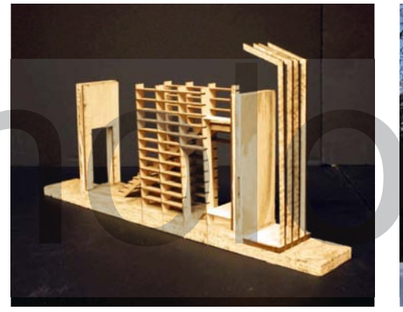
On February 8, the studio presented the Itasca design to guest critics including Katrin Klingenberg, Executive Director of the Passive House Institute US (PHIUS), and NDSU's architecture program faculty, Cindy Urness and Mike Christenson. Three days later, on a site visit to Itasca State Park, the students also received feedback from the client.

The research station administrators were looking to replace a number of dilapidated faculty cabins, starting with the so-called "Cabin Number Five." The administrators had recently set a goal to significantly reduce energy consumption, hence their interest in ultra-efficient Passive House standards. The new cabin was required to accommodate up to four people at a time and would include a fully functional kitchen. The new cabin was to have the same approximate footprint as its predecessor, although it was to be reoriented in line with the cardinal directions to optimize solar gains.

The proposed cabin's shape was very simple, almost archetypal: a cubic volume with a pitched roof. The implied form was completed by a screening device on the cabin's east side. The south-facing windows were protected by panels which slid on exterior tracks. In future iterations, the shading device as well as the roof's pitch would be reoriented. However, the arrangement of internal spaces – kitchen and toilet opposite living room, separated by stairs to lofted sleeping quarters – would remain relatively unchanged for the project's duration.





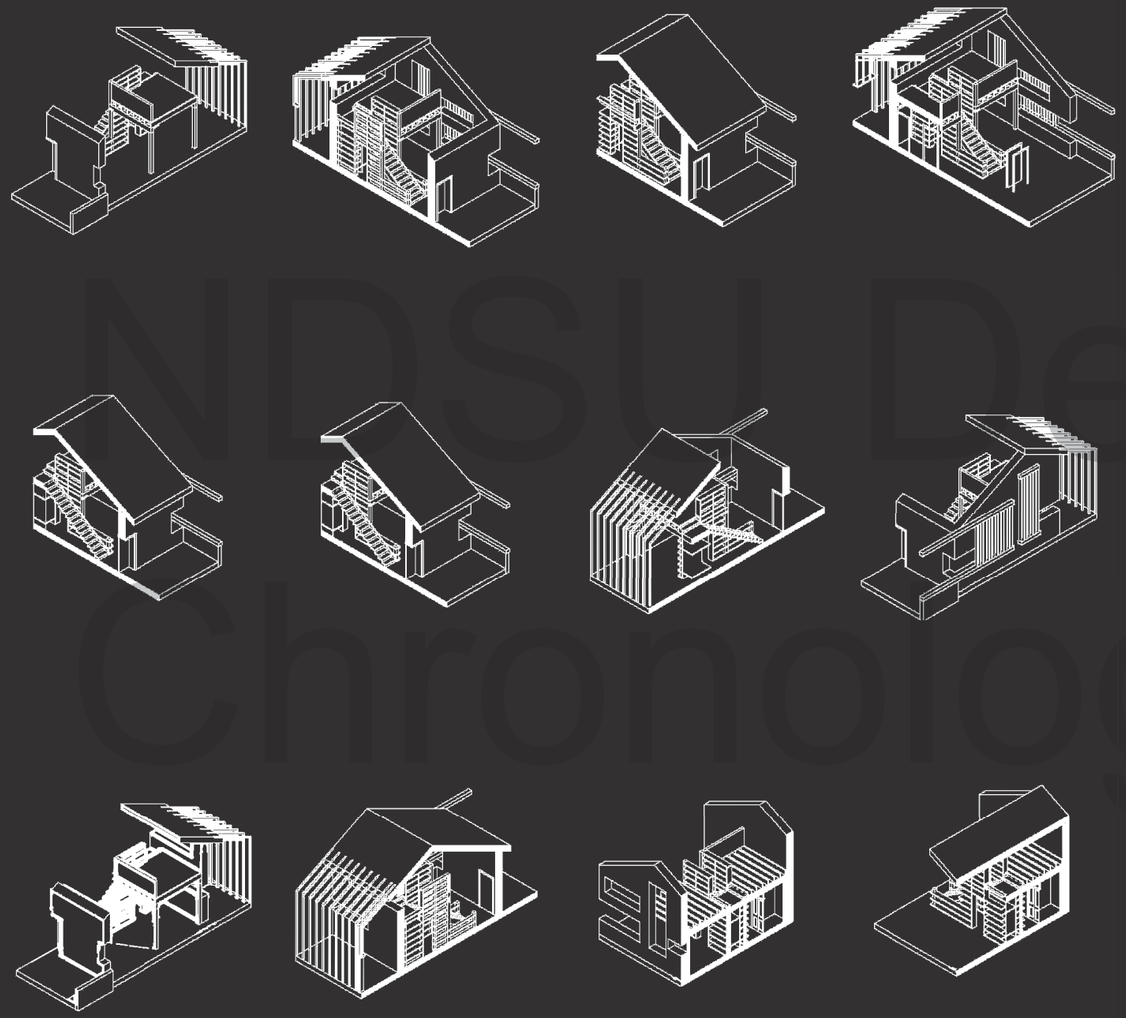
The team proposed a wall assembly of structural insulated panels (SIPs) backed by a 2x4 "utility wall." This arrangement would allow for plumbing and electrical conduit without compromising the SIPs' thermal performance. This concept would carry through future iterations.

During the visit to Itasca State Park, the clients led a tour of the proposed site. The administrators held a short orientation and offered students the chance to ask questions – an opportunity which led to very valuable discussion. It was evident the team's intentions aligned with the client's vision.

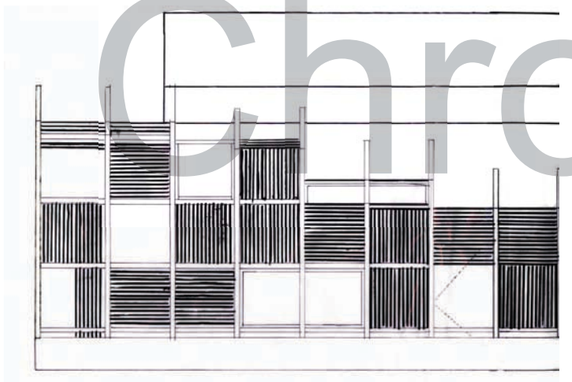
After these introductory conversations, the students formally presented the design. Five large presentation boards addressed its various aspects. The first board illustrated contextual information and process documentation. The second board showed the integration of storage within the cabin's structural elements – a detail indicative of the team's strategy to conserve space throughout the design. The third board focused on the architectural experience through a series of perspectives depicting a visitor's movement into and through the cabin. The fourth board showed drafted plans, sections, elevations, and passive solar studies. The final board detailed the cross-section of the proposed wall assembly from foundation to roof.

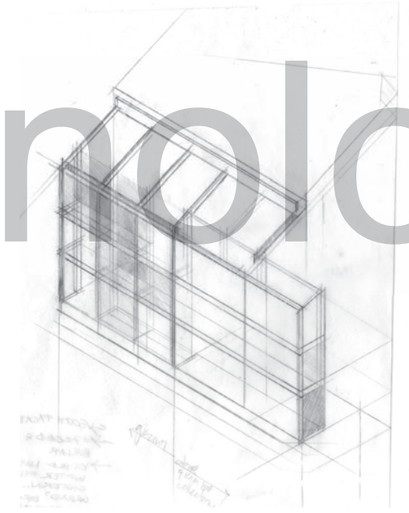
The schematic design was well-received by the client, excited at the prospect of adding the building to the campus; it met their basic needs as well as their expectations for quality. The review provided students with important feedback in the form of comments, suggestions, and insights which would guide the team through design development.

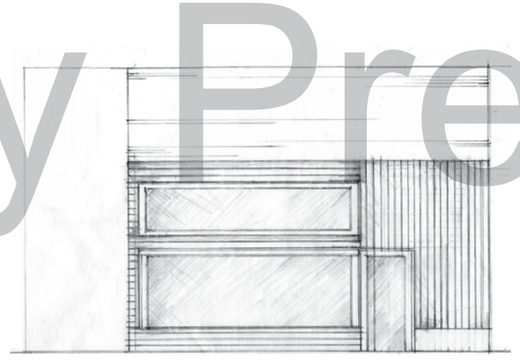
It became apparent that among all of the clients, Itasca personnel were the best prepared to offer time, support, and expertise on an ongoing basis. For these reasons, Itasca was selected as the project's ongoing client. The next phase of the project would be predicated on the assumption that the cabin, after its exhibit at the State Fair, would be permanently relocated to Itasca State Park.

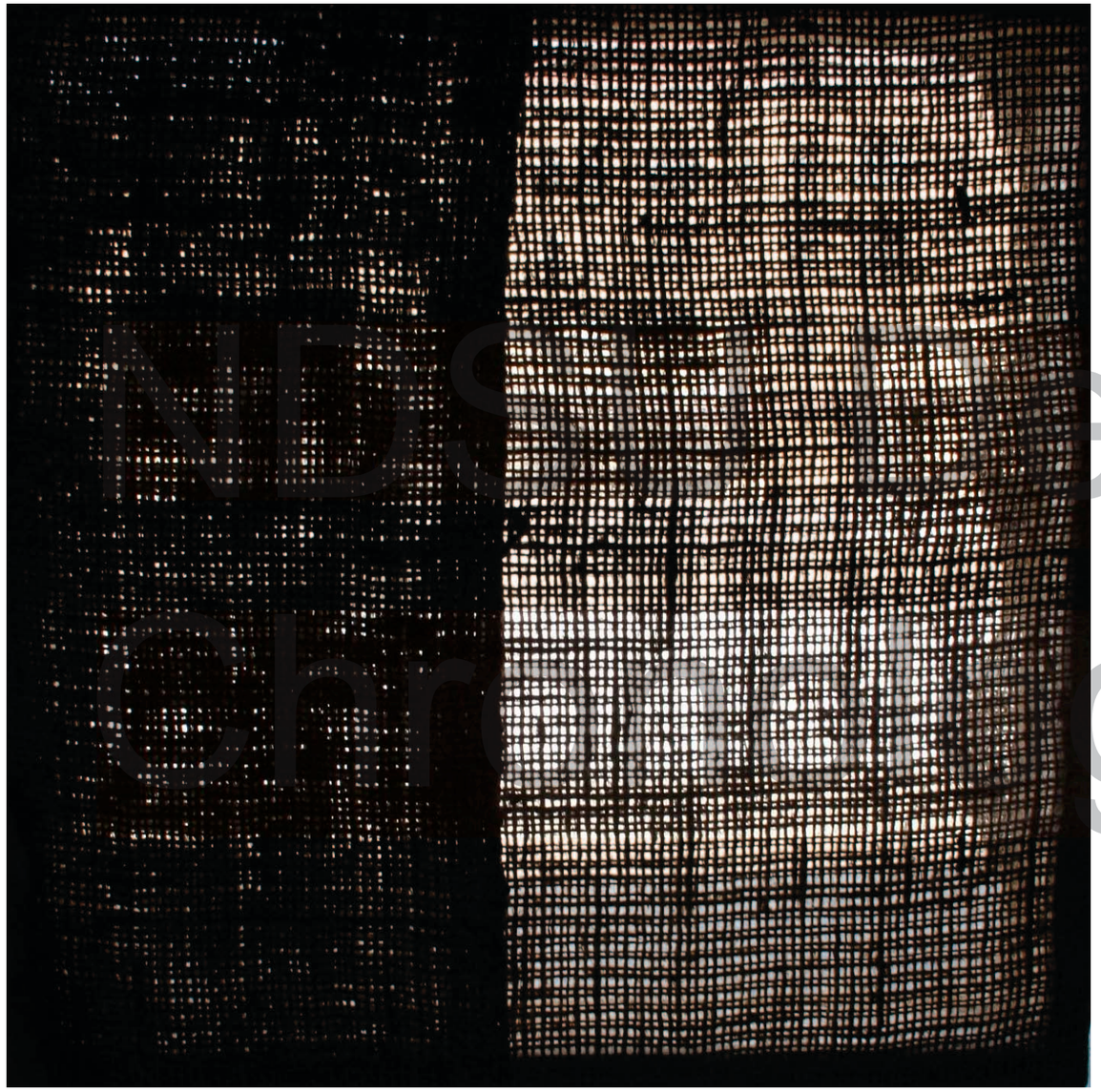


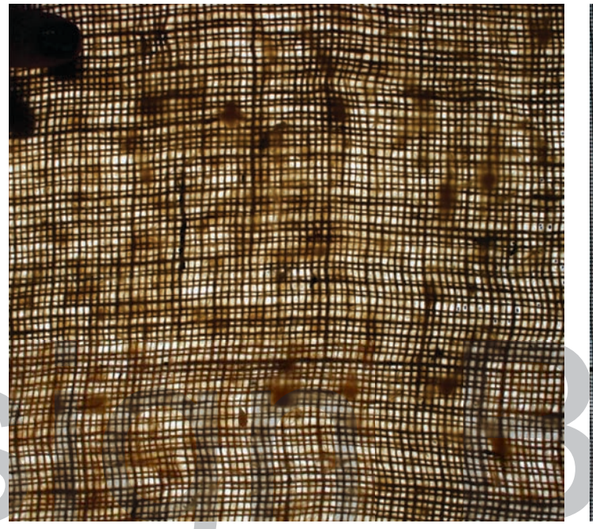
Design Development

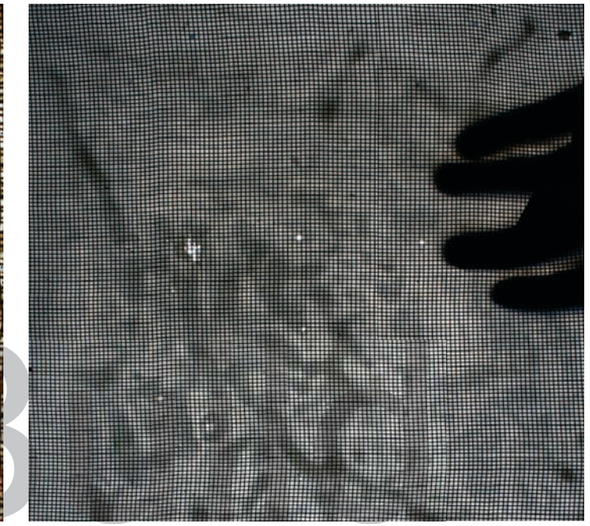


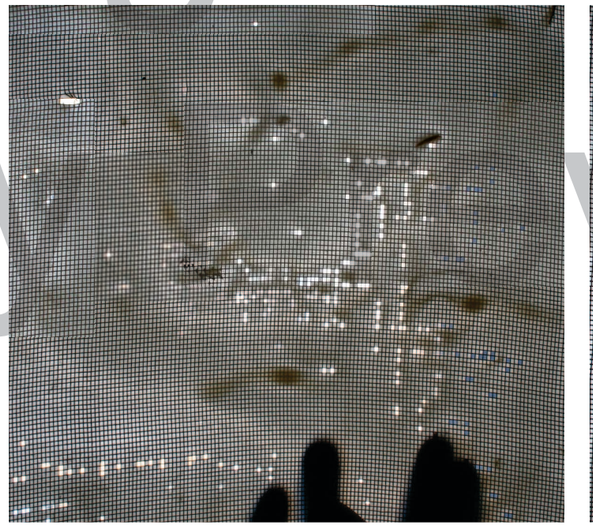


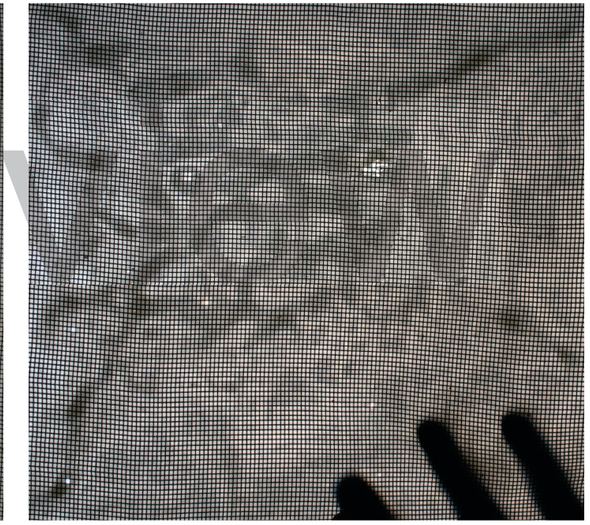


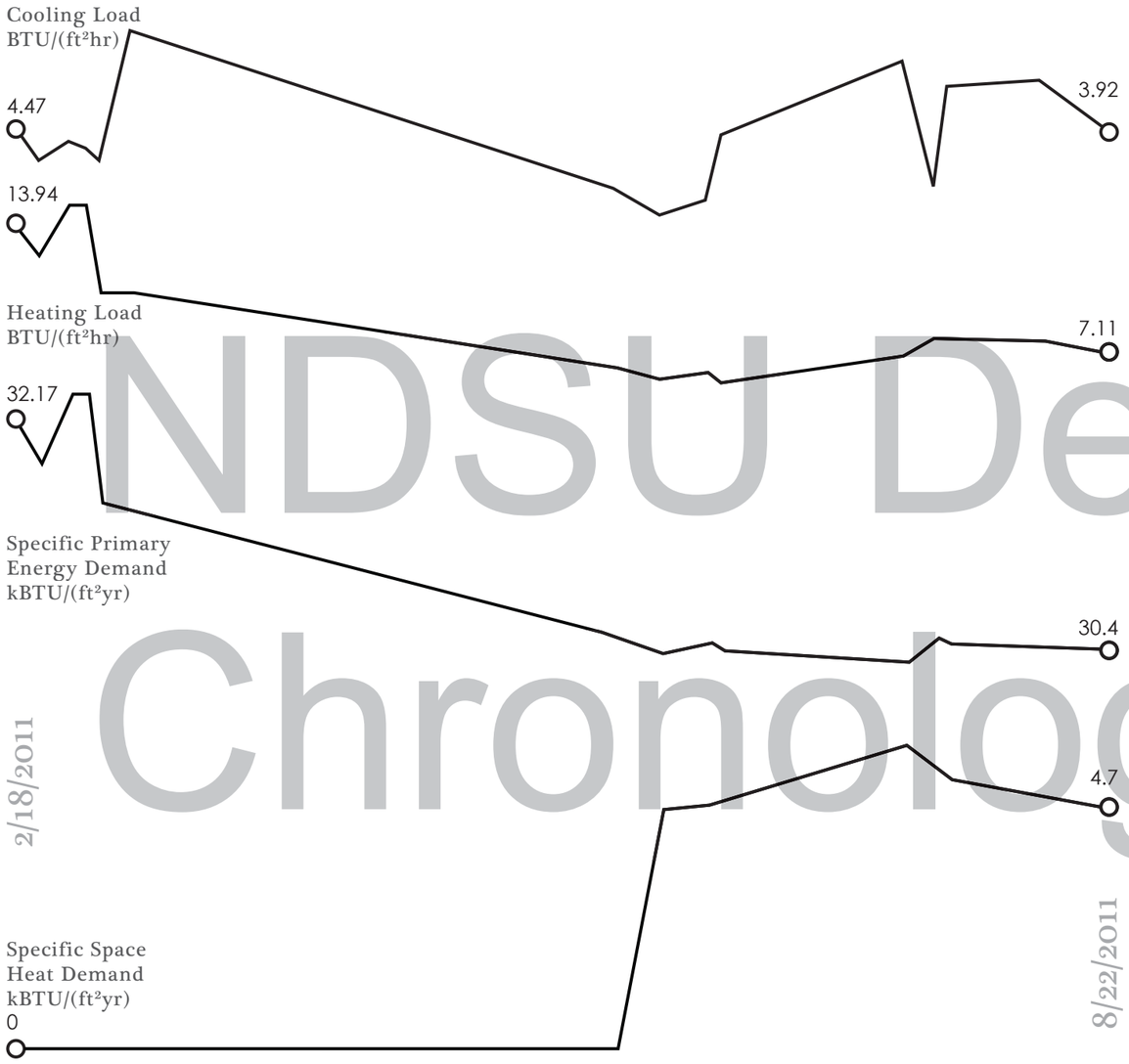












Energy use modeled in Passive House Planning Package through various design iterations

PHPP

PHPP is an abbreviation for Passive House Planning Package, energy-analysis software which runs on the Microsoft Excel platform. There are three basic requirements to achieve Passive House certification.

1. Specific Space Heat Demand: 4.75 kBTU/(ft²yr)

Annual energy use for heating or cooling cannot exceed this threshold, an approximate reduction of 75%-90% of the energy used for heating or cooling in an average code-compliant home.

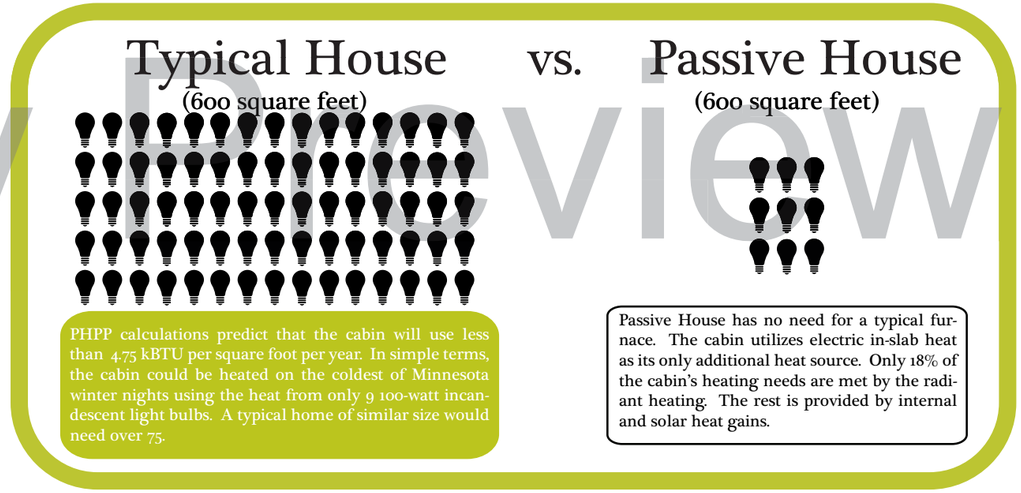
2. Pressurization Test Result: ≤ 0.6 ACH @ 50 pascal

This is to ensure that the building is not losing energy to the outside due to leaks. The pressurization test is conducted with a blower door to detect and repair any leaks before any finishes are applied in the construction process. Final blower door test is conducted after completion.

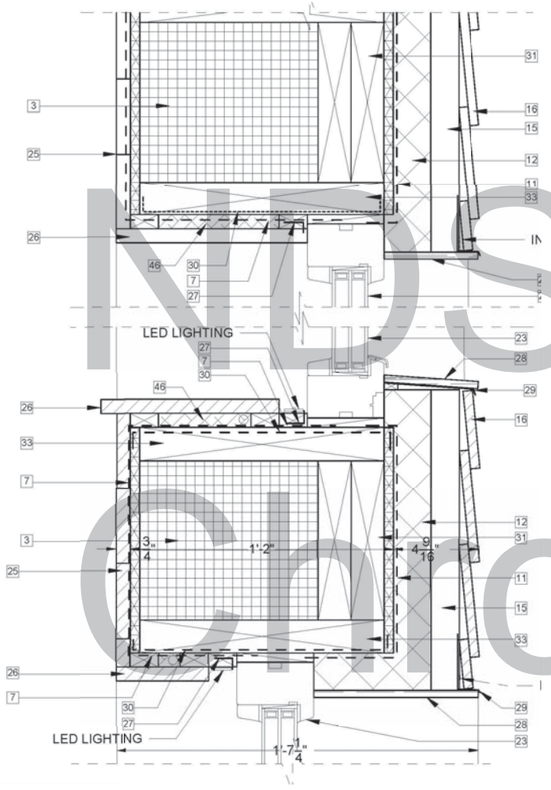
3. Primary Energy: 38.1 kBTU/(ft²yr)

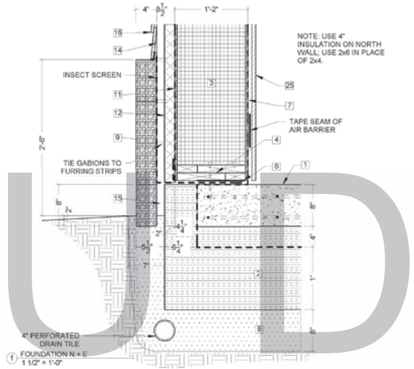
The building's total energy use cannot exceed this amount. Appliances, lighting, and anything else that uses electricity is counted as part of the energy use. This also includes energy for heating and cooling.

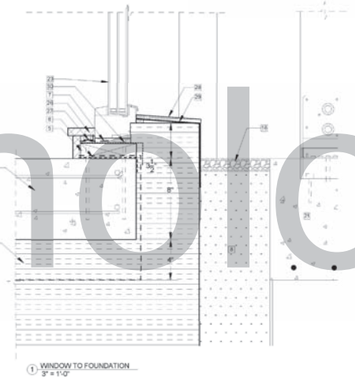
As we designed the cabin the impact of every wall type, ground condition, roof design, window placement, building orientation, shading structure details was tested in the Passive House Planning Package. Using this as a feedback loop in the design process allowed us to test the design for energy efficiency among our many other concerns.

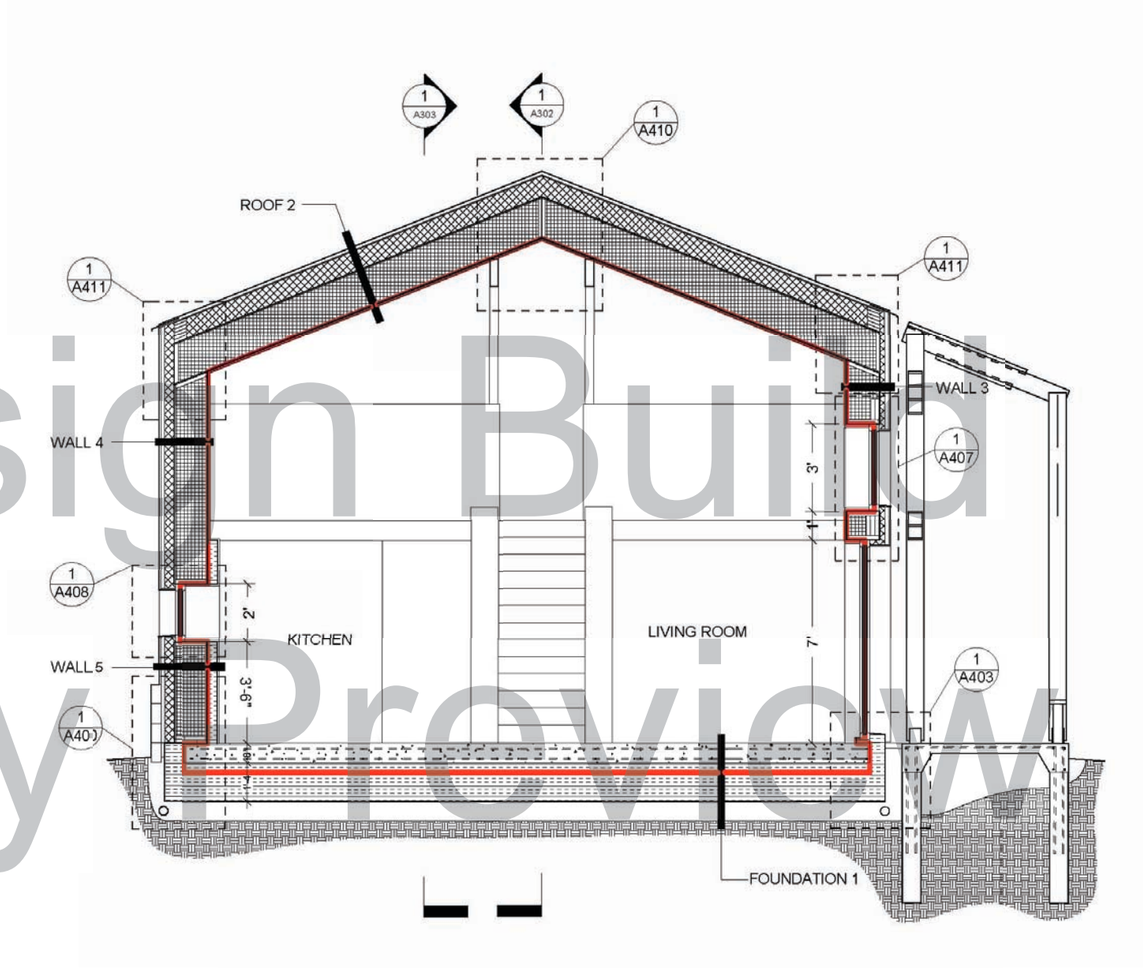


Voices: 27, 28

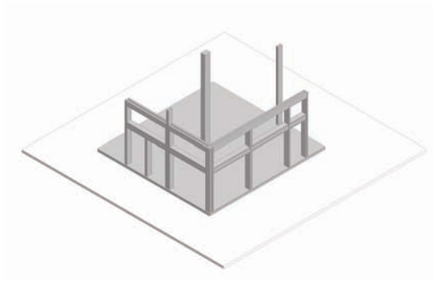


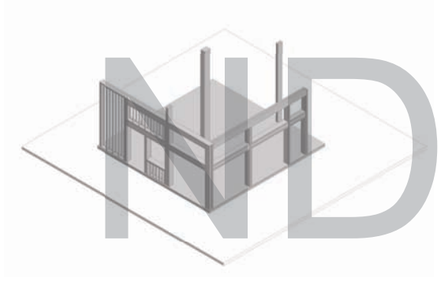


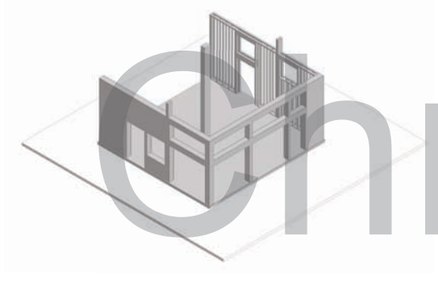




SIP connection details







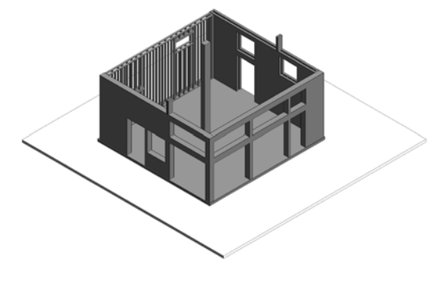


Photo by Mike Chistenson

Build view