



The Northern Housing Project

THESIS PROJECT



Northern Housing Project



NORTHERN HOUSING PROJECT

By

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Housing shortages are affecting many cities around the world and Canada is not impervious to the continually growing population's demand for adequate homes. Iqaluit, Nunavut is yet another city ailed by housing scarcity due to the limited availability of local resources, lack of specialized trades' people and the harsh local climate that deteriorates most structures. This thesis will delve into the underlying factors currently propagating the continuing housing scarcity and decay in Iqaluit, Nunavut and will seek a new housing type to better accommodate the local population.

At present existing western housing developments do not address nor reflect the rich and varied cultural background of locals which restricts traditional way of life. Key factors that help define the objectives and design parameters have been derived from background research into the socio-cultural, climate and current labour and resource realities of the region. The Northern Housing Project with the help of western co-housing concepts will address the needs of the local indigenous inhabitants as well as the requirements of the immigrating population.



ABSTRACT

I would like to thank the following people:

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1.0 Introduction

The housing issues faced by northern communities in Canada are numerous and complex. They include housing shortages, expensive cost of construction, high lifecycle costs, difficult environmental conditions, damage caused by climate change and lack of culturally integrated housing. Each of these issues is significant on its own, and when combined, they produce a housing system that is in need of a radical overhaul. The goal of this thesis is to assist in certain aspects of this overhaul through the use of architectural design. In order to offer realistic and relevant alternatives, these designs will be presented with a specific location in mind, namely the northern city of Iqaluit.

Beginning with introductory details on the city of Iqaluit, we will examine a number of notable housing issues. Then there will be a review of some of the existing case studies worldwide that have sought to address various issues relevant to northern locales. In conclusion, an architectural proposal will be developed.

1.2 Background

The following are background details on the city of Iqaluit and its geography, population, climate, history, and economy.

Geography and Population

Iqaluit is located in the Arctic region of Northern Canada, on the south coast of Baffin Island, at the head of Frobisher Bay. With its population of 6700, Iqaluit has the distinction of being the least populated Canadian capital and is the only capital not connected to others by a highway (Statistics Canada, 2006). However, it is a fast growing community with a large Inuit population, which accounts for roughly 3500 of the 6700 residents (Redfern, 2012). The remaining residents represent various cultures from across Canada and the world.

History

Following the Second World War, Canada established sovereignty over its northern lands, which are known today as the three territories of the Yukon, Northwest Territories and Nunavut. The international committee responsible for national sovereignty over lands required that a permanent human presence be established on a land in order for a country to claim it as its own territory. Therefore, during the 1950s and 1960s, the Canadian government began to establish permanent communities in the North consisting mainly of Inuit people (Bonesteel, 2006). This caused a significant displacement of many existing Inuit communities with families being separated from each other and placed in remote communities.



Figure 1 - Aerial View of Iqaluit
Source: <http://www.ge.com/innovation/baffin/images/1-aerial.jpg>

Although the initial living conditions in these settlements were often harsh, the government eventually provided services such as health care, education and employment opportunities. The current Inuit generations were attracted to these benefits and left their nomadic lifestyle to move into settlements; thus communities were formed in increasing numbers (Friedman & Debicka, 2012). In the late 1990s, a number of these communities were gathered into the territory of Nunavut, thereby giving importance to the new territory's capital of Iqaluit, a city chosen as the capital due to its location as the southernmost gateway to the North by both sea and air.

Economic Conditions

According to Statistics Canada, the average family income of households in Nunavut is \$62,680 annually, compared to the national median of \$69,860. Not only is the median family income lower than the national average but the cost of living expenses is much higher than in the rest of Canada due to its remote location (Statistics Canada, 2010).

Iqaluit is a growing city that is ideally positioned to become a regional hub for economic and social activity; however, its lingering and increasing housing issues remain a challenge that need to be further addressed. Efforts to build new housing are countered by severe climate conditions and by the sheer remoteness of Iqaluit with respect to the rest of Canada's major urban centers.

1.3 Climate Change in the North

Having reviewed Iqaluit's background, it is important to more thoroughly examine the climate-related changes facing the North in general, and more particularly the Inuit environment.

Climate conditions in Northern Canada are some of the most challenging in the world. The average January and July temperatures vary from -26.6 to 7.7 degrees Celcius respectively (Eldorado Weather, 2014). The snowfall in the region is relatively light; however, the snow does not typically melt and large buildups due to wind are common. During the winter months, wind speeds regularly exceed one hundred kilometres per hour (Nielsen, 2007). Additionally, the arctic ground cover consists of a thick permafrost layer that stays frozen throughout the year. Most buildings in the North are built with foundations that are designed to rest on this permafrost (Nielsen, 2007).

Over the course of the last century, the climate in northern Canada has been warming at an unprecedented rate, causing ground temperatures to increase, sea ice to diminish, glaciers to melt and sea levels to rise. Northern communities are experiencing significant impacts socially, environmentally and economically as a result of (climate) warming. From a housing perspective, one of the most significant ways climate change will impact the North is through its effect on infrastructure. A city's infrastructure supports most its key services including housing, roads, schools, hospitals, and communication facilities; therefore, the long-term durability and sustainability of infrastructures in Nunavut will depend on the successful tackling of climate change issues (Lewis, 2010).

Northern communities have infrastructures that were built with technology designed to withstand climate conditions based on past data. Recent climatic variations are causing damage to this infrastructure, as it was not built to withstand such changes. One result of climate change has been the melting of the permafrost layer; this has caused severe structural problems in many buildings and roads. It has been confirmed through studies that even small changes in temperature cause significant reductions in permafrost thickness (Lewis, 2010).

Furthermore, research has shown that there is a growing correlation between warm temperatures and volatile weather. Small changes in temperature can result in an increase in severe weather events, which in turn cause infrastructure damage. In 2007, a blizzard brought higher than usual winds across the northern city of Iqaluit, causing severe damage to buildings in the area (Nielsen, 2007).

Anticipated changes in the volatile weather include heavier rains and snowfalls; these will create conditions that the infrastructure was not designed to cope with. An increase in rainfall can also alter runoff patterns and negatively affect drainage systems (Nielsen, 2007).

The rise in sea level is also a dangerous outcome of climate change which has already affected coastal communities in the North. The various locations of different regions in Northern Canada give them different relationships to the vertical movements of the earth's crust. The central Arctic region and Hudson Bay tend to rise while the peripheral regions of the Arctic are sinking. As a result, peripheral Arctic regions have already become vulnerable due to the rise in sea levels (Nielsen, 2007).



Figure 2 - Effects of Melting Permafrost on Structural Stability of building #1
Source: Photo by Serouj Kaloustian, 2012



Figure 3 - Closer look at building in figure 2
Source: Photo by Serouj Kaloustian, 2012



Figure 4 - Increased Snow Accumulation May Result in Structural Problems
Source: CMHC

1.4 Traditional Inuit Lifestyle

The following are various elements of the traditional Inuit lifestyle that will be covered in the sections below: Nomadic Travel, Shared Economy and Skills, Social, & Kinship.

Nomadic Travel

For generations, the Inuit people of Nunavut lived a traditional life in the Arctic, moving from one place to another with the seasons to hunt caribou, muskox and seal, or fish for char and whitefish. The Inuit did not wander aimlessly in search of meat and fish. They visited established seasonal hunting and fishing camps each year as sources of food. When the hunting was good, the spring, summer and fall were times to hunt and travel, while the mid-winter was a time to spend with the family, tell stories, play games, and learn about Inuit oral history and ancestral legends. As they knew they would return, they often left behind the tools and implements needed for hunting caribou and other summer activities (Cully, 2011).

The climate dictated when and where they would move. An early spring meant the caribou might migrate early. A late spring and cold summer meant the caribou might be late or change their migratory route altogether. The Inuit camp had to be established and ready for the caribou migrations, coming North in the spring and south in the fall. If they missed a fall harvest the camp might go hungry or even starve during the winter (Cully, 2011).



Figure 5 - Traditional Inuit Lifestyles
Source: Places in time (2007)
Author: Savoie Sylvie, Laroche Louis

Shared Economy and Skills

When an animal was caught, the camp shared the food equally. Sharing and interdependency were traits of the traditional Inuit economy. The encampment included people with different skills. One man might be a good seal hunter or tool maker; a woman might be a good maker of waterproof footwear. All these activities were necessary for the survival of the camp; also needed were good navigators, shamans, and other specialists. No one individual possessed all the requisite abilities, so group survival was dependent on the knowledge and talents of individuals. If a hunter were injured, his family would be provided with food and care until he recovered (Central Arctic, 2001).

Camp size was determined by the number of animals (food) in the immediate area available to support it. Too many people and not enough food meant the camp would have to split up, with one group moving to a new location. If there were lots of caribou and seal, smaller camps could unite and families could afford to have more children. Essentially, the amount of people that the individuals in the camp with special skills can support is the maximum sustainable population of that camp. If the population exceeds this sustainable size, they must form a new camp where other individuals could fill specialized skill niches (Central Arctic, 2001).



Figure 6 - Traditional Inuit Lifestyles
Source: Places in time (2007)
Author: Savoie Sylvie, Laroche Louis

Social

The basic unit of Inuit society was the family. A household might consist of a wife and husband, unmarried children, an adopted child, and maybe someone's widowed mother or a widowed sister. The oldest active male was the family spokesman (Central Arctic, 2001).

A cluster of several households from five up to twenty of related people formed the next unit, the hunting group. Within this group there was no single leader, and decisions were made by consensus. Different leaders would emerge with a number of specific skills, such as the ability to navigate during a storm or to locate a caribou herd (Central Arctic, 2001). The overall regional community, consisting of various scattered hunting groups, made up the outer limits of kinship bonds. As households or individuals migrated, they could rely on the help of relatives in the other hunting communities who were part of the same overall regional community (Central Arctic, 2001).

Kinship

While the term "kinship" usually applies to people related either by blood or marriage, the Inuit extended it to include those close to them. Through certain rituals these individuals all became one's relatives. Another means by which an individual was made kin was through adoption. Inuit adoption, however, created more than a bond between the adopted child and his or her new family. It linked the new parents and the natural parents. All these new links served to establish bonds of co-operation and trust between previously unrelated people (Central Arctic, 2001).

Traditional Inuit communities consisted of several interrelated families. Outside one camp, several others within the region were bound together as an Inuit territory. Kinship between these camps was mostly derived from distant familial connections. Therefore, the entire Inuit community was inter-related and individuals had different levels of kinship (Central Arctic, 2001). Within the camp, authority was mostly derived from a communal decision-making process unless a particular person was adept at leadership. Most decisions, however, were made by individuals who were good in one particular area such as hunting (Central Arctic, 2001).

1.5 Westernization of Inuit Lifestyle

Following World War II, permanent settlements began taking shape across Canada's Eastern Arctic. Attracted to the communities by services such as health care, schooling, and opportunities for wage employment, Inuit increasingly left behind their semi-nomadic existence. To improve the living conditions in the settlements, the Government of Canada initiated the Eskimo Housing Loan Program (Bonesteel, 2006). The first housing prototype, introduced in 1959, was called the "matchbox" because of its small size - 3.66 by 7.32 meters (12 by 24 feet). The matchbox design was initiated and tested by the government in Ottawa and was poorly designed for the Arctic environment. The result was that residents typically fell behind on their payments because of the high costs of heating and maintenance during the long winter. Throughout subsequent decades, the designs of housing prototypes were repeatedly revamped in an attempt to address issues of affordability, accommodate large Inuit families, and improve the quality of the prefabricated homes imported from the South (Knotsch, 2011).

Units delivered across the Arctic embodied Westernized notions of the household and, for one thing, introduced partitioning between rooms, a foreign concept to the Inuit, who were used to dwellings with one communal living space.

To this day, public housing in Iqaluit fails to adequately meet the needs of Inuit households: overcrowding remains a serious issue and houses remain ill-adapted to the cultural requirements of families. Thus, inhabitants' use of spaces has been different from that intended by the builders; for example, animals were butchered in the living areas, meat was stored in bathtubs and dining room tables were used as work benches and for indoor repair of snow machines (Knotsch, 2011).

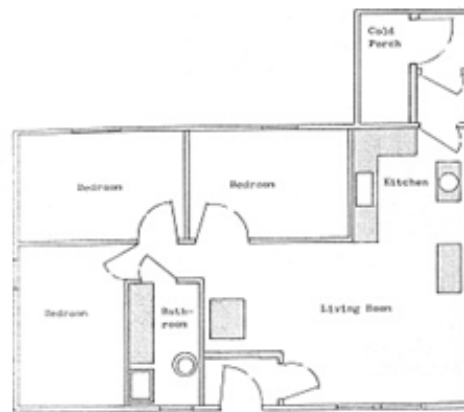
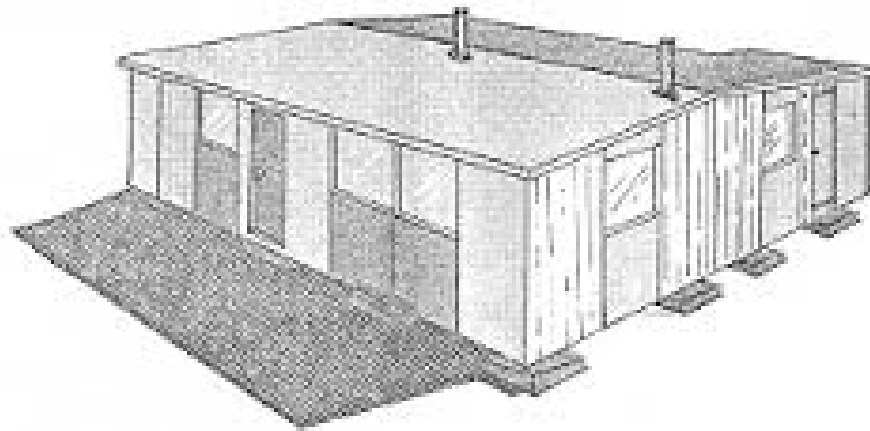


Figure 7 - Westernized "Matchbox" Housing
Source: www.polarcom.gc.ca

1.6 Review of Existing Construction Process

The following section includes a detailed review of the existing construction processes for housing in Iqaluit. Some of the housing challenges associated with climate change have been addressed. Other issues include the high cost of construction, lack of available skilled workers, and high life-cycle costs on properties. All of these factors have led to a shortage of housing, and the task of constructing new housing to fill the shortage is an extremely difficult and expensive process. Let us examine a typical housing construction project from start to finish (CMHC, 2008).

Initial phases of construction involve designers, engineers and surveyors. These types of skilled workers are not generally available in northern Canada and also locals are not being trained in adequate numbers to meet future needs. Therefore, the necessary professionals are usually flown in or asked to do the work remotely, which makes the initial design phase much longer. Also, the lack of an official Nunavut building code makes education in this area difficult. Currently, architects and engineers developing projects in Nunavut use various documents and guidelines that have collections of past precedents and “rules of thumb”, to find solutions for constructing buildings in the region.

After the designing and engineering have been approved, the expensive and time consuming process of ordering and shipping materials begins. This is especially true in northern cities such as Iqaluit, where the only methods of shipping supplies and materials are by air or water, both of which can be affected by severe weather conditions. As a result, the average construction project duration in Iqaluit is nearly two years. The challenges are further compounded by the fact that construction supplies are sent once a year by ships or barges during the late summer months or by seasonal ice roads. There is also no guarantee materials won't be damaged or stolen along the way. These factors significantly add to the cost of construction, which in turn necessitates interim financing to pay for materials (CMHC, 2008).

Shipping building materials to Iqaluit is very expensive not only because of its remote location away from major manufacturing bases but also due to its natural geographic limitations, a major one being that the city cannot dock any sizeable ship to unload materials conveniently due to a very shallow water bay. Builders in Iqaluit must order their materials from the south and wait several months for them to be shipped in. This not only significantly lengthens the duration of each construction project but also may lead to complications in the event that the materials that were ordered no longer fit the requirements of the project due to unforeseen changes.



Figure 8 - Shipping of materials in Iqaluit
Source: Photo by Serouj Kaloustian, 2012



Figure 9 - Typical Structure in Iqaluit
Source: Photo by Serouj Kaloustian, 2012



Figure 10 - Poor maintenance of a home in Iqaluit
Source: Photo by Serouj Kaloustian, 2012



Figure 11 - Poor maintenance of a home in Iqaluit
Source: Photo by Serouj Kaloustian, 2012

Although the city of Iqaluit has tried to implement modular construction in the form of prefabricated structural insulated panels (known as SIPs), these are currently manufactured in the south and must be shipped to Iqaluit. This process makes construction very expensive because shipping to Iqaluit is based on a weight in relation to volume pricing policy. This is why shipping pre-assembled modular walls for houses, which occupy more space on a ship than the individual material elements would otherwise occupy, have made prefabricated construction in Iqaluit very expensive.

When the time comes to start actual construction on the site, builders contend with a variety of environmental conditions that are exacerbated by climate change; one of these conditions is building on permafrost, for which special foundation technology must be constructed (CMHC, 2008).

Furthermore, the location of Iqaluit, near the Arctic Circle causes most of the ground to be a mixture of layers of soil and permafrost. The permafrost layers, especially in the active upper parts of the ground, thaw during warmer seasons and freeze during winter which causes significant ground instability and movement. Such unstable soil conditions have made construction complicated and expensive because of the need for specialized foundations for each new building.

Most current foundation technologies have been designed taking into account the fact that these foundations rest on the permafrost layer. They try to reduce the amount of its melting by lowering temperature through different means. Resulting foundations typically last about 20 years. These technologies are temporary and will not be able to support their buildings when significant climate changes occur that result in more rapid melting of permafrost. Therefore, foundations must in some way be supported directly or indirectly by the bedrock underneath to ensure long term survival of the buildings.

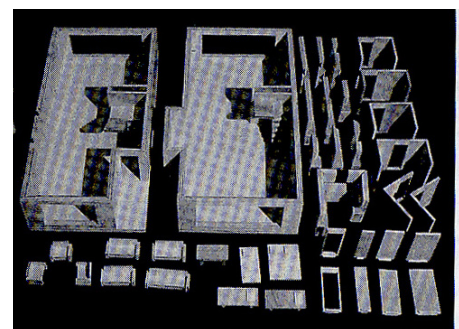
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2.0 Case studies

The following section explores some interesting case studies for architectural design solutions that are in use in various areas worldwide. These case studies can be divided into two main categories: climate/orientation and adaptable housing. These particular studies were chosen because they address similar challenges to those found in Iqaluit.

Climate and orientation-related factors are a key consideration for housing construction in the North. Erskine's Arctic City, and Children's First Centre in Inuvik were chosen because they each offer interesting insights in development methods in the North.

Perhaps the most important factor for housing in Iqaluit is the consideration to meet the socio cultural requirements for the predominantly Inuit population at the same time meeting the multicultural presence in the City. The Next Home, and the "North by North Housing" conceptual study takes a look at how concepts of adaptable housing may provide solutions to socio cultural needs.



2.1 Climate and Orientation

2.1.1 Erskines Arctic City

The Swedish architect, Ralph Erskine, inspired by many sea travels to both North Africa and the Arctic, went about designing urban patterns that would positively relate to the climate. His premise was simple: "In the arctic, it is important to catch the sun and avoid the breeze; in the heat it is equally important to avoid the sun and catch the breeze." Erskine's well-known project for an "Arctic City" carefully takes into account the climate conditions of its location as well as the social organization of its inhabitants (Continuous Construction 2009).

Erskine's design consisted of an inhabited wall structure raised on pilings above the permafrost and bent into a horseshoe-shaped ring that encircled detached family housing units. The Inuit would inhabit the houses in the centre and the wall structure would contain apartment units for non-indigenous people; it would be an enclosed communal area with shops, restaurant, and a library. A principle feature of Erskine's design is the semi-enclosed wall structure that acts as fortification against the elements. It essentially creates a microclimate intended to protect the houses within from prevailing winds (Continuous Construction 2009).

This case study served as an influence to implement a semicircular structure that protects the community from the prevailing winds, and helps brush the wind and snow away from the community. This is an alternative to using large expensive fences, as is common nowadays. Thus, the concept is to utilize programmed spaces and the buildings themselves to be oriented in a semi-circular form to protect the community rather any fence structures.

Erskine's arctic city was also designed to be placed on the south side of a hill which helps further protect the community from the prevailing winds. Unfortunately, Iqaluit's terrain and possible sites for construction do not have a direct hill that could be utilized for this purpose.

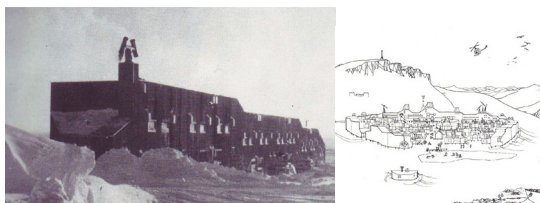
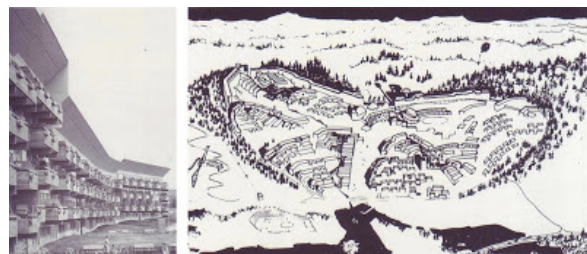


Figure 12 - Erskine's City in an Arctic Climate
Source: eng.archinform.net



2.1.2 Childrens First Center Inuvik

In Inuvik, Northwest Territories, the Children's First Centre is the only building in the community specifically designed for early childhood care. Inuvik's strength as a community, its remote location, and its extreme environment all helped shape the design of the building. The plan is oriented north-south to provide protection and shelter from prevailing north winds that are frequent in the Inuvik area. The plan of the building gently arcs around a central playground area that faces south in order to maximize solar exposure and to provide shelter against the cold northwest winds. The building design also maximizes solar orientation, bringing natural light deep into the building core in the winter. Classroom and group-use spaces straddle the south facing arc, while a covered walkway connects the active-use areas to the sheltered outdoor play area (Canadian Architect Awards, 2012). Due to the remote location of the project, where trees are scarce and too small for use in construction, most building materials are shipped from the south. Furthermore, the town of Inuvik is located in a region of continuous permafrost, a condition that necessitates a specialized adfreeze steel-pile foundation system. Using northern ingenuity, the project team was able to source 2,000 lineal metres of steel drill pipe abandoned by the oil and gas industry in the 1980s for use in the extensive adfreeze steel-pile foundation system.

The foundation also includes an exposed exterior cavity below the building. The fact that it is naturally ventilated means that it does not inadvertently transfer heat to the ground below; such transference would cause melting and shifting of the foundation. Due to the vented cavity and to interior crawlspace requirements that are typical of many buildings in Inuvik, the main floor will be situated approximately eight feet above the existing grade. Extensive earthworks and grading were required to gracefully provide barrier-free access to the raised building. Cladding will consist of a pine wood soffit, steel grate, corrugated metal siding, and composite resin laminate panels with colors inspired by the northern landscape.

The Children's First Centre served as a design influence as it has taken into account many of the important environmental conditions of Erskine's arctic city and applied them in a single building. The building is in a semi-circular form to help push away and protect the outdoor playground from the northerly winds. This semicircular building opens up on the south side to maximise natural sunlight from the south into the programmed spaces.

It is also important to note that the more active programmed spaces of the building are located on the South side. This influenced the placement of all the community programmed spaces on the South side to maximise natural light into them.

Another thing that was derived from this case study was the idea of a protected outdoor space in the centre that has constant sunlight throughout the year.

Considering the fact that the Inuit people have a lot of activities that involve the outdoors, I have dedicated a courtyard in the centre that is protected from the northerly winds and can be accessed at all times of the year.

Figure 13 - Children's First Centre in Inuvik, Kobayashi+Zedda Architects Inc.
Source: awards.canadianarchitect.com/?portfolio=childrens-first-centre



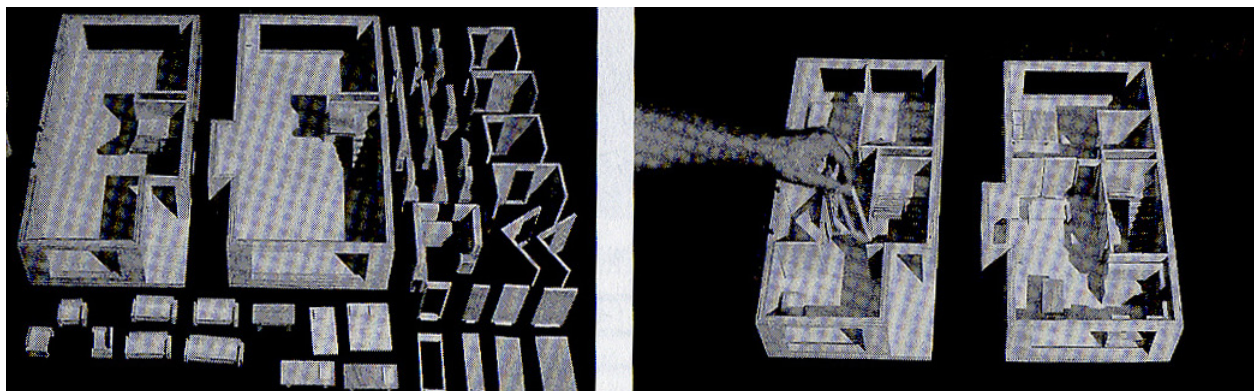
2.2 Adaptable Housing

2.2.1 The Next Home

The Next Home Design principles directly acknowledge the economic and demographic pressures currently facing North Americans. Builders can no longer ignore the new contemporary household with its diversity of interior design needs in their consideration of future housing prototypes. An essential design element is the realization that lifestyle-as one of the defining characteristics of people's lives as citizens, consumers, and householders- is a feature that shifts in accordance with a dynamic lifecycle process. A home that could be altered with a minimum of effort and expense at a time of change in the lives of its owners, whether through such a minor intervention as the rearrangement of furniture in a nonrestrictive space or through more vigorous modification such as the relocation of living or storage spaces, is a home that evolves with the lifecycles of its households rather than becoming rigidly obsolete in a conventional matter.

The Next Home utilizes prethought and modular components such as walls, kitchen cabinets, furniture etc. as its core concept, in order to create affordability and rapid customization by its occupants. The Next Home project is intended as an independent house for one family that would have spaces allocated for everyday living needs such as laundry, kitchen facilities, and storage.

Figure 14 - The North House -adaptive housing 1996
Source: http://faculty.virginia.edu/GrowUrbanHabitats/case_studies



In the north, where construction costs are high, space is a valuable resource and where houses are often attached to one another in the form of row housing, perhaps it would be a more efficient solution to have utilities as shared resources (kitchen, laundry and storage). This would eliminate the spaces for such programs within the individual dwellings themselves so that the occupants could maximize the potential for flexibility within their private dwellings.

The Next Home case study has influenced my design by proposing the use of modular interior wall panels that allow residents to change the interior layouts of units. This is a feature that shifts in accordance with a dynamic lifestyle process. The core concept of this is to create affordability and rapid customisation for residents. In Iqaluit maintaining a home or even making small adjustments to a house is very expensive due to the fact that there are no trades people and they need to fly from the south. This idea of providing interior wall panels that allows residents to change the layouts of the units is an ideal approach for the north. This is not only a more affordable solution but allows for customizations by a diverse population mix of Inuit and domestic immigrants with different needs. While the Inuit prefer more open concept spaces, domestic immigrants, on the other hand, generally prefer more fragmented spaces. This concept was also applied within the community programmed spaces and not just the residences, allowing for community spaces to reflect the specific diversity of a population.

Figure 15 - Avi Friedman and The Next Home
Source: Friedman, A., 'The Next Home:
Affordability Through Flexibility
and Choice open house



2.2.2 The North by North Housing

This case study is a contemporary take on what housing should be in Iqaluit and it would serve as an important resource to take note from because unlike earlier housing projects in Iqaluit this study attempts to figure out from scratch the core issues and elements that need to be addressed but also re-thought to make better housing. Avi Friedman realizes the importance of the socio-cultural needs that are currently

missing in existing housing found in Iqaluit. He has gathered interesting points to consider in terms of lifestyle and Inuit Culture, as well as important physical requirements that may be necessary to build in the north. Some of these cultural insights include the fact that Inuit are artistic in nature and enjoy creating works of art through stone. Therefore designated areas with easy access to toolsheds and storage would be a great consideration. These works of art also represent an important component of the economy among Inuit therefore it is important to provide an area to store and display these works of art where others can view and purchase. In addition Friedman highlights the importance of providing children's play areas and also areas where artists can create large scale stone sculptures. However demarcating an area like this conventionally would require an architectural feature such as bollards, pavement, fencing which are not feasible and would be a complicated matter because there is no legal framework that defines property in terms of land. The building in itself is considered property therefore it would be conceivable to theorize a way to circumvent this issue by designating a common area architecturally through the building itself. This may also tie in to the many environmental issues that Friedman mentions such as wind and snow accumulation (NBNH 2007).

Avi Friedman tries to make current housing approaches in Iqaluit better. He realises the lack of cultural touch within the current housing types. He dedicates additional spaces that are important for Inuit, such as workshops, to aid in their rich culture of stone work.



Figure 16 - The North by North Housing
 Source: Friedman, A., [1952-]. (2007). North by north housing Iqaluit, Nunavut, Canada. Canadian Architect, 52(3), 16-19.

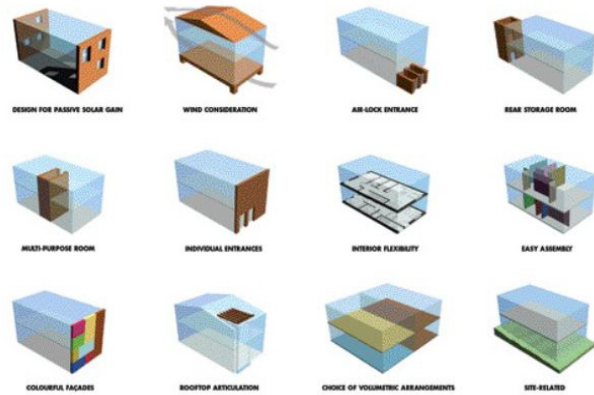


Figure 17 - The North by North Housing
 Source: Friedman, A., [1952-]. (2007). North by north housing Iqaluit, Nunavut, Canada. Canadian Architect, 52(3), 16-19.

As such, this case study influenced the design of dedicated workshop spaces for the community to utilize. The design also includes dedicated arts and craft spaces to allow local residents to create cultural artwork and display them in the gallery located on the south side of the building. The gallery area is also open to the public and can generate a source of income for the community.

Avi Friedman also emphasizes the importance of outdoor play areas. This, just like the Childrens first center helped influence the design of the courtyard in the centre of the community to allow all residents to part take in outdoor activities at all times of the year.

The first two precedents, which related to climate and orientation, influenced the overall design of the community. The community was designed in a way to protect the internal common areas from northerly winds, while the orientation of the structures was designed in a way to maximize sunlight for communal areas. Thus, these precedents served as useful examples that impacted the program layout.

The second set of precedents, which related to adaptability in housing, had a greater influence on the individual level. These examples helped shape the design to meet individual needs through the use of modular panels and customizable spaces. They also influenced the decision to make certain utilites shared, in order to maximize space and customization on a personal level.

COHOUSING

3.1 Introduction to Cohousing

According to the Canadian Cohousing Network, cohousing “describes neighborhoods that combine the autonomy of private dwellings with the advantages of shared resources and community living” (Canadian Cohousing Network, 2004).

Cohousing is a way of living that brings to individuals a greater sense of being connected to both community and land. Cohousing units are developments that are owned and managed by the community that lives in them. They generally keep cars on the periphery and have a centrally located common house that provides a center for community activity.

Cohousing started in Denmark in the late 1960s when a group of dual-income professional families were searching for better childcare and a way to share evening meal preparation. Nearly 300 projects have been completed in Denmark since the creation of the first community. In the almost 50 years since its inception, cohousing has matured and now embraces an intergenerational mix of family types. This makes it attractive to young families and single parents as well as to retired couples and singles (Hanson, 1996).

“In Today’s fast-paced world of competition and lonely individualism we need a place to belong, where we feel safe and supported. And yet when we need to get away, we need a place to be ourselves-quiet,seperate and secure.”

Chris Hanson

In the late 1980s the term cohousing, roughly translated from the Danish “Bofael- lesskaber” (living communities), was brought to the US. The idea resonated with many on this side of the Atlantic, and within months, many groups got started on the path to creating and living in a cohousing community (Hanson, 1996).

Cohousing developments may vary in size, location, type of ownership, design, and priorities, but they share some characteristics, including the following (Hanson, 1996):

- “Participatory process: Future residents participate in the planning and design of their community. They are responsible as a group for most of the final design decisions”.

Prior the design process the community comes together and discusses what is important to integrate into the design, what program is necessary and what layouts are most desirable. Scale, logistics and future possibilities are also discussed.

- “Intentional neighborhood design: The physical design encourages a strong sense of community. With central pedestrian walkways or village greens, cars are generally relegated to the edge of the project, and sometimes to underground parking structures”.

The cohousing design favours pedestrians over vehicles and ensures safety for children by creating safe zones from automobiles so they can play freely. Also it is at this stage where the final configuration of the community is chosen based on the needs of the community and from the surrounding site conditions. Walkability is integral rather than ease of access to car, this contradicts the usual suburban design of a house and garage side by side and encourages exchanges between neighbours. This design promotes community interaction rather than isolating the individual by one solitary unit.

- “Private homes and common facilities: Communities are generally designed to include significant common facilities, however, all residents own their own private home that includes a kitchen. As an integral part of the community, common areas are designed for daily use and to supplement private living areas”.

Community areas are to be placed in close proximity to the individual housing units so that people can gather with ease of access at central location to the rest of the developments. these common facilities include additional spaces that would be too costly to incorporate within each dwelling, such as game rooms, large storage spaces, and other communal gathering spaces. These common spaces again promote interaction and encourage community life. The design would provide opportunities for social exchanges, collaboration in the work and creative spaces and essentially ensure a support structure that does not exist without outside organization in city neighbourhoods of the south. These outside organizations would be small foundations, associations, non-governmental organizations, businesses and government funded groups.

- “Resident management: Unlike a typical condominium homeowner’s association, residents in cohousing usually manage their own community after they move in. They make decisions about common concerns at regular community meetings”.

Community meetings are designed to resolve issues among neighbours, promote community activities, safety and maintenance of the premises as well as other community outreach opportunities for example gardening and carpentry projects. These meetings ensure that residents do not feel excluded from the important daily running of the cohousing, but also provide a much needed outlet where people can vent their grievances and contribute their own ideas on how to benefit or improve the community.

- “Non-hierarchical structure and decision making: It is said that “there are leadership roles, but not leaders in cohousing”. Decisions result from community consensus”.

During the community meetings and gatherings some people are chosen by the community to have an important role in making decisions that affect the entire community. Typically people are elected to be in charge of different positions

which are assigned with specific obligations that oversee the smooth operation of the community project.

- “Optimum community size: Communities seem to work best when they contain between 12 and 36 dwelling units. Smaller or larger groups can work, but they have special challenges. Some are too intimate, or have limited funds for common facilities. Others are too big to allow residents to get to know everybody, or too administratively complex”.

Cohousing groups smaller than the optimum size, result in the community being more demanding because the residents would be more dependent on one another. For example, if a member is in charge of a specific priority within such a small group, this would limit the community to also participate in that specific priority because that one member would be sufficient enough. In addition, small cohousing community residents often find it difficult to maintain the energy and spirit to organize common activities over many years. Communities that are within the optimum size can captivate many degrees of involvement and thus resulting in a healthier longer lasting community.

- “Purposeful separation from the car: In addition to intentional neighborhood design, separation of cars from dwellings is a key feature of successful cohousing community design. Interaction is more effective when cars are parked away from private residences”.

Assigning a specific space for the car and removing it from close proximity forces the community members to walk within their community thus allowing more interactions to take place between neighbours and encourages socialising. This eliminates the idea of people leaving their dwellings and escaping into their car without the opportunity for chance encounters.

- “Shared evening meals: Cohousing groups usually choose to share several evening meals together each week in their common house. This tradition started with the early communities in Denmark and it effectively brings residents together for a convenient and pleasurable time of fellowship and sharing. Decisions about menus, who cooks and how often, who pays for meals, and so on are managed in a variety of ways. The level of participation also varies from group to group”.

Communities take every opportunity to come together to socialize and the sharing of bread is just one more way to promote encounters, meet new and old friends on a weekly basis. With the communal kitchen this shared space provides yet another place for engagement and exchange of ideas not only recipes.

- ‘Varied levels of responsibility for development process: The control of design decisions and the responsibility for the development process vary from one group to the next. Some groups maintain complete control and do their own development. Other groups have limited input into the development process and simply purchase the final housing product”.

There are many cooperative communities and some do not follow the most common characteristics listed previously, of these the most prevalent idea is that the community is built without the input from its future inhabitants and most purchase a unit only after the development is already built. This kind of development comes to fruition without the help of its community however it is important to note that the community comprises of people who believe in the idea of cooperative housing and this is proven because of their decision to join, invest in and contribute to that type of neighbourhood.

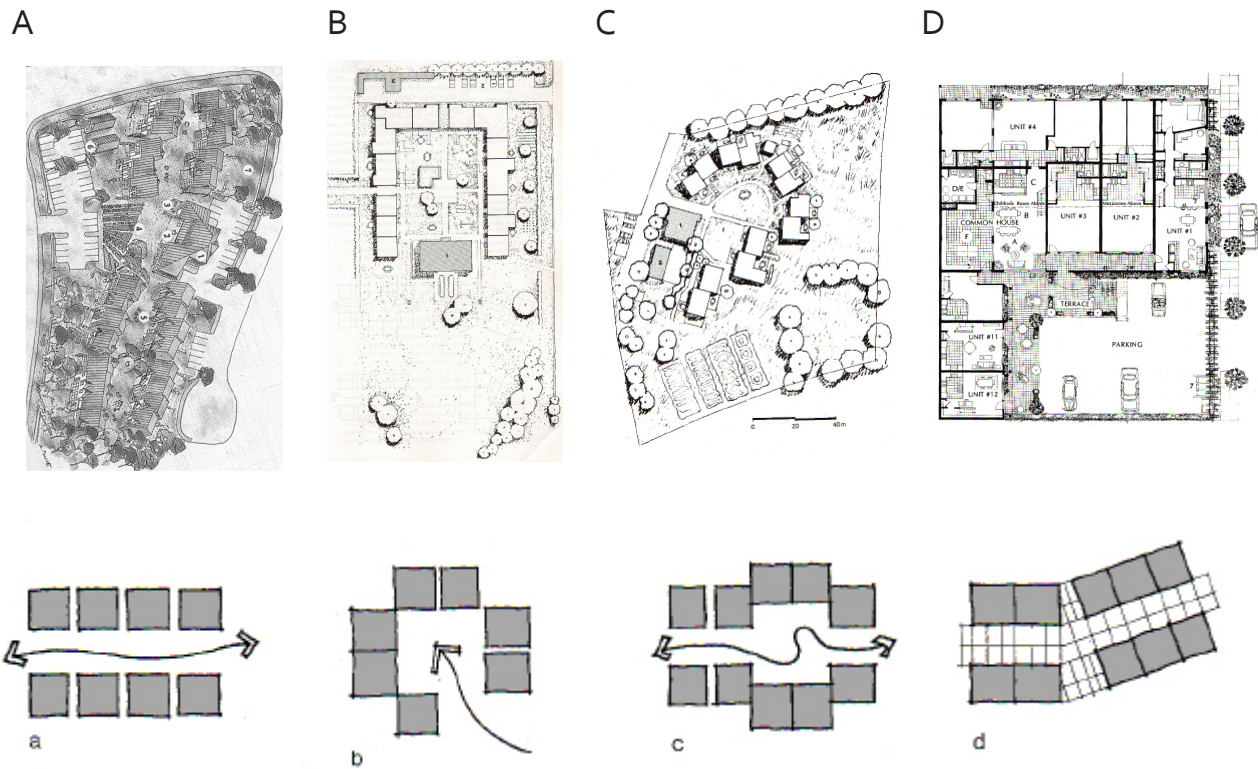


Figure 18- Four configurations for Co-Housing
a)Emphasizing pedestrian walkway
b)Central courtyard orientation
c)Pedestrian walkway and courtyard ideas combined
d)Covered environment

Source: The Cohousing Handbook

Figure 18 displays the four most common configurations for a cohousing structure (Hanson, 1996).

In North America more than 65 cohousing communities have been completed, and hundreds of groups are meeting regularly, trying to realize their projects (Canadian Cohousing Network, 2004).

3.2 Benefits of Cohousing and Parallels to Inuit Traditional

Aspects of Cohousing are parallel to Inuits traditional lifestyle

Hanson details some general points about the benefits of communal living.

(Hanson, 1996):

- 1) "Safe and supportive environment: In a world of increasing crime, it's nice to know there are people who will look out for each other. Since all residents know each other, strangers are spotted and questioned instantly".
- 2) "Opportunities for social interaction and collaboration: Many people are tired of being isolated; cohousing provides the option for regular human interaction without sacrificing privacy. Interaction offers Cohousers the opportunity to share their skills and talents—such as music, story-telling, cooking and gardening-- with other members of their community".
- 3) "Sharing resources: By sharing resources, people living in cohousing have access to many more facilities than they would on their own. Gardens, play areas, workshops, darkrooms, crafts rooms, lounges and kitchen and dining areas are often part of cohousing common facilities".
- 4) "Raising children: Given the stress of modern parenting, cohousing is an ideal way to raise children with support from others and this is true especially of single parents. It provides children with safe places and appropriate facilities in which to play outside of their homes. Their playmates are members of the community and parents share child-minding duties with others".
- 5) "Environmentally friendly: Sharing resources with others puts less strain on the environment. Working as a group, there are more opportunities to reduce, reuse and recycle".

Cohousing shares with traditional Inuit housing lifestyles the sharing of resources within a community. However, whereas the Inuit lifestyle derived from cultural traditions, the western concept of co-housing arose out of practical need among families in a community whose members were not necessarily related to one another. When co-housing first started in Denmark, several families needed someone to look after their children during the day while they worked. Community members decided to pool their resources and children were minded in a communal day-care concept.

The lifestyle of Inuit in Iqaluit today is very different from that of their ancestors. Historically, the Inuit were divided among various settlements across a large expansive territory. There was no centralization but rather intimacy within each community. Present-day Iqaluit is a concentration of people in one large city, a western-style hub that arose without much regard for its local Inuit inhabitants. This single centre contains a much larger population than that of traditional Inuit communities. A single Inuit resident may not form an effective connection to his community but may feel rather lost in this Western-style societal structure. The strange paradox arises of Inuit living among a larger population, yet feeling more alone and isolated.

Iqaluit could benefit from the regaining of traditional values within the framework of a western cohousing model. The city could be decentralized into many communities; within each of them, people would share stronger bonds and yet at the same time belong to the greater whole of Iqaluit.

Northern Housing Project

4.0 Design Strategy

The following sections include the design proposals. Subsequent sections detail development strategy, site selection and design solutions.

Cohousing Goals

The following cohousing related goals developed by Hanson could be adapted to our proposed development in Iqaluit (Hanson, 1996):

General feel

- Encourages a sense of community
- Feels like home
- Facilitates privacy as well as community
- Shows reverence and respect for our part of the world
- All-encompassing sense of nature
- Feeling of warmth and physical comfort

Sustainability

- Allows for opportunity to add appropriate technology later (as new technology evolves)
- Encourages saving money
- Allows for expansion of some homes
- Reduces need for driving and commuting

People/relationships

- Safe environment for families and children of all ages
- Encourages flexibility in lifestyles

As a designer, I would like to explore these ideals of cohousing and to identify how they can meet the needs of the Inuit people through architectural design.

4.1 Population Growth

An important consideration in the assessment of development strategies for the city of Iqaluit is a review of its population growth. In recent years, Iqaluit has experienced rapid population growth. The 2006 Census recorded a population of 6,184, an 18.1% increase since 2001. This made Iqaluit the fastest growing community in Nunavut. It was also among the 15 fastest-growing communities in Canada between 2001 and 2006 (General Plan 2010).

Nunavut has the highest fertility rate and youngest population in Canada, giving it the distinction of having the highest rate of natural increase in the country. The 2003 Iqaluit General Plan projects population growth to the year 2025, as depicted in Figure 20. A medium-growth forecast was used as the basis for this plan. It estimated that the population of Iqaluit will reach 11,326 in 2025, assuming an annual average growth rate of 2.97% (General Plan 2010).

Population growth and housing challenges have led to a severe housing shortage in Iqaluit. According to the 2006 Census, there were 2,460 housing units in Iqaluit and the average household size was 2.9 people. At 2.9 people per household, the average household in Iqaluit is smaller than in Nunavut as a whole (3.7), but larger than the national average of 2.5. Based on household averages and projected population growth, the target number of required housing units will be 4,500 by 2030, as per Figure 19 (General Plan 2010). This means that the target number of required housing units per year will be 187. The housing shortage in Iqaluit will only worsen if changes are not made.

Housing Projections

Projection	Total units needed by 2030	Current supply of units*	Additional units needed by 2030 (Total – Current)	Average Units / year
Low	3,730	2,829	901	43
Medium	4,500	2,829	1,671	80
High	5,043	2,829	2,214	105

Figure 19 - Housing Projections
Source: Iqaluit General Plan By-law

Population Projections to 2022 in 5-year increments

<i>Year</i>	<i>Low Projection¹</i>	<i>Medium Projection²</i>	<i>High Projection³</i>
2006	6,520	6,520	6,520
2007	6,802	6,802	6,802
2009	7,082	7,198	7,270
2010	7,226	7,405	7,516
2015	7,993	8,532	8,877
2020	8,842	9,830	10,484
2025	9,780	11,326	12,382
2030	10,820	13,050	14,625

Figure 20 - Population Projections to 2022 in 5-year increments
Source: Iqaluit General Plan By-law No. 703

4.2 Location and Site Selection

The following section discusses the site selected for development of a new housing project to address the housing shortages in Iqaluit.

The selection of a site for my proposal necessitates knowledge of the history of building development in Iqaluit. It is also important to consider the limitations and opportunities presented by the conditions of the city in its current state. Both of these considerations are reviewed here through the use of an overall map of Iqaluit that features graphics representing key factors.

The original inhabitants of Iqaluit settled on the land now known as Apex; it is located on the south-east part of the current city. After World War II, the United States set up a military airport; its runway is still being used today. A small community started to form around this airport and it became the core of the current city. In subsequent decades, the native population of Nunavut increasingly migrated to Iqaluit, and the area near the harbor in this core was developed with housing units. As Iqaluit started to become a central hub towards the end of the 20th century, peripheral housing developments populated by domestic immigrants from across the country began to spring up toward the east end of the city. Most of the new population consisted of federal government workers or scientific researchers. It is important to note that most of these domestic immigrants were from areas of Canada that had strong western influences. They brought with them western-style housing that did not necessarily accommodate native cultural needs. The building construction trend for the past two decades has been towards mostly residential development. A lot of the residential developments featured suburban detached and semi-detached houses. These houses occupied land that was increasingly distant from the city core. (City of Iqaluit, 2010).

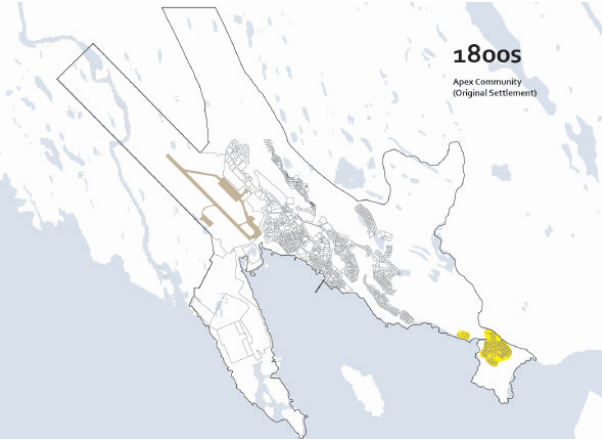


Figure 21- Land Development in Iqaluit
Source: Illustration by Serouj Kaloustian, 2013

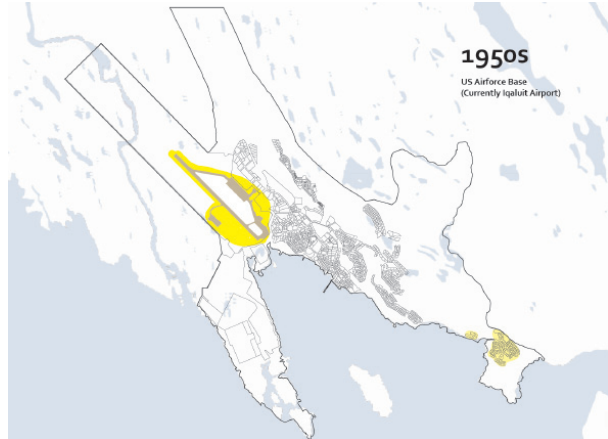


Figure 22 - Land Development in Iqaluit
Source: Illustration by Serouj Kaloustian, 2013

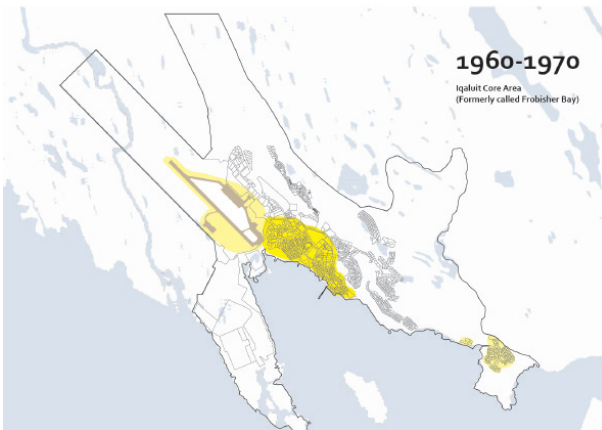


Figure 23- Land Development in Iqaluit
Source: Illustration by Serouj Kaloustian, 2013

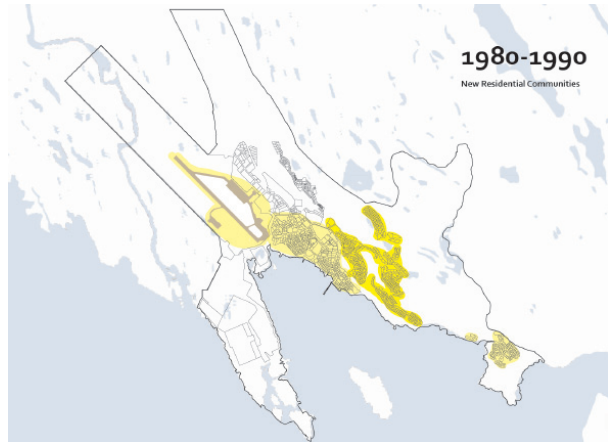


Figure 24 - Land Development in Iqaluit
Source: Illustration by Serouj Kaloustian, 2013

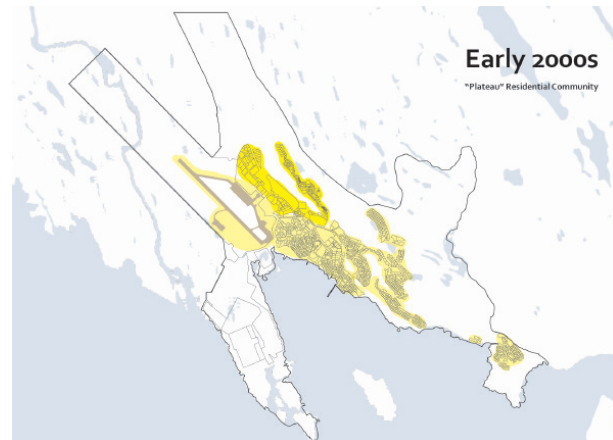


Figure 25- Land Development in Iqaluit
Source: Illustration by Serouj Kaloustian, 2013

In terms of the current conditions of Iqaluit we need to look at the opportunities and limits imposed by various circumstances. These include land use, city and natural boundaries, topography, circulation and infrastructure. The core of the city constitutes a mixed-use program that includes commercial and cultural points of interest. The north-west area of Iqaluit is mostly occupied by the airport runway and its infrastructure. The south-west end of the city is predominantly industrial. The east side of the city has been developed in the past two decades and is residential.

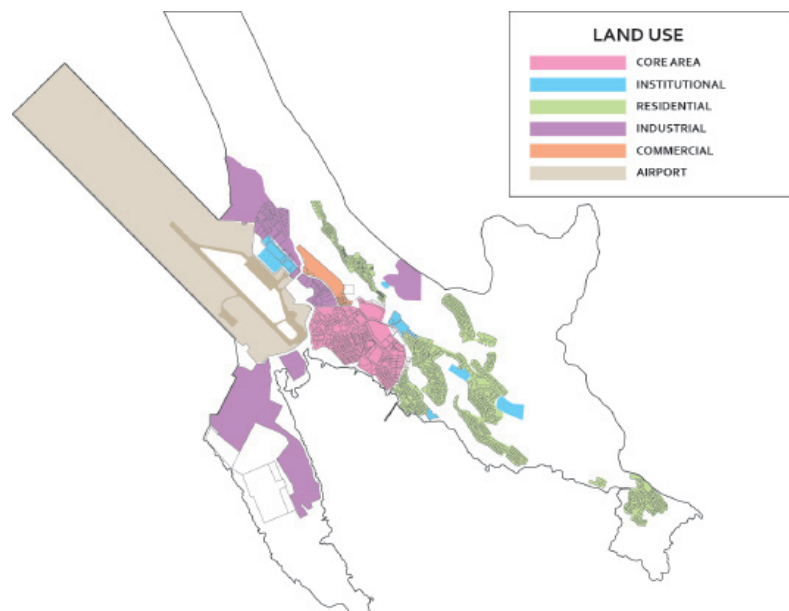


Figure 26 - Iqaluit Land Use
Source: Illustration by Serouj Kaloustian, 2013

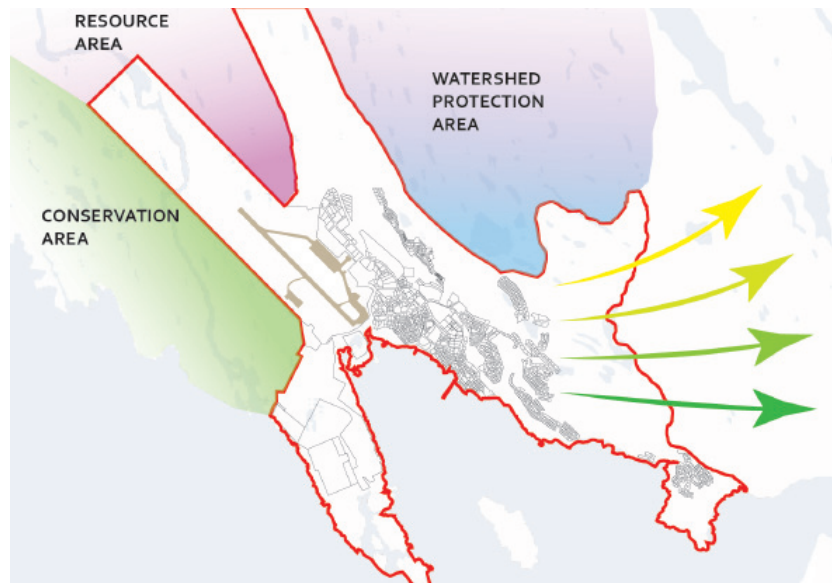


Figure 27 - Iqaluit Natural boundaries
Source: Illustration by Serouj Kaloustian, 2013

In general, anything outside Iqaluit's official boundary is restricted for development due to government-enforced preservation of natural land. In particular, the area directly north of Iqaluit where its main water supply is located is off-limits for development. The area west of the airport is designated for natural conservation and the north-west as a natural resource area for potential mining and industrial uses. The only area available for further residential development is therefore that empty area within the east boundary of the city towards Apex. However, even in this area, much consideration must be given to the natural topography of the land: it can only accommodate a horizontal development pattern since its topography is horizontally oriented as it slopes down towards Frobisher Bay.

In regards to circulation, Iqaluit has very few paved main roads that link together most of the neighbourhoods and secondary routes that are mostly dirt or gravel based. This is due to the fact that building roads is one of the most expensive projects for the city. This might also explain why Iqaluit virtually has no paved surfaces for pedestrian circulation such as side walks. This is evidently a very important obstacle for people to move around the city on foot. During the winter months snow can accumulate throughout the city creating a natural barrier for anyone without a car to travel. In other words, any new residential development would either have to be built alongside the existing road infrastructure or if new roads must be built they must use them very efficiently. There are currently two main paved roads going through the undeveloped east side of the city. One of these roads goes south east linking the town of Apex to the core of the city. The other aptly named "the road to no where" that goes north east toward the Tundra. These are two routes that development can potentially exist alongside.

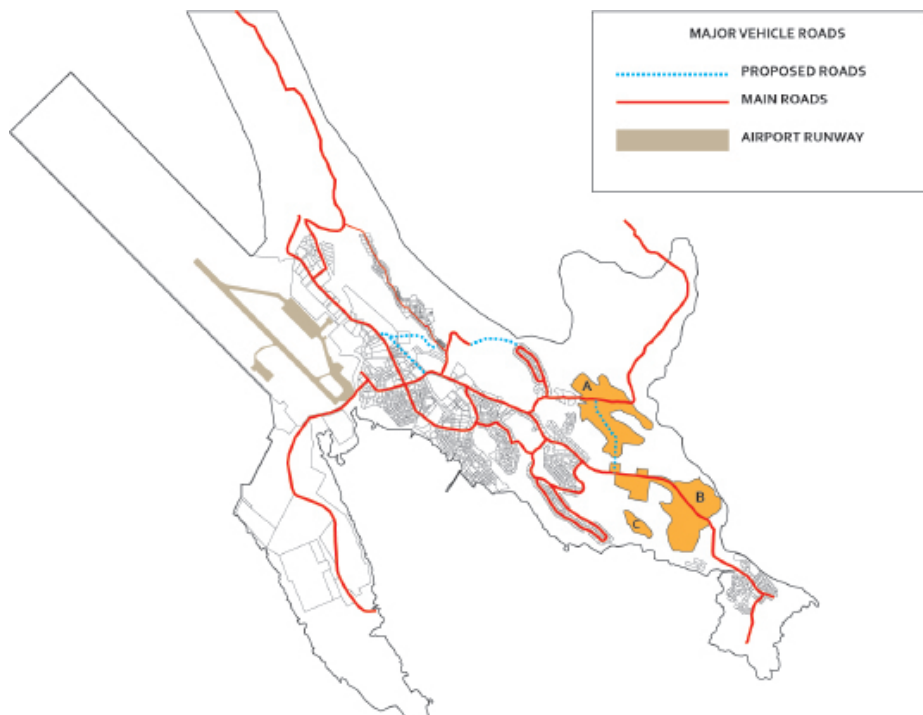


Figure 28 - Circulation
Source: Illustration by Serouj Kaloustian, 2013



Figure 29- Possible Sites for Future Development
Source: Illustration by Serouj Kaloustian, 2013

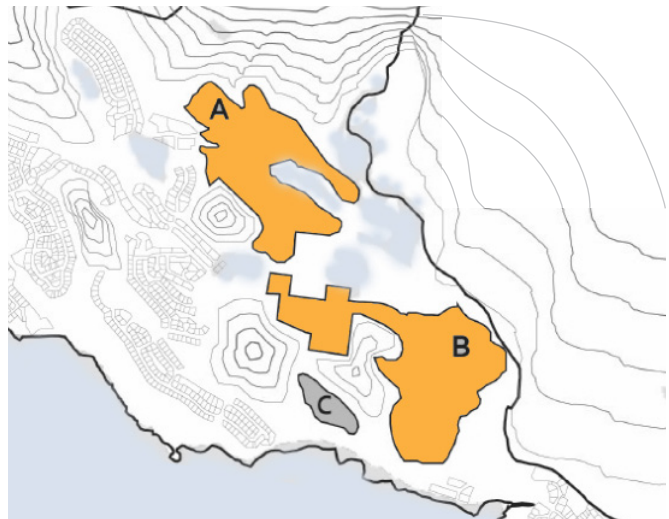


Figure 30 - Topography Surrounding the Sites
Source: Illustration by Serouj Kaloustian, 2013

As mentioned previously, the main water supply of Iqaluit comes from a lake reservoir in the city's north end that is situated at a higher elevation than all its built parts. Several water booster stations are spaced at intervals to pump water throughout the city. Each booster station has a certain radius around which it can pump water; therefore, the further away from the lake reservoir a development is, the more boosters it will require to maintain its water supply. Another consideration is that it is very inefficient and expensive to pump water up a slope. So any new development will have to be located at a lower elevation than the booster station serving its area. Based on information regarding land use, city and natural boundaries, circulation and infrastructure, the two main areas with development potential are in the city's south-east; these are marked as sites A and B in Figure 31.

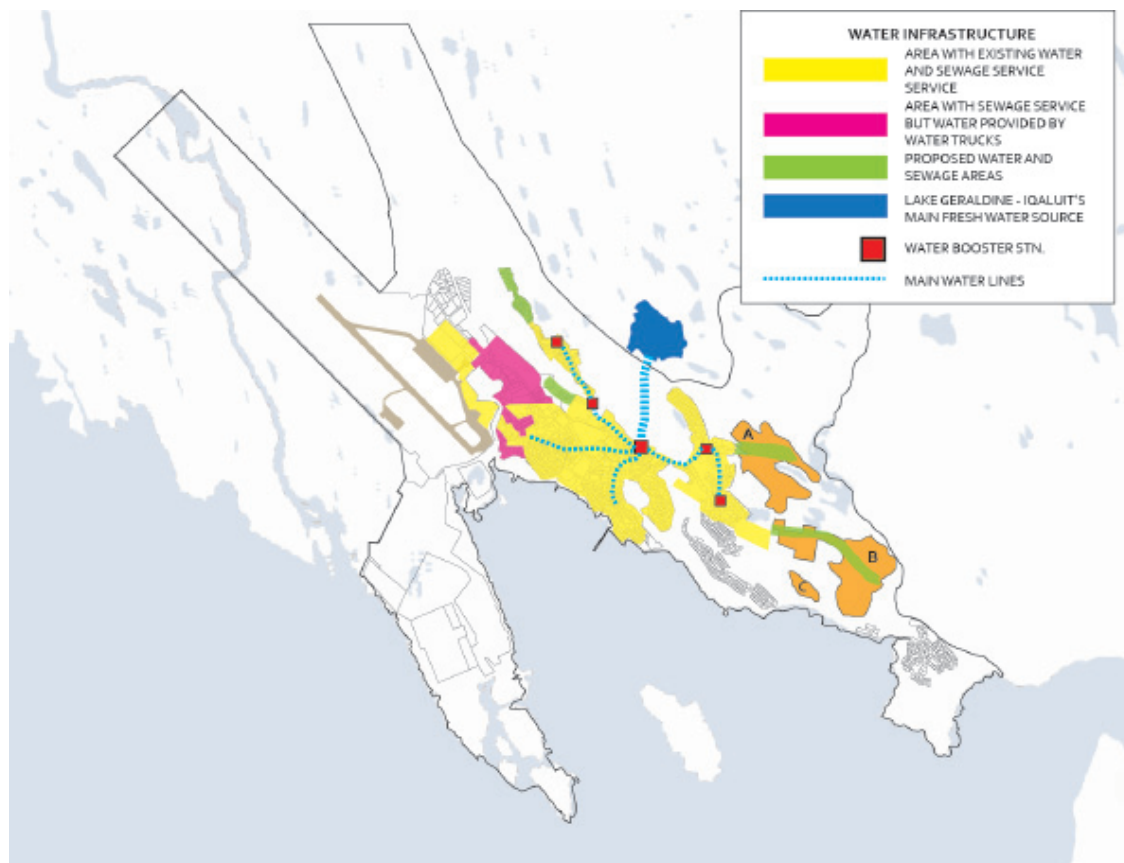


Figure 31 - Iqaluit Infrastructure
Source: Illustration by Serouj Kaloustian, 2013

From a climate perspective, the development neighboring Site B (which was built within the last decade) has an experimental wind and snow barrier fence on its north side to block wind-blown snow from the north, as seen in Figure 32. Such barriers have been recently introduced in Iqaluit. They are expensive and also their efficacy is currently unproven. They will be considered in the production of my design for this site.



Figure 32 - Snow barrier fence
Source: Photo by Serouj Kaloustian, 2012

4.3 Design Considerations

The following section outlines the development of a design for new housing structures in Iqaluit that will incorporate solutions to a number of the existing challenges. Based on the consultations I conducted in Iqaluit, I feel that the housing issue can only be solved by addressing several major interconnected factors. These factors are manufacturing/assembling, labour force, climate conditions, building technology and culturally appropriate housing.

From a logistics perspective, one of the main factors to address is cost reduction. This can be achieved primarily through reducing labor costs. It would involve training and hiring skilled local tradespeople rather than flying them in from elsewhere. Also, the use of easy-to-assemble modular materials would decrease labor hours and also training time for workers.

From the perspective of climate, one must consider the strong northerly winds that ravage Iqaluit during the winter. Housing structures must incorporate well-insulated windshields on the north side. These windshields must be designed not only to provide internal insulation but also to direct wind away from exteriors. It is also important to consider that winds coming from the north can disperse over a wide area and do not land only on the north sides of structures. It would be ideal for the structure to surround a common area like a shell and block winds from every direction, thereby creating a more hospitable living environment.

From the perspective of culture, our strategy will address many of the cultural challenges the Inuit have faced with westernized housing. Living quarters should not be as compartmentalized as before, and areas must be allocated for such Inuit needs as meat preparation and storage, machine repair, and smoking. The project will be flexible in regards to providing spaces that can be used for a variety of purposes. The entire community will be surrounded by a wind shield that encloses a circular common area. This circular form is symbolic of the decentralized group governance found in Inuit societies.

New developments in Iqaluit have been mainly residential due to the high demand for housing there. As the population continues to grow, houses and new developments tend to be increasingly located distant from the city centre (which constitutes the only mixed-use area). Although Iqaluit isn't very large, heavy snow becomes a significant hurdle to pedestrians during winter months. The concept of cohousing will allow community residents to be more self-sufficient even under adverse weather conditions.

My proposed strategy is to create a hybrid of western cohousing and traditional Inuit lifestyle. This hybrid will be responsive to Iqaluit site conditions and serve as a model for a community.

From the perspective of infrastructure, Iqaluit's most valuable resource is its system of expensive paved roads. A new community must either utilize these roads to the utmost or lay out new ones with particular regard to efficient use, for instance, by the creation of shared parking lots that would eliminate the need for car owners to drive up to individual houses. Such a layout would help promote a pedestrian-friendly community and result in mixed-use development at its centre. There is also the consideration that cars and gas are expensive commodities that most of the population can't afford.

As noted in previous sections, construction in Iqaluit is very expensive due to climatic and logistic issues. The development of every square foot is significantly more expensive than in more southerly cities. A concept like cohousing would greatly benefit the population by reducing individual home costs by means of use of shared programs, for instance, kitchens, laundry and entertainment venues.

Since Iqaluit has a strong winter wind problem and since cohousing is based on the concept of shared resources, individual communities need a common infrastructure that will defend against northerly winds and wind-blown snow. In order to be economically feasible, the infrastructure should not be separate but rather a part of individual homes.

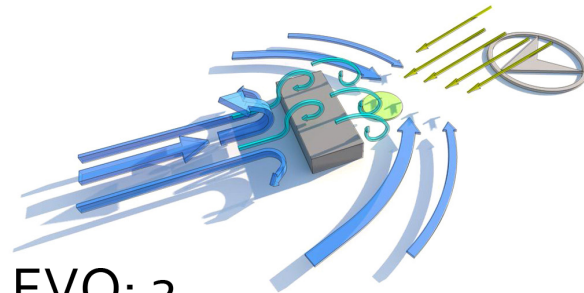
Considering that northerly winds are often the biggest enemy to development in the North, I have taken into account that a facade in a semicircular form would allow the wind to blow over and away from the center of the community, thus protecting the central communal space from heavy blowing winds and snow pile-up.

The form is specified as semicircular. It would have an opening on the south side in order to harness the essential resource of sunlight, which is very scarce throughout much of the year.

EVO: 1

EVO 1

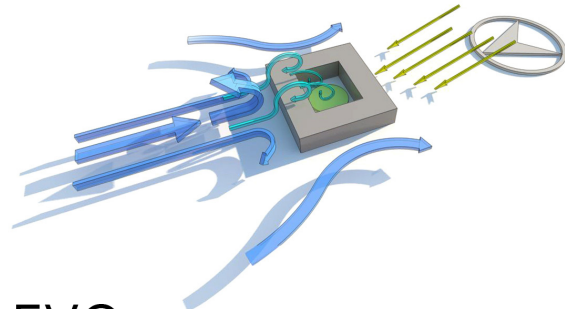
Explains how heavy winds can also approach the community from the east west depending on the surroundings. Due to this, precautions need to be taken to avoid any turbulent winds coming into play outdoors.



EVO: 2

EVO 2

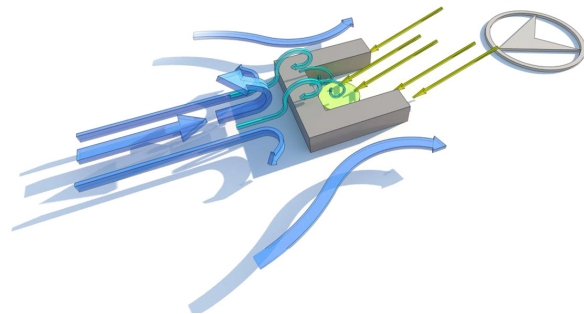
Explains how the building is now completely surrounding the outdoor courtyard to stop any strong winds from approaching it. However this blocks off the sun from the



EVO: 3

EVO 3

Due to the fact that no wind approaches the community from the south, it is crucial that part of the building on the south side be removed to bring as much light as possible into the community at the same time as it manages to protect it from prevailing winds striking from the north side.



EVO: 4

EVO 4

The physics of wind explain the fact that when wind hits a rough straight-edge surface like in EVO 1 it will introduce a lot of force and pressure to the north side of the building. It will also cause turbulence once it hits the building and this may result in turbulent winds striking the community courtyard. It is crucial that strong winds pass over the building. This is achieved by making the building in a circular form, to help the winds smoothly pass around and over the building if needed.

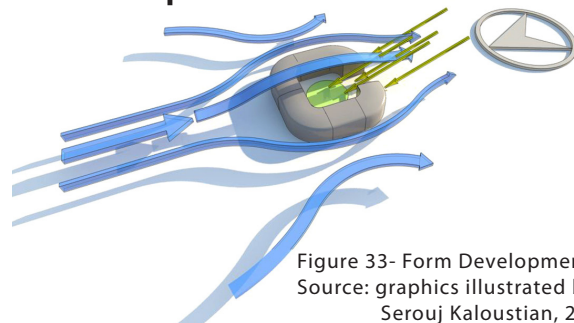


Figure 33- Form Development
Source: graphics illustrated by
Serouj Kaloustian, 2012

Based on the population census and housing data presented in Section 4.1, I will develop a program to meet the challenge of the Iqaluit housing shortage. According to this data, one hundred eighty seven units will be required per year to meet the demand of the population growth.

According to Iqaluit building-use statistics, the ratio of residential to other uses within the city is 65% residential to 35% other. This proportion was scaled to aid in figuring out the cohousing program. To further expand on this program, this thesis will in addition use ratios derived from major-use categories (residential and other). This program uses charts to demonstrate the percentages related to specific uses that were utilized.

The chart shows that the program's residential category is subdivided into further categories that include types of family structures. It is important to accommodate a housing system that will meet the demands of all types of families and at the same time reduce expenses. In order to keep construction costs down, all units must be of a modular size and also be capable of being expanded if necessary, for instance, by placing interior wall layouts so that they connect several units to form one larger unit.

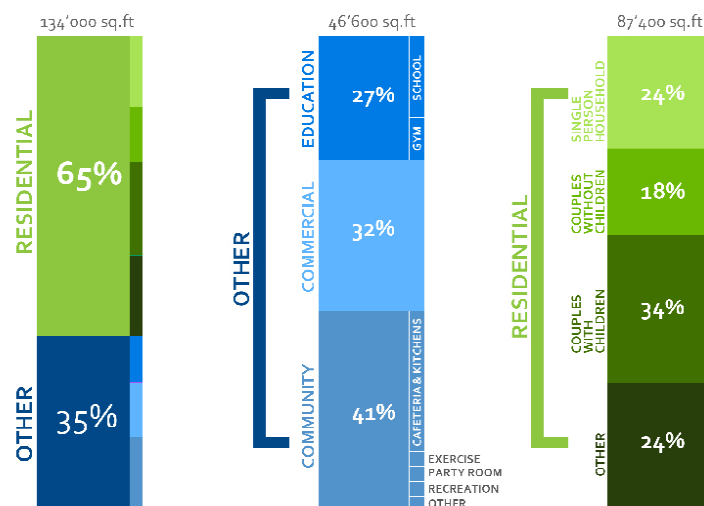


Figure 34 - Design Proposal Programs
Source: Illustration by Serouj Kaloustian, 2013

Northern Housing Project

5.0 Design Proposal

The subsequent sections discuss various elements of my design proposal.

The proposed housing community design is a semi-toroidal form with four corners. This form surrounds a common exterior area in the center and has a large opening on the southern side to help maximize entrance of low-angled sunlight into it, as well as to bring light into the units on the north side. The exterior façade is essentially a wind barrier designed to direct wind and wind-driven snow from the north away from the central space, in order to make it safe for community members. The exterior façade will be made out of an efficient insulating wall mostly made of fiberglass sandwich panels that will reduce cold bridges as much as possible. This will provide for very limited window openings. Glazing on the south wall of the units will allow for maximum entry of southern light.

In terms of scale, the development will have a total of approximately forty residential units divided into three levels built into the windshield super structure. Every level will accommodate such utilitarian programs as kitchens, laundry facilities and storage that will be shared by everyone living in the community. The remaining major program will be dedicated to shared communal spaces for such purposes as meetings, parties, exercising and commercial endeavors; these will be situated on the south side as close to the street as possible. This way the community has a safe and protected environment, yet remains open and welcoming to those outside it.

In terms of circulation, the three levels will be connected by stairwells situated in all four corners. Furthermore, every unit will be connected by a common catwalk on the inner side of the community and facing the courtyard. Limited parking will be provided within the southern opening nearest to the road. Thus, the community will be pedestrian-friendly but also still allow the option of traveling with a vehicle if necessary.

Each unit would be a modular size and dimension with built-in floors and ceiling tracks to which modular interior wall panels could be added or removed as necessary. Walls between units could be removed for horizontal expansion and floor panels could be removed in a predetermined manner for the purpose of vertical expansion.

Cohousing communities could be placed in any new development around Iqaluit near roads since water and sewage infrastructures could be placed alongside them with relative convenience. There is also the potential for several of these cohousing communities to be connected to one another through catwalks placed at interludes close to roads, thereby forming a broader streetscape.

The commercial and communal programs are situated on the south side near the street to allow social interaction between community members and members of other communities. It is also in this part of the program where residents could come together to make decisions on behalf of the community and where most social interactions would take place.

Just as traditional Inuit settlements had a central area where members shared their resources and skills, the plan provides a central outdoor area to be used by community members as a venue for sharing skills and engaging in outdoor activities. Programs such as the kitchen are not only utilitarian but also provide an opportunity for community members to share cooking skills. Access to mixed-use programs such as commercial and communal spaces will mean that community members do not have to travel far to meet the needs of their day to day activities. They will have more time and will be able to spend it more productively.

With regards to reducing living costs, one key area where this could be done is the reduction of the cost of housing itself. Architecturally, this means simplification of structures and designing them for economical use of resources. Simplification of the structure could be done by making modular units that are uniform throughout. Structural members could also be modular; for instance, exterior windshield sandwich panels could be mass-produced in a factory for cheaper costs and higher quality. Also, the use of prebuilt elements will mean that highly specialized labor from the south will not be necessary to put buildings together, again reducing total construction costs.

Building units into a superstructure will reduce the total area of walls that are exposed to the outside; individual units could conserve heating energy. The units themselves can be modified according to their family's needs in a cheaper way than conventional housing: interior walls can be moved around through the use of detachable wall panels. The images in Appendix A illustrate how each unit can potentially benefit from vertical circulation by the utilization of detachable floor panels and collapsible stairs.

All these measures help not only to reduce the overall living costs of community members but also to provide the option of affordably customizing the living environment.

5.1 Design Program

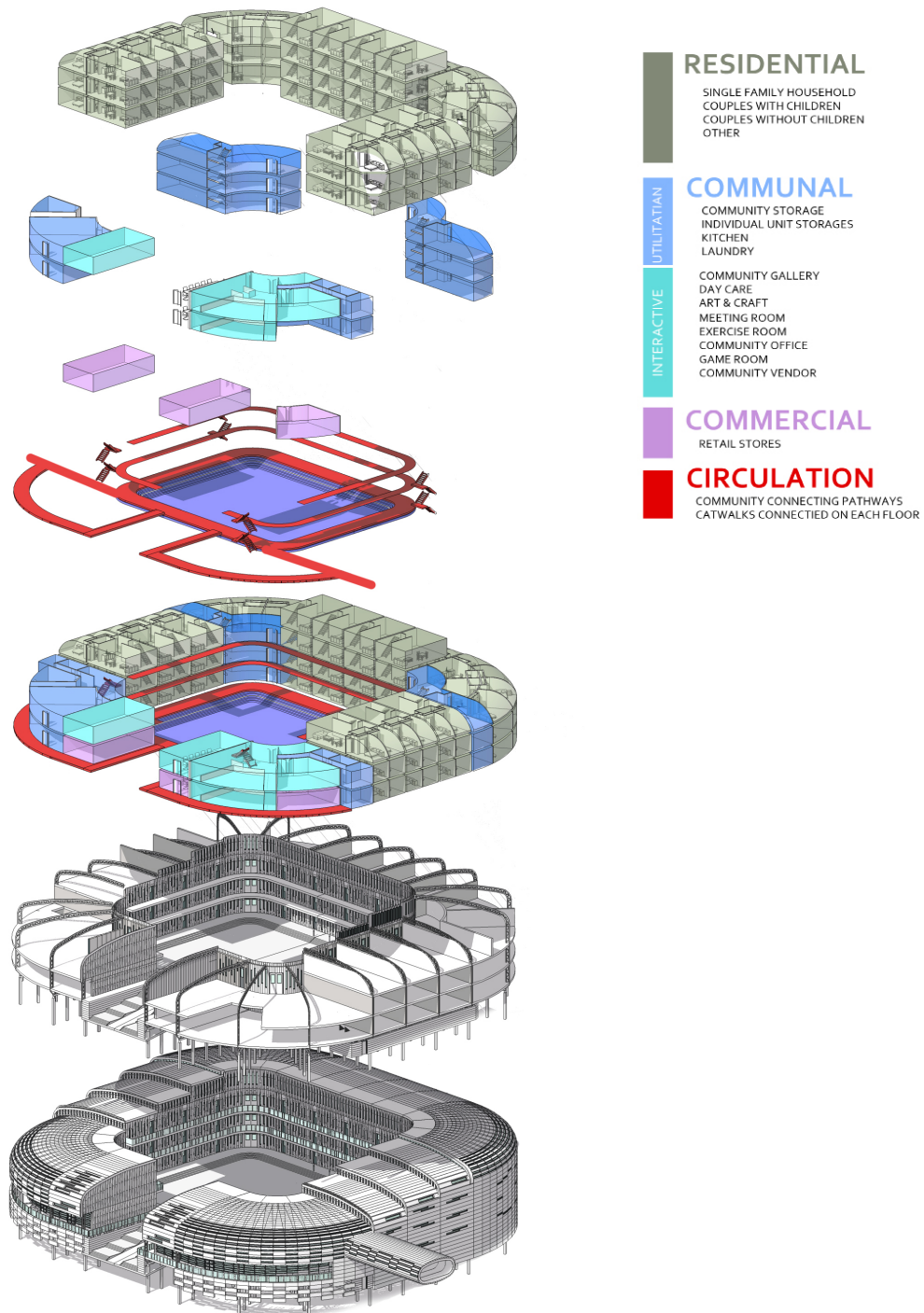


Figure 35 - Design Proposal Programs
Source: Illustration by Serouj Kaloustian, 2013

The cohousing community is divided into three main categories of program: communal, commercial and residential. The communal and commercial programs are essential to activity and culture; therefore they are placed on the community's prominent south side, its prominence being due to the orientation of sun and wind patterns. This requires the co-housing community to be placed on a north to south axis.

Communal

In the new design proposal, I have placed the communal program towards the south side facing the street. Community members will spend a lot of time in these communal spaces and therefore these spaces should maximize the entrance of sunlight. Also, having most of the activity happen closest to the street makes it easier to engage people on the street, and to make them feel active in their community.

Commercial

The community also has some commercial program aspects. The placement of retail spaces on the south side facing the street will encourage people on the street to shop locally. Also, having commercial spaces readily accessible will discourage people from going to the city core for purchases and make shopping convenient for community members.

Residential

Residential spaces are placed more towards the northern side of the complex and away from the street. This placement design is intended to provide more privacy to the units. The maximum number of units that could be found within each community is around 40. This makes for a community size suitable for a cohousing development.

In the following floor plans you can see how the program has been designed on each level. The first floor contains the same amount of residential units as the other two levels; however, it in addition contains the entire commercial program. This has been done for two main reasons:

- 1) It encourages people to purchase things as they leave or enter the community.
- 2) It encourages people walking through the street to interact with the community, whether socially or through commercial transactions.

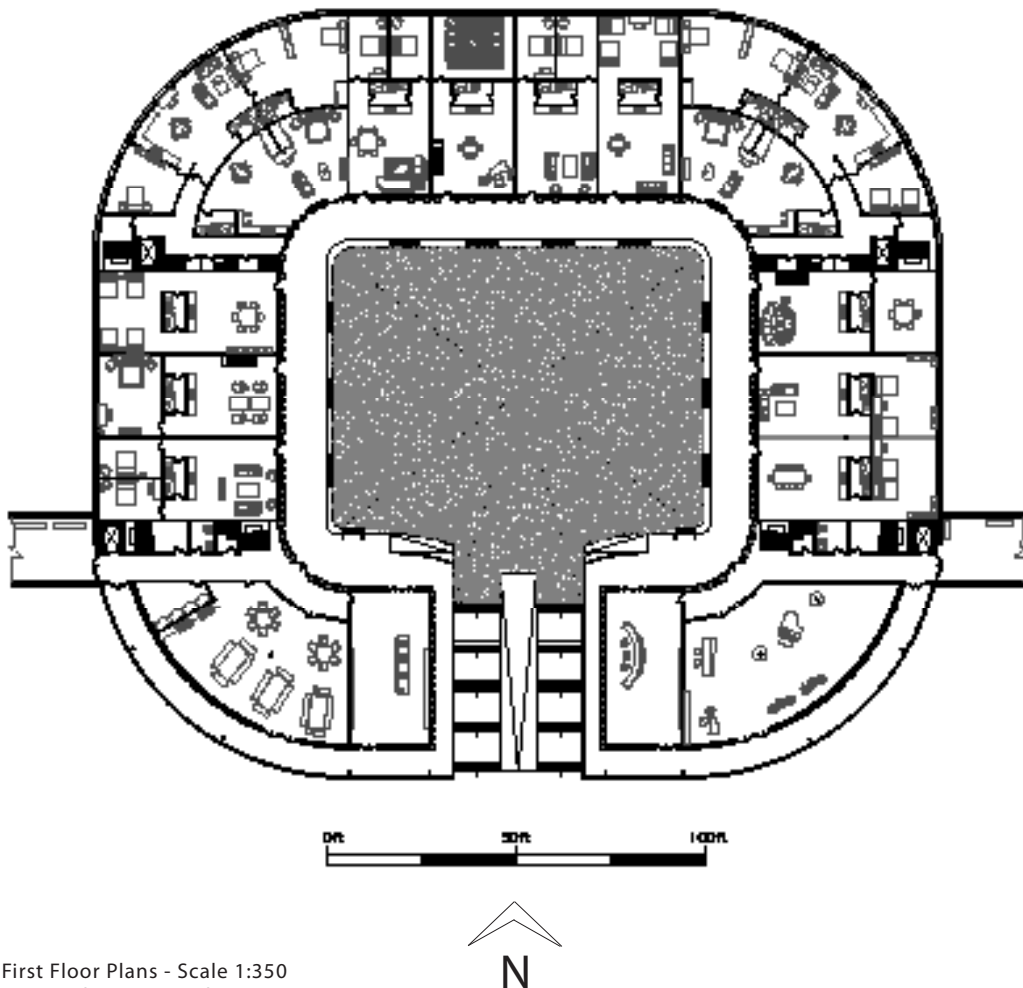


Figure 36 - First Floor Plans - Scale 1:350
Source: Illustration by Serouj Kaloustian, 2014

The second level contains the same amount of residential units as the first and third. Most of the program on the south side comprises community spaces such as a game room, arts and crafts room, day care, kitchen, and laundry. In these shared communal spaces, members can create art, watch movies, play cards and pool, cook together, study, etc.

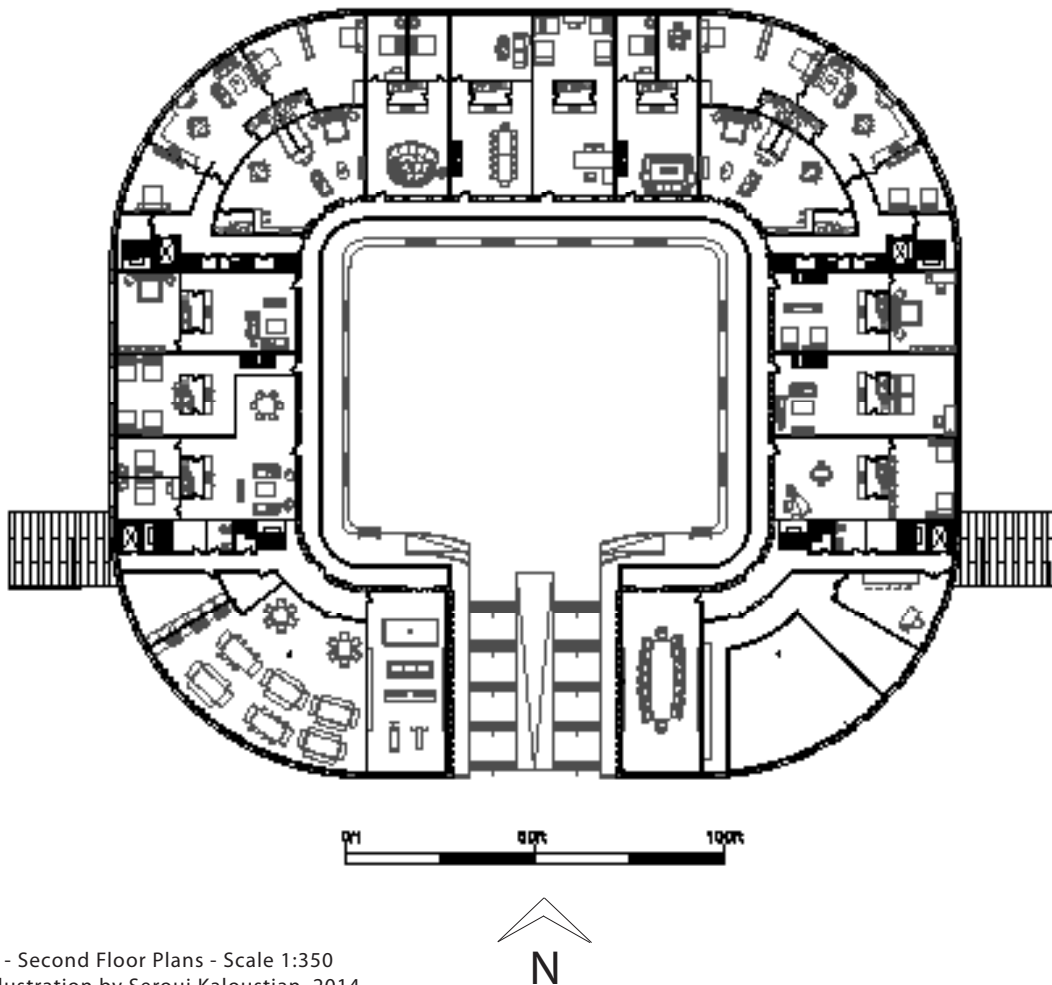


Figure 37 - Second Floor Plans - Scale 1:350
Source: Illustration by Serouj Kaloustian, 2014

On the third level are found the same number of residential units as on the lower levels. The community portion of the building has been moved due to consideration of the low winter sun angle; maximum sunlight is provided to all units, including lower-level ones on the north side. Figure #52 shows the sun angles and how it affects the units.

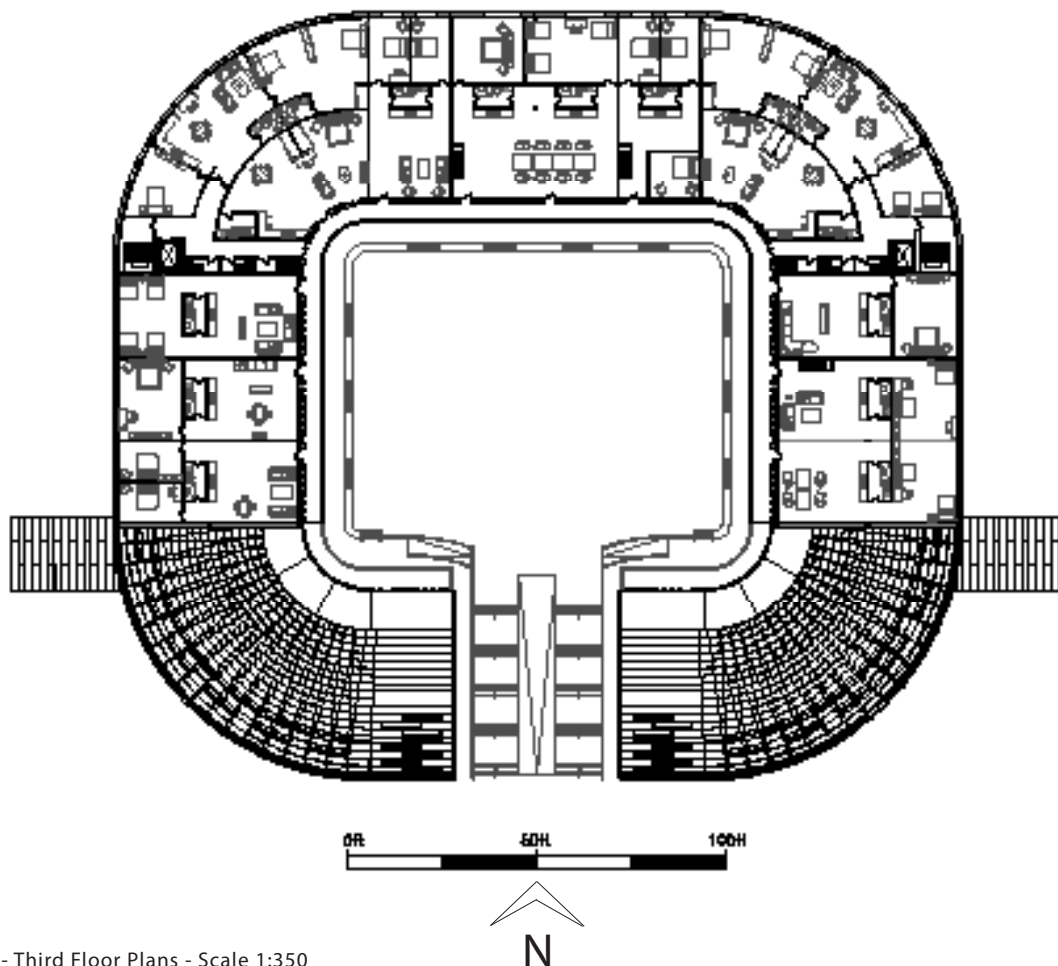


Figure 38 - Third Floor Plans - Scale 1:350
Source: Illustration by Serouj Kaloustian, 2014

The Tundra level, in other words the level of the street is where you will find the entrance to the parking garage which is hidden underneath the whole co-housing community as shown in figure #39 & 43. There are about 26 parking spaces available and few dedicated snowmobile parking spaces. On the east and west side of the parking there are the two entrance ways to the community for the residents, and between the entrance ways there are storage spaces provided for the residents.

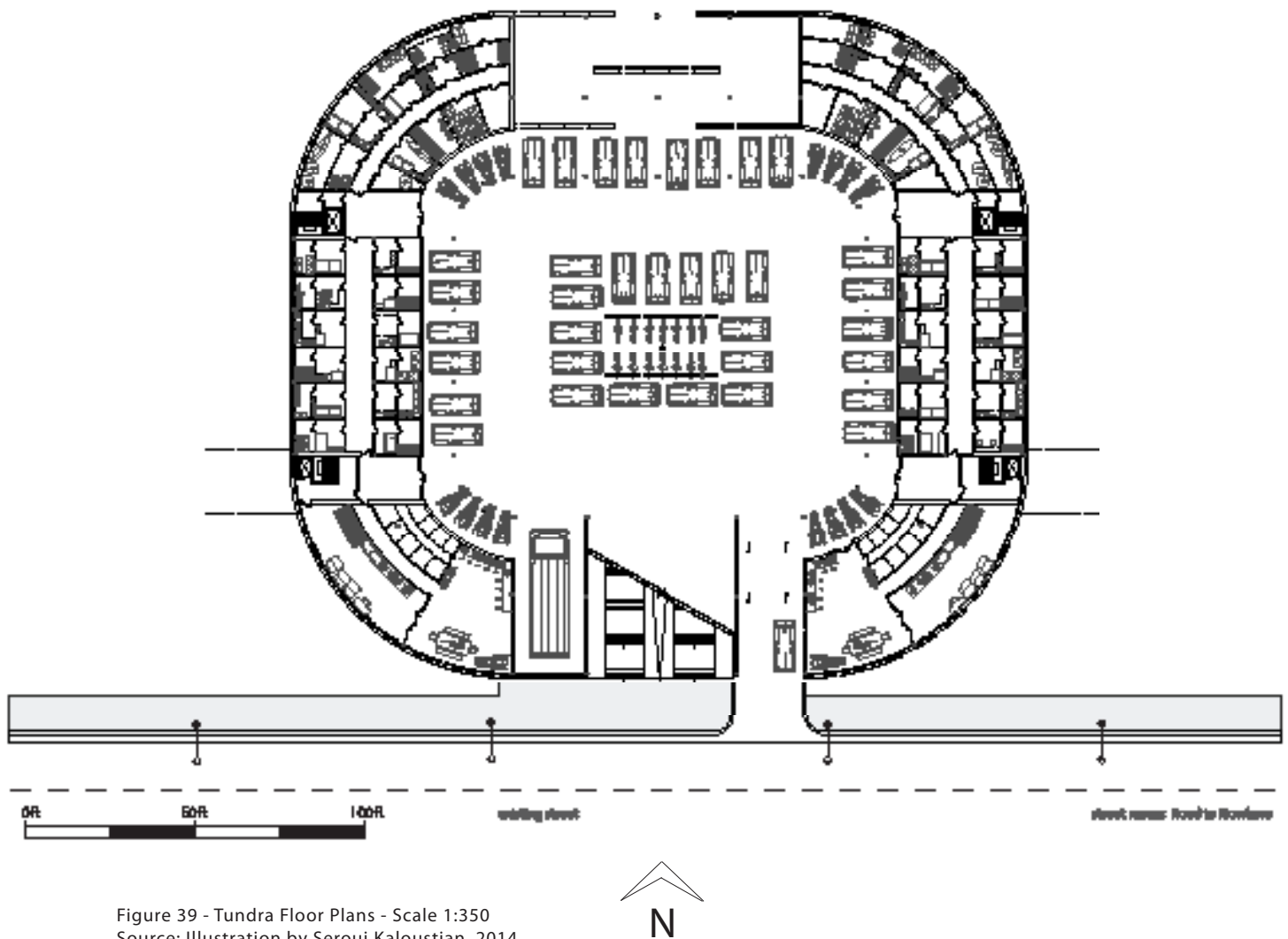


Figure 39 - Tundra Floor Plans - Scale 1:350
Source: Illustration by Serouj Kaloustian, 2014

5.2 Community Orientation

The city of Iqaluit's existing road infrastructure primarily runs horizontally east to west. There is a strong likelihood that future roads will also follow this pattern due to two factors: first of all, the land follows a mostly horizontal contour towards the bay on the south and it is more feasible to build roads that follow this contour. Secondly, the city's trend of expanding towards the town of Apex located to its east has resulted in east to west links between Iqaluit and Apex. Consequently, the default orientation of the cohousing community is most likely going to be on a horizontal road, much like as in the recent housing development known as "The

Figure 40 - Entrance for Residence

Source: Illustration by Serouj Kaloustian, 2014

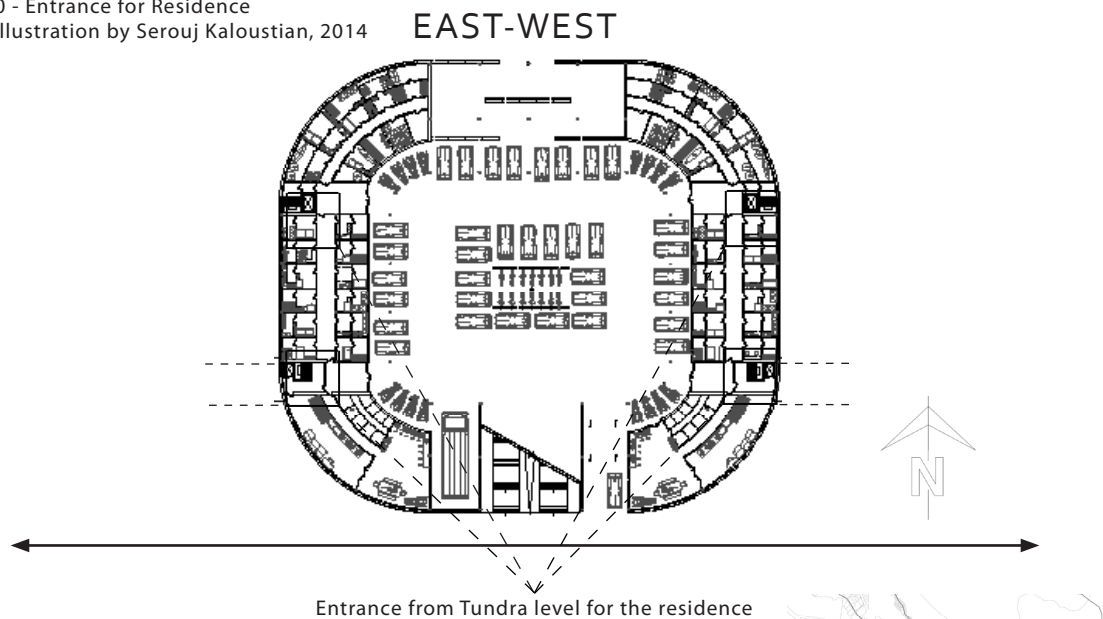


Figure 41 - City Plan with Communities - Scale 1:20000

Source: Illustration by Serouj Kaloustian, 2013



Figure 42 - Exterior Perspective of Communities - Scale 1:20000

Source: Illustration by Serouj Kaloustian, 2014

As a result of this form, the south side of the community provides a safe haven where people can experience more sunlight and feel protected from harsh northerly winds. It is therefore an ideal location for social, communal, and commercial programs that provide members of the community with safe and comfortable spots to convene in, as well as areas where they can welcome outsiders into the community. Architecturally, the community connects to the street with a large walkway and steps that gradually lead into the main courtyard located at its centre.

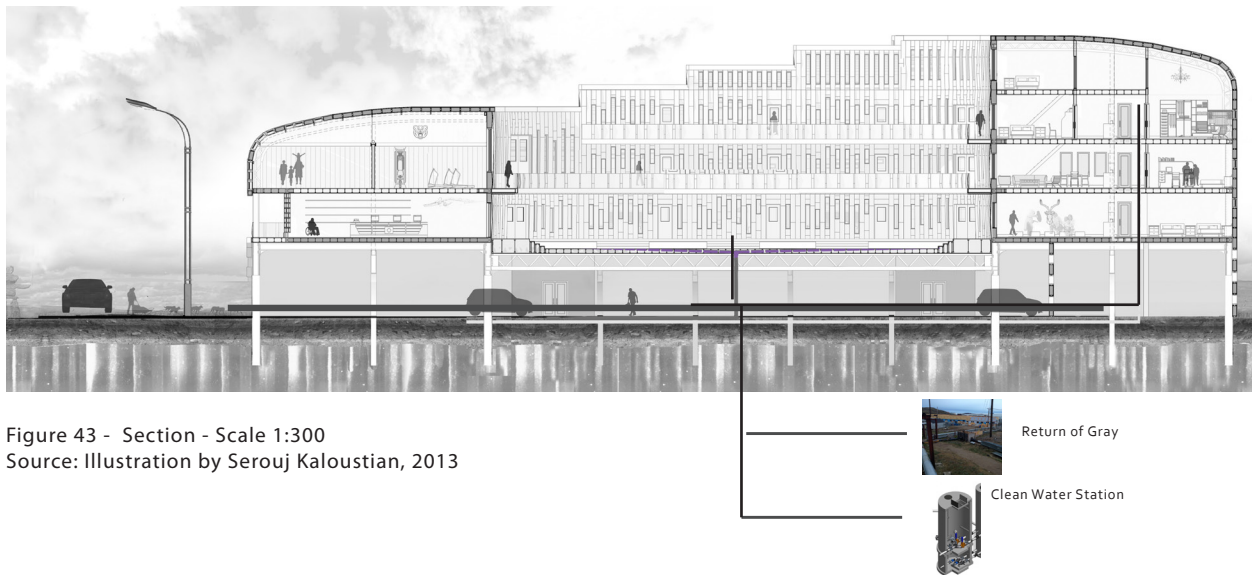


Figure 43 - Section - Scale 1:300
Source: Illustration by Serouj Kaloustian, 2013



Figure 44 - Perspective of Entrance
Source: Illustration by Serouj Kaloustian, 2013



Figure 45 - South Elevation - Scale 1:300
Source: Illustration by Serouj Kaloustian, 2013



Figure 46 - West Elevation - Scale 1:300
Source: Illustration by Serouj Kaloustian, 2013

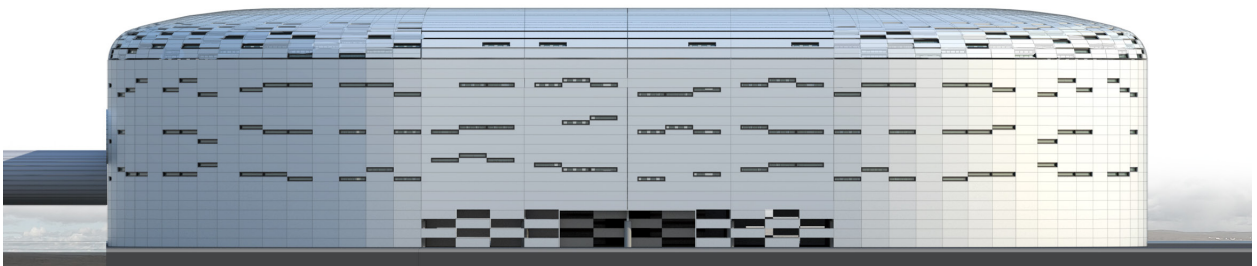


Figure 47 - North Elevation - Scale 1:300
Source: Illustration by Serouj Kaloustian, 2013

5.3 Windshield Characteristics

The prevailing winds in the north can reach up to 100km/h and create an inhospitable environment in which to perform outdoor activities. Some kind of wind obstacle such as a windshield must be created to shelter from these conditions. In our cohousing community, the windshield is represented by an entire building that is shaped so as to push the wind away and over the central courtyard. In standard wind to obstacle calculation ratios, there is usually a 1:10 ratio of height of the obstacle to length of ground that the prevailing wind would pass over before descending again. Since the overall width of the community is less than 10 times its height, the entirety of the courtyard inner space would be protected from prevailing winds. Activities could therefore take place any time of the year, provided that outdoor conditions were reasonable.

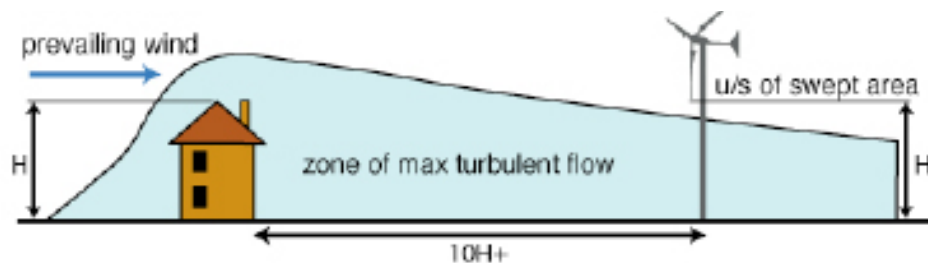


Figure 48 - Prevailing Wind Diagram
Source: <http://greenspec.co.uk>



Figure 49 - Section - Scale 1:300
Source: Illustration by Serouj Kaloustian, 2013

5.4 Materiality

A strong insulating windshield is needed. Fiberglass sandwich panels are an ideal envelope material for extreme weather because of their high capacity for retarding the passage of heat and cold between environments. They do not expand or contract and also are lightweight and durable. Fiberglass panels are often found in Iqaluit buildings.

What are Fiberglass sandwich panels?

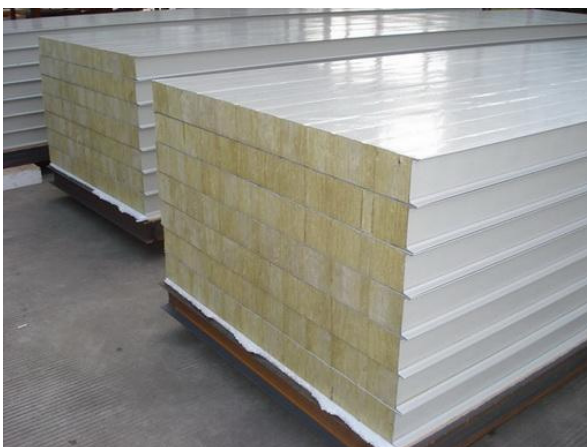
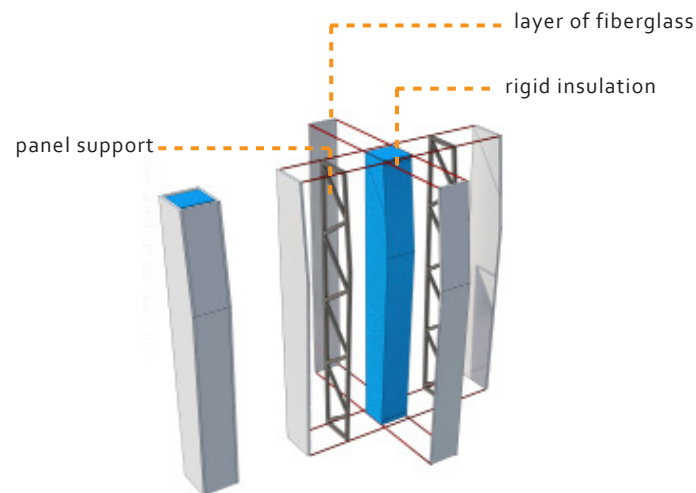


Figure 50 - Fiberglass Assembly
Source: Illustration by Serouj Kaloustian, 2013

5.5 Structure

Although the community follows an overall round toroidal form, each subsection follows a very simple post and beam structure. The primary backbone of this structure is a deep truss on the bottom that helps stabilize and distribute the load from the floors down to several pylons that extend deep into the permafrost. The next most important structure is a curved truss that determines the overall round shape which holds up all the exterior fiberglass panels as well as the girder beams, which in turn hold the floor joists and walls.

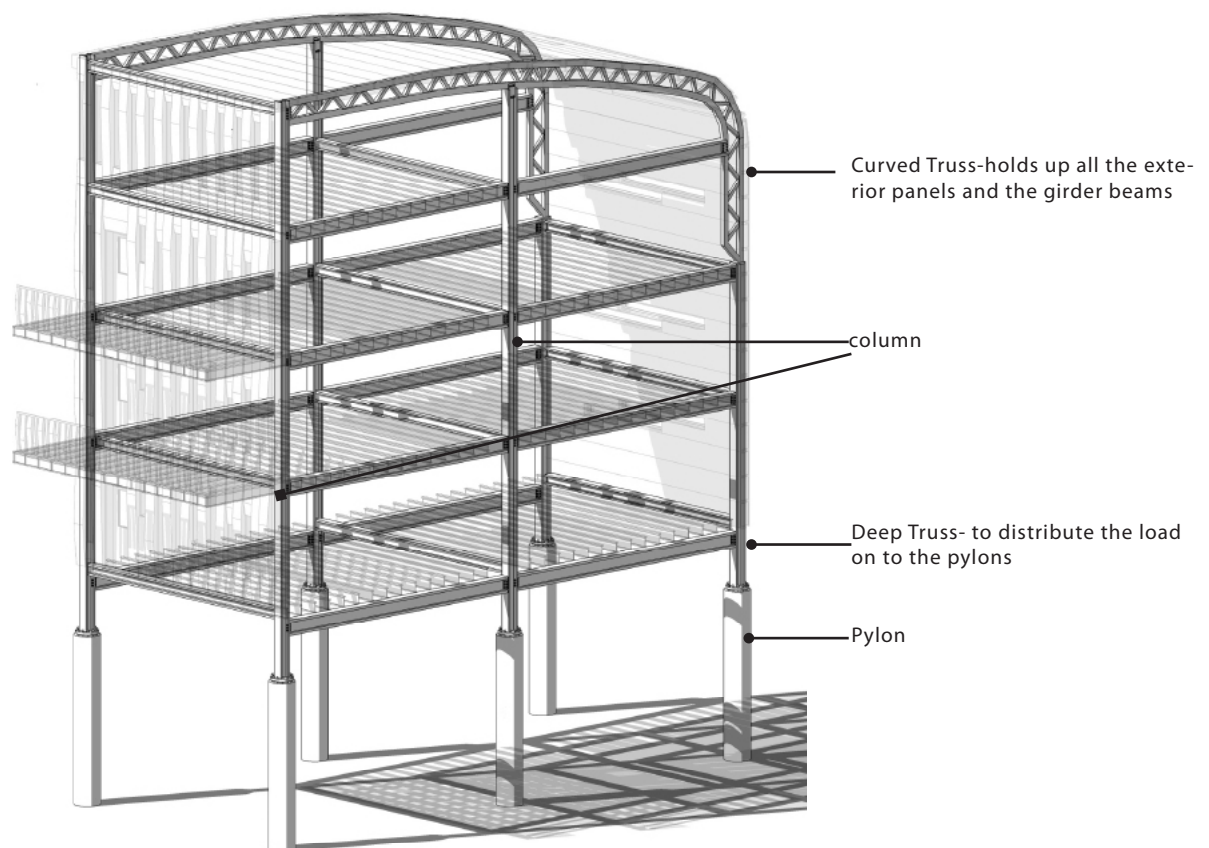


Figure 51 - Structure for Cohousing Design
Source: Model and Photo by Serouj Kaloustian, 2013

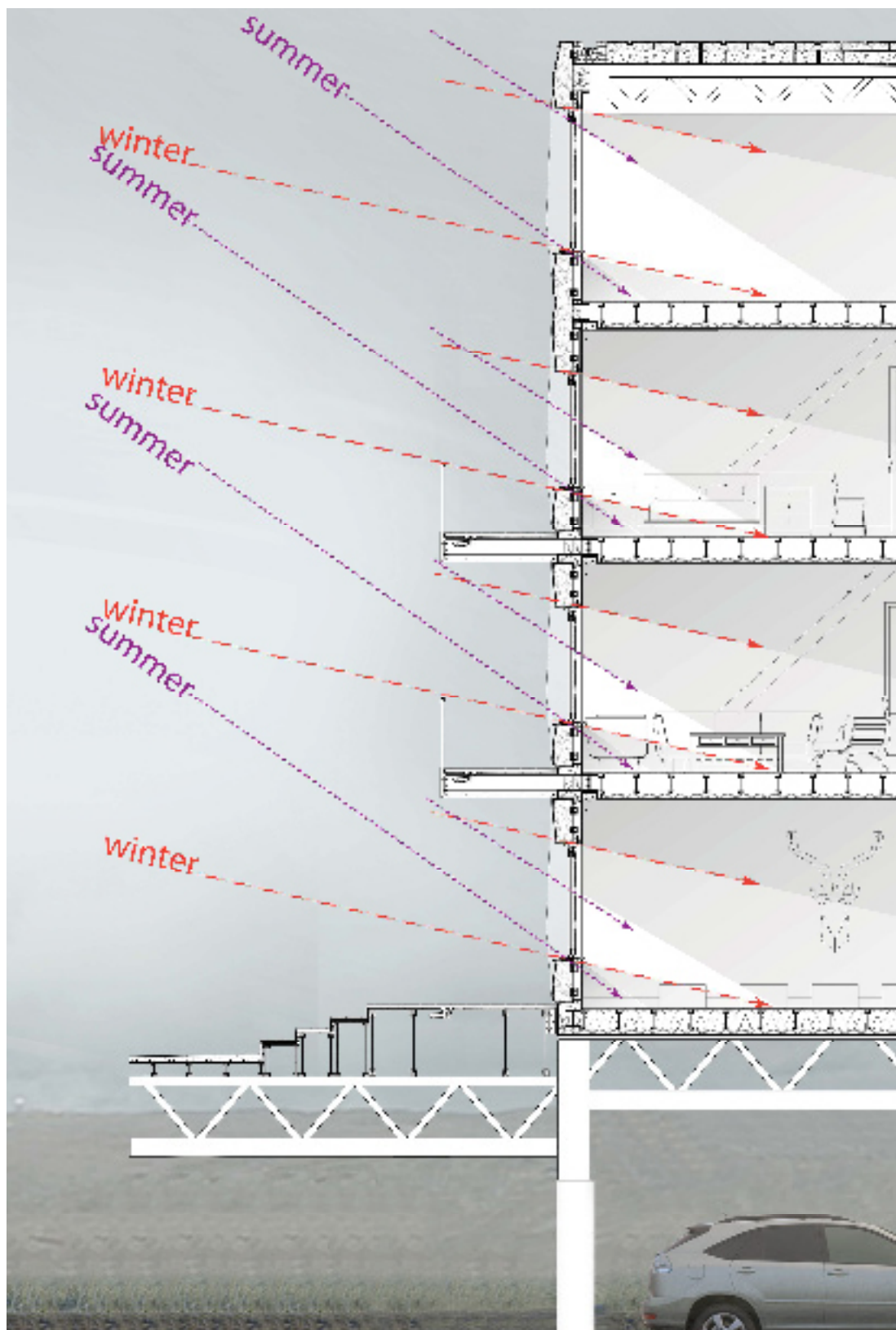


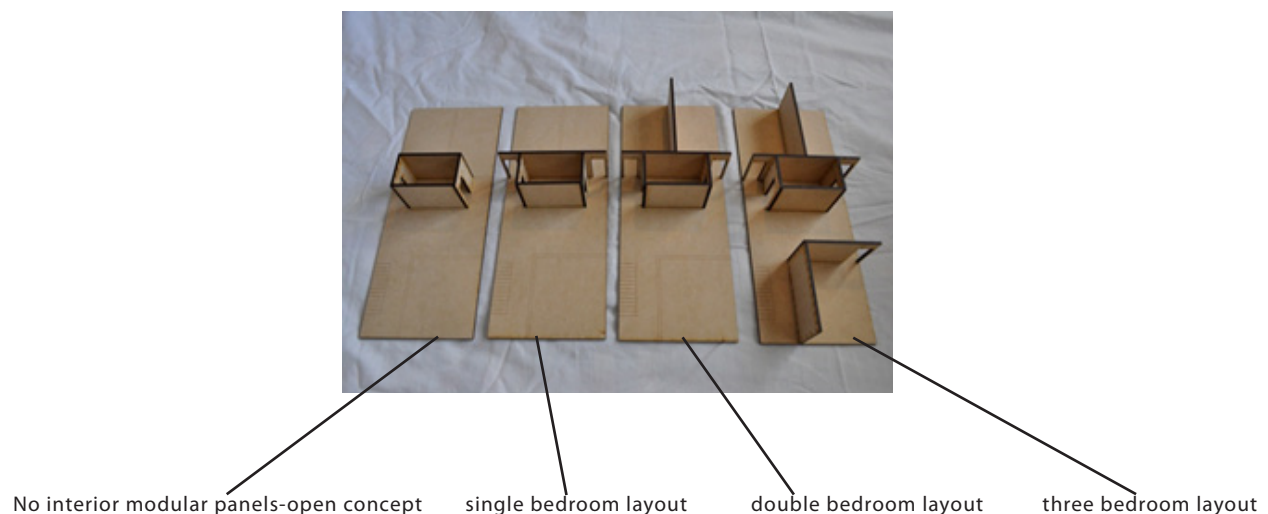
Figure 52 - Detail Section of Resident Wall Assembly
 Source: Model and Photo by Serouj Kaloustian, 2014

5.6 Unit Flexibility

The units in the development are flexible. They are built with modular panels that can be used anywhere within the units where rails are provided. There are many permutations for their uses and people living in the units can customize their spaces as desired. For example, if a family preferred an open-concept space with one bedroom rather than a unit with multiple rooms, they could align the panels accordingly.

The exterior walls of the units are fixed and can't be moved. Their exterior panels need heavy insulation and must be assembled by special tradespeople. They protect their units from any thermal bridges that could leak cold air into the units. Figure 44 in the appendix shows the possible permutations for each unit.

To illustrate an example of this flexibility, let us consider that a family of two might initially occupy a default unit with a basic living room, kitchenette and one bedroom. The next life stage for this family might be the introduction of a child or several children; such a change would prompt them to extend their household by adding a second unit. This expansion would be accomplished by adding panels to the side walls; these panels can be removed, or can be replaced by doors in the case of a horizontal expansion. A family could increase their living space in many different ways by using whatever permutation and expansion possibilities that suit their lifestyle.



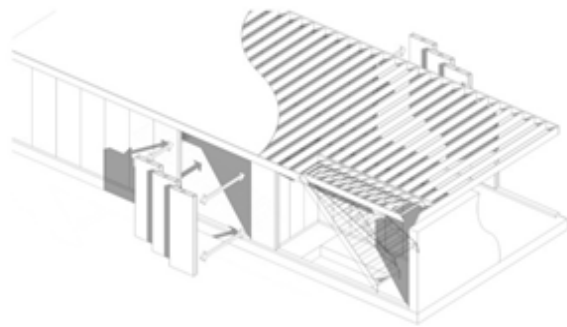
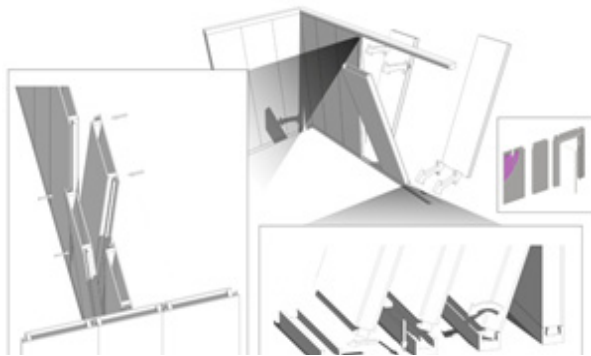
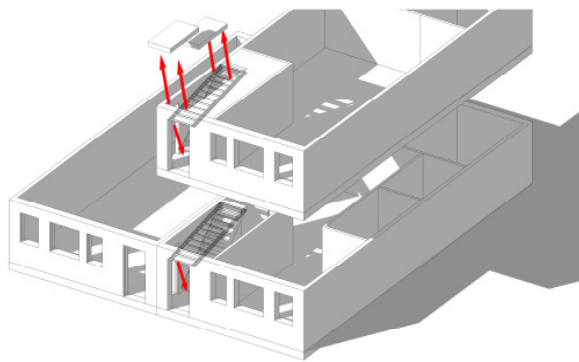
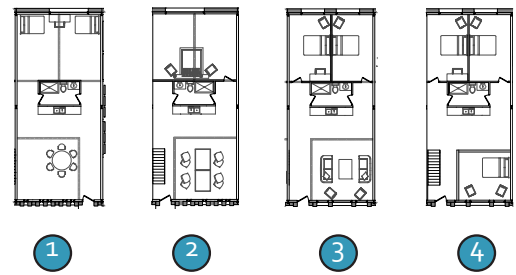


Figure 53 - Modular Panel Assembly
Source: Model and Photo by Serouj Kaloustian, 2014

Given that the units are flexible and can be transformed into a number of permutations, some permutations are from a sociocultural perspective which are more suitable for Inuit life-styles and others suitable for domestic Immigrats.

Figure 54 -Unit Permutation Possibilities
Source: graphics by Serouj Kaloustian, 2013



- ✕ Inuit compatible
- Immigrant compatible

		open concept	single bedroom	double bedroom	triple bedroom
Vertical Flexibility		1	2	3	4
open concept	1	✕	✕	✕□	□
single bedroom	2	✕	□	□	□
double bedroom	3	✕□	□	□	□
triple bedroom	4	□	□	□	□

		open concept	single bedroom	double bedroom	triple bedroom
Horizontal Flexibility		1	2	3	4
open concept	1	✕	✕	✕□	□
single bedroom	2	✕	✕	□	□
double bedroom	3	✕	✕□	□	□
triple bedroom	4	□	□	□	□



Figure 54 -Interior Space of Unit and Possible Panel Placement
Source: Model and Photo by Serouj Kaloustian, 2014



Figure 55 -Interior Space of Unit and Possible Panel Placement
Source: Model and Photo by Serouj Kaloustian, 2014



Figure 56 -Interior Space of Unit and Possible Panel arrangement
Source: Model and Photo by Serouj Kaloustian, 2014

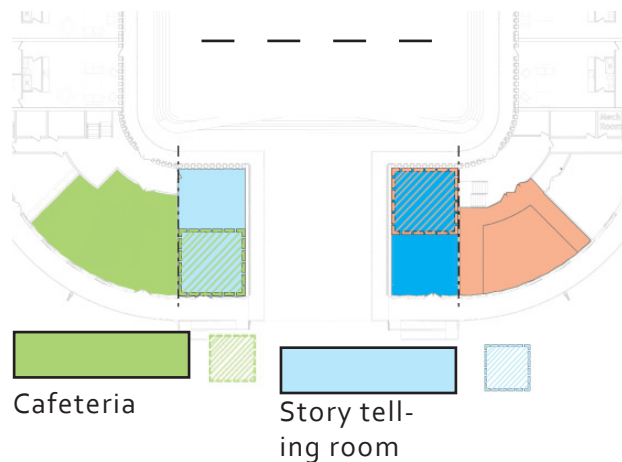
5.7 Community Flexibility

Each community has the potential for a different mixture of residents considering that more than half the population of Iqaluit, 55%, is Inuit and the rest represents a mix of different cultures. One community might have a population with a high majority of the residents being Inuit while another could have one that represented different cultures. Community programs must be flexible enough to accommodate demands of different cultures in specific communities. This can be achieved through flexible interior panels much like the ones in the residential units.

Examples:

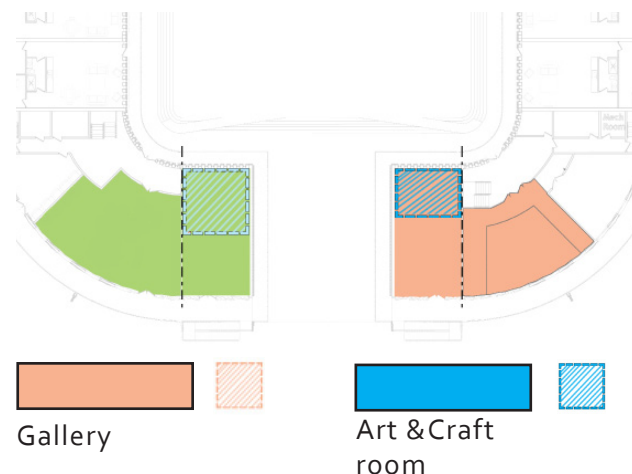
Default

Considers the possibilities for communal spaces if 55 % of the population are Inuit and 45% are domestic immigrants.



Majority Inuit most consolidated

Considers the possibility that majority of the residents in the community may be of Inuit descent, which may create more demand for specific types of program spaces.



Majority Non-Inuit most fragmented

Considers the possibility that majority of the residents in the community may be domestic immigrants, a condition that could create demand for different types of spaces within the program.

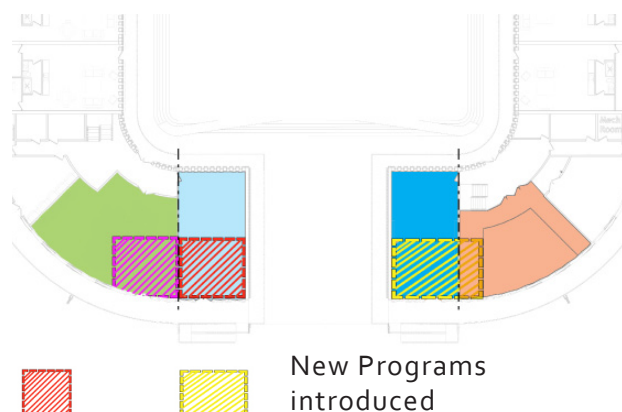


Figure 57 -Possible Flexibilities within Community Spaces
Source: Model and Photo by Serouj Kaloustian, 2014

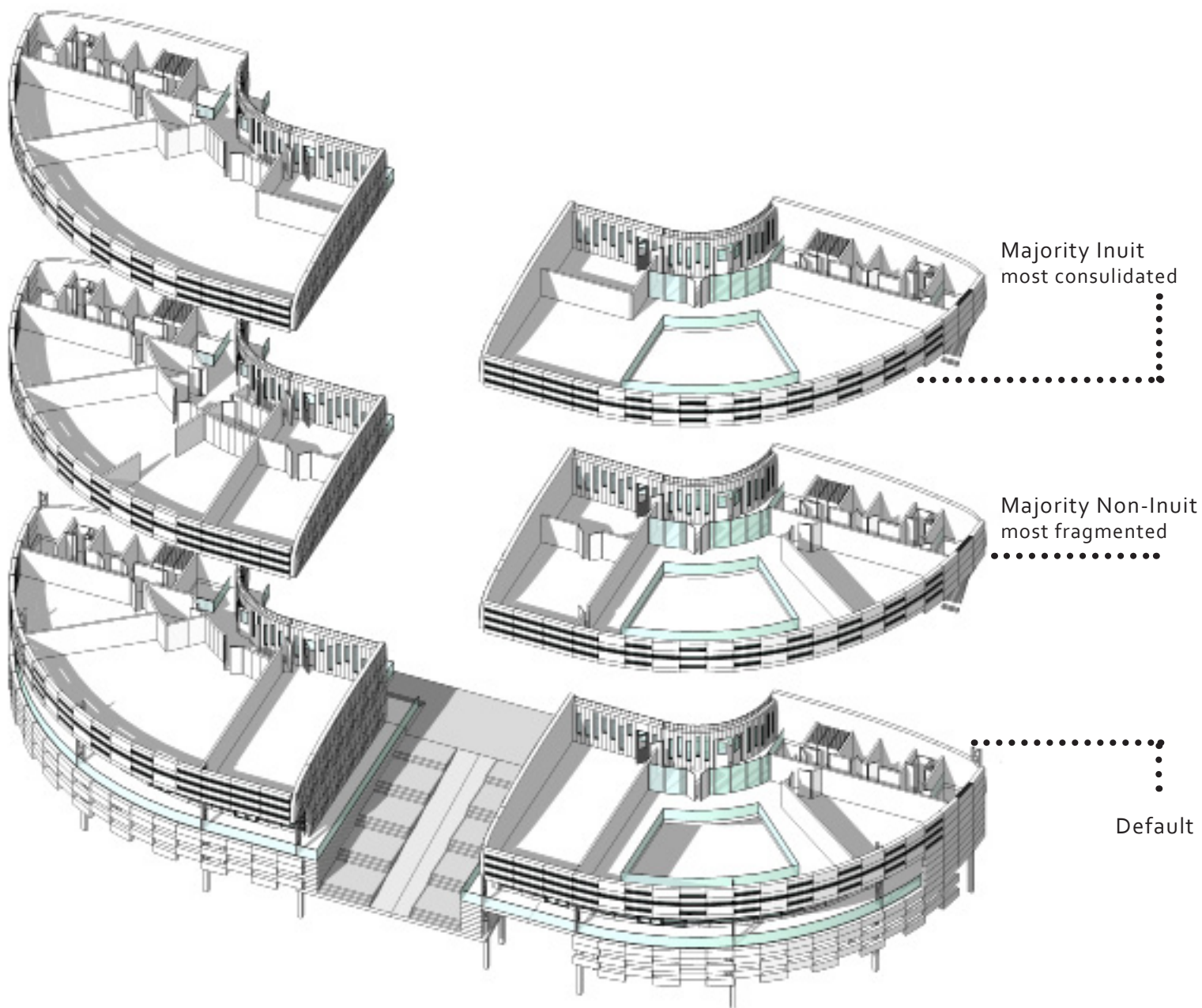


Figure 58 -Possible Flexibilities within Community Spaces
Source: Model and Photo by Serouj Kaloustian, 2014

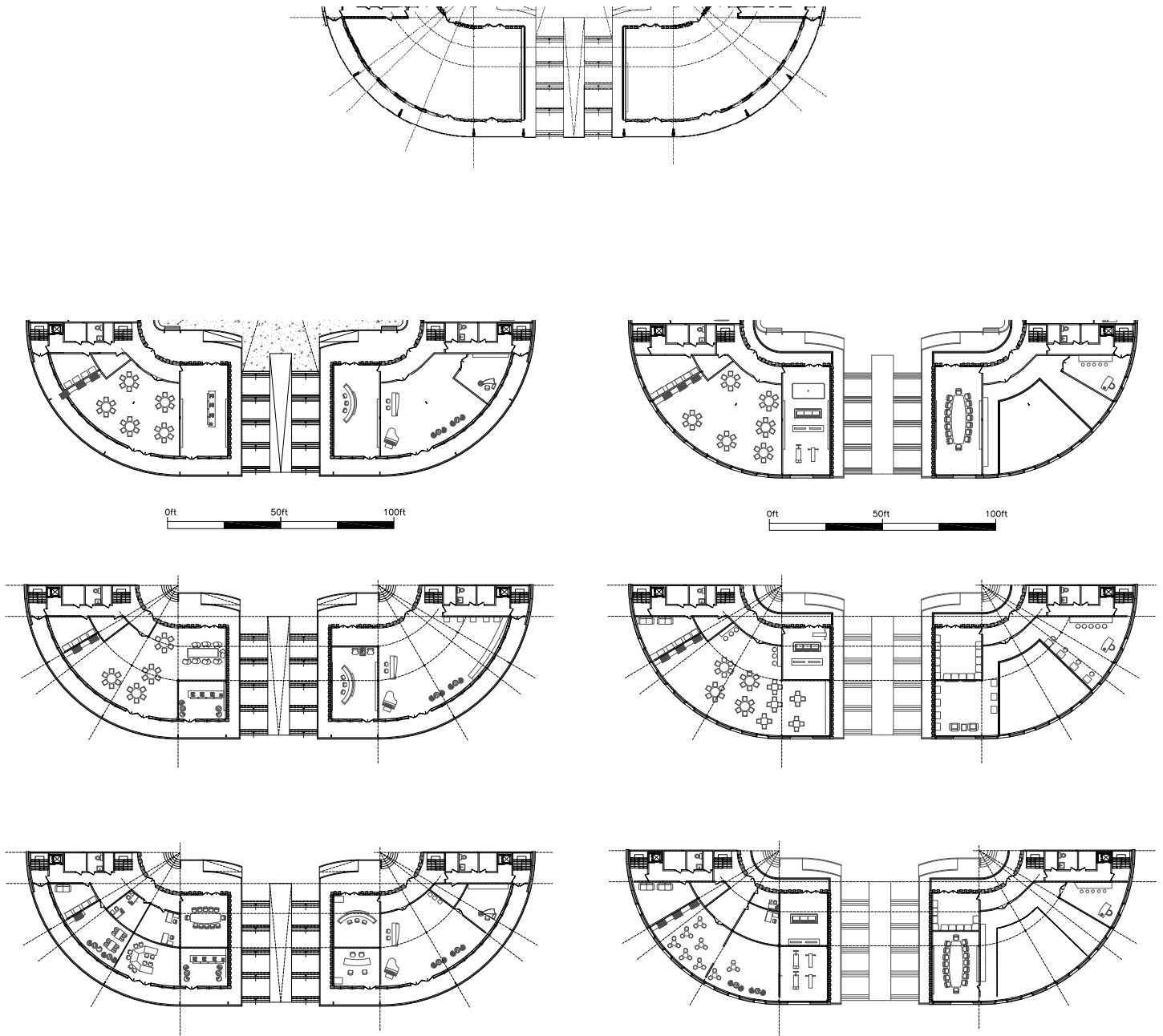


Figure 59 -Plans With Rails for Possible Flexibilities Within Community Spaces
Source: Model and Photo by Serouj Kaloustian, 2014

5.8 Courtyard program Flexibility

The physical form of the community forms a shell around a centrally located space that programmatically functions as the courtyard and communal space. Aside from the indoor programs located on the south side of the community, the courtyard forms the exterior portion of this program. Large parts of the Inuit culture revolve around exterior activities that are governed by the four seasons of the year. For instance, in the spring many Inuit go out hunting and bring back their catch to share within the community. In the summer, traditionally resources were high and this supported larger number of people to gather in one area to carry out larger communal activities and games. In the fall, when the days shortened and the weather turned cold people had the need to start preparations for the winter. They stored the summer's catch and crafted supplies needed for their survival. During such times small social gathering such as drum dancing were important social events. The courtyard is designed to be physically and conceptually an open concept area that can be adapted to different outdoor activities depending on the season. The orientation of the courtyard also helps it adapt to different scenarios because it does not necessarily have a specific focal point. In other words, the surrounding perimeter of the courtyard is made up of equally spaced alternating stairs and seating that have no specific hierarchy. It will be dependent upon the community to choose where they would like to sit and observe the activities. This kind of a programmed outdoor courtyard structure allows for multiple focal points, which means that more than one activity can take place at the same time.

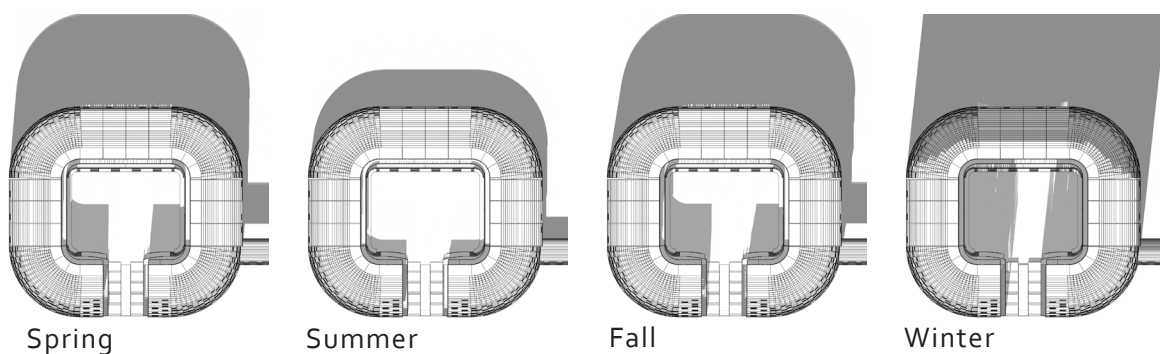


Figure 60 -Sunlight within courtyard at different seasons
Source: Model and Photo by Serouj Kaloustian, 2014

In terms of architecture, the courtyard is the central hub of the community, as all circulation leads to it. So, in essence, the courtyard is a predetermined architectural space in which exterior activities can be focal points.

In regards to circulation, the first thing a resident will see upon leaving his or her dwelling is a view of the courtyard. Thus, if any activity is taking place within the courtyard the resident would be encouraged to join in. The resident's path of travel would be through a common stairway that leads to the courtyard. This stairway also joins together different catwalks leading to the courtyard from other parts of the community. This will create opportunities to cross paths and interact.

Pedestrian flow from the street is able to access the community through the southern opening that has two rows of stairs and a ramp going through the middle that leads directly to the courtyard. Consequently, if visitors would like to visit the interior community programmed areas, their path would lead through the courtyard and encourage social interaction.

In the case where two of these communities are located close to each other, side by side, members within each community would not have to exit their communities from the exterior to access one another. They will instead be able to travel from one community to the other through a connecting bridge. This bridge is an enclosed walkway that will be protected from the exterior environment and it is connected on the ground level of each community. The bridge has glazing on the south side in order to bring in natural light and also provide views of the tundra for the residents as they walk. The path will run along one side of the gallery space which will be exposed by glazing, thus giving a welcoming visual of the community art work. This provides yet another opportunity for other guests to socially interact along the way to the courtyard.

Due to this design, the community fosters a positive environment while also welcoming engagement with visitors. The next paragraphs will illustrate the flexibility of the courtyard and how it can be used at different times of the year.



Figure 61 -Community Gallery
Source: Model and Photo by Serouj Kaloustian, 2014

The spring is a time when traditionally the Inuits went out to hunt and gather food in a sudden shift from dormancy to lots of activity. This is when the sun starts to rise higher from the horizon and the days become longer. During this season the courtyard will receive more daytime light due to the sun's higher angle, and direct sunlight will penetrate more than half of the interior courtyard space. Therefore during this time activities that could happen within the courtyard space include sharing of resources, such as hunters and fisherman distributing or selling their catch in the courtyard space. This is an opportunity for residents and visitors alike to be able to obtain rare items that are only available seasonally in close proximity to where they live.



Figure 62 -Courtyard During Spring
Source: Model and Photo by Serouj Kaloustian, 2014



Figure 63 -Courtyard During Summer
Source: Model and Photo by Serouj Kaloustian, 2014

In the summer during the solstice the sun reaches its highest zenith angle of 45 degrees, which brings direct sunlight to nearly all of the courtyard area, as shown in Figure 60. The average high temperature in the summer reaches nearly 12 degrees celcius. Considering the fact that in the winter there is low light conditions and that temperatures could reach minus 50 degrees celcius, the summer high temperature in relative terms is a very temperate condition that would allow various outdoor activities for the community to engage in as a whole. The courtyard is also designed as a seating venue to be able to spectate activities and sports which could be jointly held by multiple communities in close proximity. The courtyard is able to do this by perimeter seating adjacent to the walkways along side dwelling entrances, as well as the exposed catwalks that have full view of the courtyard from the floors above.



Figure 64 -Courtyard During Fall
Source: Model and Photo by Serouj Kaloustian, 2014

During the fall the sun angle is very similar to the spring, large part of the courtyard is still open to direct sunlight. During this season the days gradually get shorter and temperatures start to fall. Traditionally, the Inuit took the supplies they gathered during the spring and summer and engaged in storing of these supplies as well as crafting tools, equipment and clothing in preparation for a more comfortable winter survival. Instead of people distributing or selling their hunting and fishing catch they would organize into crafting groups within the courtyard to produce various items, tools, and equipments that may be needed for the community during the winter and also be able to engage in commerce with other communities.

In the winter the sun is very close to the horizon and there is only direct sun coming into the center of the courtyard through the opening that is created on the south side of the community shown in Figure 60. This light however only lasts a few hours a day and temperatures on average will fall to minus 40 degrees celcius. There are harsh northerly prevailing winds that would further make these conditions more dire. The form of the community creates a windshield barrier around the courtyard therefore this space would be protected from wind and wind blown snow. This will encourage winter activities to be held in the courtyard. The courtyard can be used for different cultural activities such as drumming around a fire and can also be converted to an ice rink.



Figure 65-Courtyard During Winter
Source: Model and Photo by Serouj Kaloustian, 2014

5.9 Cohousing Characteristics

The following images will detail the ten most common characteristics of a cohousing development, as noted previously, and will illustrate how they are incorporated into my design. Each characteristic is highlighted to show the particular relevant location in the model.

2. Opportunities for Social Interaction and collaboration:

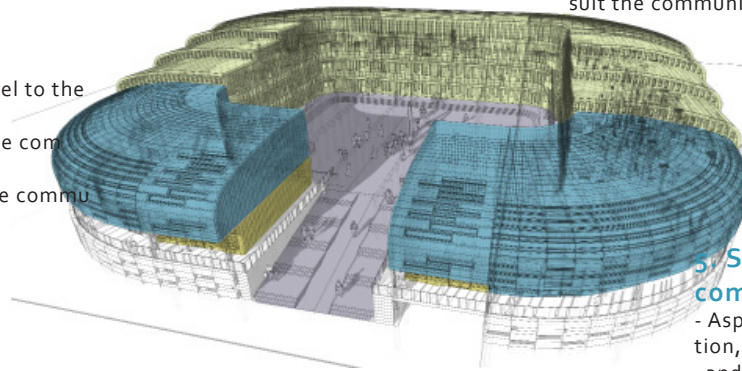
- Common Facilities dine together
- Connecting paths provide opportunities to encounter people
- Field/Park located in the middle of the community.

4. Environment adapts to occupants:

- adaptable units allows the residents to customise their personal spaces themselves in order to suit their personal needs.
- The community in large can also jointly reshape the common programmed spaces to suit the communities needs.

3. Pedestrian Friendly

- No necessary need to daily travel to the city core
- parking is hidden underneath the community.
- indoor walkways connecting the communities together



1. Safe and Supportive Environment:

- Guard against severe northerly wind and snow
- Outdoor sheltered area

5. Sense of Belonging to community

- Aspects such as Resident participation, contribution and sharing of resources makes a resident individual responsible for his or her community hence belonging to it.

Figure 66 - Cohousing Characteristics
Source: Illustration by Serouj Kaloustian, 2013

1.Safe and Supportive Environment

The cohousing community has two important environmental aspects one being safe and the other supportive, both are major ideas behind cohousing.

The people of Iqaluit currently have very limited opportunities to gather and socialize primarily due to the limits imposed by nature in the form of the harsh climate. Most people are forced to live rather isolated and independent lives, a circumstance that is not conducive to the building of a community. The proposed cohousing community creates an outdoor space that is shielded from the harsh weather; Its close proximity to the living spaces of residents makes it an easily accessible central gathering space. The form of the structure allows visual appearance of the courtyard from every unit surrounding it. This makes the community a safer environment.

As a result of the environment now being safe from the elements and also the fact that families live in close proximity, they can support each other in one major way, namely looking after each others children. This essential core aspect of cohousing is especially applicable to this community since in traditional Inuit culture, children were raised by all the members of the community, as opposed to just their own parents. Inuit children learned by example; they observed community members in the camp common area, which in this community is represented as the communal program which occupies the south side of the building. This program includes spaces such as a story-telling room, kitchen, game room, exercise room, community board room, arts and crafts room and gallery.

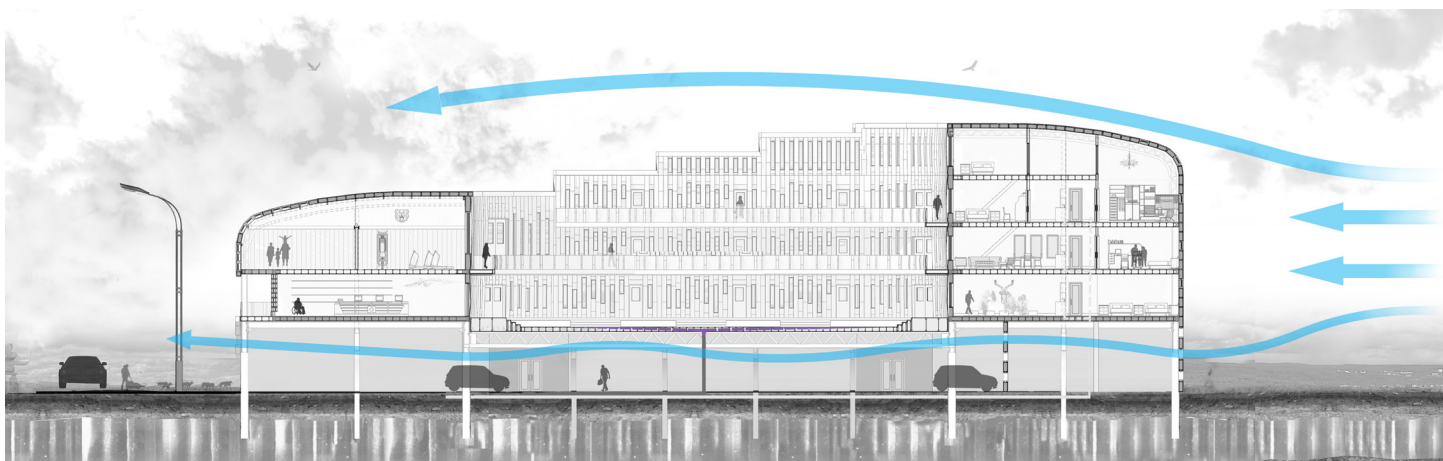


Figure 67 - Central Courtyard protected by prevailing winds
Source: Illustration by Serouj Kaloustian, 2013



Figure 68 - Central Courtyard southern light influence
Source: Illustration by Serouj Kaloustian, 2013

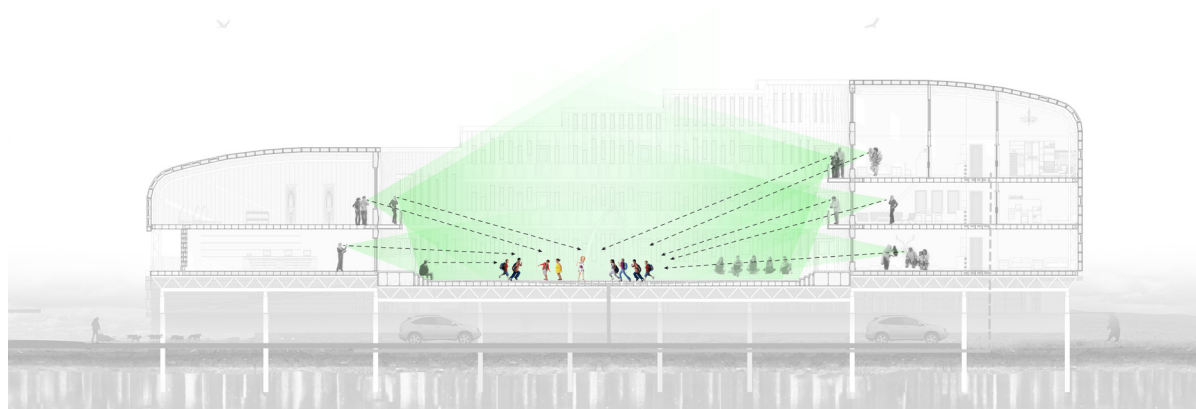


Figure 69 - visual appearance of central courtyard
Source: Illustration by Serouj Kaloustian, 2013

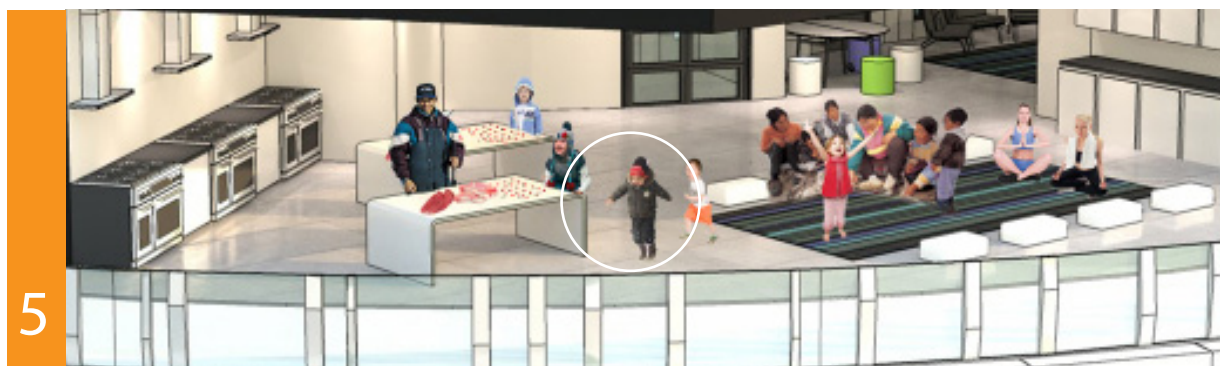
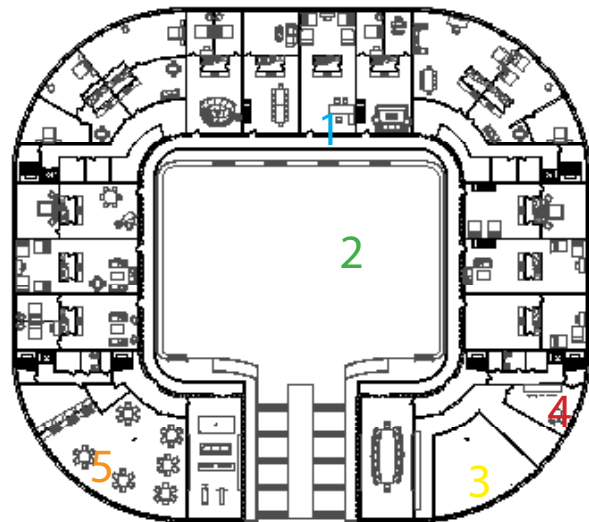


Figure 70 - kids journey throughout a day
Source: Illustration by Serouj Kaloustian, 2014

2. Opportunities for Social Interaction and collaboration

The common gathering space not only provides the community with a primary focal point but also offers opportunities for social interaction and involvement in many of the day-to-day programs. The south side communal/commercial program allows for activities such as dining and cooking in the community kitchen, use of the community gym, and participation in the events held in the various community activity rooms. Collaborative self-sufficiency is a key concept in this community. This can be enabled by the collaborative effort of everyone in the community; availability of many services and resources means that everyone can contribute their unique skills. For example an elderly person may share his or her experiences with younger generations in the story-telling room.

Considering the high building and living costs in Iqaluit, it is not feasible for every family to have utilities such as a full kitchen and laundry in their own personal homes. The cohousing community provides shared utilities that everyone in the community can access. Individual costs of living are reduced, as are costs of resources. These spaces have been situated in the community program primarily on the south side of the building. They include the kitchen, Laundry, exercise and game room, meeting room, storage and gallery.

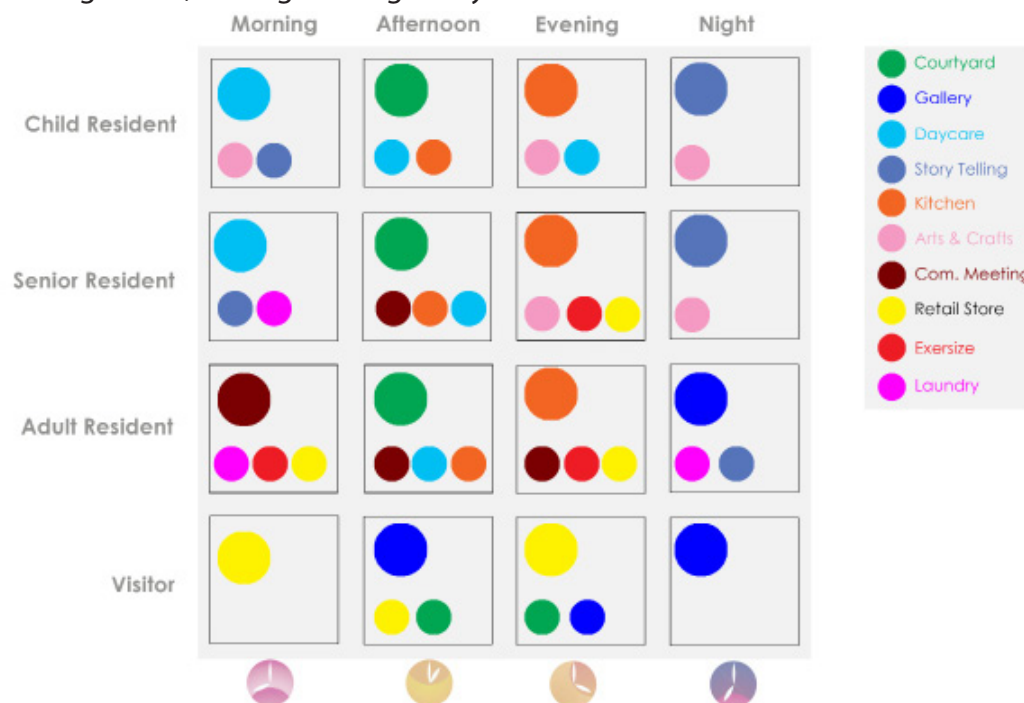


Figure 71 - Social Interaction patterns
Source: Illustration by Serouj Kaloustian, 2014

3. Pedestrian Friendly

Most of the commercial and cultural programs in Iqaluit are situated in its down- town core. However, new developments are continually being built further away from the city core. This results in an increased travel time for residents to get to work or shop for their daily needs. This is not a workable situation due to the high costs of car ownership, and also considering that pedestrian infrastructures such as sidewalks are poorly developed. Decentralizing the program of the city may help reduce the need for people to travel to its core. The cohousing community is designed to be its own self-sufficient town, where residents can live, work, shop and be entertained. Considering that communities could be placed next to one another these communities will be connected through protected walkways, thus allowing residents the freedom to walk from one to the other. It will encourage vehicle-free living.

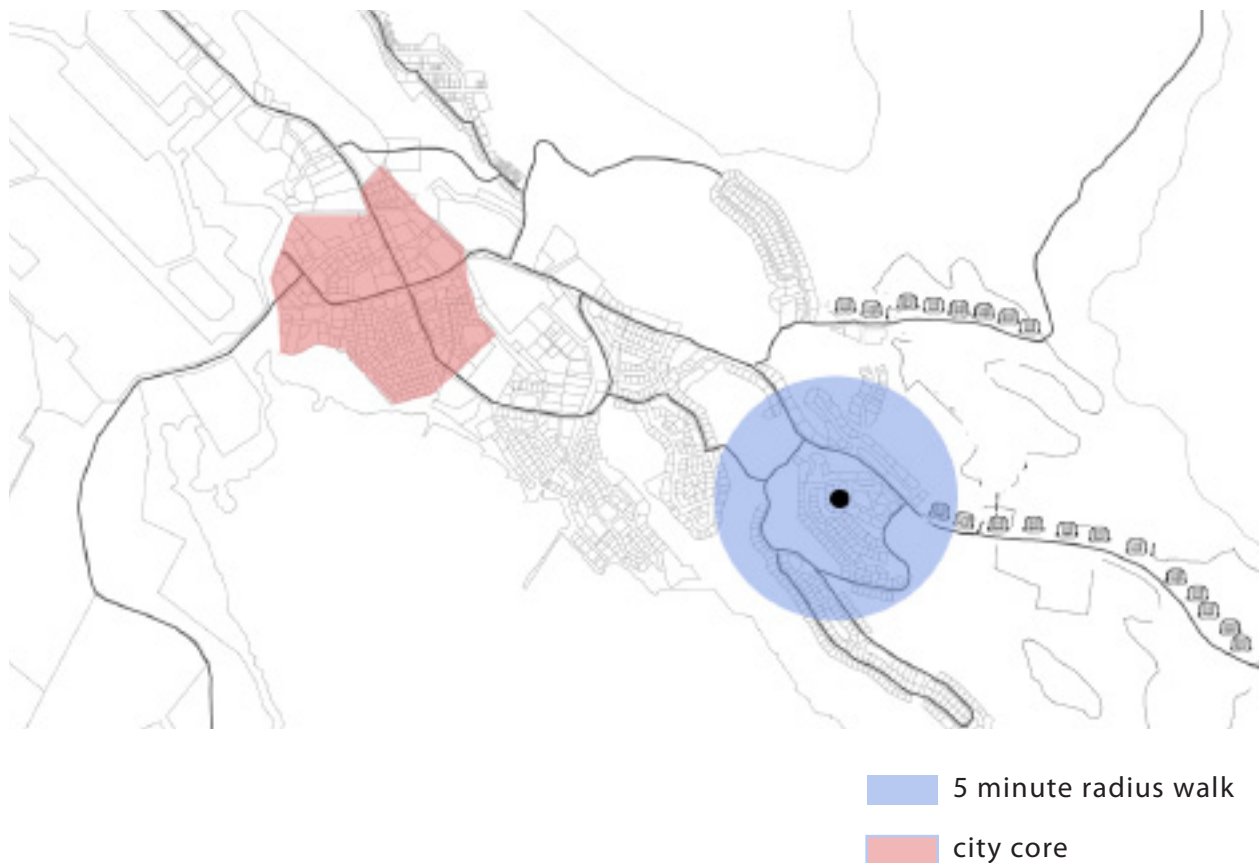
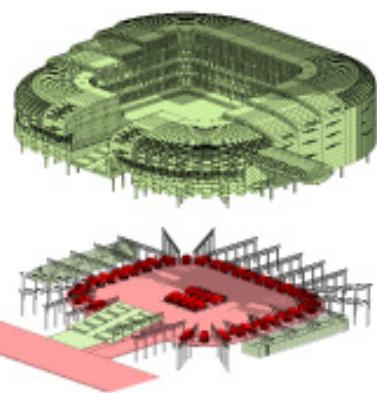


Figure 72 - 5 minute radius walk
Source: Illustration by Serouj Kaloustian, 2014



4. Environment adapts to occupants

Most of the interior elements are constructed using modular units. Families are able to customize their own spaces through the use of easily movable modular panels within their unit. This will help families avoid costs of moving and renovating. Also, due to the fact that everything is built based on modular panels, maintenance and replacement costs will be more manageable. The community in large can also jointly reshape the common programmed spaces to suit the communities needs.

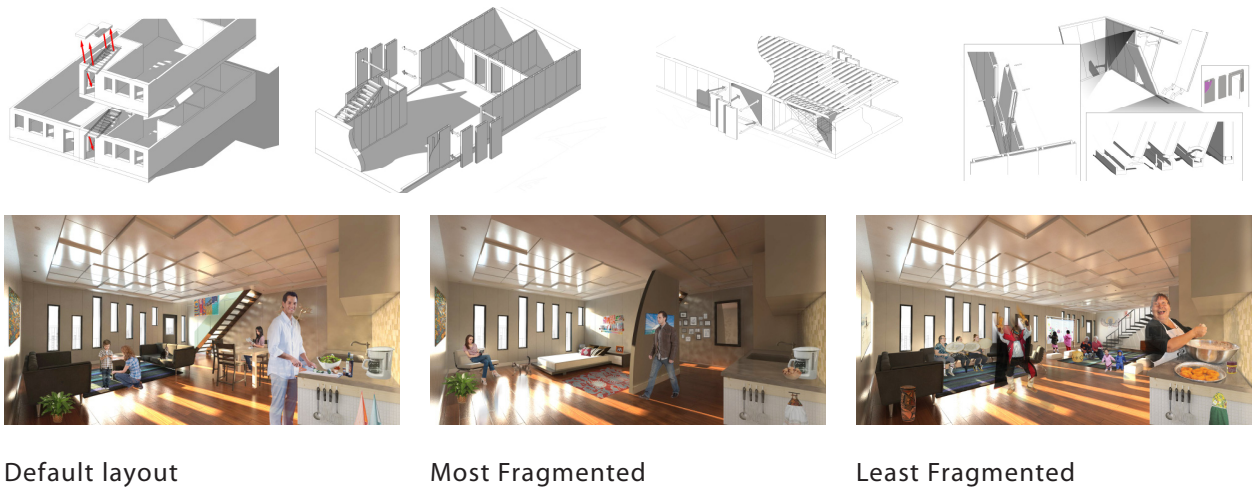
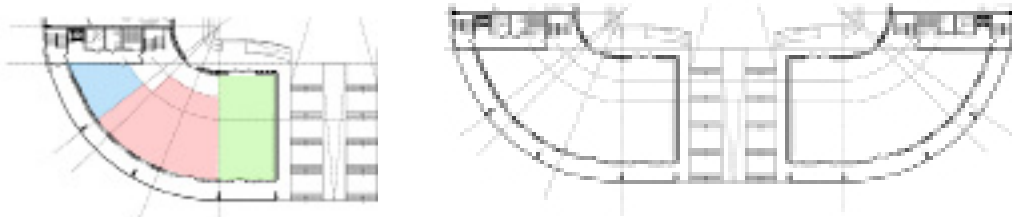


Figure 76- modular panels arranged in different ways
Source: Illustration by Serouj Kaloustian, 2014



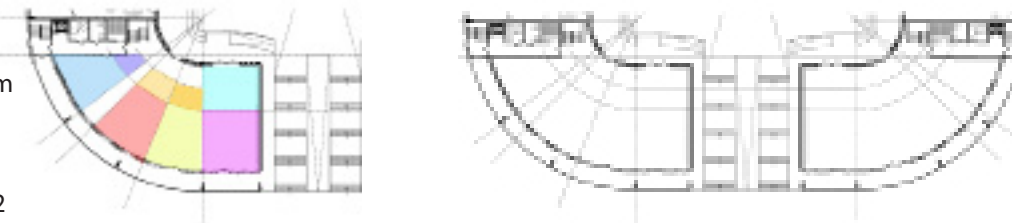
- Kitchen
- Laundry
- Game Room



Default layout



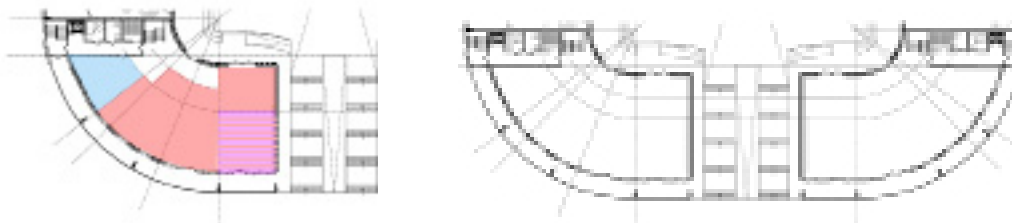
- Kitchen
- Laundry
- Meeting Room
- Retail Store
- Office Space
- Office Space 2



Most Fragmented



- Kitchen
- Laundry
- Food Storage



Least Fragmented

Figure 77 -community flexibility in programmed spaces
Source: Illustration by Serouj Kaloustian, 2014

5. Sense of Belonging to Community

The Inuit traditionally lived as part of a greater collective. This arrangement gave them a sense of purpose and happiness. The modern-day situation has resulted in many Inuit being individually isolated; one consequence of this is that their emotional health suffers. Looking at Iqaluit in an architectural context, one can see that the city has followed many North American examples of suburban development where families are divided amongst individual houses. In order to bring back the traditional Inuit style of communal living we must bring people together architecturally by joining their living quarters into one safe structure; their sharing of resources will enable them to contribute to the whole of the community.



Figure 78 - Sense of Belonging to a Community
Source: Illustration by Serouj Kaloustian, 2013

Northern Housing Project

6.0 Conclusion

Iqaluit, Nunavut is a city in the north that is faced with the issue of inadequate homes; these homes do not reflect the socio-cultural needs of the people nor respond to the existing rough climatic conditions. The harsh winter conditions are an unceasing reality for the residents of Iqaluit. The current housing developments lack ways to work around or control the prevailing winds. The city spends copious amounts of money to build tall fences around housing neighbourhoods to protect the residents from harsh assault by wind streams. This Northern Housing Project provides security through architecture, with its semicircular form; the building protects its inhabitants from the prevailing winds and allows them to engage in outdoor activities within a protected environment. The Northern Housing Project also considers the scarcity of natural sunlight which primarily enters from the south in this design. The building is orientated to maximize natural light into all of the buildings facades. With the growing population and the need to expand the city, future developments have to reinvent housing in the north and people need to initiate measures that will secure their traditional ways of living for generations to come.

At present existing western housing developments in Iqaluit do not address nor reflect the rich and various cultural backgrounds of local residents, which restrict their diverse lifestyles. Investigating the socio-cultural aspects revealed that the Inuit community has a history of a shared life, which has been crucial to their survival. Everyone had something to offer, to trade, to teach and to contribute. Living in this communal way was educational and it allowed everyone to learn from one another. The Northern Housing project attempts to reintroduce a communal way of life and bring back a sense of belonging. Transplanting and building on western ways of communal living, The Northern Housing project derives similar necessities and interdependencies and integrates them into a new housing type. These include the cohousing ideas of sharing resources like the communal kitchen, gallery, workshops, outdoor program space such as the courtyard and the pedestrian walkways. The communal kitchen for instance would ensure gatherings

between family and friends meanwhile the gallery and the workshops would cultivate ideas and promote creative exchanges.

The absorption of socio-cultural norms and their adaptation into current building practices would ensure that future housing employs strategies that will better suit the people and their way of life. These strategies include the flexibility of interior spaces that give the residents and the community ultimate flexibility to adapt spaces to individual routines without the need for specialized trade's people. Expanding on this idea, there are also provisions to accommodate specific programmed spaces that let the community live with their own rituals and cultural norms in a safe environment protected from the surrounding climatic elements.

The ideas of western cohousing that have been adapted to the Northern Housing Project were derived from *The Cohousing Handbook: Building a Place for Community* by Chris Hansen. Of the nine characteristics to a successful cohousing community, six have been implemented into the Northern Housing Project. The first two that have been integrated into the design are that pedestrians take precedence over the convenience of an automobile. The design groups all vehicles on the tundra level and encourages walkability within the building. The third characteristic of a cohousing community is the integration of common facilities like the community kitchen, the gallery or the courtyard; meanwhile other spaces supplement the private areas such as the workshops and the game room.

Meeting rooms are a part of the fourth characteristic that supports community engagement in the management and major decision for the maintenance of the Northern Housing Project. The fifth distinguishing trait of a cohousing community is that the number of dwelling units should remain small, the number of units in the Northern Housing Project falls under the optimum community size. The main and most important idea and the sixth main characteristic is that the entire community shares. The building promotes the sharing of resources as well as ideas, the kitchen promotes the sharing of food and the meeting rooms promote the sharing of responsibilities. The overall design of this community is to encourage engagement between neighbours, families and friends.

The three remaining characteristics of the Northern Housing Project have not been implemented. They all relate to the participation of future residents in the pre-design stage and/or to the post construction phase, where the community would maintain and share responsibilities as they pertain to their cohousing.

Since one of the defining characteristics of cohousing communities is that the design process involves participation of the residents, this is a limitation of the current study which has not taken into consideration the view and perspectives of Inuit and immigrant inhabitants of Iqaluit. Further adjustments to this scheme would address this important shortcoming. In this regard, the current proposal deviates from the participatory process in that the overall structure is predetermined and imposed.

The layout of the courtyard is flexible to accommodate a variety of programs and cultural needs. In addition, the courtyard was left open to accommodate traditional winter Inuit activities. Enclosing it with a roof would have ensured a more comfortable and consistent temperature during the winter time for the community, however this would be unnecessarily costly meanwhile most of the Inuit activities during the winter time are outdoors. For the purposes of allowing access to nature but also sheltering the individual from the harsh prevailing winds the building cradles the courtyard with the help of the semicircular form. This is where community feedback would be most beneficial to ascertain whether the benefits of such a roof to the users would outweigh the costs and import of materials. Much in the same way the storage spaces and workshop located on the Tundra level could have been located closer to the units, perhaps even within the units themselves. However, this would have reduced the number of units, or their area or that of shared spaces.

Another area of future work is the public realm. The façade that faces the street could have been designed with a better connection to the community. The entrance and engagement between neighbours and families begins only in the courtyard and after entry to the building. The public space between building and the street is

ambiguous to outsiders and a visitor cannot simply pass by the building and become instantly engaged. This in-between space would benefit from further investigations.

Another area of future development is investigating possible methods and technologies that would allow this housing type to be transplanted onto varied and more difficult terrains, so that other neighbouring cities in the north could also accommodate such communities. Possible other research can delve into a range of south facing orientations which could help reduce the restrictions of building placement and the limiting alignment to the south light. In addition, further examination of the permafrost conditions and investigating new techniques and technologies for building foundations that would help them better withstand the changes in the permafrost layer, would help the community adjust and improve their building practices significantly. This project could have further delved into the construction and the logistics to additionally reduce cost of construction which include shipping, material and available labour market. To further the agenda of this new housing type itself, it would be of great value to engage the community to obtain feedback and criticism on the design and to build on the ideas that contribute to the discourse on the housing issues of the north.

This Northern Housing Project investigated more than just housing shortages in the north; it examined possible strategies that could address the rich cultural background of locals. The proposal is a design approach which utilizes concepts of western cohousing and closely mirrors the Inuit communal way of life. It opens the doors and welcomes back the tradition of communal living meanwhile giving plenty of opportunities for individual self-expression. Uniquely the building ensures preservation of customs and practices that are tied to the very identity of the Inuit people, while utilizing western knowledge of building to create a sanctuary for all.

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