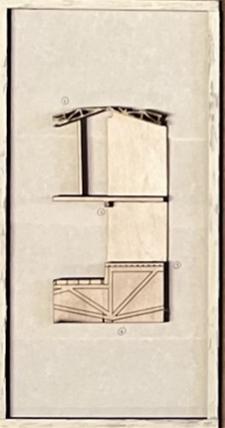
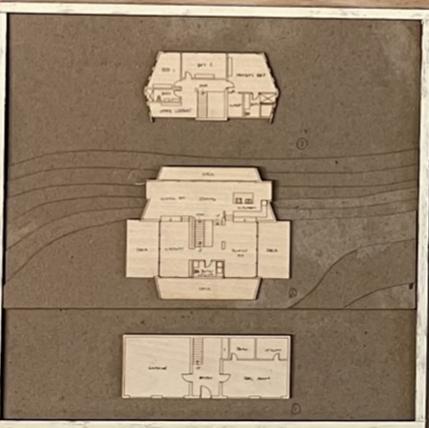


DETAIL



1. Long support
2. This cantilever is anchored to composite floor system
3. This cantilever rests on foundation wall

CUSTOM



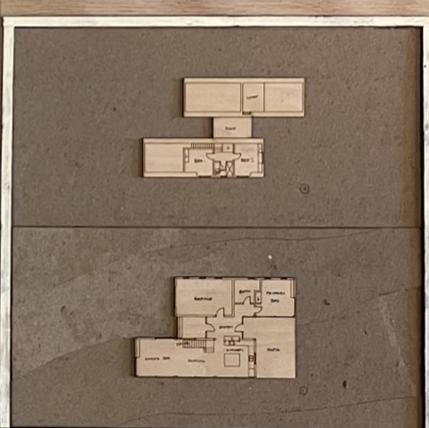
THE WEIRD MACHINE

HOMES AND MATERIAL



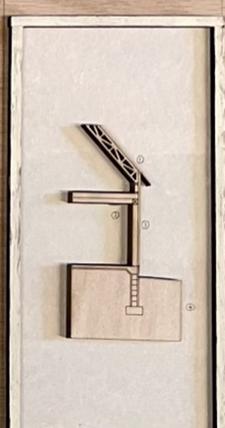
1. The weird machine cantilevers over the hillside
2. The groundplane in the living space hides the foreground in the view
3. Nuvole is oriented towards the sunset over Duluth
4. The outside is brought inside by the movement of the grass

ECONOMY



NUVOLE

DETAIL



1. Prefabricated truss sits on steel wall
2. Long superstructure supports joist
3. Wood siding
4. CMU foundation anchors the house in rocky terrain

RENTALS AND GENTRIFICATION

The tourism economy in Duluth has grown significantly since the opening of Canal Park, and has amplified since the shift to online work following the pandemic. Duluth's growing audience has caused the average price to buy a home up 73% between 2019 and 2022. This is significant compared to the 26% growth of average annual income in Duluth between 2018 and 2022, according to the annual 2018 - 2022 housing indicator reports published by the city of Duluth.

The growth in property value has made the ability to buy or rent at a sustainable price near impossible for Duluthians, since the majority of investment is coming from outside the city.

These projects explore the possibility to increase value to investors without compromising rent. This is done in rental properties where rent is still sustainable.

"Gentrification drives on the migration of exclusion of non-tenant communities, pushing out long-term residents."

OLD



TRIPLEX TO FOURPLEX

BUILDINGS AND ADAPTIVE



DUPLEX TO TRIPLEX

REUSE



OFFICE SPACE TO HOUSING

VACCANT OFFICE SPACE

When the freeway that crosses through Duluth MN was built, there was a new vision of a city that could reap huge benefits for growing tourism globally. This vision included changing the canal, which was a dump throughout the 80s, into a park where people could enjoy the lake, Duluth's history, restaurants, and shops.

The shift of focus from the downtown to the canal changed business, among other factors, like online shopping, big-box retail, and the development of Miller Hill. Because of this, Duluth's downtown consisted primarily of office space, with a great deal of unused space, particularly retail. This shift was worsened by the freeway separating the downtown and canal, and after the pandemic, compounded by the shift to online work.

This project explores the conversion of retail and office space to apartments.

"Downtown is where business thrives. It's not about expanding into this old" (interview)

PREMISE



Labor shortages in Duluth and the surrounding area have caused the price of housing to increase. High living expenses and the lack of affordable housing options have caused the price of housing to increase. The reconstruction of the freeway didn't only make Duluth more accessible, but it also included the redevelopment of the canal, changing it from a dump to a tourist hotspot.

MODULAR



RAILCAR NETTLE

HOMES FOR CONSTRUCTION



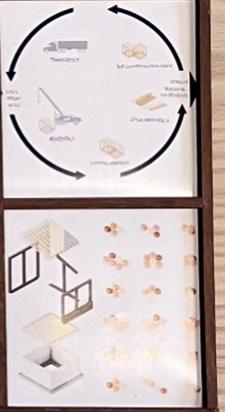
FOUR-SQUARE BUTTERFLY

WORKERS



LANTERN LONGHOUSE

RESPONSE



The modular timber frame system is designed to be a sustainable, low-carbon, and long-lasting building solution. The system is designed to be reused until the end of its cycle.

DULUTH'S ECONOMY

Duluth is a vibrant city in a beautiful place. From its ocean-like setting with its long beaches, to its rocky hiking trails, Duluth offers a desirable experience to almost every one that visits. The reconstruction of the freeway passing through Duluth has aided a subsequent growth in tourism. The reconstruction of the freeway didn't only make Duluth more accessible, but it also included the redevelopment of the canal, changing it from a dump to a tourist hotspot.

The traffic passing through Duluth has only grown its tourism economy. This large audience has attracted the attention of investors from outside the city, increasing prices permanently changed the labor force, with workers looking for higher wages. The construction labor force is among these professions.

Since the covid-19 pandemic, tourism has only increased with more remote work in the economy. This has caused the price of housing to skyrocket, and the cost of living in Duluth to increase even more.

CONSTRUCTION LABOR SHORTAGE

LABOR SHORTAGES AND RISING LIVING EXPENSES
Skilled labor is a challenge in Duluth primarily because of the lack of affordable housing options. This issue turns prospective workers away from Duluth and to cities where wages match basic living expenses. According to the housing indicator reports published annually by the city of Duluth between 2018 and 2022, the average income of Duluth residents has increased 26.2%, while the average cost for a home has increased 73% between 2019 and 2022.

COMPETITIVE WAGES AND BUILDING MATERIALS
According to an office manager for a construction company in affiliation with the Associated Builders & Contractors in Duluth, increasing material prices have made the balance between competitive bidding and competitive wages difficult to achieve. Lower wages have also compromised the capability to find skilled labor. Construction laborers are also the last ones to get paid for a project. To build a project from pre-manufactured panels might sound cost effective, but laborers still have to assemble the panels at the end of the day.

MANUFACTURING
High costs for construction materials are the result of many circumstances specific to the material. In Northern Minnesota, wood is an abundant but expensive resource depending on how it is processed. The average stump price or cost to enter a property and cut down a pine tree as timber was unaffected by the pandemic, opposed to the inflated cost of processed lumber. When employees make over \$1,000 dollars a year on average according to the BLS, Technology is also an issue according to V&H, a log manufacturer based in Orr MN. The cost of bringing new lumber processing technology to a dealership to get fixed compromises business, leaving small companies with old machinery.

MODULAR HOMES

HOMES IN DULUTH

ENTRY LEVEL HOUSING AND AFFORDABLE HOUSING
In this project, affordable housing is defined as government subsidized housing. In Duluth MN, affordable housing exists, but has a strict application procedure. Most Duluthians who are struggling to find affordable rent options do not qualify. These people contribute heavily to Duluth's economy but struggle to find entry level housing that fits their financial needs. Opposed to government subsidized rent, this project focuses on home ownership, and renovation strategies that can help families save for a home, while still providing an incentive to investors.

LAND SCARCITY
Available plots of buildable land are of increasing scarcity in Duluth. This is mostly due to the slope and rocky formations throughout Duluth that can increase construction costs. Rocks can be hard to predict and can lead to homes being partially redesigned during construction. The other reason for land scarcity is the concentration of homes in convenient areas, further from the rock formations.

CURRENT INVESTMENTS
Duluth provides a tax break to investors who allocate 10% of their housing units to affordable housing. Like all affordable housing, to live in these units requires a strict application procedure. New developments in Duluth have followed this trend, but the issue of entry level housing, or rental options that allow residents to save persists. New major investments have included the conversion of schools into apartment space, following the construction of new schools. These developments include, Old Central High School, Central High School, Central Middle School, and Nettleton School.

RENOVATIONS

COST EFFECTIVE ARCHITECTURE

TIMBER AND MANUFACTURING
Stabilizing wages for construction workers requires designing with ethical material choices that are profitable for the owner and the builder. This can be done with a local resource, with as little manufacturing as possible, like timber. Northern MN is known to have some of the highest quality timber in the world. By limiting the manufacturing done to timber, it is possible to construct buildings to last with a sustainable, and economical material choice.

3 WAYS TO COMBAT LABOR AND HOME SHORTAGES
MODULAR TIMBER FRAMING
Timber is a sustainable resource when it is used and harvested properly. This part of this thesis proposal is the development of a modular timber system with mass produced components that can be reused through adaptive reuse, or reconfiguration. This proposal is a series of modular home types that house construction workers.

RENOVATING UNUSED SPACE IN RENTAL PROPERTIES
Rental properties are a vital part of Duluth's economy, existing primarily in old houses that have been converted to multifamily residences and office space. With monumental shifts in the housing market following a rise of remote and remote work, these spaces can be reorganized to bring value to the investor, but not compromise rent.

ETHICAL MATERIAL CHOICES IN HIGH-END RESIDENTIAL ARCHITECTURE
Economic material choices must meet all ends of the market. Cost effective materials in high-end residential architecture are a fully applied expense to each project, providing the space to implement more labor expenses embellishing the material.

CUSTOM HOMES

ADAPTIVE REUSE

Sustainability in a northern climate can be a challenging ambition to meet, provided the constraints of cooler weather, and less sunlight. Sustainability in Duluth is better implemented with attention to embodied energy. The requires a keenness to design with local resources, with low embodied energy, and a long lifecycle. Large timber members can be reused multiple times, as a building material, or as a source for smaller products at the end of its cycle. This is how designers can approach adaptive reuse in new construction.

Adaptive reuse of older structures is another effective strategy to meet environmental goals. In Duluth, builders and designers will become increasingly reliant on their ability to renovate the old housing stock.

DETAIL	CUSTOM	HOMES AND MATERIAL	ECONOMY	DETAIL
	THE WEIRD MACHINE		NUVOLE	
RENTALS AND GENTRIFICATION	OLD	BUILDINGS AND ADAPTIVE	REUSE	VACANT OFFICE SPACE
	TRIPLEX TO FOURPLEX	DUPLEX TO TRIPLEX	OFFICE SPACE TO HOUSING	
PREMISE	MODULAR	HOMES FOR CONSTRUCTION	WORKERS	RESPONSE
	RAILCAR KETTLE	FOUR-SQUARE BUTTERFLY	LANTERN LONGHOUSE	
DULUTH'S ECONOMY	CONSTRUCTION LABOR SHORTAGE	HOMES IN DULUTH	COST EFFECTIVE ARCHITECTURE	ADAPTIVE REUSE
	MODULAR HOMES	RENOVATIONS	CUSTOM HOMES	

