The Mechanical Pathway:

Reactivating a Derelict Rail Corridor in Edmonton

by

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Submitted in partial fulfilment of the requirements
for the degree of Master of Architecture

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SCHOOL OF ARCHITECTURE

The undersigned hereby certify that they have read and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled “The Mechanical Pathway: Reactivating a Derelict Rail Corridor in Edmonton” by Michael Nally in partial fulfilment of the requirements for the degree of Master of Architecture.

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Signature of Author

DEDICATION

To my parents, Dermot and Mary, and my sister, Susan.

Thank you for all the support throughout this process.

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ABSTRACT

This architectural thesis addresses a derelict urban rail corridor and the possibility of combining architecture and landscape to reactivate its latent potential as a dymanic seam in the urban fabric.

Edmonton is a city built on a foundation of interconnectedness with the nation. Rail access has established the city as a staging hub for various industrial practices since the mid 19th century: import and export, agriculture, oil and gas, etc. As inner city rail access as been discontinued, parcels of rail land have been left as relics; nostalgic reminders of a formerly expansive arterial mechanical network, in turn connecting the city to a mechanical backbone spanning the nation. This architectural intervention will reactivate a piece of rail land in the northwestern part of downtown Edmonton by establishing a dynamic activity corridor around an energy-harnessing machine.

Apart from in-depth studies in renewable resource harvesting and climate, the thesis is driven by studies in rail and agricultural mechanisms, as well as existing post-industrial park typologies.

ACKNOWLEDGEMENTS

I acknowledge the help of my supervisor Richard Kroeker for his ingenuity and ability to gently push me when I was timid, and my advisor Emanuel Jannasch for his passion and guidance at key moments during this uncertain process.

To all my friends at the school, past and present, a sincere thank you for all the education you have emparted, support you have given, and good times we have shared. You have made this an incredible experience.

To Daryl Procinsky and the staff of ONPA Architects, thank you for your big ideas and your support during the early stages of my investigation into this thesis.

INTRODUCTION

THESIS QUESTION

How might architecture and landscape negotiate contextual gaps to reactivate a derelict piece of rail property in Edmonton?

PLACE

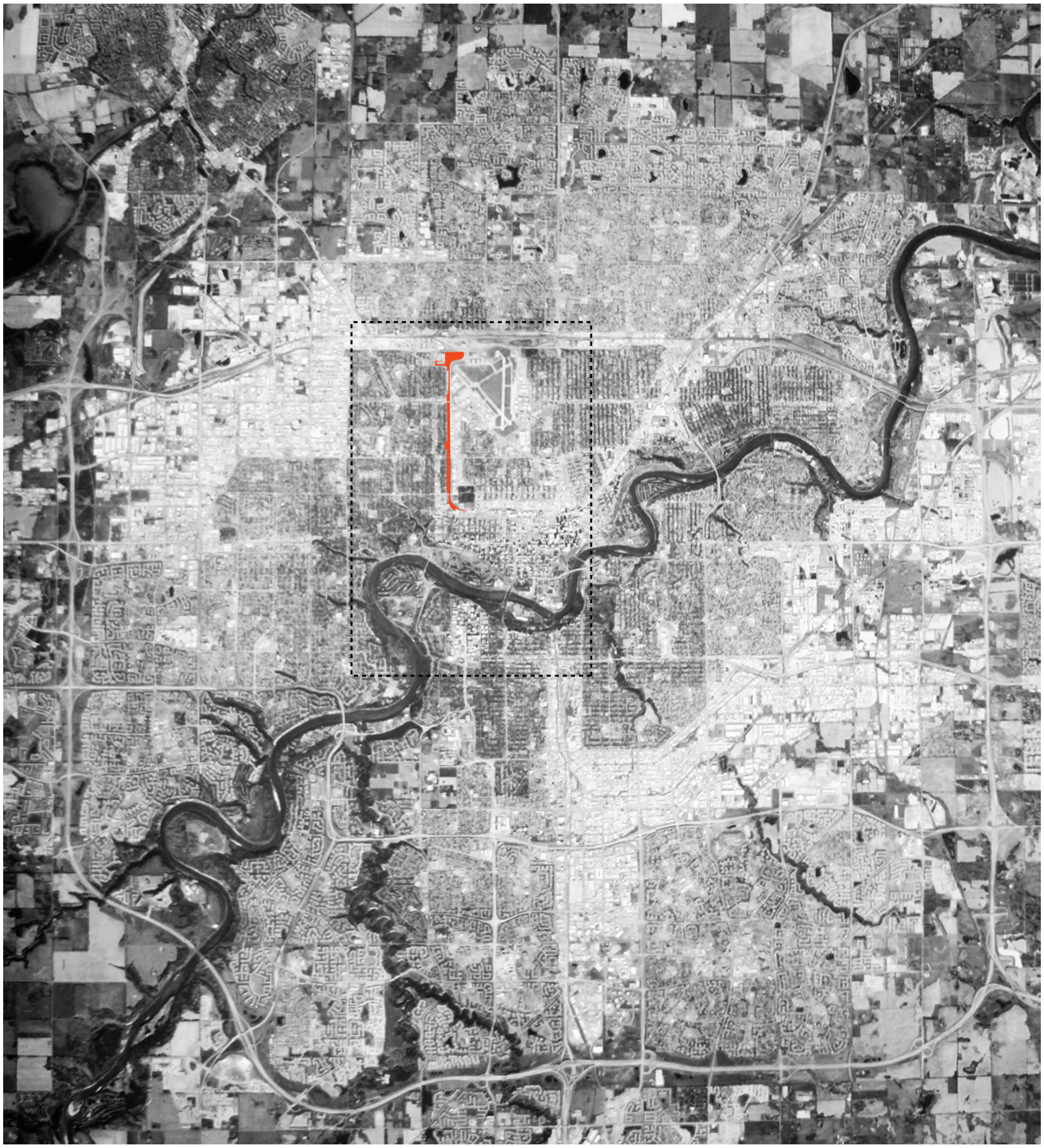
EDMONTON, ALBERTA

Edmonton is the provincial capital of Alberta. It exists at the 50°N parallel. The city is bisected east to west by a fast moving section of the North Saskatchewan River and its associated valley: the longest stretch of connected urban parkland in North America. Edmonton sits just east of the foothills of the Rocky Mountains, about 2 hours from Jasper. The North Saskatchewan River is powered by drainage from the Rockies. Edmonton currently identifies most strongly with its strategic northern location and climate. It is the principle port of call for all amenities going north to centers such as Fort McMurray, Yellowknife or Whitehorse, either by road, rail or sky. It is the main rail transport hub of Western Canada and sits among some of the country's most fertile farmland (City of Edmonton 2007).

Fort Edmonton was a grouping of trading posts founded by the Hudson Bay Company in the late 18th century, all located in Central Alberta. The fifth and final trading post was renamed Edmonton and was located on the north side of the river. Edmonton has remained an important transport hub throughout its existence, now as a major central hub of the Canadian National (CN) and Canadian Pacific (CPR) rail systems. The CN Tower in Edmonton held the title of tallest building in Western Canada from 1961 to 1973, punctuating the importance of the company in the city. The municipal airport of Edmonton, now in the process of decommissioning, began regular flights in 1929 and, along with rail development, was a major contributing factor as to why the city gained its pseudonym as the 'Gateway to the North' (Heritage Canada 2010).

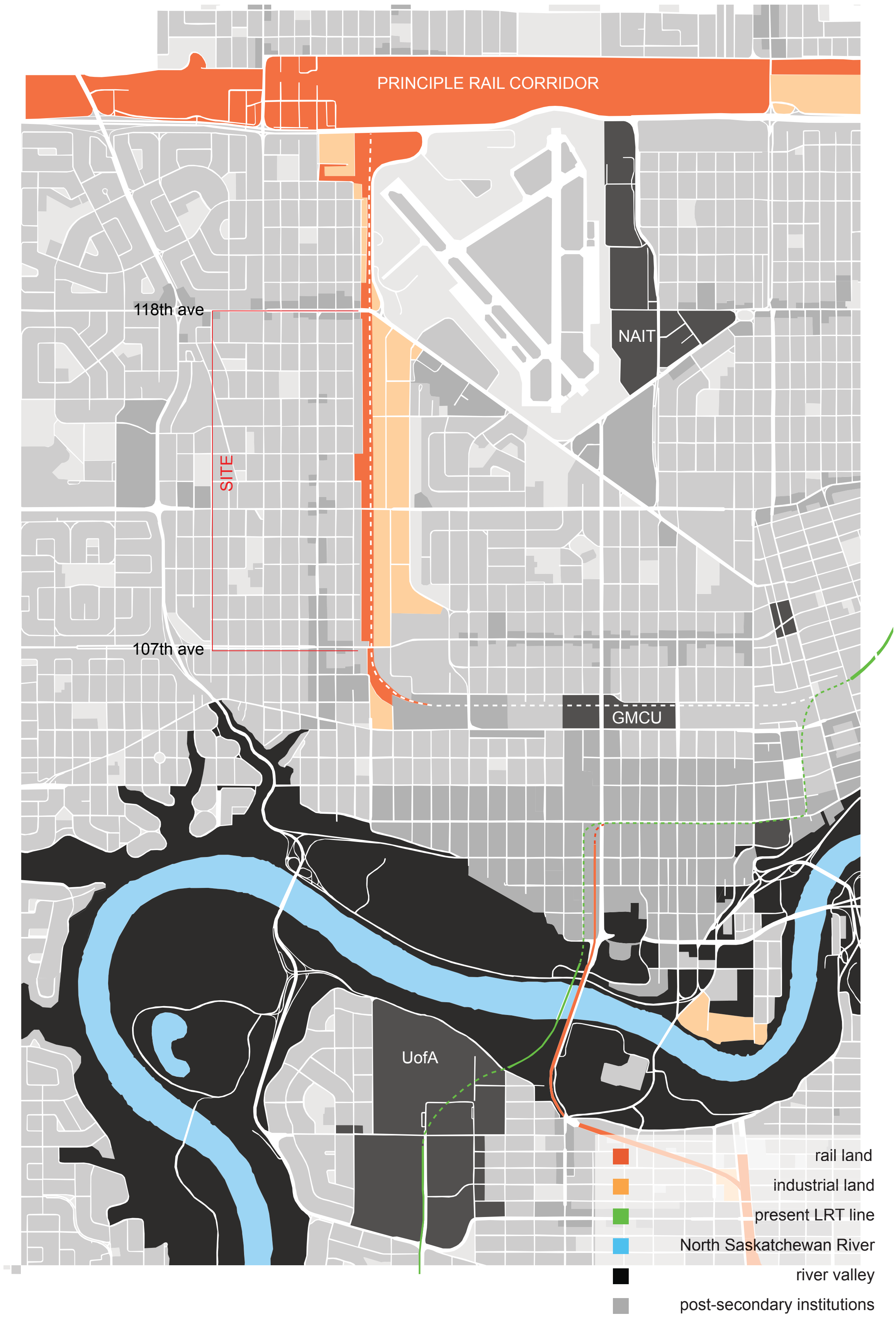
Edmonton is indicated by the larger of the two red dots. The smaller is Halifax.

Map of Alberta.



Satellite image of Edmonton.
Site and limits of site model indicated.
(Bing Maps)

Site model of dotted rectangle in previous map.



PRINCIPLE RAIL CORRIDOR
118th ave
SITE
107th ave
NAIT
GMCU
UofA
rail land
industrial land
present LRT line
North Saskatchewan River
river valley
post-secondary institutions

In 1930, the city had a population of 80000. The first major oil discovery in Alberta happened just south of Edmonton in Leduc, in 1947. The subsequent oil boom crowned Edmonton the “Oil Capital of Canada”, and during the 1950s, the city increased in population from 149000 to 269000 (City of Edmonton 2007). This explosion of population and increase in individual net income led to rapid expansion of the housing market, following the trend of other North American cities by building far from the city core in large low-density sprawl which eventually spawned the car and truck culture so prevalent in Alberta today. The city’s status as a transportation hub (both passenger and freight) made it a very convenient place for oil, gas, agricultural, and other goods to be transported cross-country (Churcher 2010). After a relatively calm but still prosperous period in the 1960s, the city’s growth took on renewed vigor in parallel with high world oil prices, triggered by the 1973 oil crisis and the 1979 Iranian Revolution (Heritage Canada 2010). The oil boom of the 1970s and 1980s ended abruptly with sharp declines in oil prices on the international market, however Edmonton’s location in relative proximity to the northern Albertan tar sands allowed it to continue its expansion when prices would spike in the 90s. As job numbers on the oil rigs increased rapidly with improvements in extraction technology, the influx of foreign and domestic youth to Edmonton increased as it became a staging ground for those seeking to work in oil. At the decline of the oil boom in 1981, the population of Edmonton was 550000. Today the population sits at 850000 and growing (City of Edmonton 2007).

As trucking now provides a more economical means for the transport of goods over short distances, rail property in most urban centres is being sold and developed. How might the charactistics of these specialized pieces of land inform their development and improve the neighborhoods they intersect?

Canadian National Rail.

Canadian Pacific Rail.

Important dates in the history of Edmonton:
Note the first major oil discovery and the subsequent changes to the site shown in the images.
(Satellite Images from City of Edmonton Archives)

CLIMATE

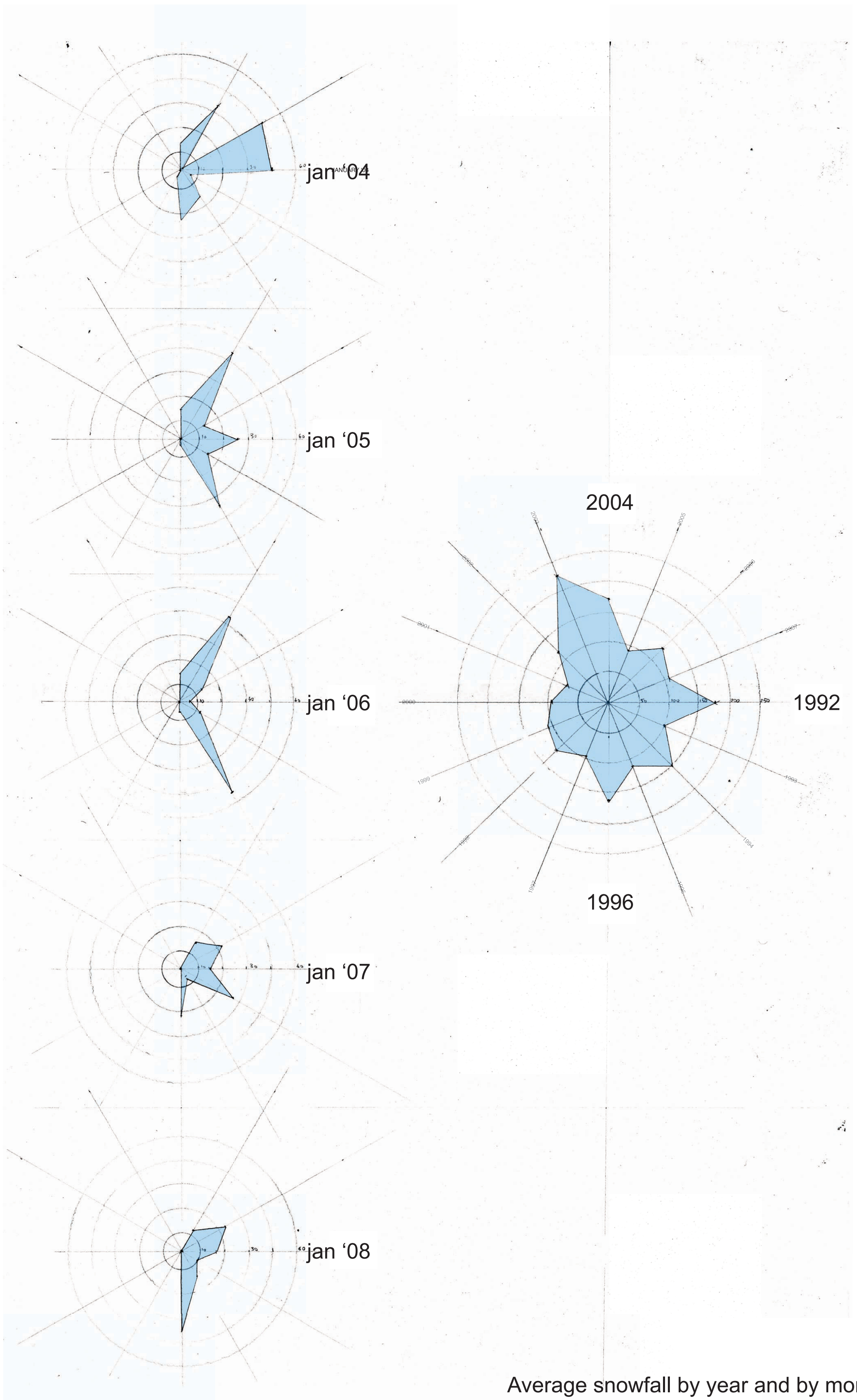
The climate in Edmonton is one of extremes. Summer lasts approximately from May until September. Temperatures often soar as high as 30°C and with a very dry climate, most days are hot, bright and clear. Due to its northern location, the city enjoys the summer sunrise at about 5am and sunset at 10pm (Chetner 2003). These long days allow for extended outdoor activity time whether it be biking and running in the river valley, team sports around the city, or golf at one of the many golf courses. Summer in Edmonton is a short but lively time, with large festivals or events every other week, most notably the Jazz, Blues, Folk and Fringe Festivals. There is an obvious sense of movement in the city as it defrosts after the long winter. Many drive to one of the surrounding lakes, to Jasper, or down through Calgary to Canmore or Banff to escape the heat of city and enjoy the mountains. In the summer, the shopping and bar districts of Whyte Ave., Jasper Ave., and the university areas are bustling until quite late at night, with successful patios taking advantage of a high sun angle and the resultant long days.

Winter comes quickly and without warning. The city is known for the unpredictability of its winter weather. Snow has fallen during every month of the year save July and August. During my last visit it snowed 20cm over the May long weekend. The temperature in the depth of winter rarely rises above -15°C making it essential to plug in cars left outside overnight. The sun rises around 9am and sets around 4pm; the city is cold and dark (Chetner 2003). The image of the city changes dramatically in winter. The white that shrouds every surface chases the people indoors. Parking garages and indoor pedways link downtown buildings, leaving the streets to the cars and the sidewalks empty.

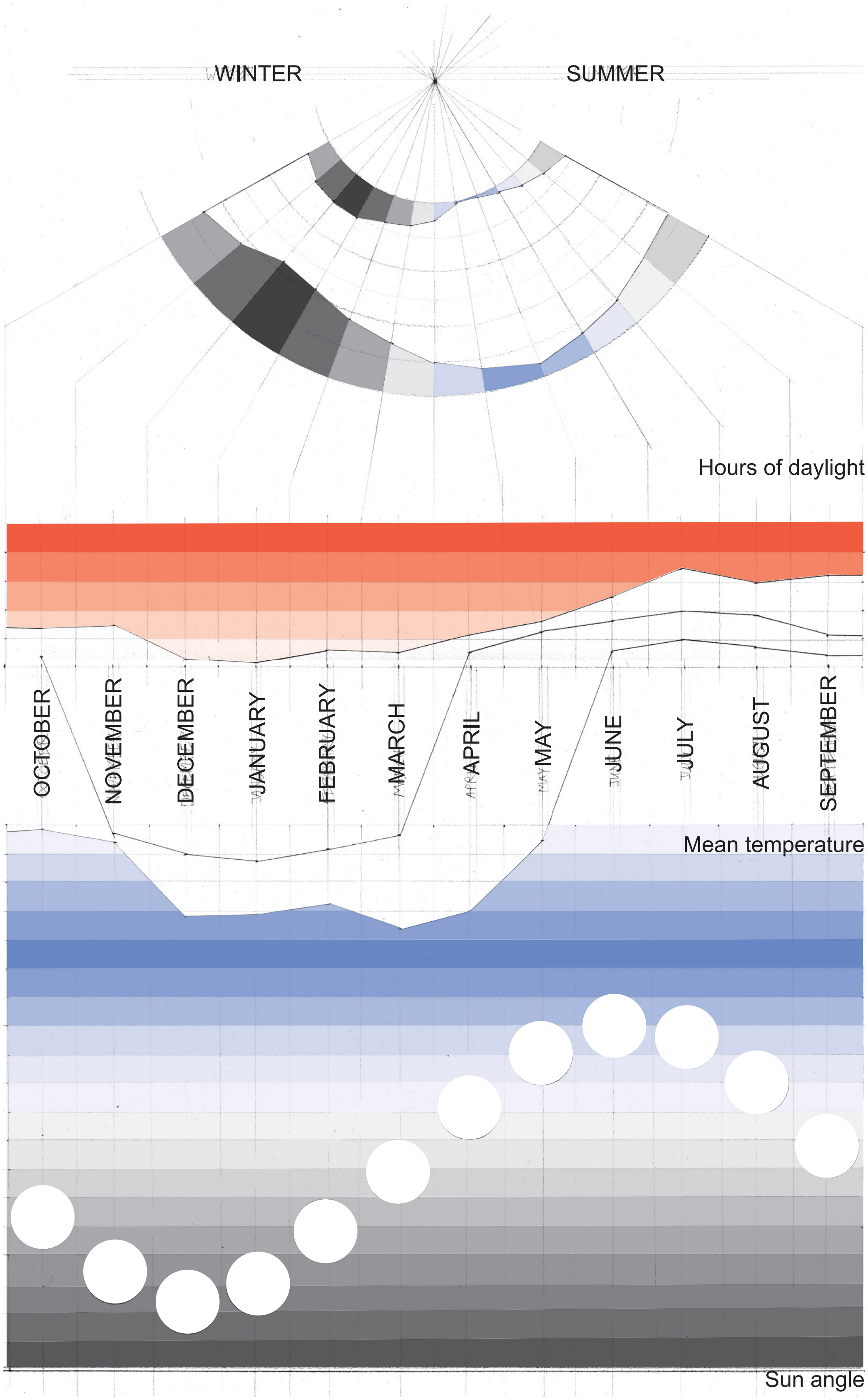
Outdoor hockey rinks quickly open throughout the city where soccer and basketball were played weeks earlier. Golf courses are groomed for cross-country skiers. On weekends, many flock to Banff or Jasper to ski and snowboard; the rest gather in the cities expansive malls, rushing from house to car, from car to destination, and back.

Leisure activities in winter are strictly outdoor or indoor. Malls, of which Edmonton has many, are extremely busy in the winter months, and as commercial nodes around the city, become important hangouts for youth. Because of the vast residential neighborhoods outside of the city centre and the inefficiency of the public transportation system, it is very difficult to commute downtown without a car, and expensive even with a car. Young people have adopted the mall as a microcosm of the downtown. The lack of suburban density has resulted in the decline of gathering space. The mall has taken the place of the square, the park and the shopping district in these neighborhoods. This is especially true for those of lower incomes, and huge low income neighborhoods are therefore immobilized and stranded. The handful of successful parks in Edmonton are all part of the river valley system, which cuts through the heart of the city. These parks are beautifully maintained by the city, but cater to a small, largely upper class portion of the population due to their location in the downtown district of the city. The public park revolves around the local school and in winter, therefore, the local rink. This does not allow for much imagination of use, nor inclusive gathering. In the summer months, it encourages none at all.

How might reclaimed industrial land act successfully as space for gathering and activity outside of the city centre?



Average snowfall by year and by month.



WINTER
SUMMER
Hours of daylight
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
Mean temperature
Sun angle

PROCESS

MECHANIZATION OF FARMING

Canadian Pacific Railway land offerings from 1880. (Canadaspace, 2010)

Agricultural irrigation machine. (Baron 2010)

Alberta grain elevator and CN train access. (Stevens 2008)

The production and processing of plant and animal byproducts has been an essential practice in Alberta for almost 150 years. Agriculture has been one of Alberta's most profitable industries since its colonization.

The Canadian Pacific Railway reached Alberta in 1883 (Churcher 2010). This accelerated the settlement of Western Canada brought on by the Dominion Lands Act of 1872 which allowed 160 free acres to anyone willing to build a permanent residence within three years. It also allowed farmers to buy the neighboring lot for a $10 administration fee, leading to more profitable farms relative to American farms to the South. Access to rail allowed for rapid distribution of tools, building materials and other commodities, increasing the speed at which land could be divided and cultivated. The flat terrain and soil composition established Alberta at the helm of the agricultural industry in Canada. Ever since, agriculture has occupied a significant position in the provinces economy. Alberta now produces half of Canada's red meat, with over 3 million cattle resident in the province. It is also a huge producer of grain, predominantly wheat, canola and barley (Cross and Bowlby 2006). Where many smaller farms once existed, mechanization and streamlining of processes has allowed for much larger commercial farms to run effectively with minimal amounts of labor (Giedion 1969, 163) The grain elevator, once an iconic image on the Alberta horizon, is becoming less common as produce is being trucked to larger, centralized processing facilities.

Such has been the way of the agricultural industry throughout

North America, where mechanization has progressed rapidly since the invention of the first mechanical reaper in 1831 (Giedion 1969, 130). As the price, and therefore speed, of production plays such a vital role in the success of a farm at any scale, the introduction of machines to progressively minimize human or animal contact with agricultural processes has always been the goal of the inventor.

> The farmer, if need be, can complete his harvesting single-handedly. Otherwise, it suffices for a lad of ten to stand on the platform and see that the sacks are being correctly filled. Increased production, freedom from exertion, human and animal, and gratifying work: seldom are all these so happily combined.
>
> (Giedion 1969, 147)

Mechanical reaping became the standard by 1850, assisted hand-binding in 1870, fully automatic binding and knotting in 1880, etc. The introduction of steel frames allowed farm equipment to be much lighter and stronger, again reducing the stress on animals as well as the need for continual maintenance. In 1880, an estimated twenty man hours were needed to harvest an acre of wheat. By 1930 this number was down to six (Hall 1979, 23). The replacement of horsepower with the internal combustion engine had arguably the most significant effect on production rates. An estimated 1.6 million tractors were in use in America by 1939 (Giedion 1969, 161). The same speed of mechanization can be witnessed in slaughterhouses, dairy farms, or any other facet of the agricultural sphere.

> We are in the time when the assembly line or production line extends into every sphere. Even if nature refuses to merge beginning and end in one swift process, and needs time to grow and ripen, ways and means are nevertheless found to integrate the beginning and the end into line production.
>
> (Giedion 1969, 163)

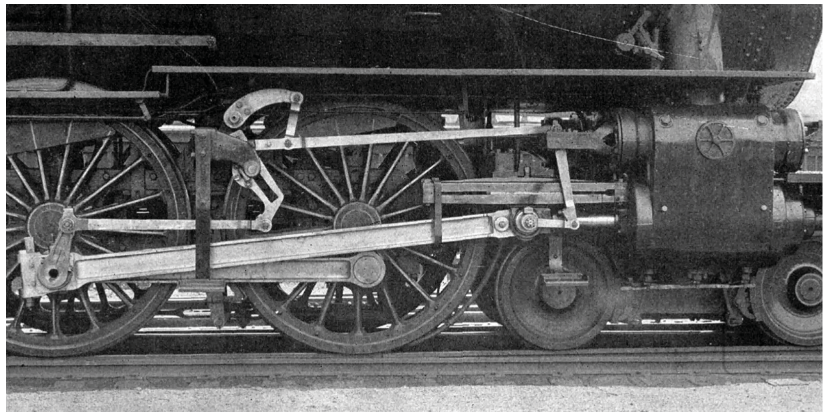
The concept of combining processes is the great driving force behind the speed of the mechanization of agricultural practices.

MECHANIZATION OF RAIL

Retired train axles near Halifax Port.

The mechanization of the train and development of the resulting rail industry has grown, much like the agricultural industry, alongside innovations in mechanical, material and chemical engineering, machining, etc. The first production locomotives used variations of the crank and flywheel method of converting the linear motion of the steam piston to the circular motion of the wheels. This was an innovation, patented in 1780 by James Pickard, which allowed the principles behind early steam engines to be used in transportation. The first successful steam locomotive was invented by Richard Trevithick in 1804, and as the potential of the technology gained popularity, innovators pushed the design rapidly in parallel with other developments at the height of the industrial revolution. By 1830, steam locomotives were being mass produced in Great Britain and in the United States, being used in mining, forestry, and eventually the movement of passengers and freight. (Churella 1998, 14) The steam locomotive was eventually replaced by the diesel train in the mid 20th century. Diesel allowed similar power output, but with an engine which operated much cleaner, cooler, more reliably, used less fuel and could be operated safely by one driver. The principal initial success of diesel trains over steam was their associated manufacturing processes. Steam locomotives were usually custom-made for specific railway lines, therefore economies of scale were difficult to achieve (Churella 1998, 18). Diesel trains used much more precise tolerances in their manufacturing processes, but this increased difficulty made them more conducive to mass production and standardization, with fewer machine shops competing for contracts.

> ...manufacturer Baldwin offered almost 500 steam models in its heyday, EMD (subsidiary of Caterpillar) offered fewer than ten diesel varieties.
>
> (Churella 1998, 19)



Walschearts valve gear.
(Morven 2004)

Train repair roundhouse with turntable.
(Melby 2010)

CN Rail was the first North American railway to use diesel locomotives in mainline service in 1929 (Churcher 2010). The rapid progression from horse-drawn modes of transportation to fuel powered travel are the result of rigorous advances in mechanization and manufacturing, whether directly or indirectly linked to the rail industry.

Canadian rail expansion was one of the principal catalysts for confederation. The rail lines were expanded largely by private investment, with government incentives of huge land grants for those investing in the main, trans continental trunk. In the late 19th and early 20th century, most sections of Canadian rail were owned by groups of private investors. The largest section was the Canadian Northern Railway (CNoR), which connected Quebec City and Vancouver via Ottawa, Winnipeg and Edmonton. When WWI almost halted any new immigration and most wartime contracts had been won by the Canadian Pacific Railway, the profitable lines of the CNoR could not cover the costs of ongoing construction projects. When the company requested financial aid in 1918, the federal government gained a controlling number of shares, and an appointed Privy Council decided that the railroad would be joined to other federally owned branches to form the Canadian National Railway. This consolidation resulted in the longest railway in Canada, with Edmonton and Winnipeg as the primary prairie hubs. The completion of the High Level Bridge in 1912 (CPR) across the North Saskatchewan River was key in the amalgamation of Edmonton (north of the river) and Strathcona (south of the river) into a single city. The bridge was an engineering first and though rail use was discontinued in 1989, it retains its nostalgic status as a monument to past industrial triumphs (Churcher 2010).

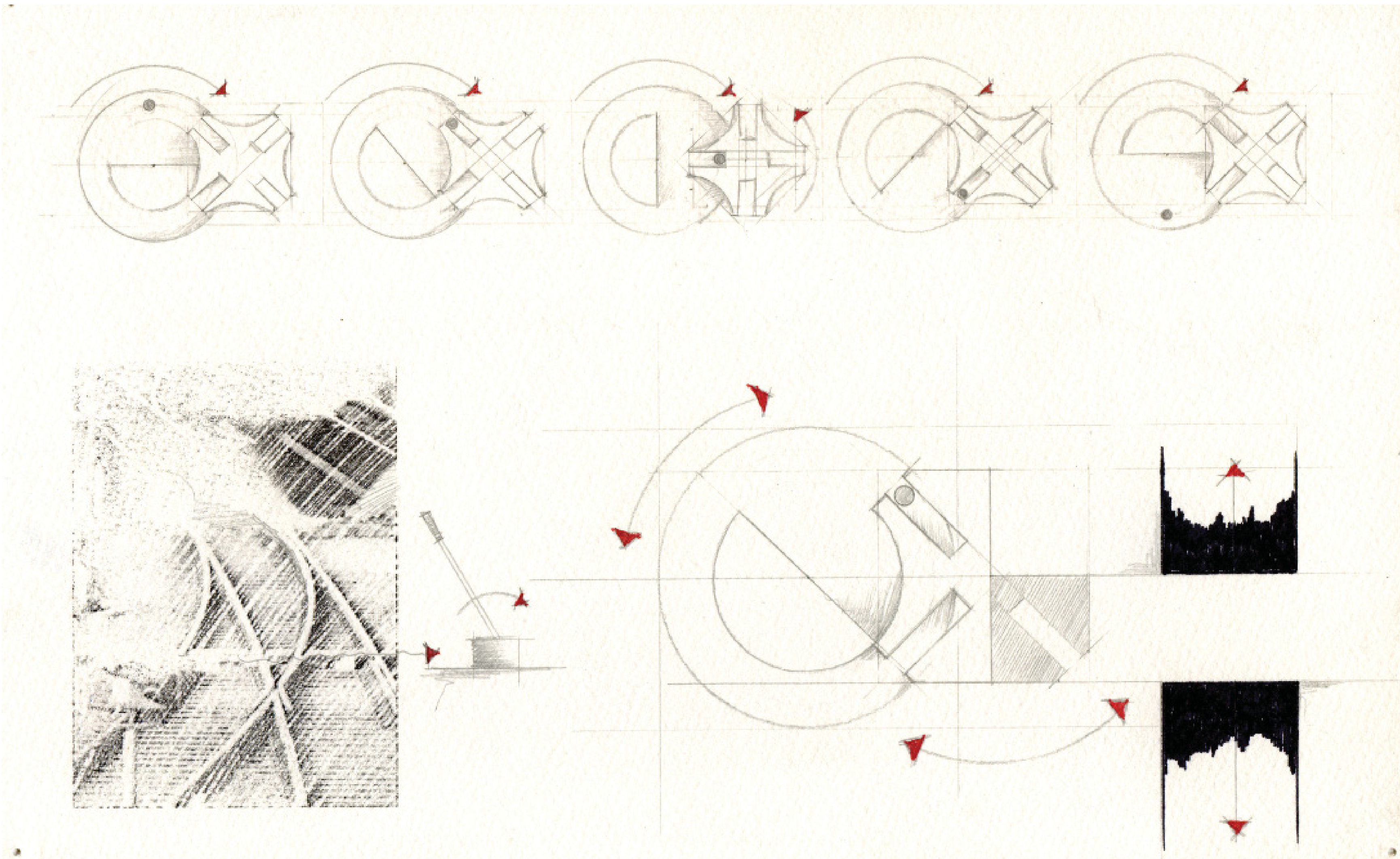
Edmonton forged its reputation on its connectedness with the rest of the country. Businesses relying on import and export of freight continue to benefit from the unique position the city holds along the Trans Canada route.

Train platform on top of truss.

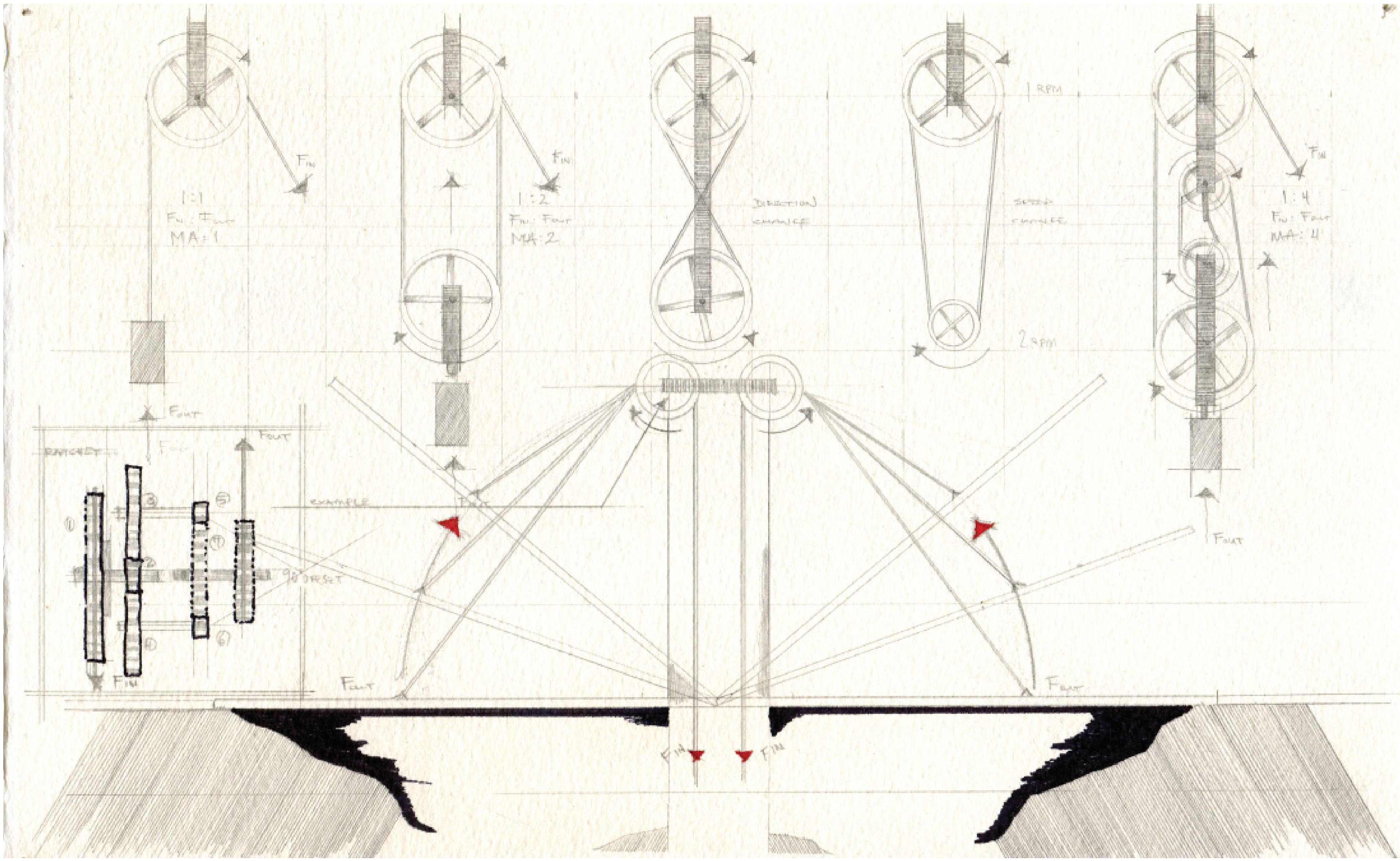
Structural detail.

Road platform inside truss.

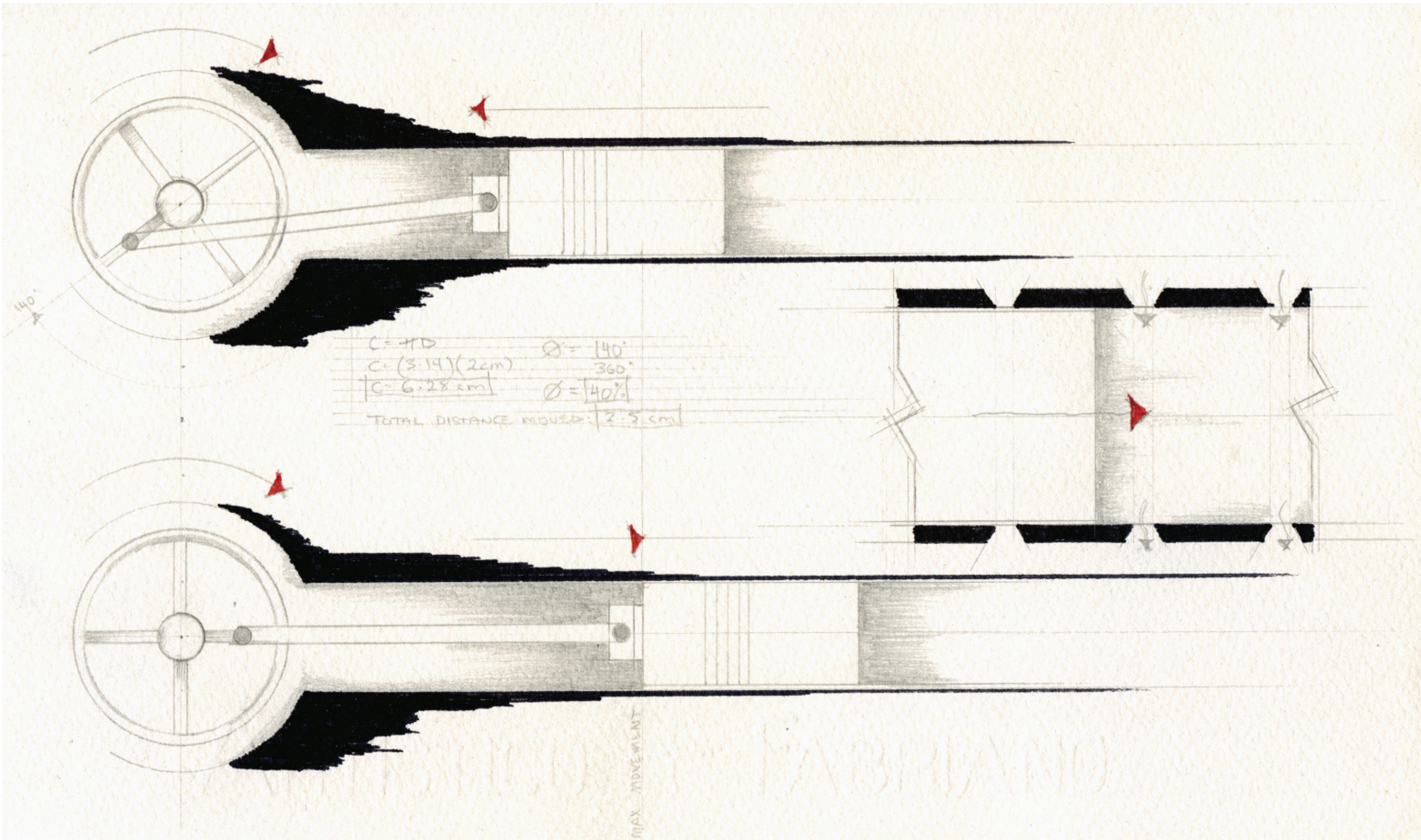
The Edmonton High Level Bridge: first train in 1912.
(Edmonton City Archives)



Study drawing of a Geneva Stop: a mechanism used most commmonly to set intermittent timings (watches, rail switches, etc.)



Study drawing of simple pulley systems, used to produce mechanical advantage.
Concept of a mechanical bridge operated by a pulley system shown.



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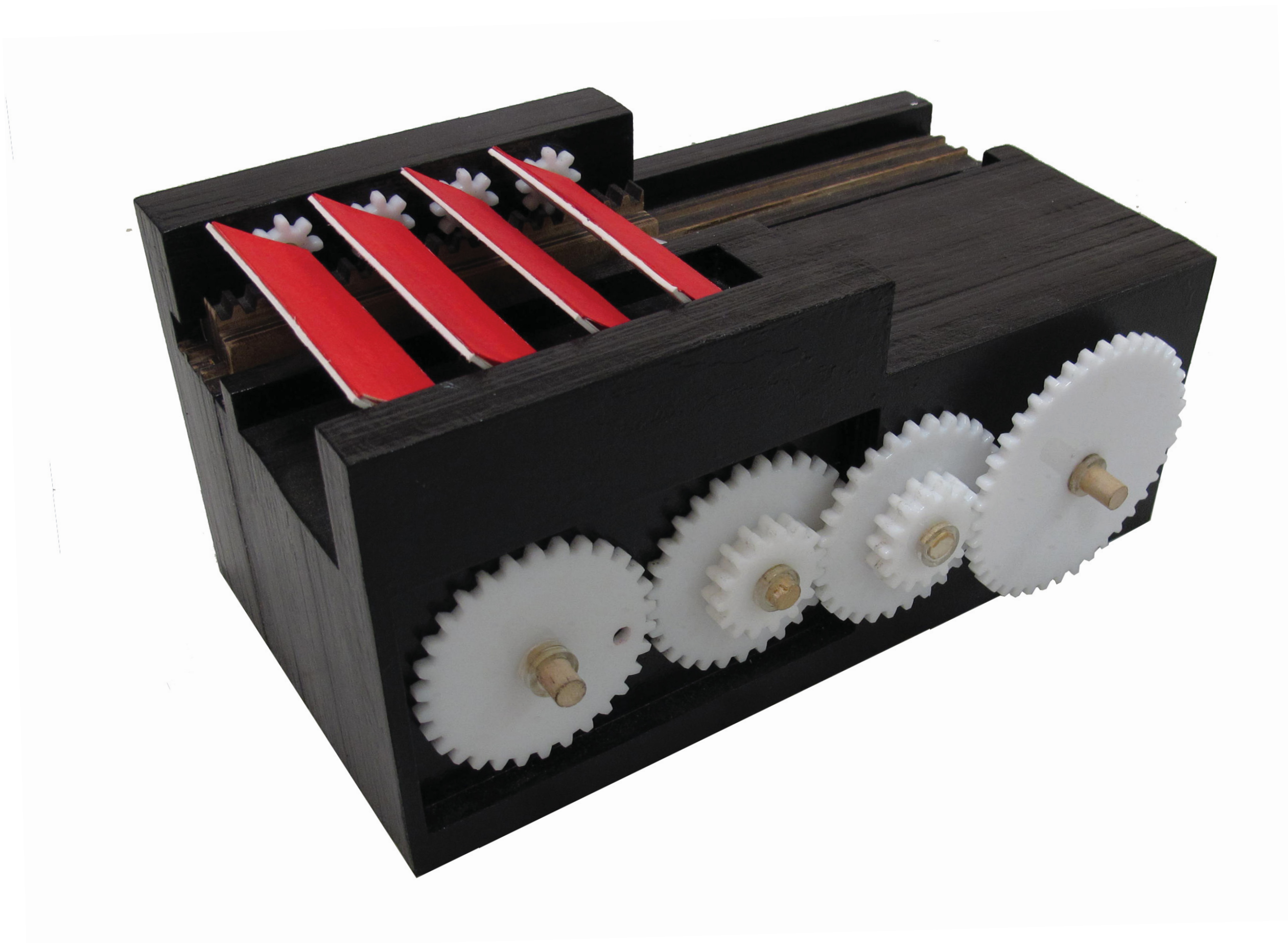
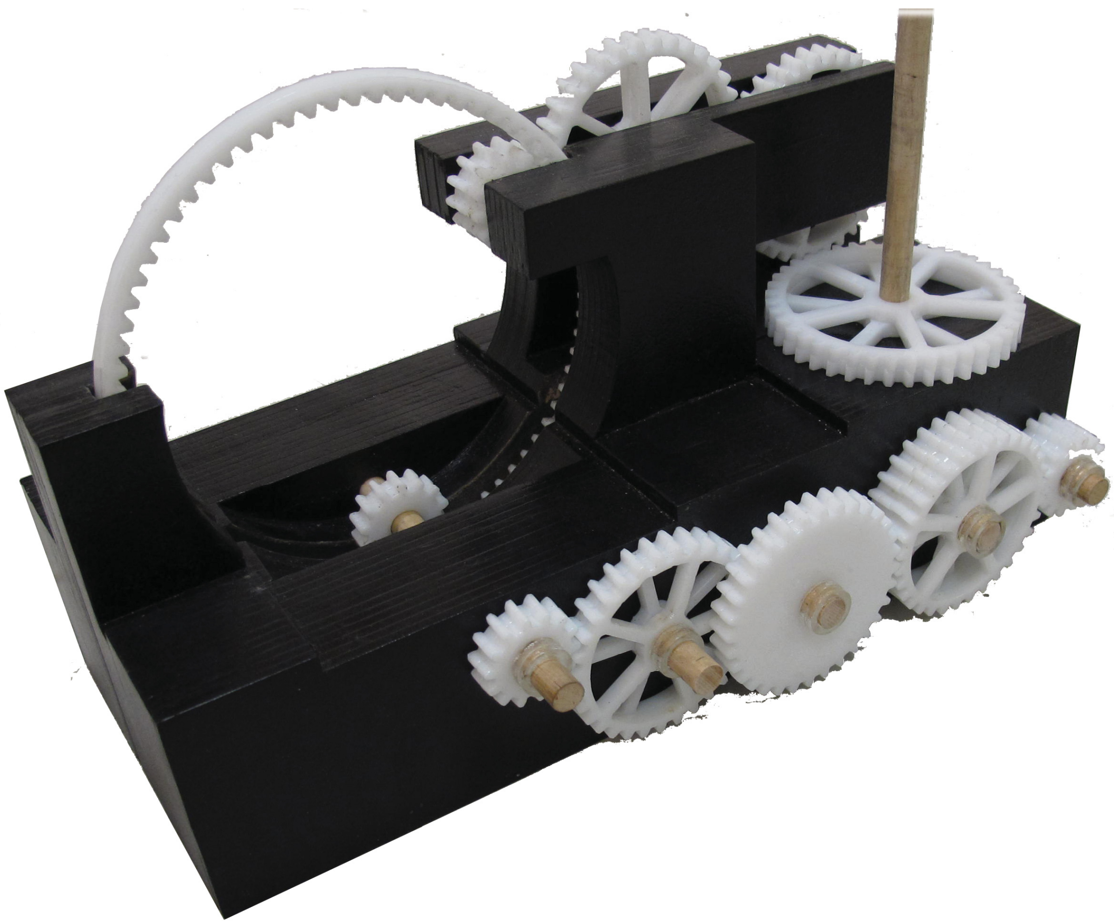


Study model of a gear mechanism designed to convert rotational motion to linear motion (like a crank and flywheel), eventually controlling the pitch of four louvers. Early idea for sun collection device.



Study model of a gear mechanism designed to control the yaw output of a vertical mast via a gear train through which an uninterrupted pathway can be built.

1967
Note the rail cut on the East side of the site. Several smaller businesses can be seen established along the West side of the rail.
(City of Edmonton Archives)

SITE

PAST

The proposed thesis site is situated to the Northwest of downtown Edmonton, Alberta, in a neighborhood called Inglewood. It was formerly part of the expansive CN Rail lands which serve as the main intersection point for the transportation of goods via rail. Since the oil boom, CN has been slowly selling their land parcels for further development of the downtown core. As shown in the archival photos, the site in question has changed dramatically in the past 60 years. With oil deposits found in Leduc in the late 40s, the influx of workers was immediate (Heritage Canada, 2010). Such population growth put added pressure on the ability for the city to provide amenities. The city expanded outward from its core, with industrial sites developing adjacent to the various rail passages. It was imperative to allow for efficient import and export of large amounts of goods from manufacturing, storage, or other operations. Several other much smaller businesses took advantage of the proximity to both the rail and its associated industrial zone, setting up on the residential side of the tracks. The outlines of hockey rinks can be seen spotting the length of the site. The area was alive and energetic, both in terms of business and production, as well as leisurely activity. In the early 80s, at the decline of the oil boom, rail use was discontinued on the site. This meant the demise of businesses relying on the shipping capacity of the train. Soon the rail was removed entirely, closing the big bay doors at the rear of each industrial building permanently (City of Edmonton Archives). Both the residential and industrial had turned their backs on the site. The rail served as the mechanical backbone that both the residential and industrial neighborhoods grew around and prospered from, the sites activities dependent on the the rail, as well as the geometry of its associated site.

Current site with streets. (Bing Maps)

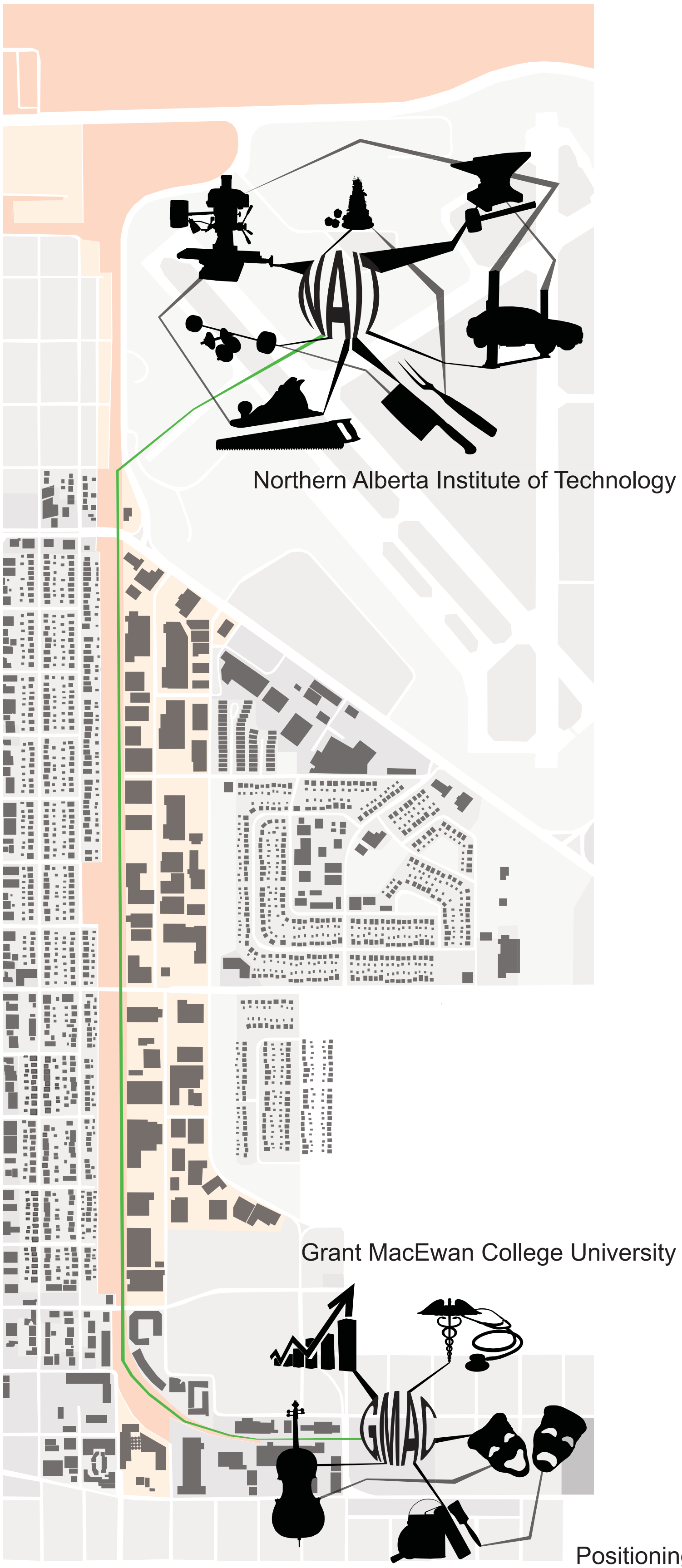
PRESENT

The site now sees limited bike and pedestrian traffic on weekday mornings and evenings; hardly any on weekends. There are often a few homeless people sleeping in the shade of the industrial buildings during the long summer days, and garbage can be seen strewn about the grass in places. There is a tense juxtaposition of building types, the site existing as a void in the otherwise dense urban fabric. The site is intersected by three busy streets traveling east-west, the northernmost end of the site hitting the southwest tip of the Edmonton City Centre Airport (ECCA). The ECCA was the first airport to be licensed in Canada (1929), yet despite its rich history, is scheduled to begin closing in 2010. (Heritage Canada 2010) The airport covers 144 acres and is perfectly located as an extension of the Edmonton central business district. The Northern Alberta Institute of Technology, an immense college which occupies the entire eastern border of the airport, has committed to expanding its campus onto a substantial plot of current airport land. The college currently trains 17% of Canada's apprentices, with an enrollment of 85 000. (NAIT 2010) The southern end of the site curves east into the downtown area of Edmonton, where it has been developed into a mall and the campus of Grant MacEwen College University. Future plans for the expansion of the city's light rail system include a stop underneath Grant MacEwen and a major hub at NAIT. With existing stops in the far south and northeast parts of the city, this suggests access for a large group of people. The aforementioned stop at NAIT will expedite the movement of people to and from future developments on the airport lands (City of Edmonton 2007)

Future LRT north expansion.
(City of Edmonton 2007)

The dimensions of the site are 2300m long by 55m wide. It takes 20 minutes to walk the site from north to south.

Site photos, April and June 2009.



Positioning of two schools as site bookends.

DESIGN STRATEGY

THE HINGE

The hinge is a powerful mechanical effecter of change in the built world. It is usually a type of bearing which connects two solid objects, and allows the objects a specific range of motion in relation to each other. (Joslyn 2009) The hinge is a simple device that also carries metaphorical significance in a dichotomic environment such as the discussed rail corridor. This metaphor will aid in conceptualizing the connections between user-groups or site conditions. How might the design elements serve metaphorically as hinges around which different conditions revolve?

WINTER AND SUMMER

Winter and summer are the overlords of all that happens on the site. They dictate the activities that are possible and when they are possible. The seasons also dictate the energy investment needed to pursue these activities. The site must react to its environmental context to address these concerns. A system which pursues the production and distribution of renewable sources of energy provides the opportunity to begin infusing the site with movement through mechanics. The design and development of a continuous outdoor activity pathway provides the surrounding community with badly needed year-round recreational and gathering space, and an opportunity to embrace their unique northern climate. The site activities will be designed around the productive capacity of the mechanical systems; the architecture will reflect their movement. The future development of the airport property to the North of the site suggests the possibility for development along this corridor, with the system and pathway as its backbone.

THE PATH AND THE PARK

> Neighborhood parks need people who are in the immediate vicinity for different purposes from one another, or else the parks will be used only sporadically. If parks lie idle, it is bad for them and their neighborhoods, but they do not disappear as a consequence.
>
> (Jacobs 1993, 198)

Rideau Canal (Ottawa).

Winterlude Festival (Ottawa).

Pond hockey tournament.

The current swath of greenspace does not constitute the existence of a neighborhood park. Instead the site must be infused with various elements which draw users throughout the day and year. Physical activity in the form of team and individual sport is very popular in Edmonton. Biking, running or rollerblading in the summer are matched in popularity by skiing and skating in the winter. Cities such as Winnipeg and Ottawa experience similar temperatures, and benefit from the immense success of their winter pathways, used in the coldest of temperatures, and at all hours of the day and night. The primary goal of the project is to bridge the three obstructing roads, creating a continuous activity pathway to be used throughout the year, connecting the eventual redevelopment of the airport and the downtown core of Edmonton. The resultant park is therefore made up of a series of unique moments along the pathway, all catering to different interest groups, but creating a continuous experience. The summer pathway changes dramatically in winter. Skiers and snowshoers venture off the beaten trail, children fall and create obstacles, necessitating wider lanes. People stop periodically at kiosks for hot drinks and food; places to gather as temperatures drop.

The activity pathway will move through different activity zones which provide space for winter and summer recreation, relaxation and food growth. In the summer months, these would become space for soccer, ultimate frisbee, or football.

THE MACHINE

The rail corridor formerly served as a distribution node for the industrial buildings flanking the site as well as for the small businesses set up around the rail line. Similarly, the Machine will provide for the site, but also has the opportunity to influence its adjacent context. In Edmonton, the seasons are vastly different from one another, however hinging moments can be detected in many processes, for example: the collection of snow for its capacity to cool, as well as the use of the eventual melt water. Because snow-clearing is a fact of life in winter cities, collecting it for later use is possible. Before the existence of refrigerators, ice was harvested and stored in subterranean, insulated icehouses (in the Middle East as early as 1700 BC). The enormous value of the cold it provided would be used to preserve food throughout the year (James and Thorpe 1994). In Edmonton, the value of this stored energy is in its ability to cool homes in the hot summer months. The latent energy contained in 11 tonnes of snow is equal to the amount of energy consumed by the average Albertan home for air conditioning in a summer. A tonne of snow melts to provide approximately 100 L of water (see Appendix for relevant calculations). A large amount of collected snow could therefore influence a considerable number of homes in the adjacent residential neighborhood, while providing a sizeable amount of water for use on the site.

An activity pathway and energy-harnessing machine require power to work. Edmonton, one of the sunniest cities in North America, experiences some 2300 hours of sun and 17h on its longest day, making it one of the best locations in Canada for the collection of solar energy (Pelland 2006). Sun-tracking solar arrays and wind turbines will power the site, moving with the sun and the wind, their movement celebrated in the architecture.

> Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change, so as to still remain essentially the same function, structure, identity, and feedbacks.
>
> (Walker 2004, 5)

The machines collect environmental by-products which in turn become useable resources for the site, whether in terms of energy, cooling, light, or water. The principle end for these products will be either the surrounding community, or the activities along the pathway. The exhausted water from the summer cooling cycle is pumped into the site every fall, and is used to hydrate plots of growing space. Urban agriculture is a fundamental step in furthering the resilience of a community. The ability to provide food for oneself throughout the year is both valuable in this basic sense, but also as a teaching tool, a pastime, etc. The infusion of green into the white winter landscape would create a compelling image along the pathway, and would provide activity at different hours of the day and night.

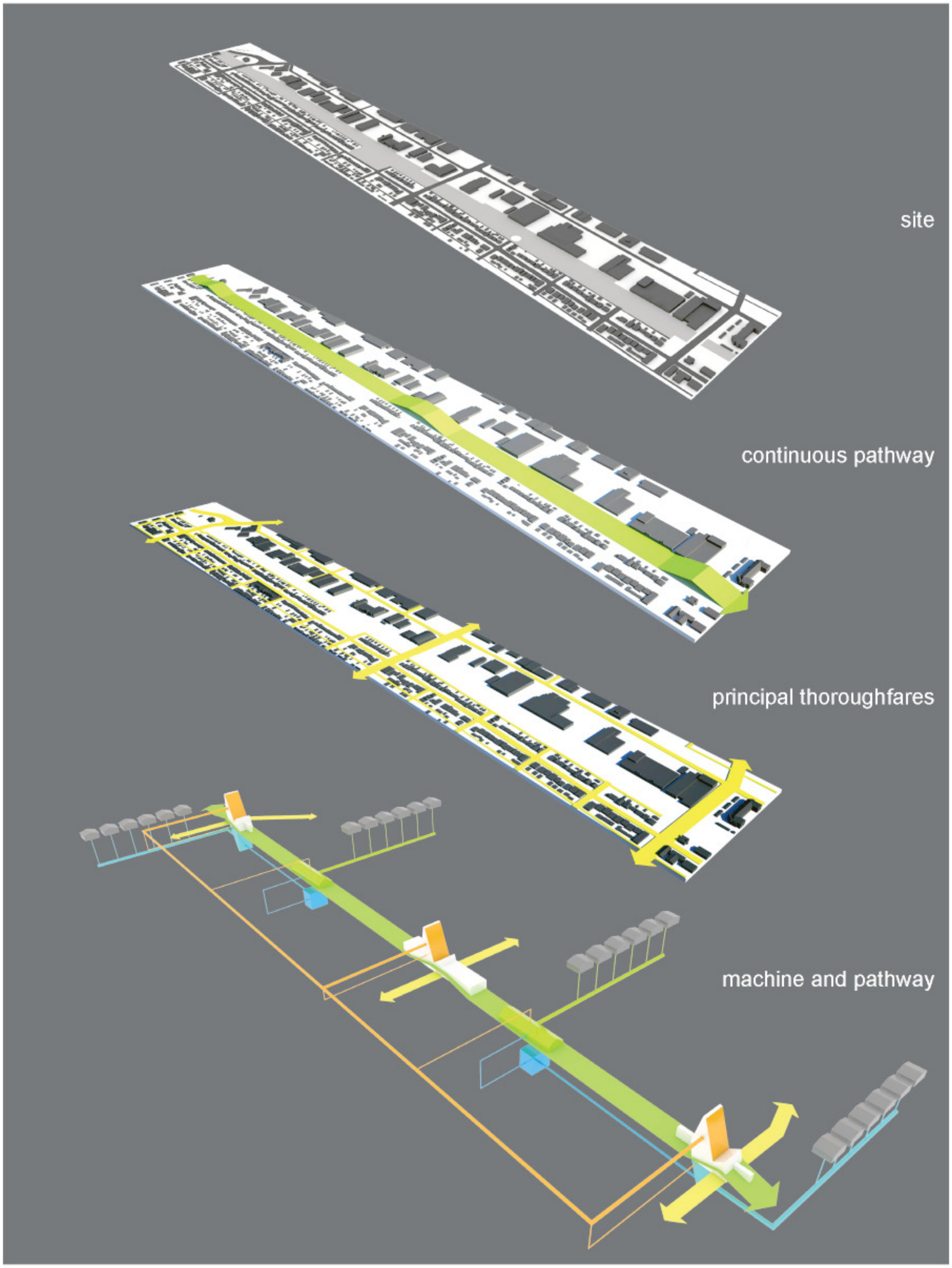


Diagram of site strategy.

MEMORY

Landschaftspark
Duisburg-Nord
(Wahler, 2007)

How might this project serve as a hinge between past decline and future growth? Central to this thesis is the belief that an abandoned, post-industrial site has the capacity to successfully transform without losing sight of its important past. The former life of the site is expressed by the boarded up bay doors of the adjacent industrial buildings and in the faint lines where the rails used to lie. The intention of the project is to infuse the site with life, not directly related to the past function of the place, but perhaps reminiscent of it.

> Apart from historical importance, the iconic incorporation of the industrial vestiges into the park offers an interesting aesthetic. The juxtaposition of abandoned relics with the lush green park creates a sense of mystery and industrial romanticism that invites exploration. Faced with decaying industrial ruins, users of the park are also challenged to consider the relationship between technological progress and their natural environment. As a whole, the post-industrial park can be commended in staying true to not only the original landscape but also in furthering dialogue about the environmental consequences of industry.
>
> (Studiomezz Editorial 2010)

The Highline Project, New York City.
(GraduallyGreener 2010)

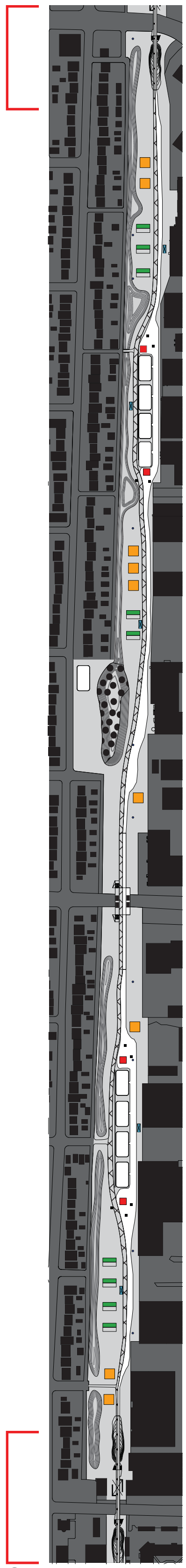
The goal of the project, through mechanical elements and a bustling activity pathway, is to establish an intervention that is a contemporary, functional representation of the site's past life. In this way, it takes on new program, not only as a system and as a pathway, but also as a monument and a museum.

> A monument can incidentally be a work of art or a public facility; it can even give pleasure. […] Its sanctity is not a matter of beauty or of use or of age; it is venerated not as a work of art or as an antique, but as an echo from the remote past suddenly become present and actual.
>
> (Jackson 1980, 91)

This new, post-industrial, pathway offers the opportunity to showcase some relics of the past amongst some of the working machines of the present. Expired elements from the rail corridor north of the site will become showpieces along the pathway, places to sit and reflect, places for children to play, etc.

Gasworks Park, Seattle. (Deveraj 2010)

The Highline Project, New York City. (Glekas 2009)

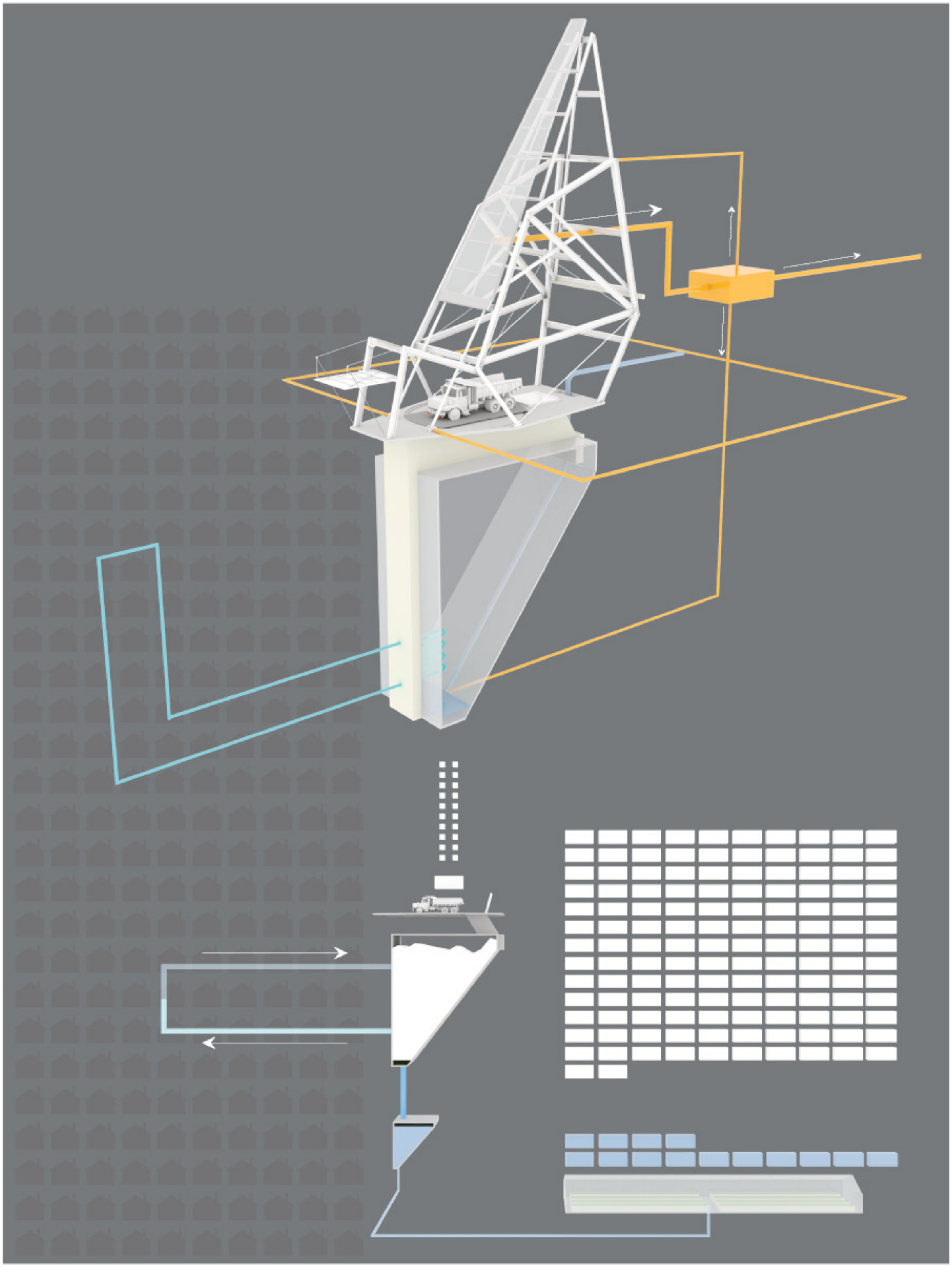


Snow Machines
(Winter Site Plan)

DESIGN

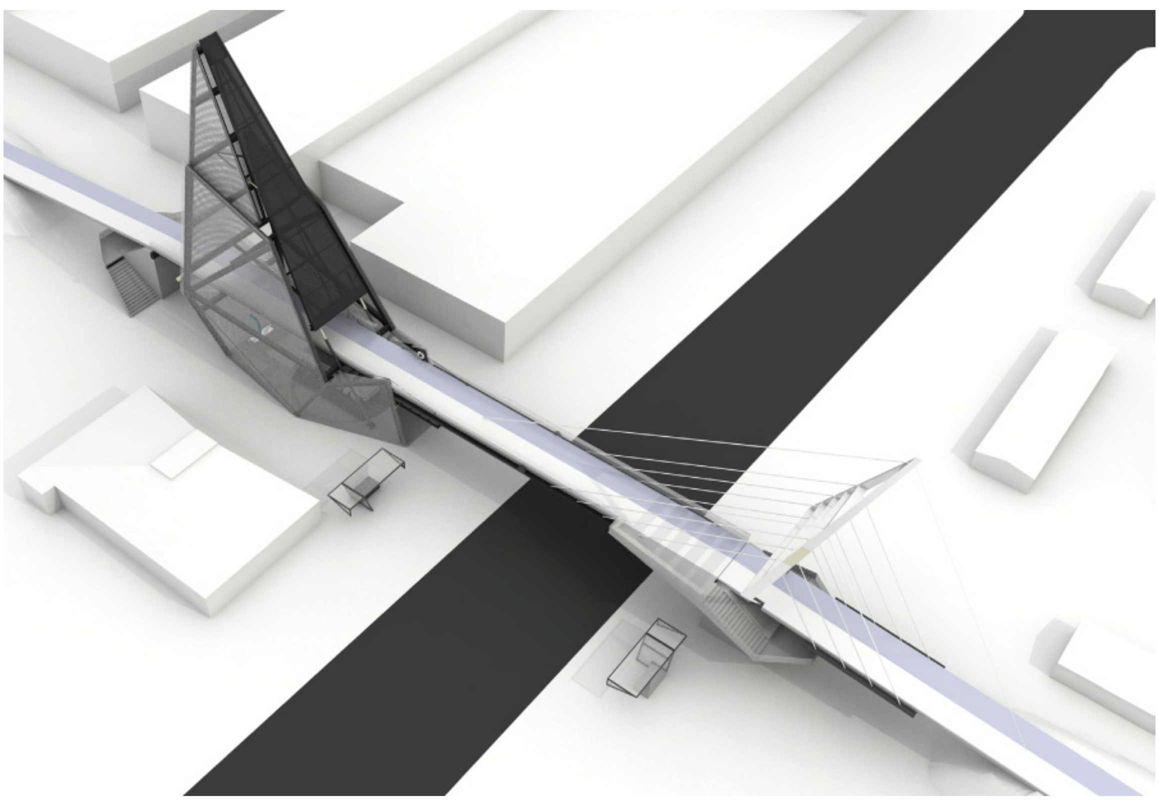
THE SNOW MACHINE

When approached from the south or north via the pathway itself, the site is first experienced via a pedestrian bridge which carries the user over either 107th or 118th avenue, which cuts through the site. These bridges pull the skiers, skaters, and bikers into the site through the first mechanical intervention: the Snow Machine. Each underground hopper holds 3000 m^3 of snow, with the latent cooling potential of 270 average Albertan air conditioners during the hot summer months (see Appendix for dimensions and calculations) (EPCOR, 2010). The cavernous underground reservoir is roughly triangular in section, so as the snow melts into water during the summer months, it compresses the remaining mass, reducing its exposed surface area. The winter months see most of the movement in these pavilions: trucks driving in and out after each snowfall, slowly filling the reservoirs. Due to spacial restrictions, a turntable allows the trucks to enter and leave through the same door, rotating 180° to dump the snow and exit. Throughout the year, movement is also expressed in the sun collector above the pathway. It tracks the sun in both yaw (around the Z axis) as well as in pitch (around the X axis) (see diagram). These two types of movement happen at different speeds. The sun moves east to west across the sky (yaw tracking) every day, however the pitch of the collector changes slowly throughout the year to accommodate the changing angle of the sun through the seasons, from 15° in the winter to almost 65° in the summer (see previous climate diagrams)(Pelland 2006). The piston driven movement of this machine changes the amount of shade and therefore the experience of the bridge throughout the day and throughout the year.

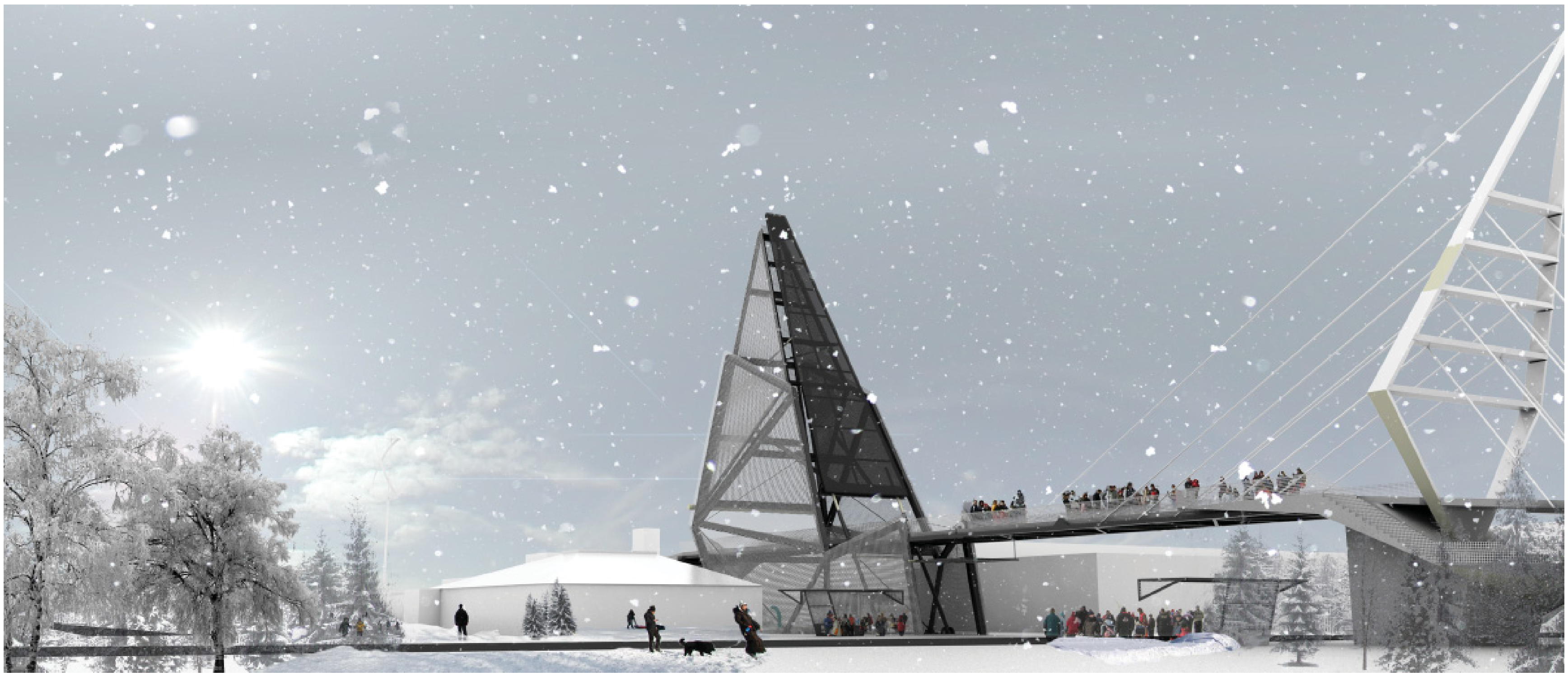


Graphic description of the Snow Machine.
(see Appendix for volumes and energy calculations)

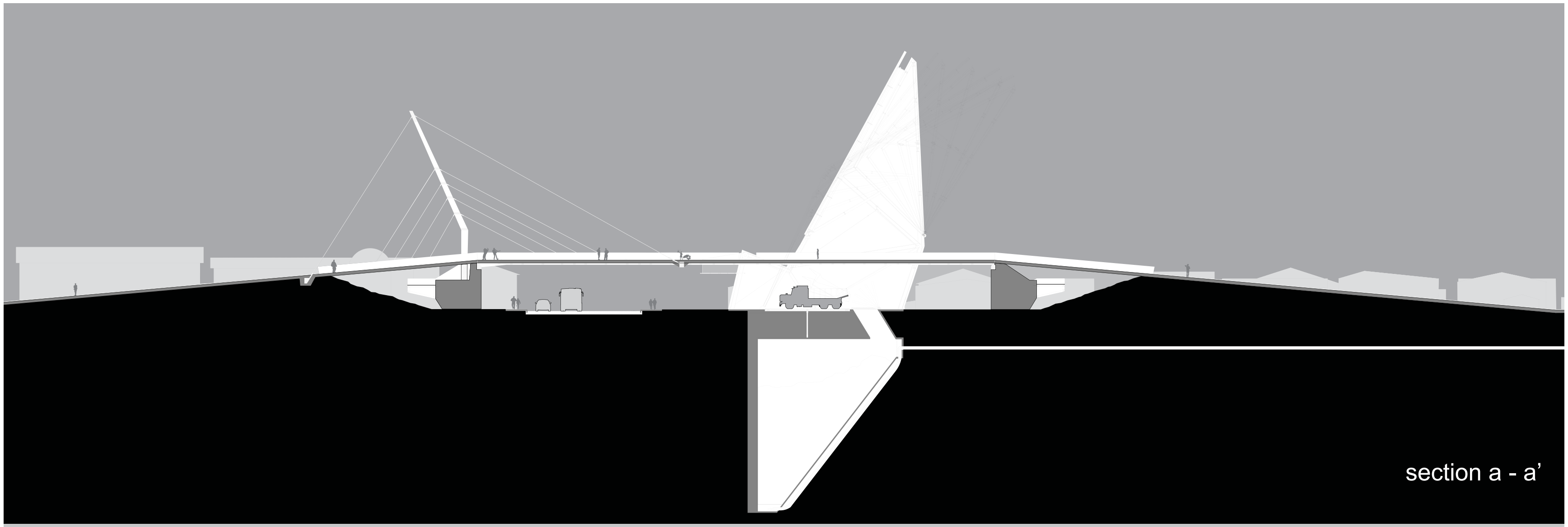
The building is designed to echo the structural aesthetics of the high level bridge to the south. A structural steel frame supports a perforated steel screen as well as the sun collector and its associated mechanical parts. The building, lit from the interior, is a beacon at night. The three bridge pavilions frame the site physically in their siting and size as well as announce their presence from a distance due to their vertical scale. The main span of the pedestian bridges is a cable-stayed steel and concrete deck. The northernmost extremity of this span is supported by the frame of the snow machine, reinforcing the idea of the pathway and the mechanical system existing congruently. Covered bus stops are provided on both sides of the street, despite limited current access to bus routes on this street.

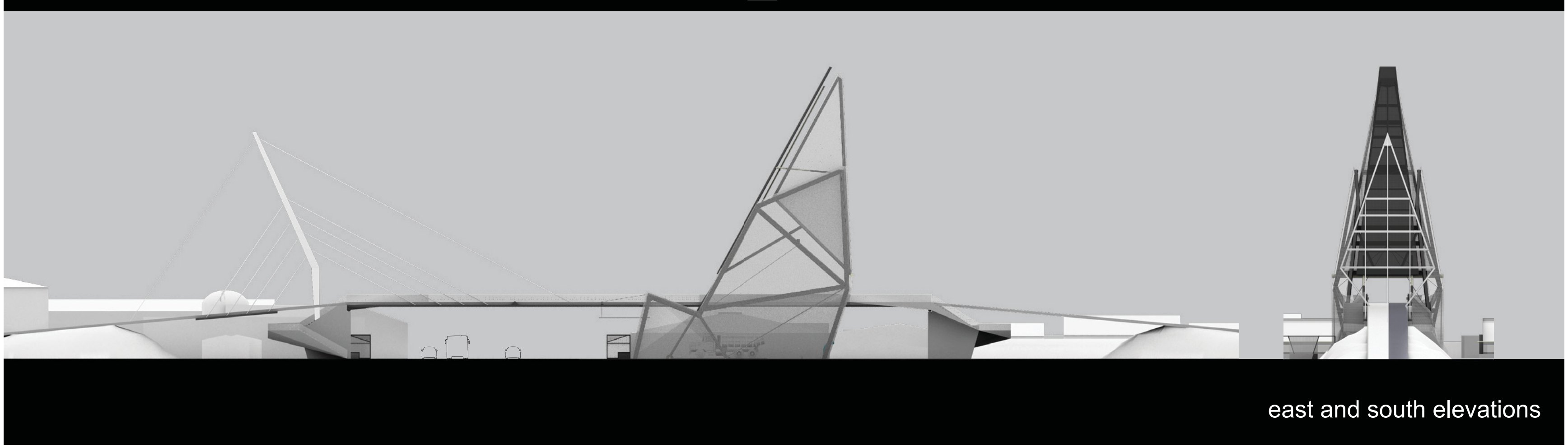


107th ave. Snow Machine and bridge.

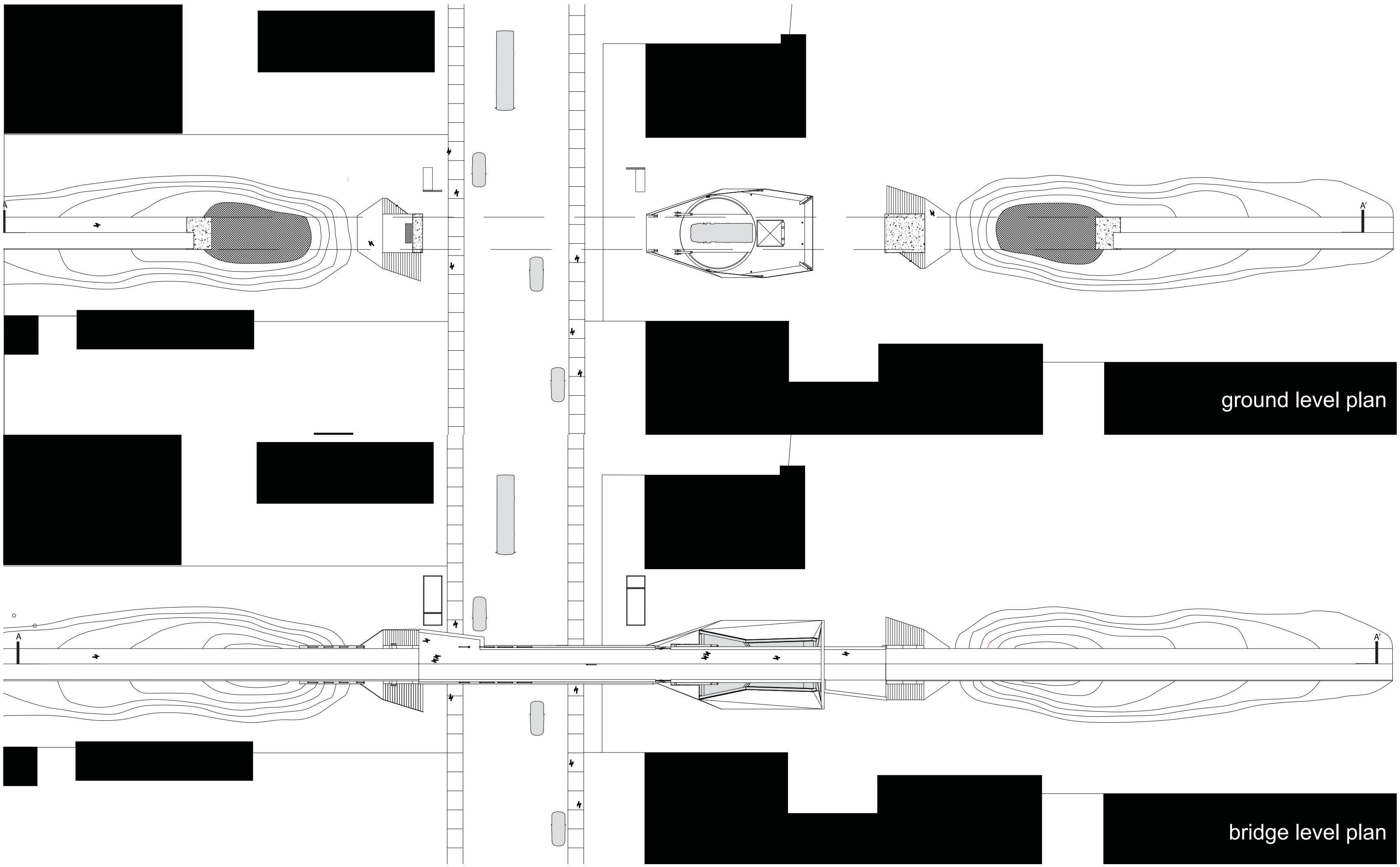


107th ave. Snow Machine and bridge: winter use.



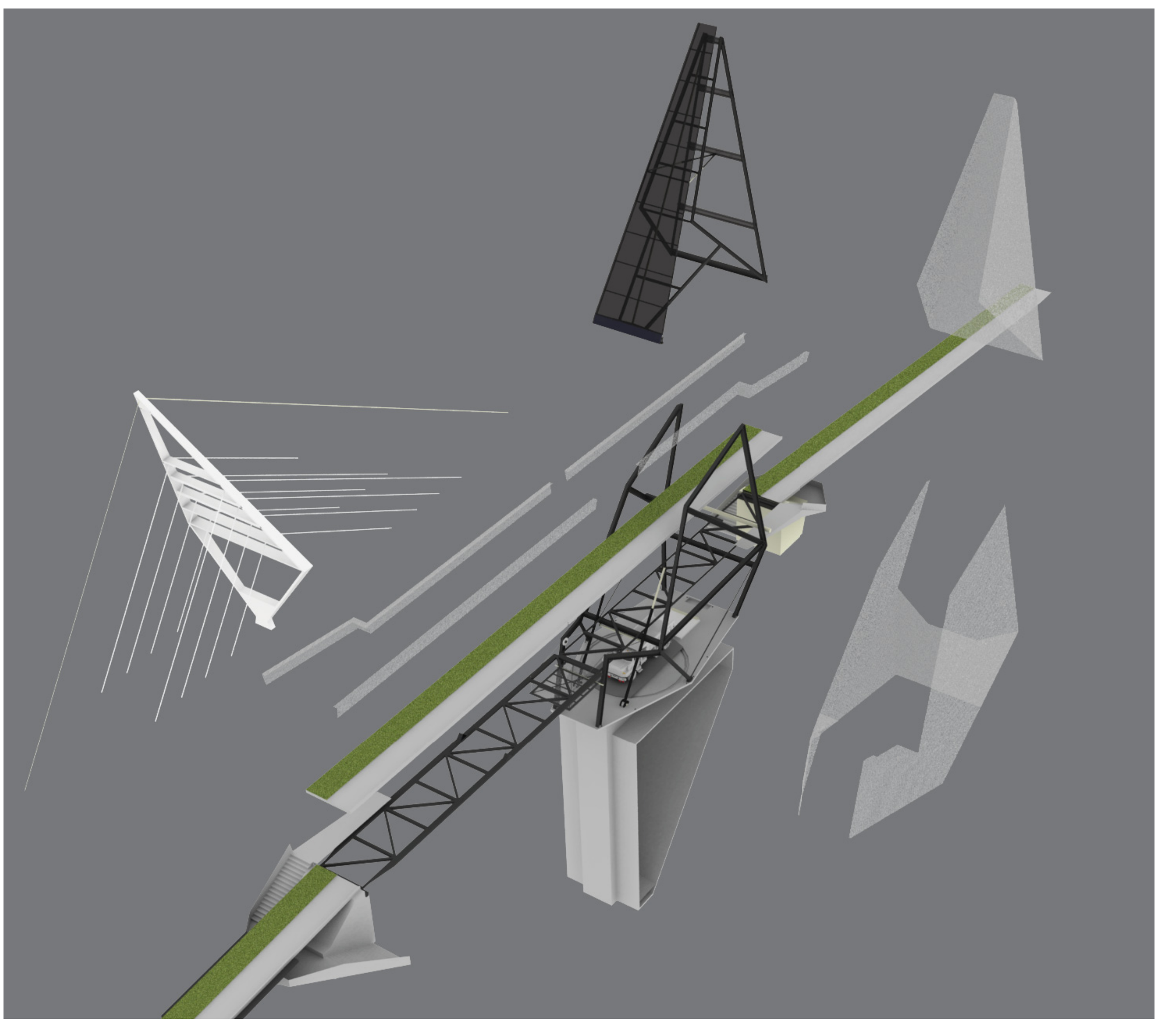


107th ave Snow Machine and bridge.

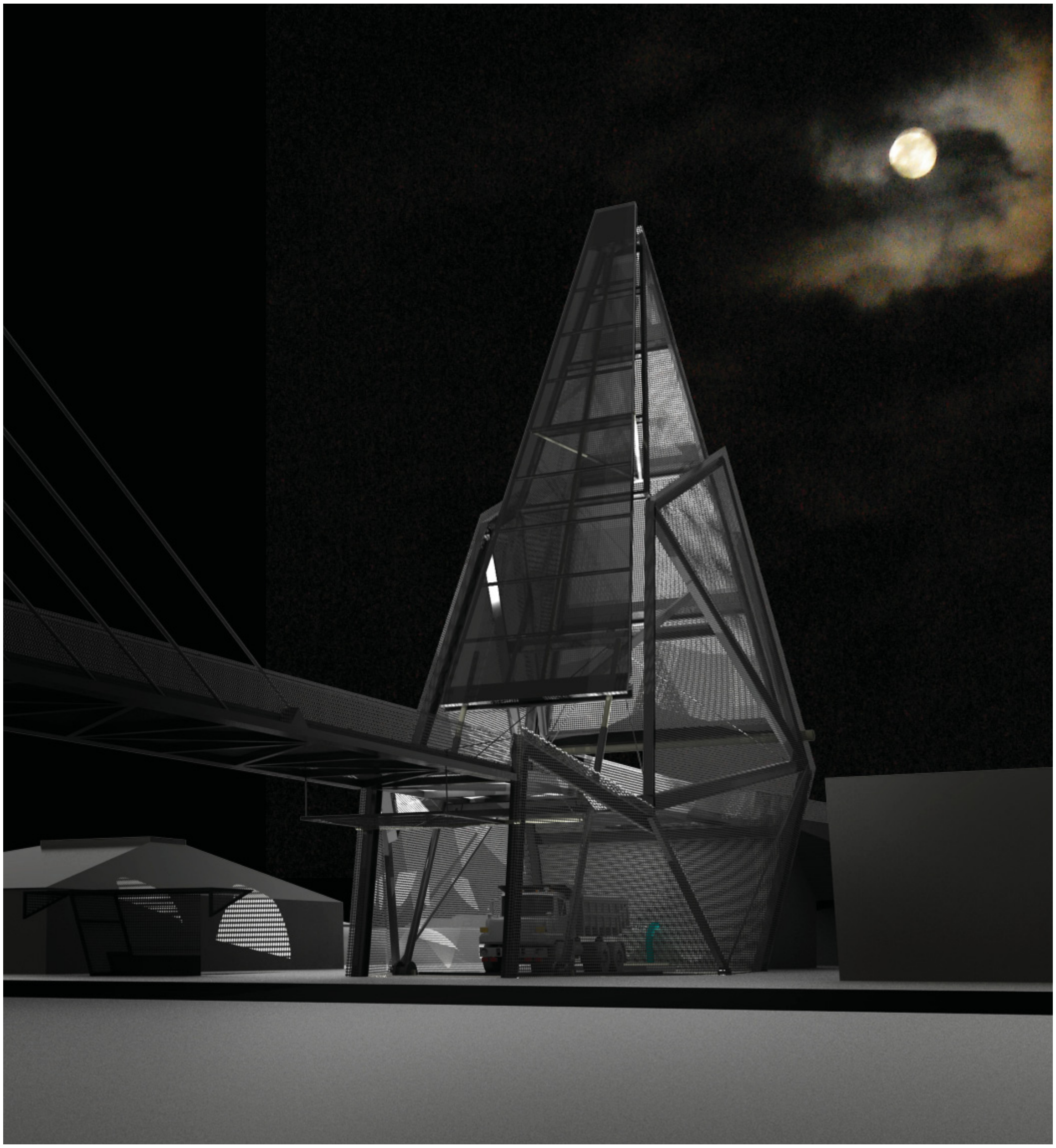


107th ave Snow Machine and bridge.

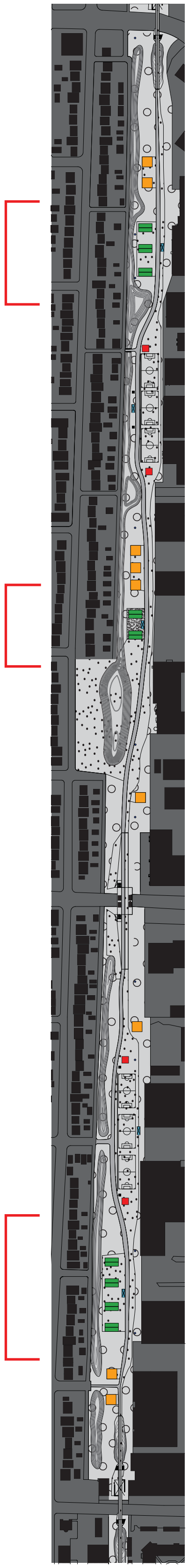
These buildings are gateways, acting both as site threshholds, but also as input points for the mechanical system. From the pedestrian bridge one can see the site stretch out before them before descending into it. Grass on the bridges connect a summer pathway formerly intersected by the three thoroughfares. In winter, snow covers both grass and concrete and is groomed for skiing and skating. This transition ensures activity throughout the seasons.



107th ave Snow Machine and bridge: exploded components.



107th Ave Snow Machine as a beacon.



Agricultural Machines
(Summer Site Plan)

THE AGRICULTURAL MACHINE

As the user is drawn deeper into the site via the pedestrian bridge, the site begins to reveal the output uses for the collected resources. The Agricultural Machines are nine greenhouses gathered in three groups along the pathway. Each grouping of greenhouses is paired with an underground water reservoir: filled yearly with exhausted water from the Snow Machines. Each Snow Machines yeilds 300m3 of melt water, equal to 300,000L (see Appendix for relevant calculations). The greenhouses use the principle of thermal storage to help negotiate extreme temperature change throughout the day and year. Most greenhouses are heated by electricity or natural gas, with market prices making this a costly pursuit in the winter months (Qiang 2004).

> Solar energy is the most cost effective means for greenhouse heating. In middle and northern China, simple, inexpensive and energy conserving solar energy greenhouses have been used to produce vegetables in winter, late fall and early spring since the 1980s. Manitoba's winters are cold but sunny. This significant amount of solar energy provides opportunities for Manitoba greenhouse growers to reduce or even eliminate heating requirements in operating greenhouses during winter or early spring.
>
> (Qiang 2004)

Edmonton has high hourly solar insolation rates during the daytime in winter (9am to 4pm) (Government of Alberta, 2003). Using strategically placed thermal mass, the greenhouses can collect direct daytime solar energy for use in mediating the low nighttime temperatures. The greenhouse floor is set below grade to take advantage of the thermal mass of the earth. The back (north) wall of the greenhouse is a monolithic concrete mass: the principal storage device for daytime solar energy (see graphic representation on page 40). The insulated, mechanically operated shield covers the south-facing glazed surfaces

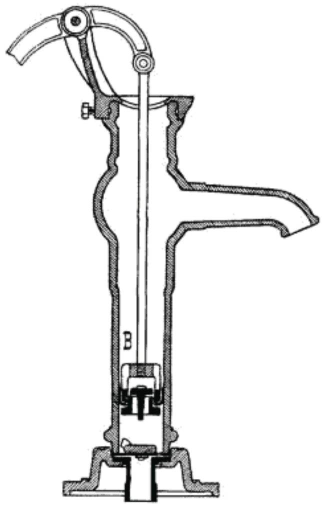


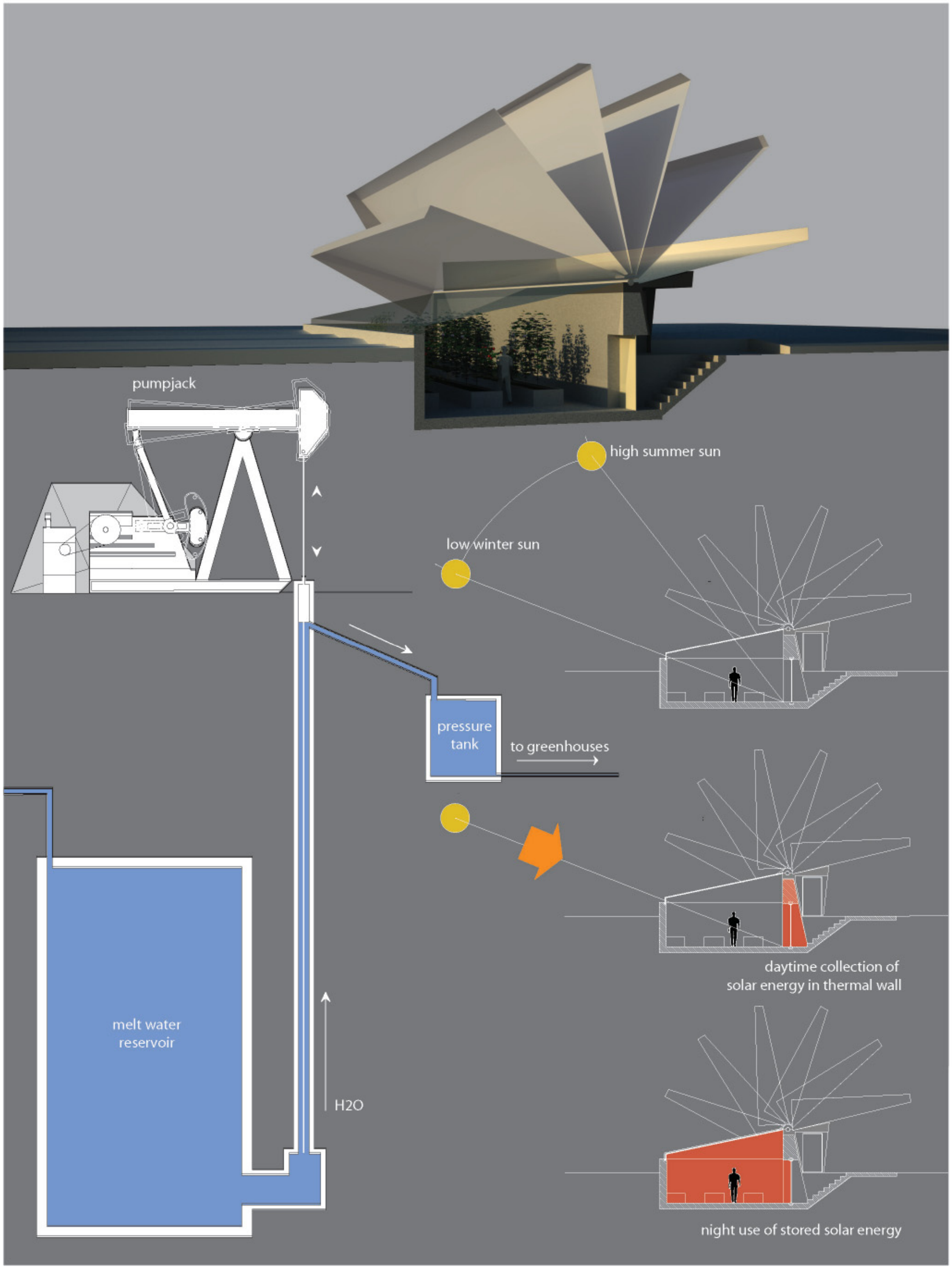
Fig. 9.

Drawing of a positive displacement hand pump. (Gideon, 1969, 138)

at night, preventing leakage of the stored heat being flooded back into the greenhouse from the thermal mass as the temperature drops. One greenhouse provides $100m^2$ of growing space; $10m^2$ for 10 families. The site provides enough space for 90 families to grow food throughout the year, and could provide double that amount or more during the summer months (outdoor space). The $900m^2$ of total interior growing space is serviced by 600,000L of melt water from the two Snow Machines (see Appendix for relevant calculations). The water in the reservoirs is pumped from the reservoir into an adjoining pressure tank, to which the greenhouses are directly connected. The pumping mechanism is expressed in the form of a pump jack above ground, a mechanical feature whose movement is controlled by the rate of water use in the greenhouses. A decrease in the amount of water in the pressure tank triggers the pumpjack to draw more water from the reservoir.

Besides the baseline value of locally grown produce and flowers, these greenhouses could become valuable teaching resources for children from the surrounding schools, as well as for the elderly. There is a strong existing network of community gardening clubs in Edmonton, and this would become the largest combined plot in the city. (Community Garden Network of Edmonton and Area 2010).

Alberta pump jack. (Griggles 2010)



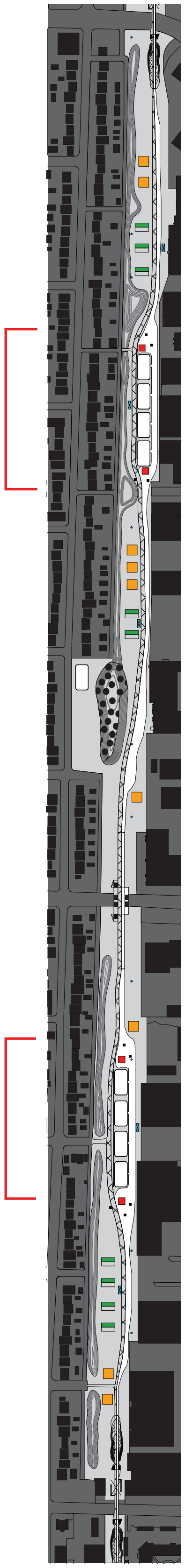
Graphic description of the Agricultural Machine.
(refer to Appendix for all volume calculations)

Winter on the pathway.
(Agricultural Machines and associated Pumpjack to the left)

THE WATERING MACHINE

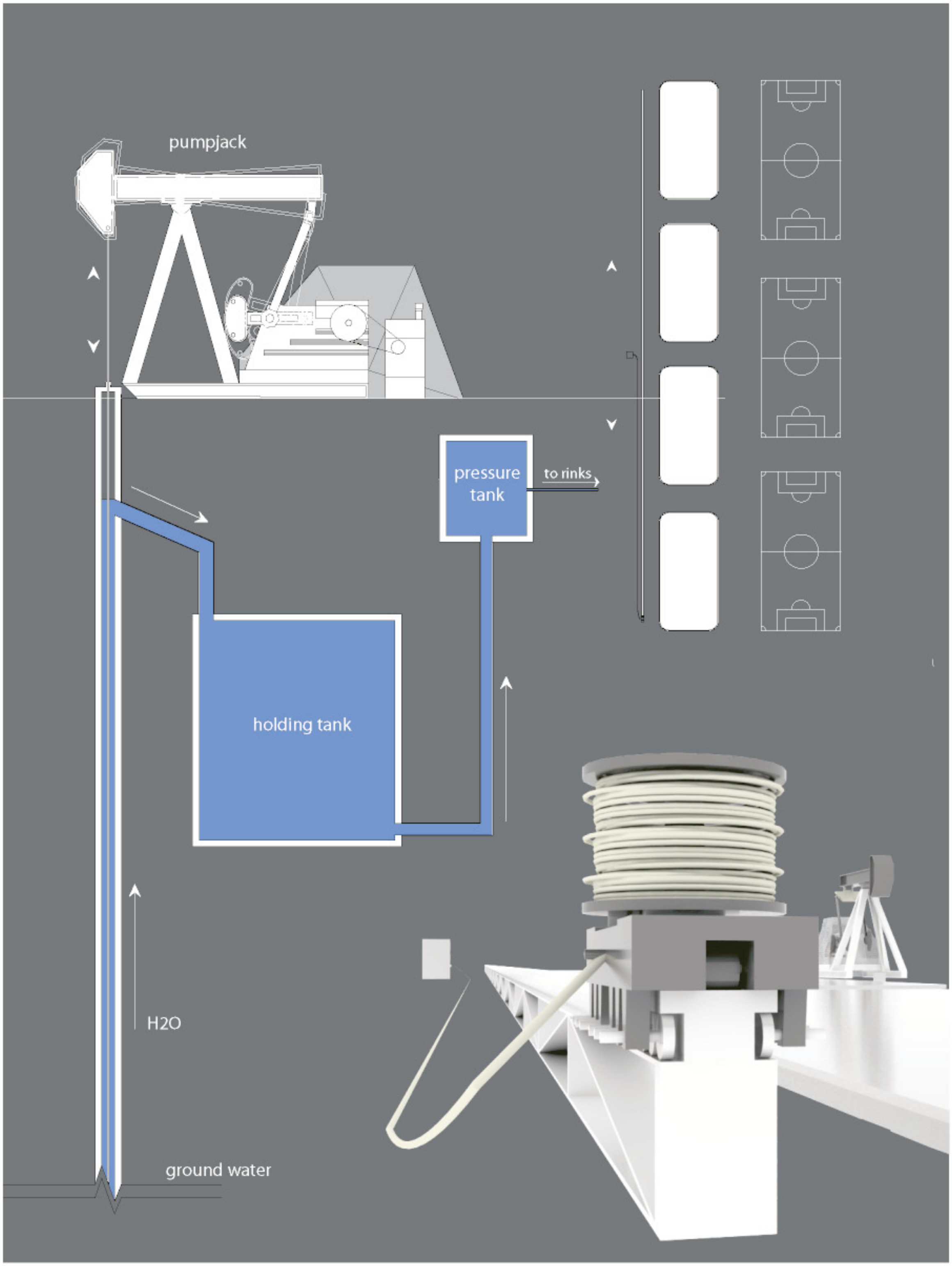
The Watering Machine relates to the process associated with the upkeep of hockey rinks in the winter and playing fields in the summer. Outdoor hockey rinks, depending on the frequency of use, need to be flooded at least twice a week. The water for this must come from a static source.

The width of the site require that the rinks be placed longitudinally along its north-south axis. Eight rinks are arranged end to end in two banks at the north and south ends of the pathway. In the summer months, four rinks are replaced by three soccer fields. Water for their upkeep is drawn from a ground source well, and stored in a similar reservoir to the system described for the greenhouses. Everytime the rinks are flooded or when the fields are watered, the associated pumpjack pulls more water from the well, refilling the reservoir. This process would be more frequent in the winter months than in the summer. The distribution of this water is facilitated by a large hose reel which rolls along a fixed track alongside the playing surfaces. A flexible connection between the rolling reel and the static water source allow the groundskeeper to water all the surfaces at once. The rolling track also doubles as a fence that onlookers can sit or lean on; a gathering point and rest spot.



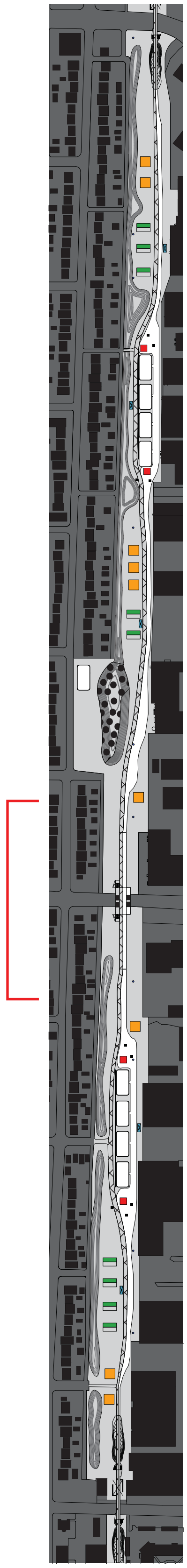
Watering Machines
(Winter Site Plan)

Rink flooding in early winter. (Moore 2008)



Graphic description of the Watering Machine.

Winter on the pathway.
(Hockey rinks with associated Watering Machine)



Production Machine
(Winter Site Plan)

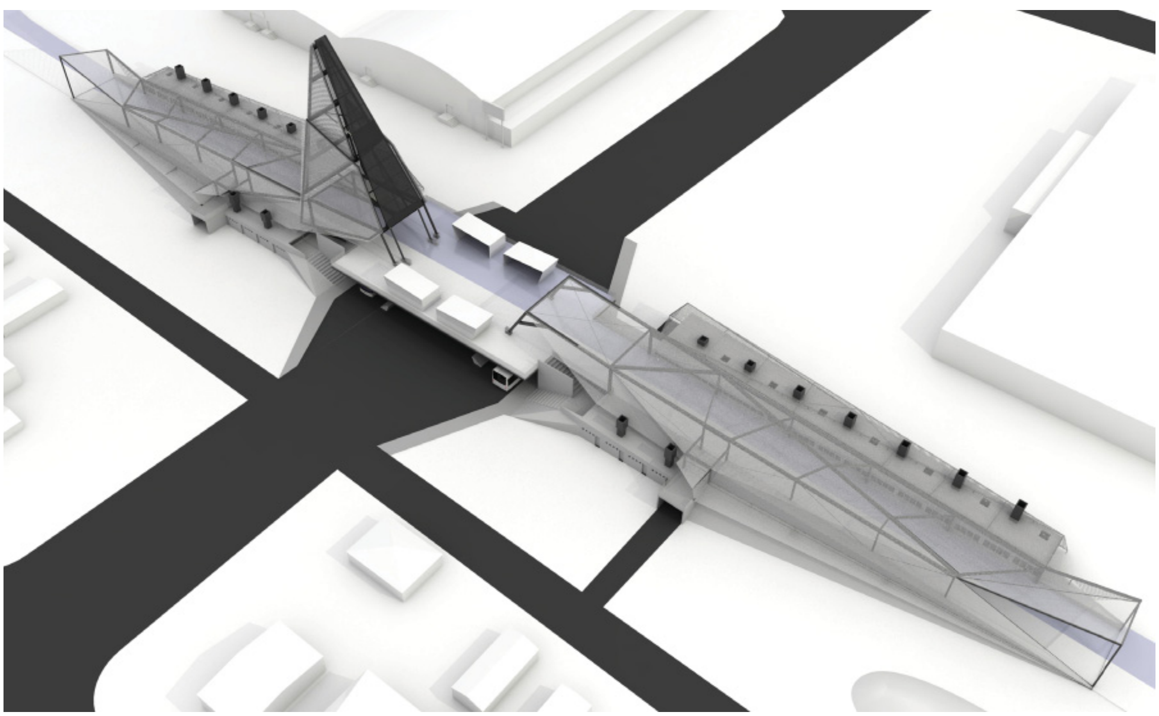
THE PRODUCTION MACHINE

The site needs a center, a park with which the city can interact. The Production Machine embodies the small businesses which used to thrive off their proximity to the rail line. Existing at the 111th ave crossing, this is the busiest part of the site. It benefits from an active street, good public transportation access (City of Edmonton 2007), and could serve as a central gathering point for residents and workers alike. Visitors will rise to the pathway from the busy street below, the bridge deck serving as the hinge around which the tranquility of the path and the speed of the city revolve. The bridge is the axis of rotation, the streets moving east-west and the pathway north-south: the two can be watched and enjoyed from this central space.

Both the Northern Alberta Institute of Technology and Grant MacEwen College University are growing institutions. Both have programs from which many graduates have the option to begin small businesses which require studio, workshop, or practice space. Most housing priced for students or new graduates is not adequate for use as a studio, and sometimes not conducive to late working hours. The inclusion of a small number of different sized workshop and studio spaces on the site would provide the opportunity many students lack when trying to break into a career. These spaces are offered along the inclined path to the bridge deck, and provide eyes on the park and covered path, as well as commerce for the kiosks. In turn, the site would provide free advertising for those using the spaces. When the rail line was removed, gone too were many of the skilled workers and their production facilities. These studio spaces pay homage to the past use of the site and transform this bridge building into a machine for the production of art.

> The district, and indeed as many of its internal parts as possible, must serve more than one primary function; preferably more than two. These must insure the presence of people who go outdoors on different schedules and are in the place for different purposes, but who are able to use many facilities in common.
>
> (Jacobs 1993, 198)

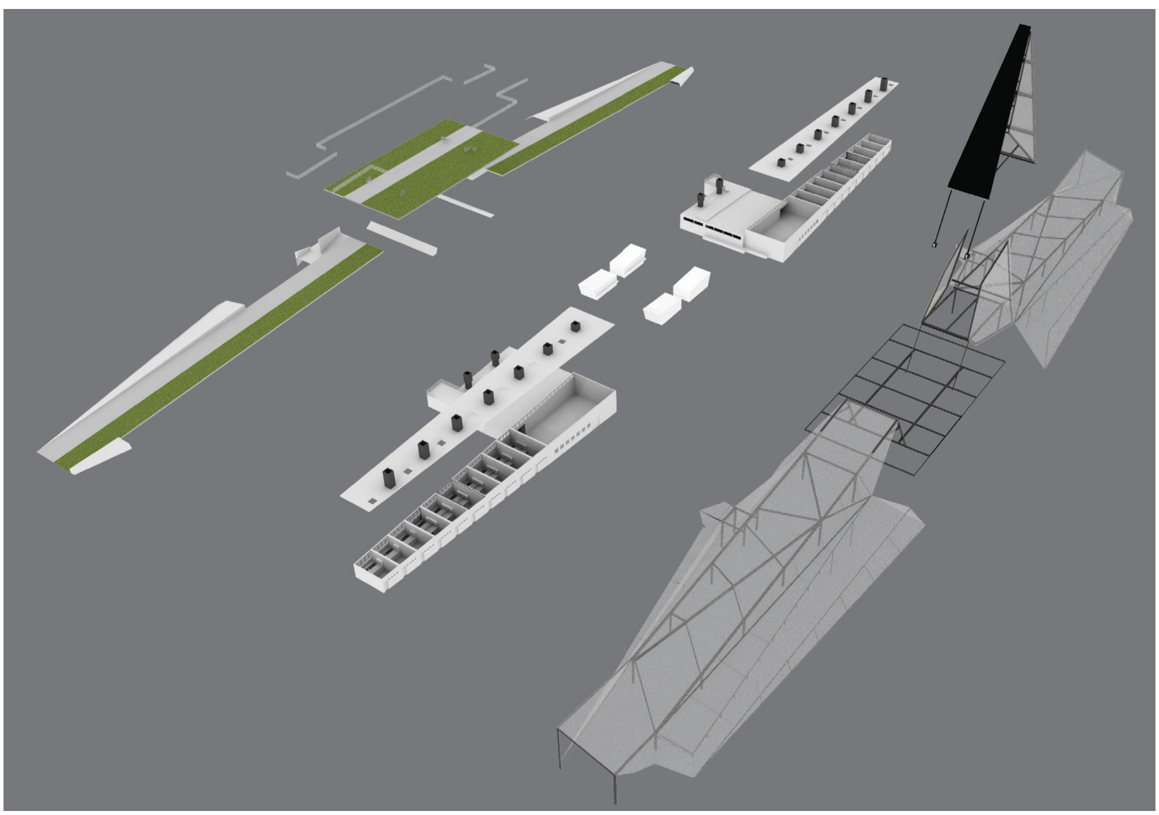
The inclusion of production spaces around a small area also promotes the exchange of ideas. Students from different institutions, receiving different training, inevitably meet and absorb the different work. The studio spaces become the hinge around which ideas flow, skills are traded, collaborations or partnerships are formed. A successful public space benefits from varied users (Jacobs 1993, 198). On the bridge deck, the space would benefit from four user groups: the workers in the local industrial zone, the resident students or graduates working in the rentable studio and shop space, the huge residential community adjacent to the site, and the students and others using the site as a pathway. The work produced by the artisans will be displayed on the site, which becomes a changing canvas and a promotional tool.



111th ave Production Machine and bridge.

The Production Machine is a hub of activity along the path. It serves as a meeting point, a comfort stop in winter, a rest stop for bikers, skiiers, etc. It is the hangout for those renting studio space and a place to exhibit their work. The coffee shop, corner store, restaurant - the place where people get the morning paper or a carton of milk, becomes a vital neighborhood node for interaction (Jacobs 1993, 80).

The studio spaces are housed in buildings which flank the inclined portions of the pathway. Car access for material drop-off is provided for the two large communal workshops from the existing alley which accesses the rear of the houses adjacent to the site. Here too, a large solar array moves with the sun to collect energy, changing the experience on the deck as it turns; acting as a beacon. The pathway provides views down into the studios as one approaches the central gathering space: a connection between those working and those playing.

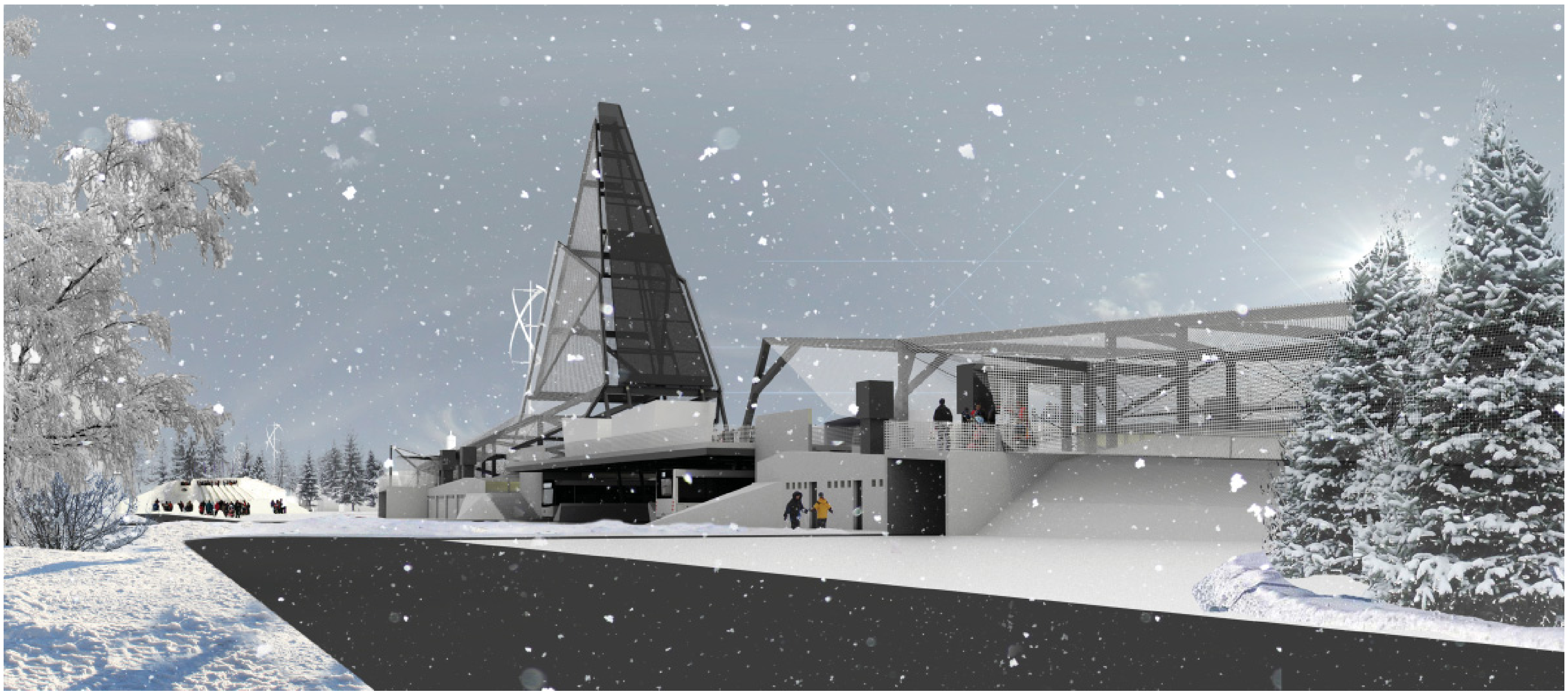


111th ave Production Machine and bridge: exploded components.

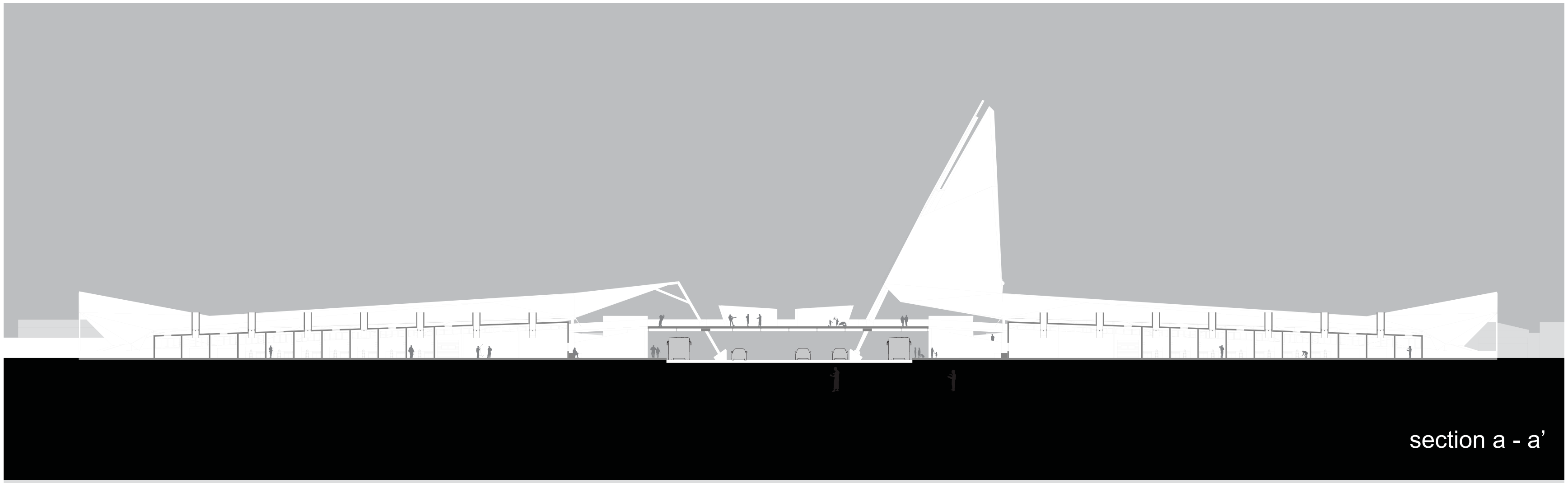
Half of the studio spaces and both large workshops are ventilated by stacks punching through the exterior perforated metal screen. Along with the faceted surface and material palette of the canopy, the sudden scale change of the solar collector, and the supporting structure of the two, these suggest an industrial, factory aesthetic.

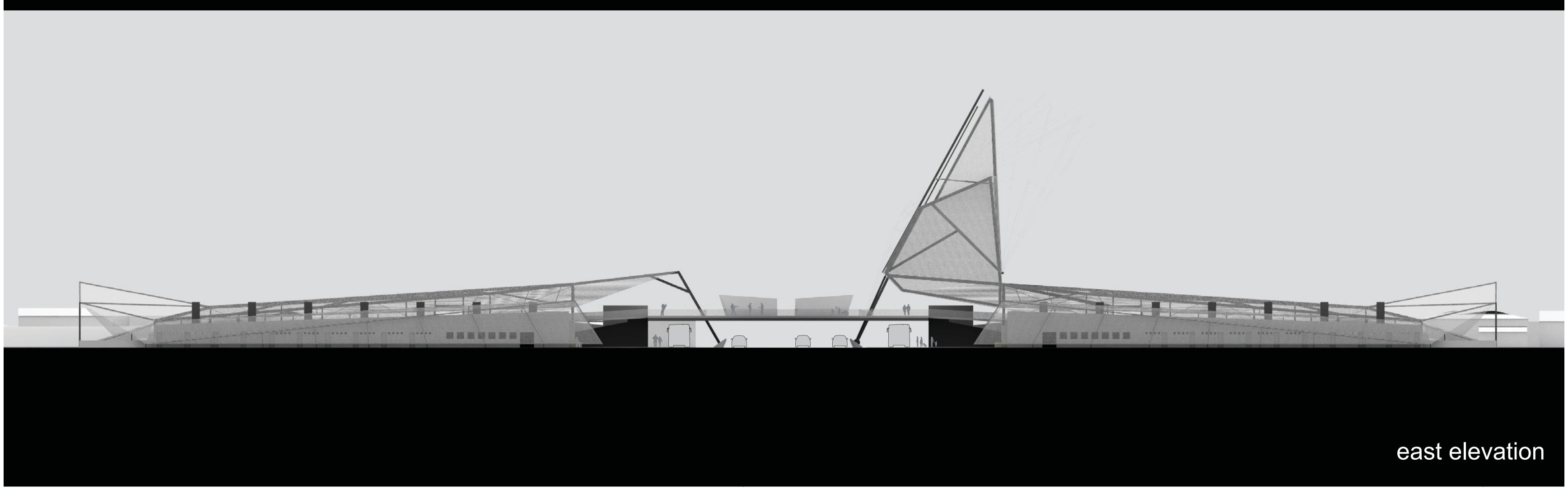
The deck of the bridge houses several small kiosks. Food and coffee are served while bikers or skiers get their chains repaired and tires inflated, or skis waxed and bindings tightened. Bikes, skates, skis and snowshoes are rented out and maintained. A guitarist plays during the summer months while people read the paper or play chess at tables.

Beavertails kiosk, winter on the Rideau Canal, Ottawa.

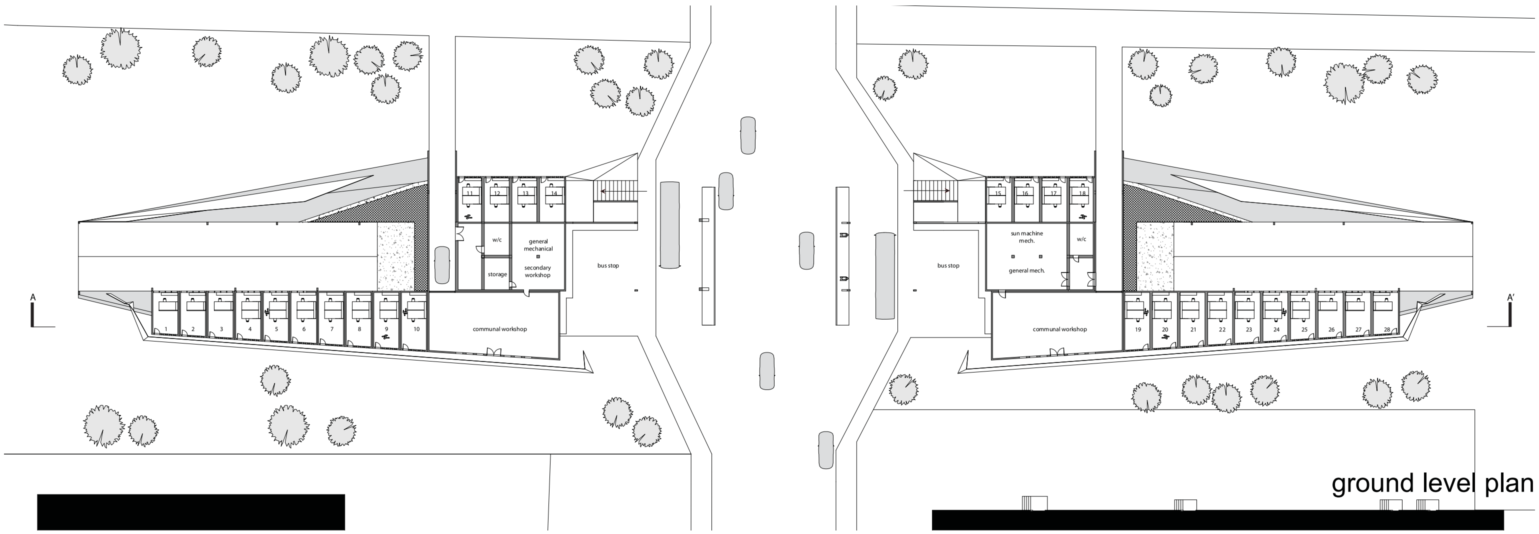


111th ave Production Machine and bridge: winter use.

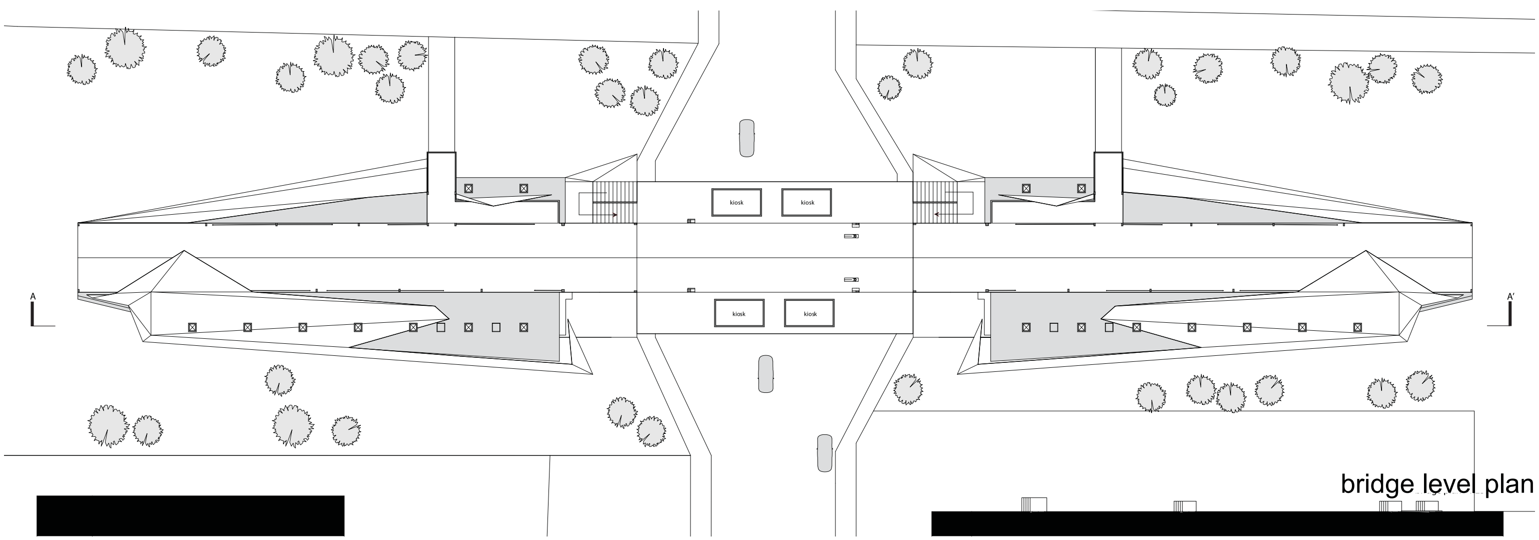




111th ave Production Machine and bridge.



ground level plan



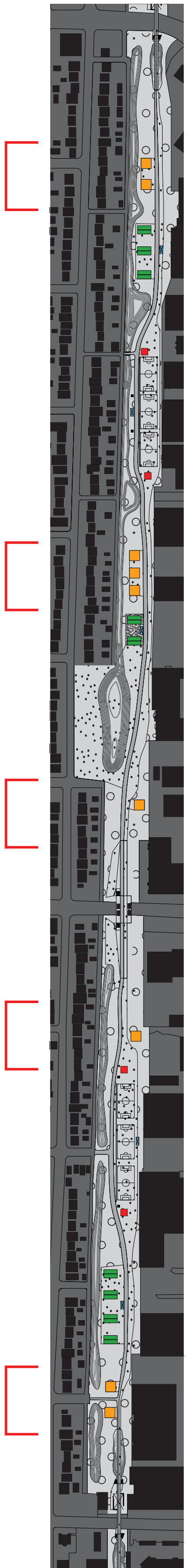
bridge level plan

111th ave Production Machine and bridge.

THE MECHANICAL MUSEUM

The inclusion of retired industrial relics (trains, containers, etc.) into the pathway is a way of bridging the past and present, the metaphorical and the literal. These pieces become playgrounds for children, museum artefacts for the enthusiasts, or memorials to a time past. They provide a dramatic backdrop for the seasonal activities of the site, whether playing hockey and skiing or biking and running.

These vestiges are treated differently then the ruins of Duisburg-Nord for example. They are celebrated through reappropriation, not left untouched.



Mechanical Museums
(Summer Site Plan)

Landschaftspark Duisburg-Nord.(Baum 2010)

Retired train along pathway in summer.

SUMMARY

The mechanical system, which serves as the backbone for the activities on the site, exists at different scales. The bridges and inputs for the system are large interventions, wayfinding devices announcing their presence from a distance. Along the site, the smaller mechanical moments permeate the procession along the path, reminding the user of their connection to the system; of its function and application. The pathway, however, is the main catalyst for change. It is what attacts people to the site and what brings enjoyment. It is the connective tissue between the downtown core of the city and the developments to the north. The machine exists to support the pathway and its program, but neither are successful without the other.

> A common and tragic mistake that many North American cities have made in recent decades is to try and engineer winter out of existence.
>
> (Walljasper 2009)

The project exists as the first phase of a much bigger possible reality. The catalyst created could easily grow into a more ambitious development. As NAIT grows in size, it might begin inhabiting the industrial buildings which flank the site. With the path now established and heavily in use, the backs of the industrial buildings might open to embrace the site once again. Gallery spaces and workshop demonstrations might bleed out into the park space, engaging those using the site. The pathway itself might extend through the city like the railway once did, crossing the river over the High Level Bridge and down into the University of Alberta and trendy Whyte Ave. In a city like Edmonton, winter should be constantly engaged, not feared. The city offers possibilities of transforming a currently stagnant city into a model of outdoor activity and sustainability. This thesis offers possibilities for the first step.

APPENDIX

SNOW AND WATER CALCULATIONS

Albertan house: air conditioner used for 300 hrs per year
average central air condtioning unit uses 3.5kW per hour (kwh)

3.5 kW x 300 hrs = 1050 kWh
average cost of electricity = 0.07$ - 0.10$ per kWh
operating cost of approximately $100 per year

Winter Snow Collection

1 truckload = approximately 20m^3
capacity of 1 underground reservoir = 3000m^3
3000m^3 = 142 truckloads
3000m^3 of water ice (compressed snow) = 3000 tonnes
3000 tonnes = 3 000 000 kg (6 600 000 lbs)

Latent heat is the amount of energy released during a phase transition, without a change in temperature.
(ie. melting snow into water)

latent heat of snow = 334 000 J/Kg
334 000 J/Kg = 334 000 000 J/tonne = 334 MJ/tonne
latent heat of reservoir = 334MJ x 3000tonnes = 1 002 000 MJ

As the snow in the reservoir melts, it is remains very cold until all the snow has melted and the water reaches ground temperature (at the end of the summer).

melted water is = 0°C
assume ground temperature = 15°C

1 calorie (cal) = energy needed to raise 1 gram of water 1°C

1000 cal = energy needed to raise 1 kg of water by 1°C

3000 tonnes of snow = 300 tonnes of water

300 tonnes of water = 300 000L (80 000 gal)

1L of water weighs exactly 1 kg

1000 cal x 300 000L = 300 000 000 cal to raise the water 1°C

300 000 000 cal x 15°C = 4 500 000 000 cal

4 500 000 000 cal = 18 836 MJ

cooling capacity of 1 reservoir = latent heat of melting snow to water + energy required to warm the resultant water up to the surrounding ground temperature

1 002 000 MJ + 18 836 MJ = 1 020 836 MJ

1 MJ = 0.28 kWh

1 020 836 MJ = 283 566 kWh

total kWh / average kWh per household (air conditioning only)

283 566 kWh / 1050 kWh = 270 houses

The quantity of snow collected in one of the two proposed reservoirs therefore contains the cooling power equivalent to the approximate amount of energy required to cool 270 albertan homes. The two reservoirs combined have the capacity to offset the energy consumed by the air conditioners of 540 homes.

3000 tonnes of snow melts to produce 300 000L of water

2 reservoirs = 6000 tonnes of snow = 600 000L of water

1000 m^2 of greenhouse space provides 10 m^2 for 100 houses

600 000L of water provides 600L per m^2 for the year

(to be balanced by city supply when reserves are low)

SOLAR POWER CALCULATIONS

The solar collection machines in the proposed design have full pitch and yaw tracking capabilities, therefore the FTS statistics from the Pelland study are used (full tracking to within +/- 5°. The panels used in the calculations will be assumed as 200 W/m^2.

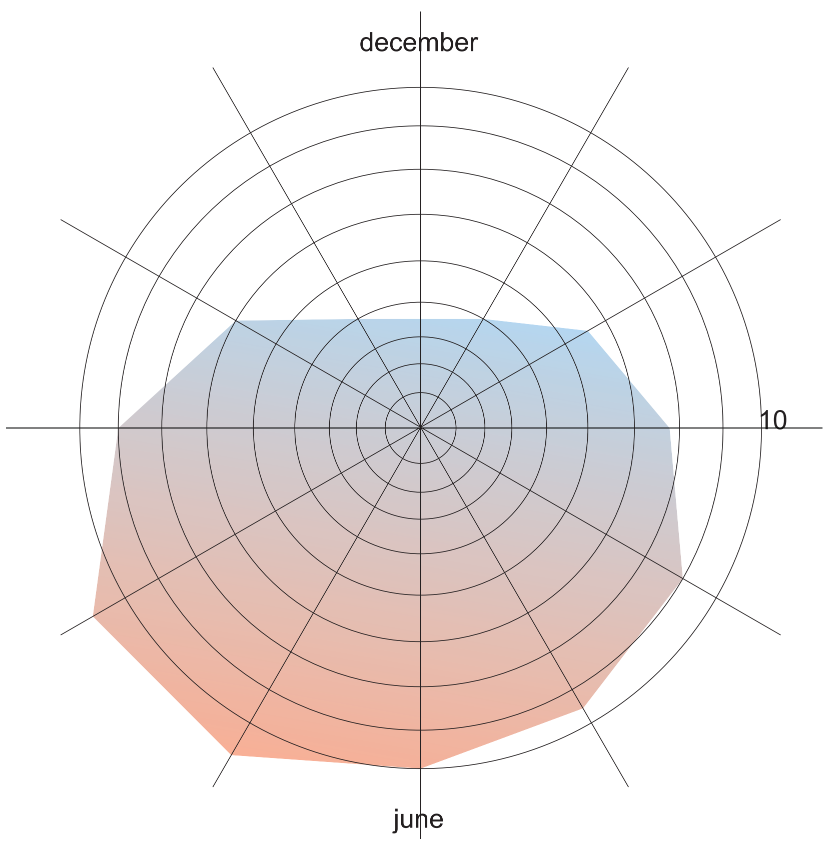
each tower has 6 m x 30 m of photovoltaic panels

6 m x 30 m = 180 m^2

3 proposed towers = 540 m^2

Insolation is the amount of usable solar radiation recieved in a given place over a determined period of time.

monthly mean daily insolation (kWh/m^2) rates for Edmonton are shown in the graphic below (FTS system only)



addition of (average monthly insolation x of days) = year total

total insolation for a dual axis tracking system in Edmonton

= *(2536 kWh/m^2) x kW of panels used*

1000 W = 1 kW

200 W = 0.2 kW

average solar panel efficiency between 65% and 85%

0.2kW x 0.75 = 0.15kW/m^2

0.15kW/m^2 x 540m^2 = 81 m^2 of 1 kW panels

2536 kWh/m^2 x 81 m^2 = 205 416 kWh produced per year

average Albertan household consumes 600 kWh per month

600 kWh x 12 months = 7200 kWh

average cost of electricity = 0.07$ - 0.10$ per kWh

7200 kWh x 0.085$ = $612 per year per household

205 416 kWh produced / 7200 kWh = 30 households

30 households x $612 = $18 360 per year

The energy collected by the 3 photovoltaic arrays on site will offset the power consumed by approximately 126 homes per year, yielding a savings of approximately $18 360 per year. This amount of energy would be enough to power all the ongoing activities on the site.

(Pelland, 2006)

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