these precedents, this design for housing for Pikangikum people will feature small modules to make the structure, continuous thermal control layers in the wall assembly, and a focus on central gathering space.

*Cardinal House Image Credit:
Element 5*

*The Foxboro Image Credit:
Royal Homes*

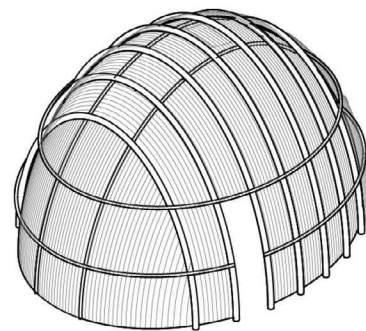
Precedent



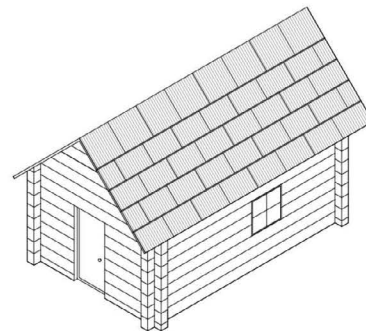
Cardinal House by Douglas Cardinal | 2019
Elsipogtog, New Brunswick



The Foxboro by Royal Homes | 2020
Ontario

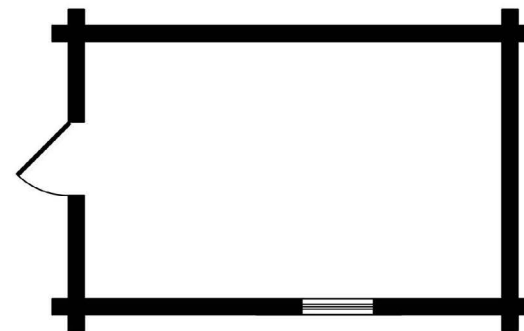
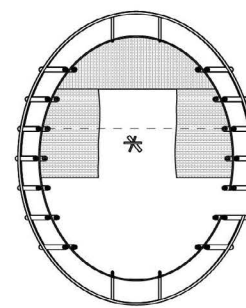
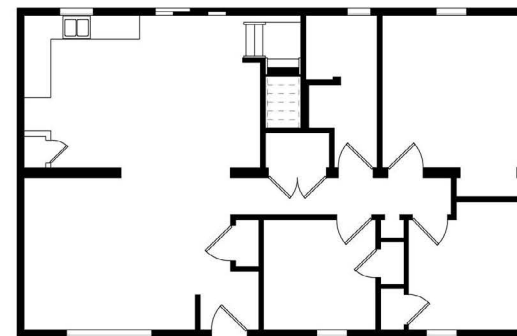
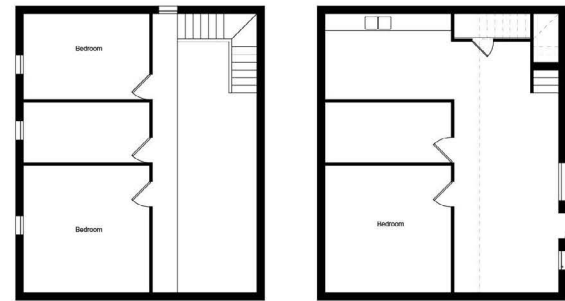


Waaginogan/Wigwam | 1930's and earlier
Pikangikum, Ontario

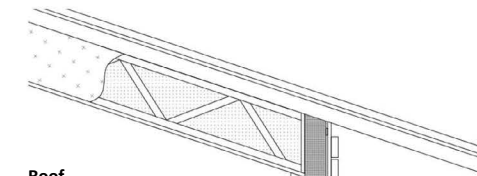


Log House | 1930's and earlier
Pikangikum, Ontario

Plan

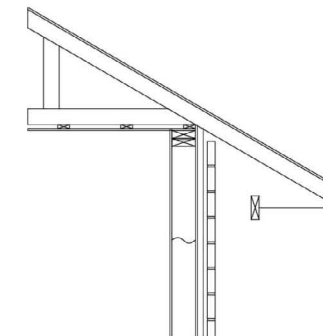


Material Assembly



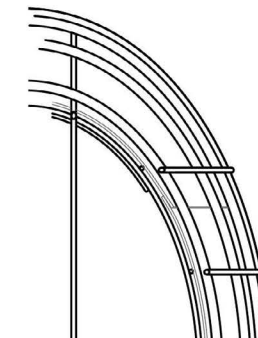
Roof
Plywood Sheathing
BOXX Roof Panel (Truss, Cellulose
Insulation, Air Barrier)
100 mm CLT
Vapour Barrier
Furring Strips
Standing Seam Metal Roofing

Wall
100mm CLT
6" EPS Insulation
Horizontal Strips
Vapour Barrier
Vertical Furring Strips
Cedar Plank Cladding

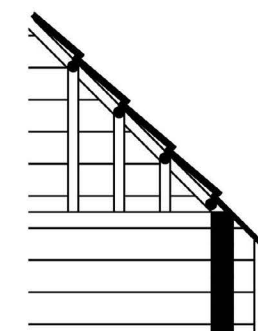


Roof
Engineered Trusses
Insulation
Plywood Sheathing
Roofing Membrane
Shingles

Wall
2" x 6" Wood Studs
5.5" Cavity Insulation
7/16" Wall Board
Building Wrap
1.5" Rigid Insulation
Airspace
Cladding

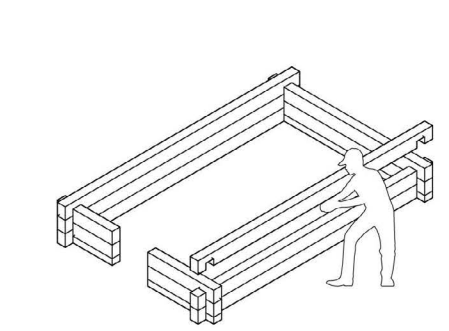
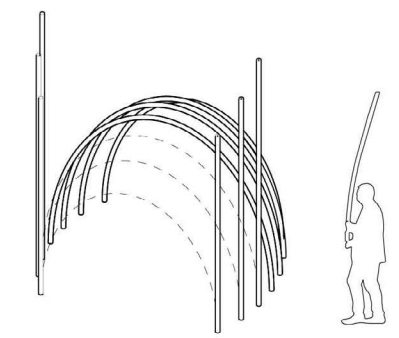
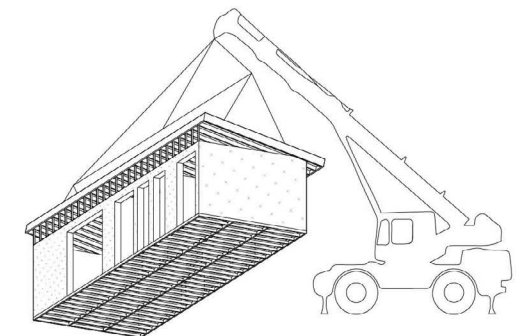
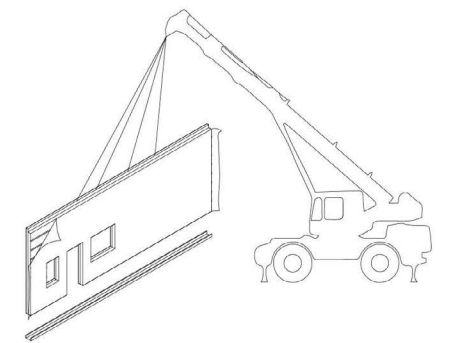


Wall/Roof
Bent Saplings
Spruce Boughs/Canvas
Bent Saplings



Wall
Stacked Logs
Roof
Timber Framing
Wooden Shingles

Module



Pikangikum's Cultural Values

A relationship with the land informs Pikangikum peoples' cultural values and way of life. The name Pikangikum is itself tied to the place the Nation occupies, coming from the Ojibway word *Biikanjikamiing* which refers to the way the Berens River spreads into a lake before narrowing again as it moves east to west.¹¹ The people share the land with all Creation and as a result, believe it is important to maintain reciprocity in these relations.¹² For example, hunters will share excess fish they catch and give thanks for the game they harvest.¹³ People maintain direct relationships with the other "living ones" with whom they coexist.¹⁴ These relationships are present in *mitigookaywin*, the relationships with trees and harvesting practices which form the Light Footprint forestry approach.

With the WFI, values towards the land have been embodied in a land use planning mandate titled *Keeping the Land*, which provides direction and guidance to ensure resources are available for future generations by respecting the blessing of the Creator.¹⁵ Keeping the Land accommodates traditions still practiced today such as hunting, fishing, and trapping for subsistence.¹⁶ Housing built with locally made LVL may also align with Keeping the Land's goal of resource based economic renewal and employment in the community.¹⁷

In the case of material, a relation with the land has formed a worldview where agency belongs to material that is living.¹⁸ Living material has agency by *auyuhshawuhtun*, the interactions of a material with its context and the existence of a material within cycles. A housing concept that is made of natural materials and can be disassembled for other purposes at the end aligns with the world view Pikangikum people have towards material, where many things are repurposed, and little is wasted.



An adult trains younger generations in preparing fish and cultivating relationships with the land. Image Credit: The Whitefeather Forest Initiative

Constraints of the *Indian Act*

Establishing a housing project on the Pikangikum reserve would be subject to various constraints of working within the longstanding *Indian Act*. The legislation creates relationships with First Nations that requires compliance with Indigenous Services Canada (ISC) program funding requirements. The First Nation signs a Comprehensive Funding Agreement (CFA) with the ISC which dictates the flow of money to a First Nation. Funding is impacted by the nature of reserve tenure and other challenges including lengthy application processes, and loan policies.

First Nations have the right to occupy land on reserve but cannot exercise full jurisdiction over it because it is federal Crown land.¹⁹ There are challenges to finance housing beyond the allocations provided in funding agreements. First Nations must apply for a Ministerial Loan Guarantee (MLG) from Indigenous Services Canada (ISC),²⁰ the organization that replaced Indigenous and Northern Affairs Canada (INAC), which dissolved in 2017. The MLG is administered to the individual and in turn, the First Nation as a collective must guarantee the loans of the reserve members.²¹ If a member defaults on the loan, and the First Nations cannot pay the lender, ISC will pay the lender from the First Nations Market Housing Fund.²² The First Nation must then pay ISC. ISC also provides funds for housing through the Income Assistance program, and the 1996 On-Reserve Housing policy.²³ Funds from the 1996 On Reserve Housing Policy are contingent on the preparation of multi-year housing plans and housing policies by the First Nation.²⁴ Although these programs provide some support, band councils who manage the funds for their First Nations may not receive sufficient funds to address housing, and as a result, the process of acquiring a loan can take up to a year.

Lengthy application processes have prevented sufficient funds from reaching many First Nations in time.²⁵ For example, in Nibinamik – a remote First Nations community in Northern Ontario – funds for building housing were approved and materials were shipped to site.²⁶ However, when transportation of the materials to the remote location proved to be more costly than anticipated, the funds for the construction budget were depleted before construction could begin. The materials deteriorated on site for nearly a year as the First Nation applied for funding to bring in a construction crew.²⁷ The case in Nibinamik highlights the importance of easily constructable structures as funding delays are commonplace. Additionally, when population growth outpaces the rate that housing is constructed, it leads to faster deterioration of housing due to overcrowding, and further exacerbates the cycle as money needs to be spent on repairs rather than on new housing stock.²⁸

Loans for housing are distributed through ISC and the Canadian Mortgage and Housing Corporation.²⁹ To provide a loan, the CMHC requires that the project use CSA Standard 0141-05 certified lumber.³⁰ Therefore, if Pikangikum were to build a mill to provide locally sourced materials for housing, the certification to use these materials would require extra funding. Consequently, certification is adding further impediments to local housing solutions.



Material lays unused in Nibinamik as the First Nation experiences lengthy processes to acquire funding for construction crews. Image Credit: CBC News: The National.

Housing Funding Structure

To recognize barriers to making good quality and culturally appropriate housing in Pikangikum today, the structure of funding is identified here. To build houses, the band council receives funds from the federal government through ISC and CMHC.³¹ These funds have previously fallen short in meeting the demand. The band council decides where and how to allocate funding, although grants may need to be spent to address infrastructure priorities before new housing.³² Many of the houses in the community look the same, a result of a predetermined one-size fits all solution that can be cheaply built.³³ Funds for housing may not arrive in a timely manner, and the housing does not always suit the needs of the residents. In efforts to build more suitable homes quickly, some residents of Pikangikum have built their own homes.

Community Needs in Housing

To guide the design process, the current state of services and needs related to housing have been identified. The design may not be able to address all of them, but the needs are noted here for future consideration.

Ease of Transport. Pikangikum is a remote community, accessible year-round by plane and a few months of the year by winter road. There is also an access by all-weather road that connects to the community by boat/barge.³⁴ Transporting materials by plane is expensive and transportation access by vehicle is limited, making small construction modules that can be assembled by people more favourable. Rapid erection will prevent materials from deteriorating if construction cannot take place due to unpredictable weather or available skilled labour.

Ensuring ease of transport and construction can meet the rising demand for housing as the younger population ages and requires their own space. This is especially pertinent to Indigenous communities as 2011 and 2012 surveys by Statistics Canada recorded that 42% of Aboriginal people in Ontario were under the age of 25, compared with 30% of the non-Aboriginal population.³⁵

Multigenerational Housing. Many households in Pikangikum are multigenerational. This is in part from the desire to stay with one's family and in part a consequence of a housing supply shortage. The homes, unfortunately, have only been built to accommodate small families, leading to overcrowded living conditions. In a 2018 interview with Chief Dean Owen, Steve Lambert reported that a family of nine or 10 people will often share a home and sleep in shifts.³⁶ This is consistent with 2016 census data from Statistics Canada which found 11.5% of aboriginal people live in housing with a 1-bedroom shortfall.³⁷ In 2017, there was 375 homes in Pikangikum for a reported population of approximately 3000.³⁸ At the time, the shortage in housing was in part due to limited electrical capacity to power new homes on reserve.³⁹ This electricity issue is likely resolved as Pikangikum connected to the power grid in 2019.⁴⁰ An acute housing shortage, however, still exists and housing that is flexible in accommodating multiple generations is necessary.

Thermal Control and Moisture Management. Located in northern Ontario, Pikangikum can experience temperatures as low as -40 °C in the winter months and as high as 30 °C in the summer months.⁴¹ It is critical to maintain comfortable indoor temperatures for the longevity of the home. In the past, mold has been an issue in Pikangikum. This is a common occurrence

across other northern reserves as well because moisture builds up from overcrowding and ventilation is minimized to prevent the cold outdoor air from infiltrating.⁴² In a study on mold growth of reserve housing, Optis et. al found that shutting down mechanical ventilation was especially detrimental for the energy efficient housing built on reserve, which implements airtight building envelopes and a reliance on mechanical ventilation.⁴³ In comparison, older housing performed better from a ventilation perspective because they were heated by wood stoves which dry out interior space and have cold air drafted onto them.⁴⁴ Homes that need repairs may have additional challenges as the moisture control layers of the wall assembly are compromised. A 2016 study by Statistics Canada found that 19.4% of aboriginal population in Canada live in housing "in need of major repair" where major repair refers to plumbing, electrical, or structural needs.⁴⁵ Housing that is warm, moisture resistant, and easy to repair is essential to ensuring the well being of the residents.

Potable Water. Pikangikum has a functional water treatment facility, which is operated and maintained by certified members of the First Nation.⁴⁶ Most homes are not connected to a water system. Instead, residents that do not have water delivered to holding tanks via a water truck can access water at one of several spigots in the community or at the water treatment plant. In the past, lack of funding to operate and maintain the water treatment facility resulted in long standing boil water-advisories on parts of the reserve.⁴⁷ This has since been resolved. As noted, while safe drinking water is available through the treatment facility, the infrastructure to carry the water does not reach many homes. In January 2017, 80% of homes were lacking access to running water and sewage.⁴⁸ A 2018 article reported that to access potable water, residents will fill water at the water treatment facility and carry it to their homes or rely on truck delivery.⁴⁹ Water collected directly from Pikangikum Lake near the community is not seen as being safe as a sewage lagoon for the community is upstream from where the water is taken.⁵⁰ Outhouses are a common addition to residences for waste management. Housing should address the challenges of potable water.

Fire. There are frequent forest fires that occur in the Whitefeather Forest; the fires will become more frequent with climate change.⁵¹ In these emergency situations, residents are evacuated from the community,⁵² but the homes must be fire resistant to withstand structural damage to the extent possible.

Next Steps

Calculations for cost are outside of the scope of this study, but such analyses would be important to evaluate in the context of creating housing for remote Indigenous communities. Costs to consider include those for prefabricating the proposed structure in the kit of parts and the energy performance of the building once constructed. Although the structure can be extended from the cabin to create a house as large as needed, expansive roofs which become walls may add higher heating loads. This could mean that after a certain size is reached, it is no longer economical to extend the structure.



Central Gathering Space

The Hunting Cabin

The hunting cabin configuration is for a small family who wants to spend a few months living on the land. A corner formed by a window wall forms a welcoming entry into a gathering space. The space is heated by a wood stove and is the main open space in which the family can prepare meals, eat, and sleep. The areas beyond the partitions serve as space for storing tools, skins, and clothes. The partitions are hollow and can carry electrical wiring or plumbing (if this space is in the permanent home) as necessary. Floor modules on the second level can be added or removed without affecting the structure to provide a foothold while constructing the structure and provide additional space for storage/mechanical equipment. This second level is accessible by ladder.

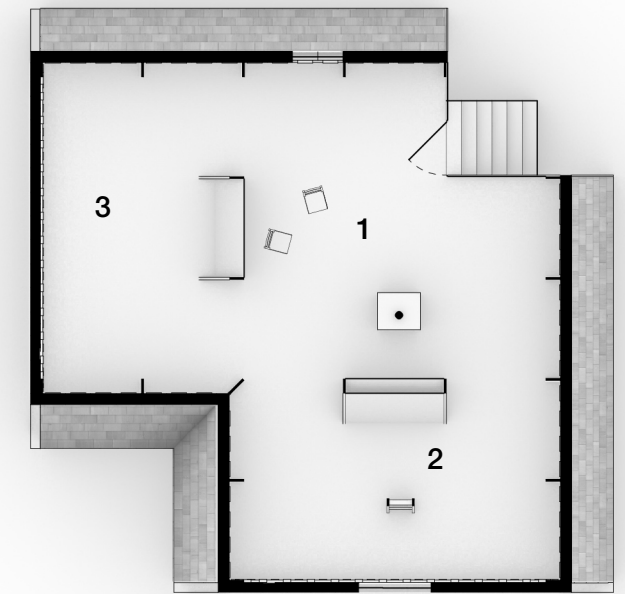
Note: For a warmer enclosure, the windows in the entry can be replaced by envelope modules hanging on the steel structure.

Moisture Management

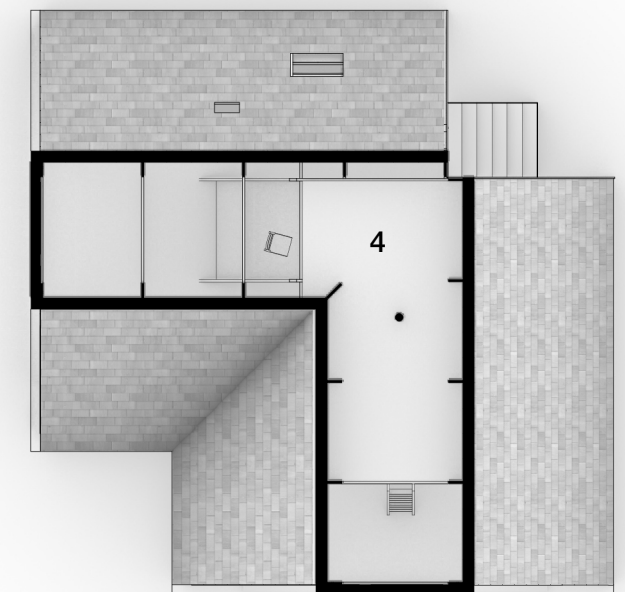
A semi open second level allows extra room for ventilation, while leaving the structure exposed on the interior of the wall assembly allows it to dry to the interior.



Central Gathering Space with Mechanical/Storage Level Above



Cabin Ground Floor Plan
Scale: 1:150



Cabin Second Floor Plan
Scale: 1:150

Legend

1. Gathering
2. Food Storage
3. Tool Storage
4. Mechanical level

The Multi-Generational Home

The home configuration is for an extended family, perhaps grand parents, parents, and young children. The structure can expand from the centre cabin on four sides, depending on the layout the family desires. In this example, the home has two wings for privacy, one for grandparents, and another for parents and young children. The wings are connected by an open dining, gathering, and kitchen area for the whole family to come together. As the structure expands sideways, vertical columns are used to maximise usable space, while outer edges return to the sloped walls which recall the traditional form of the wigwam.

If there is a shortfall in bedroom space, the envelope modules can be removed on one side as the structure is extended, and then reconstructed quickly with more envelope modules to cover the new addition. The envelope does not carry services such as electrical and plumbing providing two benefits:

1. The enclosure can be constructed without waiting for certified labour to install services.
2. The enclosure can be reconfigured if the space that the family needs changes over time.

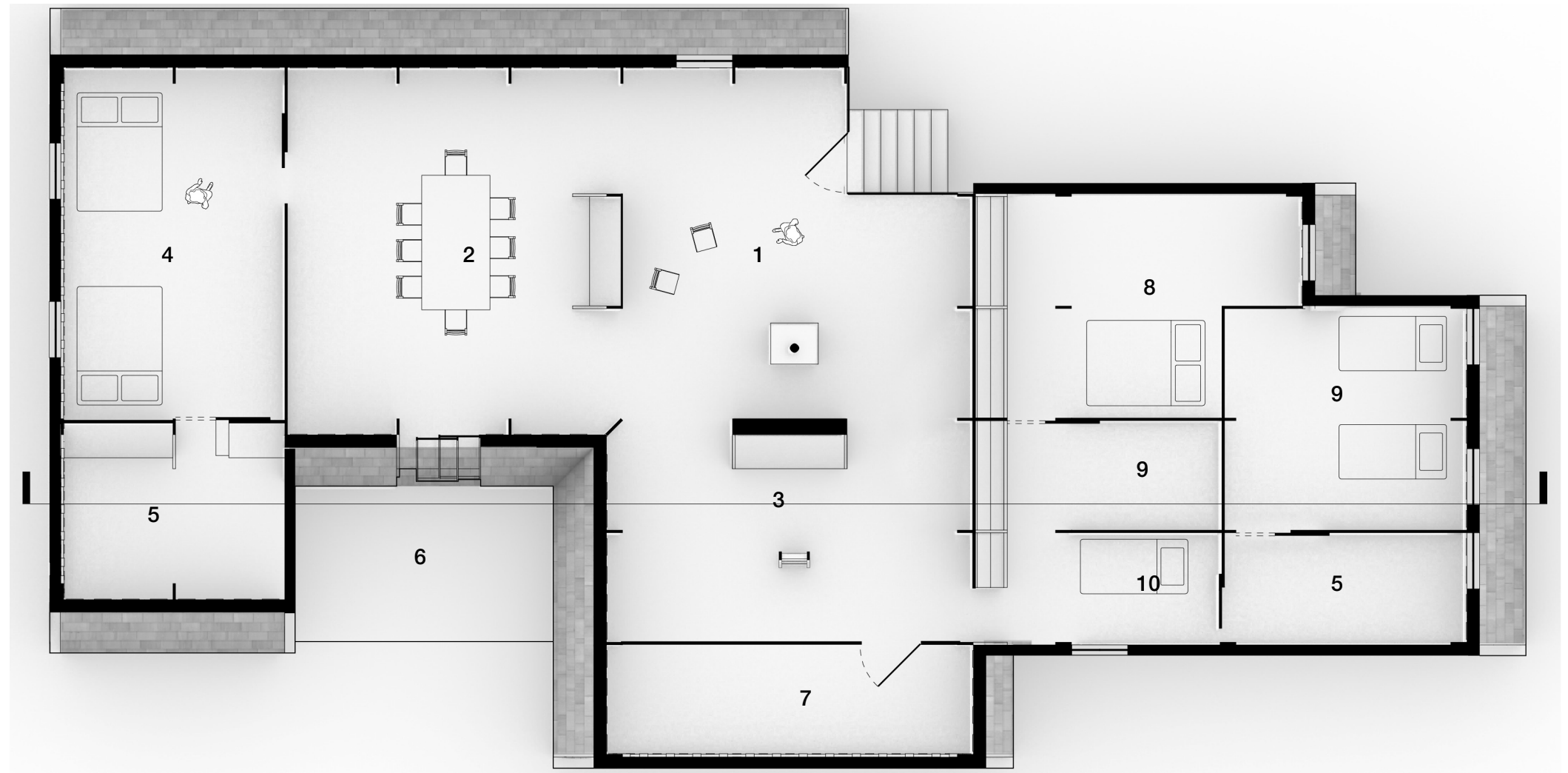
Instead, services can be added last, running underneath the raised floor system and connecting through the floor or to interior partition walls which are hollow.

Potable Water

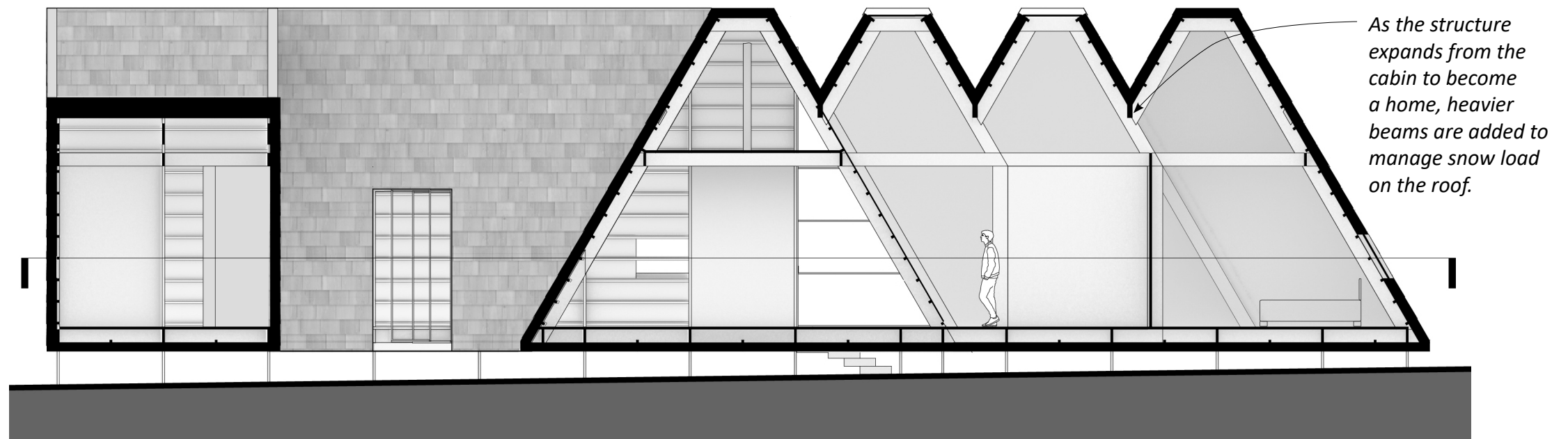
Keeping services independent of structure and enclosure enables the house to accommodate new infrastructure such as water pipes when they become available without having to be completely reconstructed.

Legend

1. Gathering
2. Dining
3. Kitchen
4. Grandparents bedroom
5. Bathroom
6. Outdoor Patio
7. Storage for game
8. Parents bedroom
9. Kids Bedroom
10. Laundry



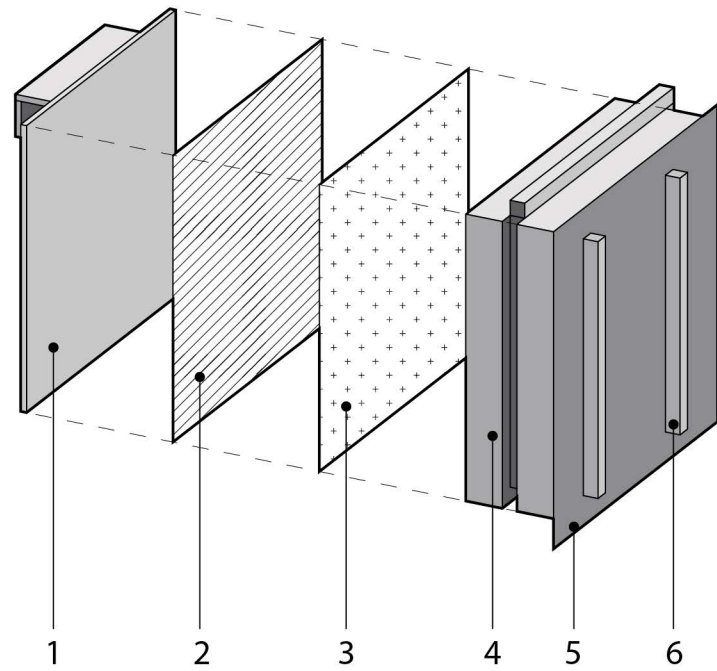
Home Ground Floor Plan
Scale 1:100



Home Section
Scale 1:100

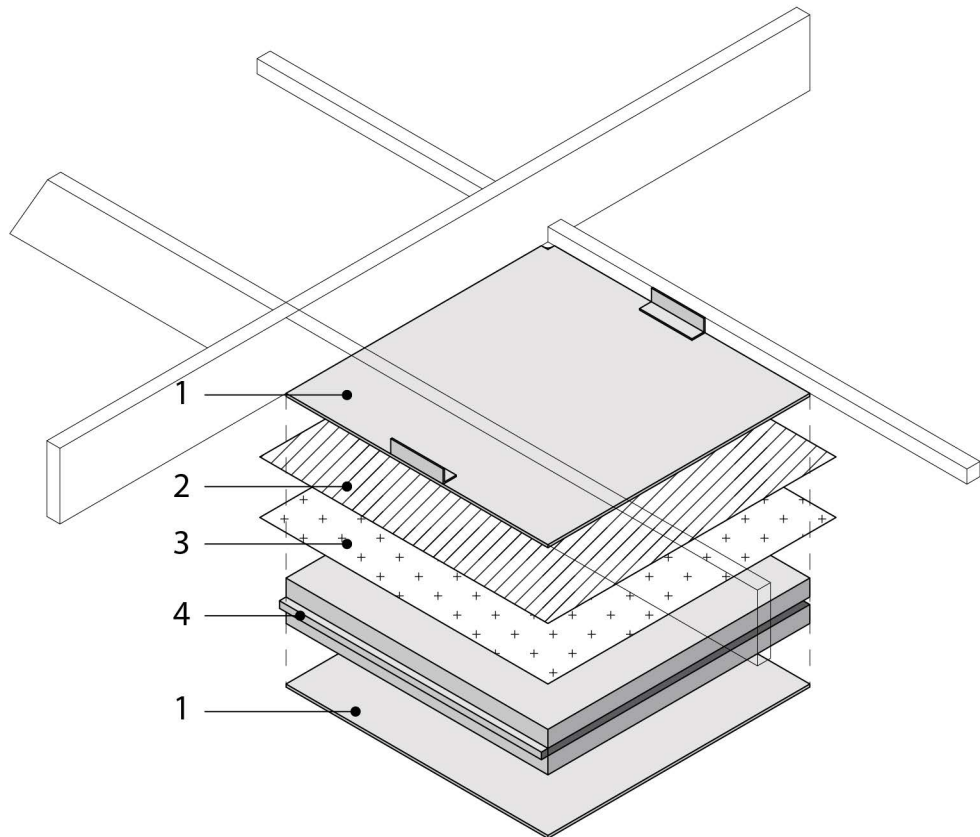
Envelope Module

Scale: 1:20. Available in various sizes for different wall types



Envelope Module - Floor

Scale: 1:25



Dining Room Perspective

Legend

1. 1/2" Plywood Sheathing and hanging clip
2. Vapour Barrier
3. Air Barrier (add sealant at connecting envelope module)
4. Wood fibre insulation
5. Waterproofing membrane (overlap at connecting module)
6. Furring strips

Shingled cladding added once all envelope modules are in place. Floor modules are hung from structure while flooring is added above it.

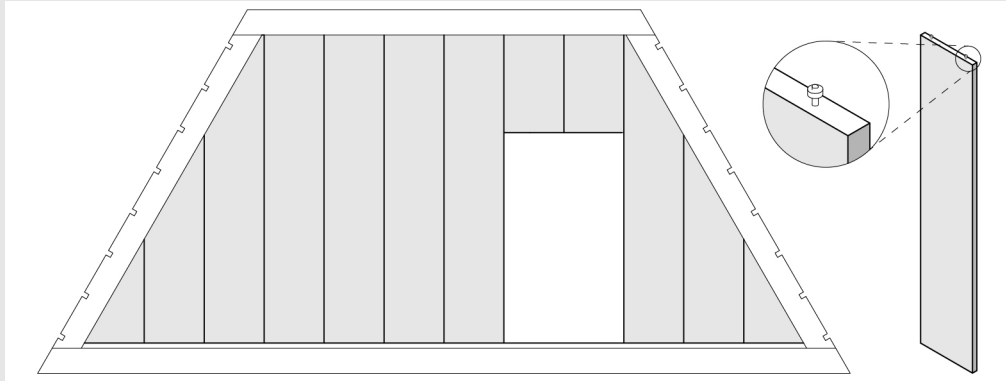
Thermal Control

Small envelope modules reduce the cost and time needed for repair if a part of the envelope is damaged as it is possible to replace only the damaged module. A damaged module must be accessed by removing all modules above and to the right of it, but these can be re-installed once a replacement module is found. Easy maintenance can help maintain warm indoor temperatures. The specific module shape shown on the left is seen in the perspective above.

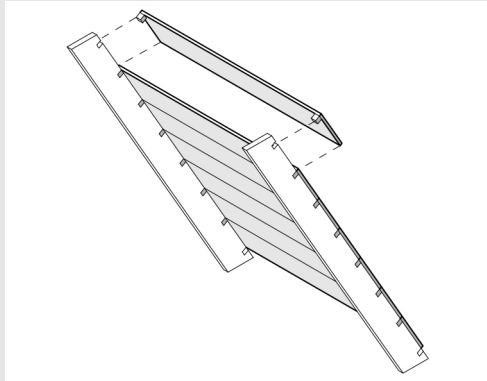
Ease of Transport

Small modules can be transported easily into remote communities or into forested locations with minimal disturbance.

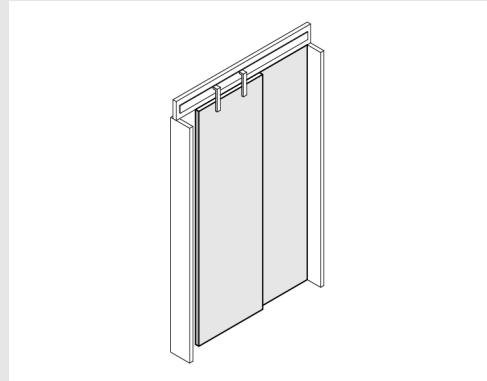
Key Parts



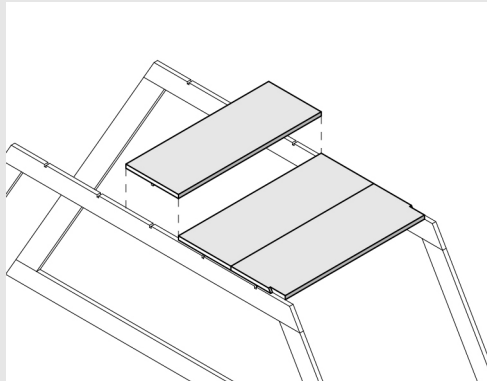
Partition 1 (plywood panel inserted in a rail)
Scale: 1:75



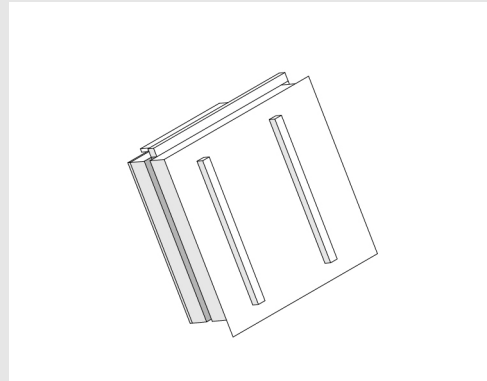
Partition 2 (plywood panel)
Scale: 1:75



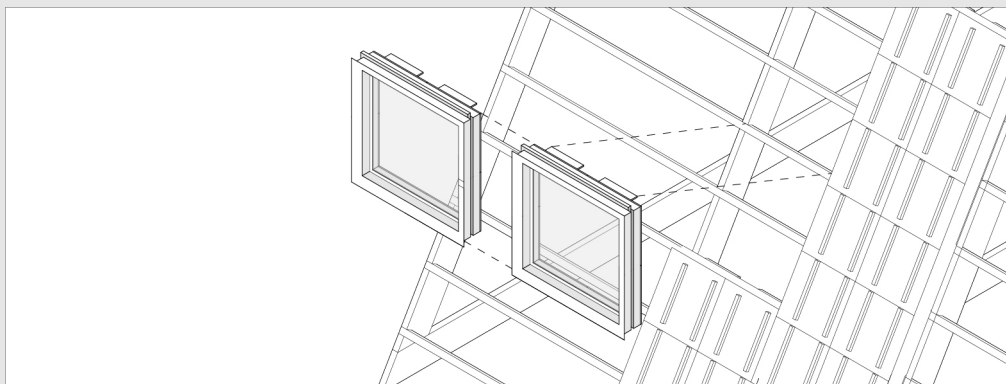
Sliding Door
Scale: 1:100



Floor Module
Scale: 1:75



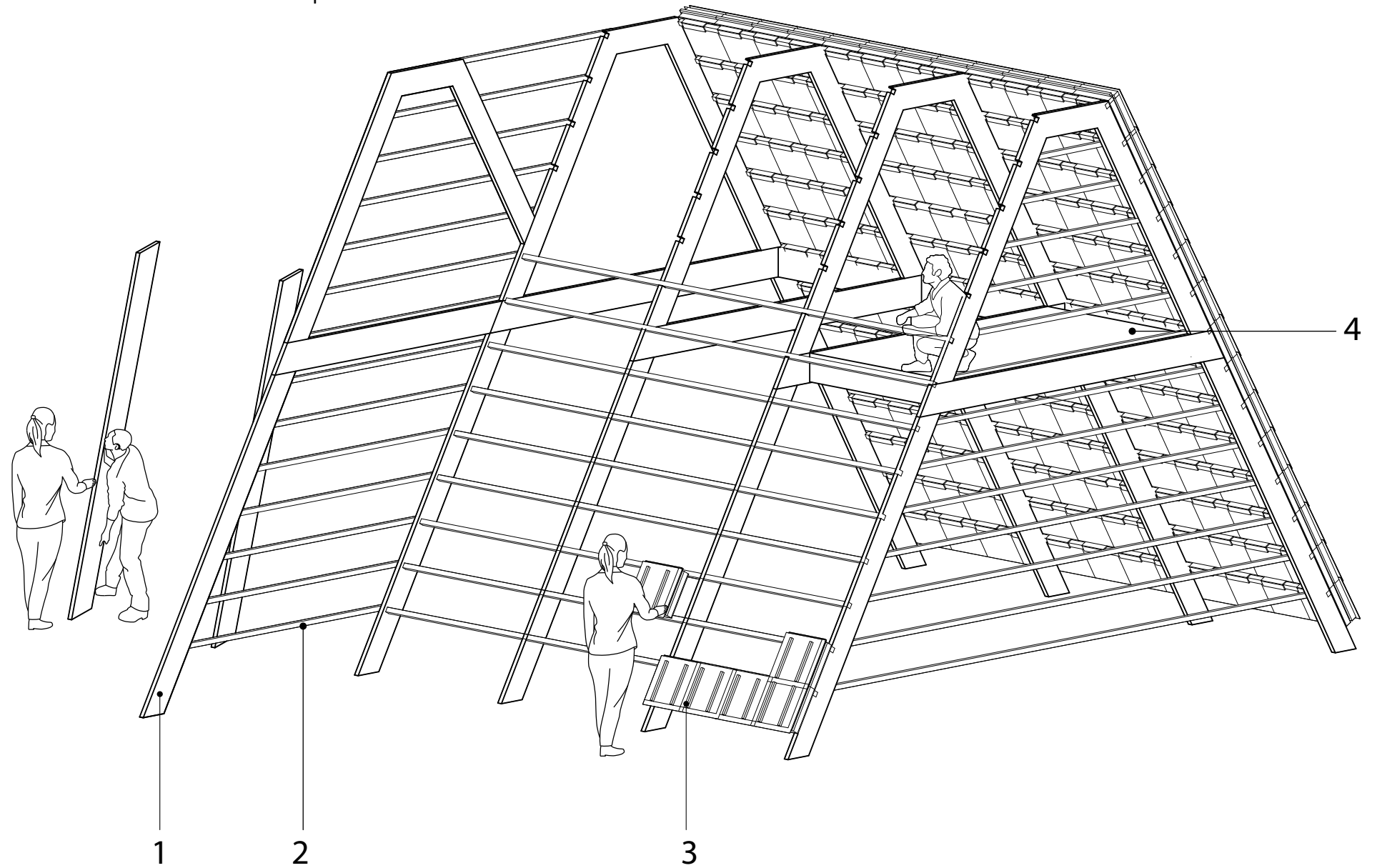
Envelope Module
Scale: 1:25



Window/Skylight
Scale: 1:50

Assembly Process Detail

Lighter portions of the structure may be assembled by people, while heavier beams — such as those used in the roof of the home — would require a crane to erect.



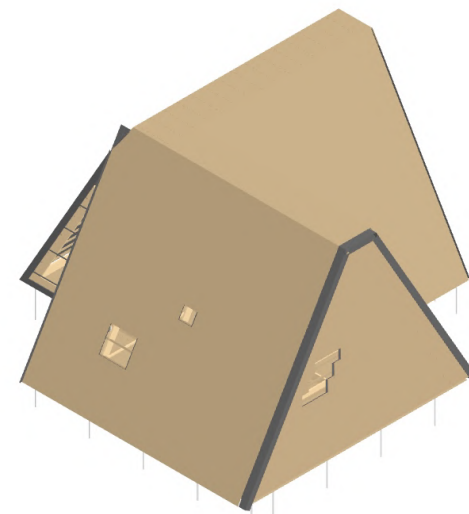
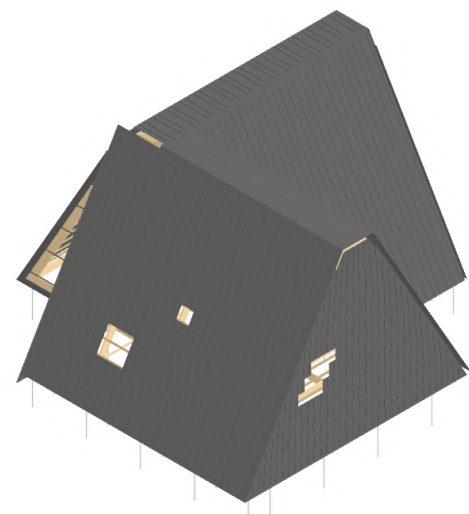
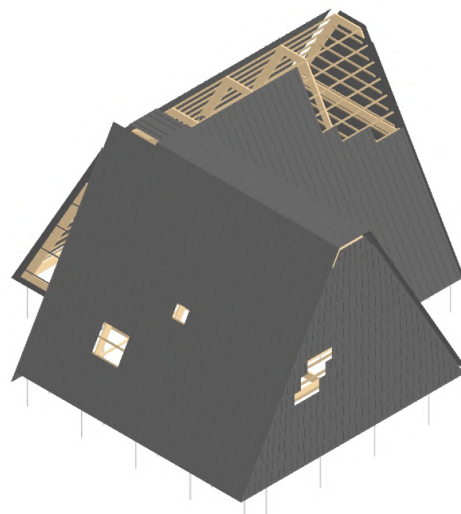
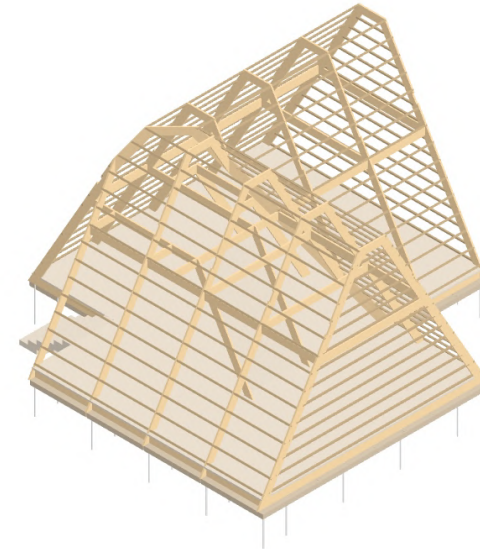
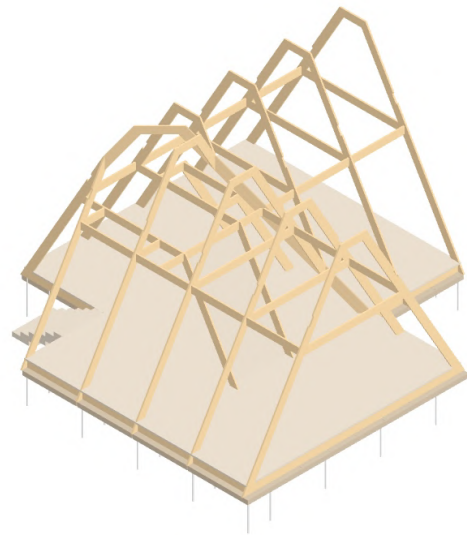
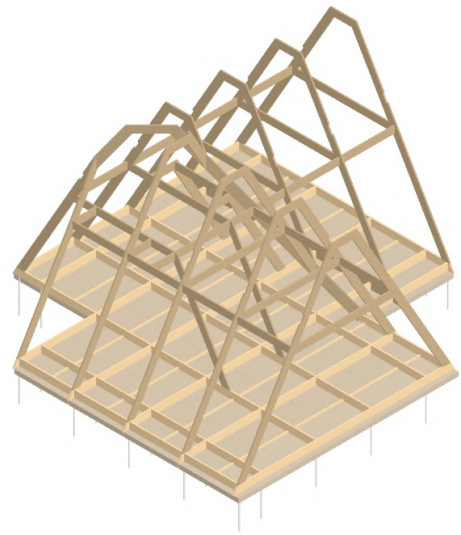
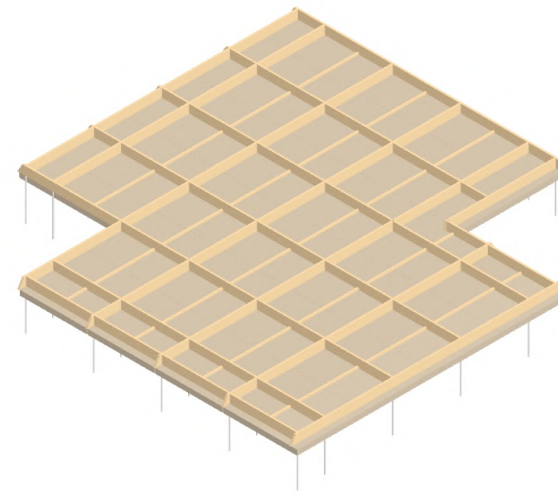
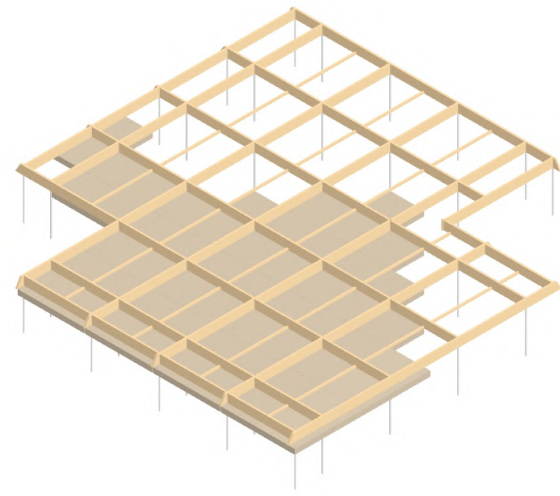
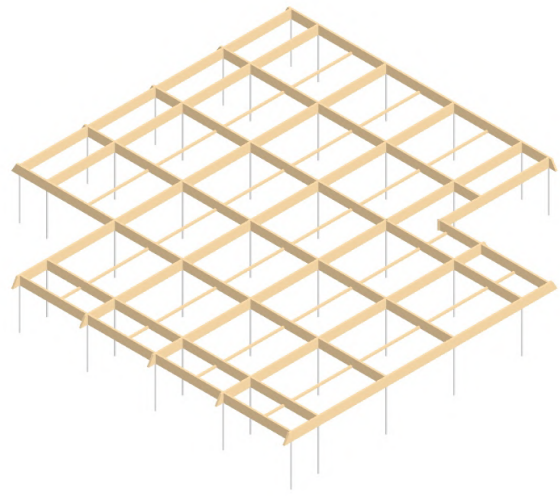
Legend

1. 50 x 250mm LVL structure
2. Ribs to attach to structure
3. Envelope module to hang on ribs
4. Floor modules can be used to stand on and add envelope modules that are higher up.

Thermal Control

Insulation extended past structure at corner modules to prevent thermal bridging

Assembly Process



1. Timber frame on helical pile foundation, with wood rods that connect to the main structure.
2. Floor modules are hung from the wood rods
3. Completed floor. Perimeter modules are different from center modules.
4. Main structure added
5. Flooring is added
6. Ribs are added to main structure
7. Envelope and window modules are hung from the ribs
8. Completed envelope
9. Cladding added

Endnotes

- 1 The term wigwam is sourced from Peter Nabokov and Robert Easton, *Native American Architecture* (New York: Oxford University Press, 1989), 52.
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- 5 Henry Spelter, R. Wang and P. Ince. "Economic Feasibility of Products From Inland West Small-Diameter Timber", (USDA Forest Products Laboratory, 1996), 16, accessed July 13, 2021, <https://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr92.pdf>
- 6 R. James Barbour, S. Tesch, J. McNeel, S. A. Willits, R. D. Fight, A. Mason, and K. Skog, *Objectives and Study Design of the Colville Study: Silviculture, Ecology, Utilization, and Economics of Small-Diameter Densely Stocked Stands* (1997), <https://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr100.pdf>, 70.
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- 8 Element 5, "Cardinal House: a healthy, resilient, mass-timber home for First Nations communities," Element 5, November 27, 2019. <https://elementfive.co/cardinal-house-a-healthy-resilient-mass-timber-home-for-first-nations-communities/>
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- 12 Andrew M. Miller and Iain Davidson-Hunt, "Agency and Resilience: Teachings of Pikangikum First Nation Elders, Northwestern Ontario," *Ecology and Society* 18, no. 3 (September 2013): 9. <http://dx.doi.org/10.5751/ES-05665-180309>.
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- 14 *Ibid.*
- 15 Pikangikum First Nation, *Keeping the Land: A Land Use Strategy*, 1.
- 16 *Ibid.*, 37.
- 17 *Ibid.*, 17.
- 18 Miller and Davidson-Hunt, "Agency and Resilience," 9.
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- 20 *Ibid.*, 8.
- 21 *Ibid.*, 9.
- 22 *Ibid.*, 9.
- 23 *Ibid.*, 8
- 24 *Ibid.*, 8
- 25 *Ibid.*, 5.
- 26 "Could a New Approach to First Nations Housing Be a Game-Changer?" *CBC News: The National*,

- November 1, 2017, video, 14:07, <https://www.youtube.com/watch?v=UpRyv5VzmjA>.
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- 28 Ontario First Nations Technical Services Corporation, *Exploring First Nations Housing*, 14.
- 29 *Ibid.*, 8.
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- 32 *Ibid.*, 14.
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- 44 *Ibid.*
- 45 "Census in Brief: The housing conditions of Aboriginal people in Canada," Government of Canada, Statistics Canada.
- 46 "Our First Nation," Whitefeather Forest Initiative.
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- 48 Chambers, "Boil-Water Advisories and Federal (In)Action," 303.
- 49 Lambert, "Housing Shortage Escalating on Ontario Reserve; PM Promises Help."
- 50 Chambers, "Boil-Water Advisories and Federal (In)Action," 299.
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