53 North: Tactical Infrastructure in Edmonton

by
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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Edmonton, Alberta is the northernmost major city in North America, but inappropriate urban form has created a winter culture of avoidance. Long, straight city streets and a proliferation of voids within the downtown urban fabric are characteristic of many American cities, but when this condition is replicated in the far north the negative aspects of the winter season are amplified as arctic winds sweep through the streets and open spaces, and daily activity is driven indoors. As urban design has failed to account for the winter conditions, architecture has overcompensated in its response. Mechanical climate control is overused creating sharply delineated areas of over-protection and total exposure, creating harsh transitions for citizens as they move through built and unbuilt environments. But as the urban design has made winter life more difficult, the voids it has produced can also provide the spaces in which winter life can be embraced. For Edmonton to become a healthy "Winter City" it must attempt new approaches in urban and architectural design to resolve both its lifeless downtown core and the societal rejection of winter.

This thesis proposes a new design tool whereby the intrinsic values of snow can be utilized to create winter public spaces to temporarily occupy the urban void. A new structure is proposed where City groups will act as coordinators sanctioning land parcels for urban interventions using the snow on each site and that cleared by the municipal workers, sculpted into basic forms. When used in combination, the forms create protective, desirable micro-climates which inject program and activity into the formerly vacant lots, introducing positive winter activity into the realm of daily life in Edmonton. The iterations in form serve a dual purpose by acting as a testing grounds, discovering new urban and architectural design strategies through experimentation and observation, informing future designs within the city.

Acknowledgements

I would like to sincerely thank my supervisor Rick Andrighetti for all your insight, for being an encouraging voice, and nudging me in the right direction when I started to veer in circles. I am also immensely grateful to Adrian Blackwell and your guidance in my discovering of the thesis, not just completing it. And thank you to Jane Hutton, even though our time was short your advice has made a huge impact on my work.

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After twelve years of university I think I'm done.

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Introduction

This thesis is intended to be a starting point, highlighting how the following two seemingly disparate urban problems can interweave with each other with each acting as a starting point for the eventual solution of the other. First, Edmonton as a city is poorly designed for its high latitude and as such the inhabitants are subjected to a violent relationship with the winter, offering either overprotection within the built environment or none at all. Second, the economic history of Edmonton created a ring of inactivity and undeveloped land surrounding the downtown core, depleting the vibrancy of the city centre. Yet the urban voids which define the condition of under-development can act as the sites for new urban winter design.

Two challenges of interest face contemporary Edmonton: a societal aversion to the winter season and an abundance of undeveloped land surrounding the city centre, and each must be examined for potential approaches leading to eventual remediation. The first chapter describes the climate conditions Edmonton faces and proceeds to examine cultural and architectural factors which alienate the inhabitants of the city with their environment. Writings by urban designers and architects concerned with environmental relationships and energy control are compared to previous winter adaptations made by Canadian cities resulting in an ethos intended to explore the creation of micro-climates in the otherwise unprotected outdoors. The second chapter seeks to understand the manner in which Edmonton developed to create such an abundance of vacant land within what should be a desirable urban centre. Theories by architects and urban planners regarding the temporary appropriation of undeveloped or abandoned urban spaces and precedents highlighting successful interventions. With the intention of using the vacant areas as a network of experimentation sites, the established urban tactics are examined to assess the suitability of an interweaving of approaches: designing in the vacant land in a manner which is sensitive to the unique character the voids in urban fabric while simultaneously creating public spaces which attempt to introduce expanded public activity into the winter months.

Just as the winter season is overlooked, so too are the unique possibilities and resources it provides. The thesis conducts an exploration into the ubiquitous elements of the winter: highlighting the materials available to build uniquely winter spaces and the use of equipment and organizations that already exist within the infrastructure of Edmonton, and how they may be re-purposed. In the third chapter snow is selected as the primary building material, taking advantage of an abundant, inexpensive, versatile, and powerfully symbolic resource. Snow is analyzed for its physical properties and how it may be utilized to affect the environment, to shape protective micro-climates to shelter inhabitants, to

improve the quality of daily activity, and to promote experimentation in urban winter design. The fourth chapter introduces the core of the thesis - by slightly redirecting the use of snow clearing equipment and utilizing the existing civic resources available to the municipal government a cooperative system between the City of Edmonton, the owners of undeveloped land parcels, and enterprising citizens can be established to sanction the temporary use of vacant land with the objective of creating urban winter spaces.

Having analyzed the chosen material and available equipment in the previous section, the final two chapters examine the potential application of the thesis strategy within the land available in downtown Edmonton. A catalogue of potential forms that could be created by the snow clearing equipment is assembled, each of which implies an interaction between human and form, generating a sample list of potential programs which may be deployed in an appropriate site. The final chapter is the synthesis of the previous research and examinations; a series of design explorations utilizing simple snow forms to introduce winter activity and experimentation distributed throughout the concentrated ring of undeveloped land surrounding Edmonton's centre.

The thesis does not conclude, it provokes a continuation. The final section summarizes the tactics described to implement a new urban strategy in which all parties from the City Council to an enterprising child can access each other's ideas and resources, and collaborate to explore future iterations on the fate of the empty downtown lots and on the relationship of Edmonton to the winter.

Mon pays ce n'est pas un pays, c'est l'hiver
My country is not a country, it is the winter

Mon jardin ce n'est pas un jardin, c'est la plaine
My garden is not a garden, it is the plains

Mon chemin ce n'est pas un chemin, c'est la neige
My path is not a path, it is the snow

Mon pays ce n'est pas un pays, c'est l'hiver
My Country is not a country, it is the winter

- "Mon Pays", Gilles Vigneault

A City of Three Seasons

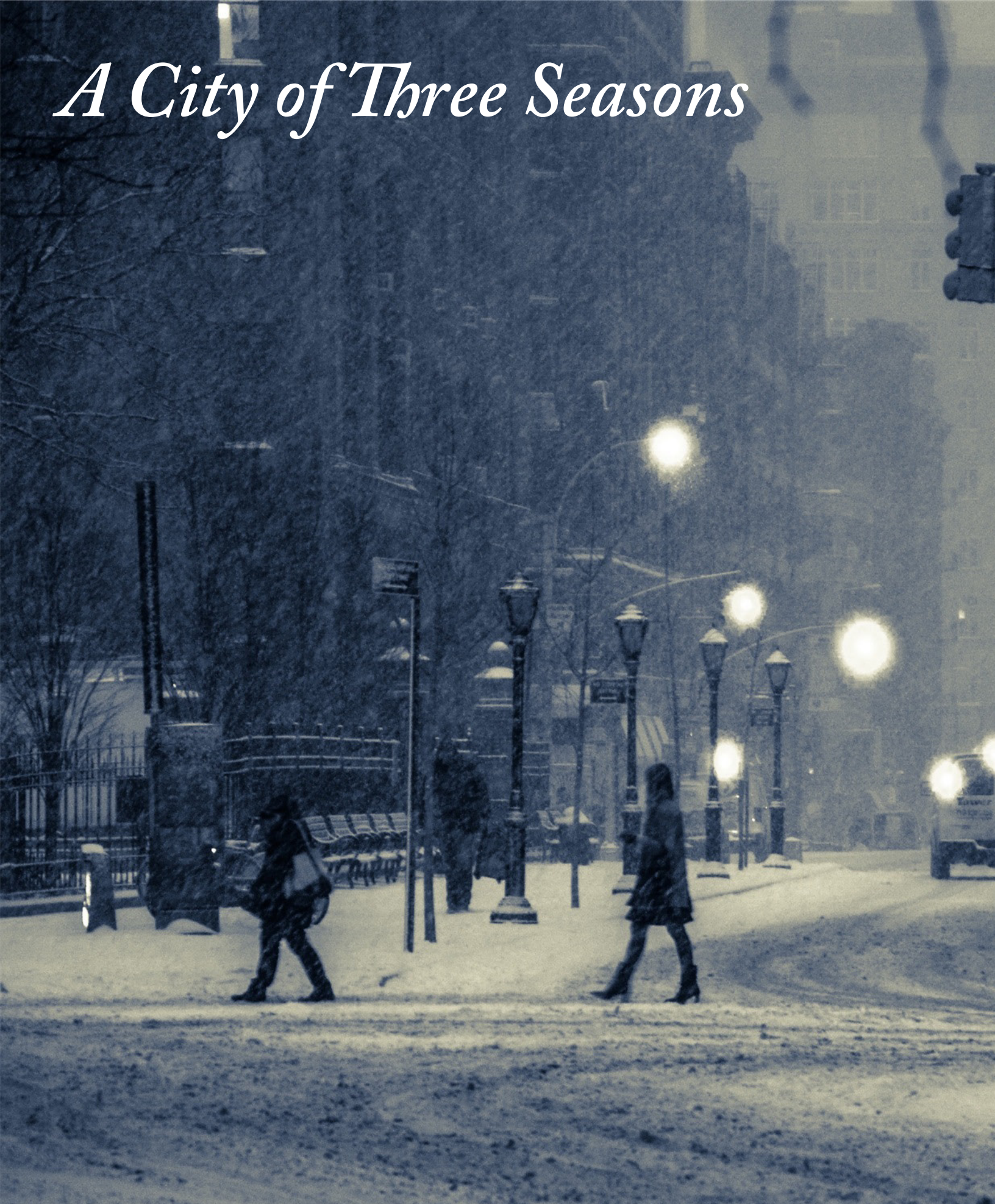
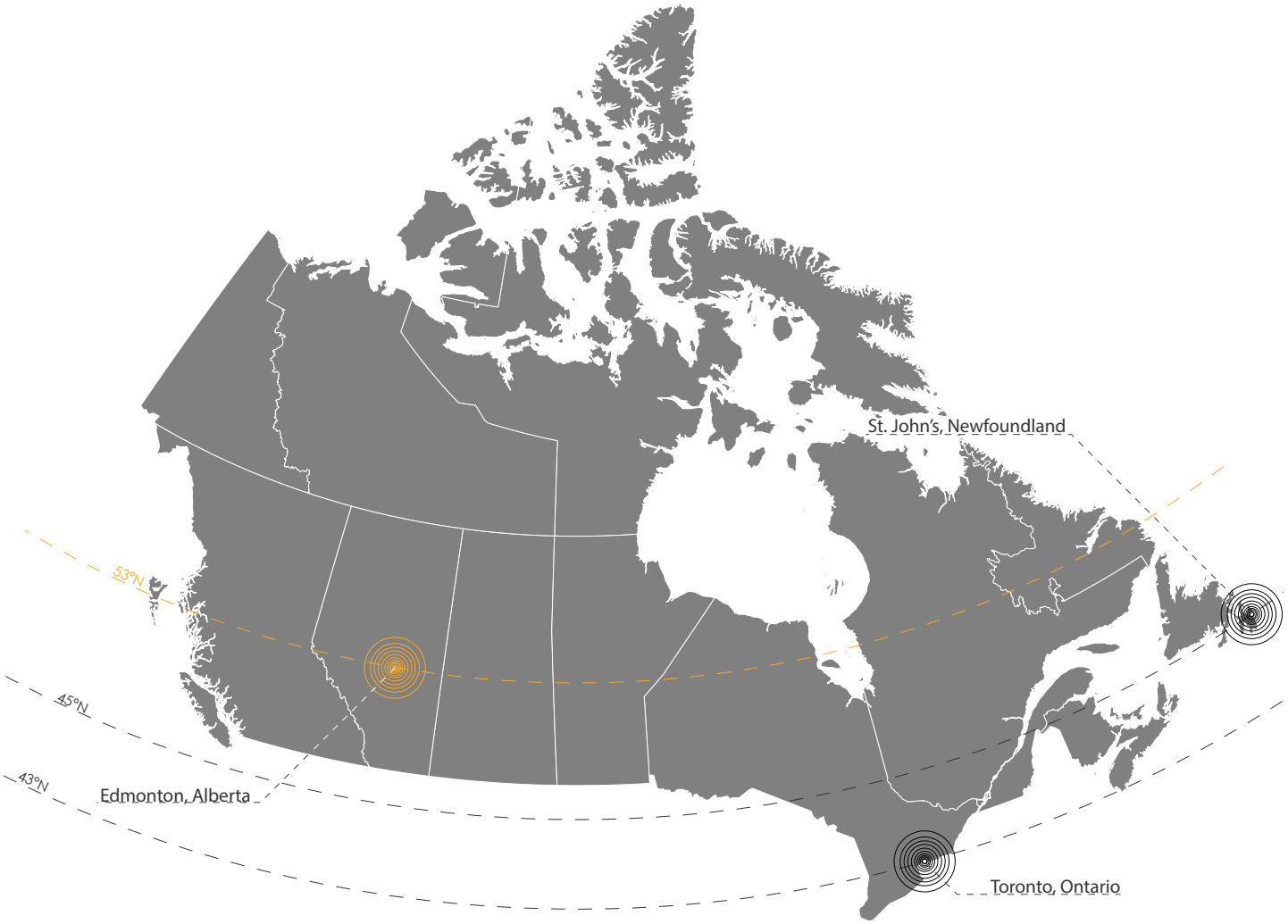


fig 1.1 Blizzard

NYC
HOW DO
YOU
ONE WAY



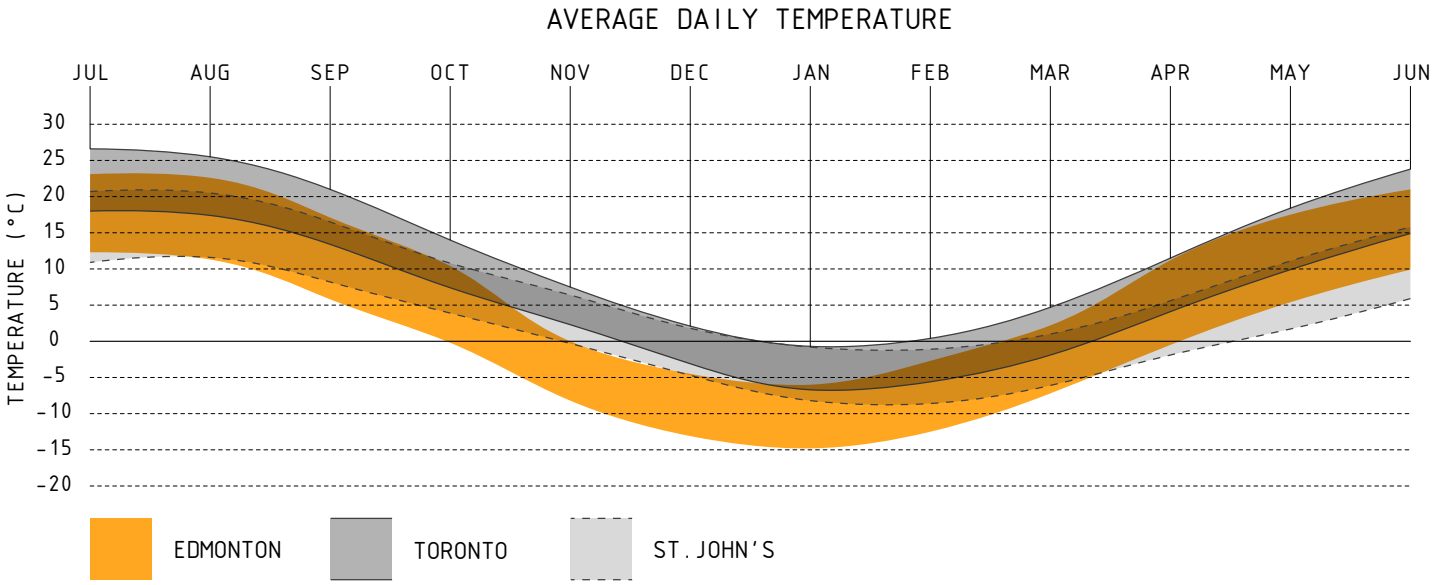


fig 1.2 Edmonton - 53 North

There aren't many frontiers left in the world, especially in North America. Henri Lefebvre's implosion and explosion of the urban across what was left of the rural is almost complete[1]. There are pockets of relatively untouched nature scattered throughout the continent surrounded by cities and their tendrils of development such as the deserts of the southwestern United States, and the national parks of the US and Canada, but there are very few "edges" left. The north is holding out as the last unbounded expanse that urbanization has yet to fully claim, and Edmonton marks the furthest outpost of the metropolis. At 53 degrees north and a metro area population exceeding one million, Edmonton is the northernmost major urban centre on the continent but somehow eschews the mantle of a Winter City. There is a strange sense of pride and denial of winter within the populace - pity the poor soul who complains about the cold in front of someone from the Canadian prairies.

> *"It's not cold outside, not compared to back home, which I am about to elaborate on to great and exhausting detail."*
>
> - Every Edmontonian ever

Despite the audible eye-rolling that follows, this ritual has some foundation. Winters in the Alberta capital are punishing with daily minimum temperatures averaging -15°C in January and routinely dipping to -40°C at least once a year[2]. There is also a respectable amount of snowfall with 1.24 m annually and moreover the snow lasts for 133 days. To quantify these values with other Canadian cities, Toronto receives 1.22 m of snow lasting 65 days with a average minimum temperature of -7°C in January, and Canada's "snowiest" city St. John's receives a staggering 3.35 m of snow but only lasting 79 days, and an average minimum temperature of -8°C. In short, Edmonton winters are harsh and sustained: twice as cold and twice as long as the country's most populated city (fig 1.2). And yet, when it comes to daily life,Edmonton is no different than the "warm" cities of ridicule. Urban life becomes a cycle of commuting from a warmed home to a warmed workplace, climaxed with hurried bursts from parking lots and bus stops, braving treacherous ice patches and bone chilling winds. Across North American, citizens have become increasingly dependent on our mastery of climate control developed throughout the 20th century and the rejection of winter as an enjoyable portion of the natural cycle has only strengthened.

1 Lefebvre, Henri. "*The urban revolution*". Minneapolis: University of Minnesota Press, 2011.
2 Government of Canada. "Canadian Climate Normals 1981-2010 Station Data" http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?stnID=1867

koselig *- Norway*

describes a feeling: intimacy, warmth, happiness, contentment. Requires physical conditions and objects to move beyond "coziness" – eg. blankets on outdoor cafe chairs, candlelit entrances, wholesome food, warm drinks.

mysig *- Sweden*

Similar to koselig, a term describing a prepared physical condition which only exists and can be enjoyed during the winter season.

hygge *- Denmark*

no direct analogue in English – related words like "coziness," "togetherness" and "well-being" only cover portions of the full meaning. Beyond merely physical comfort, hygge extends to behaviour and emotional states.

igokochi *- Japan*

derived from the words for "heart" and "ground, state". Conveys a similar, but reduced, concept as hygge – a sensation or mood.

A Hostile Culture

Winter is arguably the most dramatic threshold of the year, but has become viewed as an interruption of a perpetual state of summer instead of a distinct, essential phase of the seasonal cycle. The rejection is writ plain within the language, activity, and behaviour of North American culture, particularly within the urban Anglophone culture. The people of Quebec have a long standing, and generally more positive relationship with winter with notable documentation beginning as far back as 1883. Since then, Montreal and Quebec City regularly preceded Lent with Winter Carnivals up until World War II, and then continued again in 1954 until present day as a seasonal event[3]. It is difficult to find such a long-standing example within the predominantly English speaking cities. Nuit Blanche was first adopted into Canada by Montreal, with several other English cities followed suit over the years, but the timing of these events highlights the English disdain for the winter. While Montreal opens the city to art and performance in wintry February, somehow Edmonton, Calgary, and Toronto all hold their "White Night" festivals in the conspicuously colourful autumn.

Language itself affects a culture's perception, so chances are if you speak English you hate the winter. English's Germanic roots introduced the word "vinter" or "winter" to describe the "wet season" and was used to measure age, noting how many winters one has seen, each passing marking an end - not a beginning. The Anglo-Saxon word "wintercaerig," meaning winter sorrow, appears in the poem "The Wanderer" in the Exeter Book (1072) - a tale of a man exiled from his home, lost in the depths of loneliness and the cold of winter, remembering and lamenting all he has lost[4]. English poetry continues to slam the winter with examples like Shakespeare's "Winter's Tale" (1611) in which Mamillius utters "a sad tale's best for winter,"[5] or James Thomson opening line in "The Four Seasons: Winter":

> *"See! Winter comes, to rule the varied year,*
> *sullen and sad..."*[6]

Poetic opinions on the seasons vary, but the shadowy season is type-cast as the villain. But, it is sometimes the hero, the plucky companion, or the kind hearted soul Lewis Carrol describes:

3 "History of Festival du Voyageur inc.", Festival du Voyageur, accessed April 16, 2016, http://festivalvoyageur.mb.ca/en/fdv-inc/about-us2/history/

4 "The Wanderer: English 492 Home Page", http://faculty.arts.ubc.ca/sechard/oewand.htm

5 Shakespeare, William, and Stephen Orgel. The winter's tale. Oxford: Oxford University Press, 1998. 20

6 "The Four Seasons: Winter", https://allpoetry.com/The-Four-Seasons-:-Winter

> *I wonder if the snow **loves** the trees and fields, that it kisses them so gently? And then it covers them up snug, you know, with a white quilt; and perhaps it says, "Go to sleep, darlings, till the summer comes again."*

While English culture and perception of winter is tilted towards the negative there is still a quiet appreciation, but full acceptance is still distant.

A notable signal of the English aversion to winter is the lack of specific words which exist within other northern cultures, but escape adequate translation. Three noteworthy examples exist within the Nordic cultures of Sweden, Norway, and Denmark which exclusively describe positive feelings towards winter. "Mysig" and "koselig" are Swedish and Norwegian words which prove difficult to translate into English. These two phonetically similar words describe a feeling of intimacy, warmth, and contentment, but require physical conditions and objects, such as candlelight and hearty meals, which move beyond a feeling of "coziness". Hygge elevates beyond koselig or mysig: moving beyond describing physical comfort, extending to social behaviour and emotions by inviting friends and loved ones together to enjoy rich meals (lots of alcohol helps), wrapping up in blankets and furs, talking, playing games, creating pockets of light and warmth in the cold dark winter (fig 1.3) - all encapsulated within a single, short word. But it is the culture that gave that word meaning. Mysig, koselig, and hygge can only exist because of the cultural embrace of the fourth season.

Even the Danish initially faced struggles with incorporating winter culture into modern society, but over the course of 50 years they have successfully transformed. During the WinterCity Strategy symposium held in 2012 and in an interview with Elise Stolte of the Edmonton Journal, architect Lars Gemzoe described the changes in Danish culture since his childhood to use as precedent or encouragement[7]. In Copenhagen, hygge began to present itself in an urban context in 1962 with the closure of Strøget, a major street adjacent to the City Hall, to all vehicular traffic. Initial response to the plan was negative - the public was full of the cliché doubts "... we don't have the climate for pedestrian streets... it doesn't match our culture". Strøget has since become an international precedent for transformation of urban space to make cities for people, not cars. Danes visiting Italy enjoyed the outdoor piazza cafés, and modified the concept to suit their own conditions. Cafés now spill onto the streets and squares, but they also set up braziers and blankets, leaving their furniture outdoors all year. Public spaces host rotating exhibitions year round continually drawing people outside. A skating rink was installed within a central traffic roundabout, and

7 Gemzoe, Lars Gemzoe, *"Winter Cities, Edmonton 20.01.2012."* (Symposium, Edmonton City Hall, 2012)

Source: http://www.kuketalu.ee/en/1333-2/

fig 1.3 Hygge

Source: http://nordicnoir.tv/news/what-is-hygge/

Source: Lars Gemzoe https://archiveds.wordpress.com/2012/12/18/the-seasons-in-the-city-winter/outdoor-cafe-warming/

Source: http://trouvailletraveling.com/walk-denmarks-capital-copenhagen/

fig 1.4 Urban Hygge

Source: https://gringopotpourri.com/tag/european-christmas-markets/

Source: https://hannaswalk.com/tag/kobenhavn/

Source: http://olafureliasson.net/archive/artwork/WEK109190/ice-watch

Source: http://olafureliasson.net/archive/artwork/WEK109190/ice-watch

Source: https://archiveds.wordpress.com/2012/12/18/the-seasons-in-the-city-winter/street-exhibits/

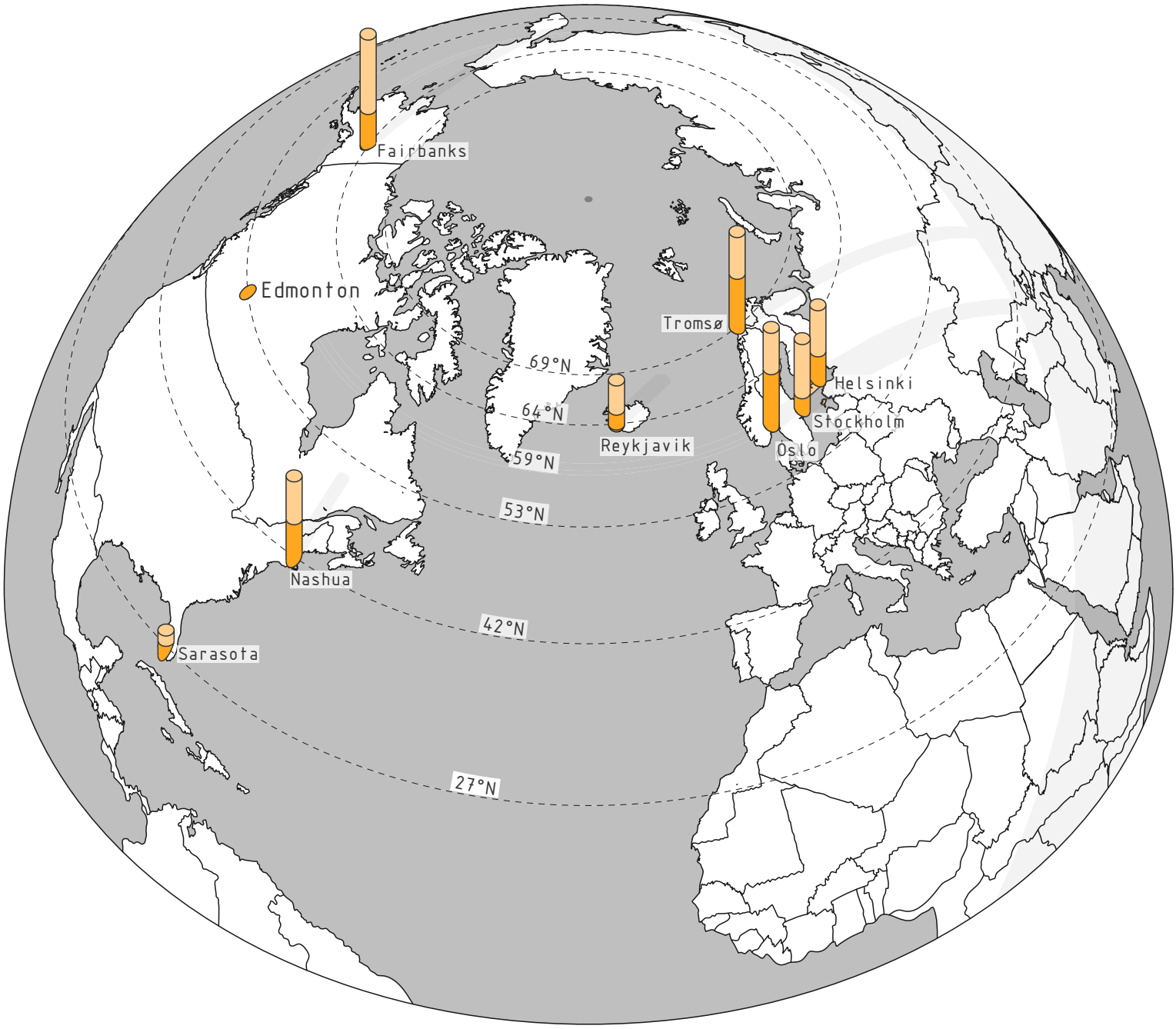
fig 1.5 Urban Hygge - cont

soon afterwards a local mall staged a fashion show on skates. The oil crisis of the 1970s also introduced cycling as more than recreation to the populace, and today represents 1/3 of all commuters (70% continuing through winter as well). Small changes were introduced into the city, and the public responded and expanded upon them. Incremental shifts in perception influenced a significant portion of people to reoccupy the streets and spaces all year, transforming Copenhagen into a "city of faces"[8]. A city which once behaved much like a North American counterpart slowly adapted their cultural norms, but they required stimulus.

Healthy Culture

One of the darker aspects surrounding winter is the physical and psychological condition known as Seasonal Affective Disorder (SAD) – a cycle of depression and recovery linked to the changing of the seasons, particularly the winter months. While the effects of the changing seasons on a person's mental well-being has been observed for hundreds of years, it was not quantified until 1980 by Dr. Norman Rosenthal working at the National Institute of Mental Health in the United States[9]. SAD is characterized by symptoms of low energy, extended but low quality sleep, increased appetite, decreased sex drive, and cognitive and mood problems. Milder cases of these symptoms are instead described as the "winter blues". In the worst cases these symptoms can culminate into effects as serious as clinical depression or extreme weight gain. Rosenthal's recommended treatments are daily light exposure from an intense artificial source, increased exercise, modified diet, and outdoor excursions during intensely bright winter days to reverse the biochemical causes of SAD[10]. In short: "get outside and play".
An interesting trend occurred when Rosenthal collated data from other studies to link the proportion of people affected with SAD and their relative latitude[11], which has been transposed to fig 1.6. Within the United States, the prevalence of SAD - expressed as percentage of the local population, with the second number representing SAD and "winter blues" cases - ranged from 1.4% (4.0%) in Sarasota Florida at 27º north, to 9.2% (28.3%) in Fairbanks Alaska at 65º north. In Europe, Oslo and Tromsø had higher SAD rates, but less of the total population is affected overall. Stockholm Sweden and Helsinki Finland, both at 59º north have rates even lower than Nashua, New Hampshire, which is 1,900 km further south. The most astonishing case, however, is in Reykjavik, Iceland with only 3.8% occurrence of SAD at the extreme latitude of 65º north, just outside of

8 Gemzoe, *"Winter Cities, Edmonton 20.01.2012."*
* First elements of the path were built in 1900, but modern expansion occurred in the 1970s.
9 Rosenthal, Norman, *Winter Blues: Everything you need to know to beat seasonal affective disorder*, New York: The Guilford Press, 2006, p 3-17
10 Rosenthal, 111-189
11 Rosenthal, 64



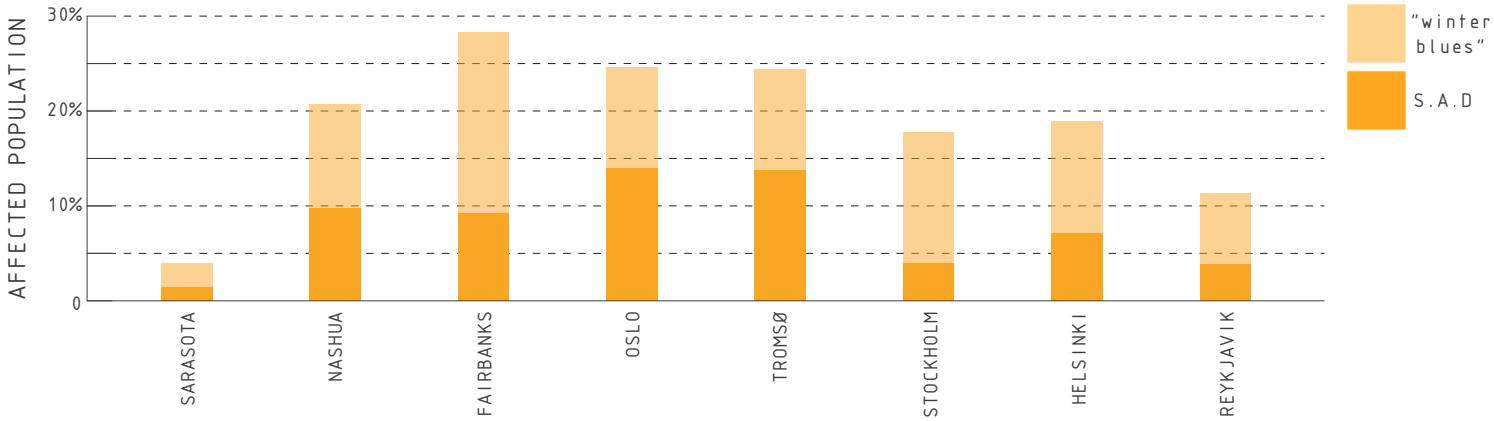


fig 1.6 Seasonal depression and latitude

the Arctic Circle. Rosenthal believes genetics is a key factor[12], but this doesn't explain the differing rates of the three Nordic nations. What is unexplored is the effect of culture. Daily winter activity, embracing the season, may have protected these populations against the psychological and physical reactions generated by Seasonal Affective Disorder. Through hygge, koselig, and mysig, these societies have adopted cultural behaviours which mimic the treatments recommended by Rosenthal, preserving mental and physical health by promoting mental and physical health.

Urban Design

North American Winter Cities have developed in a perplexing manner, doggedly repeating the methods tested and developed further south, which are connected to the romanticized ideals of ancient Greece and Rome. Ancient plazas and boulevards, once created to enjoy the cooler evening hours of the Mediterranean day, have been transplanted and rebuilt within cities that are scoured by arctic winds. The long, straight roads carried clean breezes through humid, cloying cities to relieve the populace, yet now channel frigid air driving citizens off of the streets in a desperate search for warmth. While the complete forms are what catch our attention, the shaping of the Ancient cities was subtly driven by climate and the control of wind and energy.

> *"We note that it is rare for all the climactic data to have the same importance in architectural design, but vernacular architecture certainly does not know of any constructions which have not been adapted to climatic conditions."*[13]
>
> -Ralph Erskine

In ancient western culture, wind and space were commodities. Once the heat of summer days broke life spilled onto the streets and filled the wide promenades and plazas. Residual heat in the buildings radiates upwards, cool air is drawn through the boulevards, collecting people along the way, and conversations begin. People stop to eat, drink, and simply encounter each other. As Mediterranean culture expanded westward and northward, so did this ideal vision of city life. Twisting medieval streets were left in the cores, and perfect geometries were introduced where possible, such as Julius Caesar's changes to the Roman Forum or Haussmann's rebuilding of Paris. As Western Europe colonized North America the city was transplanted again, but no longer found the constraints of twisting medieval cores to be bisected – instead there were vast undeveloped

12 Rosenthal, 63

13 Mänty, Jorma, and Norman Pressman. *Cities designed for winter*. Helsinki: Building Book Ltd., 1988, 25.

lands, and the Mediterranean ideals of perfect geometries could be the point of origin for the formation of a city.

Our fascination with the beauty of the architecture of western origins is not unreasonable, but the replication is misguided. "When studying the beautiful towns of the south, whether old or new, it is not the forms themselves which should interest us, but the inventiveness and artistry with which people solved the needs which were peculiar to their situation and time, the comfort and beauty which they created"[14]. Building on a grid makes great organizational sense, but in the north it comes with a cost (fig 1.7). No one will confuse Winnipeg with Athens or Paris, but Winter Cities like Winnipeg, Anchorage, and Edmonton are none the less built using the methods first developed in Southern Europe. Satellite imagery in fig 1.8 and fig 1.9 highlights the stark differences in city planning between northern Europe and North America. How can this design possibly function in a city ravaged by humidity and hurricanes, and also in a city so far north that winter days are barely five hours long?

> *"We have built broad piazzas and boulevards which have no place in northern climes, and that the design of northern cities should be rooted in the forms of the north, not the Mediterranean – for cities which have been well designed for the cold are often surpassingly lovely."*[15]
>
> -Frederick Gutheim

Nordic countries remained free of the Mediterranean influences until the spread of modernism, and as such have a better relationship with winter: the organic growth of their urban environments created warrens of streets with each twist and turn reducing the speed of the wind, using the built environment to protect both the exterior and interior. While the urban planning and design in Scandinavia is by no means perfect - these nations underwent their own periods of modern development with little regard for control of micro-climates, undoing many successes of their histories[16] - the legacy from their autonomy have nonetheless left them in better stead than their North American counterparts.

Building a new city, or uprooting an existing one, is a decidedly "low probability" scenario. Canada cannot change the structure of its cities, but it can, and has, made attempts to adapt the shape of the city at the scale of districts, blocks, and even streets.

14 Mänty and Pressman, 24.
15 Mänty and Pressman, 25.
16 Mänty and Pressman, 334.

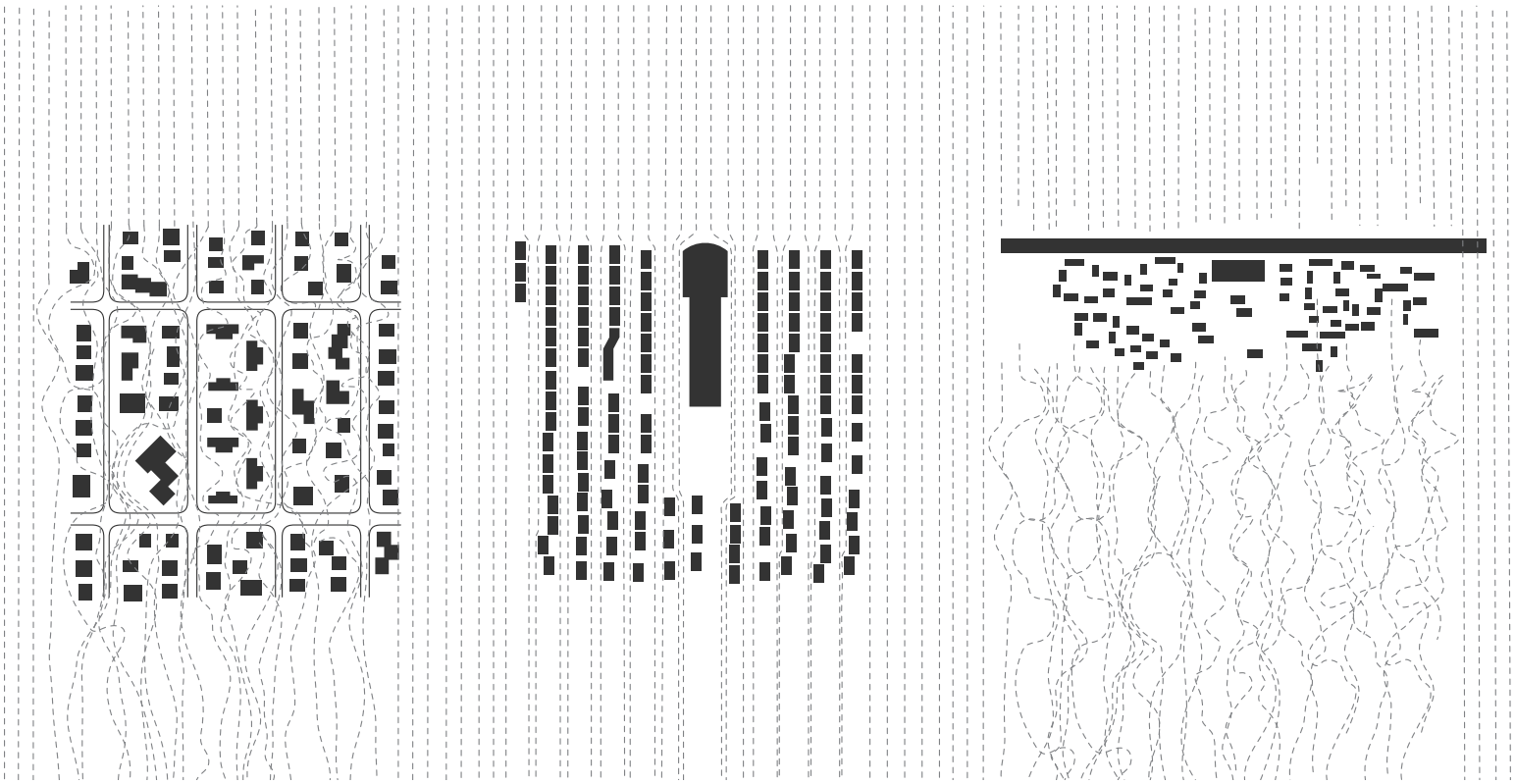


fig 1.7 Wind vs. Geometry

Source: Matthew Jull, "*Toward a Northern Architecture - The Microrayon as Arctic Urban Prototype*," Journal of Architectural Education 70:2 (2016): 214-222

Copenhagen_55° N

Oslo_59° N

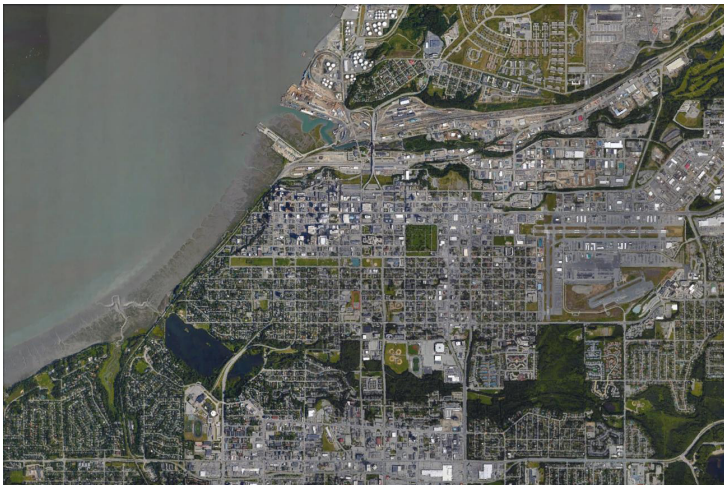
Helsinki_60° N

Moscow_55° N

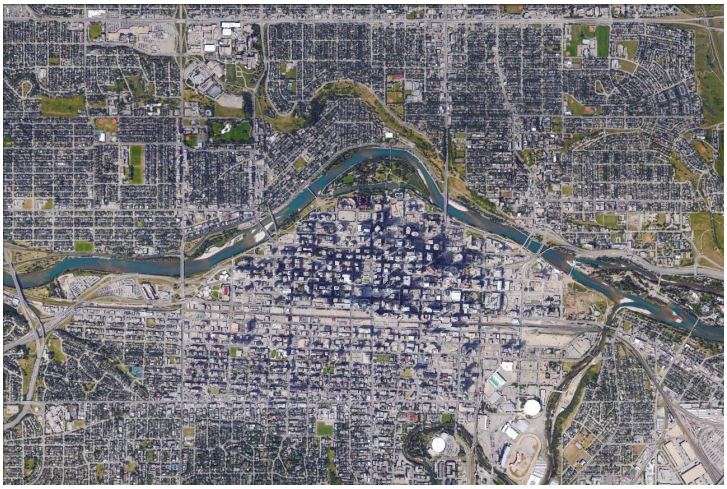
The layout of Northern European cities has a much freer form compared to their North American counterparts. While straight sections of streets do exist, the eventual twisting disturbs the laminar flow of wind, creating eddies in the current and reducing wind speeds at the street level.

fig 1.8 European Winter Cities

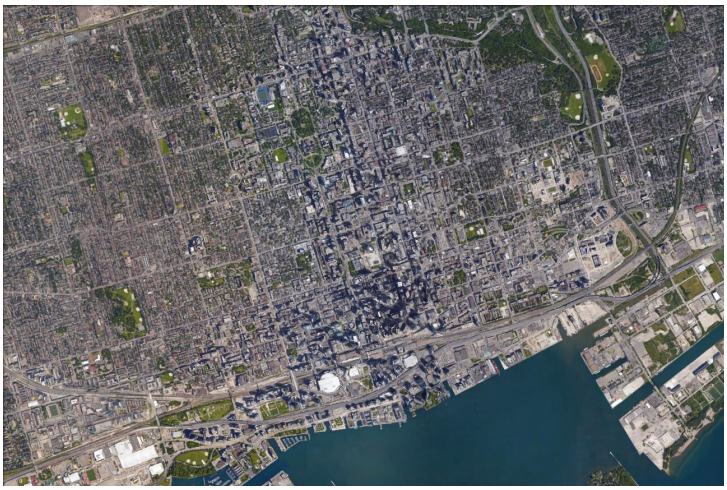
Source: Google Earth



Anchorage_61˚N



Calgary_51˚N



Toronto_43˚N

Edmonton_53˚N

Organizing streets into grids is a highly efficient method for maximizing buildable area, and makes for easier navigation of the urban realm. However in a northern climate where wind speeds can dramatically affect environmental conditions. The straight streets concentrate winds, forcing the same amount of moving air through a narrower space, increasing velocity and wind chill.

fig 1.9 North American "Winter" Cities

Source: Google Earth

Climate, Architecture, and Activity

> *"Forgetting the climate, ignoring it, or trying to eliminate it from urban reality and our imagination not only deprives us of the pleasure of different seasons, which foster agreeable as well as disagreeable situations and conditions, but inevitably leads to unexpected confrontations with the more dramatic consequences of weather."*[17]

Repeated cycles of searching for locations of warmth transforms the streets from a place of interaction, of differences and healthy urban life, to a place of isolation where the sole purpose is transportation, from high energy to high energy. Canadian urban planners and architects have changed the shape of several of our cities in an effort to return street to the pedestrians of a winter city, to improve urban life and its relationship with the environment. Norman Pressman, former professor of Urban and Regional Planning at the University of Waterloo and co-founder of the Livable Winter City Association, extensively analyzed the relatively new Canadian Urban winter responses of Toronto's PATH, Montreal's RÉSO, Calgary's +15 Skywalk, and Ottawa's Rideau Centre in his 1988 publication "Cities Designed for Winter" , and I conducted my own examination of Edmonton's Pedway system and the University of Alberta's Housing Union Building, which are all summarized in Appendix A. Three general archetypes emerged from Canadian interventions: below ground concourses, elevated concourses, and enclosed pedestrian "streets". The strategy for all of these projects is to transfer the daily activity of the street indoors under full environmental control, spaces where a continuation of city life may continue unabated, isolating the populace during inclement weather during all seasons. In reviewing the above projects, several key words kept reappearing - economy, mobility, and public space - with allusions to others - urban habitat and visual environment. These terms are Norman Pressman's five criteria for strategies to improve winter living, which are further expanded in tables 1-5. Simply accounting for topography and the climate is insufficient - each intervention must be "acutely aware of the societal values, attitudes and potential user requirements. Climate, therefore, should be seen as a modifying factor under normal design settings [but] under extremely severe conditions, it may turn out to be a *determining element*."[18]

Projects like the PATH, RÉSO, and +15 Skywalk are arguably the more successful large scale interventions in Canada, but they are of course not free from negative aspects. Private ownership of the PATH segments in Toronto

17 Zardini, Mirko, and Wolfgang Schivelbusch. *Sense of the city: an alternate approach to urbanism*. Montréal, QC: Canadian Centre for Architecture = Centre canadien d'architecture, 2005, 105.
18 Mänty and Pressman, 61.

ECONOMY

GOALS	STRATEGIES TO IMPROVE WINTER LIVING			
	SOCIAL	ECONOMIC	PHYSICAL	ADMINISTRATIVE
High degree of self-sufficiency with respect to: *· Food production* *· Energy* *· Utilize local resources to increase job opportunities* *· Preserve economic stability* *· Minimize maintenance and management costs*	*Minimize family disruption created by seasonal un-employment* *Grants to assist low income groups (heating, clothing, basic shelter)*	*Stimulate winter climate products and technology through R&D* *Winter tourism promotion*	*Expand green-house technology* *Maximize local energy sources* *Compact, mixed use development* *Balanced transportation systems*	*Government incentive policies and programmes for:* *· research* *· innovation* *· development*

MOBILITY

GOALS	STRATEGIES TO IMPROVE WINTER LIVING			
	SOCIAL	ECONOMIC	PHYSICAL	ADMINISTRATIVE
Minimize need for commuting *Reduce hazards of movement* *Encourage use of public transit and walking*	*Improve transit service to low income areas* *Provide adequate transit systems to special needs groups (handicapped, elderly, etc.)*	*Subsidies where required* *Incentives to private sector for more flexible transit (dial-a-bus, carpooling, etc.)*	*Better road and sidewalk maintenance and use through:* *· Sensitive road alignment, design and illumination* *· Provision of snow storage areas* *· Parking structures at strategic locations* *· Provide for mid-block pedestrian movements* *· Microclimatic development concepts* *· Heated ramps, stairs, and sidewalks* *· Sheltered passenger/pedestrian areas*	*Revision of current policies regarding landuse distribution and movement patterns* *Require wind and snow impact statements* *Winter management/ scheduling of public transit*

VISUAL ENVIRONMENT

GOALS	STRATEGIES TO IMPROVE WINTER LIVING			
	SOCIAL	ECONOMIC	PHYSICAL	ADMINISTRATIVE
Ameliorate quality of the built environment in all seasons, with emphasis on winter *Improve use and visual appearance of publicly-owned land*	*Instill sense of pride and belonging in the community*	*Reduce expenditures through approaches which maximize use of existing resources and also enhance visual character* *Conserve and improve resources in which investments have already been made*	*Provide high quality urban amenities in order to retain and attract jobs* *Urban design elements reflecting regional character of the community:* *· use of colour* *· lighting* *· water & ice* *· greenery* *· civic art*	*Revise current planning practice and policies to include urban design as a critical component of the planning process* *Strengthen planning, programming and management* *Interdepartmental government cooperation*

fig 1.10 Winter Design Criteria Source: Norman Pressman, "*Cities designed for winter*." Helsinki: Building Book Ltd., 1988: 59-61

URBAN HABITAT				
GOALS	STRATEGIES TO IMPROVE WINTER LIVING			
	SOCIAL	ECONOMIC	PHYSICAL	ADMINISTRATIVE
Create climate responsive residential development and related outdoor space *Provide energy efficient housing*	*Spaces for resident groups to promote greater social contact* *Provide basic facilities (shops, day care) within the residential complex* *Extend public transit to serve major residential developments (medium density)* *Integrate recreational facilities*	*Incentives for passive solar gain and innovation*	*Microclimatic principles for site development through:* *· compact form* *· mixed-land use* *· use of vegetation* *· district heating where appropriate* *Promote enclosed spaces for use by residents*	*Revise zoning bylaws and building codes* *Promote innovative housing through demonstration projects* *Public/private cooperation for efficient delivery systems*

SOCIABILITY & PUBLIC SPACE				
GOALS	STRATEGIES TO IMPROVE WINTER LIVING			
	SOCIAL	ECONOMIC	PHYSICAL	ADMINISTRATIVE
Improve social contact *Induce positive images regarding winter* *Provide more public spaces*	*Recreational programmes* *Winter festivals & carnivals* *Animate streets, sidewalks, and parks* *Education and winter season promotion*	*Incentives for provision of climate protected spaces*	*Indoor parks and public spaces* *Micro-climatic landscape concepts*	*Bonus systems to private sector for publicly used spaces* *Agreement between local government and developers regarding use & access of enclosed spaces* *Implementation of comprehensive systems of climate-protected spaces*

Source: Norman Pressman, "*Cities designed for winter.*" Helsinki: Building Book Ltd., 1988: 59-61

fig 1.11 Winter Design Criteria - Continued

has few incentives to self-organize, leaving inexperienced users lost. Toronto City Council took control of overall signage in 1987, but the rabbit warren is still difficult to navigate when fully immersed in one section. Both the PATH, RÉSO, and the +15 provide respite for pedestrians during the winter, but directly compete with the street-scape for the rest of the year. Full criticisms of these systems could comprise individual theses in of themselves, yet it is unarguable that all these systems are successful in that they are still being used after 50 years. Edmonton attempted to follow the lead of the other major cities with the Pedway, but the resultant is confused. Some buildings are connected by a sky-walk like the +15, while others go underground, with awkward gaps in the network making what should be straightforward trips rather confusing. Other attempts have been made with seemingly innovative strategies, but ultimately failed. In Ottawa, the Rideau Centre attempted to create a completely covered sidewalk housing bus shelters failed, becoming makeshift homeless shelters and killing business along that side of the street[19]. The canopy has since been demolished.

Whether successful or not, my critique for all of these interventions is that they protect the occupant far too greatly. Architects and Engineers have become too proficient for society's own good: we can easily achieve and maintain temperature differentials between the exterior and interior of over 70°C making our homes and offices, and now streets, comfortable in any climate. This feat, now taken for granted, is a testament to humanity's ingenuity. The consequence of this is that the surrounding environment does not exist for the occupant. There is a hard, sometimes brutal, transition from the built world to the natural; one so shocking it causes changes in behaviour as people begin to pause, adjust their clothing, and steel their minds for the coming onslaught of heat or cold and souring their connection with the natural cycle of seasons. This goes against the two fundamental approaches summarized by Norman Pressman in his opening chapter for "Cities designed for winter"[20]:

1. Do not overprotect people from nature
2. Provide protection from undesirable elements.

In Pressman's words, overprotection leads to docility and sensitivity instead of towards adaptation and sturdiness. I interpret this as having the physical divide compound the psychological divide, worsening the already strained relationship society holds with nature. If a design merely extends the boundaries of the refuge

19 "Rideau Shelters", http://www.montrealgazette.com/news/Rideau+mall+1989+These+shelters+smelled+they+became+homeless+shelters+within+five+years+almost+shops+ +that+part+street+-failed/7281803/story.html

20 Mänty and Pressman, 23.

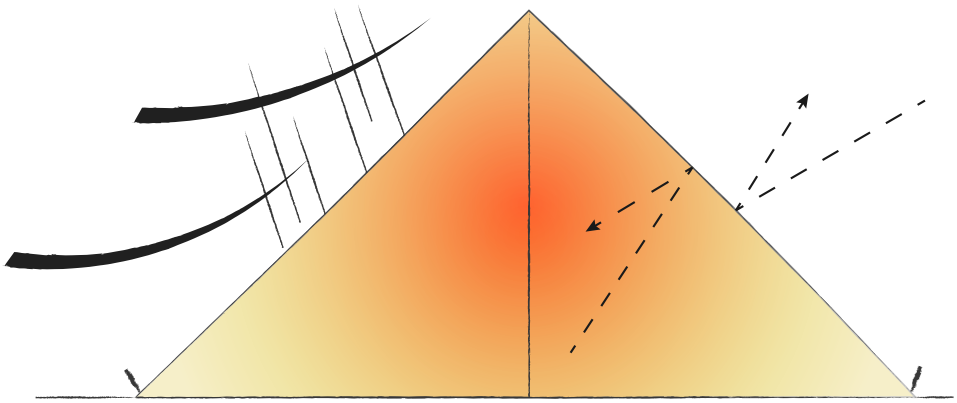


fig 1.12 Banham's Tent Source: Reyner Banham,"*The Architecture of the Well-Tempered Environment*"

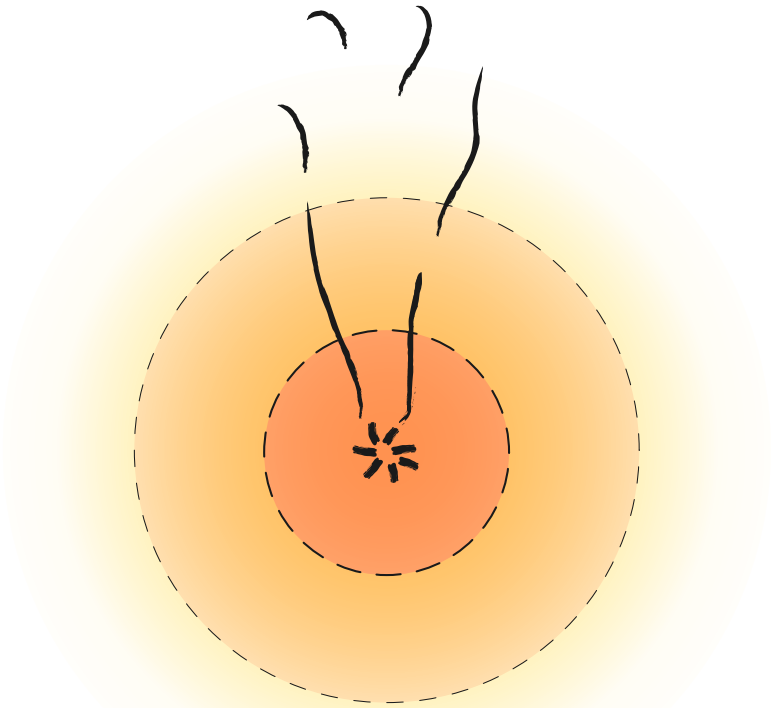


fig 1.13 Banham's Campfire
Source: Reyner Banham,"*The Architecture of the Well-Tempered Environment*"

then is not "Northern", it is a band-aid applied over equatorial design's skinned knee. The second point is clearly a caution not to completely abandon citizens to the elements either. At all times of the year, in all geographical locations, there are conditions which are simply beyond what humans have evolved to endure - punishing heat without shade or a cooling breeze is no less lethal than a howling blizzard without a wind break. Pressman encourages that existing buildings be retrofitted with means to provide "minimal contact with undesirable weather [as] it is inferred that humans prefer 'soft', protective environments as opposed to 'forced' contact with harsh wind and temperature conditions."[21] Pressman's lack of criticism for these projects implies they should fall acceptably within the second approach - providing "soft" protection from the elements as opposed to forced contact. I agree they are effective, and are in fact an essential urban armature that should exist in every winter city, but are in no way "soft". Their use is binary: the choice is to either to be outside or to be completely enclosed, maintaining the harsh transition between environments. Soft protection comes through architectural and urban design shifting the critical point of what constitutes "undesirable" weather, providing spaces in between the built and natural environments which moderate the extreme elements of both conditions. These "hard" urban designs are Banham's shelters, but society needs more of his campfires.

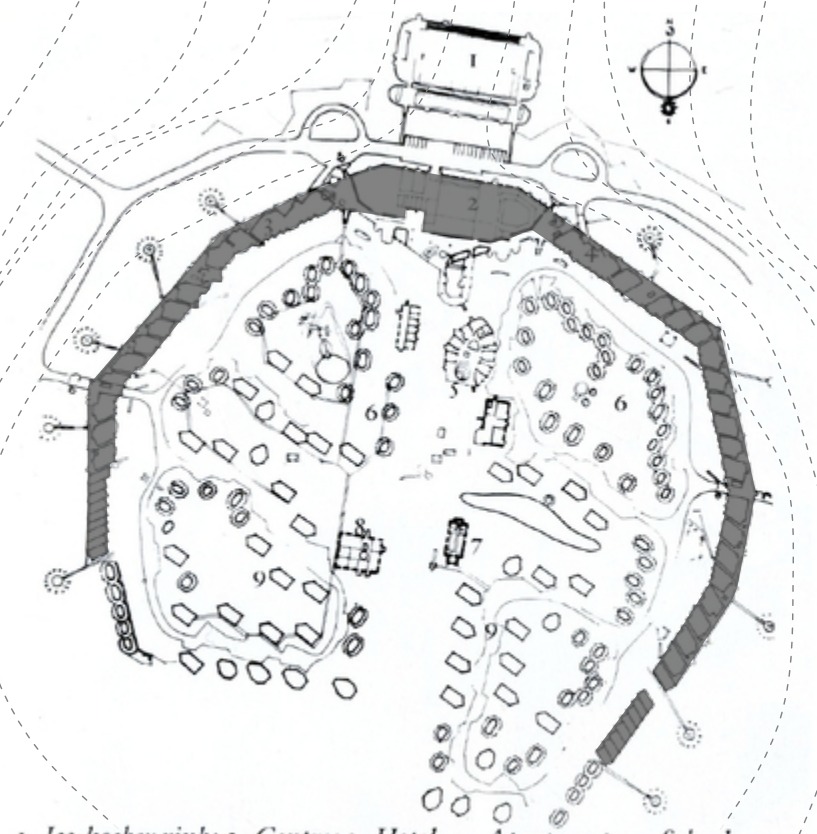
While introducing his discussion of energy use and architecture, Reyner Banham created a parable of a tribe of nomads and the decisions they make for how they would seek protection in a forest clearing: do they use the available wood to build a shelter, or burn the wood for heat?[22] The shelter, contemporary architecture's default choice, creates a hard barrier - there is a definite inside and outside, separate worlds at odds with each other. The campfire offers protection through careful manipulation of energy: program and occupation determine themselves by their proximity to a thermal "source". Instead of a hard barrier between constructed space and context, a campfire links between the two conditions through a fluid transition of warmth and activity, and the tribe members can determine their proximity based upon their present need. Hypothetically the nomadic tribe would choose how to allocate their resources depending on the coming night: to invest in constructing a shelter, or to release the entrained energy within the wood[23] - the key being they are open to *both* scenarios. Modern practice has removed that choice from the north: we always build the shelter. The campfire model must find better architectural representation within Canadian cities.

21 Mänty and Pressman, 23.
22 Banham, Reyner. *The Architecture of the Well-Tempered Environment,* (Chicago: The University of Chicago Press), 1969, 19.
23 Banham, 19

Ralph Erskine brought his own interpretation of the campfire on an urban scale to Resolute, a remote community in the Canadian high arctic on Cornwallis Island. While not in a major city - barely a hamlet in fact - Ralph Erskine proposed a new development plan in the early 1970s in anticipation with merging the local Inuit village with a Canadian forces base. Perimeter buildings holding apartments and a hotel would "turn their backs" into the prevailing wind, shielding the spaces within, dramatically changing the micro-climate (fig 1.14). Inside these protective arms would be the new and relocated community buildings (houses, school, church, and the medical centre). The challenges of transporting building materials to a remote island 74°N proved too costly, and the anticipated growth of Resolute was overestimated, preventing the project from being realized as Erskine envisioned[24], but Erskine set a new precedent within Canada. Instead of introducing energy through mechanical or chemical sources, control is exerted to preserve the energy already contained within the system. Resolute Bay is a campfire re-envisioned at the scale of an entire community.

Interpretations of campfires at the human scale have begun to appear in one location in the Canadian prairies. Winnipeg is physically so similar to Edmonton, both are prairie cities famous for their punishing winters, but Winnipeg is far more pro-active in regards to winter culture. One "architectural" example is through their annual international Warming Huts competition - an open competition, started in 2009, where the winning entries are built on the frozen Red River and the public skates, walks, skis, or sleds through the displays[25]. Every year the competition builds a sense of anticipation through the locals, and has become a point of pride for the city. The stark beauty of the meandering strip of snow is enhanced by artifacts introducing a sense of wonder and play within the visitor. There are also the beginnings of a Canadian architectural version of *hygge* as families and friends meet and gather in (hopefully) warm spaces to enjoy the season. The venue itself is remarkable - during the summer the Red River becomes an exclusive and relatively unused space accessible only by boat, and in the winter there is little reason to visit beyond skating/skiing. The Warming Huts unlocks some of the hidden potential of the river to provide public space and entertainment for a much wider array of visitor. While the majority of the designs revolve around spectacle being more art piece than architecture, and slightly less overlooking the whole "warming" thing, some entries provoke the imagination by using snow and ice to create their tectonics, shielding the occupant from the prairie winds blowing through the river valley with the constant reminder that the experience is only possible during winter.

24 Mets Egelius et al. "Ralph Erskine, architect," Stockholm: Byggförlaget, 1990, 78.
25 Warming Huts. "About Warming Huts," Source: http://www.warminghuts.com/about



1. *Ice-hockey rink;* 2. *Centre;* 3. *Hotel;* 4. *Apartments;* 5. *School;*
6. *New houses;* 7. *A moved church;* 8. *A moved health-care centre;*
9. *Moved, improved houses.*

fig 1.14 Resolute Bay - Ralph Erskine's Plan
Source: Mats Egelius and Jeremy Franks. "*Ralph Erskine, architect*"

Ice Maze, Andreas Mede Source: http://sputnikarchitecture.com/

Stackhouse, Anish Kapoor Source: http://www.cbc.ca/news/canada/manitoba/winnipeg-lessons-for-other-winter-cities-1.3989995

Polar Hen, Mjölk architekti Source: http://ca.archello.com/en/project/warming-huts

fig 1.15 Winnipeg Warming Huts

By providing a gradient of thermal comfort designers can shift the critical point where outdoor activity is possible. Lars Gemzoe described this as extending the warm season[26], but I believe this is a continuation of the wrong perspective - the warm season ends and pretending it lasts a little longer is counter productive. What should be explored are measures to make the cold less severe. Architectural interventions must be created which generate new sets of positive experiences that can only be achieved during the winter months. I previously discussed how an entire city cannot be reshaped, but it can - just not in one stroke. The large scale precedent of Resolute Bay can be compressed to fall within a neighbourhood, a vacant plot, or even a parking space, an evolution of the Winnipeg Warming Huts, strewn throughout the city of Edmonton, affecting physical and societal change through the sum of their parts.

A network of fires exists throughout Edmonton - the space between the flames is where we can repair our relationship with the cold, and Edmonton is not lacking for spaces "in between".

26 Gemzoe, *"Winter Cities, Edmonton 20.01.2012."*

A City of Dross

fig. 2.1 A City of Dross

PARIS TAILORS

fig. 2.2 10746 Jasper Avenue

Edmonton's growth followed the standard pattern shared by many mid-western North American cities - beginning as a small trading post along a river, and quickly adopting a cardinal system for the streets and avenues. Streets and avenues were laid out orthogonally, based on precedent and logic, but both were misguided. The City expanded steadily in population and size through the first half of the 20th century, but two events greatly reshaped developments. The first phase was that of acceleration and began on February 13, 1947 when the Imperial Leduc #1 well discovered vast reserves of oil in the ancient Devonian Reef formations to the south west of Edmonton and the provincial economy began to surge[1]. The population growth rate doubled from the previous decades and the City began annexing surrounding lands to accommodate. The accelerated growth from the Devon Oilfields was escalated into an explosion when development of the Tar Sands near Fort McMurray was approved in 1964[2]. In the following 18 years Edmonton changed from a city of 311,000 covering 178 square kilometers to 550,000 citizens and 684 square kilometers - an area which still stands at the second largest city in Canada with a comparatively minuscule population (fig. 2.3)[3]. With no geological constraints limiting the city's growth Edmonton exploded outwards.

The second event was a perfect storm. With the global recession of 1981 resource companies began to relocate to the suburbs in search of more affordable office space, small businesses downtown struggled to remain open and either closed down or were lured outwards by a pivotal development: the West Edmonton Mall. In 1981 the West Edmonton Mall project opened, becoming the world's largest shopping complex and a focal point for investment by both private enterprise and the City itself. Infrastructure became heavily focused on getting people to the Mall: all the suburban towns could access West Edmonton via a single road, whereas to get downtown there are a dozen different routes convoluted with multiple turns, one way bridges, and dozens of traffic lights to interrupt the journey. The roadworks themselves syphon off casual visitors from the heart of the city and push them to the outskirts. As the west end became the commercial and retail centre of the city, the provincial and federal governments began downsizing their presence within the core, pulling out of their downtown offices, further reducing the potential customers for the remaining struggling enterprises[4]. The Bay vacated its store on Jasper Avenue, and Eaton's Centre lost its primary occupant when the company went out of business further driving life

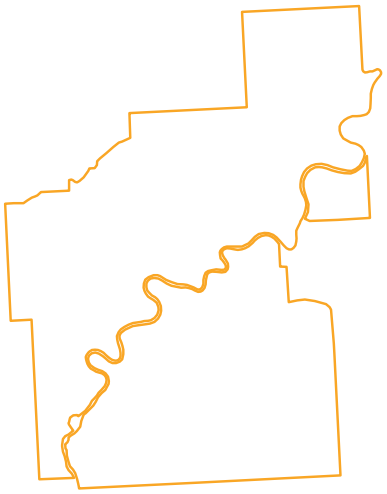
1 City of Devon. "*History of Devon,* " Source: http://www.devon.ca/Visitors/HistoryofDevon/tabid/121/Default.aspx

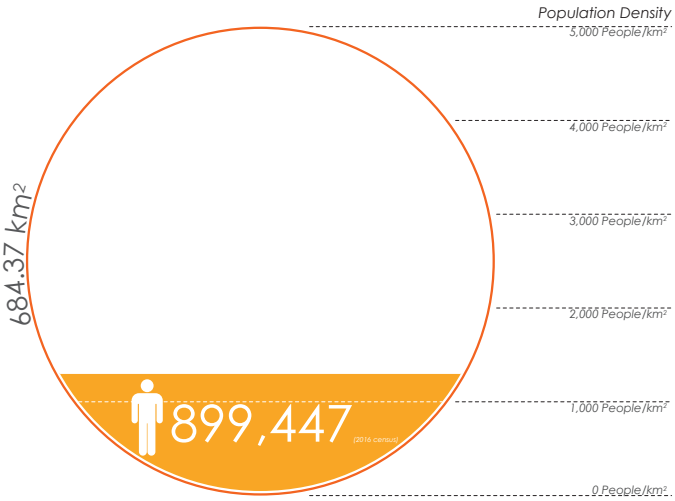
2 Suncor. "*The Oil Sands Story,*" Source: http://www.suncor.com/about-us/history/the-oil-sands-story

3 City of Edmonton. "*City of Edmonton 2016 Municipal Census,*" Source: https://www.edmonton.ca/city_government/facts_figures/municipal-census-results.aspx , p 1

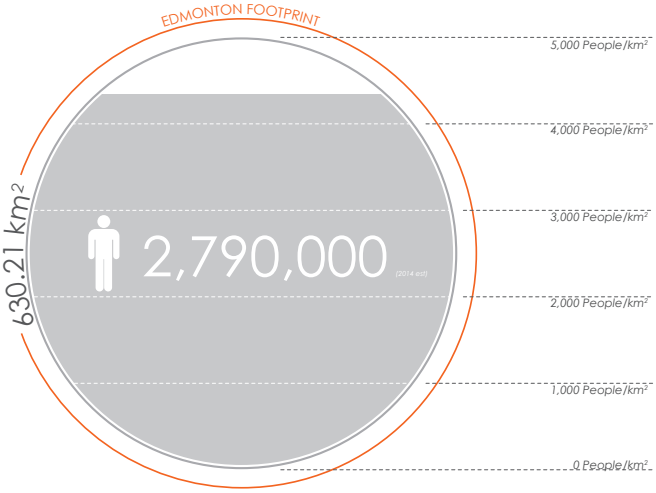
4 Vicki Hall, "*The state of Edmonton's downtown,*" *Edmonton Journal*, April 15, 2001, E7

EDMONTON





TORONTO



MONTRÉAL

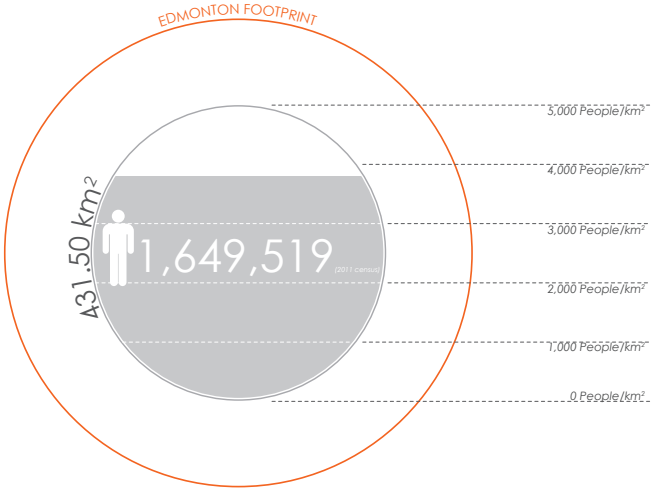


fig. 2.3 A City of Sprawl

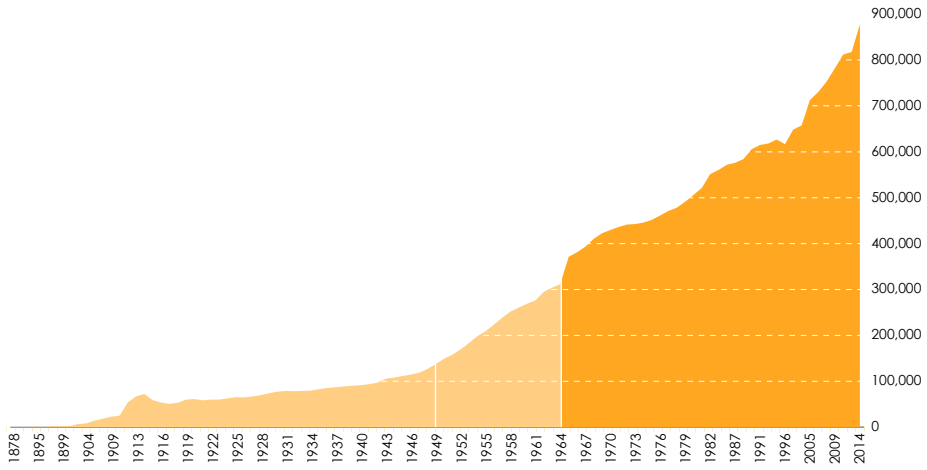


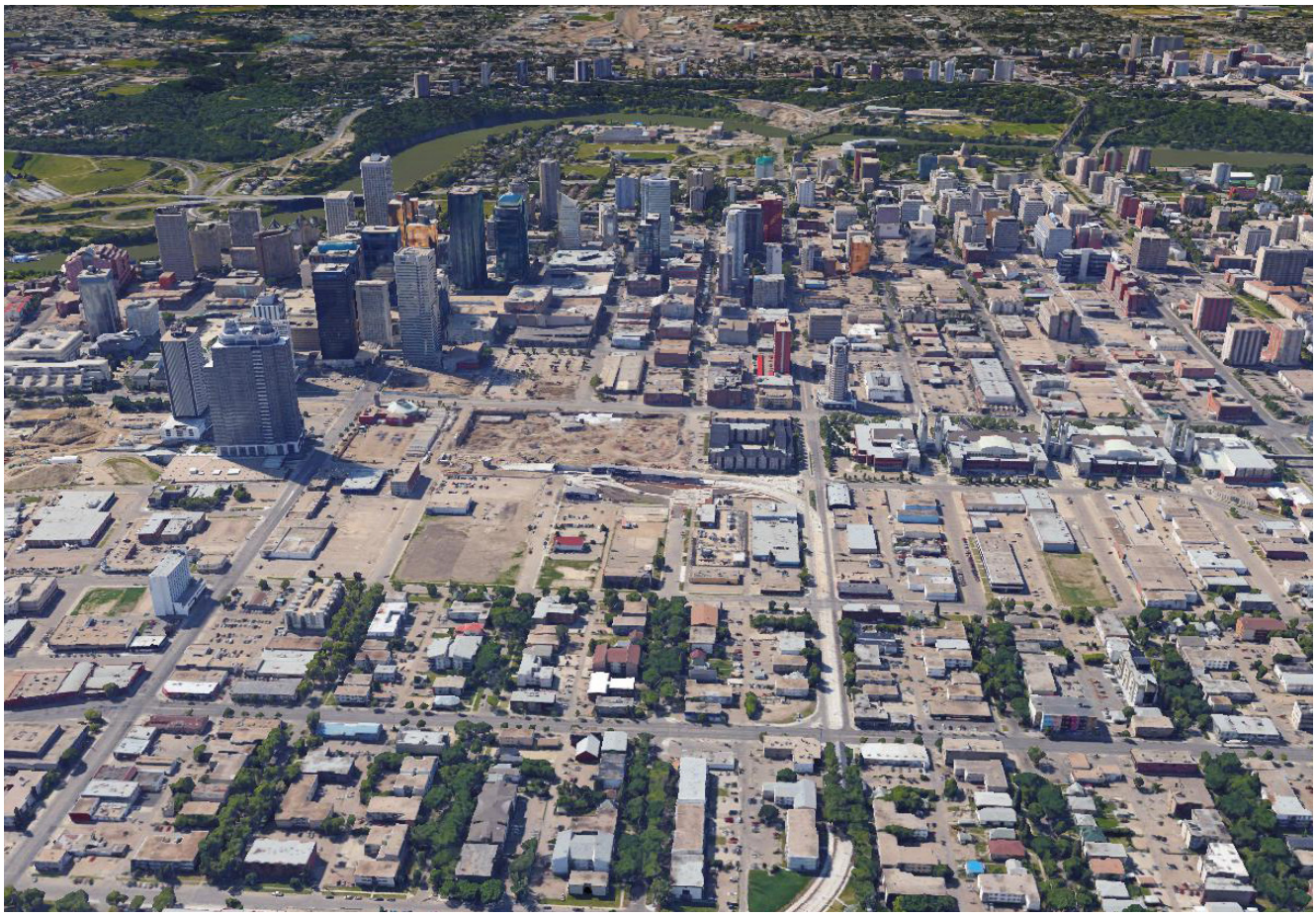
fig. 2.4 Edmonton's Population Growth

and activity from the downtown. Following this exodus, buildings outside of the central business district became abandoned as tenants could no longer afford to maintain leases, fell into disrepair, and an astonishing number were lost to flames or sledgehammers (fig. 2.5 and fig. 2.6). The resulting impact to the downtown core was a relatively intact and developed central business district surrounded by a no-man's-land of undeveloped lots. In the intervening years the land has predominantly been used as grade level parking, with very few multi level parkades by comparison, above or below grade - the downtown core has found itself encircled by a ring of dross.

Urban dross, a term popularized by MIT's professor of Urban Design Alan Berger, describes the "in-between" of the urban fabric; the spaces between the threads. Utility corridors, gravel lots, bridge embankments – these strange, vacant spaces appear between architectural constructs, either deliberately unbuilt or simply unbuildable[5]. These elements are small and scattered, and as such are difficult for society to understand and apply value to them[6]. Empty spaces become tempting targets; for developers and architects alike. The initial impulse is to remove the "urban dross", the waste, by injecting productive space into the voids. This impulse is reinforced by one's perspective of the value of dross which is not initially improved with Berger's choice of terminology: dross is waste, an undesirable element mired within negative connotations. But Berger goes on to address this negative perspective: dross is not something to be destroyed or avoided – it is a sign of healthy urban development[7]. Collectively they can become fields of potential. These spaces naturally occur in the development of cities and their sudden change of state from "productive" constructed space to strange voids creates a quality that should be celebrated and preserved; if not in

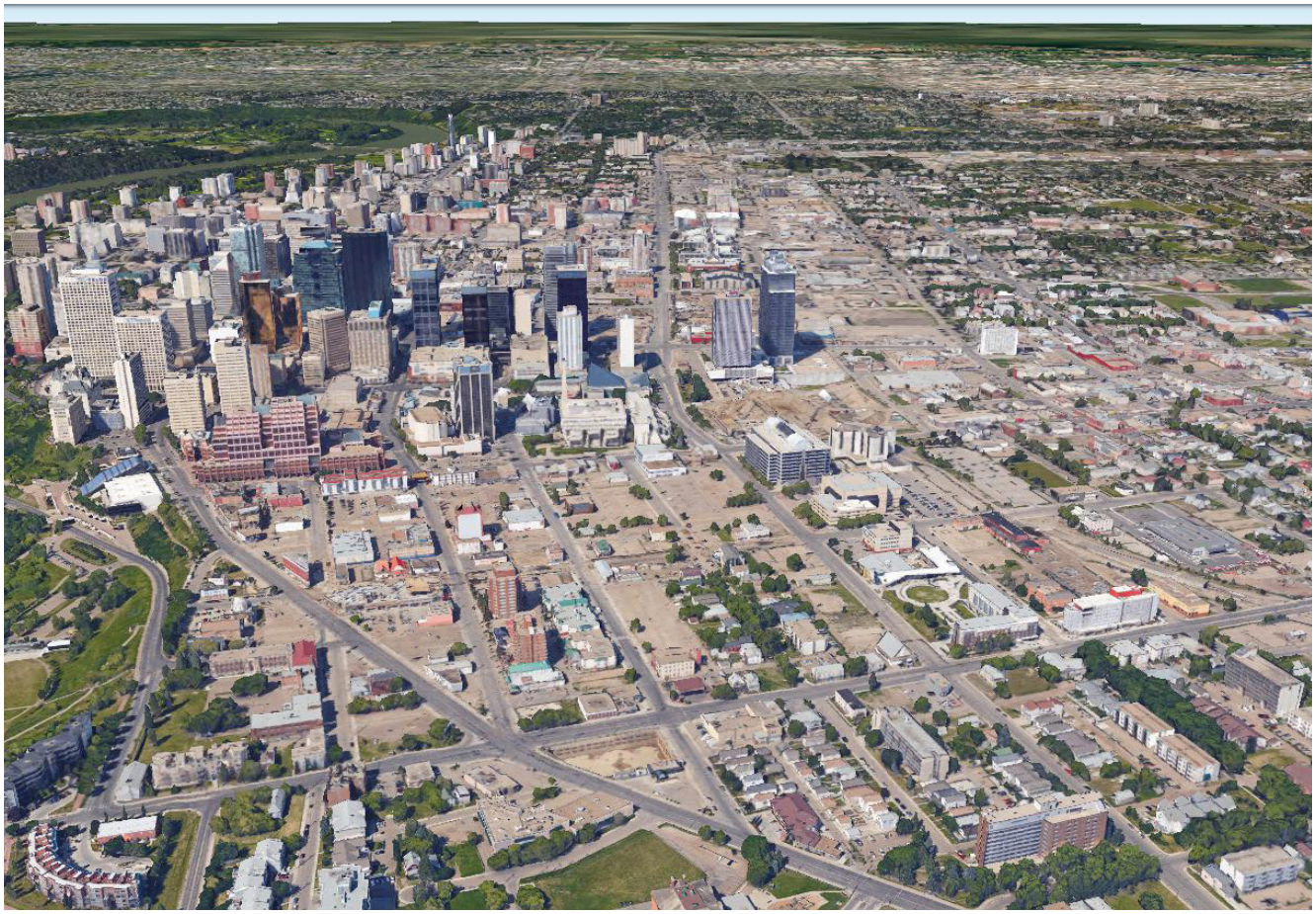
5 Berger, Alan. Drosscape: Wasting Land in Urban America. New York: Princeton Architectural Press, 2006, 26.
6 Berger, p 28.
7 Berger, p 239.

West Edge



North Edge
Source: Google Earth

fig. 2.5 The Ring of Dross



East Edge

South Edge
Source: Google Earth

fig. 2.6 The Ring of Dross – cont

keeping them "unbuilt" then at least in their unique character. In an effort to convey the sense of quality he is trying to describe, Berger calls upon a concept developed by Spanish architect Ignasi de Solà-Morales.

Terrain vague

Terrain vague are Berger's dross, the empty, abandoned spaces in which a series of occurrences have taken place[8], now denoted by the multi-layered French expression by Ignasi de Solà-Morales. In his brief but powerful essay *Terrain Vague*, Morales calls attention to these spaces through their captivation of urban photographers, the first to recognize the strange position they occupy: simultaneously among us but separate from us.

Understanding the quality of these spaces requires understanding Morales' choice in the expression "terrain vague" as there is again a barrier caused by the English language. Terrain in English is a very literal word used to describe the ground, the formality of the term lending it more towards geological use. But to the French terrain is less rigidly defined, both in its own specificity and for the areas it describes - the edges are fuzzy, but they do possess "some definition to which we are external." Morales interprets "vague" as having three simultaneous meanings. The first is the derivation from the German *woge* or sea swell, implying a sense of movement, instability, and fluctuation. Second comes the Latin *vaccus*, which became vacant or vacuum in English, or empty, but this also implies "free, available, unengaged". These spaces are void, "yet also promise, the space of the possible, of expectation." The final component, from *vagus*, is the most intuitive: indeterminate, blurred, or uncertain. While these are again negative terms, they are free from limitation, precisely containing expectations of mobility and change[9]. These are undefined, strange spaces, able to change in character at any moment, available for occupation, but free from existing definition. We are captivated by this sense of promise, and the strangeness they present from between the understood environment surrounding them. With no physical form the spaces take form with our memory - where the old Woolworth's used to be, the shortcut we would take to and from the parking lot back when we worked downtown - but once we construct within these spaces the collective memory fades, which is unfortunately the first impulse of the architect.

If the city is only viewed as a vast machine of production, these voids are where the city is no longer, but these are spaces where the city can truly define and reveal itself. Yet giving the space permanence forces the series of occurrences

8 de Solà-Morales, Ignasi
9 Morales, 26.

to cease - the collective memory of the site is forced into homogeneity and disappears - once the terrain vague becomes fixed, limit is imposed. The blind field of the future urban is pushed further out of vision by fixing a single instance within an ever changing system.

I began this work with Henri Lefebvre's appropriation of the term implosion-explosion from stellar physics, and will continue the trend by borrowing this time from quantum physics. A central tenant of quantum physics is that reality exists in every possible form until it is observed, whereupon it settles into a single state[10]. There is a parallel within terrain vague - the city is not "empty" here, it exists as all possible forms and functions simultaneously waiting to materialize. Architecturally we can preserve the uncertainty of the terrain vague by embracing a temporal approach, to use them as sites of experimentation: testing, observing, analyzing, and re-testing strategies to discover Edmonton's unique form and interpretation of itself as a winter city. As the complex requirements of the surrounding urban fabric and communities are satisfied a possible resolution is found, which can be implemented in future permanent designs. Gradually spaces of terrain vague will be lost to permanence, which is inevitable as the city grows, but others may be preserved and recognized for their perplexing value, and remain as dedicated grounds for experimentation, expression, and discourse.

Drosscape

Alan Berger is of a like mind with Morales, and is just as concerned with the Architect's instinct to convert empty space into finite form. Berger takes Morales' musings and translates them to a set of guidelines, eight strategies to repair one's perspective before designing with drosscape[11]: Berger's efforts guide designers towards new method, separate from what have become traditional approaches. The designer must recognize that these spaces are naturally occurring and did not appear by accident - there is a specific history which affects the space in the present and future which is impossible to understand from a single perspective, and as such design must act in collaboration with others who can fill in the gaps.

Berger defines drosscape as "the creation of a new condition in which vast, wasted, or wasteful land surfaces are modeled in accordance with new programs or new sets of values that remove or replace real or perceived wasteful aspects of geographical space"[12], and follows with his "8 Strategies" which I have listed in Appendix B. The 8 Strategies create the framework for a flexible, iterative

10 Australian National University. "*Experiment confirms quantum theory weirdness*," Australian National University, Source: http://www.anu.edu.au/news/all-news/experiment-confirms-quantum-theory-weirdness
11 Berger. 239
12 Berger. 236

approach, repeatedly gathering information from stakeholders, finding which attempts are successful, or perhaps more importantly which are failures, and adapting further architectural experimentation. For years a similar technique went by several titles such as Urban Pioneering or Urban Catalyst, until it appears to be solidified by two urban planners from New York City: Tactical Urbanism.

Urban Pioneering and Tactical Urbanism

An abundance of terrain vague exists within Edmonton, but the traditional methods of design do not embrace the full potential of the urban voids, or to repair the City's relationship with winter. As a result, new methods must be explored and derived. The first notable examples occurred within Berlin where the citizens themselves proved to be a source of radical urban thinking starting in the early 1990s with their concept of Urban Pioneering.

After the Iron Curtain crumbled in 1989, Berlin found itself unified once more, but riddled with pockets of terrain vague. Determining ownership of land parcels claimed by the Soviet Union at the close of World War II became extremely complicated with the withdrawal of state ownership and a return to private control, and many plots remained undeveloped for long periods. It was at this time the Berlin citizenry took action and became "Urban Pioneers"[13], occupying these vacant plots to provide the area with function they believed was missing. Abandoned buildings suddenly became discotheques, empty fields became driving ranges, vacant plots were filled with sand and became urban beaches, all on the whim of determined individuals. Many of these strategies became accepted by landowners and the municipal government, and even endorsed. Several projects in Berlin were examined for not only the program the public introduced, but also the framework developed for continued operation and revenue sources. The majority of the precedents are described in detail in Appendix A, but one in particular merits further discussion.

Tempelhof airfield, in the heart of Berlin, was decommissioned in 2008 and an international competition was held to determine its future. The design by architects at Raumlabor were the eventual victors because of their unique approach to time based development: instead of focusing on ecological processes, Raumlabor proposed using urban activity, temporary use, and development as the governing metric. Sections on the exterior side of the airport ring road were assigned a hierarchy based on intended use, and the site managers issued a "call

13 Denton, Jill, *Urban pioneers: Berlin: Stadtentwicklung durch Zwischennutzung = Temporary use and urban development in Berlin*, Berlin: Jovis, 2007.

fig. 2.7 9525 Jasper Avenue

fig. 2.8 9676 Jasper Avenue

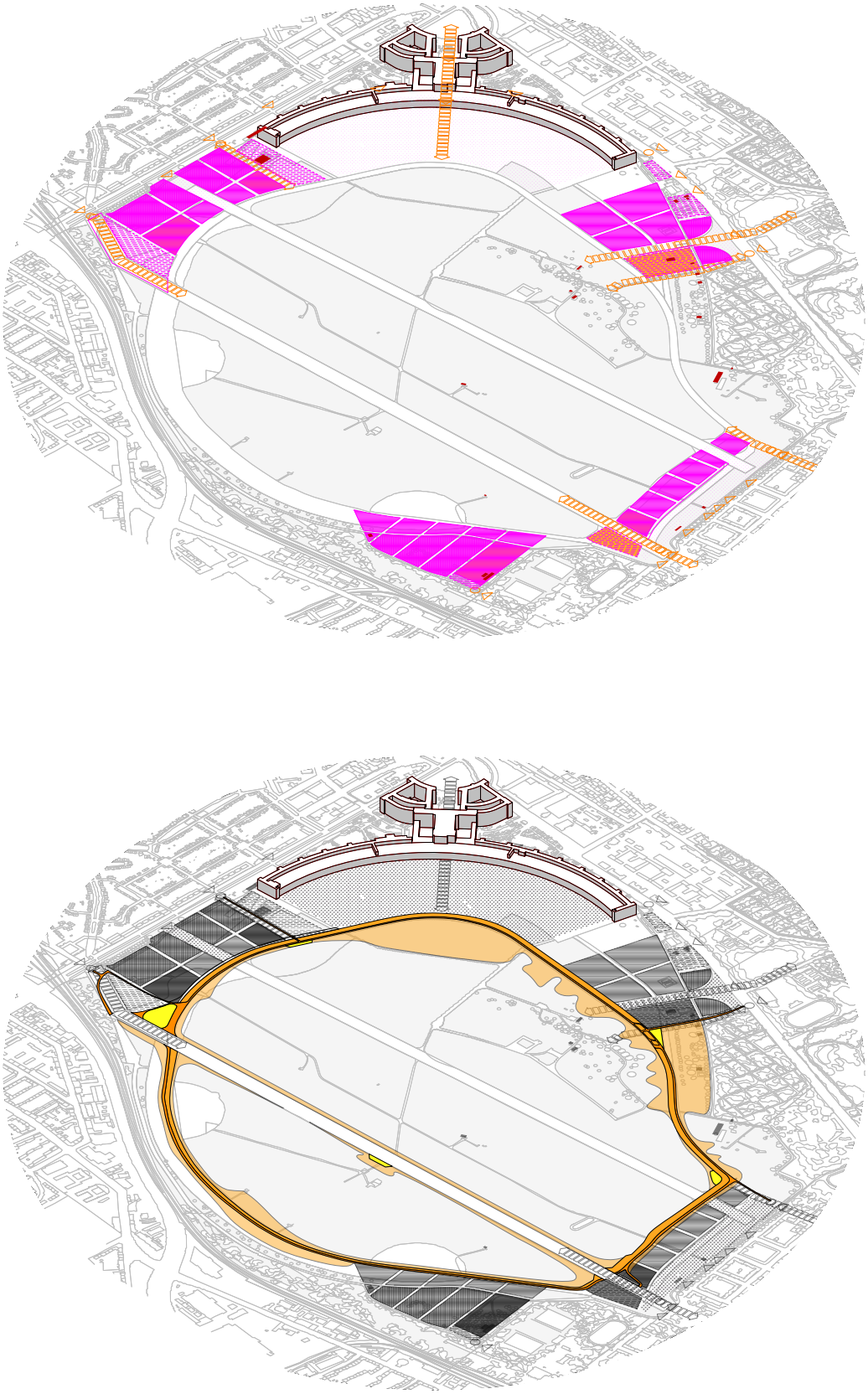


fig. 2.9 Tempelhof Planning

PIONEER FIELDS

Pioneer fields are permanently opened providing dedicated spaces for use through the "Call for Pioneers" program.

Special Room: Permanent space available for community use. No fencing allowed. Maintained by users.

Partially Opened Field: Temporary public use, fencing permitted.
eg. flea markets, playground, theatres, open air movies

Closed Field: For private use
eg. Housing projects, school gardens, etc.

Open Field: Full public use and access
eg. bar, skating, workshop

Priority Development: First areas to be opened for Pioneers due to their location and proximity to surrounding communities/ businesses.

PARK DEVELOPMENT ACTIVATION: RING

The ring road through the airfield provides a transportation route for shuttles and busses to all pioneer fields and development areas. "Hot Spots" are located at key points along route to provide services. As the ring road is 24 m wide, it can be sectioned off for both transportation and recreational uses.

Vehicle Ring

Skate/Bicycle Ring

Transition Zone

"Hot Spot"

Translated and adapted from http://raumlabor.net/aktivierende-stadtentwicklungflughafen-tempelhof/ by author

for pioneers"[14], a submission process which temporarily sanctioned approved projects forming an innovative organizational structure (fig. 2.9). Those with control of undeveloped land were now actively seeking out enterprising citizens to temporarily occupy the space. Future developers could observe the successful installations created by the community, in essence receiving free market research which can influence further investment. At least this was the original intent. For approximately five years Tempelhof became an immensely popular for Berliners - citizens routinely visited for barbecues, cycling, kite racing, and design festivals were held annually - but changes in the municipal government have attempted to steer the land use back into developers hands. Tempelhof's future is uncertain, but proved the value of cooperation between landowners and creative citizens. When given the opportunity the public quickly reclaimed the open parcels and reprogrammed them for what they felt they needed, and the public began to understand the potentials of the spaces and fought to preserve them.

The capacity for action and communication are two of the greatest strengths of this unorthodox approach. Professor Nabeel Hamdi once described it as "making plans without the usual preponderance of planning"[15]. Designs are quickly devised, implemented, and refined - but that is not to say this method operates outside of the realm of the Architect or Urban Planner. In 2015 Mike Lydon and Anthony Garcia, two Urban Planners working in New York at the time, examined the informal design process appearing in cities and reinterpreted it as a design tool incorporating traditional design experience to reinforce the potential of the new methods, and titled the technique "Tactical Urbanism".

Where "strategy" is the tool of the powerful, such as governments implementing master plans or expanding infrastructure to prepare for development, "tactics" are the response of the weak, with those wielding the former in constant dialectic with those advancing the later[16]. Lydon and Garcia describe Tactical Urbanism as an approach to neighbourhood building and activation using short-term, low-cost, and scalable interventions and policies, making use of open and iterative development processes, efficient use of resources, and the creative potential unleashed by social interaction - it does not propose one-size-fits-all solutions but intentional and flexible responses[17]. Lydon and Garcia suggest that governments must strive to work more tactically, and that citizens should learn to expand their immediate capabilities into a longer term, strategic approach - both

14 Tempelhof Airport, *Pioneer Process*, October 11, 2015, http://www.thf-berlin.de/homepage/get-involved/pioneer-process/.
15 Lydon, Mike, and Anthony Garcia. *Tactical urbanism: short-term action for long-term change*. Washington, DC: Island Press, 2015, 3.
16 Lydon and Garcia, 9.
17 Lydon and Garcia, 2-3.

Source: http://www.berliner-woche.de/themen/shakespeare-company-berlin.html

Source: Manfred Kielnhofer https://www.flickr.com/photos/contemporaryartsculpture/

Source: http://www.visitberlin.de/en/spot/tempelhofer-park

fig. 2.10 Tempelhof Pioneering

methods are of equal value and must work in concert to bring officials and the communities they serve into conversation to better shape their environments to suit complex and ever changing needs. "In order to do something big... one starts with something small and starts where it counts," and Mike Lydon and Anthony Garcia give us guidance on how to get moving[18] (Appendix B).

Information gathering, partnerships, communication, and experimentation beginning with the smallest practical scale can bring the issues of the urban scale and the hyper-local towards each other, and with each iteration of the process the subsequent attempt becomes better informed to address the conflicts at hand. No single prescribed, and most likely expensive, attempt from the top - no matter how well individually researched or benevolent - will be so well positioned to accommodate the concerns of the bottom. In just the same way, no bottom up approach has the resources, organizational structure, or sufficient information for long term projection - the two ends of the spectrum must find each other and develop rhizomatically.

Low cost prototyping and experimentation are essential approaches when attempting to affect change at an urban scale, lest incidents like the Rideau Centre shelters repeat.

Searching for Method

Case by case, Tactical Urbanism and Urban Pioneering operate in the same manner. A Pioneer has a vision of the space, gathers resources, plans, and executes with a space with or sometimes without sanction - the key being an individual must always bring the idea to the landowner. Even the Tempelhof strategy issuing a call for Tactical Urbanism projects still began as an open competition for what was assumed to be a standard park - it took the Architects at Raumlabor to convince the city of Berlin to make the space officially available for use. Tactical Urbanism is typically a bottom-up approach, but what if the City became the primary advocate? The City could create municipal programs in which willing landowners could make their properties available. Enterprising groups would no longer have to seek out their sites - they could be willingly offered in advance.

There is no shortage of available land around the downtown core, shown in fig. 2.11 within the red circle. What should be one of the densest areas transitioning between low-rise housing and the office towers of the financial centres is instead a moat of gravel. The neighbourhoods vary in character vastly as they wheel

18 Lydon and Garcia, 171-207.

around the city centre: a quiet river valley in the south, entertainment through office space and residential to the west, culture and academics to the north, and the run-down neighbourhoods to the east. Each terrain vague hosts unique communities, needs, and potentials which can respond to an official sanction to bottom-up installations, but sanction may require some innovation in of itself.

The legal framework for such a venture may require some creative thinking. The most inviting option for pioneers may be for the city to waive leasing or rental fees for public land use in undeveloped plots for approved (ie. safe) projects, or at least create a streamlined and inexpensive process for gaining approval for use with low rental fees. Incentive may be required for the private landowners, but there are some potential solutions. Participation as part of a sanctioned city wide temporary use program could be rewarded with tax credits for the owners for either sponsorship or land availability. Modifications to land titles could introduce a caveat that if no development occurs within a certain time period they must become available for tactical urbanism applications, and building permit applications for new developments could have a similar clause offering their space for at least the first season before construction is to begin. In the most extreme approach amendments to bylaws could even "force" participation for dormant sites in a "use it or lose it" manner. The most common culprits in Edmonton are the surface parking companies, but such aggressive policies might not be required for use on their land. Another combination of tax credits and reduced rates for a quantity of parking stalls could be negotiated with the city - not such a tall request considering most lots lose several parking spaces per season as stockpile zones for their own snow clearing.

Berger's eight strategies of Drosscape, the lessons of Urban Pioneering, and the principles of Tactical Urbanism serve as the inspiration for the development of what I propose as "Tactical Infrastructure". Acceptance and appreciation of the spaces provided by the history of Edmonton's development is a turning point in the perspective regarding terrain vague, and can act as experimental laboratories for temporary winter programming to inform long-term change.

Edmonton was never built as a Winter City, and cannot be rebuilt. But the prevalence of dross provides the city with an opportunity for experimentation. Before these spaces are reclaimed by developers there is a chance for new strategies to be tested, potentially at extremely low cost. Input by the community can be gathered by observing the successful projects created by tactical urbanism so long as a welcoming environment is created for the new round of Urban Pioneers.

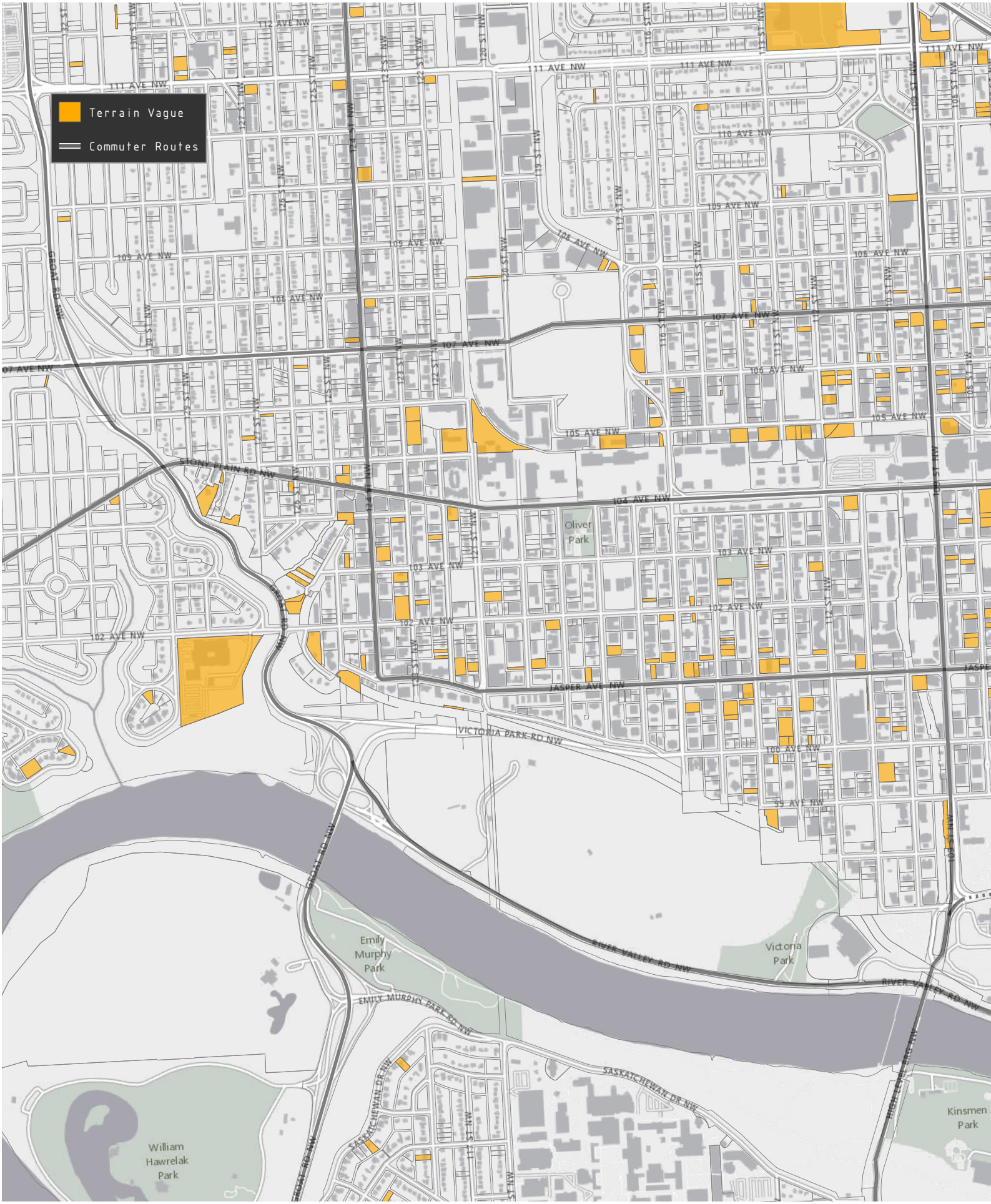


fig. 2.11 A Ring of Dross

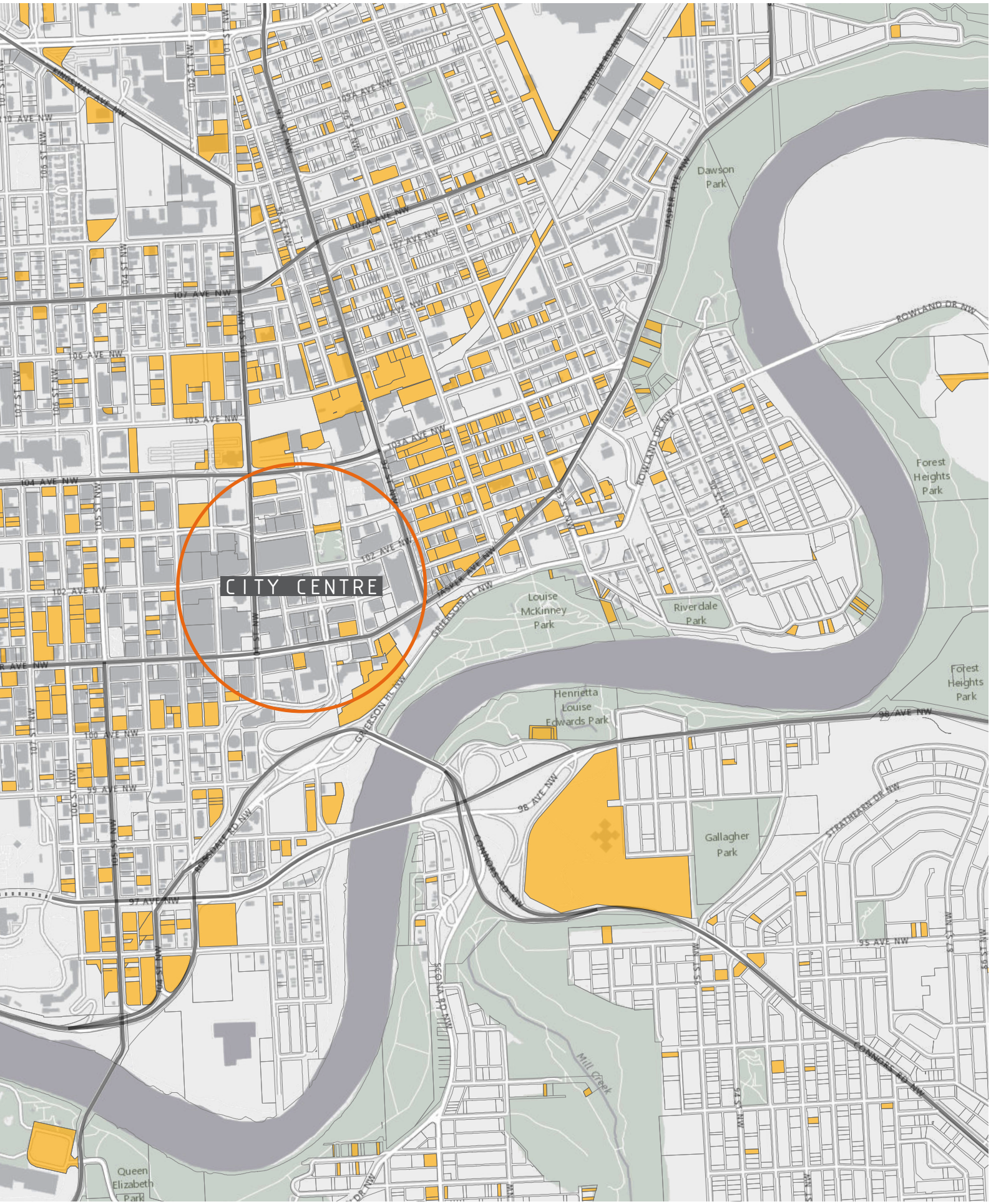

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fig. 3.1 Wintry Weather Source: http://nypost.com/2014/11/20/3rd-day-of-storm-could-leave-8-feet-of-snow-in-buffalo/

Snow

Snow is the starting point. The potential applications of snow have been largely overlooked, but that is not to say it is completely ignored. Snow and ice sculpting competitions are reaching their 12th and 14th iterations, and Hawrelak park has been host to 27 years of outdoor recreational and speed-skating events.

> *"... the same physical space of the city forms the backdrop for two parallel urban realities which are similar, but different: the daytime city and the nocturnal city... Lighting has slowly eroded the unique conditions that darkness offered us... Instead of colonizing [the city] for the eye, we might take advantage of the darkness for a time, forgetting about vision and rediscovering and remembering other sensorial experience."*[1]

Zardini's "darkness" and "nocturnal" could easily be replaced with or winter, and "daytime" with summer. Snow can be the instrument to bridge between the summer and winter urban realities. The change in perception of snow between childhood and adulthood is vast. I have fond childhood memories when the city would plough the residential streets leaving jagged mounds of ice and snow slabs along the boulevards. My walk home from elementary school changed from a boring ten minute drudge down the sidewalk to an epic hour long trek across a mountainous ridge-line. But over time the windrows became barriers keeping me from crossing the street where I wanted, then nuisances I had to clear to back my car down the drive, blocking my line of sight at the start of every trip. Ice patches on sidewalks were once proving grounds for balance, now they are patches of treachery and embarrassment. Frost is something to scrape off windshields, wonder for the patterns created is overlooked. Snow has many forms - it can be light, delicate, heavy, smooth, rough, durable, resolute, or fleeting - yet it is viewed and treated as waste. Snow is amazingly complex and elegant with a myriad of unexplored applications - not just as a physical material, but as a medium to potentially alter a society.

Mechanical Properties

Water is weird, and it doesn't get any less complex in frozen form. There are a myriad of studies, papers, analyses, and experiments trying to produce governing formulas to describe the physical properties of snow under all contingencies, but Malcolm Mellor summarizes the difficulty of the task quite well: "there is no material of broad engineering significance that under normal conditions displays the bewildering complexities found in snow. If constitutive equations and failure criteria could be formulated with complete generality for snow, they

1 Zardini and Schivelbusch, 45

would probably cover all contingencies for all real solids." [2] The list of variables that affect the mechanical performance of snow is staggering: humidity, air temperature, ground temperature, snow depth, temperature gradient, time, water content, wind speed, crystal shape, grain size, sun exposure, water purity, freeze/thaws cycles, topography, and cloud cover can alter the processes of melting, re-freezing, and sintering. To borrow from Dr. Mellor again, "it will be necessary to adopt greatly simplified rheological descriptions for snow, concentrating on the characteristics that dominate for a particular problem."[3]

Despite this complexity, differentiating snow conditions for the intended purpose of this thesis is relatively simple. In a dynamic, uncontrolled outdoor environment the qualities of the available snow will be dictated predominantly by how it is handled, and by the water content - both of which can be controlled by the "builder". Three broad categories can be established, each bearing a range of expected physical properties which can simplify the baffling complexities into malleable characteristics.

There have been some standardized strength tests to spot test snow in differing conditions. Two of the most popular are the "Hand Test", developed by M. de Quervain, and the Swiss rammsonde, a tool borrowed from soil mechanics testing. The hand test is an intuitive method to categorize relative strengths with very little equipment. Each "tool" (a fist, four fingers, one finger, a sharpened pencil, or a knife) is gently pressed into the snow surface and categorized by which instrument was sufficient to achieve deformation. These have been correlated to the more empirical rammsonde method - dropping a weighted dart into the snowpack from a controlled height and back calculating the force required to penetrate to the measured depth.

UNESCO has correlated the two methods to fall in aligned groups, which has been condensed into Table 1.1. While the rammsonde produces results in Newtons (N), the tool impact surface dimensions are standardized, so a very approximate range of compressive strengths can be extrapolated and compared to the quick, intuitive hand method.

Loose Snow

Snow in its purest form is extremely lightweight and delicate with densities ranging from between 50 kg/m^3 up to 120 kg/m^3. There is very little cohesion

2 Mellor, Malcolm. *"A review of basic snow mechanics."* http://hydrologie.org/redbooks/a114/iahs_114_0251.pdf, 287.
3 Mellor. 287

Term	Hand Test (†)	Swiss Rammsonde (†)		Strength Estimate		Bearing Estimate
		Force Resistance (N)		(kPa)		
	Object	Range	Mean	Range	Mean	
very soft	fist	0 - 50	20	0 - 40	16	Person on snowshoes (5 kPa)
soft	4 fingers	50 - 175	100	40- 140	80	Average person - Standing (55 kPa) ‡
medium	1 finger	175 - 390	250	140 - 312	200	Family sedan (207 kPa)
hard	pencil	390 - 715	50	312 - 572	400	Mountain to Racing Bicycle (300 - 550 kPa)
very hard	knife blade	715 - 1200	1000	572 - 960	800	Semi-trailer Truck (760 kPa)
ice	-	> 1200	-	> 960	-	Walls of the Jukkasjärvi Ice Hotel (600-1400 kPa)

Table 1.1 Snow hardness and strength

(†) Values from "The International Classification for Seasonal Snow on the Ground". IHP-VII Technical Documents in Hydrology N° 83 | IACS Contribution N° 1 UNESCO Working Series SC-2009/WS/15

(‡) Standing pressure only, a person walking will double the value

saltation: *The mechanism by which snow particles are eroded from or deposited onto the snow surface and transported by the wind near to the surface. The process involves particles bouncing downstream and shattering new particles from the snow surface.*

sintering: *The process by which intergranular bonds form in a powder or porous material such as snow – dry or wet, decreasing thereby the surface energy of the material. In dry snow, direct deposition of water vapour diffusing through the pore space is usually the dominant bond growth mechanism, but several other mechanisms may contribute depending on the prevailing conditions: surface, volume, and grain boundary diffusion as well as plastic flow. Externally applied pressures, e.g., overburden by snow or ice, assist the sintering process by so-called pressure sintering.*

between grains at this state as the structure relies on the interlocking of the crystal facets until sintering begins, and if only lightly disturbed will settle at roughly a 30° angle of repose. Either through additional snowfall adding weight or just natural settling and fracture of the delicately balanced crystals (or both), the snowfall can expect to sinter and compact another 7 kg/m^3 per hour for approximately six hours. As for strength, there really isn't any. Empirical tests range the compressive snow in this condition at less than 10 kPa[4], which is almost effortless to compact. Because of this low density, the snow crystals make an extremely lightweight lattice filled with mostly air, making it an impressive insulation material achieving RSI values of 3.87 mK/W (R 22 at 100 kg/m^3)[5].

Preserving the light, fluffy qualities of freshly fallen snow is actually the most difficult condition to maintain. As time passes the lattice structure continually seeks a lower energy level: each little shift in pressure causes snow grains to settle and pack more tightly together, metamorphosing into the second of three general categories for examination.

Sculptural Snow

Snowfall naturally compacts beyond settling due to either new snowfall accumulation or through saltation deposits from the wind: both processes pulverize the snow grains further allowing for tighter packing and higher densities. The process of moving snow, either manually or with equipment, has a similar effect - each push of a shovel or drop from a loader bucket shatters the grain structure, allowing the snow grains to interlock tighter. Once the entrained water vapour begins to deposit due gradual energy loss the snowpack begins to build appreciable strength. Given enough manual or natural compaction and several hours of sintering (the longer the better), the forms created could have densities ranging from between 300 to 500 kg/m^3 - strong enough to support the weight of a car, or the hard cutting lines of a bicycle. Piling of snow in this state rests reliably at 60°, but is firm enough to cut to more aggressive slopes. Insulation value can drop off quite sharply however. For example, at 363 kg/m^3 the RSI value drops down to 2.17 mK/W (R 12.3)[6] - the density increased by a factor of 3.6 from the previous example in exchange for a decrease in insulation value by a factor of six. Still, this is not insignificant being a similar value to many hardwoods.

4 Pomeroy, J.W. and E. Brun (2001) Physical properties of snow In (eds. H.G. Jones, J.W. Pomeroy, D.A. Walker and R.W. Hoham) *Snow Ecology: an Interdisciplinary Examination of Snow-covered Ecosystems* 45 - 118p. Cambridge University Press, Cambridge, UK. 101

5 Pomeroy, J.W. and E. Brun. 47

6 G. Peter Kershaw, Peter A. Scott, and Harold E. Welch. "The Shelter Characteristics of Traditional-Styled Inuit Snow Houses." *Arctic* 49 no. 4 (1996), 336.

Working with moderate snow is somewhat similar to working with clay. A surplus quantity of must be consolidated into a larger form and then "fired" to gain strength, either through battering the snow-pile or allowing it to compress under its own weight. Progress can be easily checked by simply poking the form - if you can press your finger knuckle deep into the snow it requires more time. Once your finger (or a pencil for significant strength) is insufficient to easily penetrate the volume is ready. Sculpting the mass is relatively easy and the tools required are hardly prescribed; almost anything available at hand can be used.

Structural Snow

With extreme over-consolidation snow can be pressed to the point where it begins to blur from "snow" to "ice". With densities spanning from 500 kg/m^3 to the physical limit of 917 kg/m^3 (pure ice) the material can achieve impressive strengths of 5.6 MPa[7],or two semi-trailer trucks, for the intended use. The higher densities are due to a combination of reduced amount of entrained air and an increased amount of water within the snowpack with the increased strength coming at the loss of insulation, with RSI values reaching their lowest value at 0.45 mK/W (R 2.6 at 917 kg/m^3)[8].

Finding natural conditions within a city where dry, high density snow is available for "quarrying" will be difficult, but producing similar densities is quite feasible. Conditions can easily be prepared by mixing water into the existing snow and piling it above the desired height. Compaction can be achieved through either mechanical means (such as with loading buckets from a Bobcat), or passively through pressure from over-burden reaching a maximum of 550 kg/m^3 from only packing[9] - density beyond this requires the addition of water into the air spaces. After being allowed to sinter during sustained freezing temperatures, strengths like those measured in applications like the Ice Hotels can reliably be achieved.

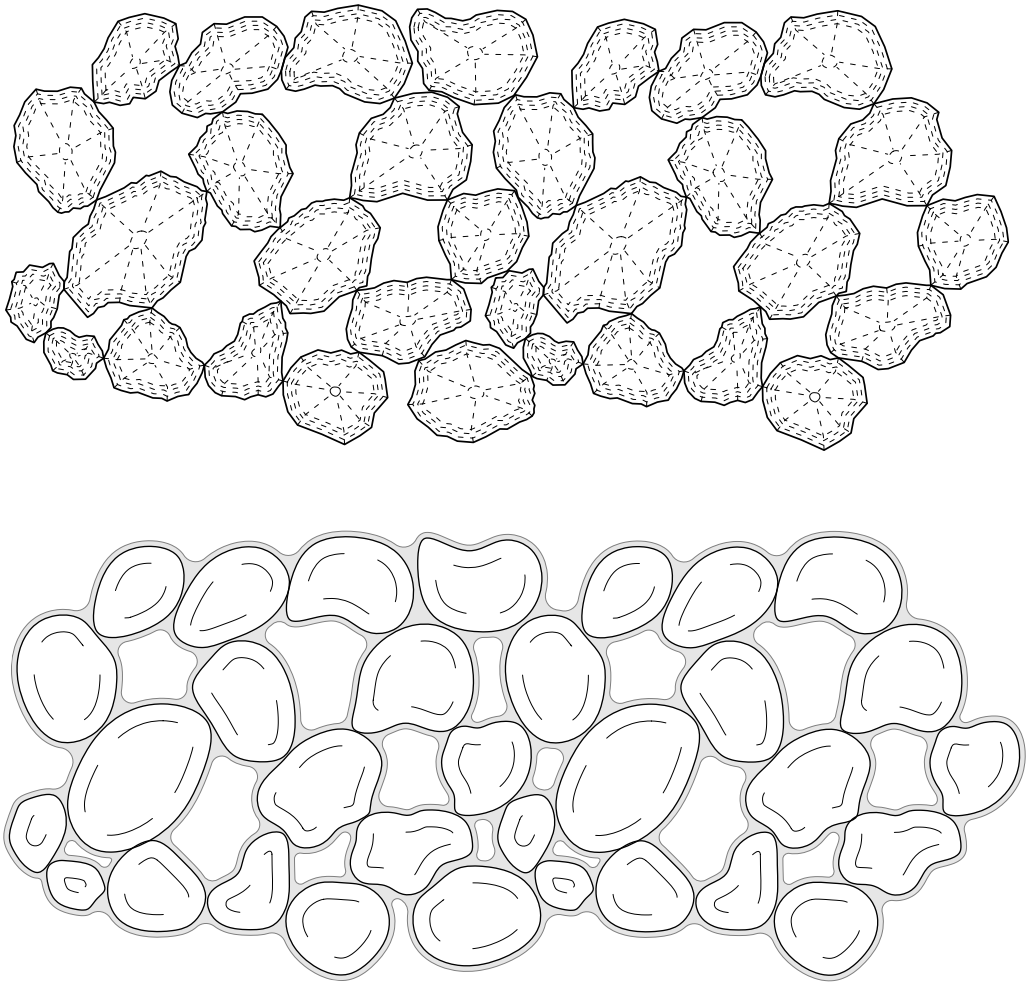
Temporal Nature

If the physical composition didn't complicate the material enough, the metamorphosis of snow with regards to time and environment makes it

7 Haynes, F. Donald, *"Effect of temperature on the strength of snow-ice,"* Department of the Army, Cold Regions Research and Engineering Laboratory, Corps of Engineers, CRREL Report 78-27, Hanover, New Hampshire, 1978, 11.

8 N.K. Vasiliev et al., "A review on the development of reinforced ice for use as a building material in cold regions," *Cold Regions Science and Technology* 115 (2015): 56–63.

9 Tabler, Ronald D. "Controlling Blowing and drifting snow with snow fences and road design," Niwot, Colorado: National Cooperative Highway Research Program Transportation Research board of the National Academies, 2003, 41.



Sintering

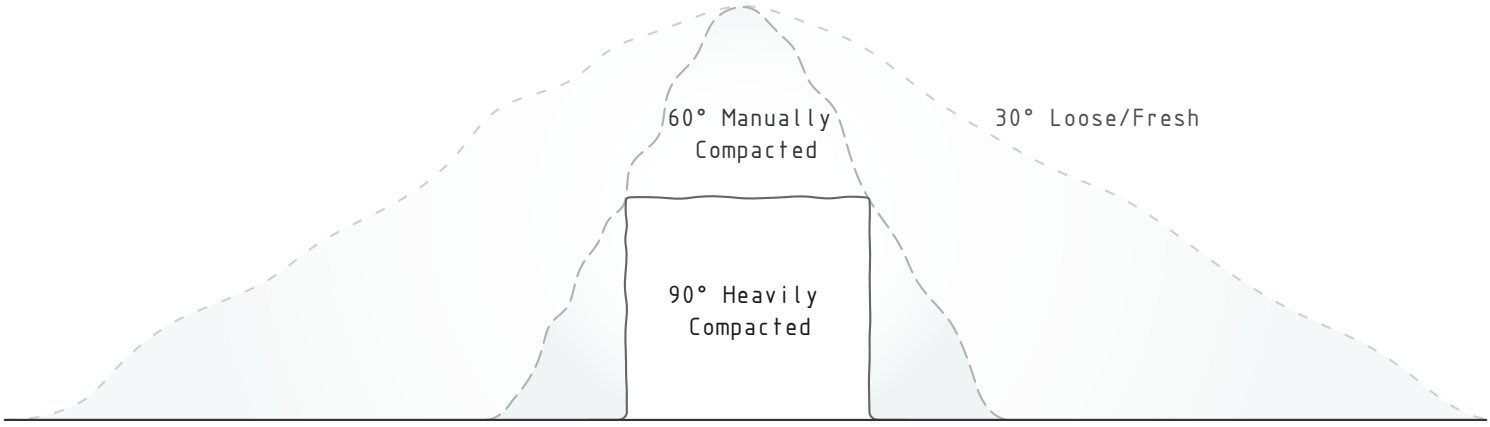


fig. 3.2 Snow Compaction

Snow Type	Density (kg/m^3)	Low Snow Melt (mm/day°C)	High Snow Melt (mm/day°C)
Loose	50	30	140
	300	5.0	23
Sculptrual	300	5.0	23
	500	3.0	14
Structural	500	3.0	14
	917	1.6	7.6
		M_f = 1.5 mm/day°C	M_f = 7.0 mm/day°C

Table 1.2 Melt Estimate

bewildering. To use snow as a (semi) permanent building material in a substantial investment would be a challenging endeavour - keeping the snow within a certain range of properties would require immense effort - but by embracing the dynamic nature the potentials of rapid deployment and experimentation can be discovered.

In recent years Edmonton has undergone uncharacteristically warm spells during what have traditionally been the coldest months. Accurately predicting how much snow will be lost to melt is verging on pointless - it would be easiest to simply measure the loss after the fact - but broad predictive ranges can be established for the snow types listed above. Professors R.J. Granger and D.H. Male developed a simple formula to calculate water loss due to melt, which can be utilized by this thesis to at least provide a sense of deterioration[10]:

$$SWE_M = M_f (T_A - T_B) \quad \text{and} \quad SWE = \rho d$$

Where:
- $SWE_{(M)}$ = Snow-Water Equivalent (melted) - m
- M_f = Melt Factor - m/day °C
- T_A = Average temperature over 6 hours - °C
- T_B = Minimum temperature which melting occurs - °C
- ρ = Snow density - kg/m^3
- d = Snow Depth - m

Rearrangement of these values to solve for "snow depth", assuming T_B is 0°C and T_A is 1°C, and Mf values measured from March to April over three years by Granger and Male, we can back calculate an estimate for how much snow is lost for every degree above zero (Table 1.2):

To use this chart choose the snow type and nearest density based on a hand test and multiply the snow melt by however many degrees above zero are forecast - the result giving a rough estimate to how much snow height will be lost in the day. The difference between high and low snow melt days can be intuitively decided - a dry day with little wind would be low, a humid day with active winds would be high, etc. If the warm spell will be extended, multiply again by the number of days to estimate how well the snow form will fare.

10 R.J. Granger, D.H. Male, "Melting of a Prairie Snowpack" *Journal of Applied Meteorology* 17:12, 1978. 1840

Snow will be lost either through temperature flux or sublimation, it is inevitable, but this process can be utilized as a design asset. As the melt water is transported through the air voids it carries smaller snow fragments, and transfers additional heat energy deeper into the snowpack continuing the melting process. The resultant is both a loss of strength and density, which in effect reverts back into a more malleable form once more. Walls and barriers can be reworked into softer, more inviting forms. Careful consideration of the snow type employed can create a space of shifting function with time, perhaps acting as a sturdy wind block during the heart of winter before shifting to a softer, habitable space later in the season, using the natural changes to make the shift easier to carry out.

If a snow layer is placed on a warm substrate without much distance between the ground and the upper surface creating a temperature gradient of more than 10˚C/metre depth hoar begins to form over a period of several days. Depth hoar is another metamorphosis snow can undergo while hidden beneath the surface: rounded ice crystals melt and reform into inverted "cup" shapes, behaving much like a stack of champagne glasses delicately balanced ontop of one another[11]. The surface of the snowpack typically turns into a crust over large, loose crystals with no cohesion. While not a safety concern in the intended application, depth hoar can become a construction and use hazard if unintentionally left to develop potentially wasting efforts, but can be avoided through hard packing or greater cover depth.

Abundance

Just examining the terrain vague surrounding the downtown core alone there is 310,500 m^2 of undeveloped land, excluding roads and sidewalks. With Edmonton receiving 1.236 m of average snowfall per year[12], the terrain vague are potential harvesting sites for 383,000 m^3 of free, versatile building material each winter. Without context, this is a pretty abstract number, but imagine 63,000 standard cement trucks and the sheer volume can be appreciated. This is of course freshly fallen snow, but it still equates to 27,500 trucks of sculptural snow, or 15,500 trucks loaded with ice blocks.

New strategies regarding collection, consolidation, and distribution need to be developed to utilize an incredible quantity of completely ignored resources - enough to reshape a society.

11 "Depth Hoar", National Avalanche Center, http://www.fsavalanche.org/depth-hoar/
12 "Canadian Climate Normals 1981-2010 Station Data" http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?stnID=1867

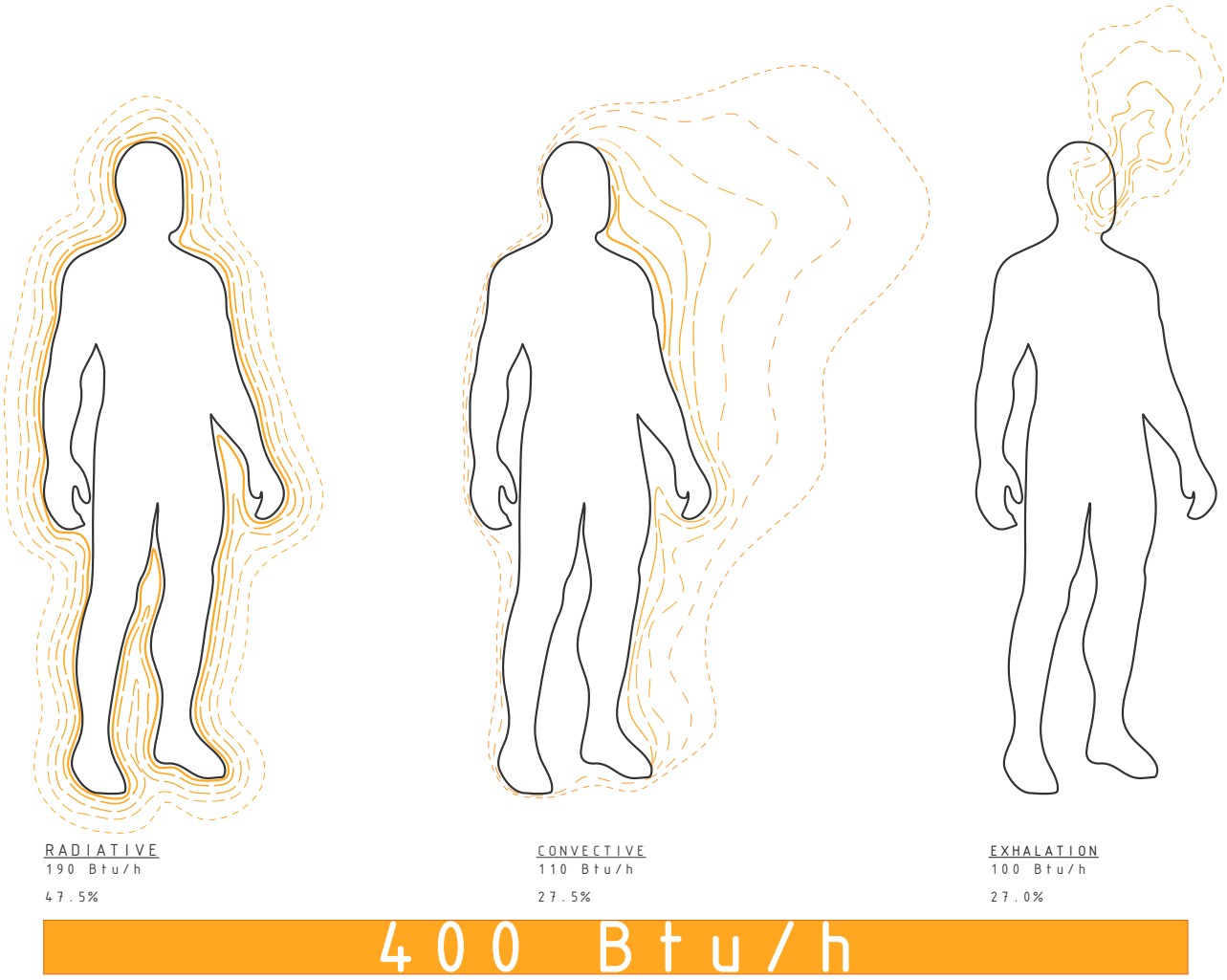


fig. 3.3 Heat Loss

Wind

"The air hurts my face. Why do I live where the air hurts my face?"

I contend that the major climate factor causing the negative emotional connection with winter is not the cold, but the wind. Physically humans are not adapted for the cold - our bodies struggle to retain heat, and even a small amount of perspiration in cold weather can be fatal - but we have adapted technologically to more than account for the failings of our physiology.

The body loses heat primarily through three different means: radiation, convection, and exhalation[1]. Unprotected, the primary mode of heat loss is radiation accounting for 47.5% of the body's heat expulsion whereby the skin's surface projects heat energy through long-wave radiation to a colder surface - provided that there is an unobstructed medium to propagate through. Secondly, we lose heat through convection (27.5%) as the air and objects in direct contact with our bodies receive a portion of our energy in an ongoing struggle to find equilibrium. Lastly is through exhalation (27.0%), expelling warm, humid air and exchanging it for cold, dry air, gradually depleting our reserves. These numbers have come from previous studies by Kiel Moe, MDes director at the Harvard GSD, in his explorations of thermally active surfaces within structures, and as such probably don't accurately represent the heat lost by an individual in winter clothing. While the body will still radiate the same amount, this heat is transferred instead to the extra layers of clothing which then rely on their own insulative value. From here the radiative losses are changed to convection or conduction: the former determined largely one's surroundings, the later by one's behaviour.

Wind Chill

Weather sense and acclimatization contribute greatly to a person's cold tolerance, but tolerance is subjective. If the goal of this thesis is to shift the critical social point of winter activity, shifting the perceived point of winter to a warmer state, attempting to increase everyone's tolerance, will be a valuable aid. With proper clothing the rate of the body's heat loss can be drastically impeded, but not stopped - the human body's response to cold is to produce more heat, trying to maintain both internal and surface temperatures. The increased heat production creates a small boundary layer of warm air around the body's surface, creating another thin layer of insulation - a gradient as opposed to an immediate change. In still air conditions, while not dramatic, this does contribute to our comfort, but once the surrounding air is in motion the boundary layer of warmer air is easily

1 Moe, Kiel. *Thermally active surfaces in architecture*. New York: Princeton Architectural Press, 2010, 9.

Wind Chill Formula

$$T_{chill} = 13.12 + 0.6215\ (T_a) - 11.37\ (V^{0.16}) + 0.3965\ (T_a)\ (V^{0.16})$$

T_{chill} = Perceived temperature (°C)
T_a = Actual air temperature (°C)
V = Wind velocity (km/h)

displaced. When cold air replaces the insulative boundary the rate of heat loss is accelerated, creating a "perceived" drop in temperature as opposed to a physical one (fig. 3.4a)- the air temperature is the same as before, our body is effectively in contact with more of it. In extreme cases this can prove dangerous causing frostbite within minutes, but even on milder days a breeze can change behaviour from people walking upright, seeing each others faces as they move around the city, to people with chins tucked into coats, drones with eyes down barely registering their world of concrete, shoes, and stiff necks.

Introducing a series of windbreaks, created from either sculptural or structural snow, where possible will vastly improve the micro-climates in their leeward side. The effects of the windbreak shapes were examined by N.P. Woodruff through a series of wind tunnel experiments at the Kansas Agricultural Experiment Station with the results summarized in fig. 3.5[2]. Of the four barrier types examined trees provide the greatest length of protection, but the priority for this thesis is the greatest reduction in wind speed making plate and triangular barriers of particular interest - both of which can be easily and inexpensively created using snow as the building material. Overall the wind profiles of both forms are quite similar, with the plate differing by creating a larger area of 75% wind speed reduction (13.5 barrier heights deep versus 10.5), and having a small pocket of 50% velocity on the windward face. In applications where a maximum amount of protection is desired by the operator a vertical plate form may be desirable, however the lower windward speeds will allow for airborne snow to be deposited, gradually changing the overall profile to triangular without some maintenance.

Reducing the incoming wind speed by 75% creates a dramatic shift in micro-climate as shown in fig. 3.5. Let's assume harsh, but endurable conditions of an air temperature of -20˚C with perhaps a 20 km/h wind, creating a perceived temperature of -30˚C. In this scenario positioning a 3 metre tall triangular barrier constructed out of hard packed snow at the "back" of the terrain vague, closing off the space, creates a 31.5 metre deep pocket that feels 6˚C warmer than the sidewalk bordering it. With clear skies and proper orientation to the sun the space can further alter the perceived temperature by another 6 to 10˚C[3]. Using natural, freely available materials a wind swept space that posed a health risk at -30˚C has the potential to become a haven of -14˚C.

2 Olgyay, Victor, and Aladár Olgyay. *Design with climate: bioclimatic approach to architectural regionalism*. Princeton, NJ: Princeton University Press, 2015. 98

3 Environment Canada. "Environment Canada Wind Chill Chart," http://www.candac.ca/candac/Outreach/Teacher_Resources_Index/tri/31.pdf

a) Wind Chill Effect

INITIAL WIND VELOCITY (KM/H) \ TEMPERATURE (°C)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	-38	-44	-51	-57	-64	-70
30	0	-6	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	-76
55	-2	-8	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

"Windy"

b) Protected Area (25% Initial Wind Velocity)

INITIAL WIND VELOCITY (KM/H) \ TEMPERATURE (°C)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	5	0	-4	-9	-14	-19	-24	-30	-35	-40	-45	-50
10	5	0	-5	-11	-16	-22	-27	-32	-38	-43	-49	-54
15	5	-1	-6	-12	-18	-23	-29	-34	-40	-45	-51	-56
20	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
25	4	-2	-8	-14	-19	-25	-31	-37	-42	-48	-54	-60
30	3	-3	-8	-14	-20	-26	-32	-38	-43	-49	-55	-61
35	3	-3	-9	-15	-21	-27	-33	-38	-44	-50	-56	-62
40	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
45	2	-4	-10	-16	-22	-28	-34	-40	-46	-52	-58	-64
50	2	-4	-10	-16	-22	-28	-34	-40	-46	-53	-59	-65
55	2	-4	-10	-16	-23	-29	-35	-41	-47	-53	-59	-65
60	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
65	2	-5	-11	-17	-23	-29	-36	-42	-48	-54	-60	-67
70	1	-5	-11	-17	-24	-30	-36	-42	-49	-55	-61	-67
75	1	-5	-11	-18	-24	-30	-36	-43	-49	-55	-62	-68
80	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68

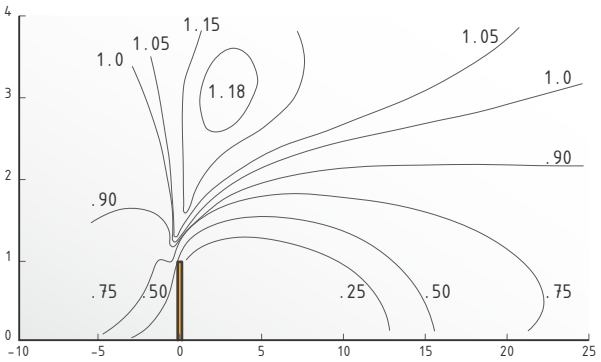
"Windy"

Low risk of frostbite
Increasing risk of frostbite: 30 min
High risk of frostbite : 5-10 min
High risk of frostbite : 2-5 min
High risk of frostbite : 2 min

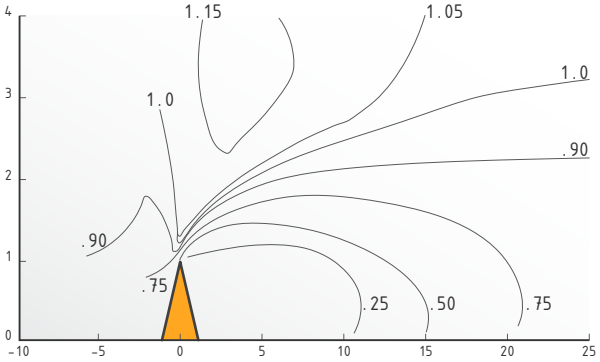
Environment Canada defines "windy" conditions as periods of mean wind speed greater or equal to 20 km/h.

fig. 3.4 Wind Chill

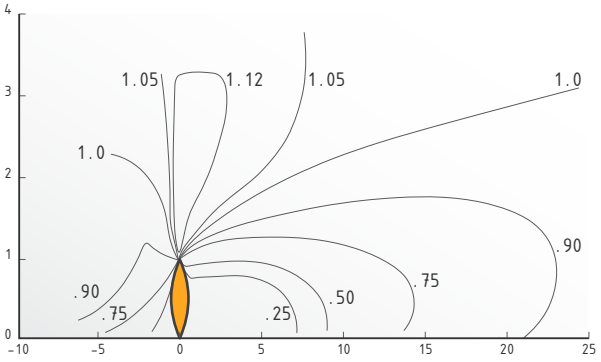
PLATE



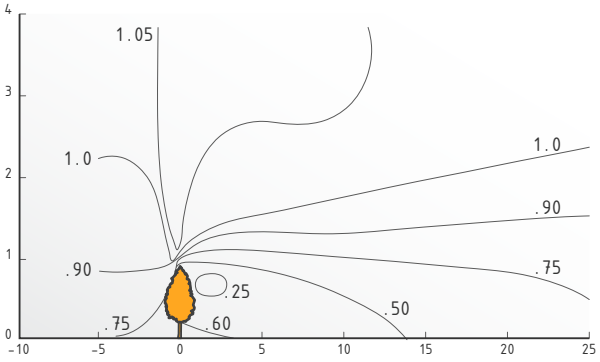
TRIANGULAR FORM

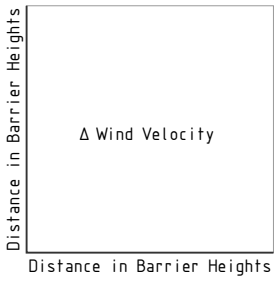


CYLINDER



TREES





TEMPERATURE (°C)

INITIAL WIND VELOCITY (KM/H)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	2	3	3	4	4	5	5	6	6	7	8	8
10	3	3	4	4	5	6	6	7	7	8	8	9
15	3	3	4	5	5	6	7	7	8	8	9	10
20	3	4	4	5	6	6	7	7	8	9	9	10
25	3	4	4	5	6	6	7	8	8	9	10	10
30	3	4	5	5	6	7	7	8	9	9	10	11
35	3	4	5	5	6	7	7	8	9	10	10	11
40	3	4	5	6	6	7	8	8	9	10	10	11
45	3	4	5	6	6	7	8	9	9	10	11	11
50	3	4	5	6	6	7	8	9	9	10	11	12
55	4	4	5	6	7	7	8	9	10	10	11	12
60	4	4	5	6	7	7	8	9	10	10	11	12

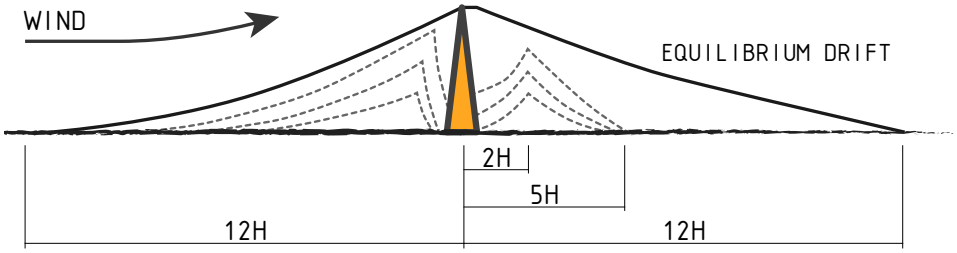
Temperature Differential (25% Initial Wind Velocity)

Discrepancies from previous charts due to rounding

fig. 3.5 Barrier Air Flow Effects

Source: Victor Olgyay, "*Design with climate: bioclimatic approach to architectural regionalism*"

a) Solid Barrier



Source: Ronald Tabler, "*Controlling Blowing and Drifting Snow with Snow Fences and Road Design*"

b) Living Barrier - Growth cycle affecting drift

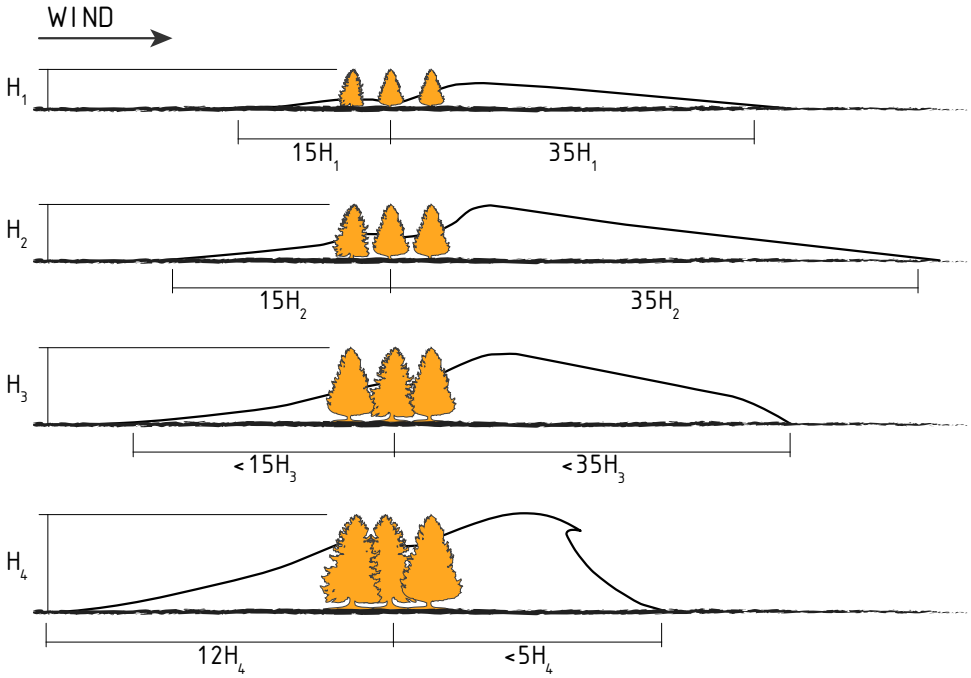


fig. 3.6 Drift accumulation - Solid and Living Barriers
Source: Ronald Tabler, "*Controlling Blowing and Drifting Snow with Snow Fences and Road Design*"

Drifting

As wind velocity decreases so to does its kinetic energy, dropping suspended snow in its wake. To break "fluffy" snow's surface and skip the fragments along requires a wind of at least 20 km/h, and 24 km/h to lift them into the air[4], and once the velocity drops below these thresholds deposition begins. Solid barriers like those proposed develop a distinct drifting pattern: the air currents typically form drifts on the windward side of the barrier with a small gap between the toe and the surface until reaching 60% of the height, upon which the windward side rapidly fills to the barrier height - the leeward side builds much slower until the opposite side has filled, then quickly reaches equilibrium (fig. 3.6a)[5]. The rate of drifting is entirely dependent on weather conditions, and in an urban environment the upwind "fetch" distance where the wind can collect previously fallen snow is often short, and so rapid drifting will be an uncommon scenario for most terrain vague.

4 Tabler, 30.
5 Tabler, 51.

As drifting does occur in the slower paced locations, the deposits should be considered as a gradual supply of fresh, clean material for continued application within the chosen space. In areas where there is significant drift collection, drifting should not be a force in contention with the design, but instead a force which compliments the use of the space - ideally a space which can respond to the winter, shifting form and function in concert with the progression of the season, or at the very least utilizes the natural delivery of material to enhance or revitalize the program which already exists.

Terrain vague which fail to capture the attention of tactical urbanists, particularly the larger spaces, can find purpose as what I am calling "snow-farms". Using snow collected from nearby streets, potentially "contaminated" with sand beyond aesthetic use, long triangular barriers can be constructed across the terrain vague perpendicular to the prevailing wind, creating traps for recapturing previously fallen snow from adjacent neighbourhoods that can be harvested and transported to places of need. Areas of the city with long rows of vegetation, or locations where landscaping is slated to be intensified, can be examined for use as living barrier snow-farms, taking advantage of existing conditions to source additional material. In Ronald Tabler's extensive report on drift control methods he provides general patterns to be expected from a "living barrier" of coniferous trees through their growth cycle (fig. 3.6b). This diagram is a pretty idealized version of drifting on the prairies with huge collection distances - replicating the volumes of captured snow in an urban setting would require remarkable winter storms, but could still maximize the yield of each snow event, gradually becoming a stockpile if the weather fails to provide a continuous supply.

Trying to predict the real world behaviour of wind without advanced modeling is extremely difficult, and computer or wind tunnel simulation requires the interested party to invest what could be a discouraging amount of capital, but these need not be project killing conditions. An error in site preparation becomes minor - knocking the wind barrier over and reusing the material, or adding/removing height is a simple process possible at any time of the project's life cycle. Wind is an underutilized material capable of reshaping micro-climates and easily acting in the place of expensive, advanced options. Through snow, wind can be treated as seriously as any other, to be harnessed or redirected, even celebrated for its potential use to enhance our urban spaces, undoing the harm it once caused.

fig. 3.7 Snow Drifts Source: http://www.huffingtonpost.ca/2013/12/03/alberta-snow-drifts-blizzard-snowstorm_n_4378932.html

fig. 3.8 April Snowstorms Source: http://www.edmontonjournal.com/news/gallery+april+snowstorm/6416232/story.html

fig. 3.9 Firepits Source: http://squawalpine.com/events-things-do/firepits-village

Heat

If radiative losses are controlled by clothing and education, and convective loss by manipulating micro-climates, strategies must be devised to address conductive and exhalative losses as well. Because of their inevitability these two trajectories are more difficult to contain - as long as two objects of differing temperatures are in contact there will be heat exchanged, and the human body will continually impart heat to cold air within the lungs and expelling it. The most viable approaches to reducing these means of heat loss are mitigation and replenishment in a manner that responds to the way the body

The body has three major defense mechanisms for enduring a drop in temperature. The two best known effects of these means are shivering and numbness in hands and feet, but the causes are perhaps less understood by some; the third is a slowing of the bodily processes - the nervous system slows and carbohydrate consumption accelerates to produce lactic acid, forcing the body to slow and conserve energy usage[1]. Shivering is the resultant of a last ditch attempt by the body to produce heat: once the body detects a sufficient loss of body heat it attempts to accelerate production by causing large groups of muscles to vibrate, producing heat by consuming energy reserves - a terribly inefficient physiological response. There is little to do to directly combat shivering, it is best resolved by avoiding the conditions which initiate it, just "be warm". Numbness in the extremities, however, is an easier challenge to tackle. The loss of sensation due to "vasoconstriction" in the extremities, the body narrowing blood vessels, to limit blood flow to the extremities and retain the majority of heat within the body's core.

Preventing conductive loss for the already compromised extremities will not only conserve energy, but also alter the perceived temperature in the same manner as a wind break. Anything left outside for a sustained period, and without an energy source, will reach equilibrium with the air temperature - but objects "feel" colder than others due to their thermal conductivity. Compared to materials like metals, ice actually has relatively poor conductivity stubbornly resisting with a k-value of 2.2 W/mK versus 73 W/mK for pure iron - in real world effects, iron steals heat from your skin 33 times faster than ice, and we all knew a kid in grade school who proved it with their tongue against the flagpole. While snow or ice isn't the worst material for a contact surface, it can certainly be improved upon. Any surface that will be in direct contact with skin, or prolonged contact with a covered body part, should have a buffer material placed on top or embedded within the snow. Tried and true inexpensive materials like wood or wool are fantastic options for this function. Common species like pine, spruce, and birch

1 Rodman, Kristen. "3 ways your body battles the cold," http://www.accuweather.com/en/weather-news/three-ways-your-body-battles-w/19490777

have averaged k-values of 0.138 W/mK (15 times slower heat loss than ice)[2] , and wool has been measured at a range of 0.034-0.067 W/mK (worst case 33 times slower)[3] - a quick trip to a hardware store or a thrift shop can change an icy slab into a surprisingly comfortable lounge or counter-top. Introducing a "warmer" material will dramatically improve the range of program which can be extended into winter temperatures.

Passively impeding heat transfer improves winter conditions, but the benefits can easily go unnoticed as while a negative influence has been removed a positive has not been introduced. Creating sheltered micro-climates will be appreciated for making winters more endurable but may perpetuate the "continuous summer" mentality - the social perception of winter will not change until positive conditions, not neutral, are created and enjoyed which can only occur in winter. To broaden the range of activity within the winter terrain vague their energy gradient must be widened, Banham's campfires must grow. Inserting heat sources into the spaces pushes the critical point further back, enabling program which could create a North American definition hygge - using literal campfires to stoke the figurative.

Adding energy into the programmed spaces will create a more thermally welcoming micro-climate, but can also be a tool to shape the behaviour of those inhabiting them, and there are a few methods to do so. The first is the most simple, and the least architectural - supplement the program with food and warm drinks. Calories are a unit of heat measurement, and calorie dense foods can provide the additional energy the body requires to produce surplus heat in addition to normal functions. Rich foods also trigger the release of dopamine Dr. Rosenthal recommended for its mood improving effects, and enhancing the ritual of living with winter instead of merely in it; building positive experience, and hopefully ones worth anticipating in the future. The second method is more conventional, and in its own way architectural: place a heater in the space. As the basic elements of this thesis are primal, snow and wind used as tools to reconnect the urban with the wild, the most prominent heat sources should be as well. Conventional wood fires, housed in something as rustic and iconic as an oil drum, generates a point source of heat easily reaching 500˚C and outputting roughly 20 kW of energy for 40 minutes[4], forming a large warmed space encouraging groups of people to gather. If a drum fire provides for groups, then candlelight

2 Prałat, K. "Research on Thermal Conductivity of the Wood and Analysis of Results Obtained by the Hot Wire Method," Experimental Techniques (2016) 40: 973. DOI:10.1007/s40799-016-0096-7

3 Z. Ye et al. "Thermal conductivity of wool and wool–hemp insulation," International Journal of Energy Research (2006) 30: 37–49. DOI: 10.1002/er.1123

4 Laura Anne Lowden, Terence Richard Hull. "Flammability behaviour of wood and a review of the methods for its reduction," Fire Science Reviews (2013) 2:4. DOI: 10.1186/2193-0414-2-4

H = 12.7 mm
D = 38.1 mm
V = 1.4479 x 10^{-5} mm^3
ρ = 889 kg/m^3
m = 12.9 g
Heat of Combustion = 43.1 MJ/kg
E = 554 kJ = 154 W = 38W/h

fig. 3.10 Thermal Properties of a Candle

can serve the individual. Using a good quality paraffin wax tea light candle as an example, the flame burns at approximately 250˚C for around 4 hours: producing 38 W of energy per hour[5], or about as much heat (and range) as a standard desk lamp. While not exactly a space heater, this is more than enough to warm the hands of a few people, and drawing the subjects close over the light and warmth for a more intimate experience - a versatile tool in altering the character of the space. If placed within a ceramic container the visitor is free to not only hold the heat source, but also free to move themselves and the point of heat about the space, escaping thermal limitations. When placed in fixed holders the candles, or a similar small heat source, create points for the visitors to gather in more private clusters, only a few people at a time, to control the density of occupation and in turn the potential function.

Heat is the final element to activate the terrain vague, complimenting the passive measures and transforming dross from the unused gaps outside of the tents into campfires linking the city together, and connecting the citizens to the real city around them.

5 Anthony Hamins et al. "Characterization of Candle Flames," Journal of Fire Protection Engineering (2005) 15: 265-285. DOI: 10.1177/1042391505053163

[tactical] Infrastructure

fig. 4.1 Snow Clearing

fig. 4.2 The new Urban Designer Source: http://yukon-news.com/news/automobile-tire-stores-swamped-as-snow-flies/

Tactical Infrastructure is a proposal for a new design tool which capitalizes on the existing systems available to a city and temporarily re-purposes them, allowing Tactical Urbanism's characteristic speed of action to be employed. It transforms people like the man to the left into a new rendition of urban designer, architect, sociologist, and artist - utilizing their skill and tools to collect, and transport raw material and shape the first stages of interventions to be refined and occupied by winter Urban Pioneers. Tactical Infrastructure directs the existing equipment, manpower, and organizational structure of city wide resources to transform a selected group of sites into experimentation grounds, discovering winter design solutions by combining top down and bottom up approaches.

Like any other major city, there is an abundance of volunteer organizations, artists groups, and community leagues who could be interested in a wide scale effort to reclaim the terrain vague of Edmonton, striving for community enhancement. However, only one entity has the resources and political positioning to become the initiator of a program to collect, distribute, and reshape the vacant land with snow: the City of Edmonton Transportation Operations (CETO). Another ally exists within the City of Edmonton, called the WinterCity Strategy group. Comprised of city officials, architects, business owners, community leagues, and social groups, WinterCity Strategy (WCS) has put forward objectives for introducing innovative winter design approaches to transform Edmonton into a "World leading Winter City"[1]. WCS has made admirable strides to introduce new winter design guidelines (sadly not regulations), promote outdoor activity, and additional winter festivals to connect the City back to the environment. Under Tactical Infrastructure the WCS could potentially act as the contact and organizational point, working with other city departments to contact landowners, acquire land-use permissions, and promote community participation. The envisioned operation would be for Urban Pioneers to contact the City requesting use of a site, describing the intended program, and detailing what support would be needed from the public works. The City's role would be that of facilitator: allowing proposals to proceed as long as they are deemed safe for the public, and then delivering additional material to the site if the in situ condition is not sufficient. Once the material and "ownership" is determined, the remaining step is to create the forms which will provide the desired tectonics and micro-climate for the intended use.

1 WinterCity Strategy. *"For The Love Of Winter: WinterCity Strategy Implementation Plan,"* City of Edmonton (2013)

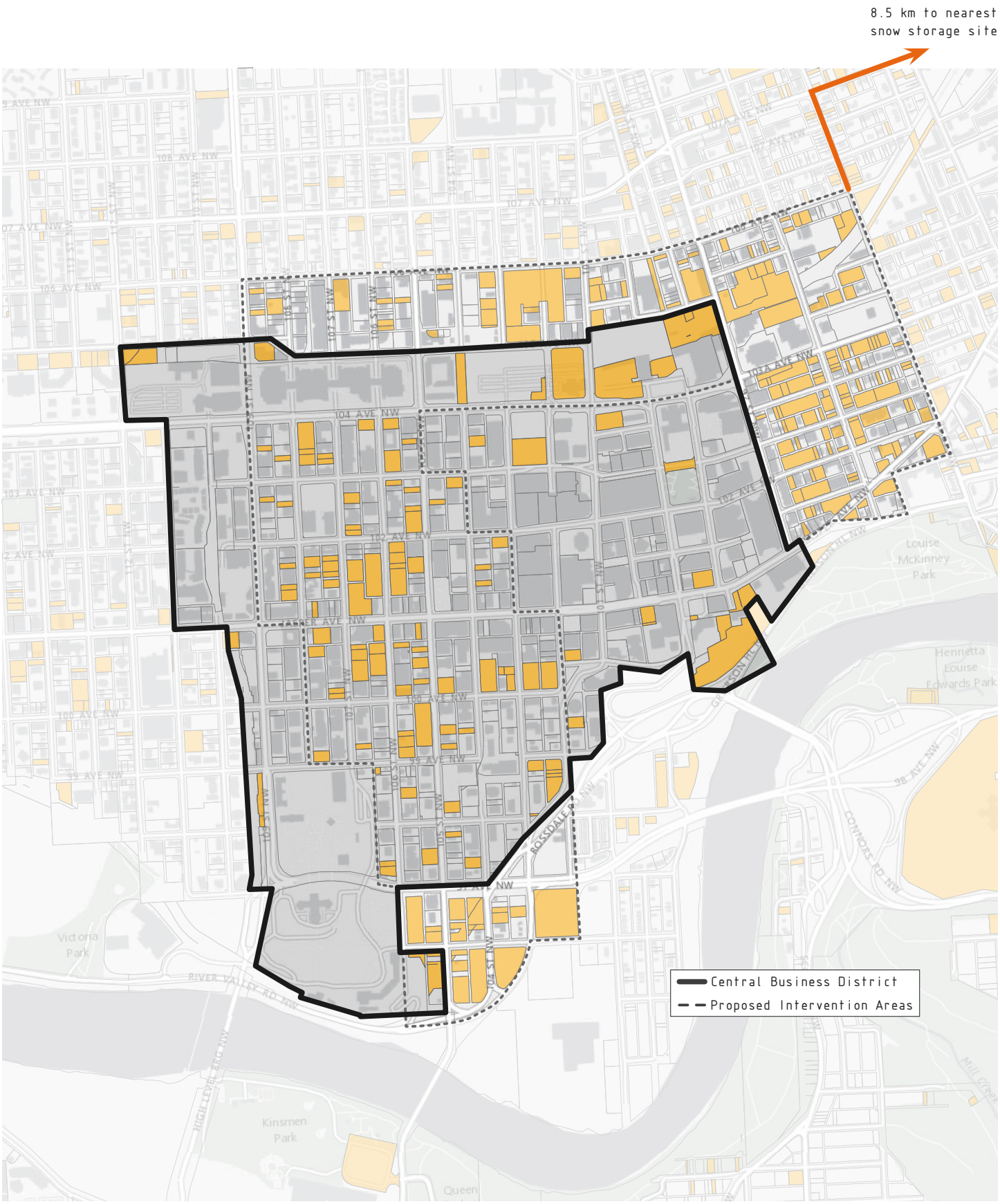


fig. 4.3 Central Business District and the Ring of Dross

Adaptation

Present snow clearing policy states for removal of snow, not just ploughing, from business districts as required[2], and once removed the snow is transported to one of five sites, the nearest being a 20 minute drive from the nearest edge (8.5 km)[3]. By slightly modifying procedures, the Transportation Operations department can utilize their employees and equipment to collect and deposit snow into vacant land plots within the downtown core, and provide the initial, large scale shaping of snow forms using their available machinery. If the removal boundaries of the CBD are extended (fig. 4.3) the highest concentrations of vacant land plots will fall within the new boundaries, improving the mobility and quality of the surrounding neighbourhoods, and providing additional material for use throughout the city. Edmonton is a land of fiscal curmudgeons, so there has to be a cost-savings trade off to assuage the grumps, but the nature of the proposed changes provide opportunity. Reducing the number of 20 km drop off round trips by making the new collection points within the expanded CBD should reduce the impact of reallocation of time and resources - the difference in paying the public workers for their extra time depositing snow in the terrain vague.

Using road snow to supplement volume does present aesthetic challenges, but these can be corrected with further adaptations. Edmonton doesn't use nearly as much road salt as other Canadian cities due to lower temperature, so to maintain vehicle traction a mixture of sand, rock chips, a small amount of salt, and liquid calcium chloride (to help the sand stick) is applied to the roads[4]. The major aesthetic villain is sand, dappling the snow an unsightly brown. The material selection likely boils down to cost per unit, but even a simple change to a white(er) sand mixture will dramatically improve the winter image of the city. If there is no reasonable alternative, clearing procedures can be adjusted if clean snow is in short supply, such as an initial pass with a loader mounted snowblower clearing the top clean layer before standard ploughs finish the process.

Environmental and spring clean-up concerns due to snow "contamination" will slightly influence the location where it can be deposited. Paved and gravel sites will scarcely be affected at all - there is no soil to absorb the sand or salts, and the increased volume of sand beyond that tracked in by car tires (for parking lot sites) can be handled in minutes with a push broom and shovel. Further study would be required for grass sites: would the concentration of salts be sufficient to have

2 Transportation Services. *"Snow and Ice Control,"* City Policy C409I, City of Edmonton (2015)
3 City of Edmonton. *"Snow Storage Facilities,"* Source: https://www.edmonton.ca/transportation/TruckRouteSnowSites.pdf
4 City of Edmonton. *"Snow and Ice Control,"* Source: https://www.edmonton.ca/transportation/on_your_streets/snow-ice-control.aspx

an impact on the soil chemistry? Plant life surrounding current snow stockpiling sites are worth examining, or the Parks and River Valley Operations group could consider the introduction of more halophyte plant species in areas of "high" salt presence. Sand removal from boulevards is completed using street sweepers, but larger amounts in the centre of a site will be more difficult to remove and as such the snow condition should be monitored for use on these sites.

The Tools

As a northern community, Transportation Operations and the citizenry of Edmonton are already well equipped with an array of tools, but these must be evaluated to discover their potentials and limitations, and from there the forms they are suited to create may be inferred. To compare apples to oranges, or in this case snowblowers to dump trucks, each equipment family is rated according to the following six categories:

> **Capacity**: quantity that the equipment is capable of displacing - not only in regards to snow volume but also rating the duration each tool would require to clear a similar mass.
>
> **Precision**: overall equipment agility and ability to both clear and deposit snow where intended by the operator.
>
> **Compaction**: how typical operation of the equipment affects the snow condition, and also ability to induce additional compaction after placement.
>
> **Spreading**: suitability for distribution of point stockpiles across an area or creating horizontally dominant forms.
>
> **Shaping**: versatility for finishing rough snow masses into smooth faces, curves, or sharply defined edges into desired final forms.
>
> **Training**: measurement of the experience and special licencing potentially required by the operator.

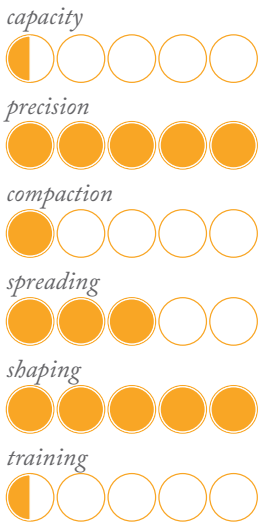
It's a simple matter choosing which scale of machine would likely be needed for a given task - if the objective is to clear out a parking lot you won't be reaching for a snow shovel - what is more important is illustrating the size of the machines, understanding the limitations of their designs, and recognizing the characteristic forms they naturally produce.

Shovel

The ubiquitous tool for Canadians to clear snow. The quantity that can be moved is heavily reliant on the physical condition of the user, but the simple shovel provides the greatest degree of control and shaping of snow deposits.

Additional compaction is extremely limited - the weight of the tool and the power that can be generated by a single person is minuscule compared to machinery - but relatively large, and surprisingly formally refined volumes can be created through consolidating snow, allowing it to sinter, and quick carving with the shovel blade.

While less than ideal for clearing an entire lot, the simple shovel is a versatile tool for shaping, refining, and maintenance of the snow interventions.



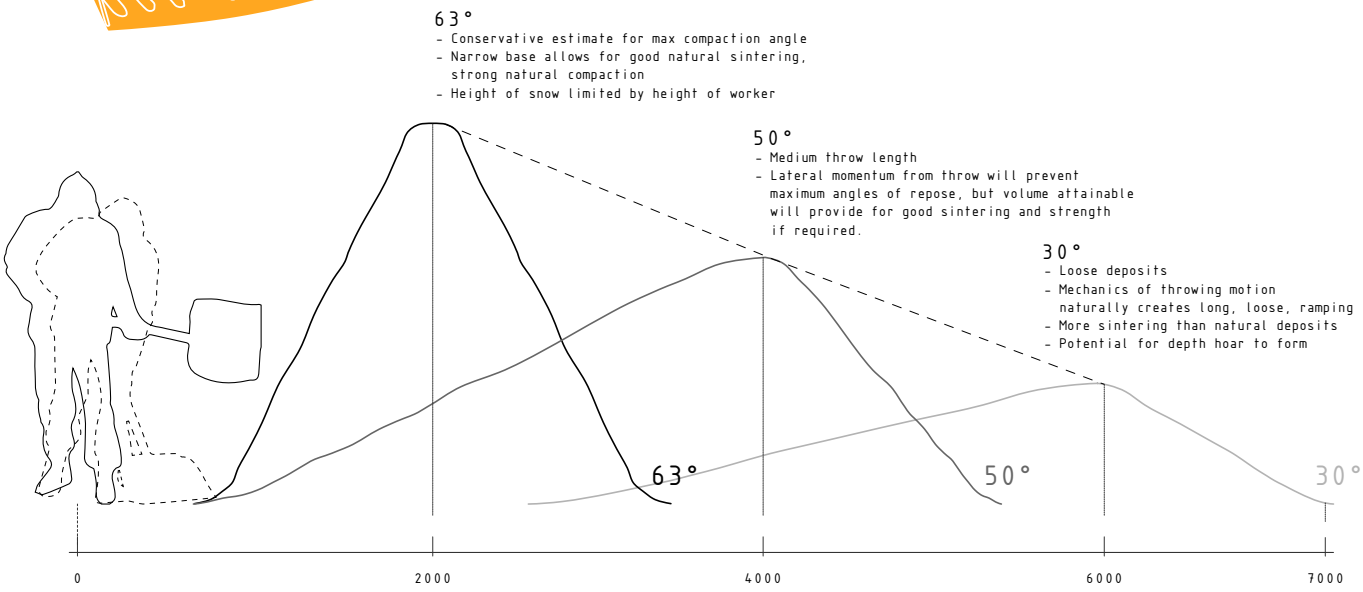
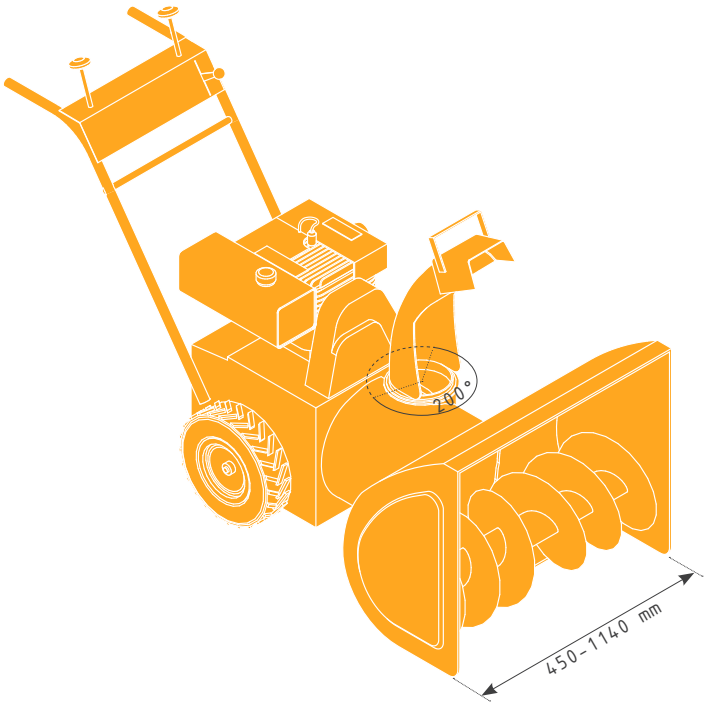


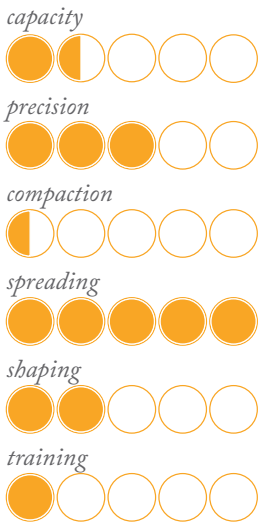
Fig. 4.4 Shovel

Source: http://cornelluniversity.tumblr.com/page/106

Snowblower



The symbol of Canadian neighbour envy, the snowblower rapidly displaces snow distances up to 50 feet. Depending on wind conditions, the accuracy of placement could easily be acceptable for winterscape sculpting, depositing large, loosely compacted formations. There is even potential use on unpaved surfaces by adjusting the height of the skid plates on either side of the auger housing. This equipment requires very little training beyond basic safety and operation. Considerably larger scale versions are available as attachments onto vehicles like trucks, skid-steers, and front end loaders. Precision is reduced with these attachments, but the ability to displace huge volumes of snow is made possible - either in a desired direction or into the backs of collector trucks.



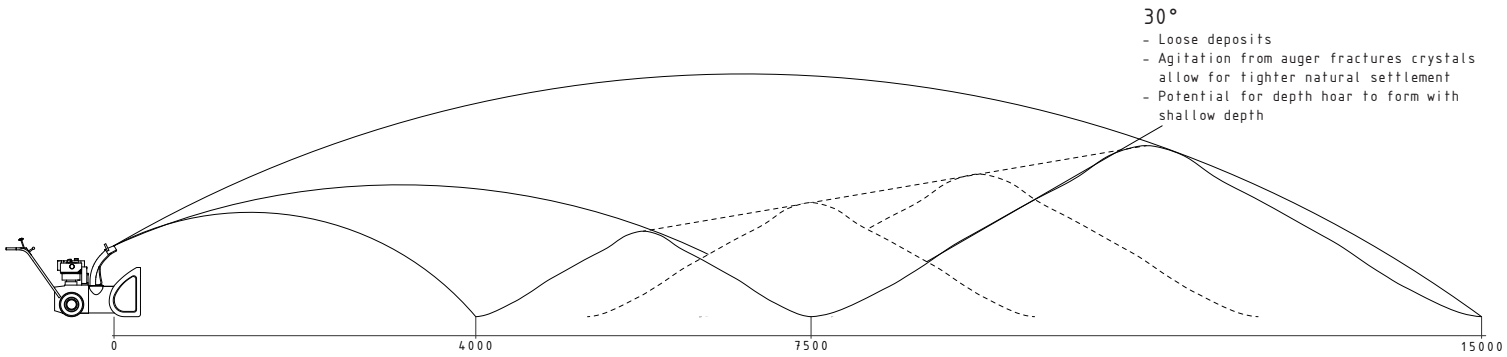
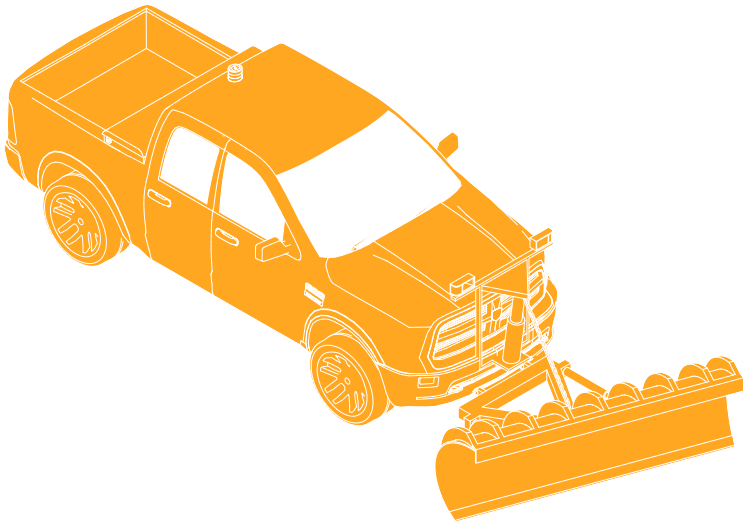


fig. 4.5 Snowblower

Pickup



A mainstay of private snow removal companies yet still available to the Public Works vehicle fleet, the snow plough attachment on a pickup is a lower scale version of a full road maintenance vehicle. The pickup can be deployed to areas too small/restrictive for heavier equipment, and does not require transportation like a Bobcat or snowblower.

capacity

precision

compaction

spreading

shaping

training

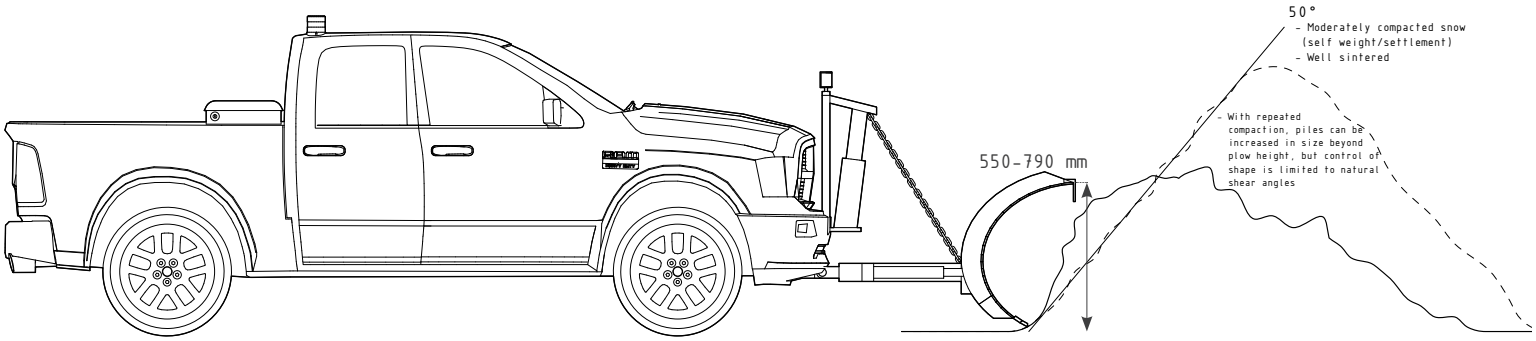
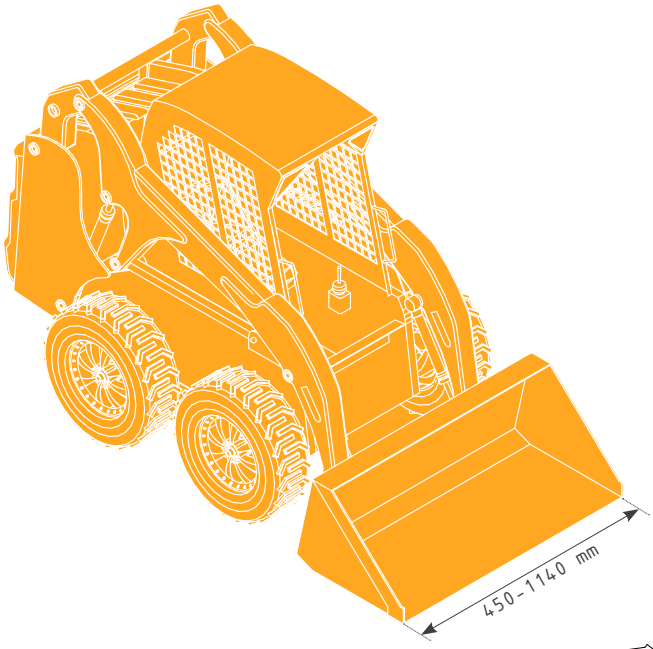


fig. 4.6 Pickup

Source: http://www.westernplows.com/products/hts/

Bobcat



The "bobcat" is a small, agile version of heavier front end loaders often seen on large scale construction sites. While significantly smaller than similar machines, it is still capable of moving significant amounts of snow quickly and with remarkable precision. This equipment still possesses the mechanical power to compact snow firmly and with sufficient training, the bucket can be used to cut and contour snow with remarkable accuracy by adjusting the bucket angle, arm height, and movement of the overall machine simultaneously, creating smooth lines or sharply defined edges as desired.

capacity

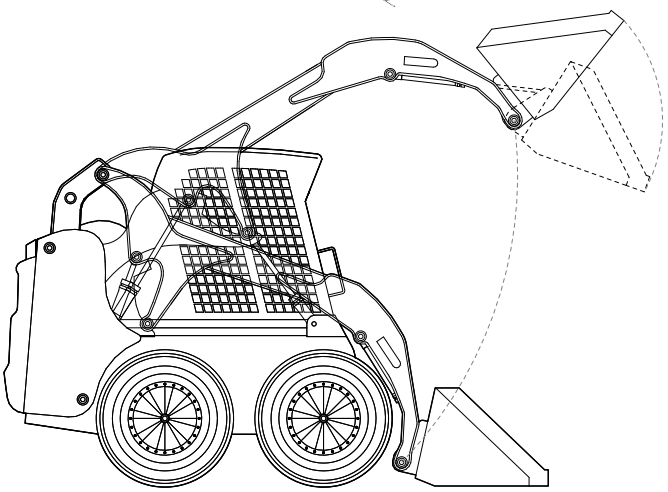
precision

compaction

spreading

shaping

training



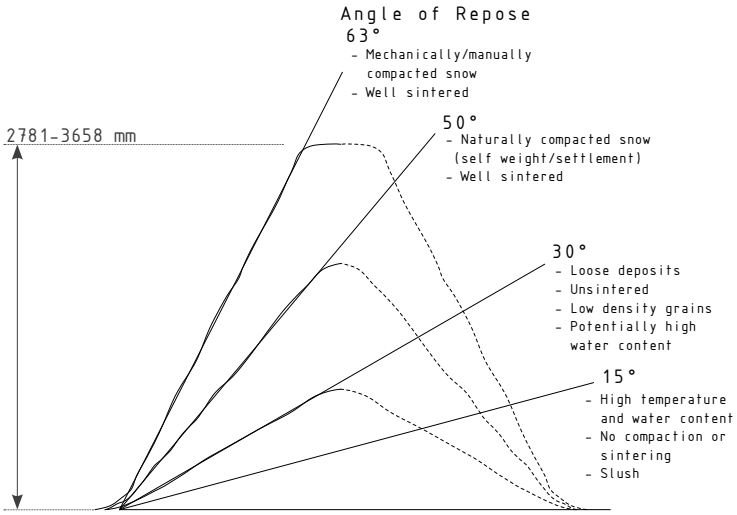
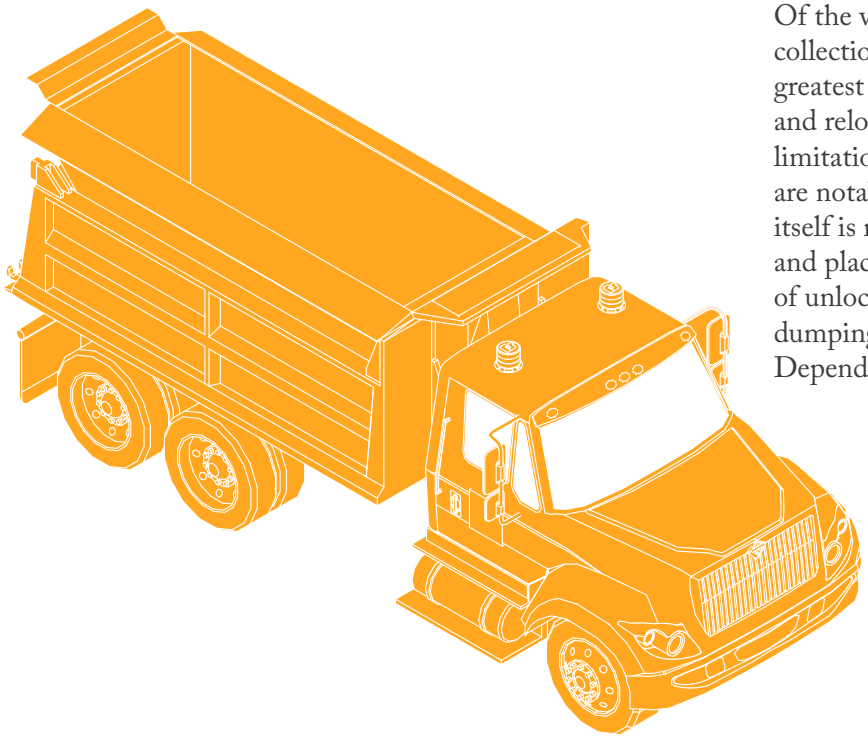


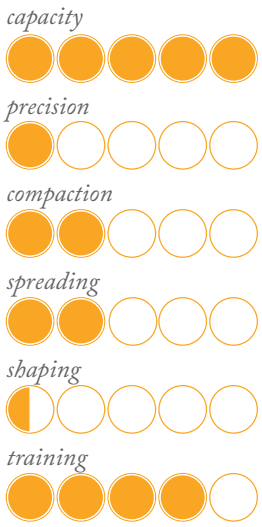
fig. 4.7 Bobcat

Source: http://puthavenfarms.com/

Collector



Of the vehicles available, the collection truck offers the greatest capacity for collection and relocation of snow. The limitations of this equipment are notable, however. The truck itself is relatively cumbersome, and placement of snow consists of unlocking the tailgate and dumping in piles or rows. Depending on the model, special licenses may be required. Finally, beyond initial placement no reasonable degree of shaping is possible.



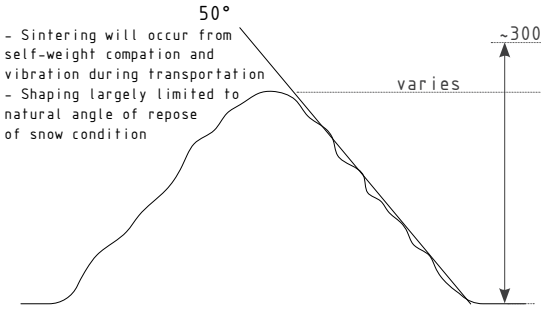
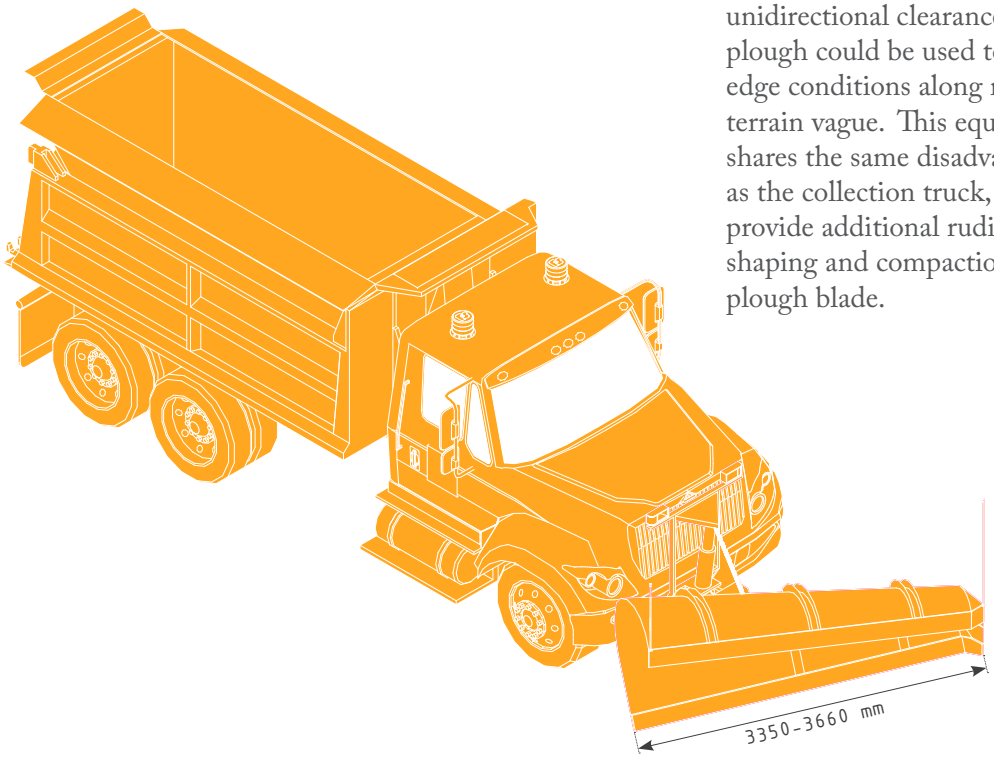


fig. 4.8 Collector

Road Plough

While mostly limited to unidirectional clearance, the road plough could be used to create edge conditions along roadside terrain vague. This equipment shares the same disadvantages as the collection truck, but can provide additional rudimentary shaping and compaction from the plough blade.



capacity

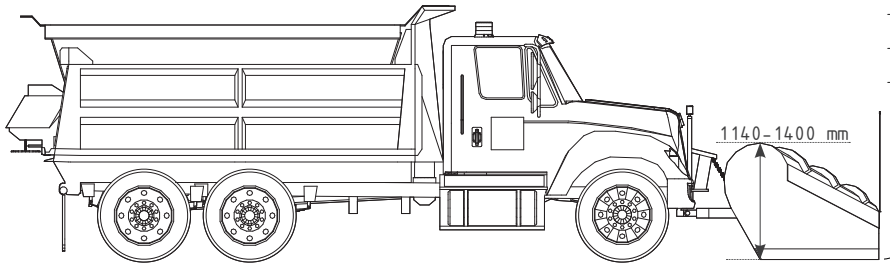
precision

compaction

spreading

shaping

training



- Heavy compaction and sintering from force of plow displacement
- Shaping ideal for long windrows, but limited capacity thereafter
- Plow side can achieve steeper angles from compaction, but leeward side controlled by sloughing

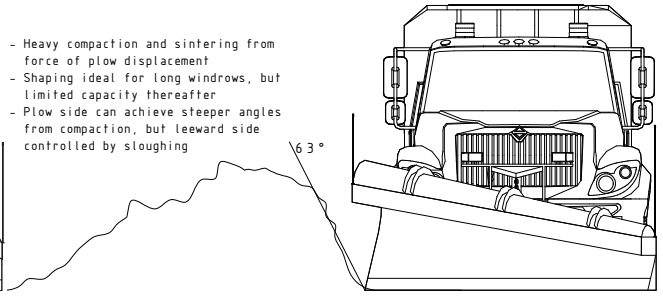


fig. 4.9 Road Plough

Loader

The front-end loader easily moves massive amounts of snow while still possessing surprising dexterity and a wide array of attachments are available. Downsides of this equipment include the cumbersome movement, transportation restrictions, and special training required, and the experience level of operators.

capacity

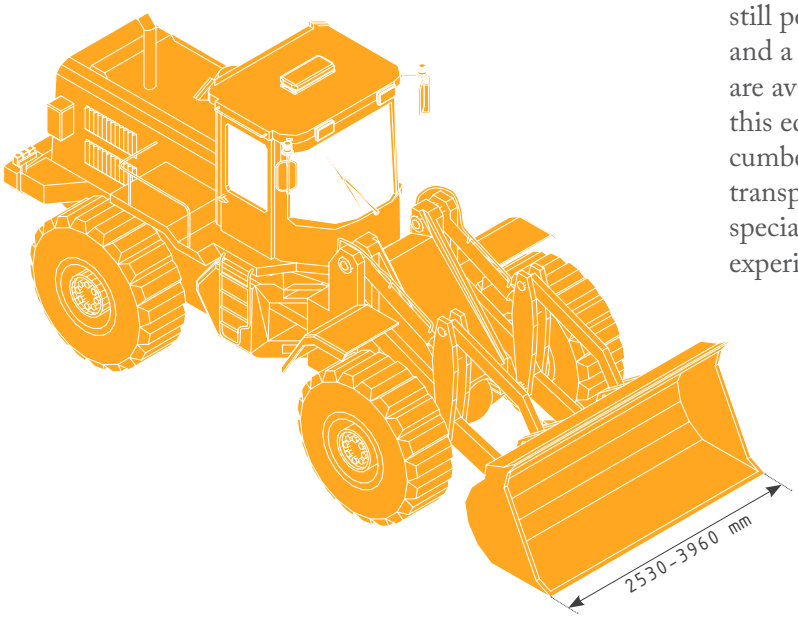
precision

compaction

spreading

shaping

training



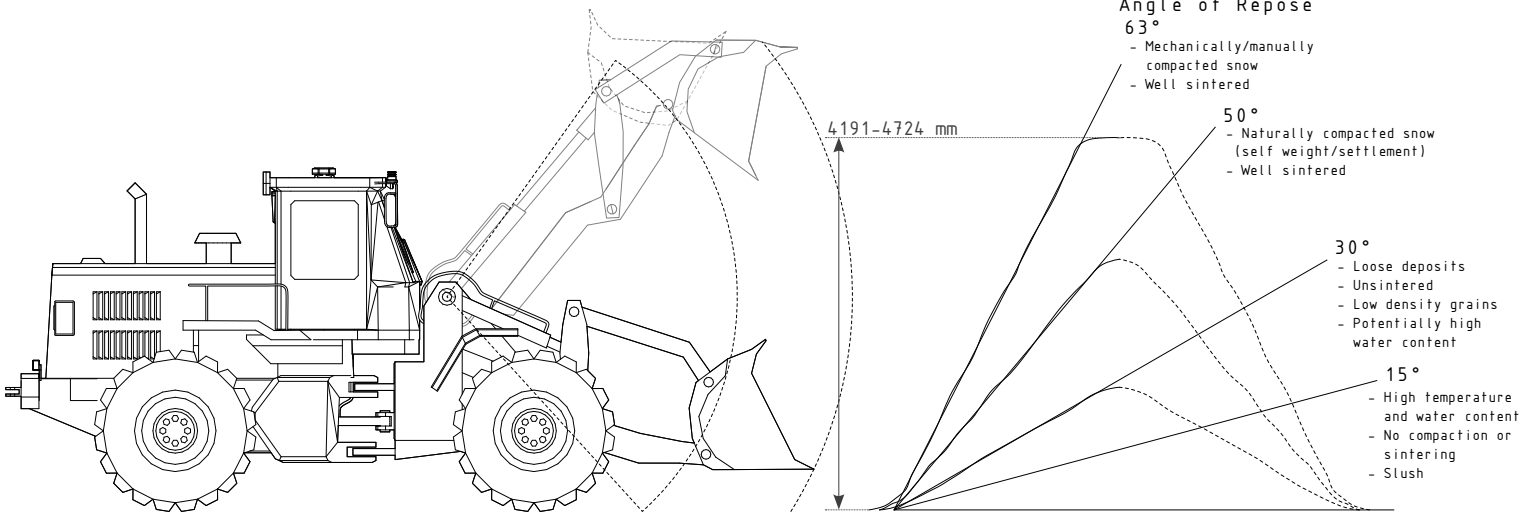


fig. 4.10 Loader

Source: http://castosnowplowing.com/

fig. 4.11 Snow Removal through the night II Mary McAvoy, 2014, Source: https://theripestpics.com/tag/lowell-mass/ (accessed March 21,2016)

These tools are dismissed as merely utilitarian, expected to mysteriously clear the streets overnight and vanish before the city wakes up. Each are more versatile than they are given credit for; their potential for sculpture ignored and the expertise of their operators overlooked. The key to Tactical Infrastructure is to extend the established manipulation of snow one step further, pausing at the end of the standard snow clearing procedure to transform the snow from heap to tectonic without exceeding the capabilities of the equipment or the operator. Instead of waste, each snowpack is carefully chosen and shaped, each space transformed by the objects created within them, the potentials of each object made possible by the limitations of the tool that created them. Yet before these transformations can occur, the city and landowners must sanction their existence and make their collective resources available.

Tactical Infrastructure

This design approach creates an intersection between the urban problematics of poor winter design and the proliferation of dross, and attempts to use the negative aspects of one as the design solution for the other. The voids in the urban fabric provide the spaces for transitional architecture to be built; where the inhabitant is both exposed to the environment but also protected from the undesirable elements. In turn the winter design interventions temporarily occupy the voids, bringing activity and social exchange without destroying, and possibly adding to, the unique character of the terrain vague found within a city.

The tactics, objectives, materials, and tools have been identified, but the resultant tectonics must be defined. These tectonics will be derived from the dynamics of the tools themselves, each family capable of producing a specific set, and each set implying function through scale and angle, suggesting how our bodies should interact with them. Just as a catalogue of equipment was required to understand their limitations, so too is a catalogue of potential forms they are suited to create.

Function ever follows Form

fig. 5.1 ***Waiting - Breckenridge Colorado***
Source: http://blog.breckenridge.com/2014/01/15/breckenridge-budweiser-international-snow-sculpting-championships-kick-next-week/

fig. 5.2 Breckenridge "Snow Stomping"
Source: http://blog.gobreck.com/index.php/breck-events/follow-along-2017-intntl-snow-sculpture-championships/

City hosted snow sculpture competitions serve as the closest precedent for the operation of Tactical Infrastructure. In the town of Breckenridge, Colorado, every January a street is closed off, 12 foot metal cube forms are erected and filled with snow by road clearing machinery, then left to sinter for a week prior to competition (fig. 5.2). Before the competition has even begun the pedestrian experience has dramatically changed: the huge blocks of snow inviting people in close to examine them, then tempting them to meander through the spaces between, instilling a sense of awe at their scale and strangeness. While the finished sculptures are beautiful, the most powerful moment is the spatial experience the simple blocks create. Attention is not focused at the minute detail of a carving - there is instead a heightened awareness of one's surroundings and location in a greater space, achieved with a few sheets of metal and a snowblower.

With only one piece of equipment and one form an entire street was dramatically transformed, but there are far more possibilities contained within these tools than are being utilized. In essence there are only two operations to be conducted in the creation of snow forms: consolidation and removal. These two simple steps can be executed jointly, individually, or in a variety of combinations generating an array of forms, and each form implies purpose. As the overall design strategy is meant to be flexible and adaptive, the list of forms that can be created by snow clearing equipment must be as exhaustive as possible to allow for functions to follow.

Exploration began with inspiration from Richard Serra's 1967-68 verb list: I compiled as many of my own verbs as I could that related in some way to manipulating snow, and then interpreted what those actions meant when processed through the catalogue of tools and applied to a site. Many were in essence duplicates, or beyond the capacity of the resources - a verb may describe an action, but could that action be made manifest with a shovel, or a loader? How exactly do these machines create volumes beyond a rough heap(fig. 5.3)? The verbs which survived analysis served to create a foundation of primal forms and the first generation of their expansions.

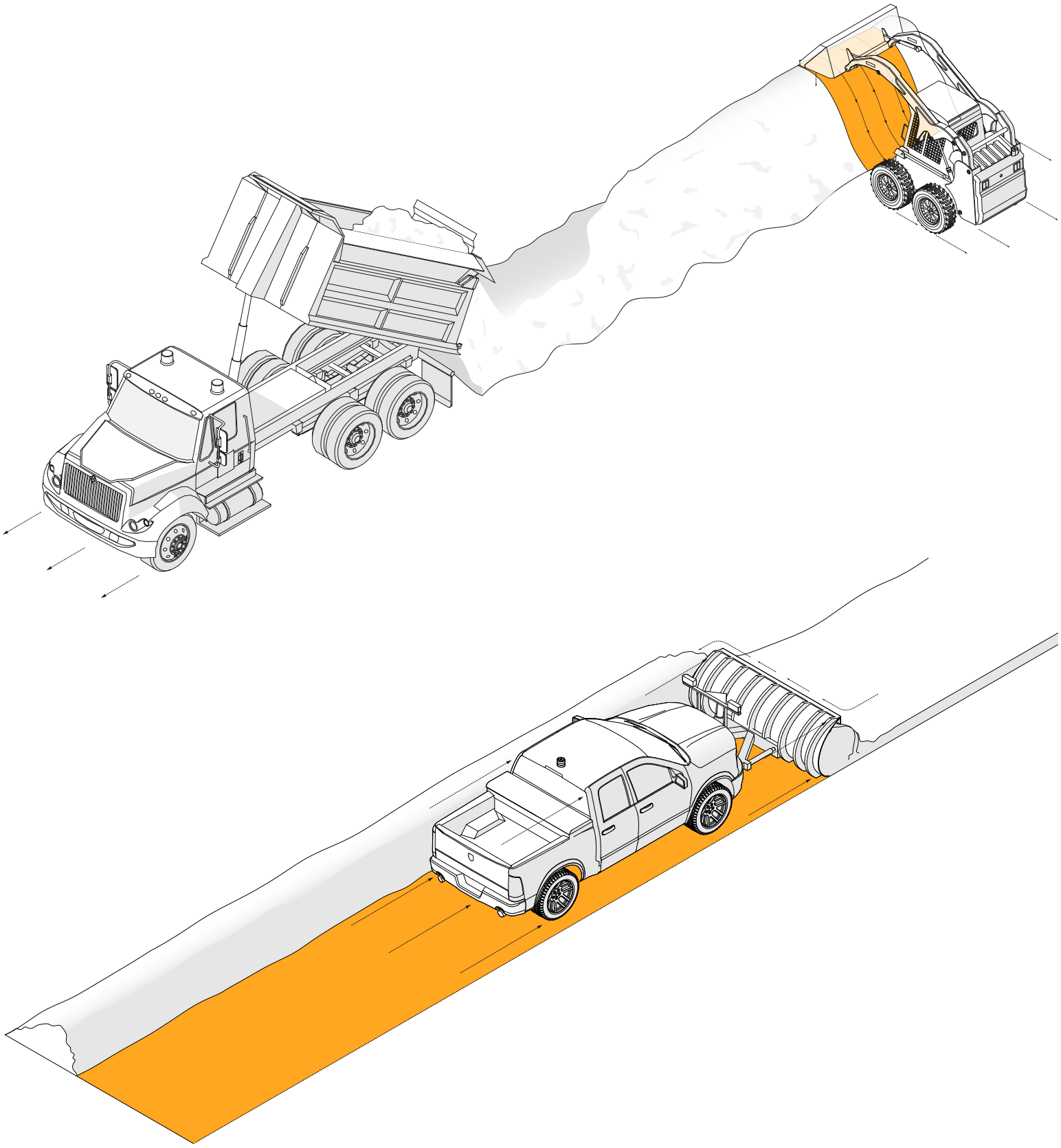
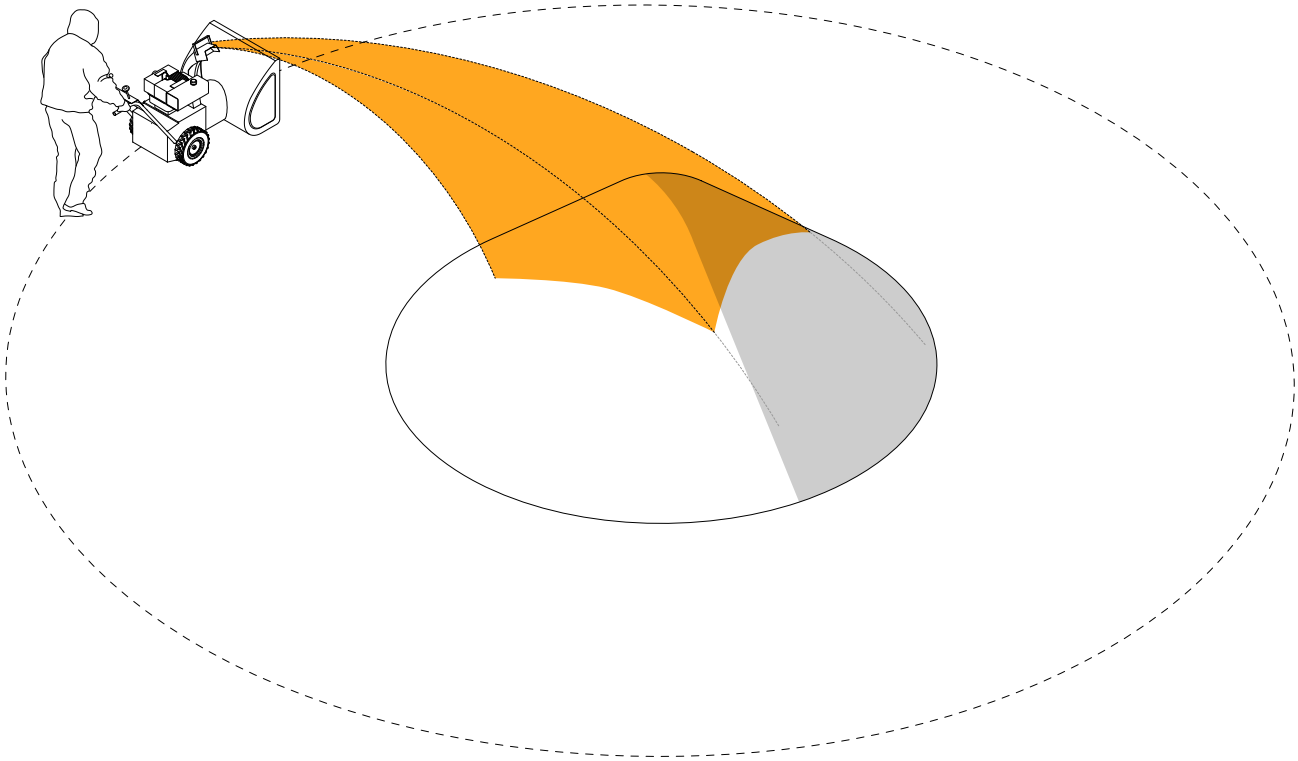
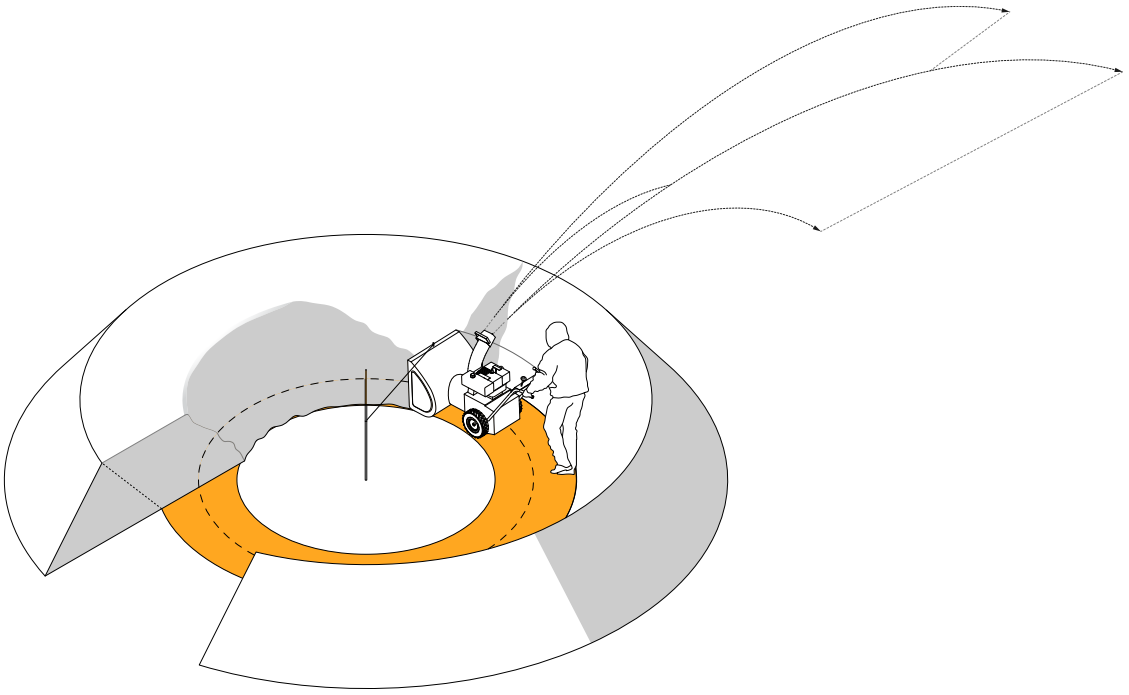
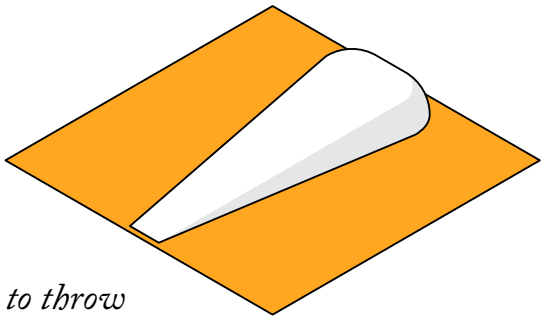


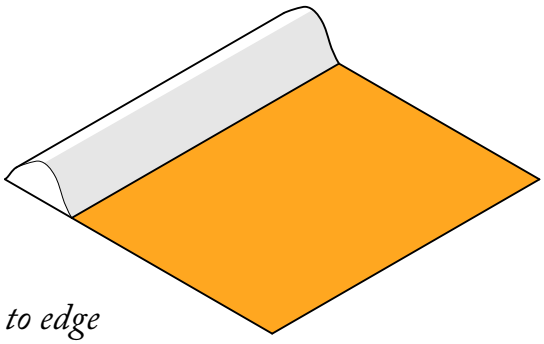
fig. 5.3 Manifestations of Machines



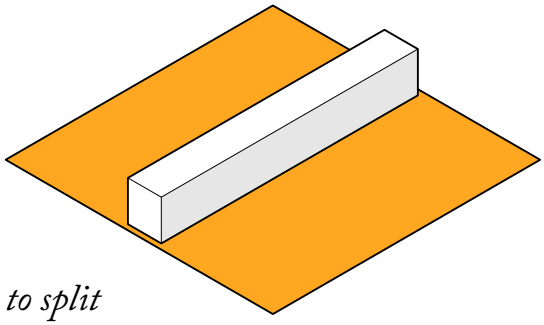




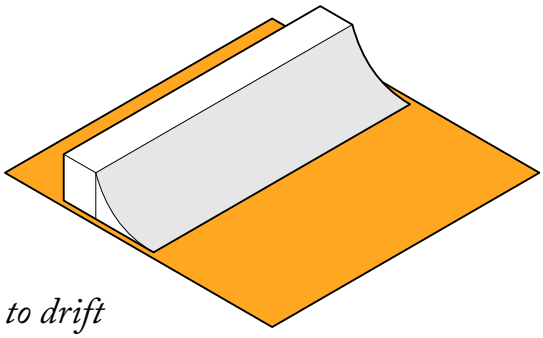
to throw



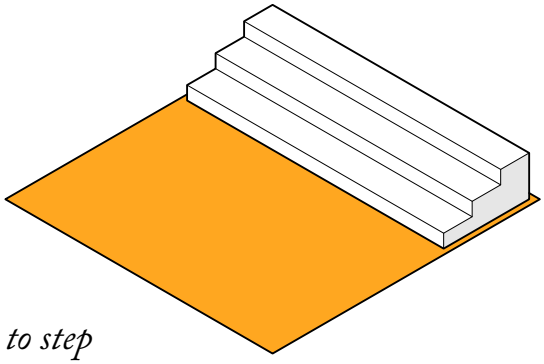
to edge



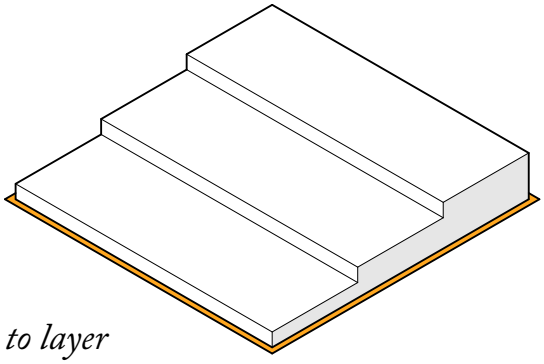
to split



to drift

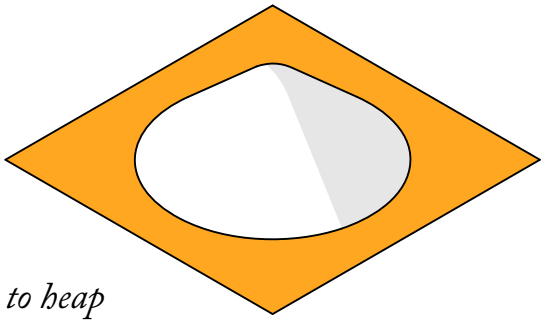


to step

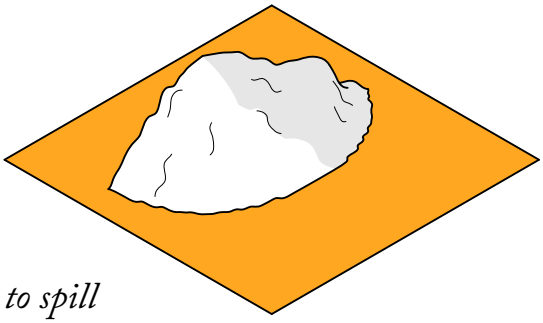


to layer

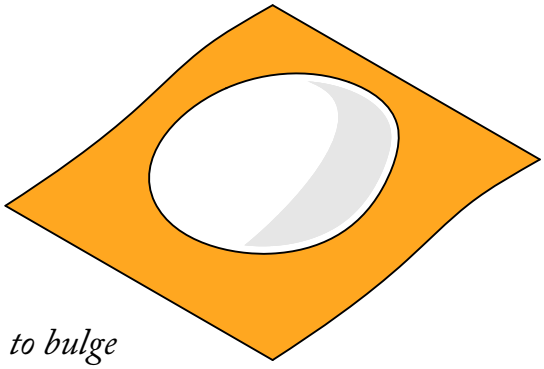
fig. 5.4 Forms List



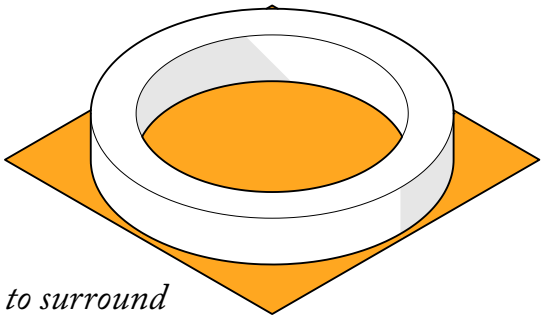
to heap



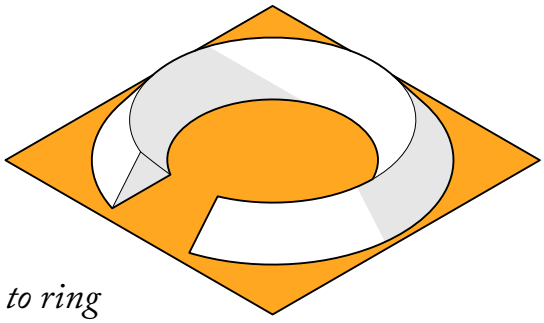
to spill



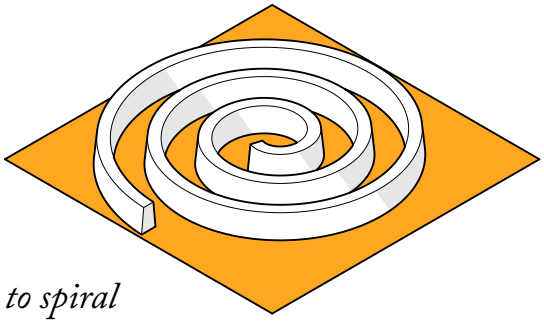
to bulge



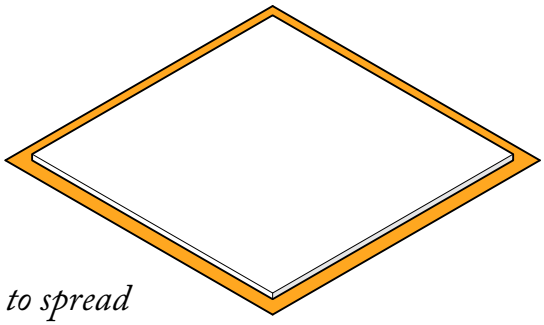
to surround



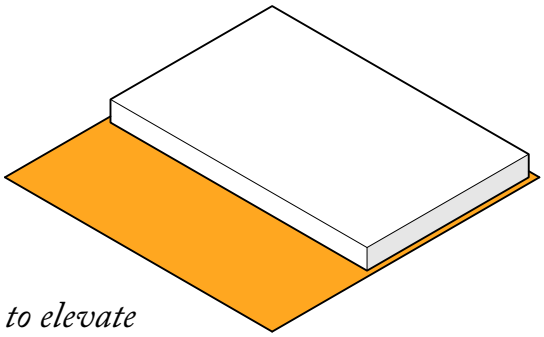
to ring



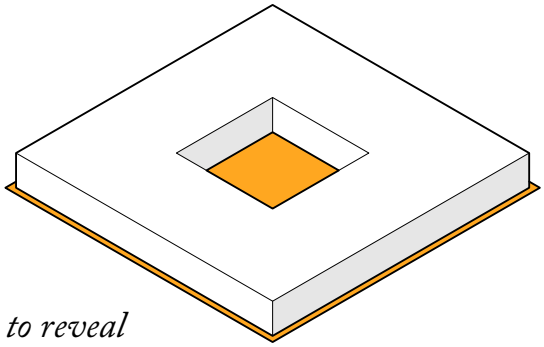
to spiral



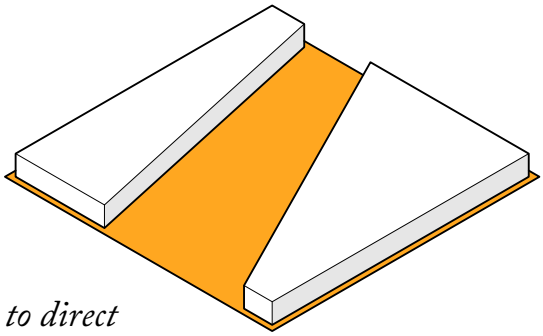
to spread



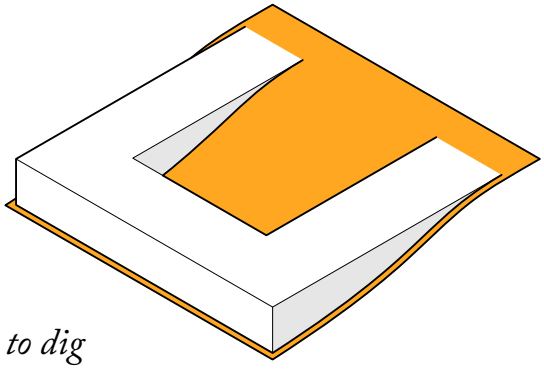
to elevate



to reveal



to direct



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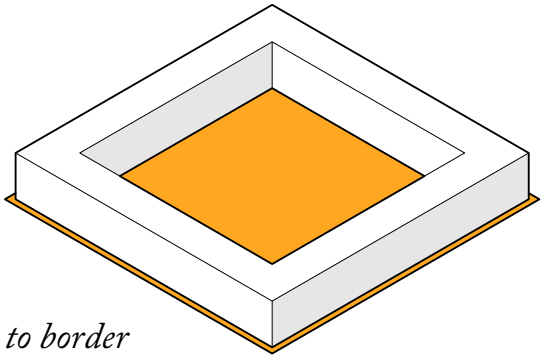
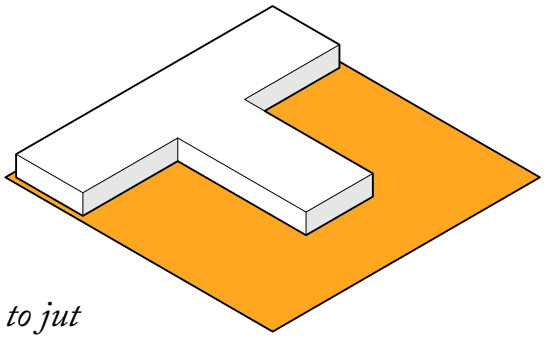
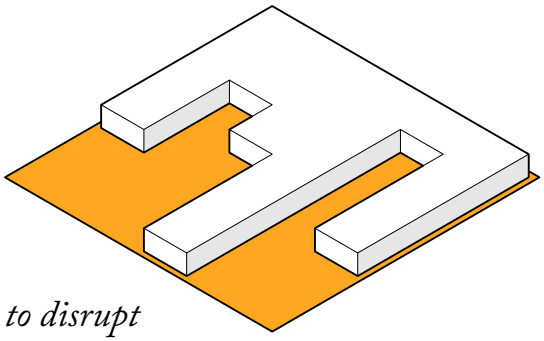


to border

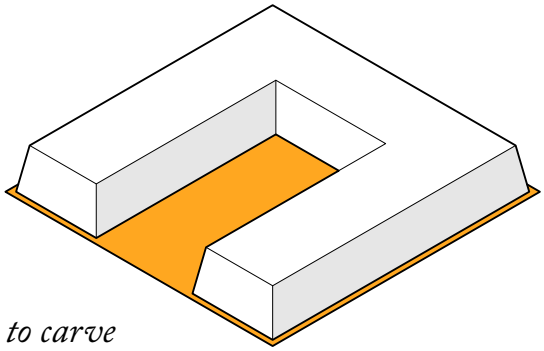
fig. 5.5 Forms List – Continued



to jut



to disrupt



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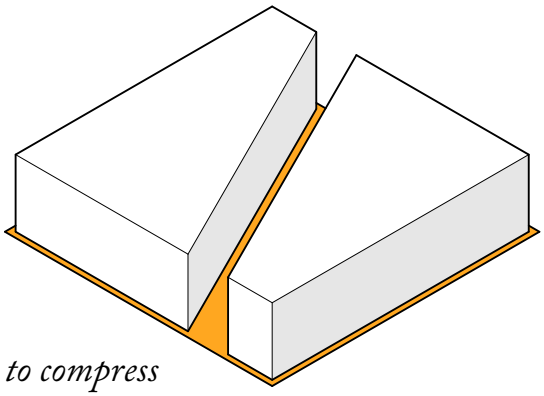
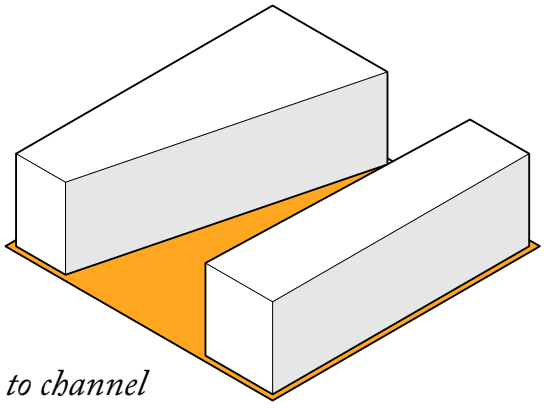
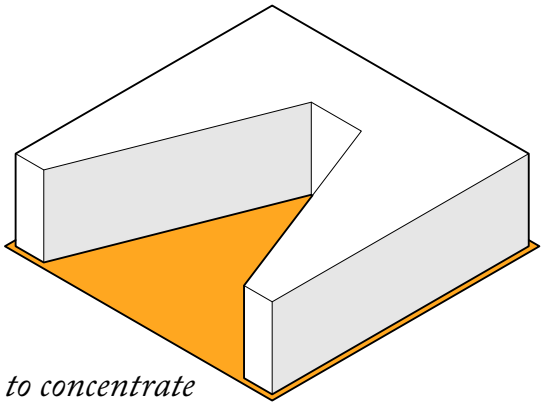


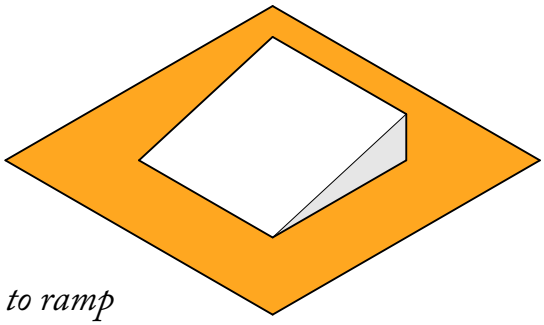
to compress



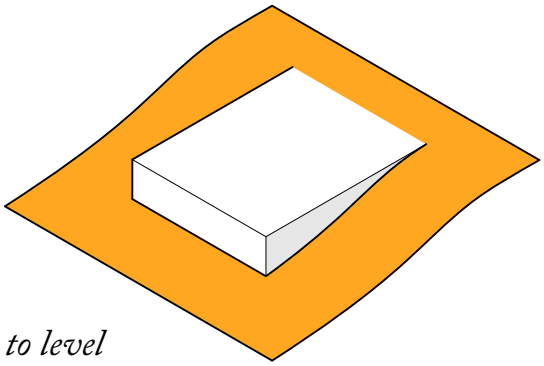
to channel



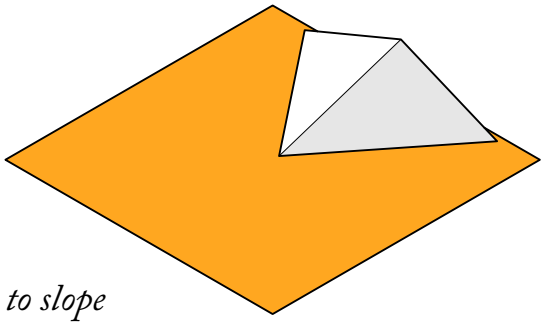
to concentrate



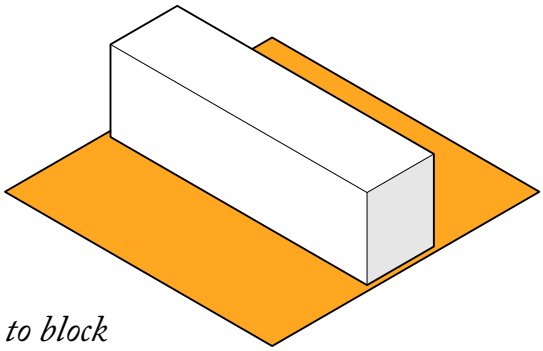
to ramp



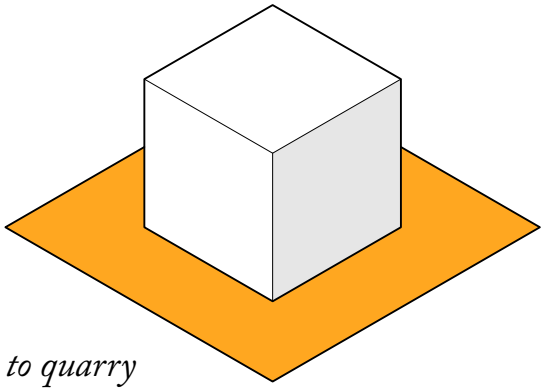
to level



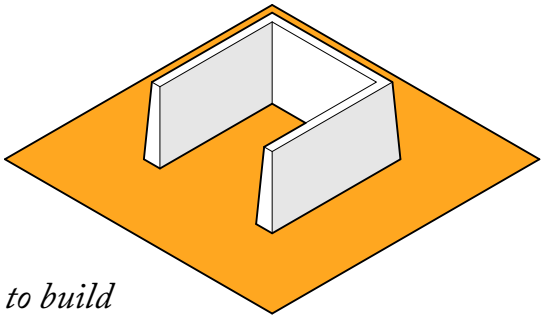
to slope



to block

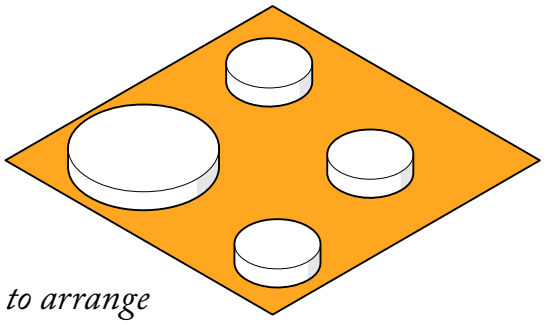


to quarry



to build

fig. 5.6 Forms List – Continued



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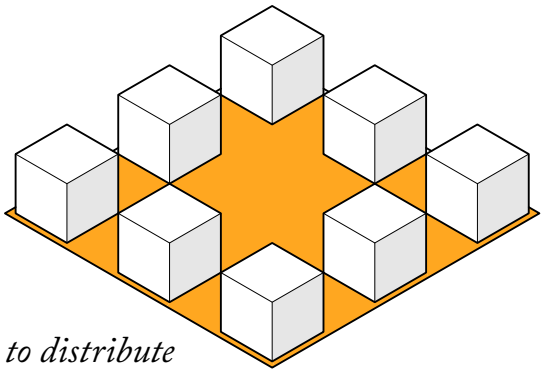
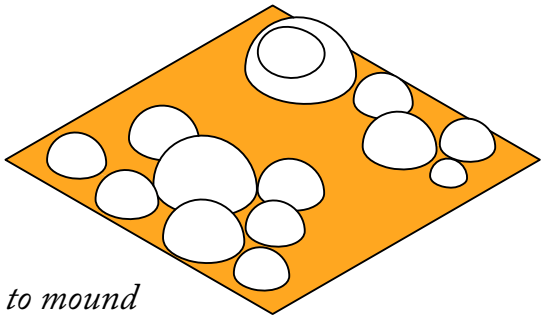
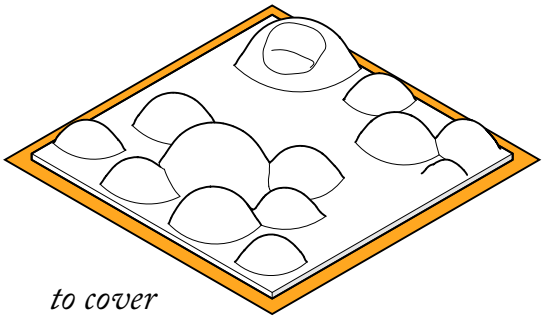


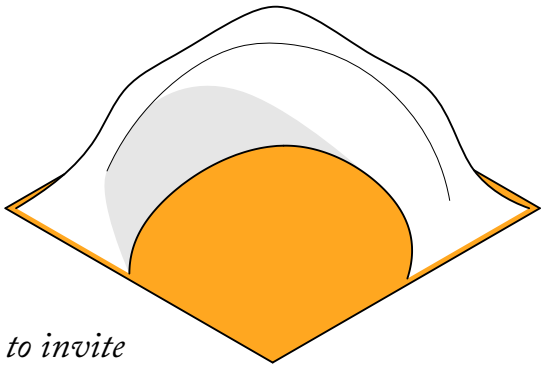
to distribute



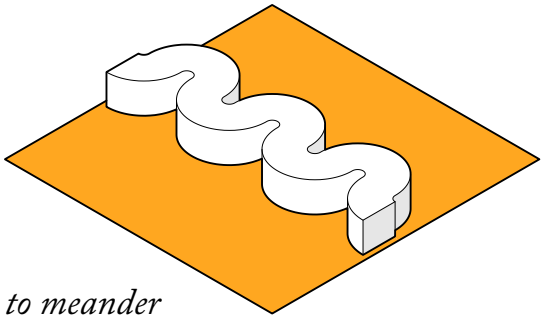
to mound



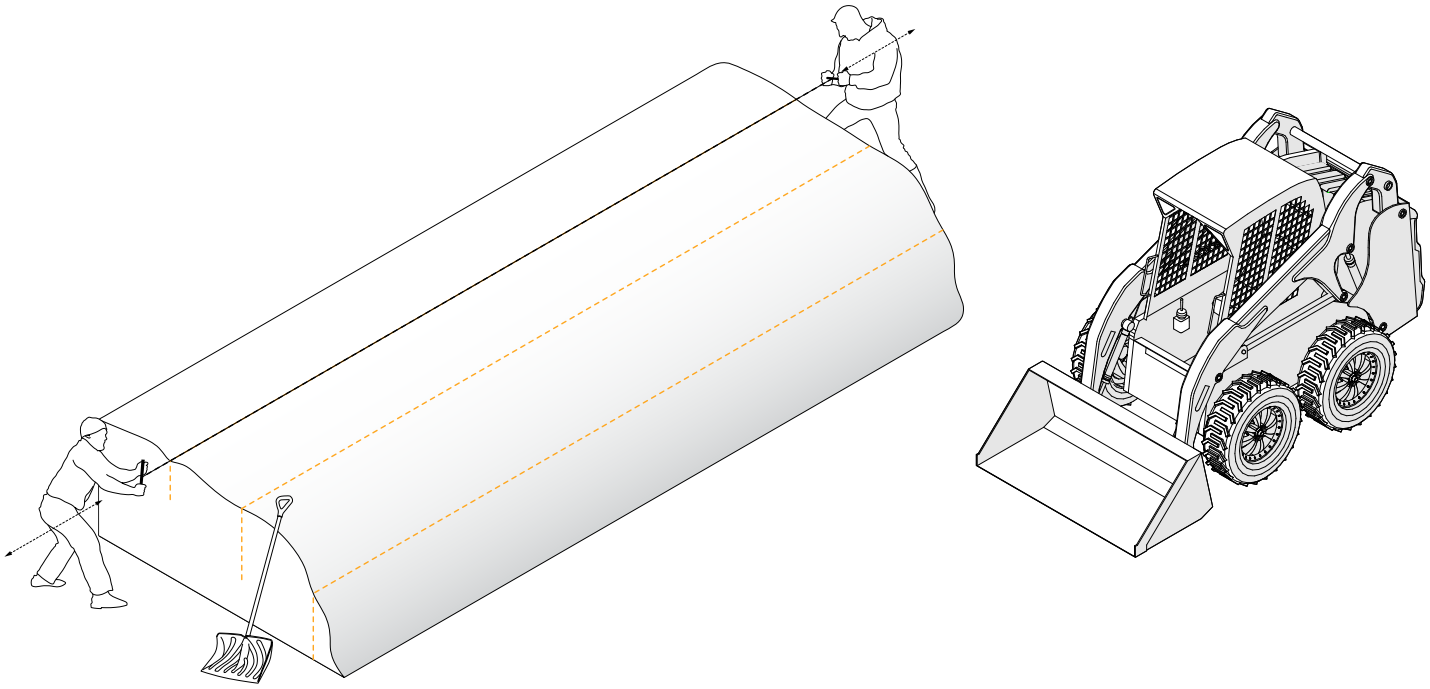
to cover



to invite



to meander



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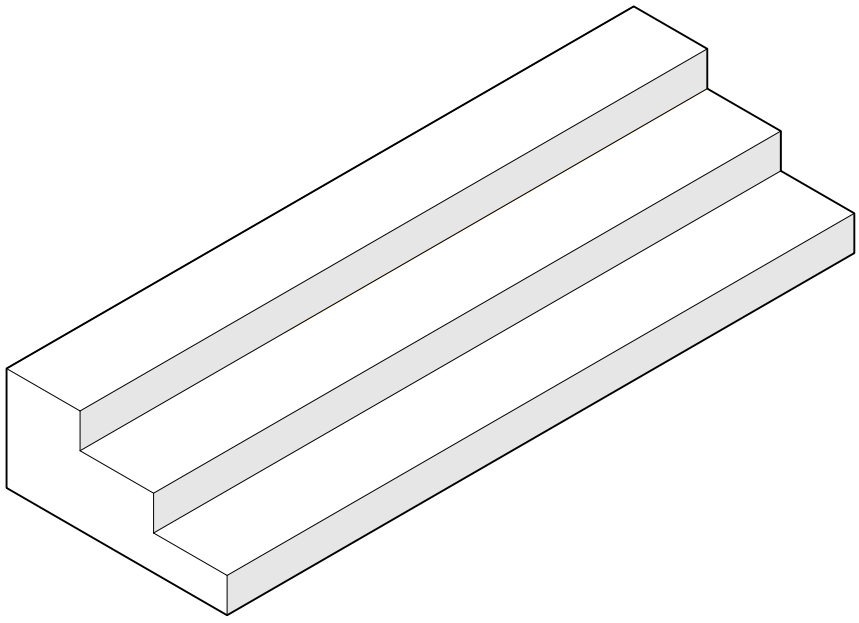
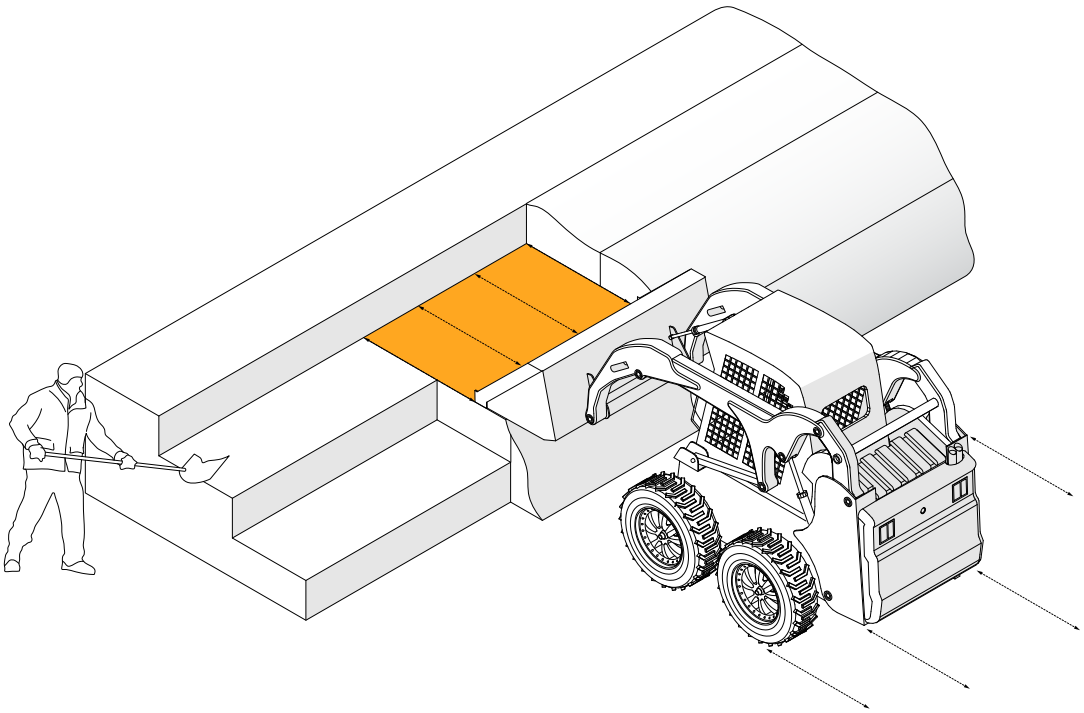


③

fig. 5.7 Sculpting Program



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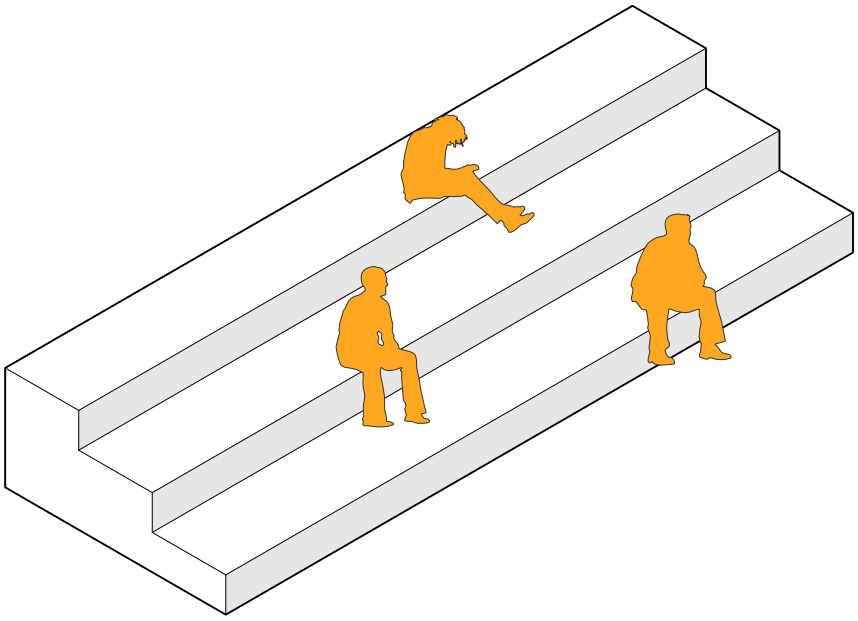

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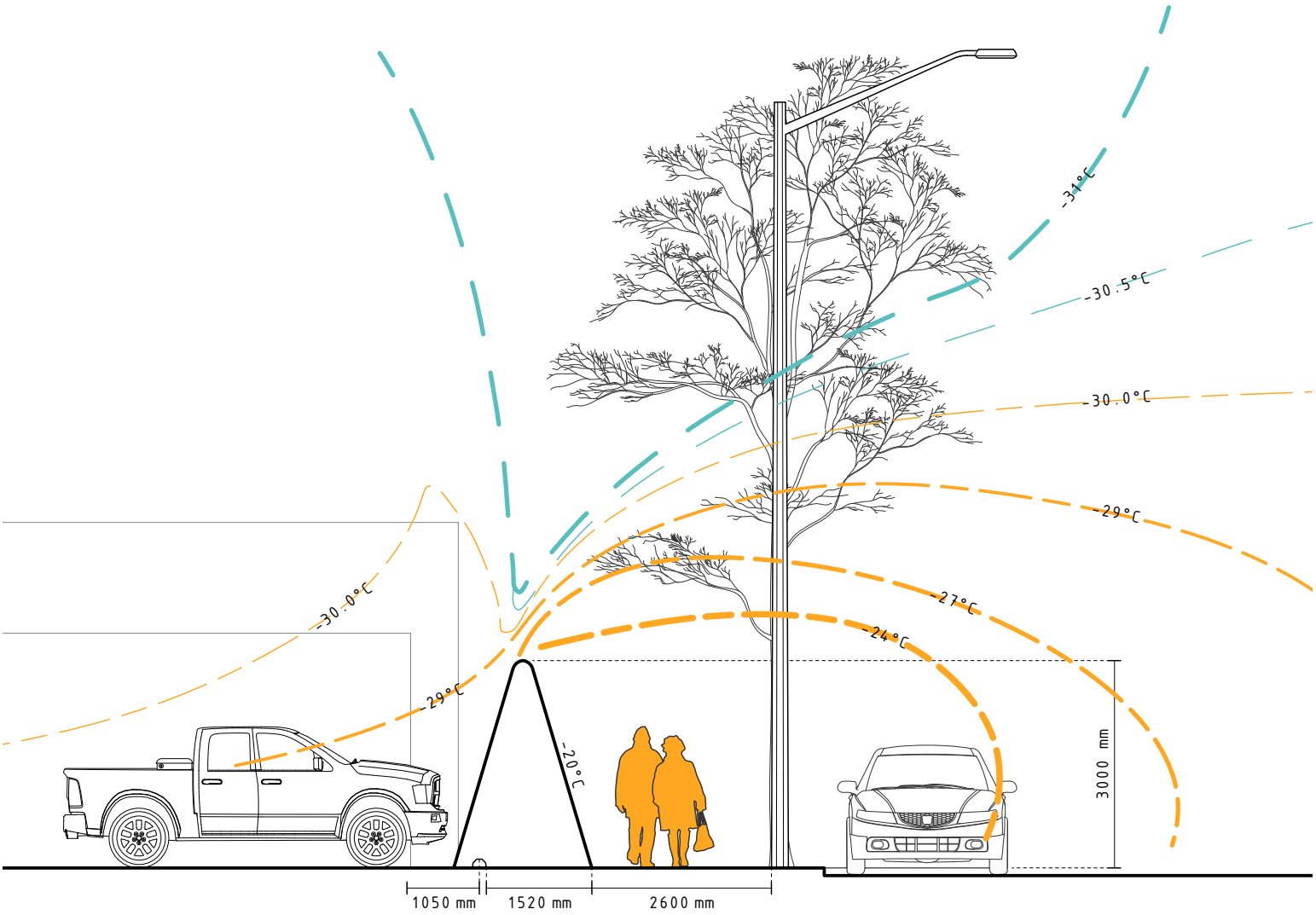


Ambient Conditions: -20°C with 20 km/h wind

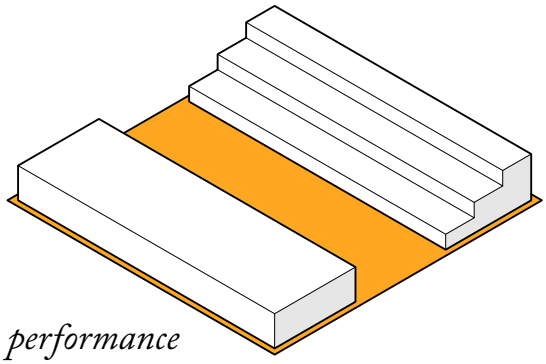
fig. 5.8 Wind Break

In more utilitarian applications a single form can be sufficient to create simple program through micro-climatic change - a long barrier to break the incoming wind and shelter those nearby (fig. 5.8), or low blocks making benches in a sun bathed nook. A tall, loose pile of snow becomes a barrier, but in just this example forming a smooth vertical face unlocks new possibilities. Cutting in a recess creates a small shelter or shelf, or adding low blocks before it transforms the barrier into outdoor screen with seating.

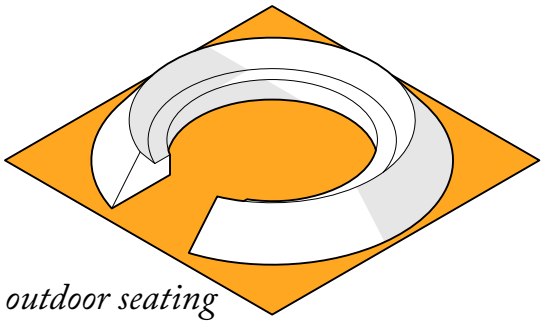
Layering and combination of forms coincides with the implied functions, and it is at this point where the interaction between the city and the public drives the urban design. Where required, the Urban Pioneer's taking control of the sites can further refine the forms to add the necessary details for the intended use while still relying on snow to provide all of the tectonics and furnishings required to activate the space. A simple kit in conjunction with the tools and equipment already available are all that is required to unlock the functions embedded within the nested forms (fig. 5.9).

① Snow Shovel
② “Wire” saw - 20 foot chain
③ Wooden trowel
④ Hand Saw
⑤ Compass Saw

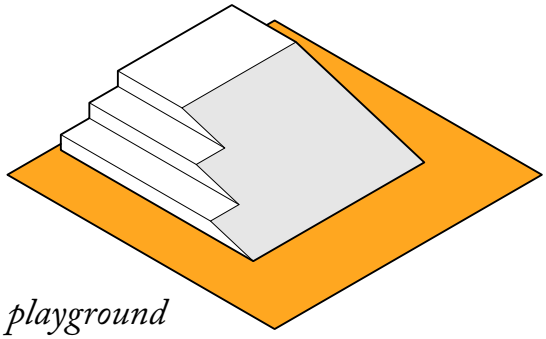
fig. 5.9 Snow Sculpture Tool Kit



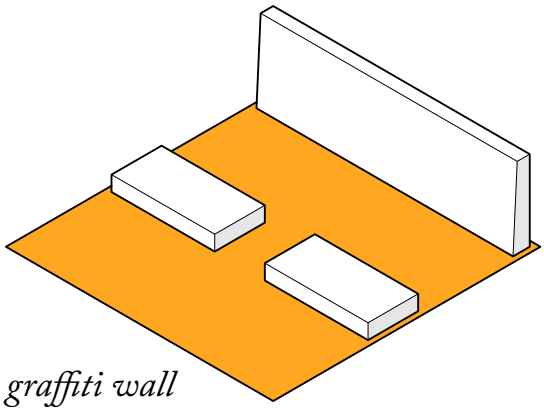
performance



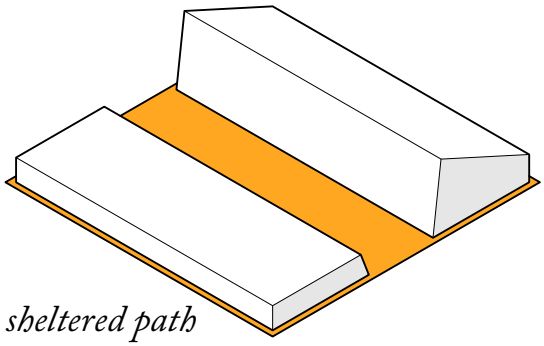
outdoor seating



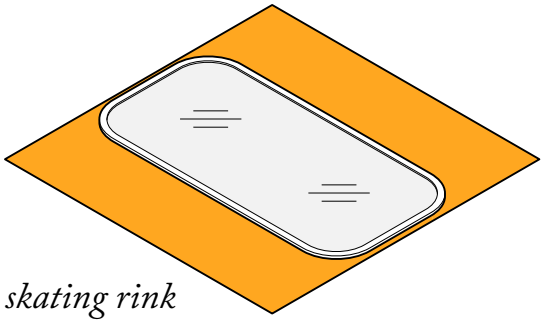
playground



graffiti wall

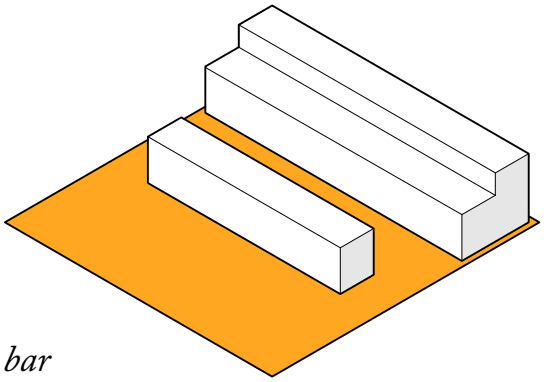


sheltered path

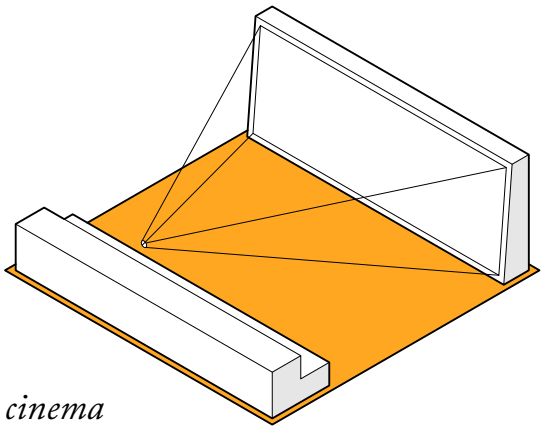


skating rink

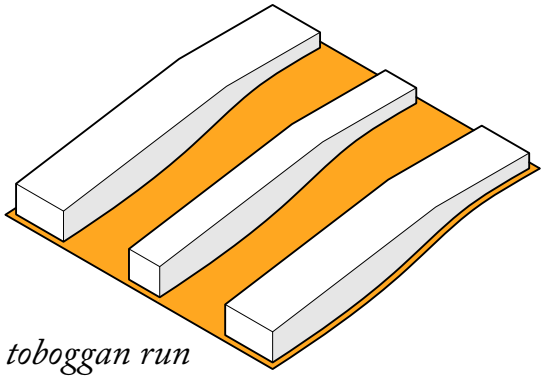
fig. 5.10 Program List



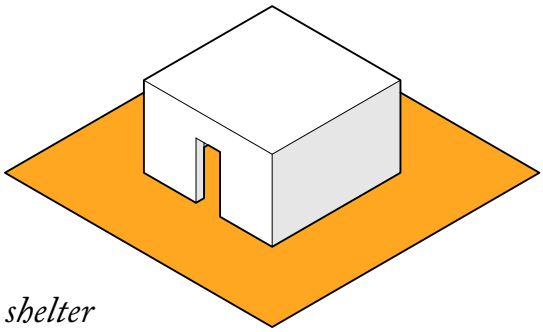
bar



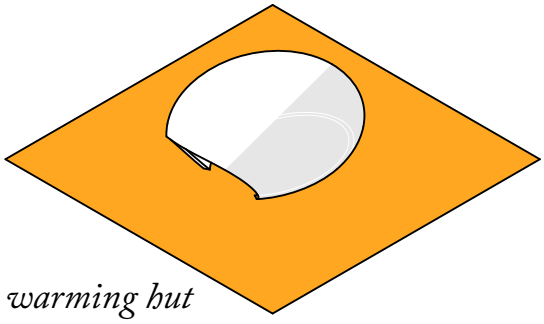
cinema



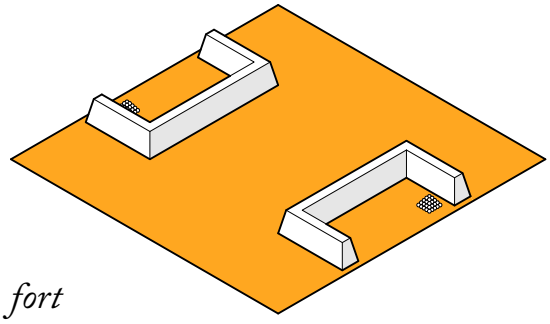
toboggan run



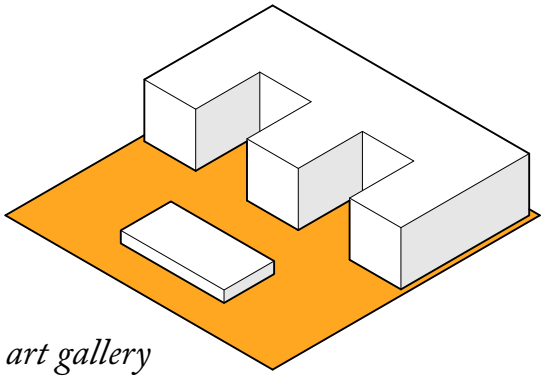
shelter



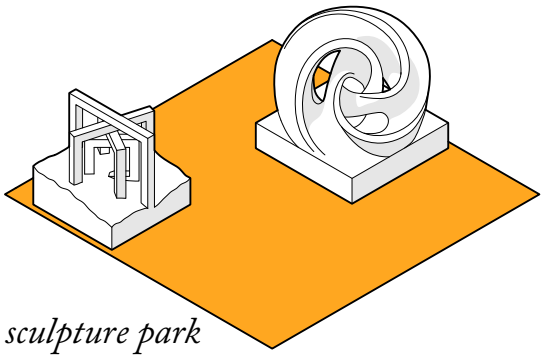
warming hut



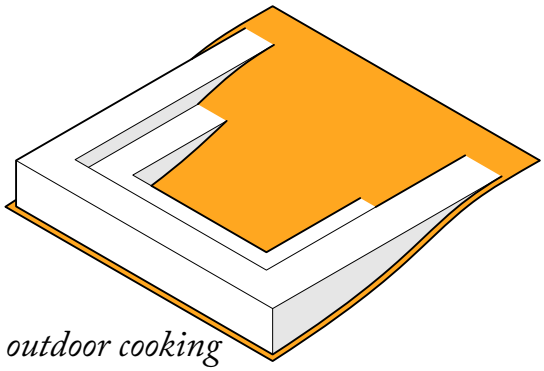
fort



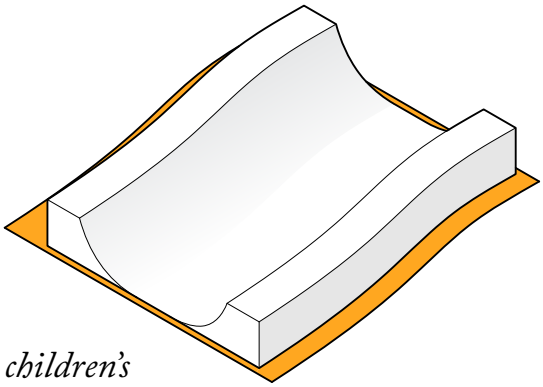
art gallery



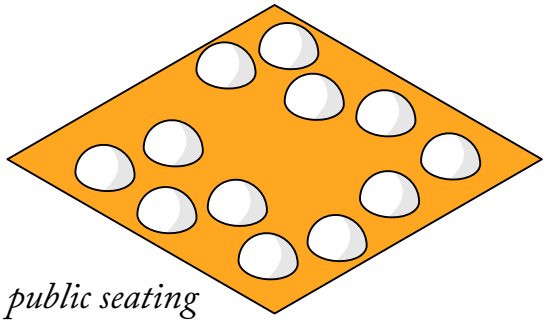
sculpture park



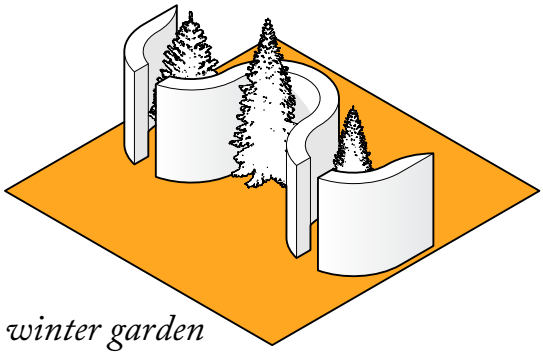
outdoor cooking



children's half pipe

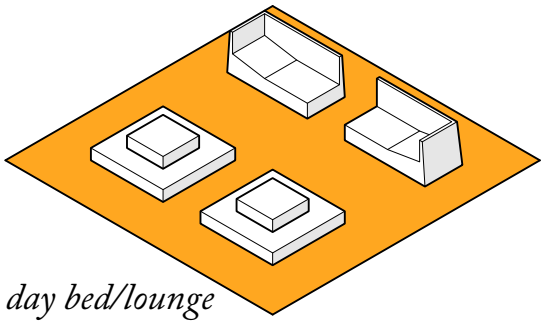


public seating

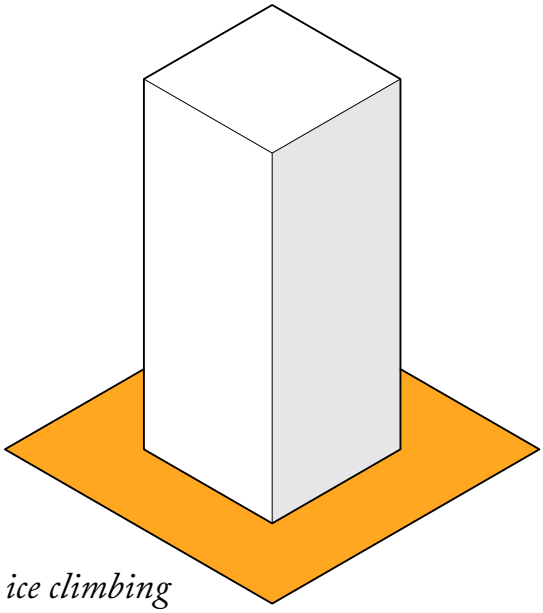


winter garden

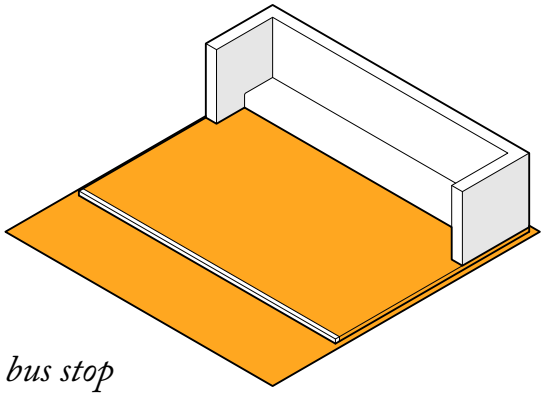
fig. 5.11 Program List - Continued



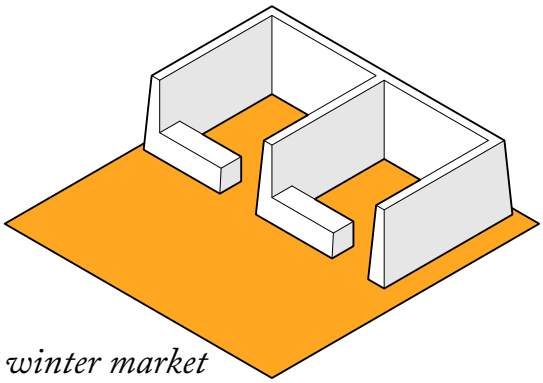
day bed/lounge



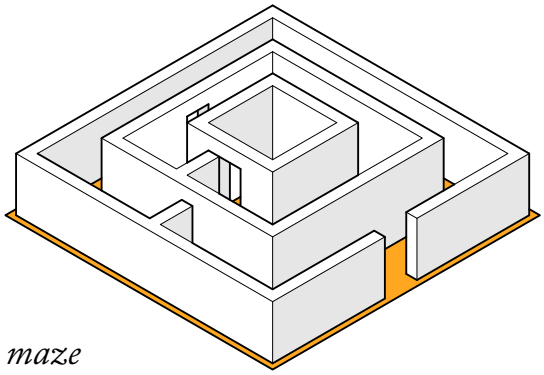
ice climbing



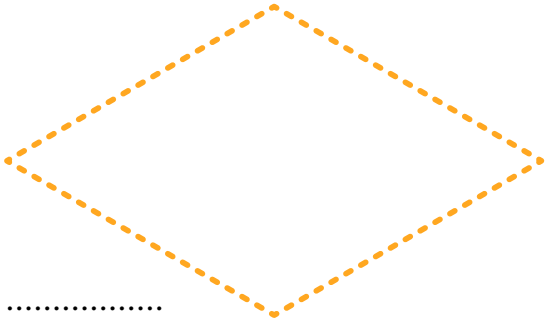
bus stop



winter market



maze



.....

If outdoor programming can be imagined it can be reincarnated in snow. During the program exploration a stark reminder of winter's cruelest aspect emerged: shelter. Protecting young professionals from a little wind chill while they sip their coffee, or giving a cluster of residential towers a winter playground is one thing, but the reality for Edmonton's homeless population is much more sinister.

Sleeping Rough

7 Cities on Housing & Homelessness, a group of municipal governments and volunteer organizations, conduct a homeless counts every two years in October to better inform policy makers and community groups in their efforts to end homelessness in Edmonton and Alberta. In 2014 the count revealed 2,307 homeless, with 617 individuals who reported as "sleeping rough[1]" - forced to find shelter in parks, garages, cars, makeshift shelters or vacant buildings - and in 2016 although the overall count dropped to 1,752[2], Julian Daly (director of Boyle Street Community Services) reported that their outreach teams worked with over 800 individuals sleeping outdoors[3], and raised concerns that a large homeless population may have been missed during the most recent count. While conditions are possibly improving, there is still a large population of people exposed to a dangerous environment.

Uplifting changes have recently been implemented by the City of Edmonton - it is now City policy to open the LRT stations to the homeless population on nights reaching -20˚C. While this is a fantastic step forward, it is not a permanent solution - on severe winter nights pressure is relieved on emergency shelters, but a night of -15˚C is still dangerous. It is by no means a proposal for a permanent solution, but Tactical Urbanism can be deployed as another tool to assist in protecting the vulnerable homeless population. Snow shelters like igloos or quinzhees are well established architectural responses to arctic conditions, but to be structurally sound their construction requires skill, experience, and crucially time. City resources must once again be examined for design solutions which may provide adequate, safe shelters that can be constructed with the same speed and efficiency as reclaiming terrain vague.

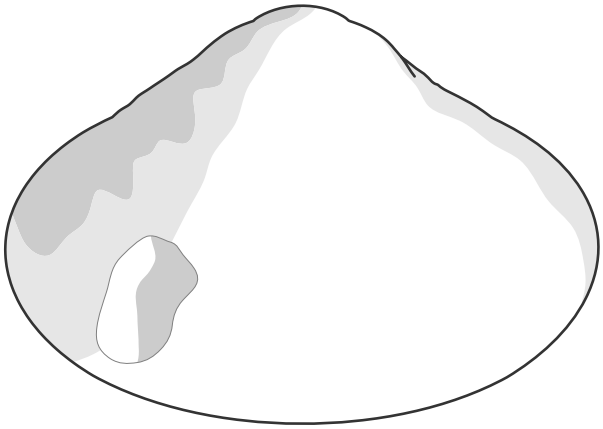
1 Turner, Alina. *"2014 Alberta Point-in-Time Homeless Count: Provincial Report,"* Turner Research & Strategy for the 7 Cities on Housing & Homelessness, (2015), 4, 71.
2 Homeward Trust Edmonton *"2016 Preliminary Homeless Count Numbers,"* for the for the 7 Cities on Housing & Homelessness, (2016), 1.
3 Lazzarino, Dave. *"Edmonton homeless count numbers inaccurate, could slow progress,"* Edmonton Journal, November 30, 2016.

Source: http://feedthehomelessday.blogspot.ca/

Source https://hopemission.com/wp-content/uploads/2014/01/

fig. 5.12 Homeless in Edmonton

Quinzhee



expense

stability

site impact

protection

time

training

The quinzhee is an extremely well established form of emergency shelter with variations appearing in Inuit, Scandinavian, and Siberian cultures. While the two are often confused, one the major differences between an igloo and a quinzhee is in duration. The more familiar igloos are traditionally a long term winter structure, constructed relatively slowly with great care, while the quinzhee primarily acts as an emergency shelter when other refuge is unavailable.

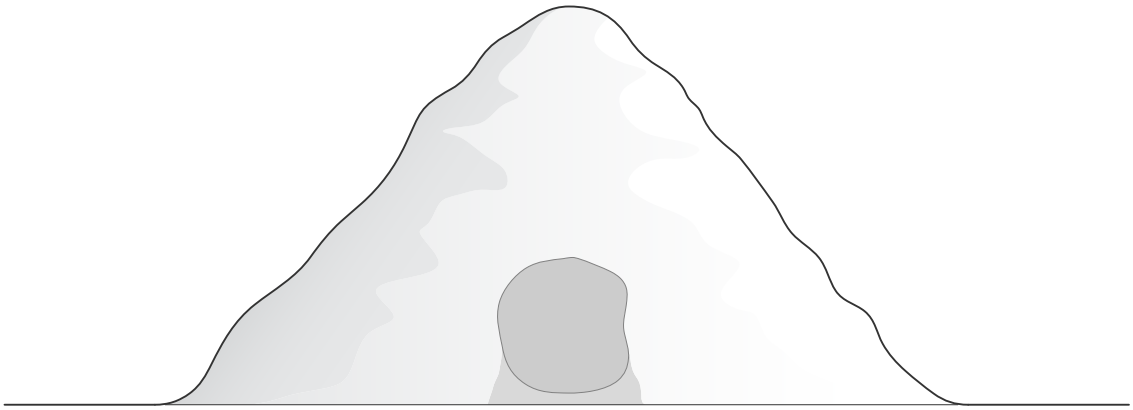
The process of construction consists of piling snow about 2.5 m wide at the base, and anywhere from 2.0 to 3.0 m tall. The snow is left to sinter for a minimum of two hours, possibly eight, depending on snow conditions. The interior is then excavated with at least a 20 cm thick shell.

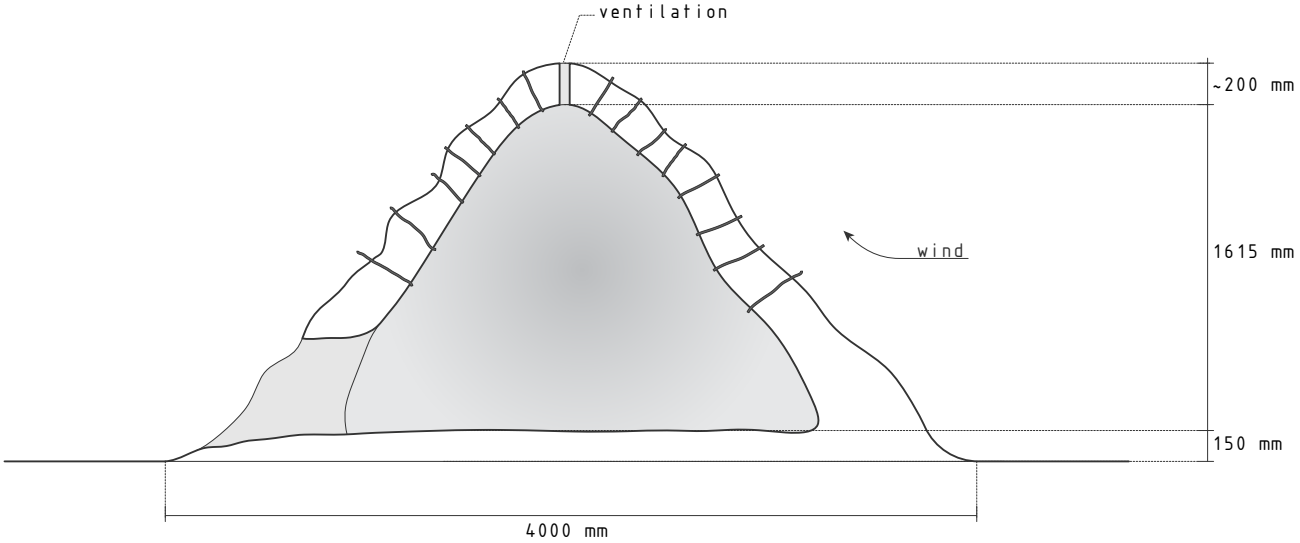
A simple technique to control the shell thickness is to insert sticks or dowels to a known depth, and excavating from the inside. Once the bottom of the sticks are visible the snow layer is at the desired thickness. Construction of a quinzhee, while seemingly simple, does require a degree of skill, experience, and time to produce. A determined worker could potentially pile the snow within an hour, wait a minimum of two hours for sintering, and then excavate to the desired dimensions within another two hours. City equipment can lower the piling to minutes, but an estimate of five hours construction time appears reasonable.

Structurally, there are concerns with a quinzhee structure. While anecdotally they can withstand the weight of a polar bear, they are ultimately susceptible to degradation from environmental factors and can easily become unsafe for occupation due to potential collapse. Paired with the time required to construct them, and their limited duration before becoming a safety concern, the quinzhee's protracted use as an emergency shelter for Edmonton's homeless population does not appear viable.

http://www.bushcraftuk.com/forum/showthread.php?t=88501

The ideal form for a shelter made purely of snow and ice would be the more famous igloo, but the specific requirements for snow quality, depth, construction training, and time make the igloo even less practical.





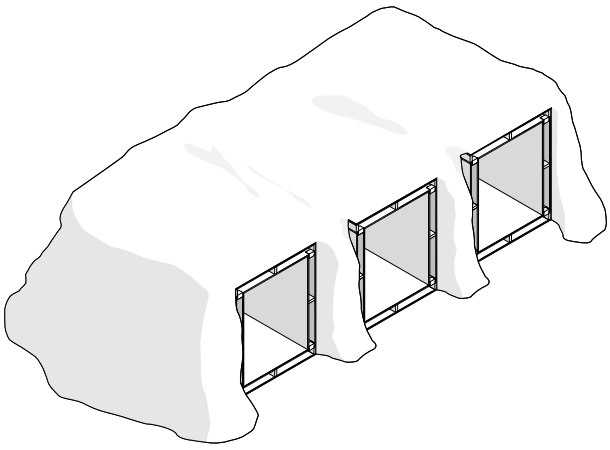
WALLS: 228.6 mm (snow) = 1.590 (9.0)

Total RSI (R) = 1.590 (9.0)

AIR VOLUME: 3.60 m^3

fig. 5.13 Quinzhee Elevation+Section

Shipping Pallets



expense

stability

site impact

protection

time

training

The architecture of the quinzhee was born of need - fast protection from fatal elemental forces - and has been tested and refined for thousands of years until taking the present form. This vernacular element is the best suited to serve as a protective shelter for Edmonton's homeless, but its unfamiliarity within the current culture makes large scale deployment all but impossible - the vernacular must be adapted to match the cultural climate.

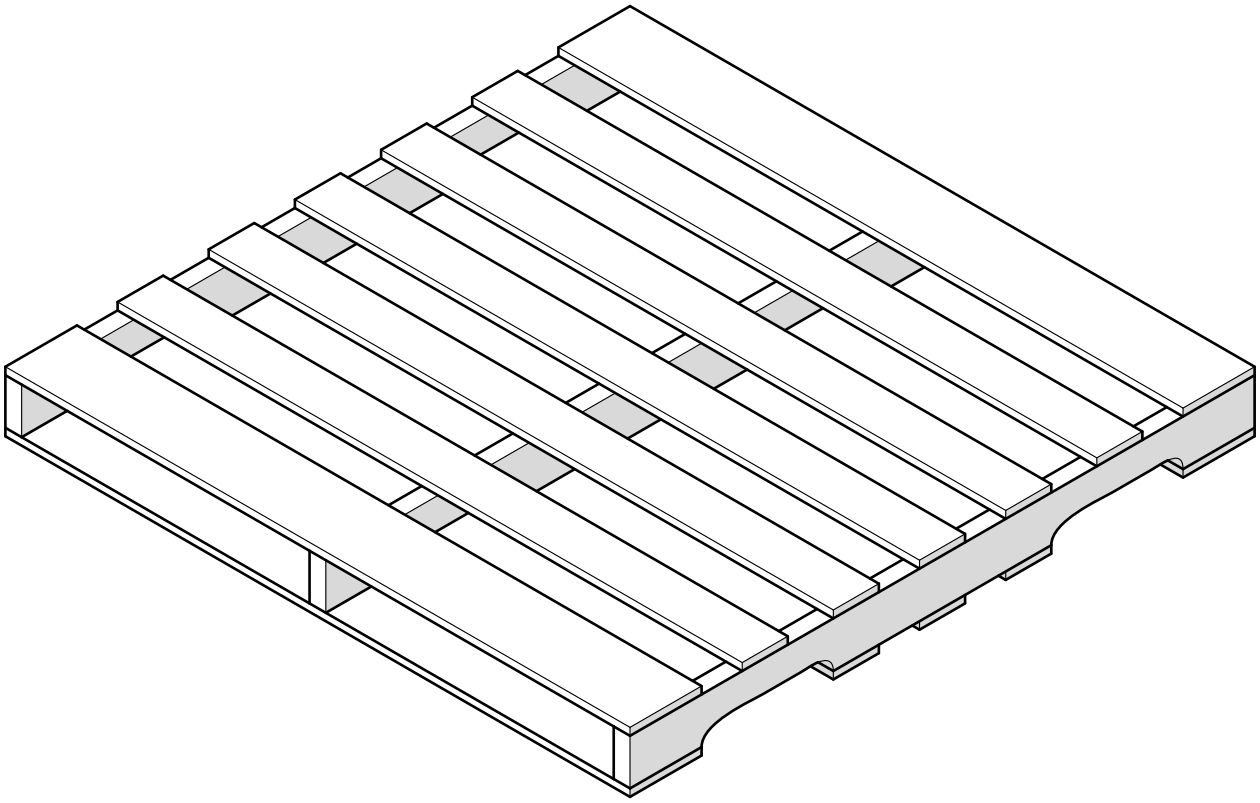
The elements of speed and skilled labour need to be supplanted by technology and resources, while maintaining the basic principles of the original quinzhee design. To serve this function, wooden shipping pallets will be examined as a technological stand-in. These artifacts comprise one of the many ubiquitous elements scattered throughout our cities - so commonplace their existence in alleyways, stacked up beside receiving doors of businesses, and piled in recycling centres barely receives notice. These artifacts are lightweight, durable, recyclable, inexpensive, modular, easily modified, and abundant to the point that they are considered waste material.

Collection of these pallets could begin at the municipal level via two means. Discarded pallets which have not been used to transport dangerous chemicals can be collected at City recycling centres. The second is to create a City recycling program which collects pallets directly from businesses as part of existing services, or provides drop off locations for use in the emergency shelter program.

Delivery could be conducted in several ways. Prior to the beginning of the winter season, the City of Edmonton Transportation Operations (CETO) would transport and stockpile pallets at locations marked for potential use as either temporary emergency shelter sites, or at City sanctioned "tent cities" for extended use. An alternative is for charitable and community organizations to request for delivery of pallets to be stored at their own facilities, or to arrange for private or volunteer transportation services to sites authorized for use.

Construction of the shelters could be carried out by several agents depending on circumstances: either by the Public Works Department employees, private or NGO staff, or by the eventual users themselves on site. Once the pallets are set in place, backfilling would be conducted either by the CETO, private snow clearance contractors, or volunteers.

Taken in groups of eight, shipping pallets can quickly be arranged to form a structure capable of safely withstanding snow loads for an indefinite period, resisting deformation from backfilling pressures, forming enough sheltered space for a single occupant, and providing thermal breaks between the occupant and the surrounding ice/snow. The volume within is easily capped of at the rear with any form of rigid material, and the opening can be covered with a blanket, tarp, or any other cap while providing a small gap for ventilation.



48" X 48" (1219 x 1219 MM) TIMBER PALLET

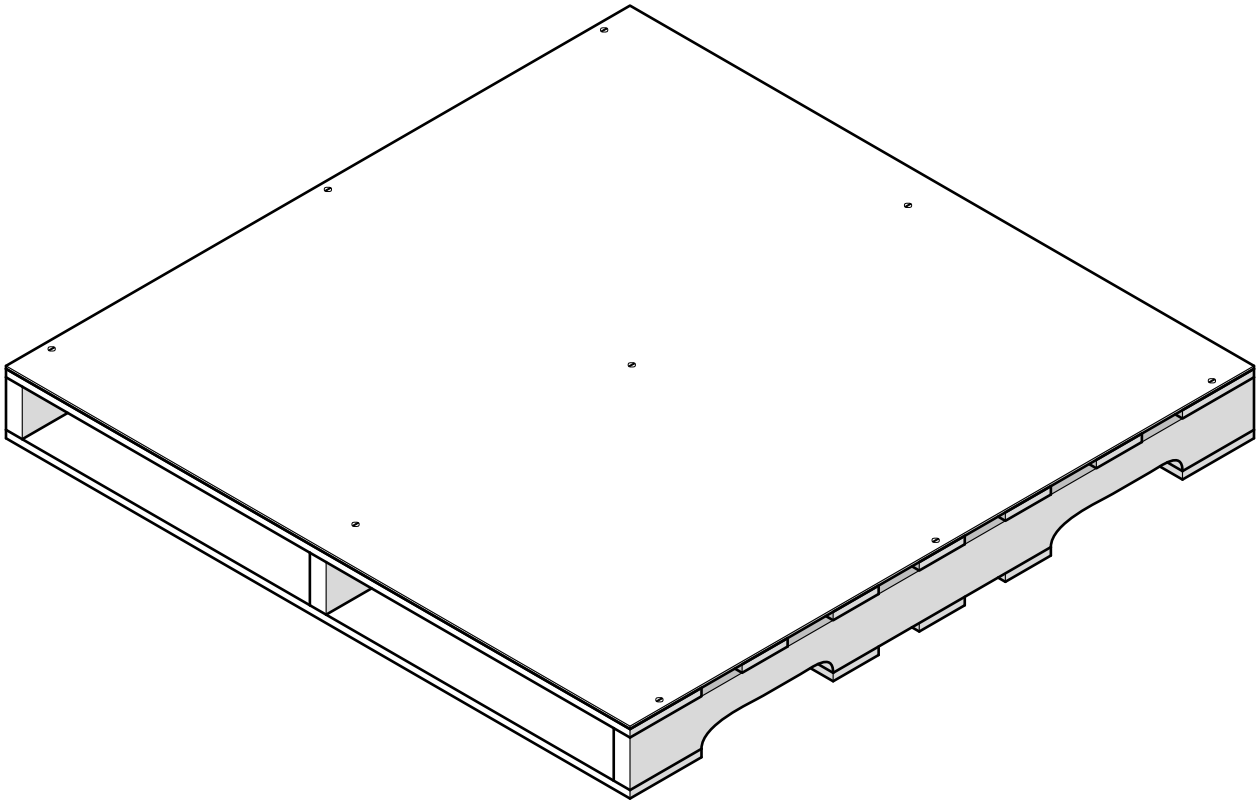


fig. 5.16 Standard Shipping Pallet

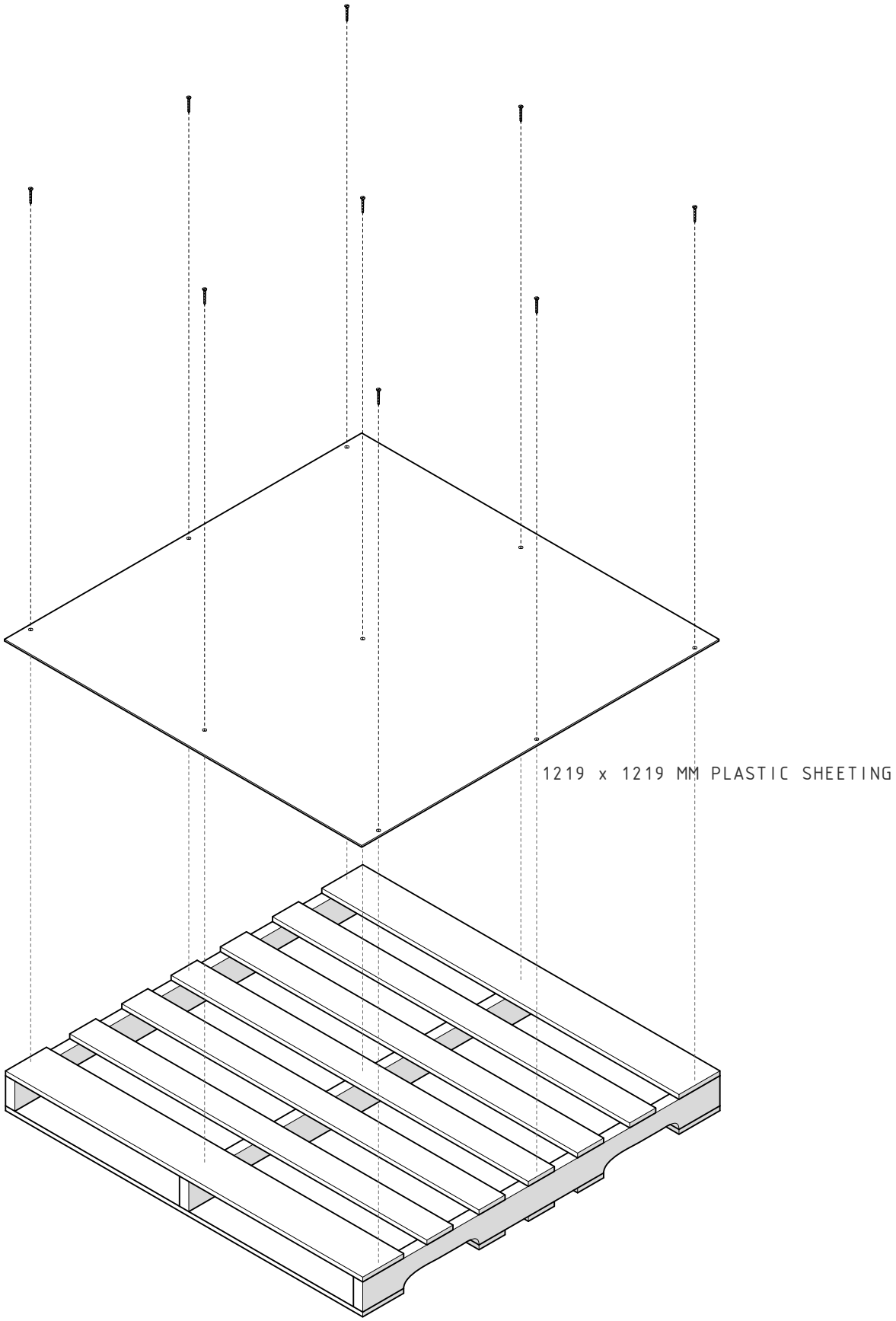
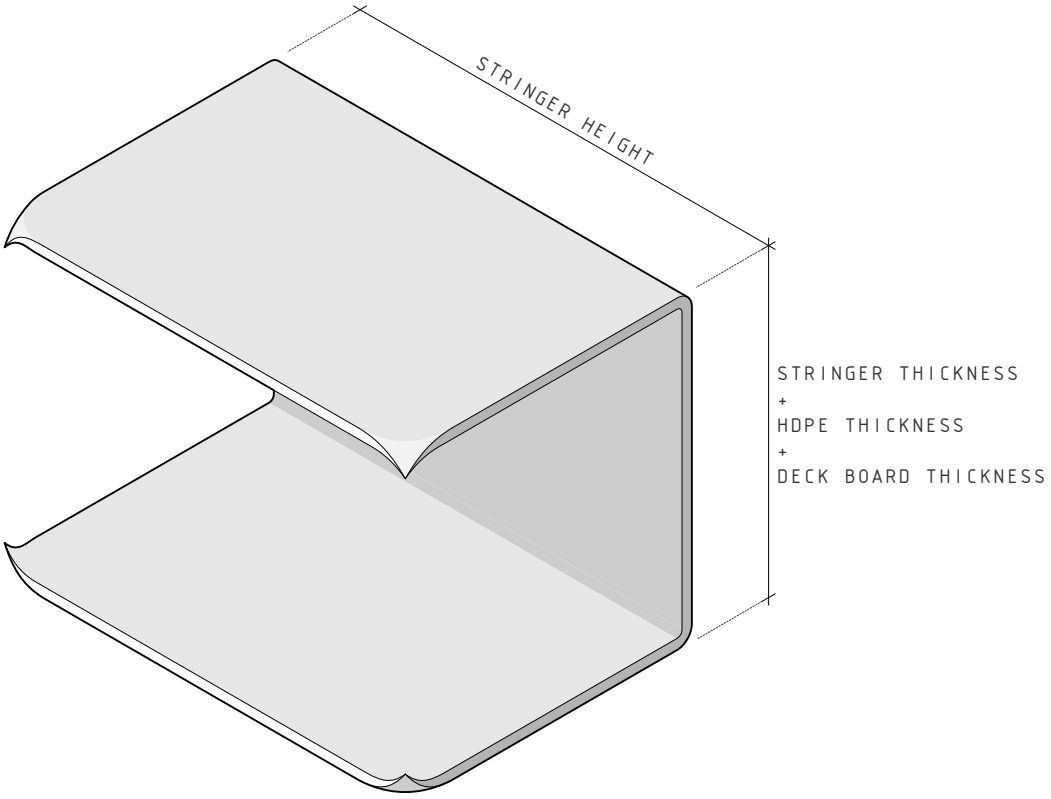
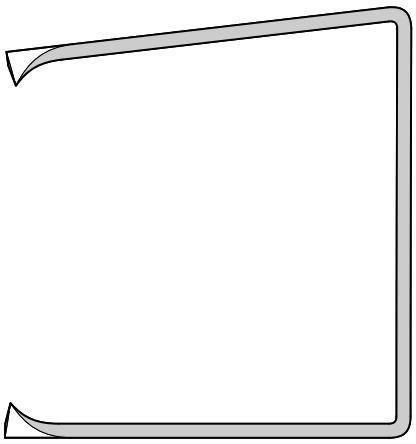


fig. 5.17 Pallet Modification

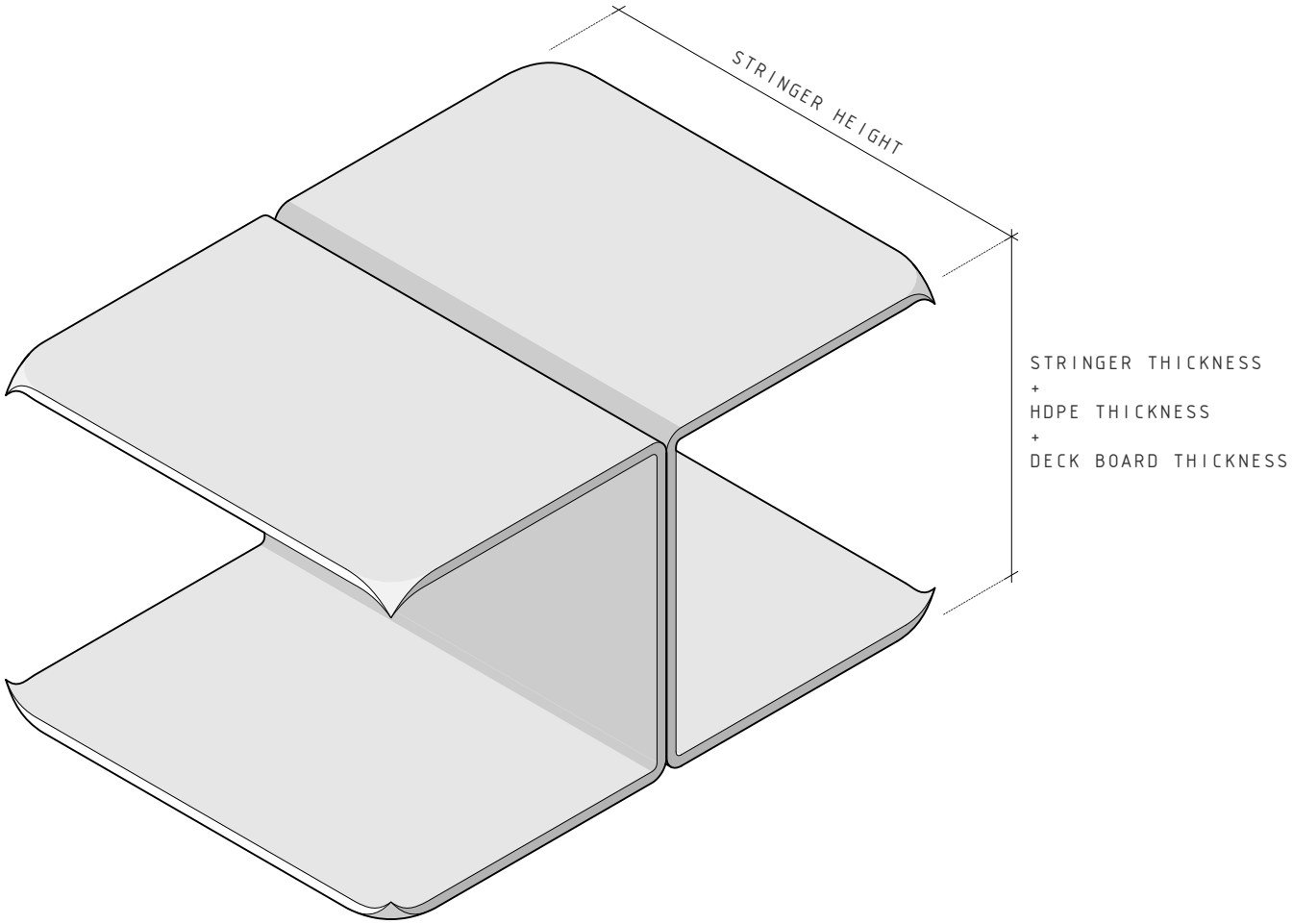




CLIP PLATES WITH DOWNTURNED CORNERS
TO PROVIDE SLIDING RESISTANCE

ONE LEG BENT INWARDS TO ALLOW FOR
PRESENCE/ABSENCE OF PLASTIC SHEET, AND
GENERATE FLEXURAL CLAMPING FORCE

fig. 5.18 Single Connection Clip



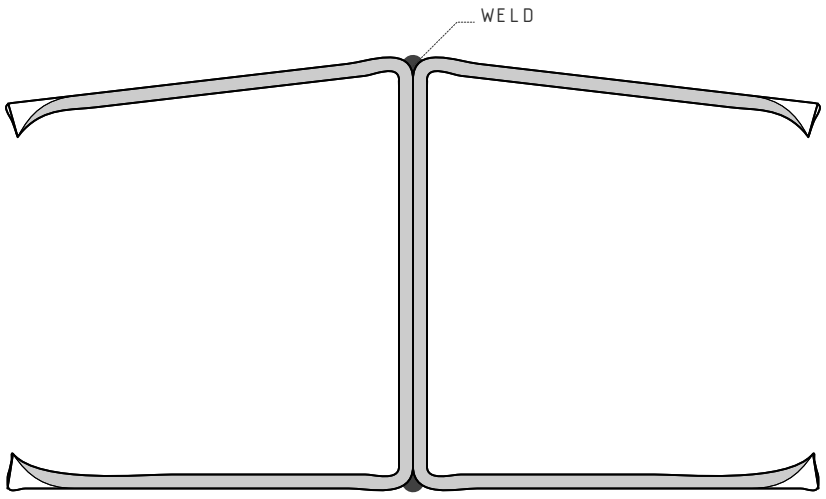


fig. 5.19 Double Connection Clip

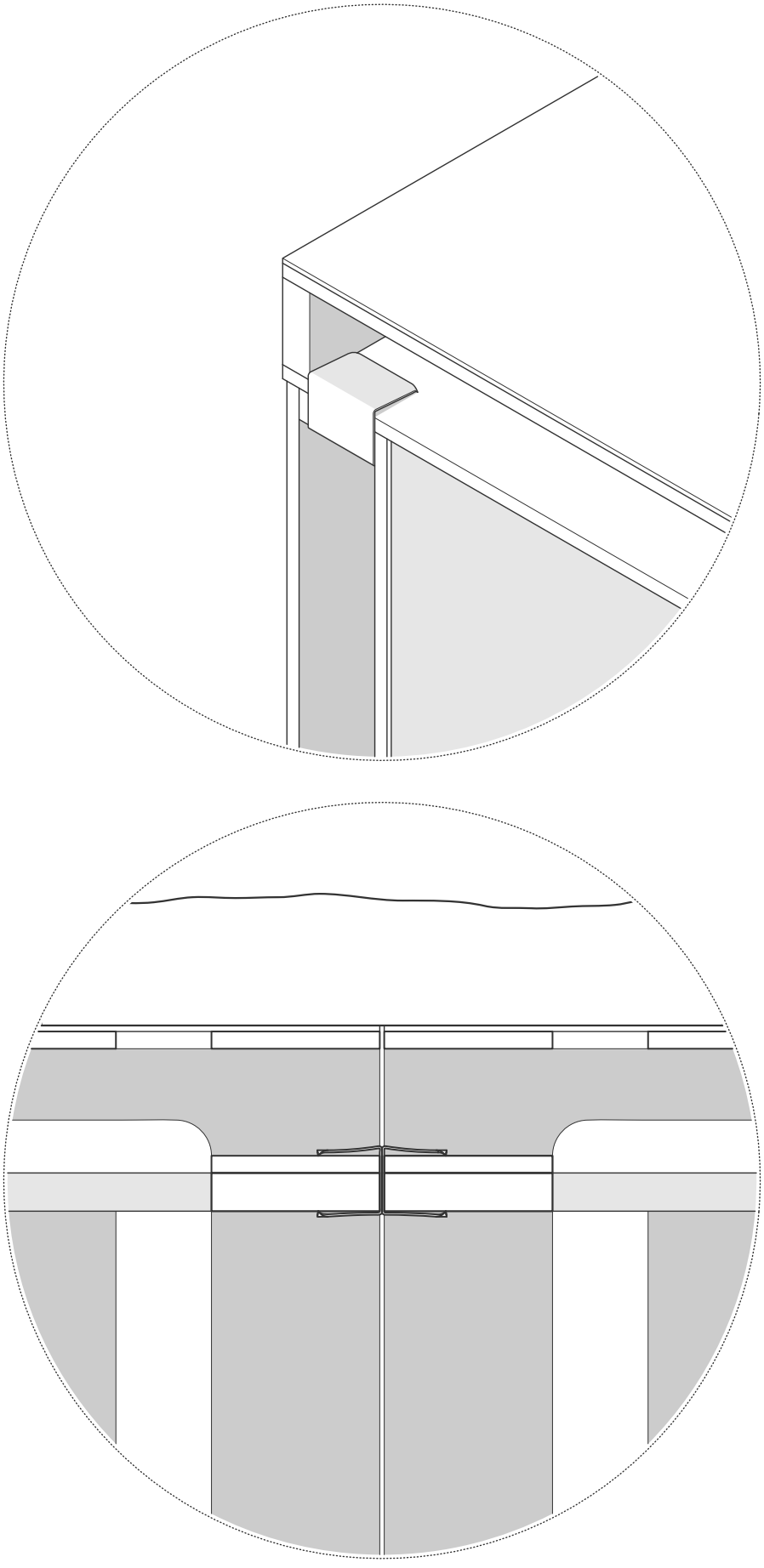


fig. 5.20 Connection Details

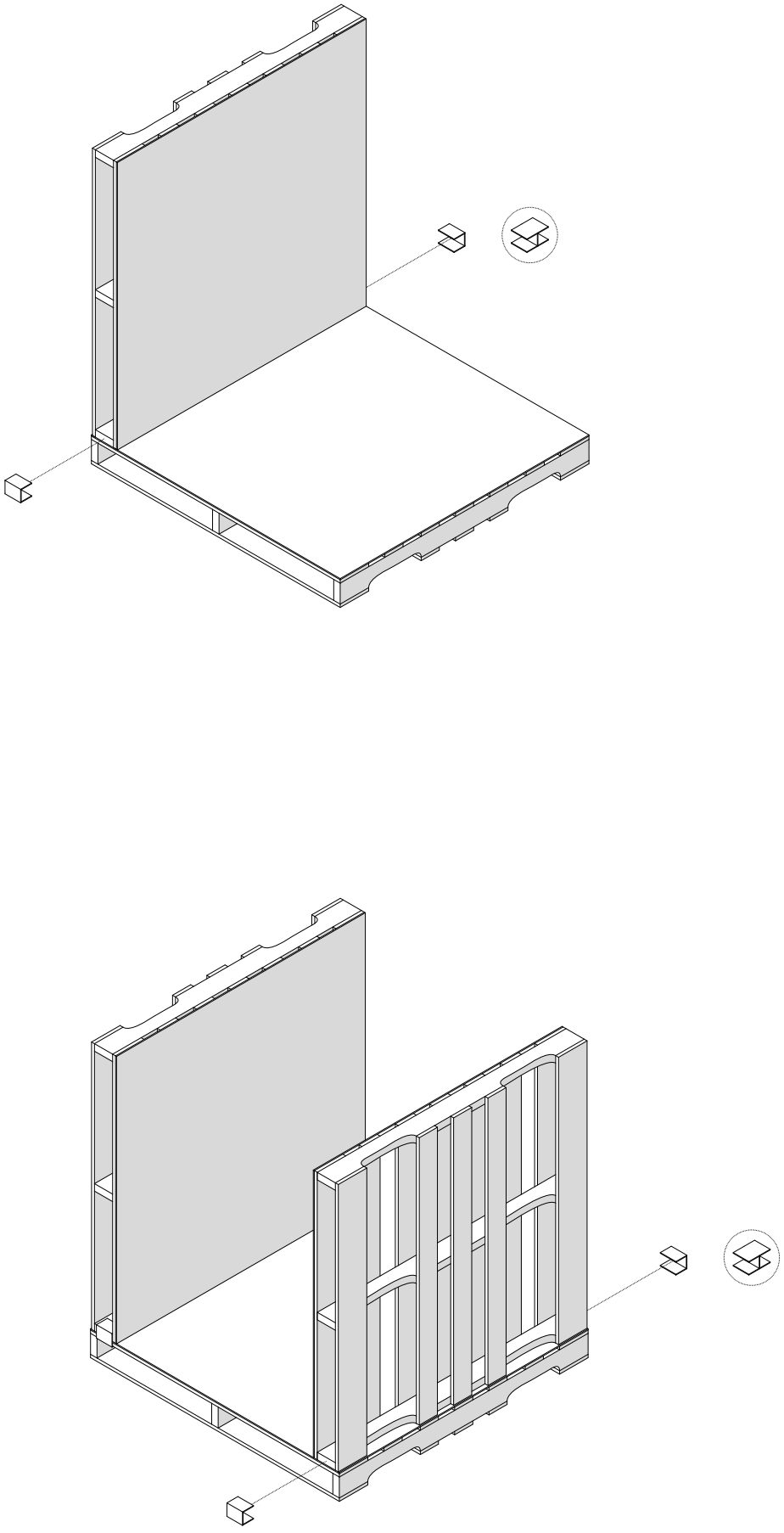


fig. 5.21 Shelter Construction

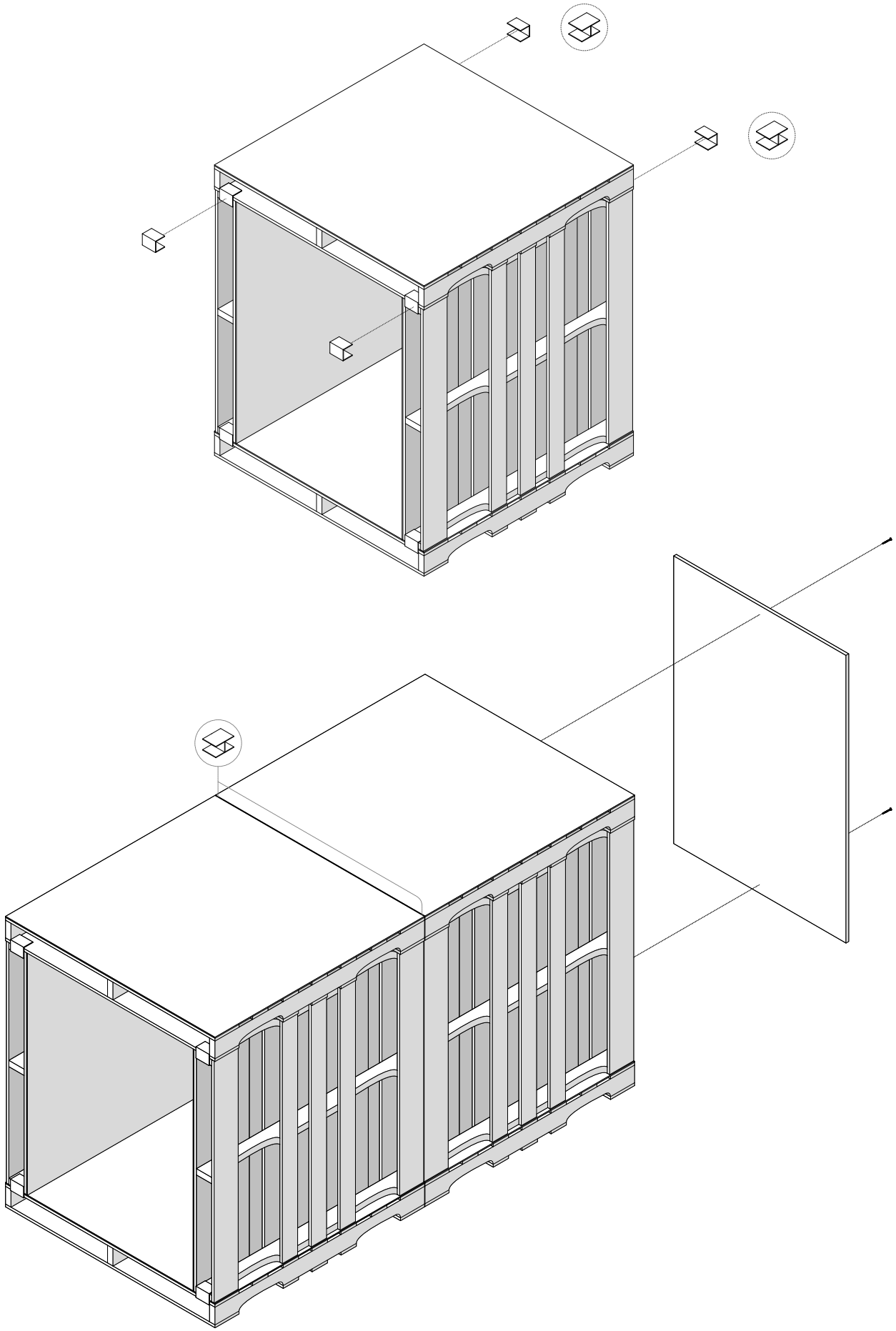
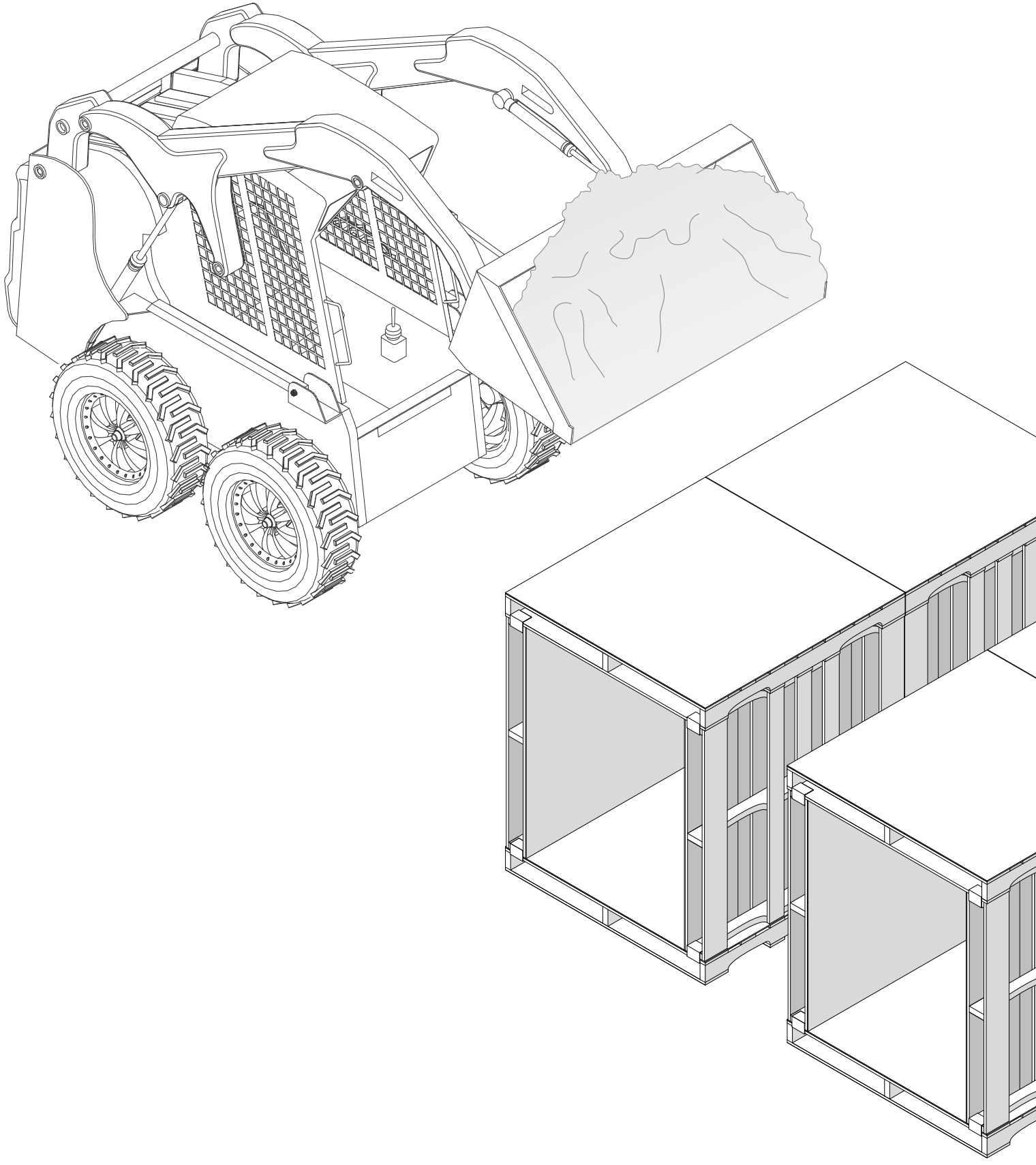


fig. 5.22 Shelter Construction - Cont



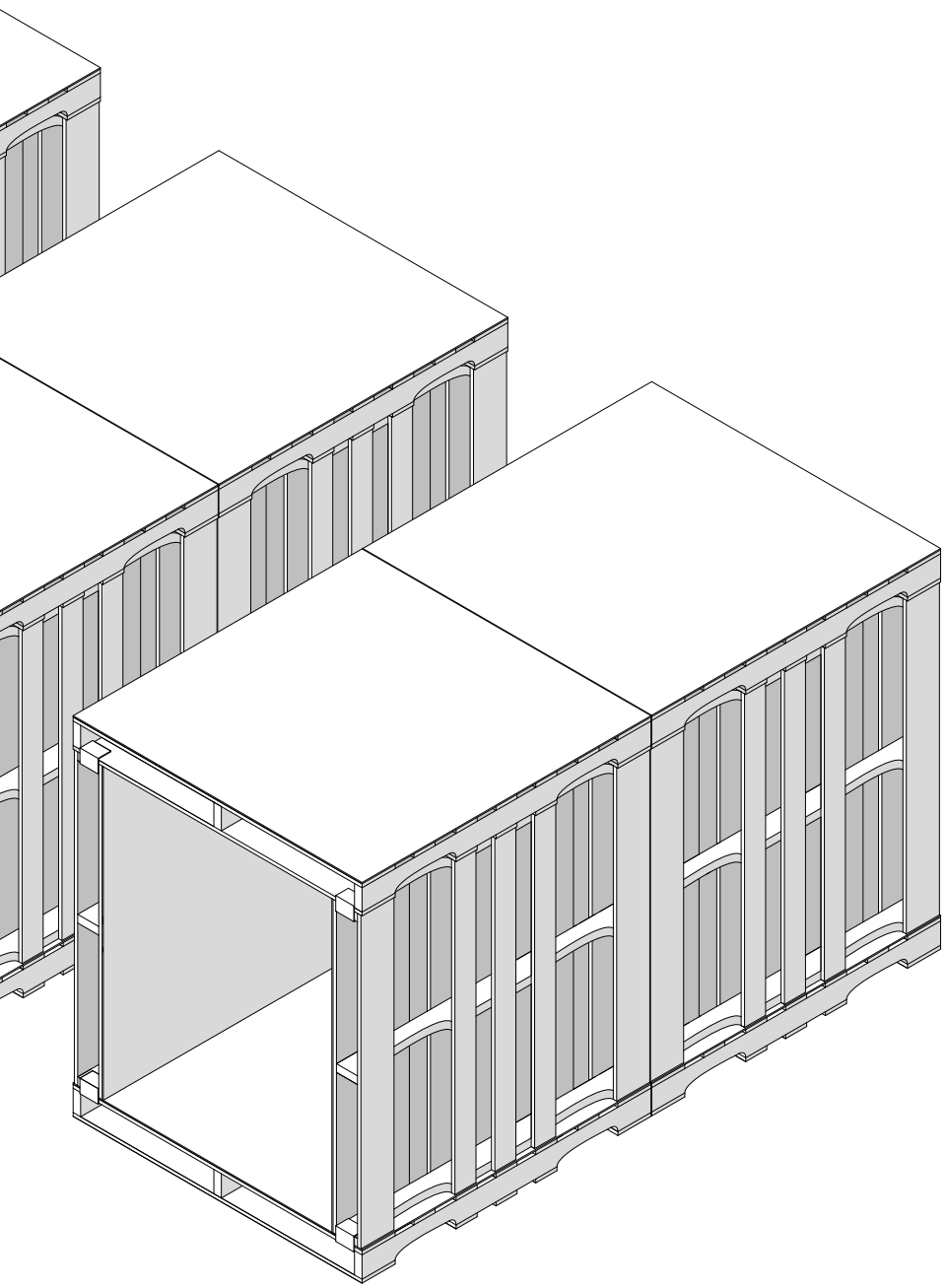
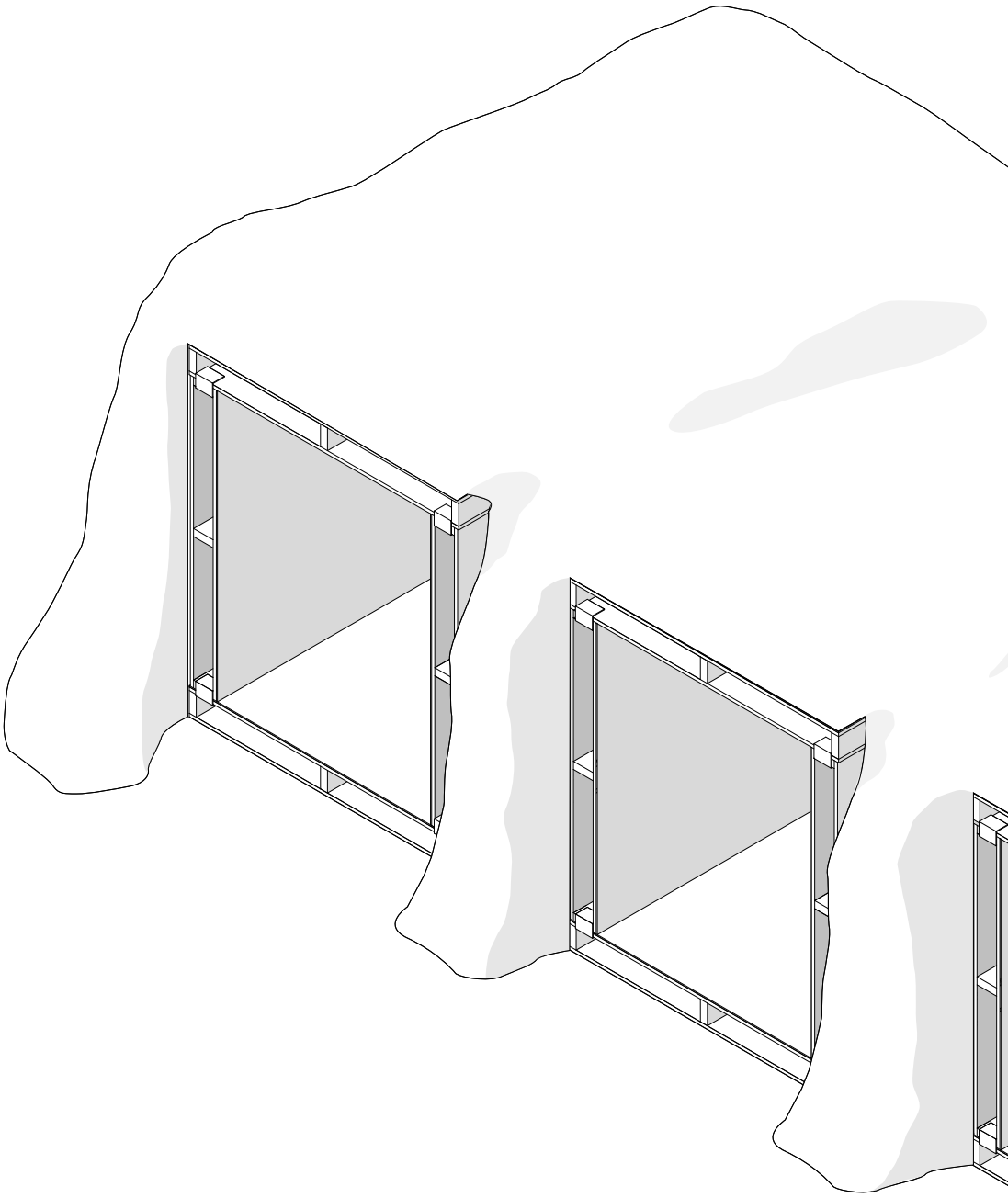


fig. 5.23 Shelter Backfilling



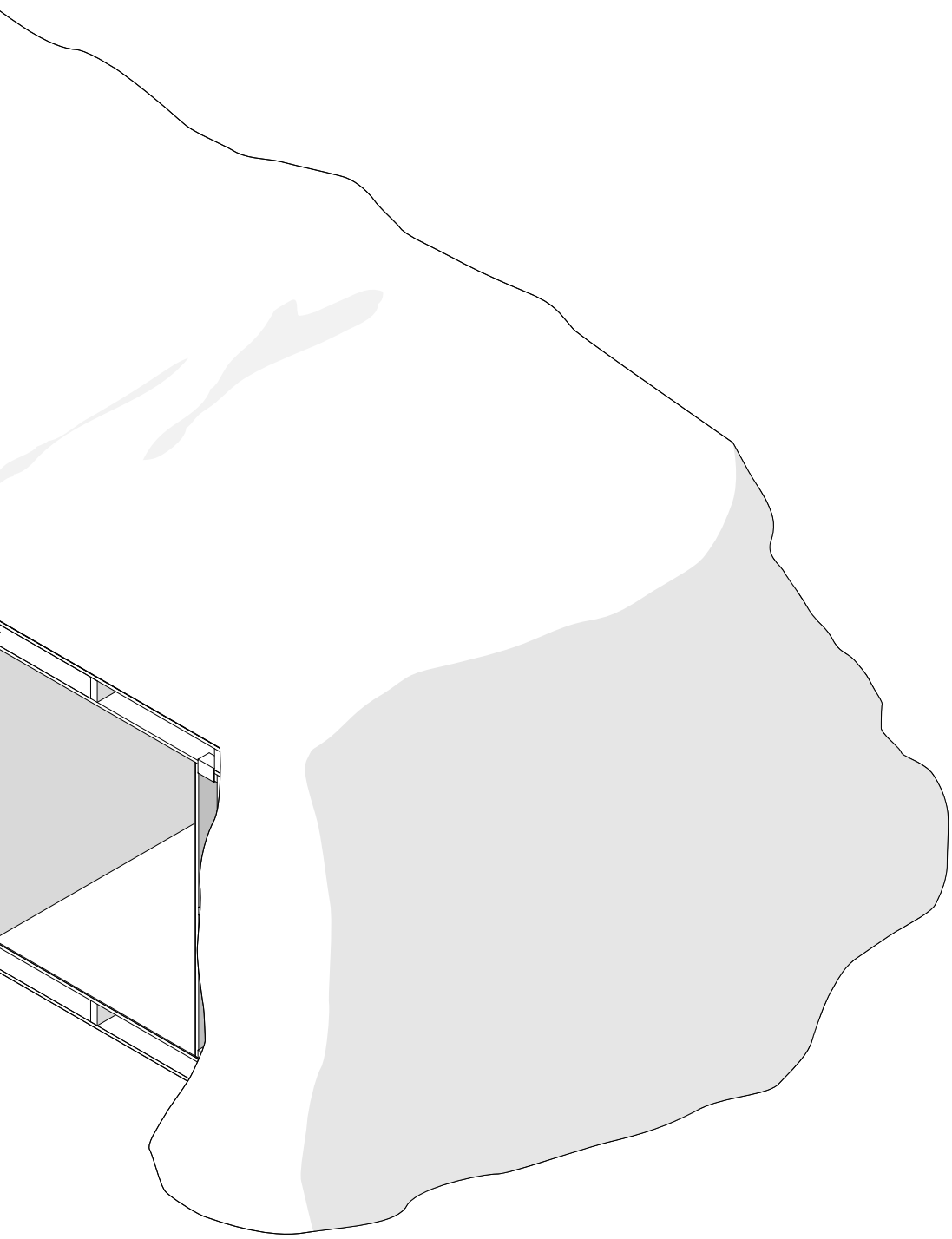


fig. 5.24 Shelter Cluster

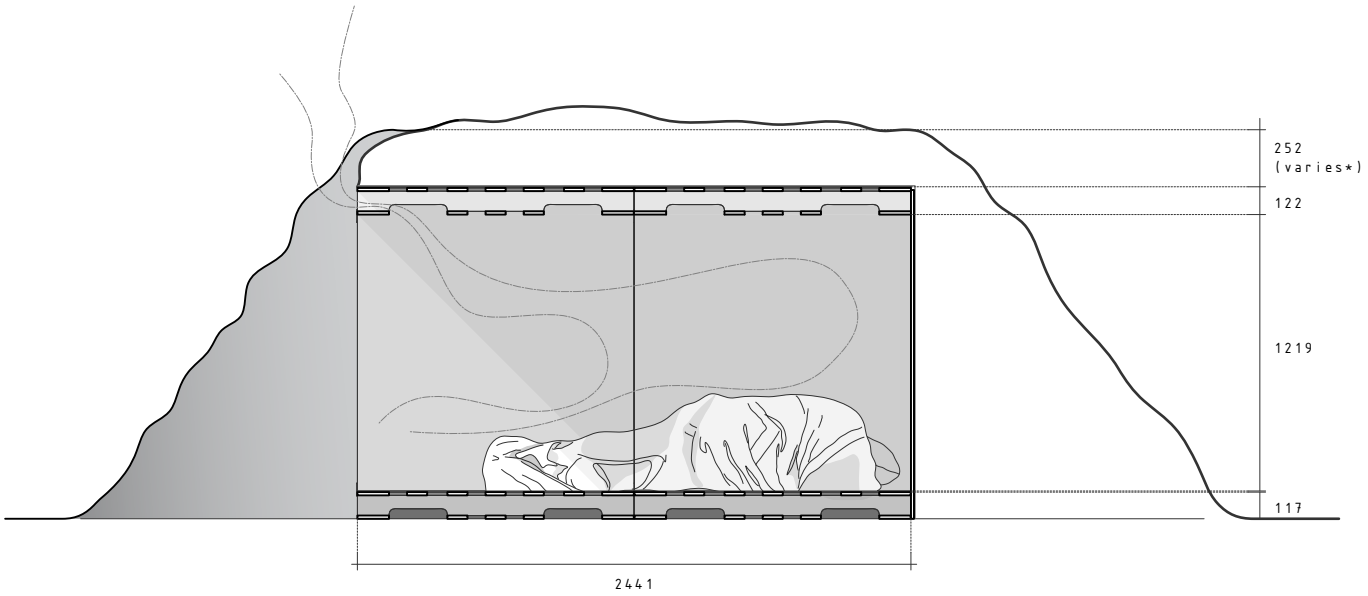
Pallets would be constrained from movement using simple metal clips, mass produced, to connect the outer stringer of one pallet perpendicularly to the bottom deck board of another. Turning the corners of the clips inwards provides biting points to prevent excess movement during backfilling - the intent of the clips are to hold the pallets in place, not to completely secure them together. Once the season is over, or the intended shelter duration is complete, the clips can be pried off either by hand or with small tools, and the pallets can be collected and removed from site.

Approximate insulation values for the elements of a shelter have been calculated in fig. 5.25, but the comfort and safety levels provided by such protection, particularly at the temperature ranges possible in an Edmonton winter.

As a source of comparison, Peter Kershaw, Peter Scott, and Harlod E. Welch undertook an assessment of two traditionally crafted igloos built at Resolute in the Canadian High Arctic (74˚41'N, 94˚54'W) for the last week of February 1993. Over the course of the six day experiment, the ambient temperature ranged from -28.2˚ to -41.1˚ C and the wind averaged 10.4 km/h. Even at the highest temperature this would account for a wind chill factor of -37.8˚C.

The difference between the two igloos was their size, with the smaller having an internal volume of 7.76 m^3 and sheltering two adults. Initially the walls of the igloo were left bare, but later in the experiment they were covered with elk skins for additional insulation. Over the course of the assessment, a temperature differential between the interior and exterior reached a maximum of 40˚C, and the three authors concluded that "the presence of two adults and the [burning of an oil lamp] maintains a chamber temperature of about 5˚C in an unlined igloo 3 m in diameter at -30˚C ambient temperature." Even during periods where the experiment's oil lamps were extinguished, the temperature differential only dropped approximately 5˚C in two hours where it remained relatively steady for another six.

Comparing the single occupant pallet shelter's internal volume of 3.13m^3 to that of the double occupant small igloo (40% volume), generous clothing and bedding, and a heavy cover over the entrance, combined with a safe heat source could duplicate the 30˚C temperature differential measured in the High Arctic. Firmly securing the opening and accounting for wind direction allows for the "weak point" of the opening to provide superior insulation compared to an $800 modern winter tent which solely relies on being air-tight for thermal control (R-value of 3.1 for a thick blanket vs. 0.1 for a plastic skin).



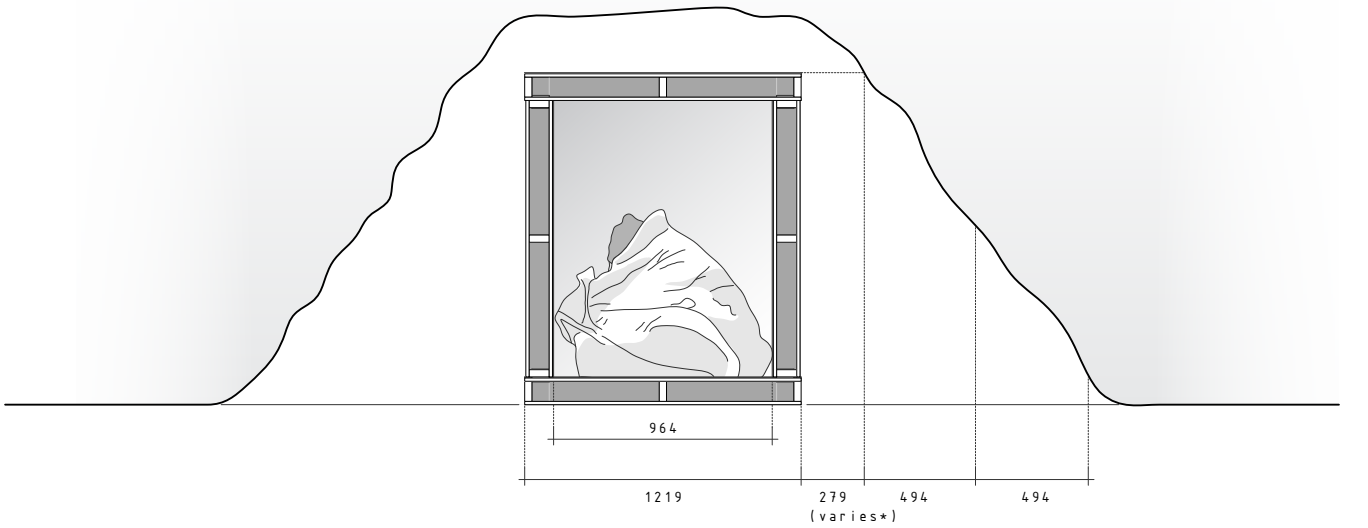
* every 25.4 mm of snow provides approximately 0.18 RSI (1R)[x]

ROOF:	252 mm (snow)	= 1.790 (10.2)	
	5 mm (PE)	= 0.002 (<0.1)	
	28 mm (wood)	= 0.275 (1.60)	
	88.9mm (air)	= 0.180 (1.00)	
	Total RSI(R)	*= 2.247 (12.8)*	

FLOOR:	5 mm (PE)	= 0.002 (<0.1)	
	28 mm (wood)	= 0.275 (1.60)	
	88.9mm (snow)	= 0.620 (3.50)	
	Total RSI(R)	*= 0.897 (5.10)*	

'DOOR':	28 mm (wool)	= 0.540 (3.10)	
and/or	28 mm (wood)	= 0.275 (1.60)	
	Max Total RSI(R)	*= 0.815 (4.7)*	

Thermal Conductivity (W/mK)	
HDPE	= 0.4300
Douglas Fir	= 0.1100
Batt Insulation	= 0.0380



WALLS:	778 mm (snow)	= 5.390 (30.6)	(average snow thickness)
	5 mm (PE)	= 0.002 (<0.1)	
	28 mm (wood)	= 0.275 (1.60)	
	88.9mm (air)	= 0.180 (1.00)	
	Total RSI(R)	*= 5.847 (33.2)*	

AIR VOLUME: 3.13 m^3

ALL MEASUREMENTS MM UNLESS OTHERWISE NOTED

fig. 5.25 Pallet Shelter Analysis

Shipping pallets are largely a waste item, with only a few small businesses collecting and reselling them to shipping companies, and others begging on Kijiji to just get rid of them. Tactical Urbanism can capitalize on this ubiquitous "waste" product by introducing a new sections in municipal recycling centres dedicated for pallets. Specimens in good condition that were not used to transport hazardous waste (painted differently) can be retained for use in the winter. From here organizations like Boyle Street Community Services, the Bissell Centre, Hope Mission, etc., can assist the City to locate land parcels for use as sanctioned "tent cities" for the winter months. Ideally these tent cities would be located close to aid organizations where the site can be monitored and inhabitants have easy access to services for those who could not find a traditional shelter space, or who actively choose to live outdoors.

Supplementing the design with simple artifacts reinforces the concept both structurally and psychologically, establishing security while simultaneously enabling the form to be rapidly reproduced en mass. Reclaimed pallets as an architectural material isn't a particularly new concept, but perhaps this is just one potential function they can serve in a larger system. Other applications, and a short list of other equally abundant and simple artifacts, can further enhance the functions suggested by the forms.

Artifacts

Balance must be struck between the urge to add supplementary artifacts to improve the spaces and maintaining the simplicity of the tactical approach. Artifacts must initially be plentiful (ideally), but as the winter experiment continues each year, specific demands will be identified and the list of artifacts may expand. However, until then the three essential items will be examined: pallets, blankets, and oil drums.

Covering the top side of the pallets with a thin sheet of plastic was originally intended to act as barrier to keep snow and melt water from directly seeping through, yet the pallets immediately resembled timber concrete forms with a slip surface, or smaller versions of the forms used at Breckenridge. The same metal clips can be used to secure the forms varied configurations, backfilled and sintered, removed (or stored on site), and finished using the same sculpting tools. When not required for formwork the pallets can serve as raised decking above the ground surface for improved traction or simply to keep visitor's feet dry and out of the snow.

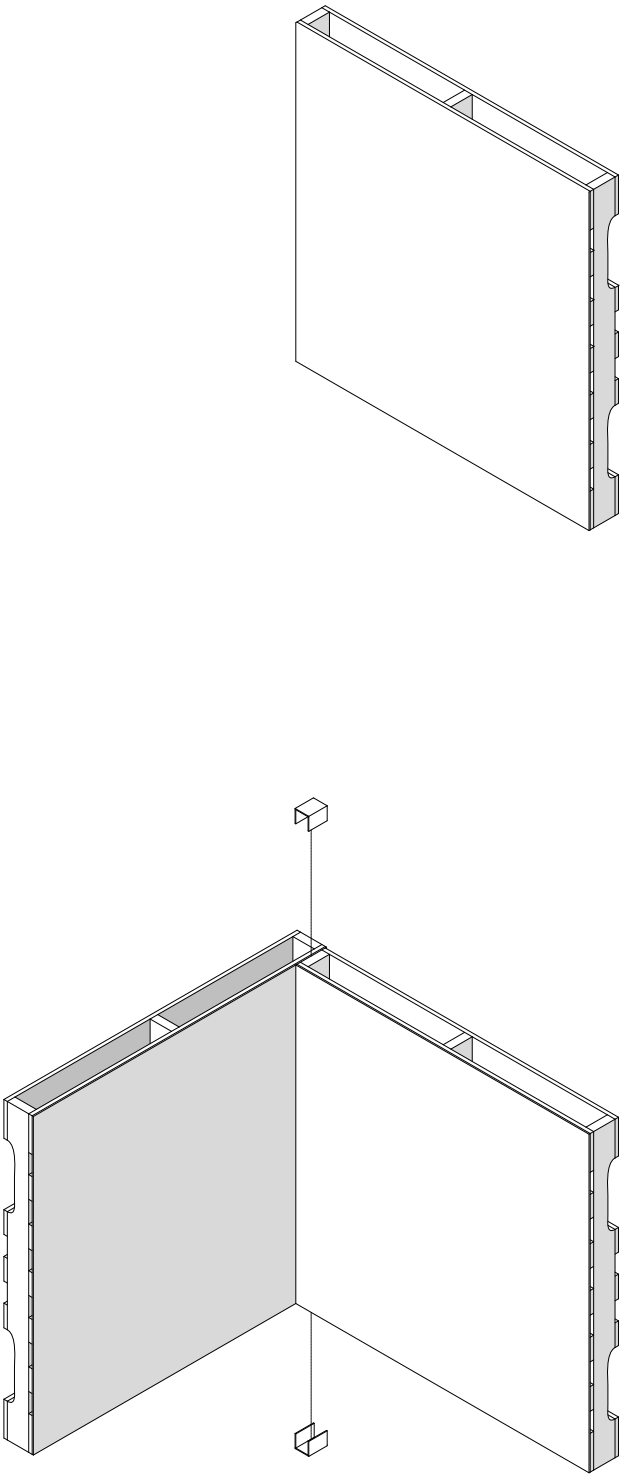
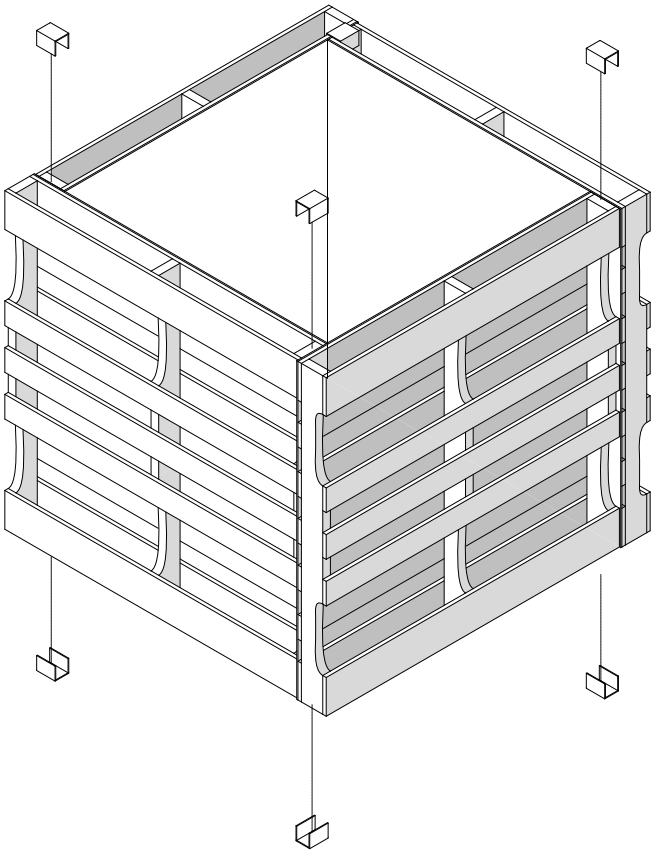


fig. 5.26 Form Construction



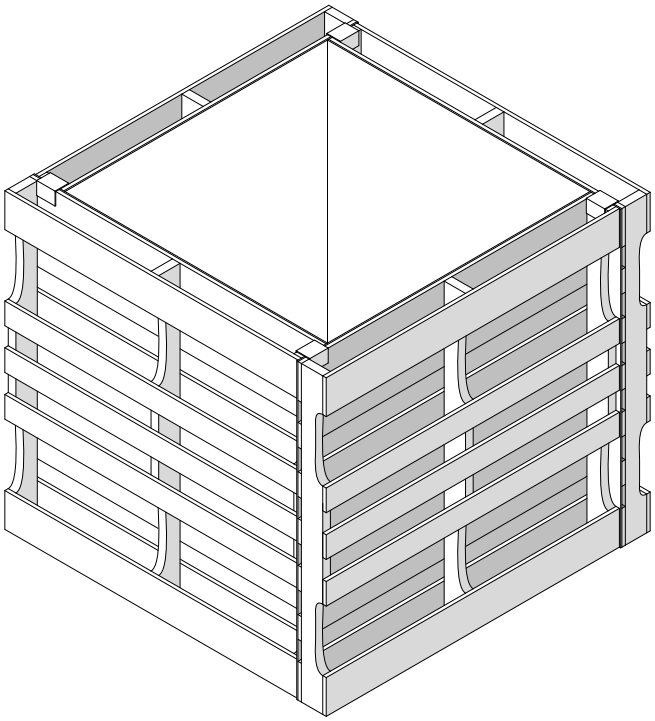


fig. 5.27 Form Construction - Cont

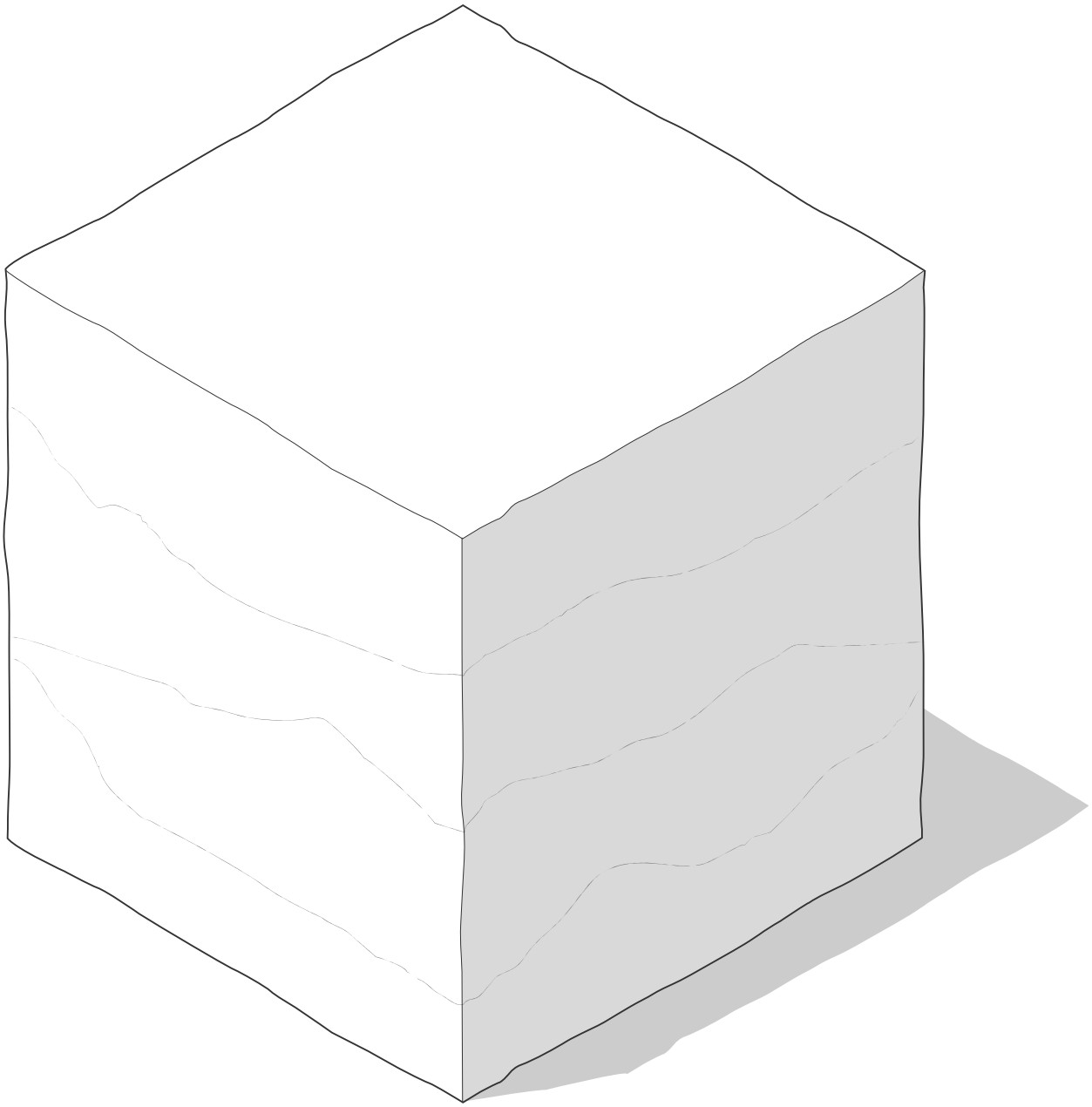


fig. 5.28 Snow Form

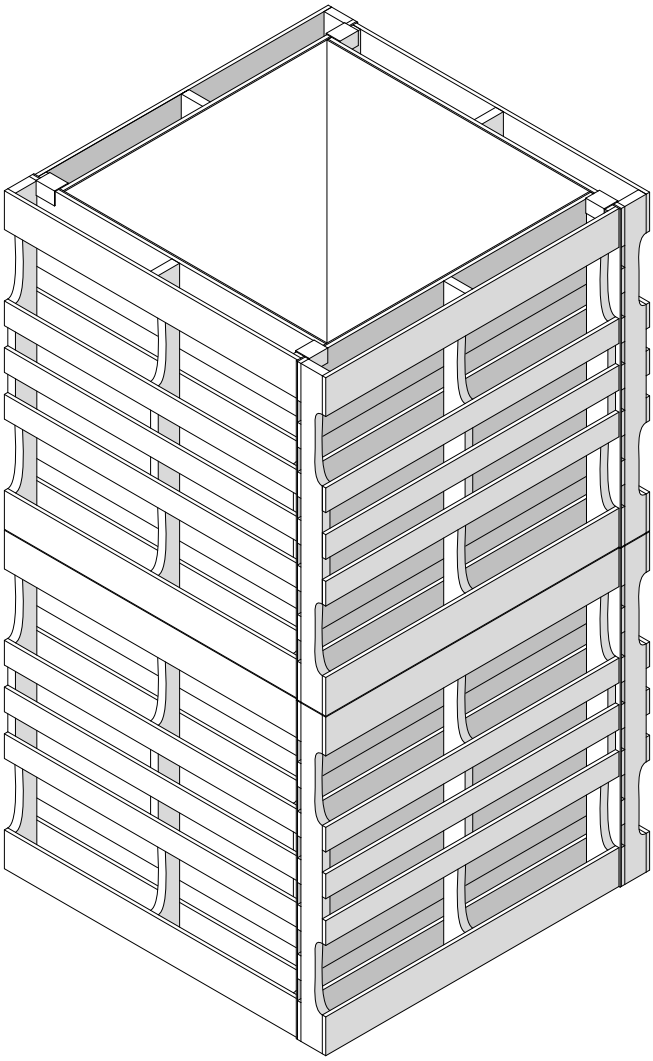
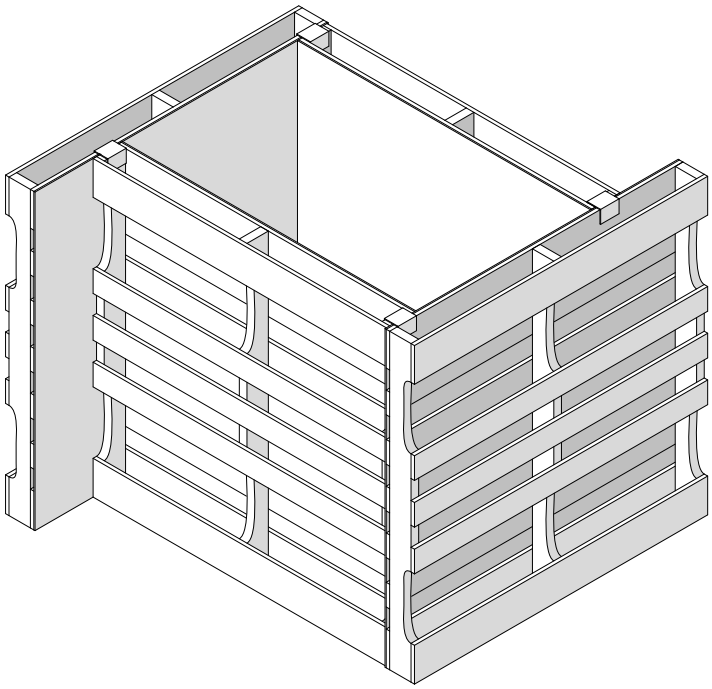


fig. 5.29 Form Variations



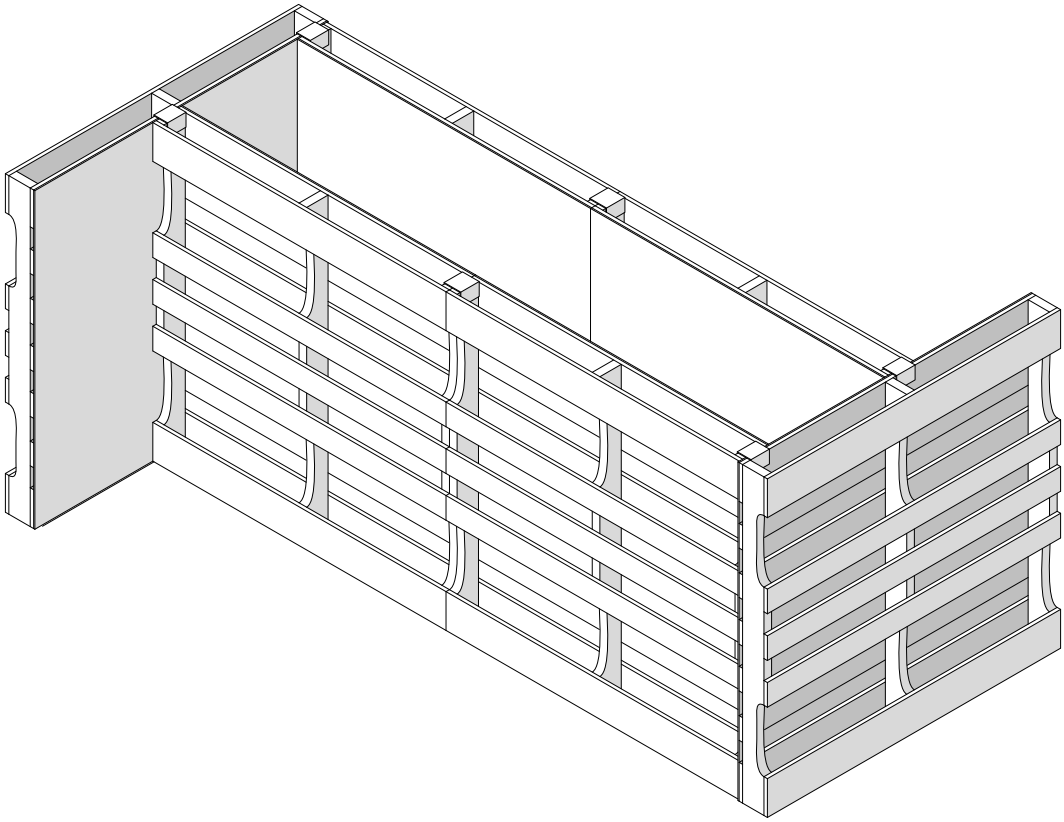


fig. 5.30 Form Variations - Cont

Pallets can be distributed via two means: either delivered using open space on the municipal trucks and trailers when they are deployed after snow events, or stockpiled in specific locations for pick up by the Urban Pioneers as required. Using pallets is a simple, cost effective means to reinforce or refine snow forms, or provide an insulative barrier between user and structure.

Blankets don't require much explanation for their primary purpose, but it is worth restating the dramatic effect they can have protecting the body from snow surfaces: simply adding a layer of wool slows heat loss by a factor of 30. Now that "keeping warm" is covered, blankets can have subtle effects on the spaces as well. To enhance the visual environment during the winter, Norman Pressman explicitly calls attention to the addition of colour[4]. The standard architectural approach would be for more investment into building facades and accent lighting, creating changes to the visual environment which could just as effectively be achieved with an assortment of fabrics populating the ground level. However, their most powerful use is as a tool to help introduce *hygge* into prairie winter culture, removing just a few more excuses to stay indoors and tempting activity to occupy the winter streets.

Micro-climates can easily be created using snow and the visitors window of comfort extended with blankets, but for many programmatic choices supplemental heat must be added to best activate the terrain vague. Another ubiquitous item, especially prevalent in oil dependant Edmonton, that can be appropriated are steel oil barrels. Coordination between the WinterCity Strategy group and the Fire Prevention Office can establish a rule set for Urban Pioneers to unlock the ability to enhance their figurative campfires with real ones, and bring point sources of energy into the Edmonton winter. Despite being cast with such a negative image by popular culture the oil drum is a very efficient option for fire control, and if anything this "rustic" image enhances the intent of the thesis by focusing on the primal nature of the three materials: snow, air, and heat. Oil barrels are lightweight, inexpensive (especially compared to propane heaters), and durable; ideal attributes for rapid distribution and flexibility of designs for all Urban Pioneers, not just the best financed. A $15 oil barrel and a few cords of wood can activate a space for hours into the night, and months into the heart of winter.

Just as Tactical Infrastructure is a first step, so too are the artifacts. With the potential for rapid turnover in each site the generation cycle can be deliberately shortened, accelerating the evolution of the forms, functions, and artifacts. Initially simple, the experiments undertaken by the Urban Pioneers will reveal

4 Mänty and Pressman, 61.

fig. 5.31 Artifact - Blankets

Source: http://keehuachee.blogspot.ca/2014/01/carouge-is-genevas-greenwich-and.html

fig. 5.32 Artifact - Oil Barrels

Source: http://www.trashorchestra.org/2008/01/

specific demands and hidden niches which may require innovative design solutions and the artifacts should be no means be forced to remain generic. A speculative design is for the tactic of snow forms in the terrain vague to be reinforced with mobile, programmed, and temperature controlled bus shelters (Appendix B). Speculation and thought exercises are effective means of planning, but at the core of this thesis is an ethos of experimentation.

Ice Theatre

In February 2016 I attempted to build my own space in an unused space located at the University of Waterloo School of Architecture. With a simple snow shovel I began to stockpile within a little used courtyard to convert the space into a small outdoor movie theatre. The winter was remarkably warm and the snow did not accumulate in sufficient amounts and promptly melted. Two weeks after my failed attempt, the Canadian Broadcasting Corporation covered the story of Graham Whatmough, a man in Fort McMurray, and the construction of his own ice theatre in Thickwood Park[5]. While at first annoyed that I had been beaten to the punch, I was later relieved: ideas for unorthodox program were shared by others, and if I was crazy to suggest it at least I wasn't alone.

On April 4, 2016 there was finally a significant overnight snowfall, and on a Sunday at midnight work began anew, and six hours later three forms began to emerge. Left to sinter throughout the day, the masses were sculpted into shape the following evening using a hand saw, shovel, and wooden trowel. A protective housing was built for speakers, a laptop, and projector, blankets were spread over the seating, hot chocolate and snacks laid out, and the space was open for the student body. The real test was seeing how long a visitor would stay. While several stopped for only as long as it took to grab a few cookies and have a warm drink, an equal number remained on the couches for as long as 40 minutes, and an average stay of 15-20 minutes.

Whatmough stated his theatre took him a week to construct as the snow conditions were less than favourable and his site relatively remote[6], my own ice theatre in a more forgiving setting took approximately 10 hours of labour over the course of two days. With the aid of a bobcat, construction would have taken perhaps one hour and sculpting remained largely the same. In only three hours of work a space roughly the size of a townhouse lot can be transformed from a completely unused space into a functioning mini-theatre.

5 CBC Edmonton AM, "*Fort McMurray man builds outdoor theatre out of snow,*" http://www.cbc.ca/news/canada/edmonton/fort-mcmurray-man-builds-outdoor-theatre-out-of-snow-1.3449872
6 CBC Edmonton AM.

fig. 5.33 Fresh snowfall - Gathering Snow

fig. 5.34 Forms: to block, to step, to step

fig. 5.35 Forms: to step

fig. 5.36 Refinement of forms

fig. 5.37 Refinement of forms

fig. 5.38 Function follows form

fig. 5.39 A distraction

fig. 5.40 [tactical] Infrastructure

Dynamics

The temporal nature of snow introduces additional layers of possibility into the interventions. The "lease" of the terrain vague might be determined in advance, but the climate during that period will have a dramatic effect on the forms and program within. Working with such a dynamic material must also consider this innate uncertainty and be incorporated into the lifespan of the design.

After documenting the disappearance of the snow theatre, the most notable changes were the overall loss of mass and a decrease in density as the smaller crystals melt first, leaving a weakened, glassy ice matrix. While I was unable to progress this design (winter was effectively over from this point), in future applications the forms could simply be repaired with the addition of more snow and compaction back to the original state. Alternatively, the decreased density makes the snow malleable once more allowing for transformation in form and function (eg. a barrier transforms into a ramp, reversing an obstacle into a path), or making complete recycling of the material on site easier for smaller equipment.

While unintended during construction, the dynamic melting of the screen highlights another design opportunity - the deterioration of form can be programmed into the material. To create the screen, snow was piled in the desired location, compacting the material manually with each lift and placing the amounts that sloughed off onto a flattened top. To maintain the "sides" of the form, extra compaction was applied throughout the process, creating higher densities at the form's extents and higher resistances to the melting forces. Once the exterior of least compacted snow had melted largely uniformly, the differing densities in the remaining mass became evident, first appearing in the April 11 entry in fig. 5.41. After multiple iterations some expertise in controlling the natural behaviour of snow can be developed, allowing for almost living architecture where after construction it automatically responds to changing thermal forces. Snow objects could potentially be nested within each other, using differing construction techniques to make one more robust, with the hidden being revealed as the sun and wind slowly deteriorate the material.

Just as the availability of the material and spaces, and capabilities of the equipment, have been overlooked, the possibilities afforded by the unconventional behaviour of snow must also be embraced. It is all too easy to equate ice to concrete, but the dynamic nature of ice and snow contains unexplored spatial experiences so different from the nature of our cities of concrete.

April 4, 2016
-3.5 °C / 9.3 mm snow

April 7, 2016
6.6 °C / 13.4 mm rain

April 8, 2016
2.9 °C / 0 mm

April 11, 2016
9.7 °C / 11.1 mm rain

April 12, 2016
5.0 °C / 0 mm

fig. 5.41 [temporary] Infrastructure

Analysis

Recycled pallets, a wholesale order of blankets, a couple oil drums, and a huge pile of snow are all the materials one would need to transform a barren city lot (or an unused courtyard with even less), with almost limitless permutations short of providing a roof. Four simple ingredients and borrowing a few of the City's employees and resources can create the forms and program to satisfy Pressman's fundamental approaches[7]:

> 1. "***Do not overprotect man from nature.***" The visitors are not overprotected, the winter sky is clear above their heads and no doors seal them in. They are surrounded by tectonics which can *only* exist during the winter, interacting directly with winter's forces instead of hiding behind heated glass boxes.
>
> 2. "***Provide protection from undesirable elements.***" The visitors are sheltered by that which they once shunned. Basic, environmentally conscious architectural principles are employed using unconventional materials in conventional ways, creating micro-climates within the urban fabric which dramatically improve local conditions. The installations provide as much shelter as possible while still being completely open to the surrounding air, but through material choices, orientation, and addition of artifacts the primal design is in fact working as hard as possible to lessen the impact of polar forces swirling just metres away.

Spatial awareness is the critical element for uniting Edmontonians with an appreciation of winter. If the pieces within the terrain vague become intricate, perfect objects they themselves become the focal point which pushes the perspective the wrong direction. Simplicity of the forms and artifacts frees the subject's attention by removing the distraction of the adverse conditions through the tailored micro-climate, and also from their modesty. The objects become ancillary to the activity they produce and frame, freeing the awareness of the visitor to remain on the experience of the transformed space and season while still remaining prominent enough for the knowledge that the same experience is only possible because of the winter.

At this point the tactic has been assembled as comprehensively as I can prepare it without lessons from full scale deployment; what remains is the strategy, how deployment of these tactics within Edmonton may reshape the urban fabric in a manner that will bridge the city and its people to the northern reality.

7 Mänty and Pressman, 23.

Winterscape

fig. 6.1 10746 Jasper Avenue

STUDIO
107
DANCE CLUB

-scape, comb. form

Forming nouns denoting a view, picture, or (literal or figurative) landscape of a type specified by the first element, as ***Cityscape n.***, ***Mindscape n.***, ***Moonscape n.***, etc

(Oxford English Dictionary, s.v. *"-scape"*, accessed November 2, 2016, http://www.oed.com/view/Entry/233395?result=9&rskey=vpGK2y&)

Drosscape, v.

1. The act of shaping or resurfacing dross, or waste, and reprogrammed by human intentions.

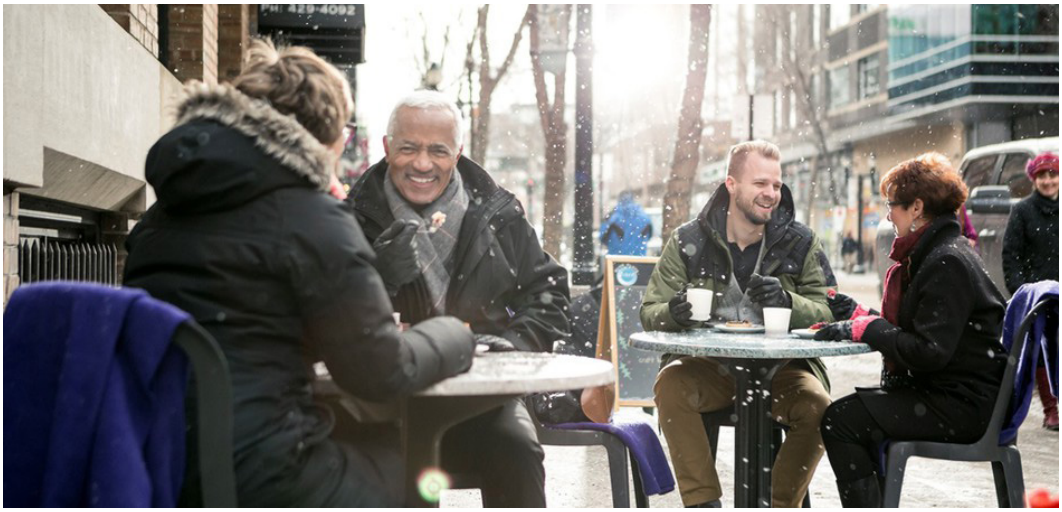
2. The creation of a new condition in which vast, wasted, or wasteful land surfaces are modeled in accordance with new programs or new sets of values that remove or replace real or perceived wasteful aspects of geographical space.

(Berger, 236.)

Winterscape, v.

The creation of a new urban condition in which urban fabric is transformed through introduction of new programs and new sets of values by manipulating polar elements and forces.

Cafe Bicyclette



Blue Plate Diner

Blue Plate Diner
Winter Patios, source: http://exploreedmonton.com/attractions/winter-patios

fig. 6.2 One foot in the snow

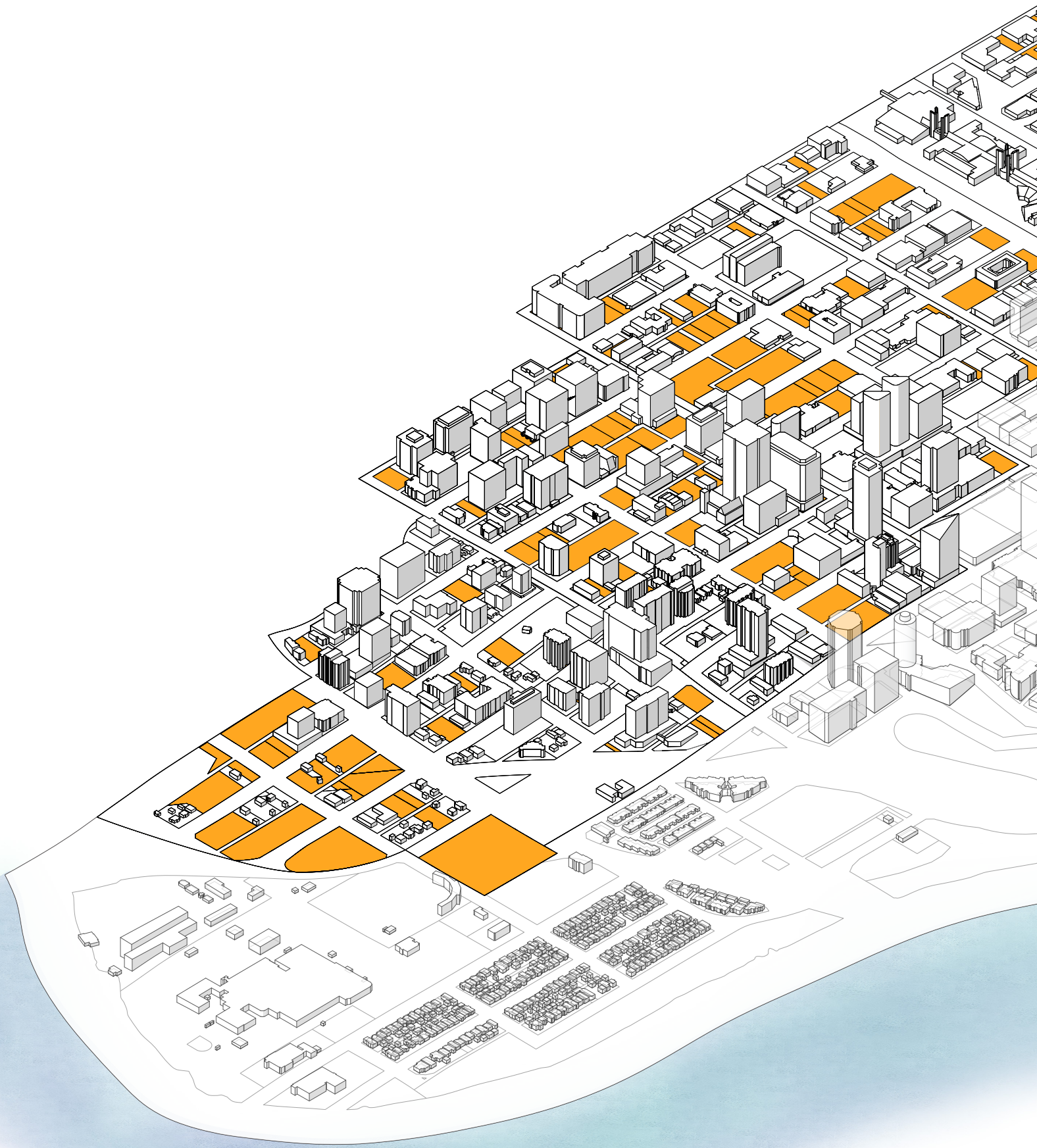
A cultural shift has started within Edmonton thanks to both City initiative and efforts by the private citizens. Instead of the occasional brief winter festival, near daily events and activities are being promoted by groups like Winter City Edmonton, and are organized for ease of access - with one Facebook like anyone who is interested can capitalize on the efforts of those across the city[1]. Daily life is also improving with all year (or at least extended) patios (fig. 6.2), but the structure of the city remains static. Beginning with a ring around the downtown core, Tactical Infrastructure can be introduced to the citizens of Edmonton to amplify the spirit and successes of the existing Winter Pioneers. What remains is to design and speculate what Tactical Infrastructure will produce under their guidance.

The Ring of Dross (fig. 6.3) surrounding the downtown centre wheels through a spectrum of neighbourhood characteristics, each with its own audience and unique condition. The Ring itself was determined by the concentration of undeveloped lots surrounding the downtown core, drawing lines to encapsulate the greatest concentration of terrain vague - while there is vacant land scattered throughout the city, the moat of gravel and asphalt surrounding the heart of the city is remarkable. The Ring is catalogued into six districts based upon their differing demographics, and provide a description of their history or present condition, the location and condition of the terrain vague, and the surface treatment of each lot. The designer can use the catalogue to locate a suitable terrain vague for an already conceived project, or begin with a vacant lot in mind and tailor an indistinct proposal to suit the unique character of the space.

Following the districts are a series of potential intervention strategies, each in a different site performing a different service to the community, illustrating the formal conditions created by snow, wind, and fire, and their subsequent changes to the micro-climates they contain.

While some of the districts do not have interventions located within them, they are by no means less important than the others, and it must be stressed that these summaries are a broadly perceived character of each area and how the city overall may expect their use: the sample designs are intended as suggestions, not prescriptions. The detailed, true character of each district is only known collectively by those who inhabit the space, and it is the interaction of the immediate locals who will give the most powerful feedback into the winter design experiments, and the forms will evolve from these beginnings over time.

1 Winter City Edmonton, *"Upcoming Events,"* Accessed January 15, 2017. Source: http://www.wintercityedmonton.ca/events/



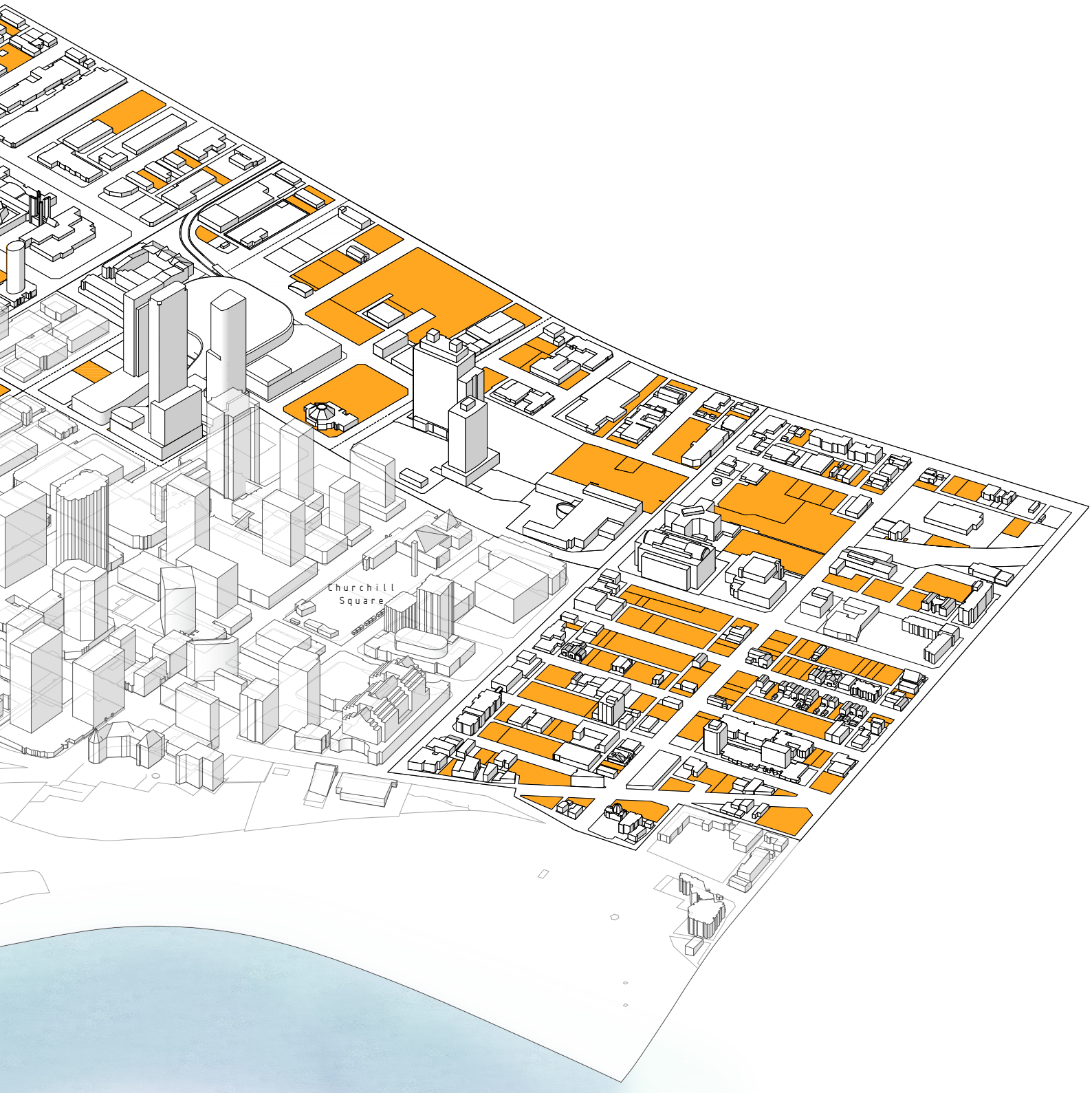


fig. 6.3 A Ring of Dross

River Valley

Located at the southern tip of the River Valley district, Rossdale is one of Edmonton's oldest neighbourhoods with a long history of First Nations activity and connections to fur trading posts for the original Hudson's bay company. Originally the neighbourhood was a populous district within the city core, but in 1915 the North Saskatchewan River flooded dramatically, damaging the local homes and businesses. In the aftermath many businesses did not return and Rossdale began a gradual change. Over the decades abandoned buildings were demolished and the ground was left to return to grass fields and treed areas, and to date is regarded as a low-income area[1]. Presently Rossdale is sparsely populated, particularly around the southern tip of the neighbourhood. Many of the grass lots act as temporary parking for the semi-professional baseball team arena, and for visitors to the river valley trails and water access points. Revitalization plans were awarded in 2009, but still no work has progressed[2].

Climbing up out of the valley across 97th Avenue is the southernmost fringe of the downtown core. While not as sparsely developed as Rossdale, there are several parking lots and grass patches within the suddenly dense urban fabric of mostly residential mid to high rise apartments, creating a sudden transitional space between the green of the valley and the concrete of the downtown.

Rossdale already possesses a brand within Edmonton - a gateway to the River Valley and the starting point for outdoor activity - which can extend into the southern edges of the downtown core.

1 Harold Kalman et al., "*Rossdale Historical Land Use Study*," Commonwealth Historic Resource Management Limited, prepared for City of Edmonton Planning and Development Department, (2004), v.
2 Carlyle and Associates, "West Rossdale Urban Design Plan," Prepared for City of Edmonton Planning and Development, Source: https://www.edmonton.ca/documents/PDF/West_Rossdale_UDP_CA.pdf (2010).

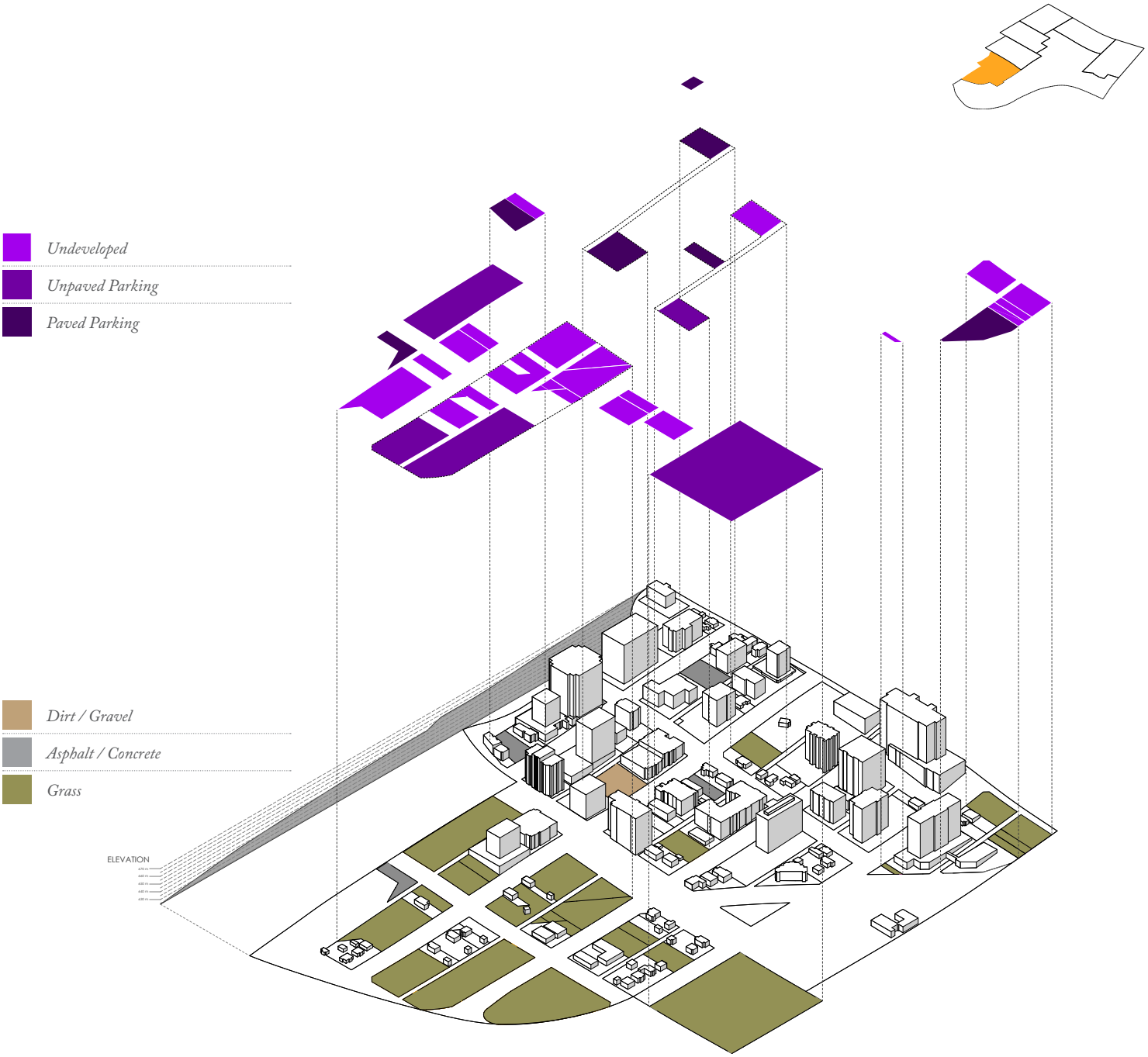


fig. 6.4 River Valley District Terrain Vagues

Hillside District

The south side of Jasper Avenue is the most developed portion of the Ring of Dross, situated on the outer ring of the central business district, but there is still an abundance of open land in the form of surface parking serving the surrounding office buildings. Dotted in between the office buildings are high rise apartments, condominiums, and hotels, giving this section a highly regimented period of street life. During the week there are surges of people moving through the area in the morning, over lunch, and the rush as offices close - heavily contrasted by the sudden serenity of weekends.

Hillside possesses the most even balance between commercial and residential structures within the Ring. While this creates an audience of potential repeat visitors to an intervention, there is lower possibility that a new visitor will encounter the space by chance. This situation creates an interesting duality: the spaces can either be tailored to suit the citizens already within the area, or be designed to invite the greater public to a neighbourhood they would seldom visit.

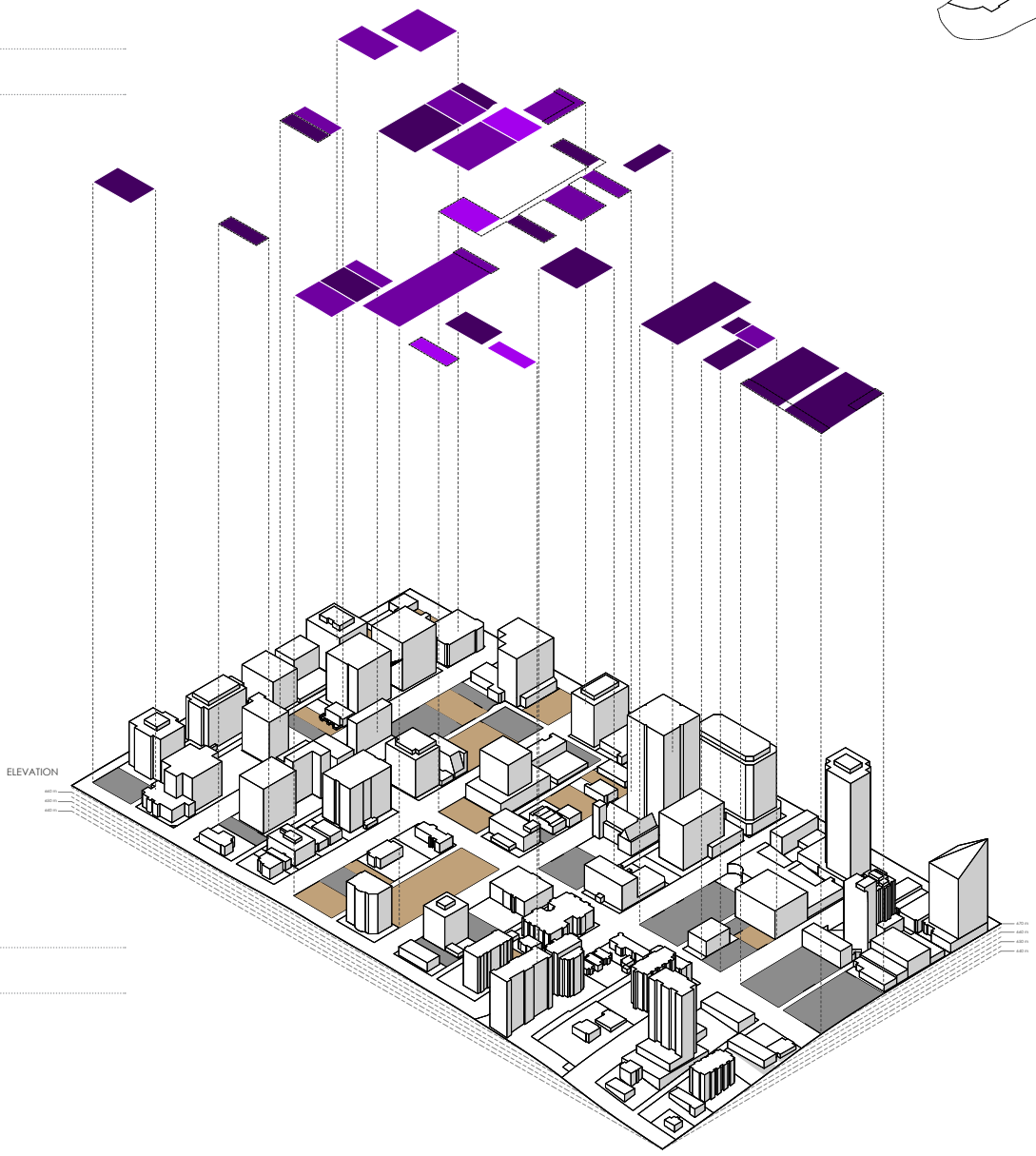
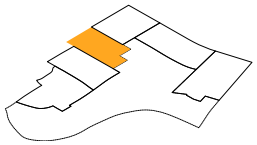


fig. 6.5 Hillside District Terrain Vagues

Warehouse District

Jasper Avenue is the "main street" of Edmonton - an arterial road carrying several heritage buildings, restaurants, bars, and venues, and from which the city expands to the north and south. There is, however, a sudden expanse of open ground where the city's warehouse district once stood. Steady expansion of the city limits drew businesses outwards, especially the completion of the West Edmonton Mall in 1981, leading to a decades long demolition phase of the warehouse buildings once populating the area between 104th and 108th streets. Now there are sections where one can see across three city blocks, straight through what should be the dense downtown core.

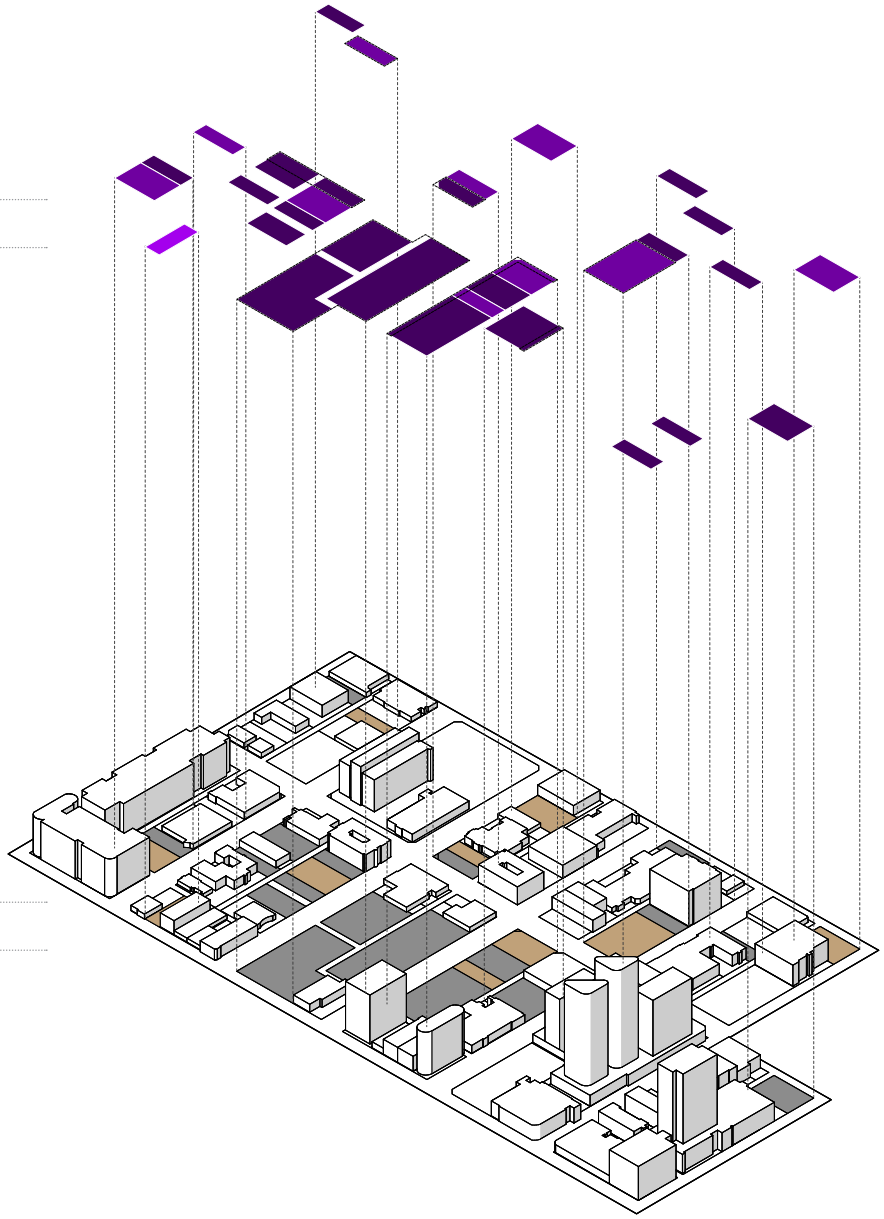
Covered in parking lots and with several major bus stops along the edges, this district is an active stopping point for commuters entering the downtown making this an area for the most temporary visitors, appearing a modest walking distance from their ultimate destinations. The diversity of end-point activity however, from business to leisure, residential, and reasonable proximity to the Grant MacEwan college, gives the Warehouse District some of the greatest depth of program options for winterscape interventions.



Undeveloped

Unpaved Parking

Paved Parking



Dirt / Gravel

Asphalt / Concrete

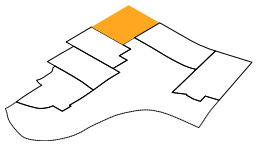
Grass

fig. 6.6 Entertainment District Terrain Vagues

Academic District

The Academic District is so named because it is centred around Edmonton's second largest post secondary institution Grant MacEwan College. Thirty years ago this area of the city was as covered with parking lots as the Warehouse District to the south, but the construction of "Grant Mac" and supporting student residences have permanently replaced many of the former terrain vague. Mid-rise condominiums are beginning to enclose the school from the east, west, and south, while the lots to the north are a mix of leased industrial buildings containing everything from dance studios to labour union offices. To the north, outside of the district, are the nearest of the low density housing neighbourhoods which comprise the majority of Edmonton.

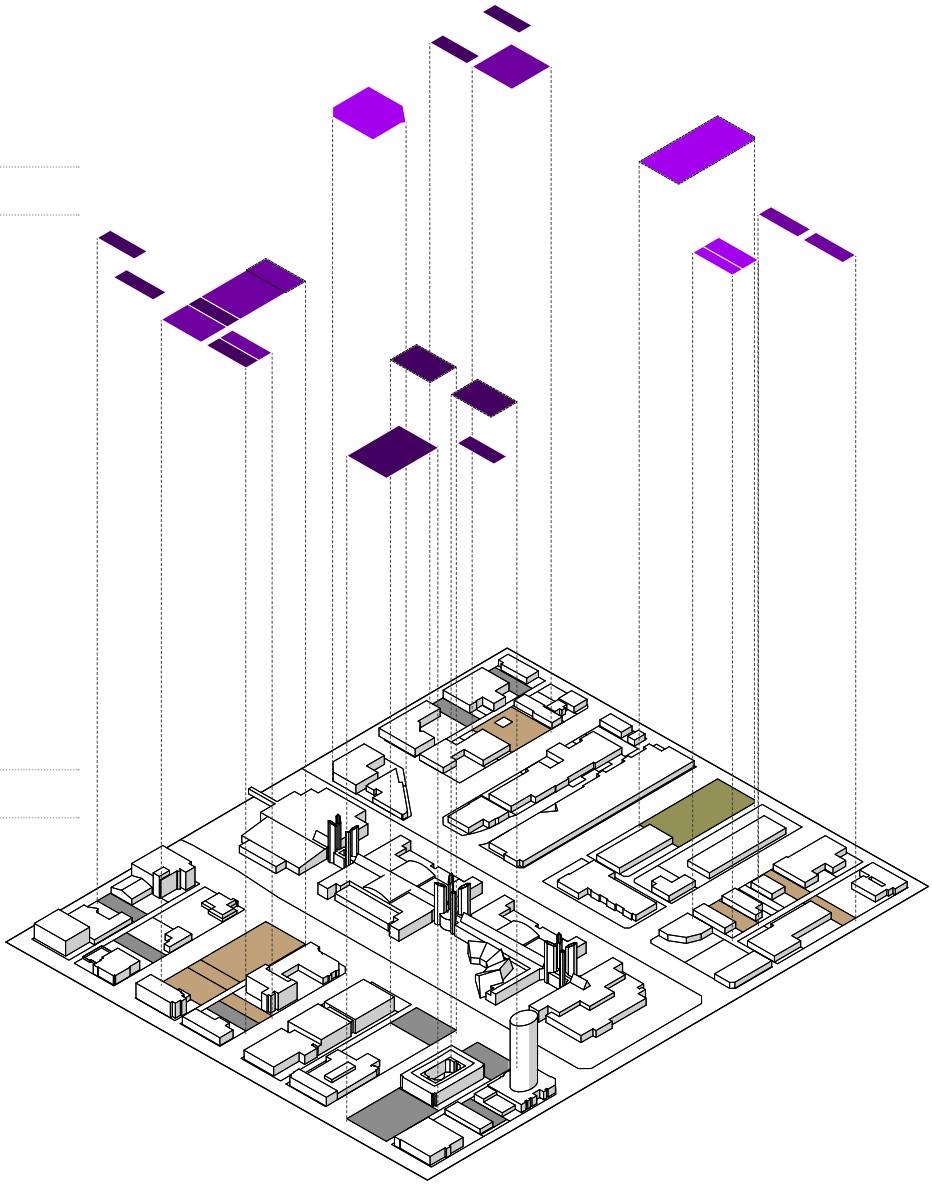
One block north of the district is 107th avenue, officially named the "Avenue of Nations" due to the multiple ethnic groups which have settled along the arterial road after immigration, which introduces intriguing programmatic options when combined with the educational presence and the potential of unexplored winter cultural exchange.



Undeveloped

Unpaved Parking

Paved Parking



Dirt / Gravel

Asphalt / Concrete

Grass

fig. 6.7 Academic District Terrain Vagues

ICE District

The once lifeless strip running east to west above of City Hall is now completely unrecognizable. The solitary CN tower (not the famous one) suddenly found itself flanked by the monolithic Epcor office tower, and the new Royal Alberta Museum (RAM). More recently, two city blocks to the east of Grant MacEwan have changed from surface parking into Canada's into the ICE District, hosting the newest NHL arena with three new high rises at its toe already reaching skyward, and more scheduled to appear within the next three years. One of the key features of the ICE District is a year round programmable public plaza - another well intended move, but potentially another Mediterranean relic. The public plaza design only exists in concept renders, so full critique must be reserved, but the plans do utilize the new high-rises as windbreaks. The area has even seen some (mixed) success with Tactical Urbanism converting a former rail overpass into the LIVINGbridge, a community garden which is sadly abandoned during the winter.

While major developments have occurred there is still an abundance of dross which can be incorporated into the new face of the neighbourhood. Affluent tennant and office workers will increase in number, and the proximity of the city's NHL team and the provincial museum and Art Gallery of Alberta increase the exposure of the terrain vague and the potential for expanding the cultural elements generated by those venues.

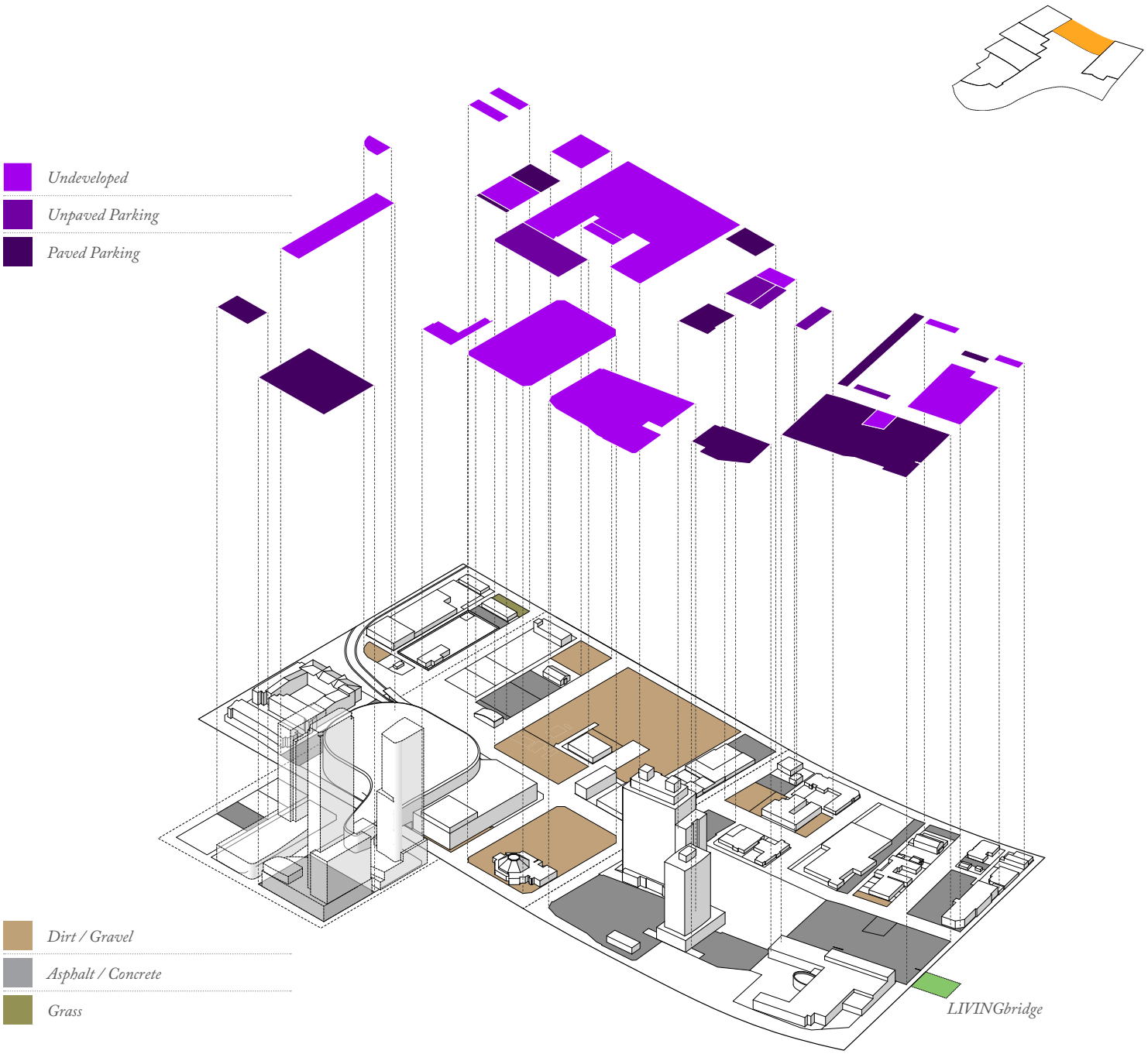


fig. 6.8 Cultural District Terrain Vagues

The Quarters

By far the most downtrodden area of the city centre, possibly all of Edmonton, 41% of the Quarters is either parking lots or simply empty. Much like Rossdale, the Quarters was once the centre of Edmonton, but the construction of the Provincial Legislature and the High Level Bridge pulled development and commercial interests westward. As property values dropped, vacancy rose along with crime, and the neighbourhood built an unsavoury reputation[1]. The western edge of the area is bordered by 97th street, home to most of Edmonton's Chinese neighbourhood and businesses, the river valley to the south, and low density residential everywhere else. Also similar to Rossdale, the Quarters is also planned for revitalization, but in this case the first phase has begun with The Armature - a linear park, pedestrian-oriented street running down 96 street, acting as a spine for future commercial and residential developments. The southern tip of the Quarters may soon find itself home the Aldritt Tower, an 80 story hotel and apartment building (double the size of the largest existing towers), having narrowly been approved by city council and largely negotiated behind closed doors[2].

The area has a diversity of ethnic communities, volunteer organizations, and residents concerned with future developments which can act as primary agents for the transformation of such abundant unused space.

1 City Of Edmonton Planning & Development Department, "*The Quarters Downtown Urban Design Plan,*" Source: https://www.edmonton.ca/projects_plans/the-quarters-downtown.aspx, 11.

2 Stolte, Eloise, "Council votes 7-5 in favour of the 80-storey Alldritt Tower," The Edmonton Journal, Source: http://edmontonjournal.com/business/commercial-real-estate/council-votes-7-5-in-favour-of-the-80-storey-alldritt-tower, Accessed April 27, 2017.

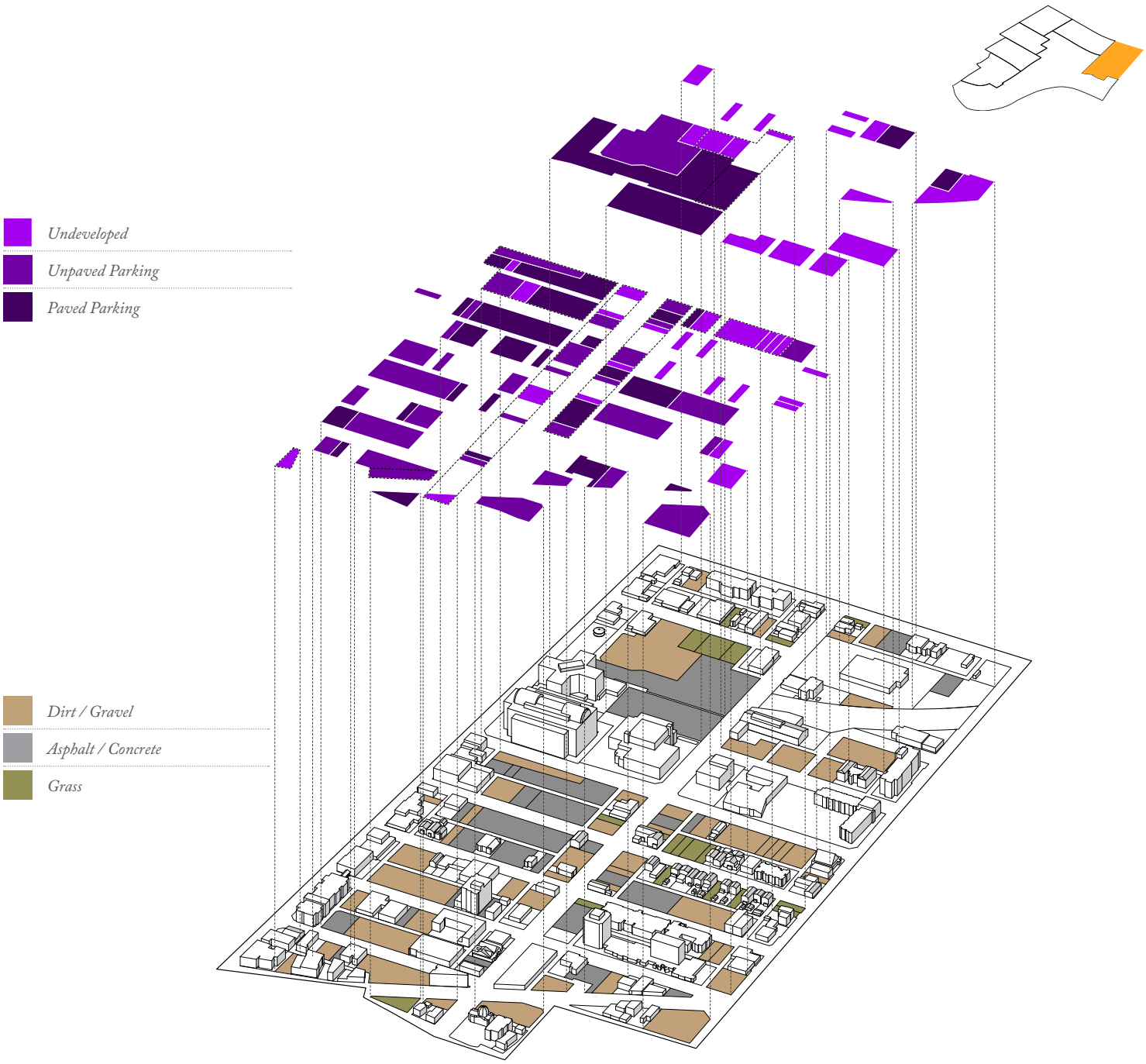
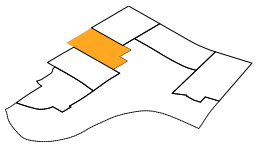


fig. 6.9 Rejuvenation District Terrain Vagues

Utility



Location: 107th Street to 106th Street, Jasper and 102 Avenue
Current Use: Paved and unpaved parking
Suggested Use: Staggered wind barriers
Description: This square block is one of the most visible blights of dross in Edmonton's downtown core. Where some sections of the demolished warehouse district were rebuilt, this square block was claimed mostly by daily parking services and has remained untouched for years. In an entire city block there are only six small buildings, and a clear path of parking lots bisects the city for almost 400 metres. Where possible, the snow deposited within the parking lots should be collected and piled high at tree plantings, property lines, and between parking rows to create a series of staggered wind barriers to introduce turbulence slowing winds as they progress across the street. There are also several bus stops with high use that offer token protection for users - tiny, unheated glass boxes. Additional barriers which extend as many directions as possible will provide some additional shelter for people waiting, potentially occupied by entrepreneurs - news stands selling warm drinks, artists, snow forts for waiting children to distract themselves, etc.

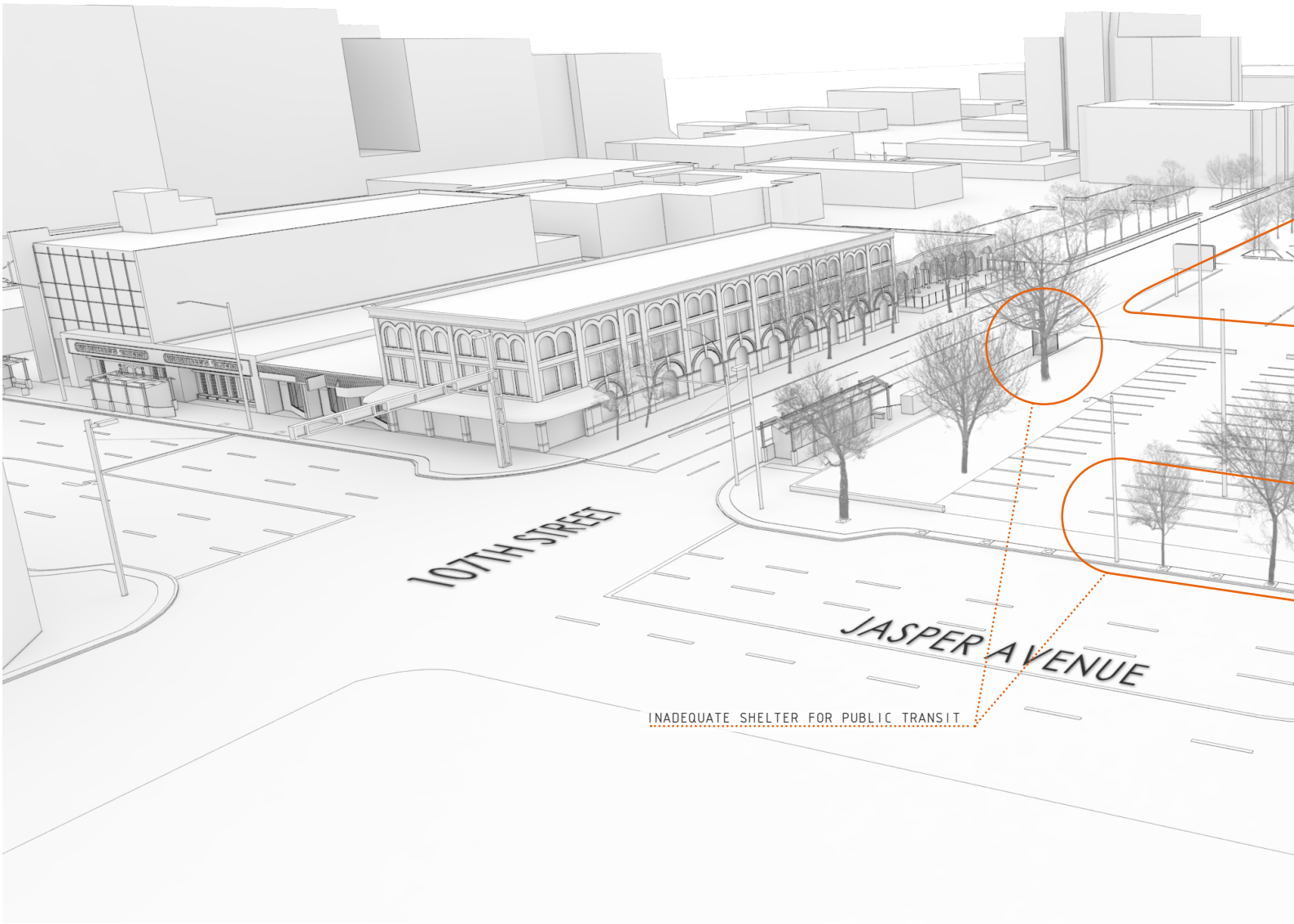
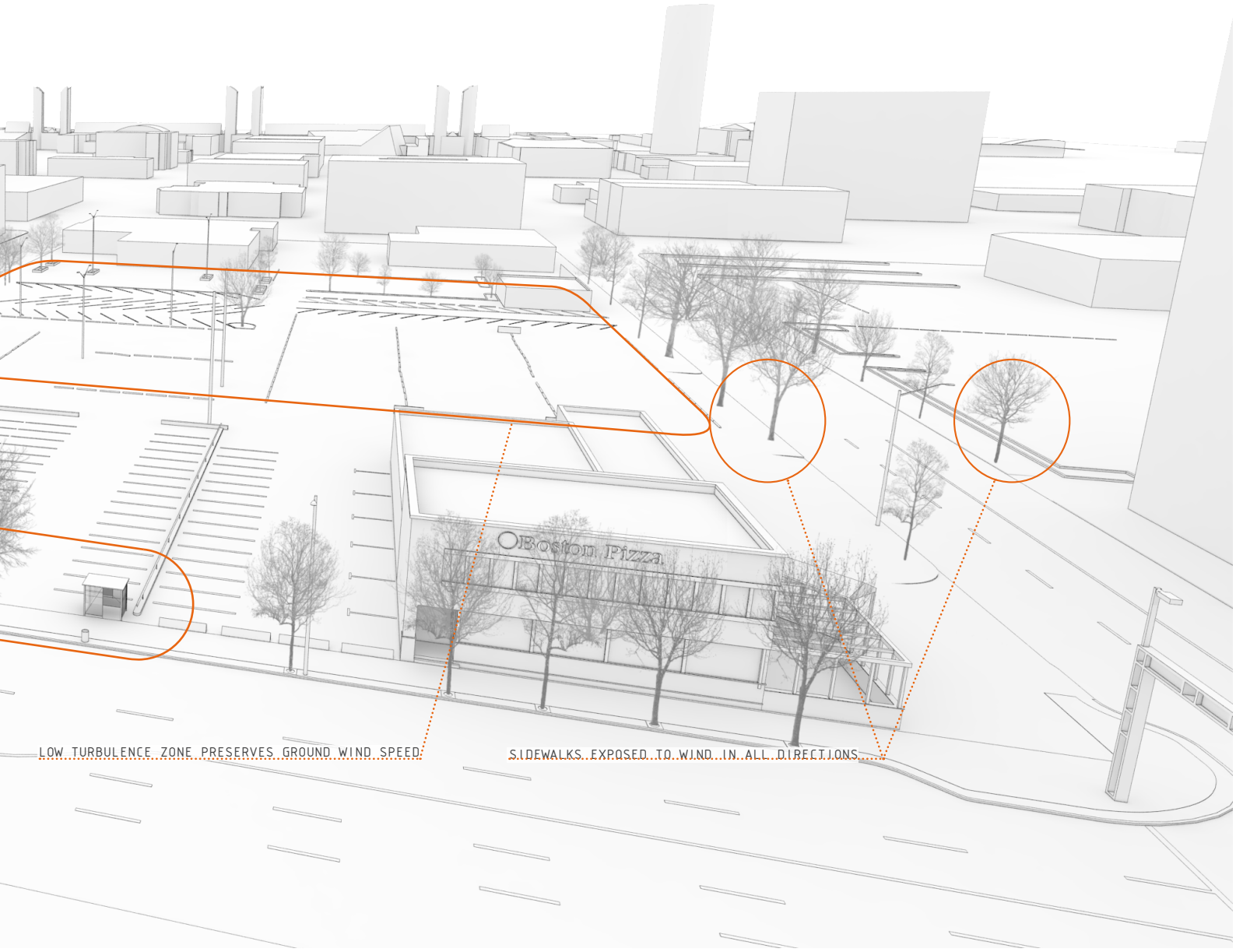


fig. 6.10 107th Parking Lots


Boston Pizza
LOW TURBULENCE ZONE PRESERVES GROUND WIND SPEED
SIDEWALKS EXPOSED TO WIND IN ALL DIRECTIONS

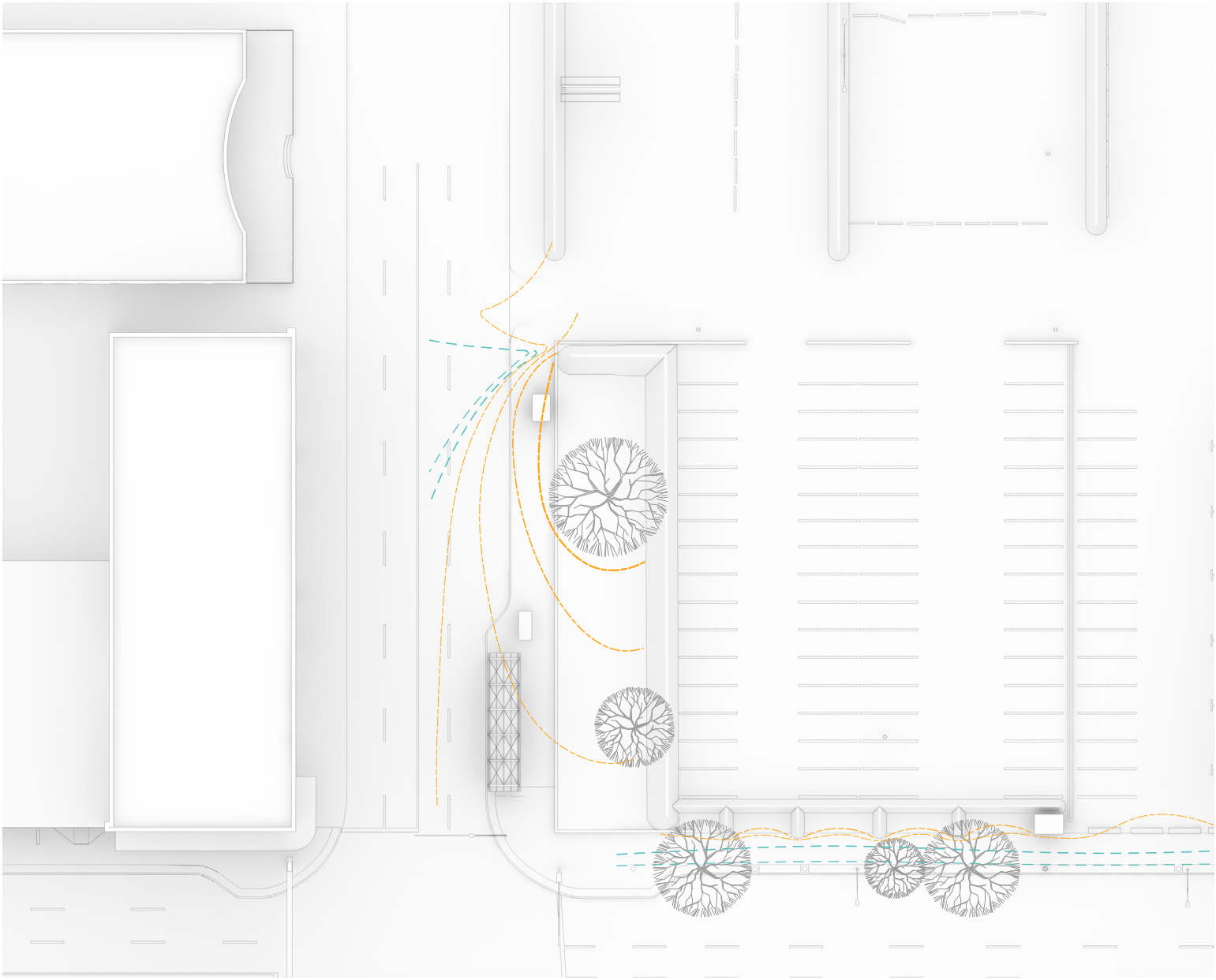
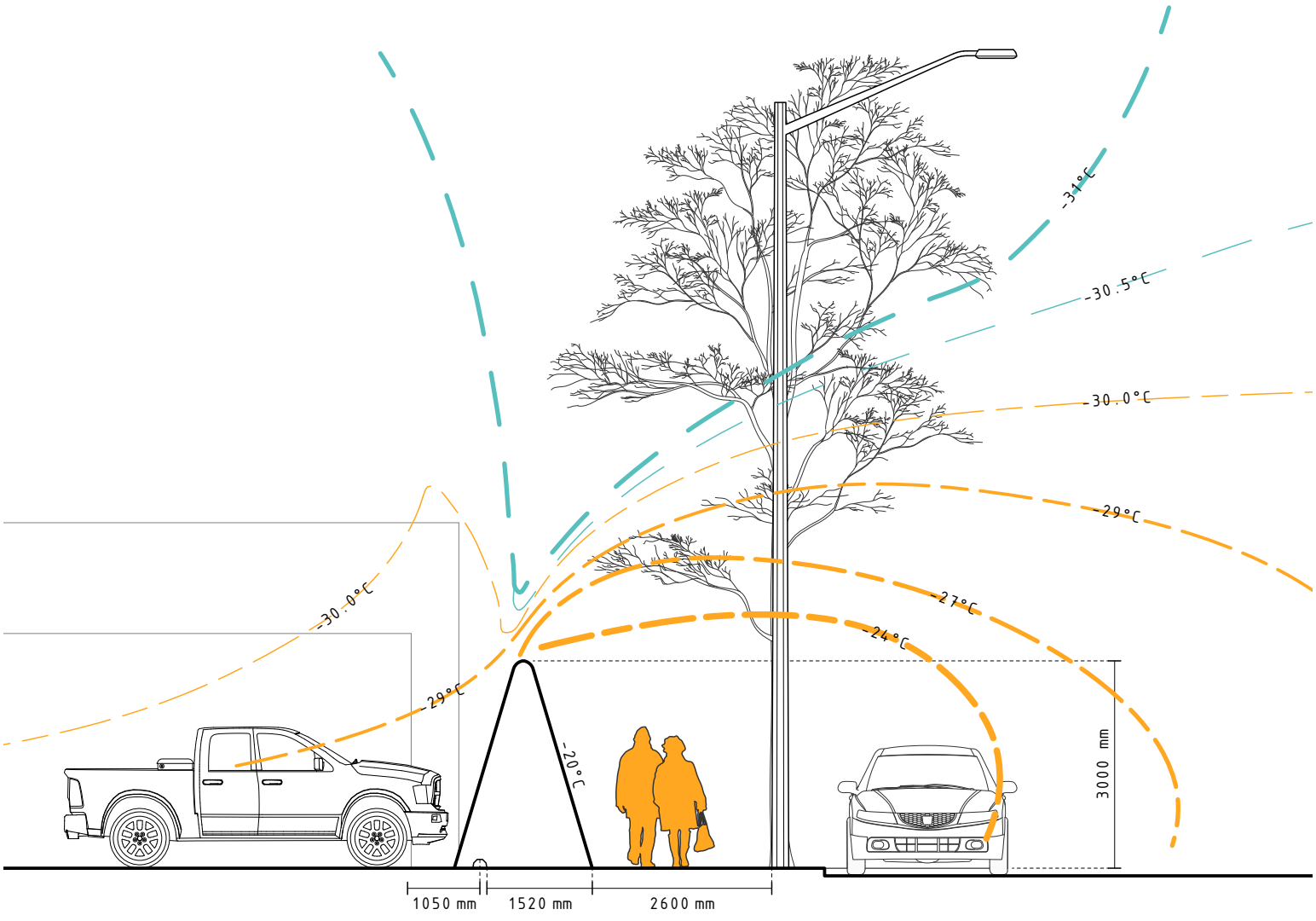


fig. 6.11 107th Utility Details



Ambient Conditions: -20°C with 20 km/h wind

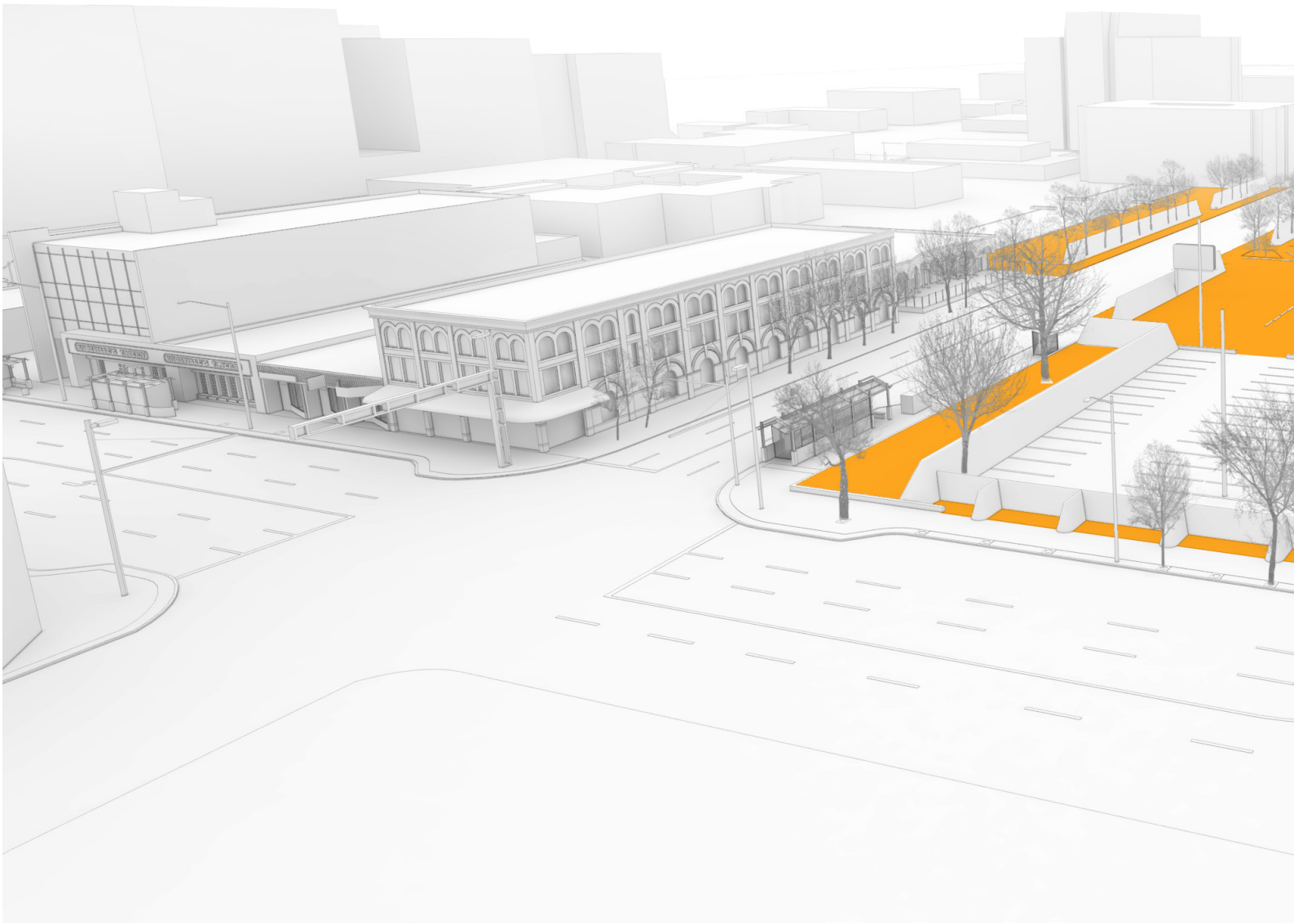
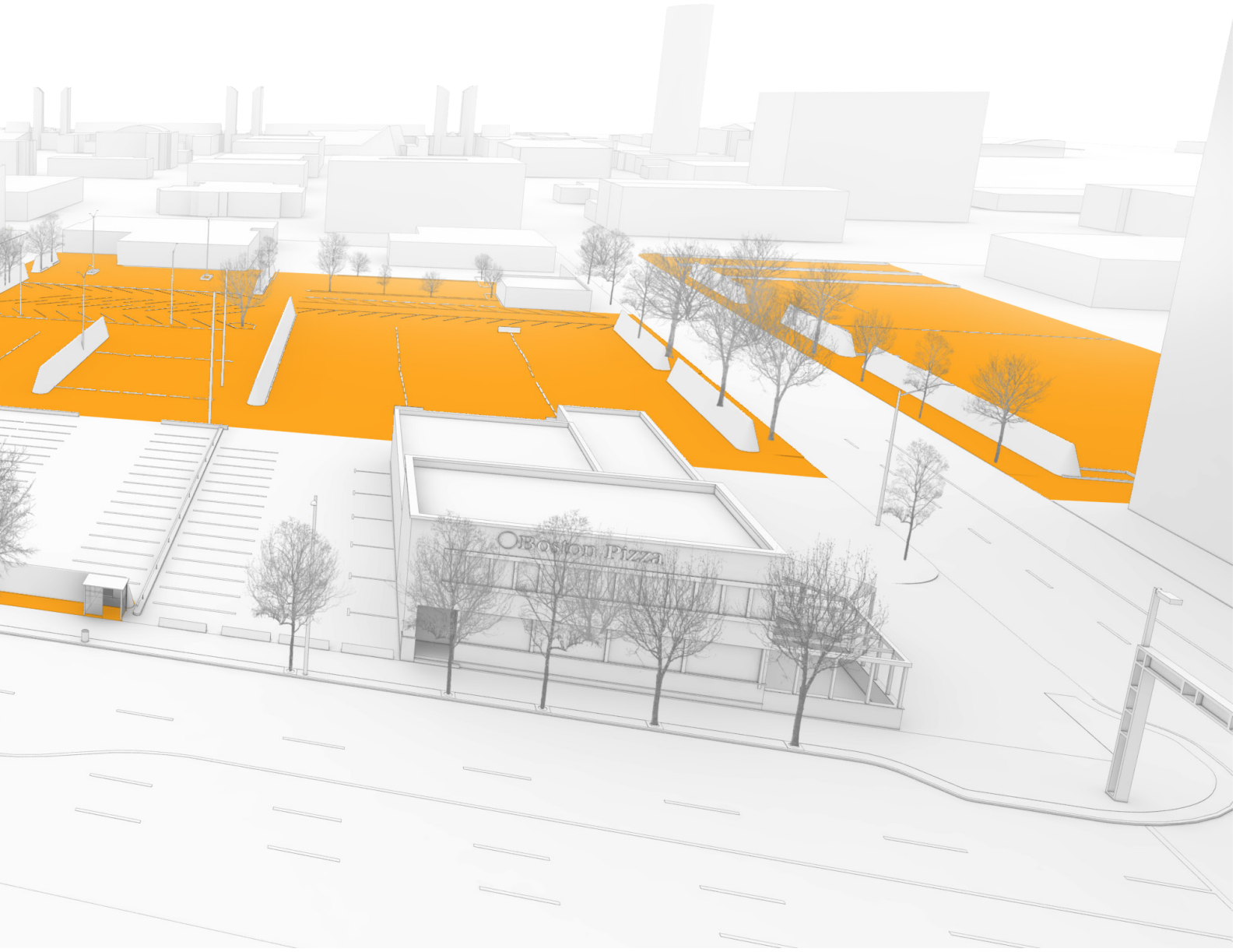
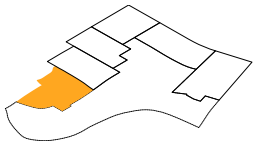


fig. 6.12 Utility


Boston Pizza

Winter Park



Location: Rossdale Neighbourhood, southern edge of Downtown
Current Use: Unused green-space and surface parking
Suggested Use: Outdoor activity district
Description: Since the early 1900s the Rossdale has undergone a slow decay - once the site of the original Fort Edmonton trading post, it is now a largely undeveloped area adjacent to the river. There is rich potential to connect to both the history and geography of the river valley. Memories of the former houses and buildings can be recreated in massive snow volumes to show the present what the past once was. Other spaces should attempt to connect to the more "natural" setting of Rossdale and embrace the sloping land (a rarity outside of the valley), copses of trees, and open air and promote outdoor activity on a larger scale.

This is a fantastic location to embrace the influence of natural forces: build the volumes and abandon them to the wind, sun, and public. Drifts form between objects changing the snowball arena into a chaotic toboggan run with banked turns; hard edges slough in the sunlight and become hills for children to conquer; simulacra of vanished houses hollowed out into cross country ski rental huts. The temporal nature of snow can be harnessed to enhance design: the natural degradation of form creates a natural progression of program.

fig. 6.13 Rossdale

UNDEVELOPED RESIDENTIAL PLOTS
– CROSSFALL OF 11 M, REUSE AS
PROGRESSIVE OUTDOOR ACTIVITY
UNDEVELOPED
RESIDENTIAL PLOTS
– MIRROR
HISTORICAL
HOUSING VOLUMES

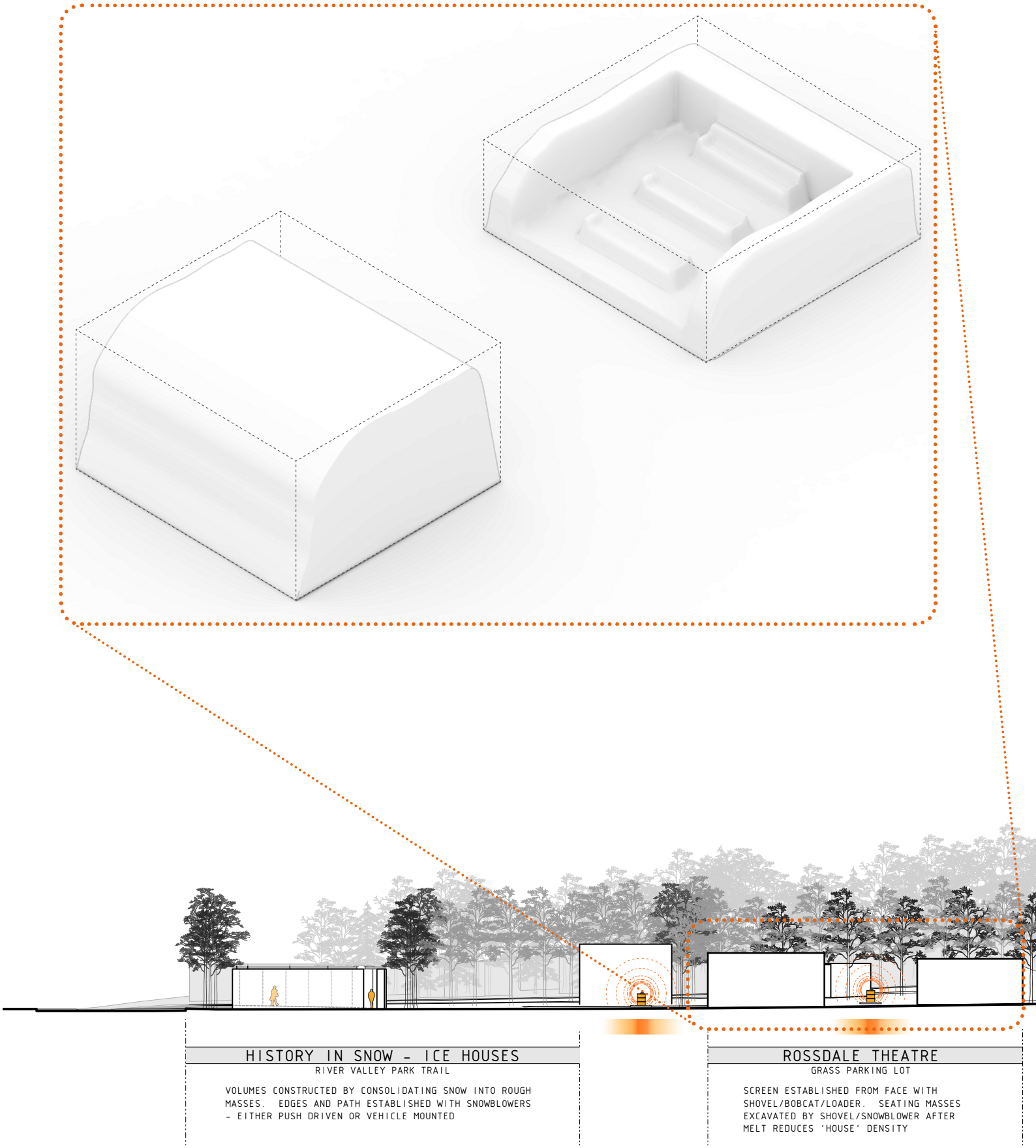
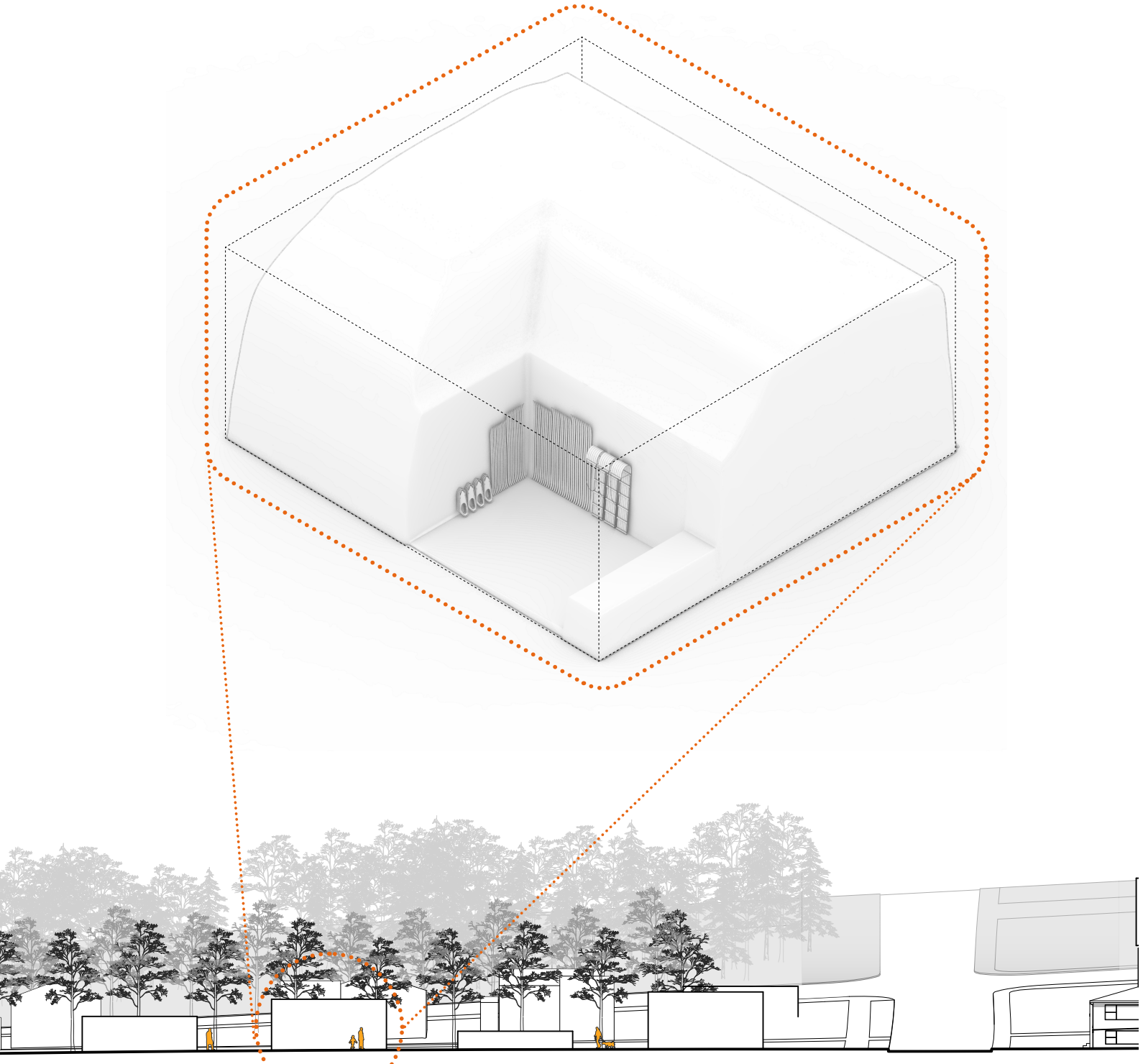


fig. 6.14 Winter Park - Section 1



HISTORY IN SNOW - ICE HOUSES

GRASS PARKING LOT

RECYCLED CONSTRUCTION FORMWORK CAN BE UTILIZED TO CREATE VOLUMES OVER THE FORMER LOCATIONS OF ROSSDALE HOUSES, TEMPORARILY RECREATING THE PAST NEIGHBOURHOOD. AFTER FORMS ARE ERECTED THEY ARE BACKFILLED USING LOADERS.

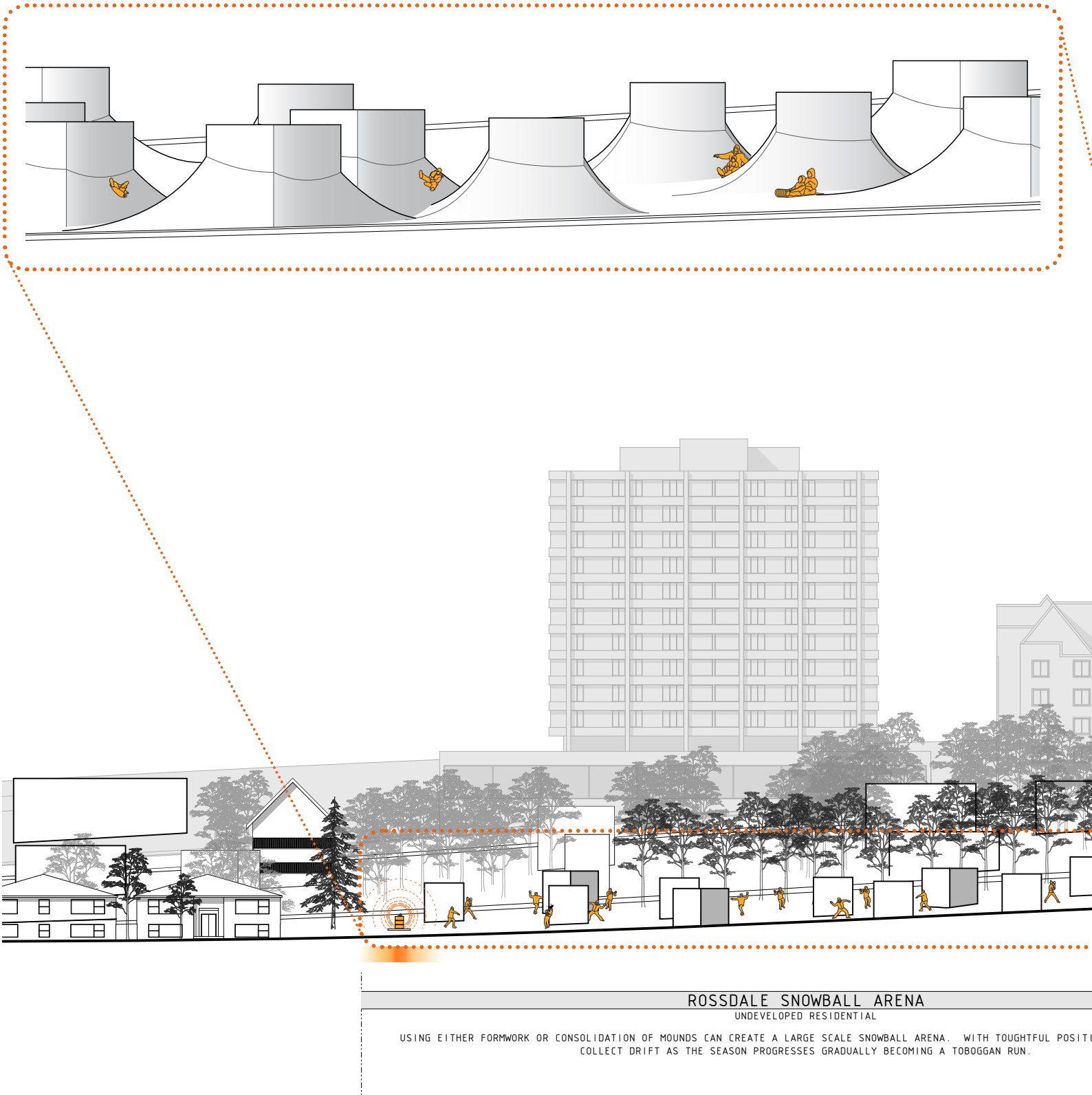
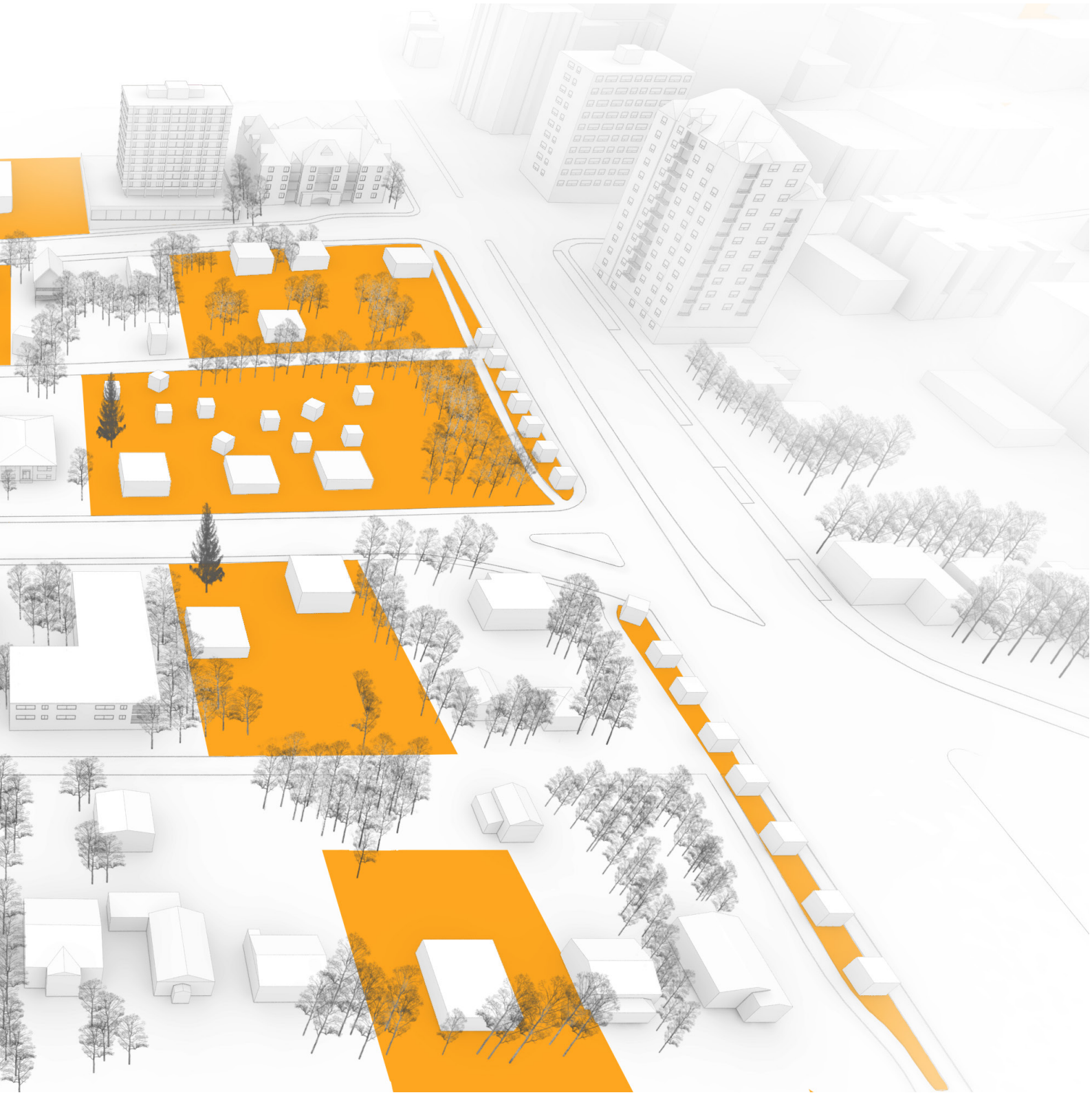


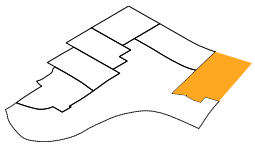
fig. 6.15 Winter Park - Section 2

ONING THE FORMS CAN

fig. 6.16 Winter Park



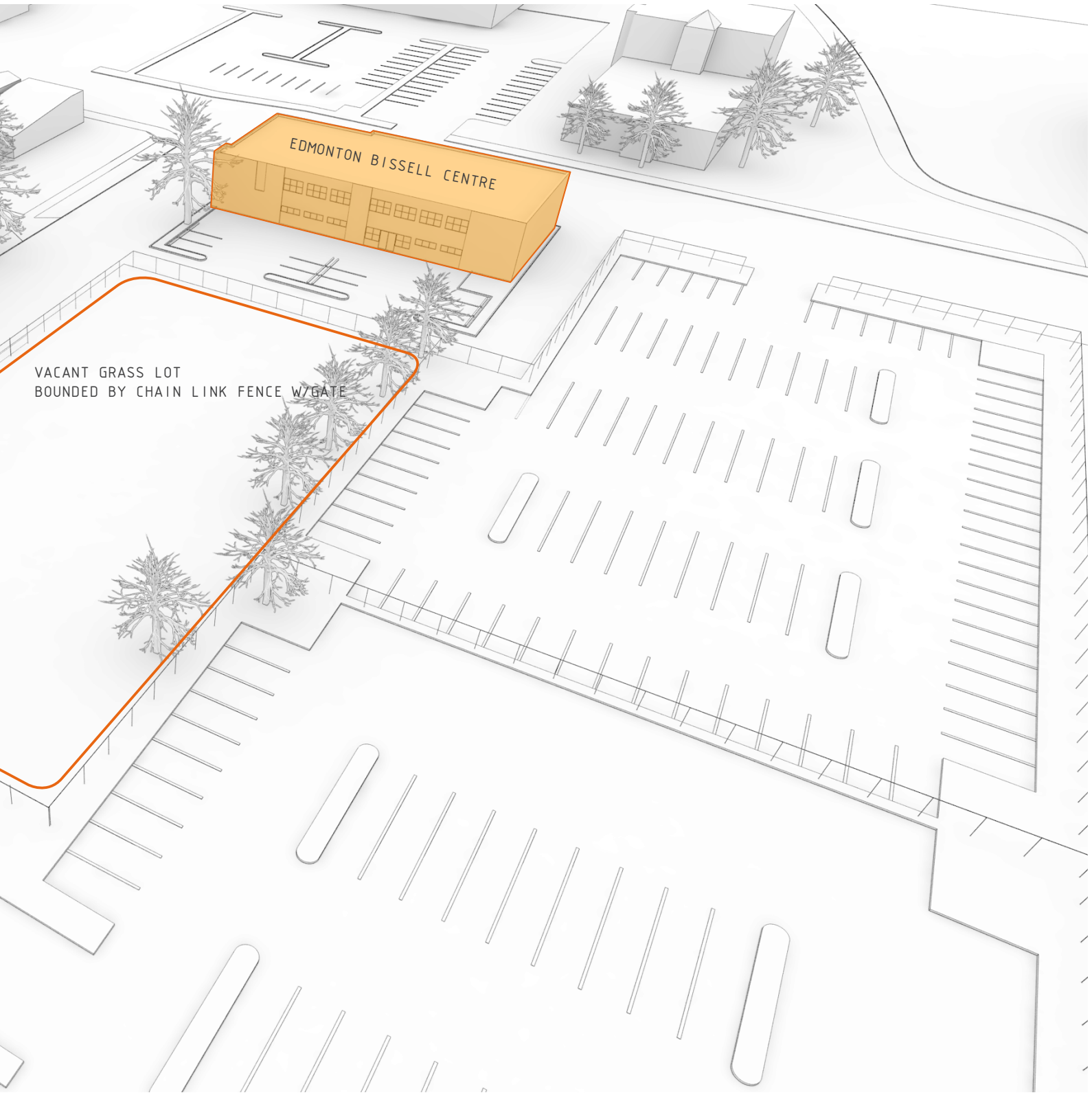
"Tent" City



Location: 9621 Street 105A Avenue
Current Use: Enclosed grass lot
Suggested Use: Sanctioned tent city
Description: During the winter the pressures on emergency shelters hits a peak and two portions of the homeless population find themselves stranded without adequate shelter: those who could not find a bed, and those who are difficult to house (either by choice or for behavioural factors). The following is a speculation on how the pallet shelters previously discussed may be deployed.

There is an empty, fenced grass lot directly behind the Edmonton Bissell Centre, ideally placed to become a city sanctioned "tent city" for either those who choose to stay out of shelters, or who are stranded on nights when the LRT stations remain closed. The site can be easily secured for the occupants and is directly adjacent to organizations seeking to aid them. Using snow from the adjacent Canada Post and Department of Justice parking lots, the windward fence line can be shielded with a high wall, and additional material used to construct the shelters themselves. Volunteers from the Bissell Centre can provide guidance, working with the inhabitants to organize clusters and openings to be sheltered from the wind, and extend their standard services into the space.

fig. 6.17 Grass Lot


EDMONTON BISSELL CENTRE
VACANT GRASS LOT
BOUNDED BY CHAIN LINK FENCE W/GATE

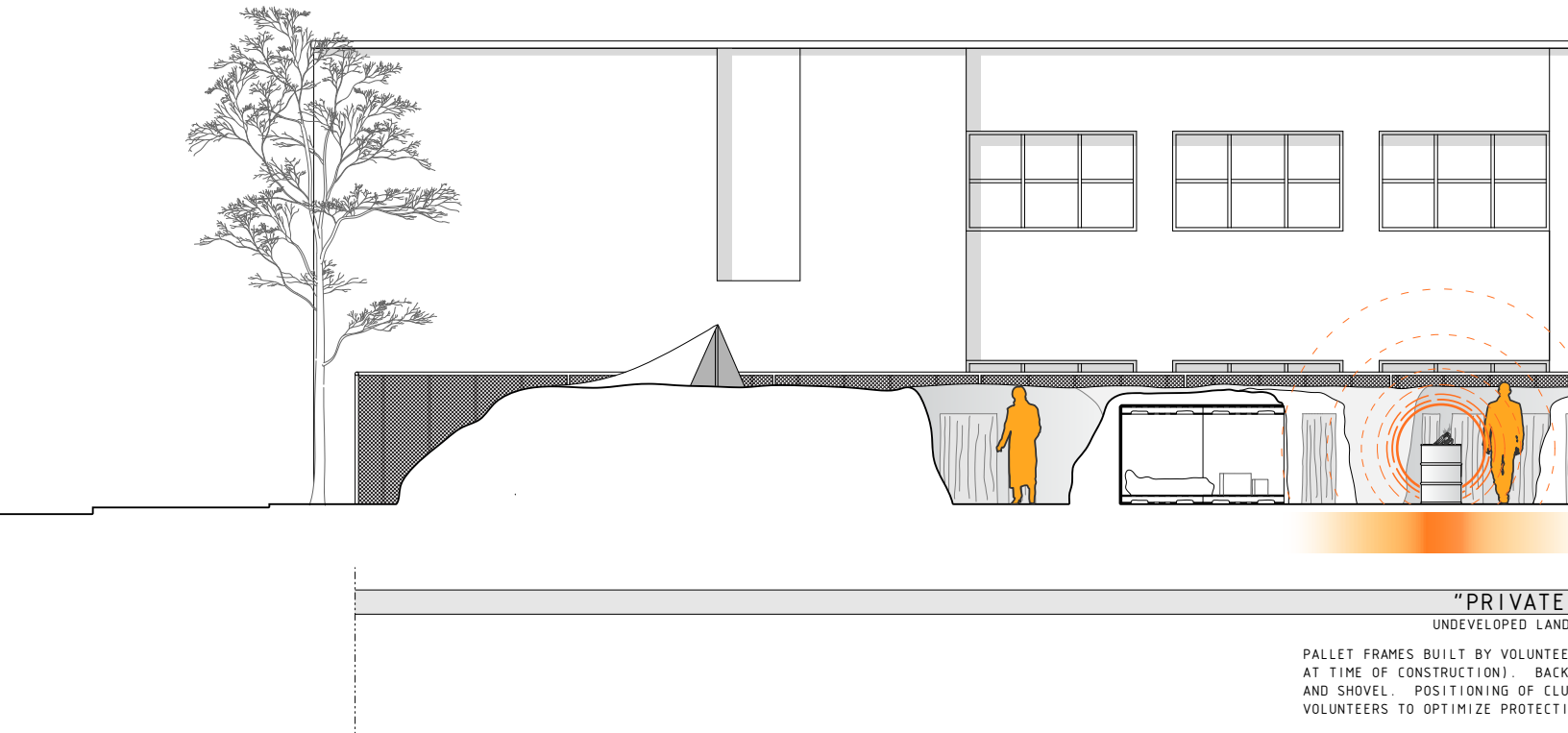
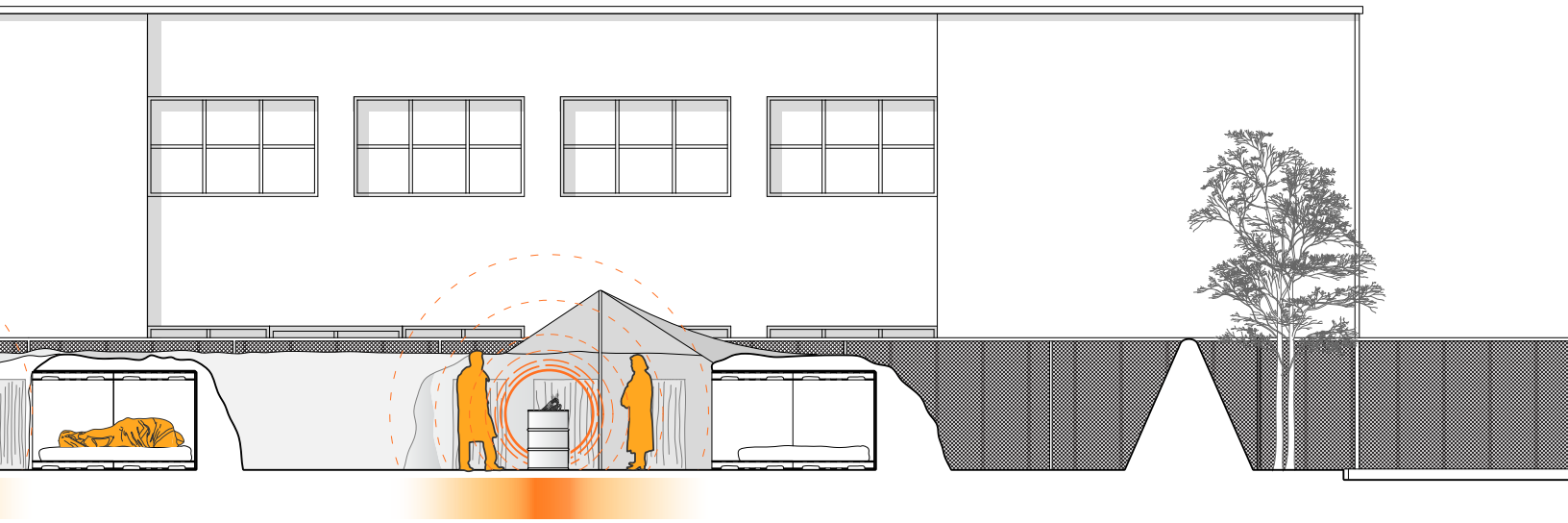


fig. 6.18 "Tent" City - Section



" GRASS LOT

, RESIDENTIAL ZONING

RS AND FUTURE OCCUPANT (IF KNOWN
FILL CONDUCTED BY BOBCAT/LOADER
STERS GUIDED BY BISSELL CENTRE
ON VALUE

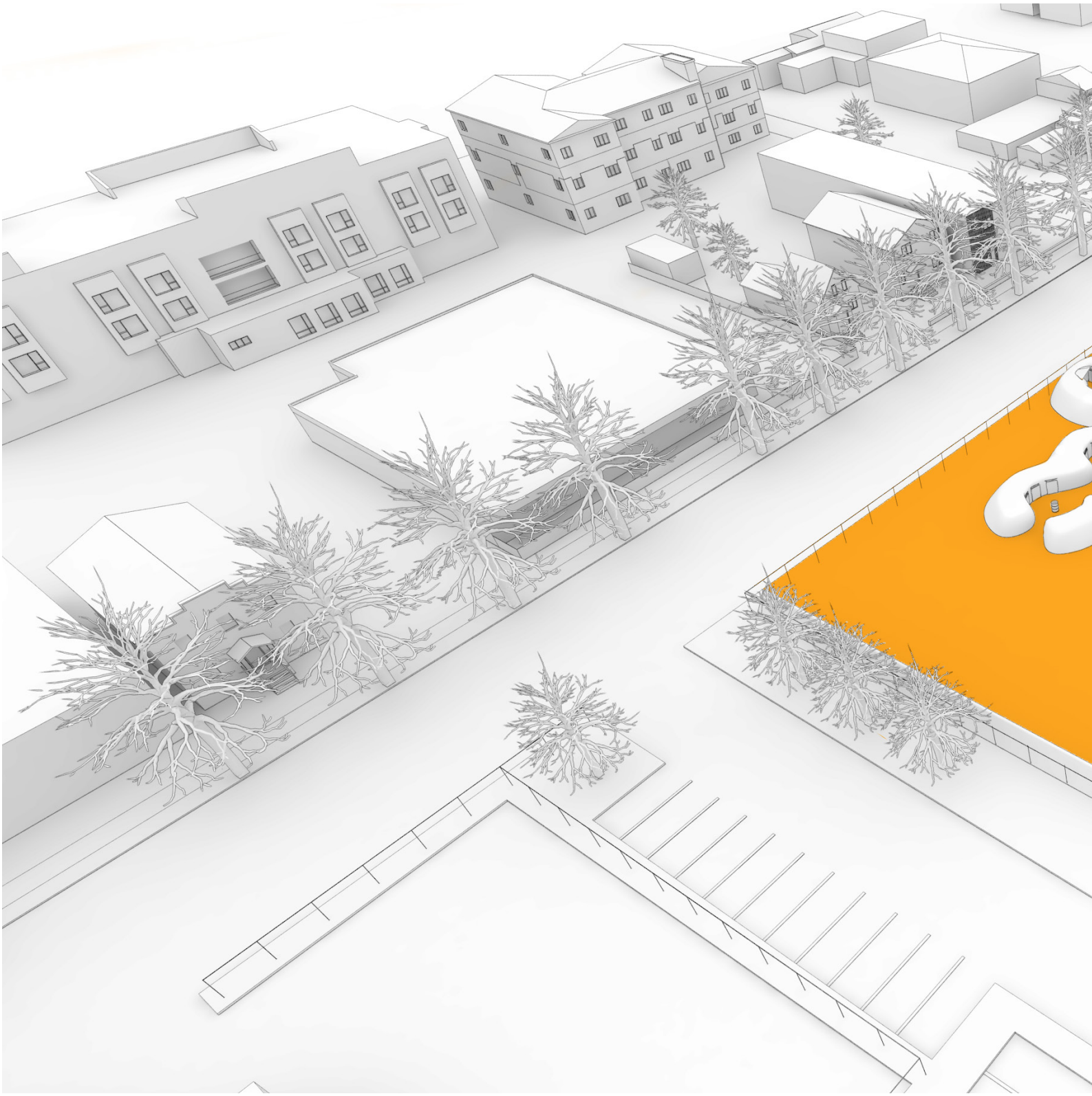
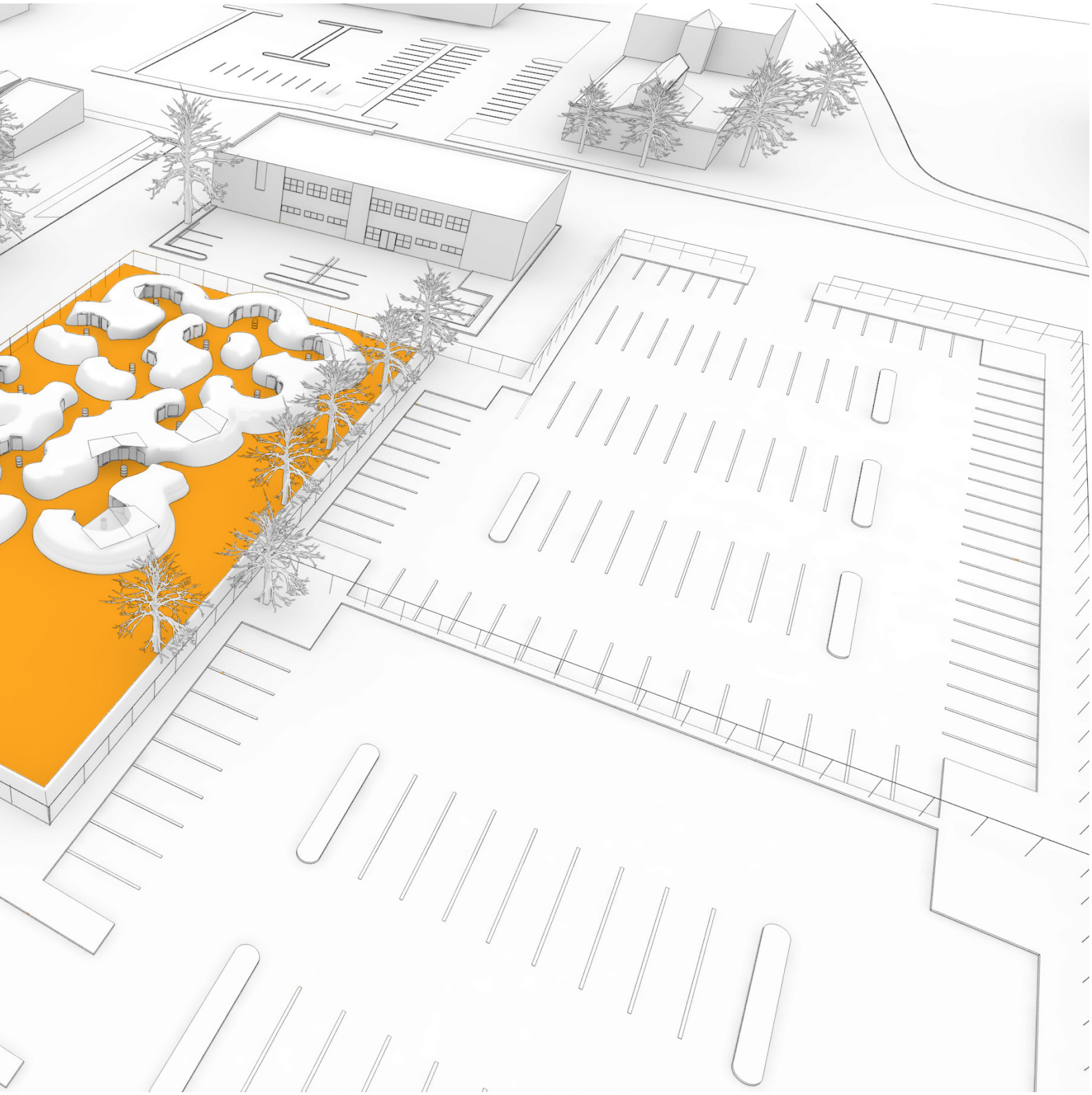
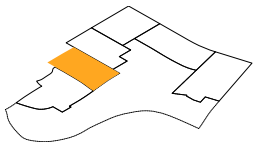


fig. 6.19 "Tent" City



Recreation



Location: 106th Street and 100th Avenue
Current Use: Closed demolition site
Suggested Use: Public skating rink
Description: Fire in 2005 destroyed the Arlington Apartments, Edmonton's first apartment building built in 1909, and the site has remained vacant ever since. At present the area is closed off with construction fencing, but there is great potential for the terrain vague. The surrounding area is a even mixture of high rise offices and residences with few "night life" venues or recreational facilities above the river valley. Converting the ruins into a public skating rink addresses a lack of family oriented outdoor activity - there are no public rinks in the downtown area - and merges a classic Canadian past-time with a unique spatial experience. This particular site is protected from the wind in the lee of adjacent buildings and being offset from the strong wind corridors created by the streets.

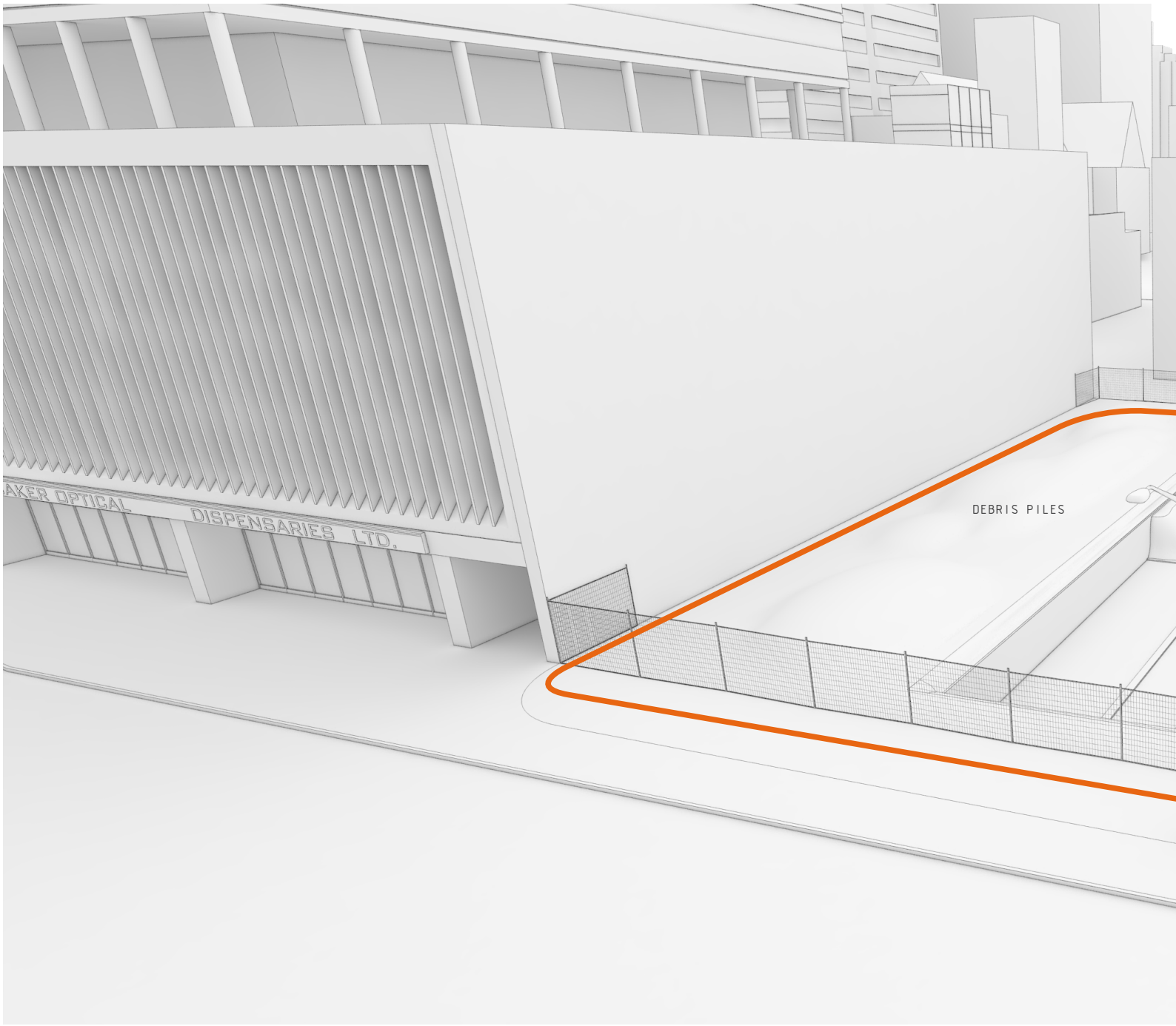
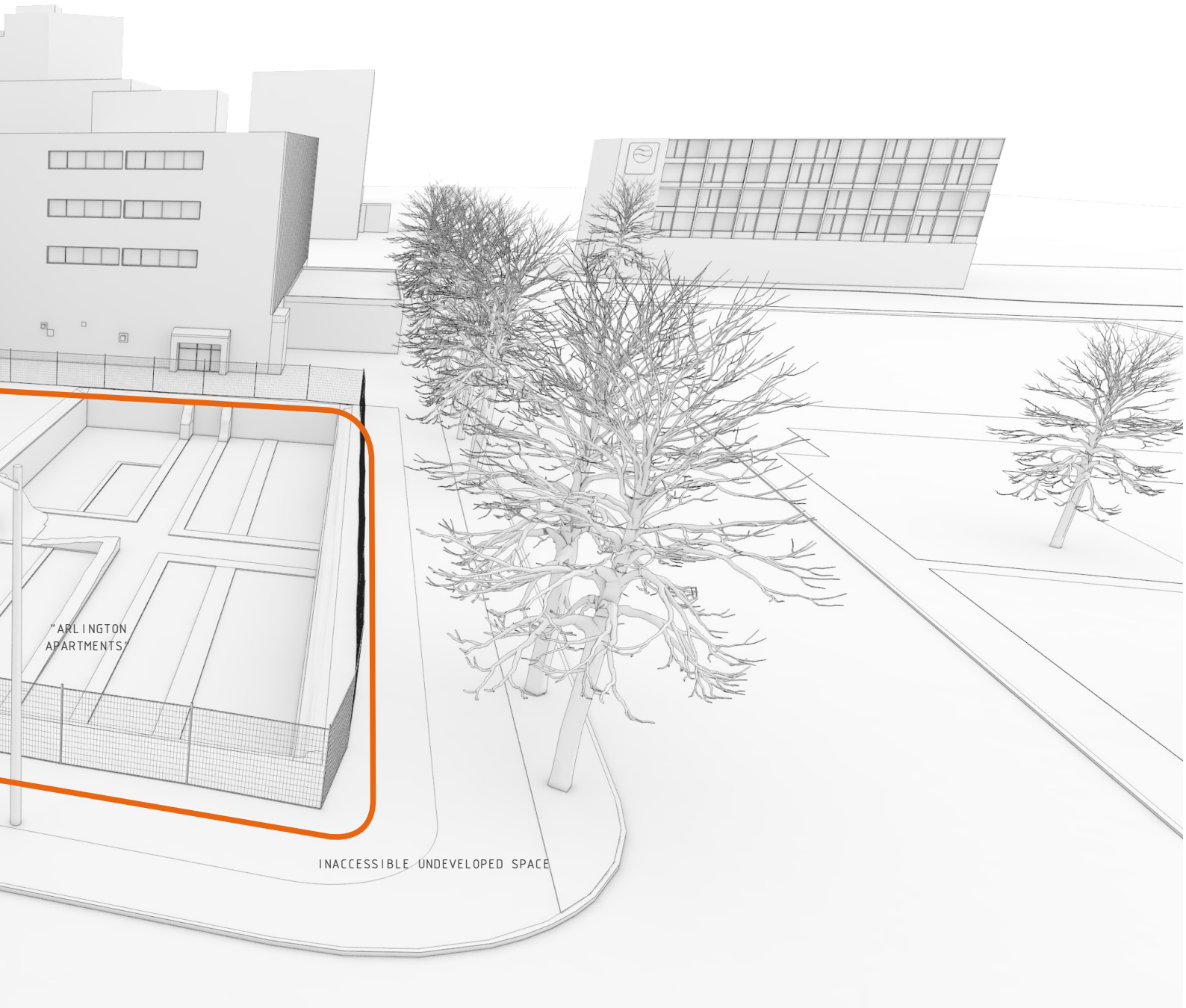


fig. 6.20 Ruins


"ARLINGTON
APARTMENTS"
INACCESSIBLE UNDEVELOPED SPACE

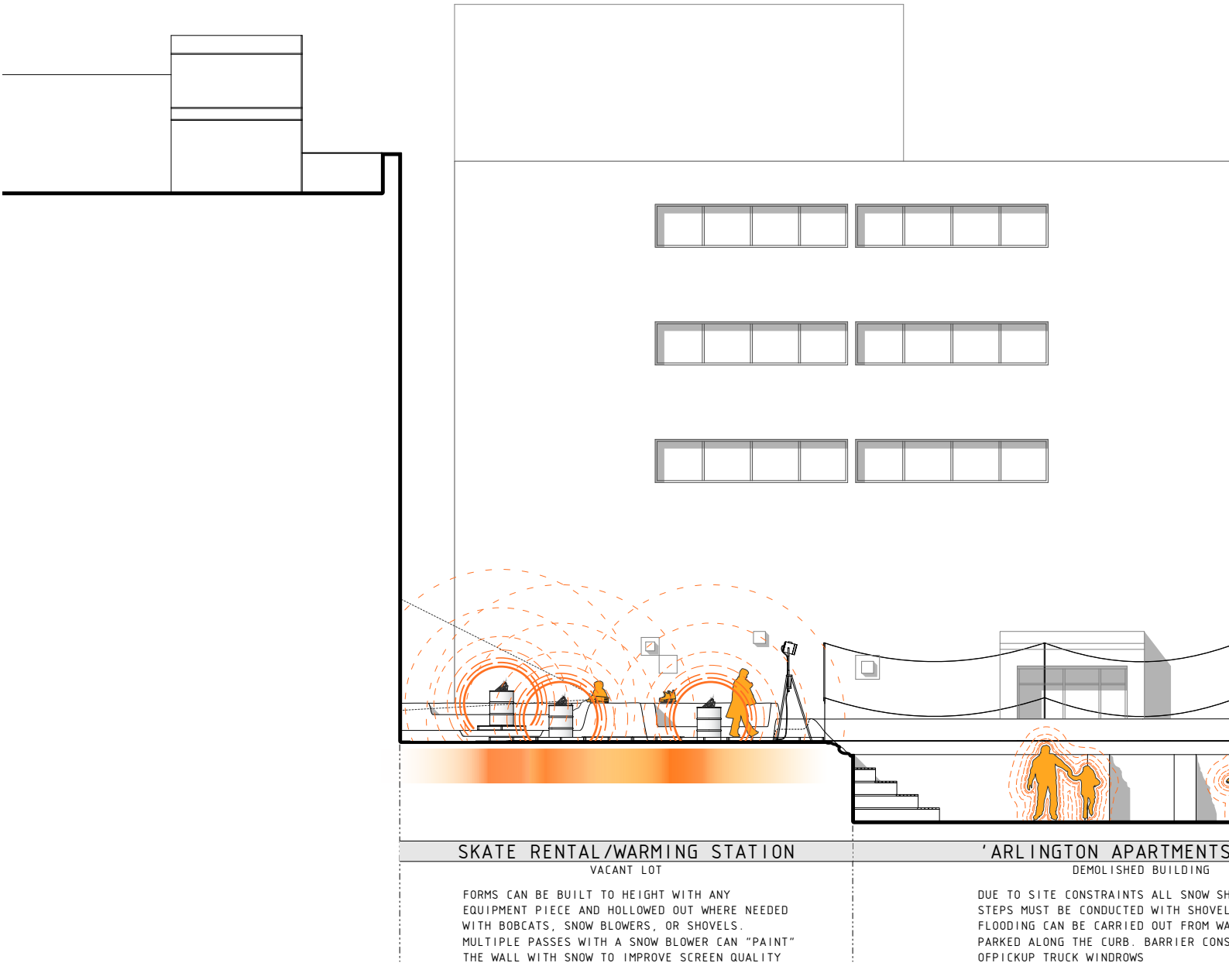
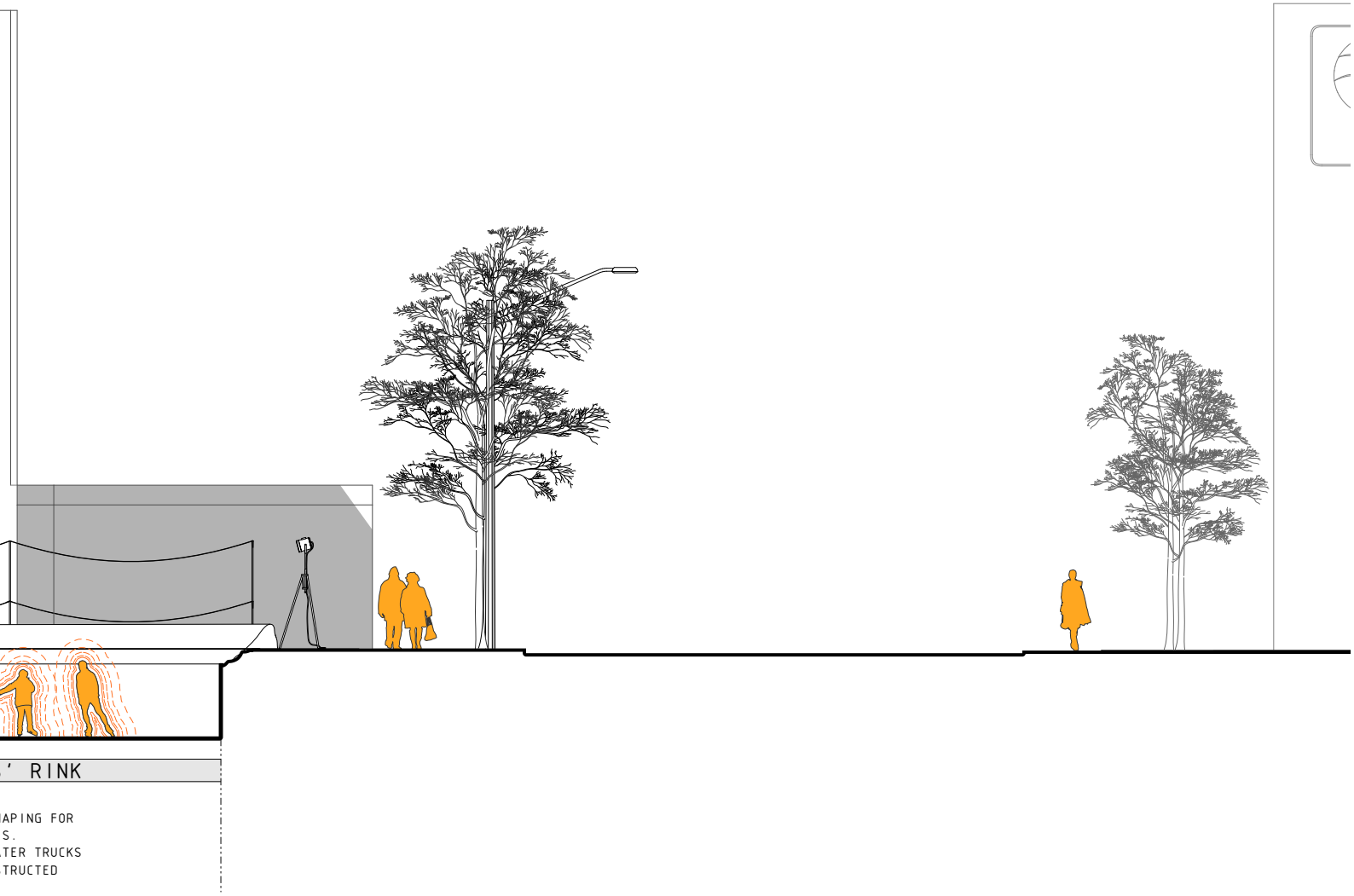


fig. 6.21 Ruins - Section



' RINK

APING FOR
S.
TER TRUCKS
TRUCTED

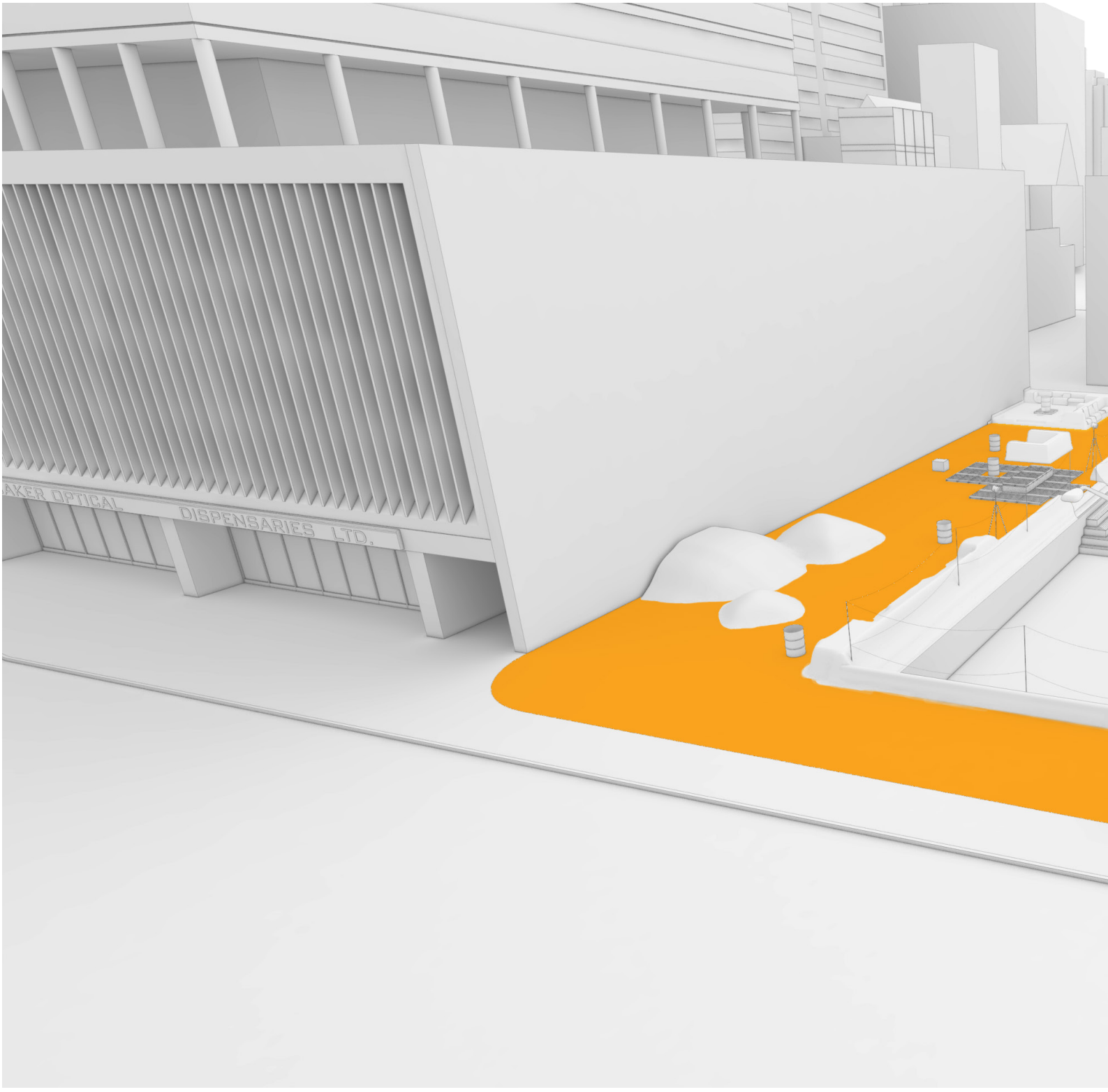


fig. 6.22 Community Rink

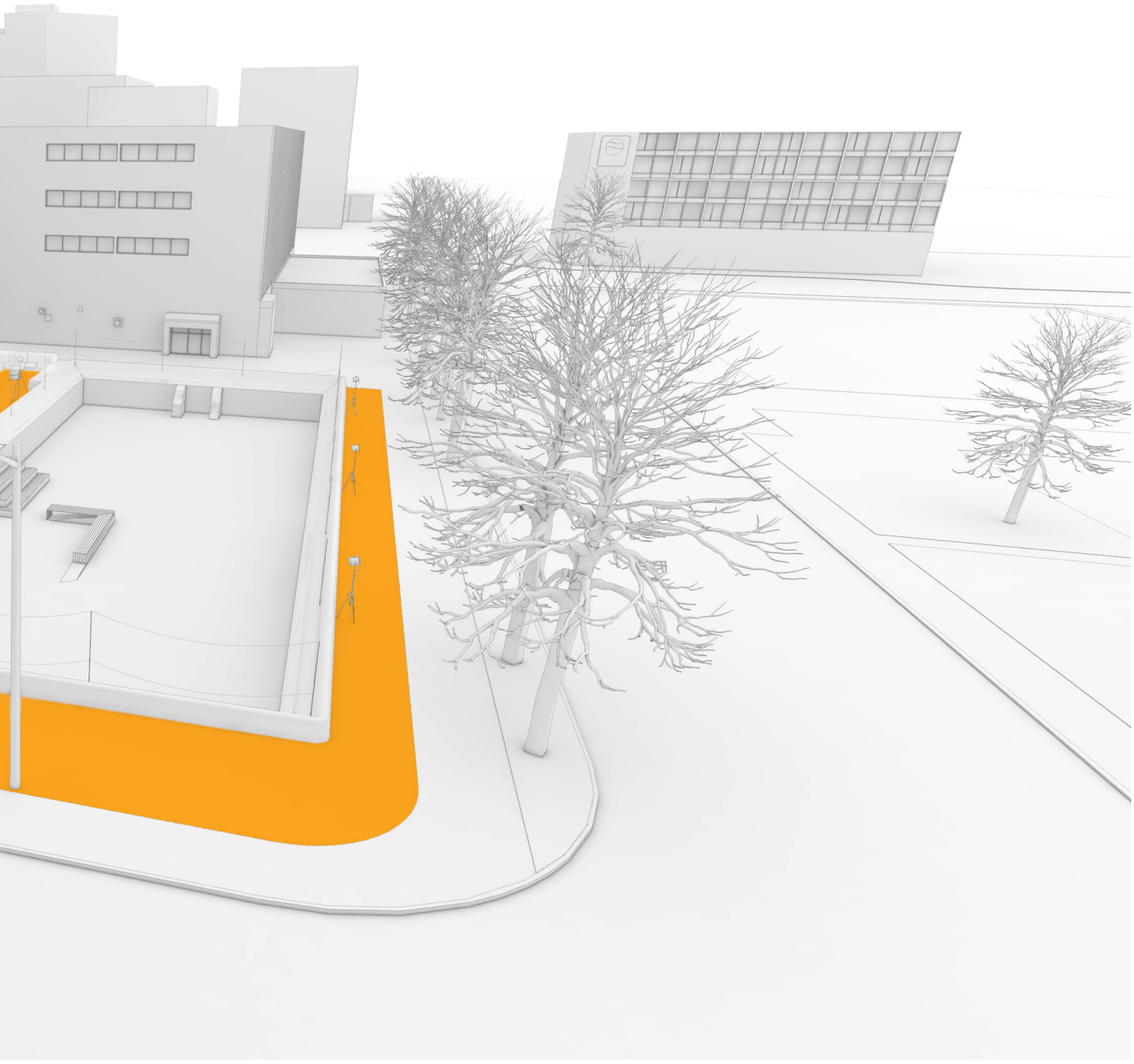
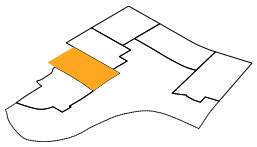


fig. 6.23 Community Rink

CHEZ
PIERRE

Urban Hibernation



Location: 104th Street between Jasper and 102 Avenue
Current Use: Rejuvenated city street
Suggested Use: Winter pedestrian street
Description: This section of 104th street has been rebranded as the "4th Street Promenade" through rejuvenation projects such as street-scaping and warehouses converted to high end apartments, and boutique food/ clothing stores and restaurants now line the street. Every Saturday from spring to autumn the street is closed off to host the acclaimed outdoor Edmonton Farmer's Market becoming a pedestrian street for a limited time, and one local business, the Blue Plate Cafe, extends their patio season deeper into the winter months than others. Considering the low vehicular traffic and proximity to the ICE district just two blocks north, the Promenade holds potential to "hibernate" from cars and transform into a winter park.

Staggered wind breaks arrayed along the full length of the Promenade will create overlapping turbulent air flow, reducing wind speeds at the ground level, with careful placement to provide immediate protection to people exiting the subway line at the south end of the street, and building entrances. The restaurants and cafés

fig. 6.24 4th Street Promenade

STRONG WIND CORRIDOR ON PREDOMINANTLY PEDESTRIAN STREET

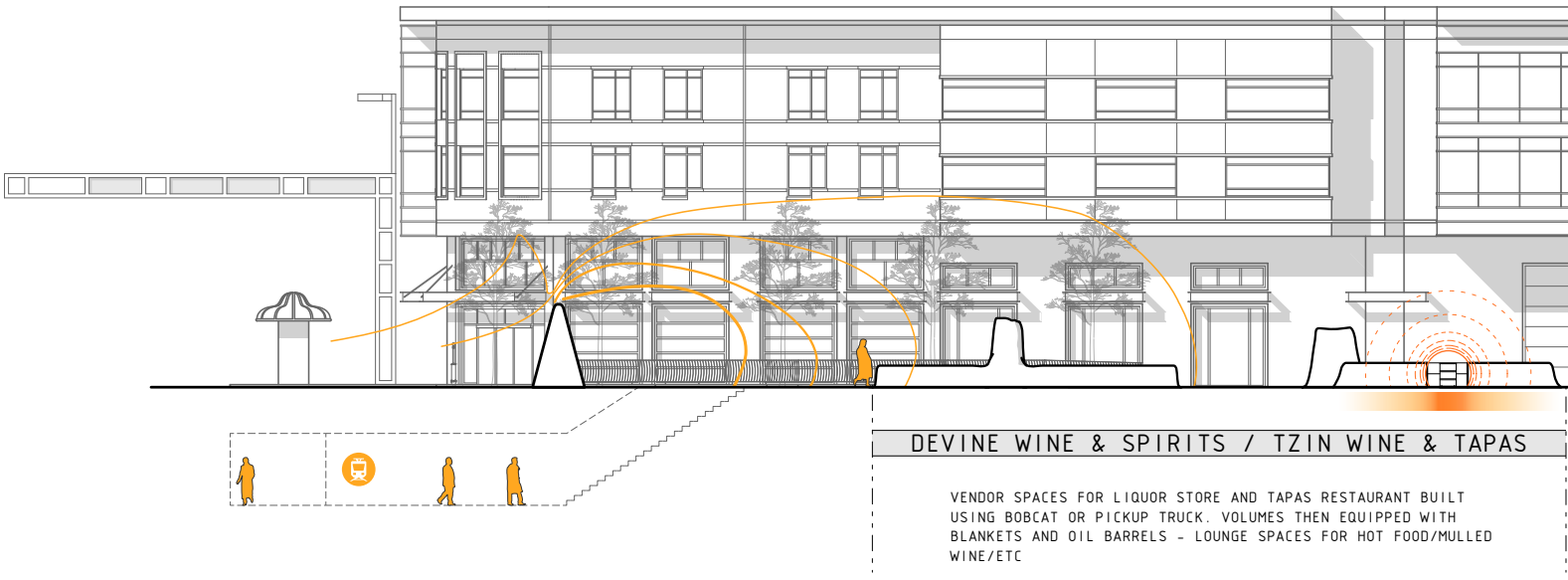


fig. 6.25 Winter Market - Section 1

MICHAEL PHAIR PARK

WELDED OIL DRUM "WALL" FIRE FEATURE - CAN BE USED AS LARGE SCALE HEAT SOURCE OR RADIANT COOKING SYSTEM. FURNISHINGS CONSTRUCTED BY BOBCAT AND SHOVEL

WINTER MARKET/BLACK PEARL AND CREDO

RESTAURANT/COFFEE SHOP

LOADER PILE OVERALL MASS INTO ROAD CENTRE AND SNOW IS ALLOWED TO SINTER. LOADERS THEN DIG OUT LARGE CAVITIES FOR OCCUPATION BY EITHER THE EDMONTON FARMER'S MARKET OR LOCAL VENDORS. SPACES ARE ENCLOSED USING SMALL SCALE TOOLS AS REQUIRED

fig. 6.26 Winter Market - Section 2

SMALL SCALE KIOSKS

SURES FOR TEMPORARY USE BY VARIOUS PARTICIPANTS ON A
IS. CONSTRUCTED USING PICKUP TRUCKS OR SNOW SHOVELS

STAGE 104

KITCHEN/LOUNGE

WIND BARRIER FOR
ALL-YEAR PATIO FORMED
USING SNOW SHOVELS

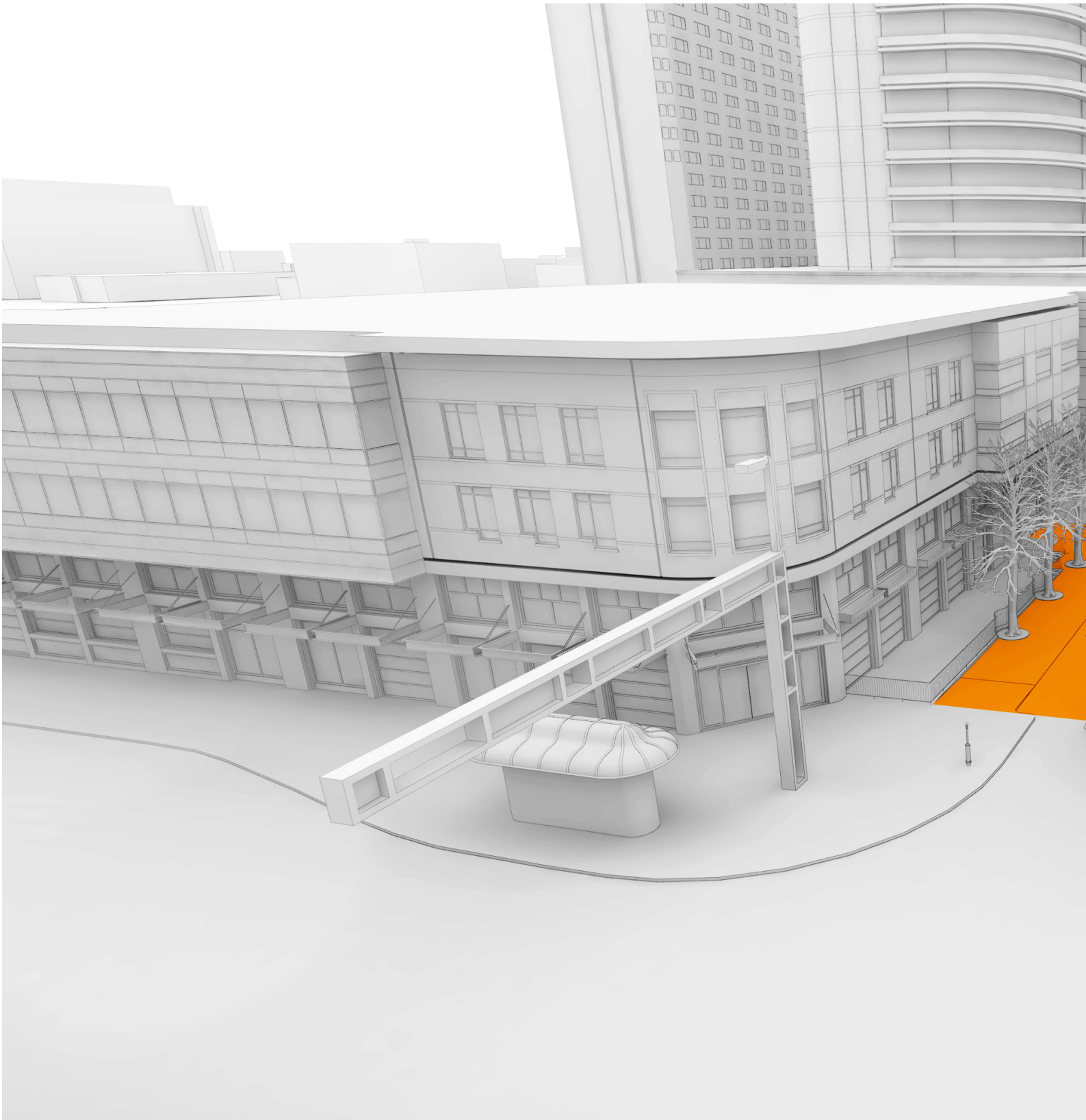


fig. 6.27 Winter Market

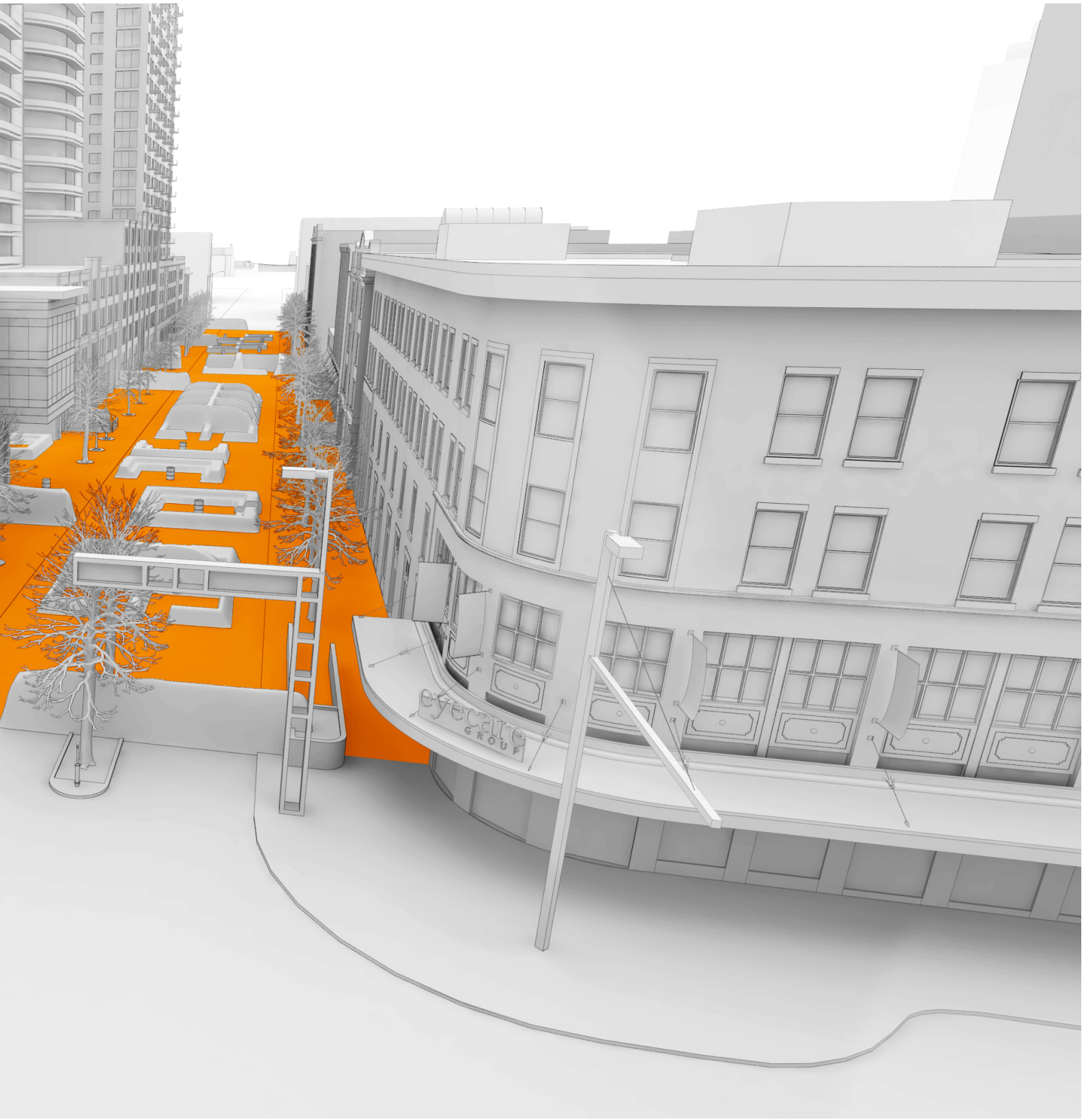
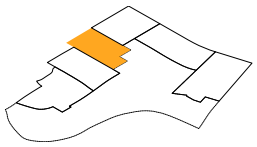

eyecare
GROUP

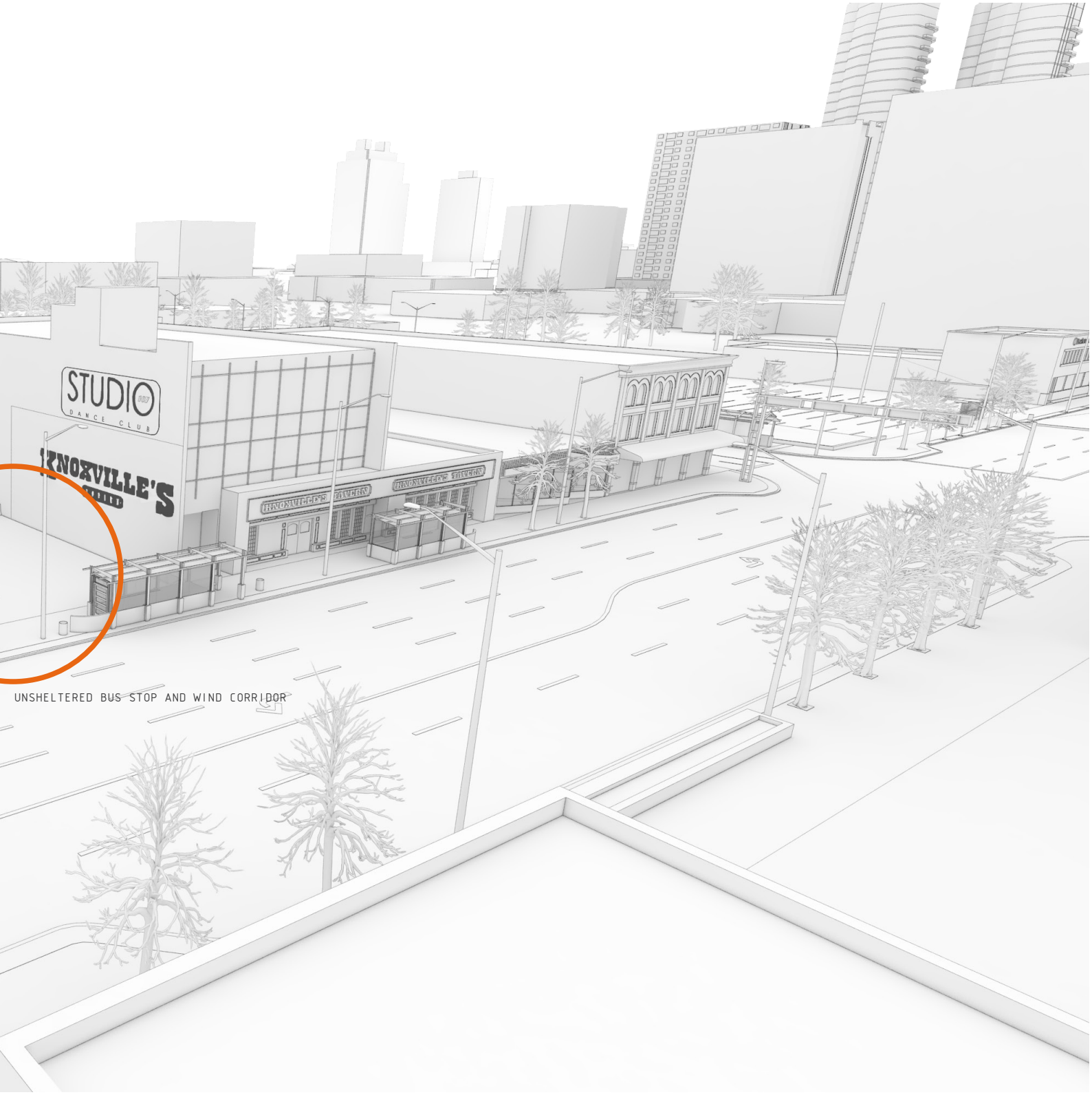
fig. 6.28 Winter Market

Entertainment



Location: 10750 Jasper Avenue, Entertainment District
Current Use: Vacant lot, bus stop and subway exit
Suggested Use: Outdoor restaurant/bar, protected bus stop
Description: Former shop demolished for decades, main activity is either a shortcut to the parking lots behind, or a place to stand off the sidewalk while waiting for a bus. The only heated shelter available during the day is within a donair shop or Money Mart to the west, which is subject to the tolerance of the businesses. There is immediate potential for the three adjacent nightclubs to the east to extend their venues outwards and introduce an ice bar into the urban nightlife which runs along Jasper Avenue. Closing off the "back" edge of the site frames a new wind protected micro-climate which can be enhanced with fire pits and candlelit tables. During the day the space provides furnishings and passive thermal control to take the edge off the winter for public transit users.

fig. 6.29 108 Street and Jasper Avenue



UNSHELTERED BUS STOP AND WIND CORRIDOR

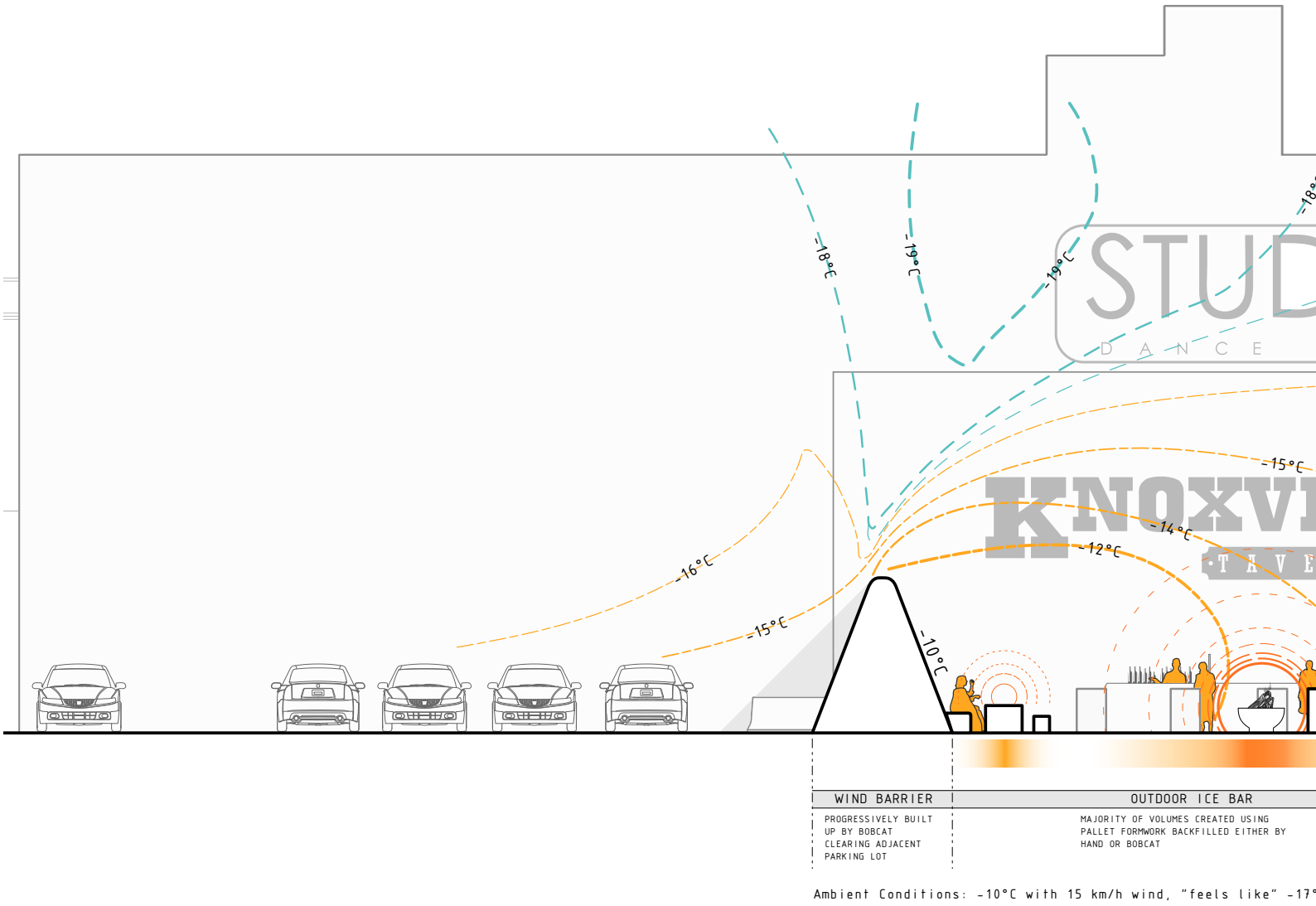
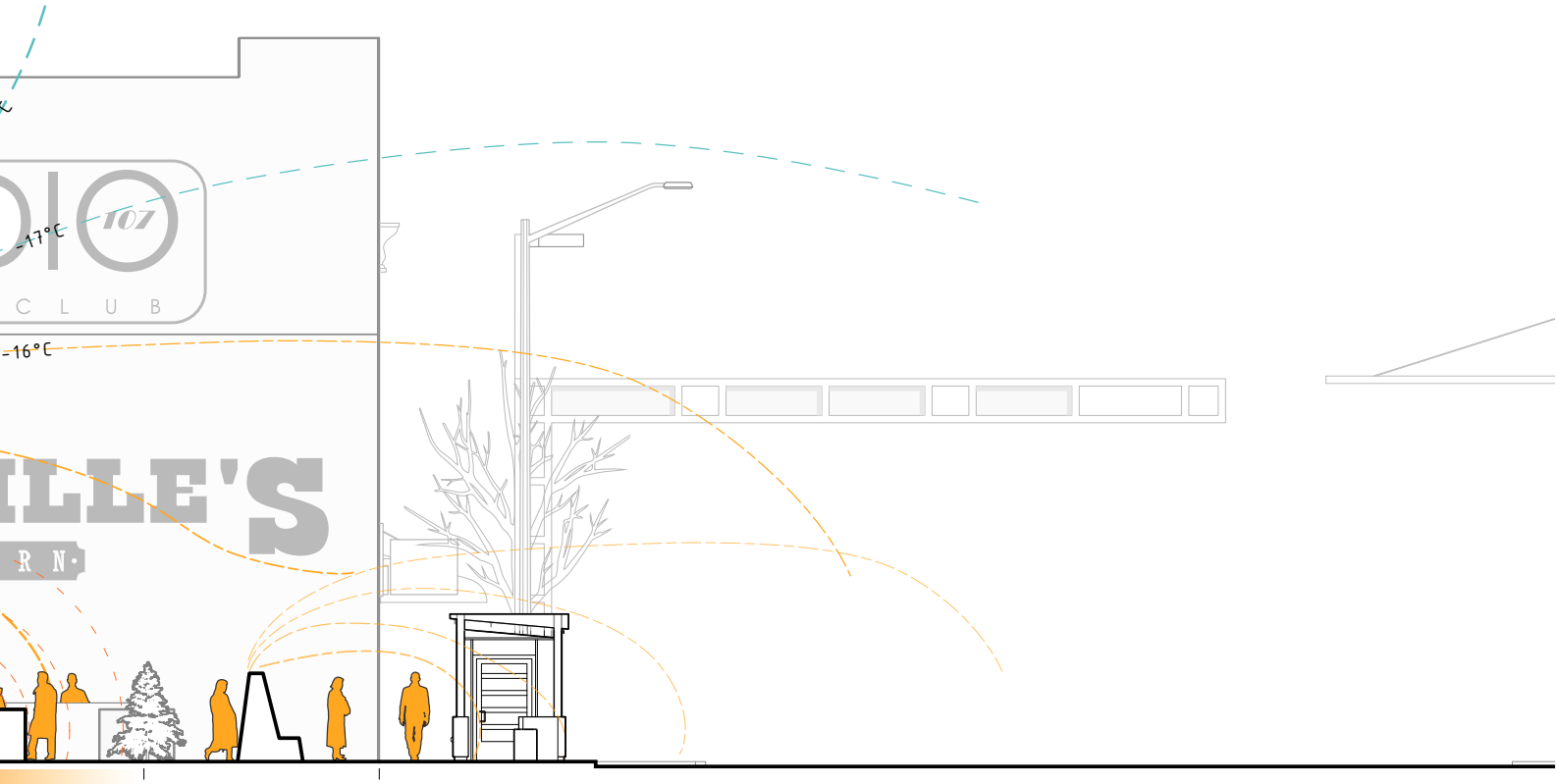


fig. 6.30 Ice Bar - Section



TRANSIT WAITING AREA

MUNICIPAL SIDEWALK CLEARING MACHINERY (SMALL BOBCATS) CREATE SEATING VOLUME, WITH REFINEMENT VIA SHOVEL

°C.

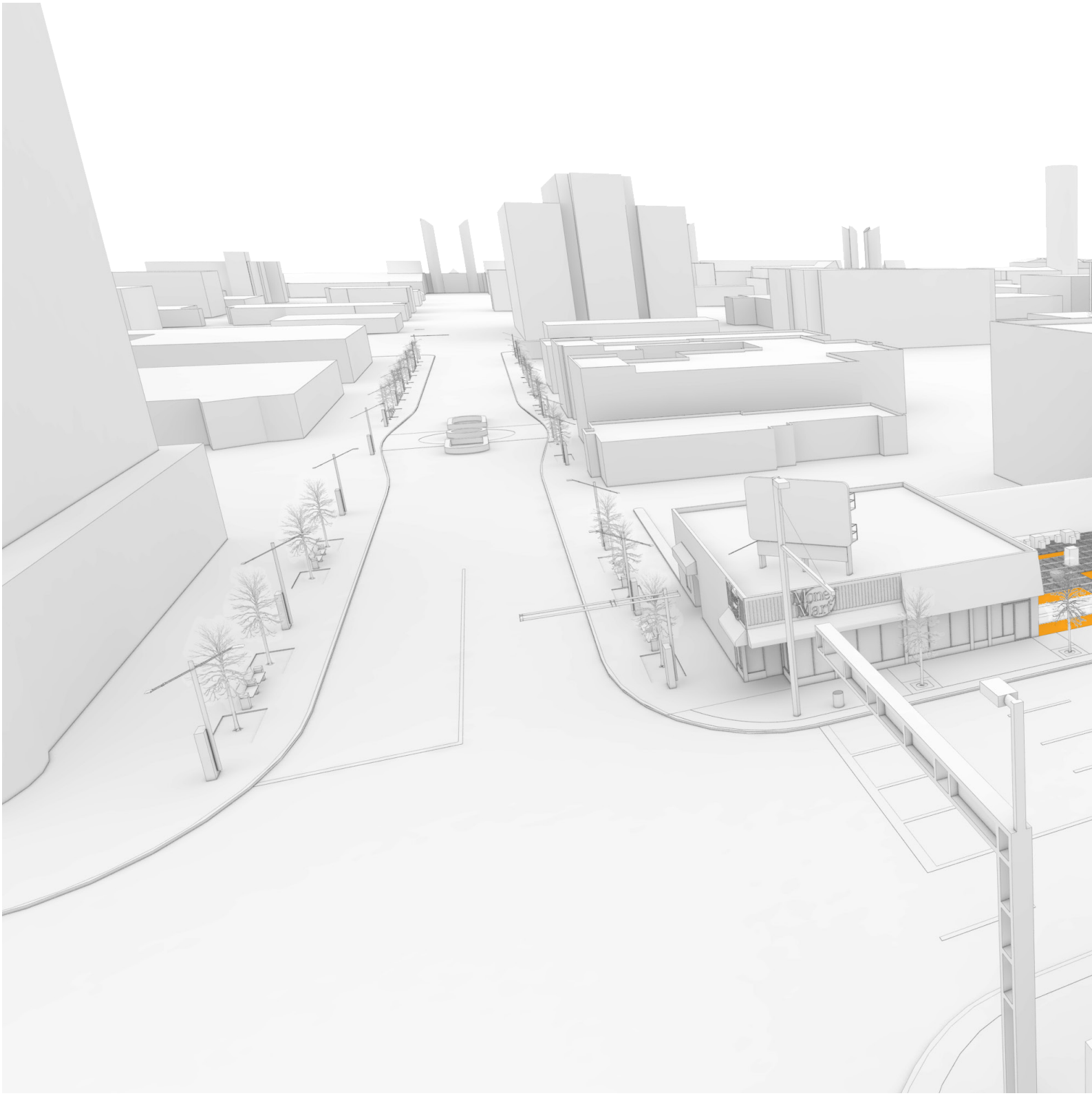


fig. 6.31 Ice Bar

STUDIO
DANCE CLUB
KNOXVILLE'S
KNOXVILLE'S TAVERN
KNOXVILLE'S TAVERN

fig. 6.32 Ice Bar

STUDIO 107
DANCE CLUB
NOXVILLE'S
TAVERN
STUDIO
107
DANCE CLUB

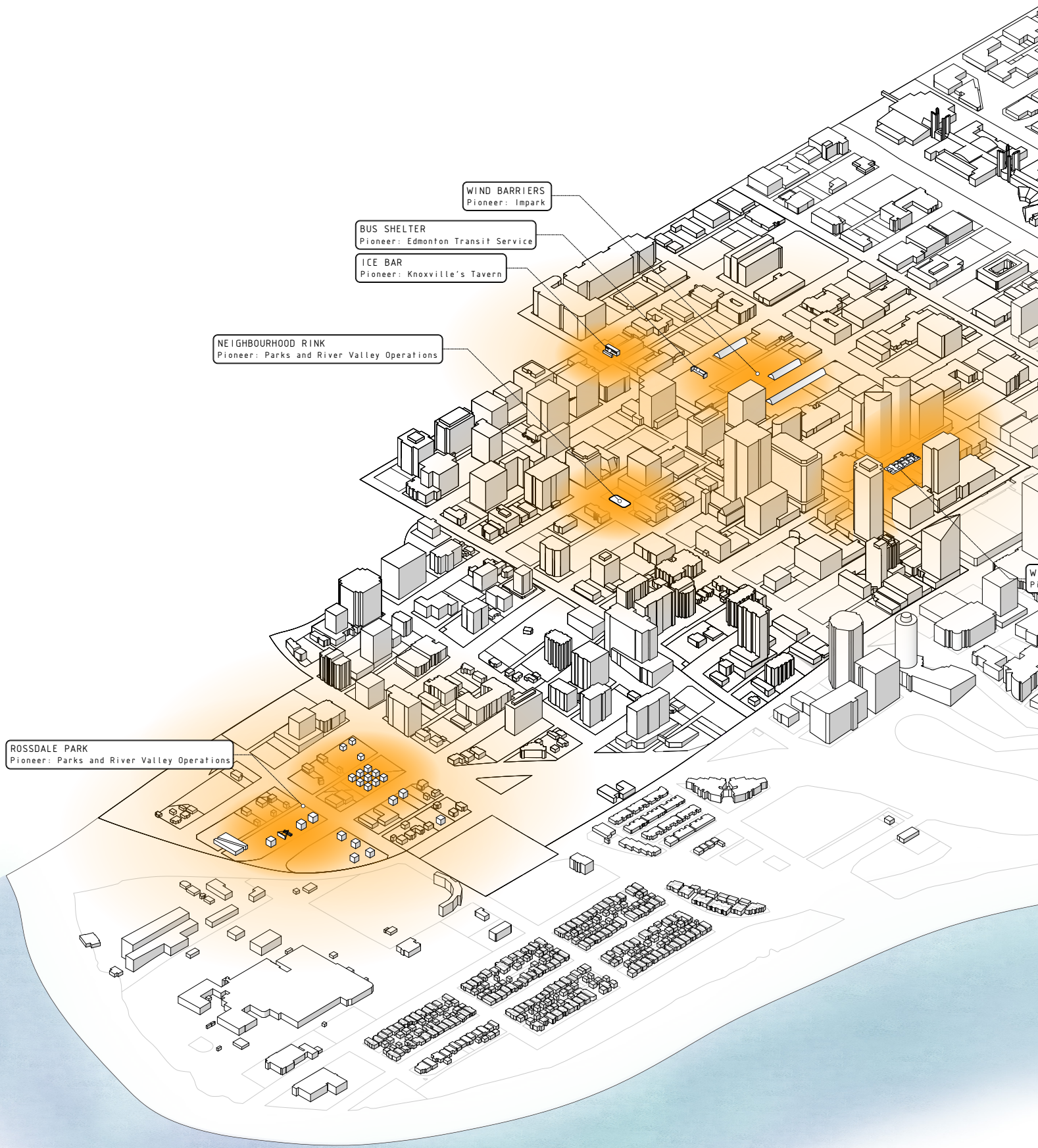


fig. 6.33 New Campfires

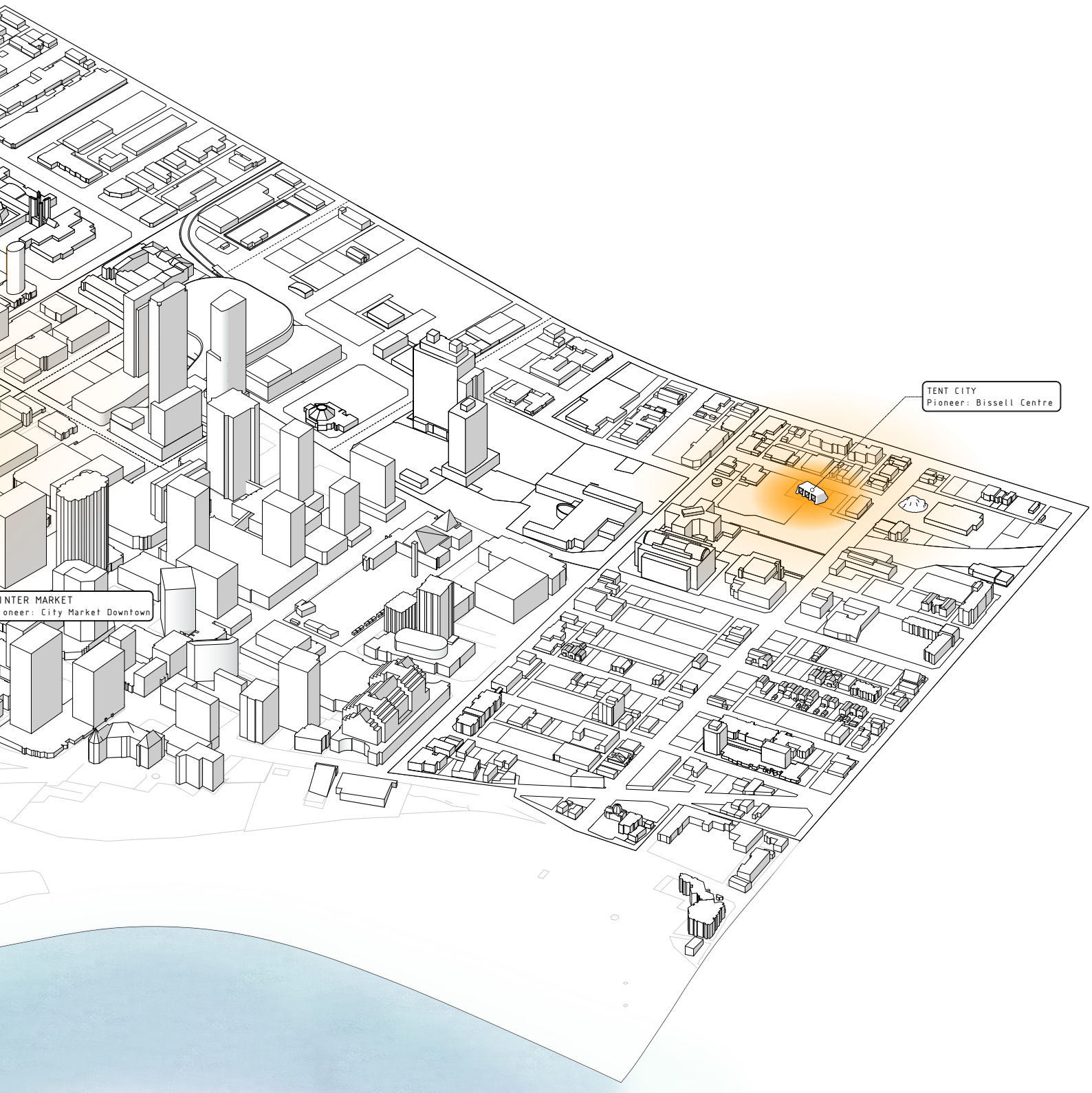
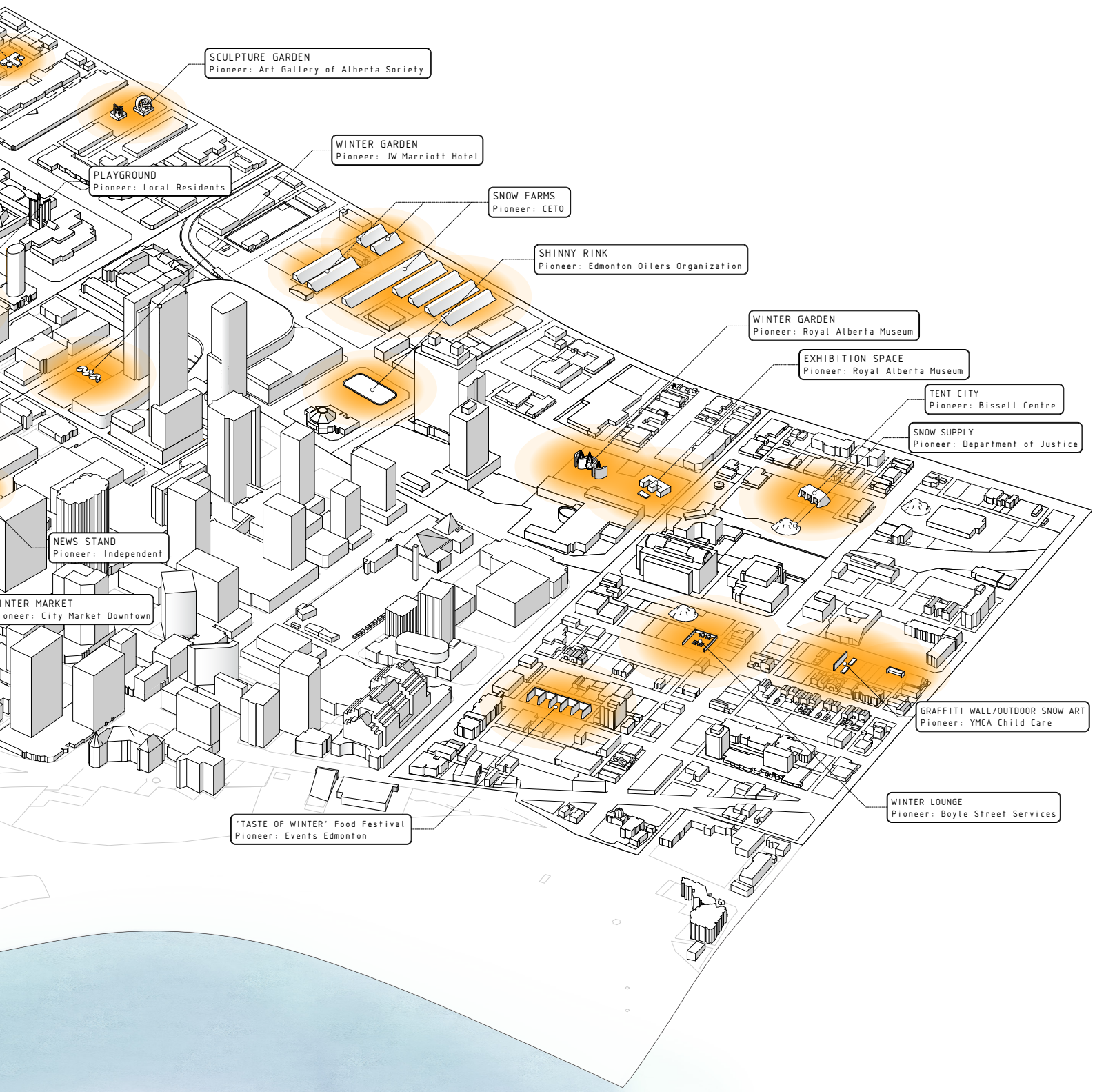

TENT CITY
Pioneer: Bissell Centre
INTER MARKET
oneer: City Market Downtown

fig. 6.34 A Ring Transformed


SCULPTURE GARDEN
Pioneer: Art Gallery of Alberta Society
WINTER GARDEN
Pioneer: JW Marriott Hotel
PLAYGROUND
Pioneer: Local Residents
SNOW FARMS
Pioneer: CETO
SHINNY RINK
Pioneer: Edmonton Oilers Organization
WINTER GARDEN
Pioneer: Royal Alberta Museum
EXHIBITION SPACE
Pioneer: Royal Alberta Museum
TENT CITY
Pioneer: Bissell Centre
SNOW SUPPLY
Pioneer: Department of Justice
NEWS STAND
Pioneer: Independent
INTER MARKET
oneer: City Market Downtown
GRAFFITI WALL/OUTDOOR SNOW ART
Pioneer: YMCA Child Care
WINTER LOUNGE
Pioneer: Boyle Street Services
'TASTE OF WINTER' Food Festival
Pioneer: Events Edmonton

The diversity of activity in a relatively small portion of the city varies dramatically, in some instances flipping across a single street. In many circumstances this diversity would nullify the suitability or appropriateness of a design, simply being too "different" to achieve the final objective. Tactical Infrastructure requires this diversity - the broad variation in site and public requirements are the challenges which will be the driving force behind experimentation in form and function. Inspiration can come from local history, community behaviours, missing amenities, childhood memories, or even just flights of fancy. With a shovel, a bit of space, a few artifacts, and a measure of resolve, the Urban Pioneer can transform the City's gift of a pile of snow into a dynamic space which answers directly to diversity instead of attempting to force conformity.

It's in the best interest of the designer to consider the nature of the neighbourhood surrounding their intervention, but ultimately the design is in their hands as any undue censorship could hamstring the overall strategy of discovery - even extremely unorthodox program may lead to breakthroughs in winter design. What is required after the terrain vague has been occupied is observation. Which programs succeeded in their objectives and which passed without notice? Which remained active longer than expected, or consistently reappear either yearly or across the city? Were the tent cities occupied or required? How effective were the snow farms at collecting drift? Where were wind breaks most effective, and what variations to them improved the shelter they provided? There is extremely little risk for each iteration, even failures still inform the observer, but the ultimate evaluation will be determined by the behaviour of the public. Enlisting the aid of all parties, from urban planning groups to individual citizens, will create a diversity of responses as extensive as the myriad of conditions within the city itself - an action for each urban demand, a combination of forms for each condition.

a Provocation

Edmonton faces two disparate problems. It is a northern city struggling to understand what that moniker means; it is a sprawling city attempting to densify through traditional, flawed approaches. Awareness of the global struggle with the former was raised in 1986 with the first international gathering, the Winter Cities Forum, which was hosted *in Edmonton*, but very little change has occurred (it has "only" taken 27 years since publication of Norman Pressman's *Winter City Design Manual* for elements to be considered an official design guide by the City of Edmonton). The problem of sprawl and dross is largely one of capital; developers have incredible influence over what fills in the urban void, but their motives are predominantly driven by finance. Yet they can't be harshly blamed for their reticence to attempt anything without a precedent: architectural experimentation is an incredibly expensive venture with little assurances of success, and the developers shoulder the greatest risk. Each problem is being investigated with progress being made for both, but neither has been "solved" as yet.

This thesis is not intended to be a solution - it is not a conclusion, it is a provocation, a call to action. Winter design and Tactical Urbanism are progressing separate from one another, but the strengths of one can help progress the other, achieving their objectives simultaneously. In adapting to winters, cities in high latitudes have heavily invested into infrastructure to maintain operations, citizens and businesses are taxed to continue the services, and the system largely goes unnoticed. Summer maintenance crews are mandated with landscaping public spaces for use, and it is simply accepted - how a winter equivalent does not exist in one of the coldest major cities in the world is baffling. The City of Edmonton has all the means at its disposal that an Urban Pioneer could dream of having access to - all it would take is a small change to bylaws and expanded communication services for the city to provide hundreds of thousands of kilograms of free material to those with an inclination to experiment with it.

The term Urban Pioneer is associated with individuals or small organizations working from the bottom-up, but the top-down can also participate in the system. While waiting for the construction climate to become favourable, developers and architects can use the waiting land plots to implement their own design experiments and modify their plans from observed evidence, or offer the space freely for the community to temporarily control, opening up an increasingly necessary communication channel between Designer and public. Some terrain vague will vanish as development carries onward, but that is an inevitable change. At least in the time they still exist they will have an opportunity to show their hidden nature and inform the design that will subsume them, carrying their memory forward. With each iteration the design strategies of both the public

and the professional may progress forwards, leading towards a potentially brand new winter design strategy, providing a full gradient of protection and experience between the wind swept sidewalk to the heated Pedway burrowing into the ground instead of the binary condition today.

Winter public spaces might sound like a tough sell, but the perception of winter in Edmonton is beginning to shift. The handful of winter events from just a few years ago have surged in number indicating a willingness, at least for some of the population, to bring activity outdoors year round. While this is an encouraging trend, the focus is still too much on spectacle and event. Running a winter marathon or an ice palace tour is a special occurrence, an event outside of the daily routine which is where full acceptance of the seasons will reside, but is currently the only option for most people. Simple forms producing unorthodox functions in the terrain vague beside which we live and work pulls winter life in direct contact with the daily routine. Pausing to drink a morning coffee in an ice lounge, or waiting for the bus shielded by a monolithic slab of snow allows new routines to emerge with an acute awareness of the conditions which make it possible. Turning a snowblower off a straight line into a circle transforms an ignored machine into a designer's tool, an ignored site into a place of activity.

Tactical Infrastructure is an attempt to provide all parties concerned with the condition of Edmonton's urban fabric a tool set: a catalogue of equipment and tectonics, and a suggestion of the potential these elements contain to start to reshape a society. It is a tool of experimentation for city planners, architects and developers to discover new design practices. It is a tool of agency for the public to address local interests. It is a means of capitalizing on each other's experience and resources to begin, as a society, the process of discovering what winter in Edmonton truly is.

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Appendix A - Precedents

Winter Precedents

PATH - Toronto, 1970* / RESO - Montréal, 1962:
Seizing upon the opportunities afforded by the massive infrastructural investments, Toronto's PATH and Montréal's RESO subterranean pedestrian networks developed in tandem with their subway systems. The greatest contribution towards winter life of these networks is the mobility they provide. Both systems extend over 30 km throughout the downtown cores, with 150+ surface entrances, integrated subway stations, subterranean parking, offices, stores, hotels, and entertainment venues[1,2]. Public transportation is encouraged by integrating subway and bus stations as tightly as possible with services and pedestrian thoroughfares. Activities which take place on the street level are pulled underground and are completely sheltered from the environment, neutralizing the winter risks for the less mobile members of the public. Shops and services located within the path are continually accessible, preserving economic stability by maintaining static conditions for the public. Public spaces and venues allow groups to maintain or promote social contact during periods where "surface dwellers" can barely lift their faces into the wind, let alone be sociable, and public art commissions bring vibrancy to everyday spaces.

+15 and Devonian Gardens - Calgary, 1965 and 1977:
Calgary examined the precedent set in Montreal and also "relocated" the streets as part of their Urban renewal Scheme No.1, but unlike Toronto and Montreal whose downtown cores rapidly rise above the neighbouring bodies of water, Calgary's downtown is located at one of the lowest elevations in the city, in the floodplain of the Bow River. Instead of tunnelling, the streets were raised 15 feet into the air creating a system of bridges and pedestrian floors spanning the spaces between and within major downtown buildings, growing to 18 km of bridges and walkways. While originally designed to be a network of open decking, the bridges and pathways were altered to completely enclose the user - with winter specifically in mind.[3] Public mobility is again a priority, but an improvement over the subterranean PATH and RÉSO is that of consistency. With the primary transportation route set at a consistent elevation there are far fewer drastic grade changes, making the +15 much more accommodating than underground systems to people with reduced mobility. Public transportation is located at grade however, so while the elevated construction allows for natural lighting and easier navigation, the price is a greater disconnect from the rail and bus station. Similar to the underground interventions, the walkways of +15 are also programmed with

1 "*Path - Toronto's Downtown Pedestrian Walkway*", https://www1.toronto.ca/wps/portal/contentonly?vgnextoid=c76e6d876c86c510VgnVCM10000071d60f89RCRD
2 "RÉSO", http://ville.montreal.qc.ca/portal/page?_pageid=7317,79977650&_dad=portal&_schema=PORTAL
3 "*Calgary Plus15 Skywalk*", http://www.calgary.ca/PDA/pd/Pages/Centre-City/Calgarys-Plus15-Skywalk.aspx

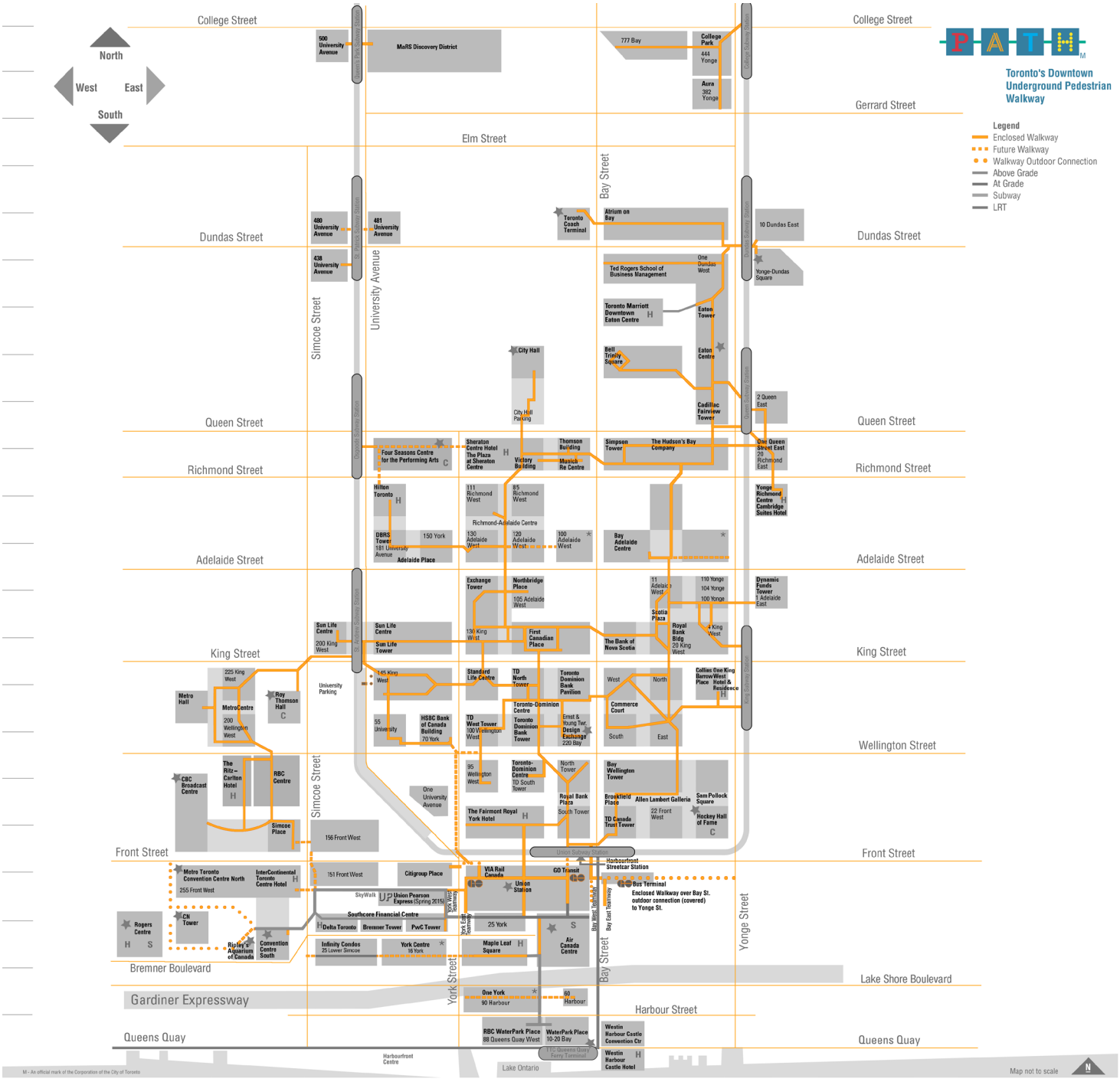
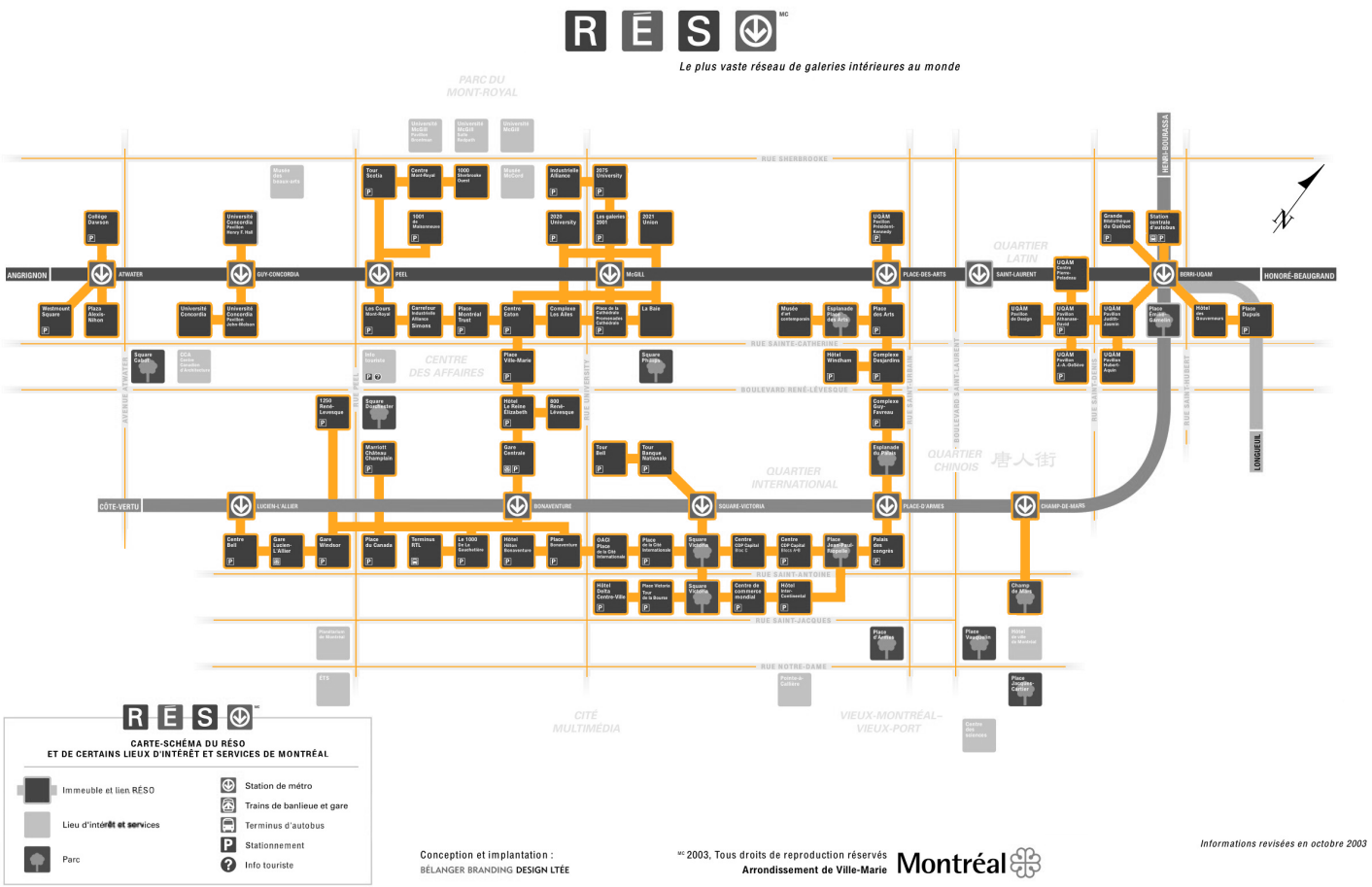


fig. A.1 Toronto - PATH

https://cafebanter.wordpress.com/2014/12/08/the-underground-p-a-t-h-of-toronto/

fig. A.2 PATH/RÉSO



http://virgula.uol.com.br/viagem/ja-imaginou-fazer-tudo-sem-ver-a-luz-do-dia-listamos-cidades-com-vida-subterranea-pelo-mundo/#img=1&galleryId=1158784

fig. A.3 Montreal - RÉSO

shops and services, but not to the same degree as the RÉSO, and certainly not the PATH, but still provide a significant economic function to the downtown core.

A bolder attempt at creating healthier urban winter life came from the inclusion of the Devonian Gardens. Constructed on the top floor of what is now The Core Shopping Centre, and one of the major nodes on the +15, 2.5 acres of greenhouse space are set aside creating one of the world's unique winter gardens. 550 palm trees and 10,000 tropical shrubs allow the public free access to a tropical oasis all year.

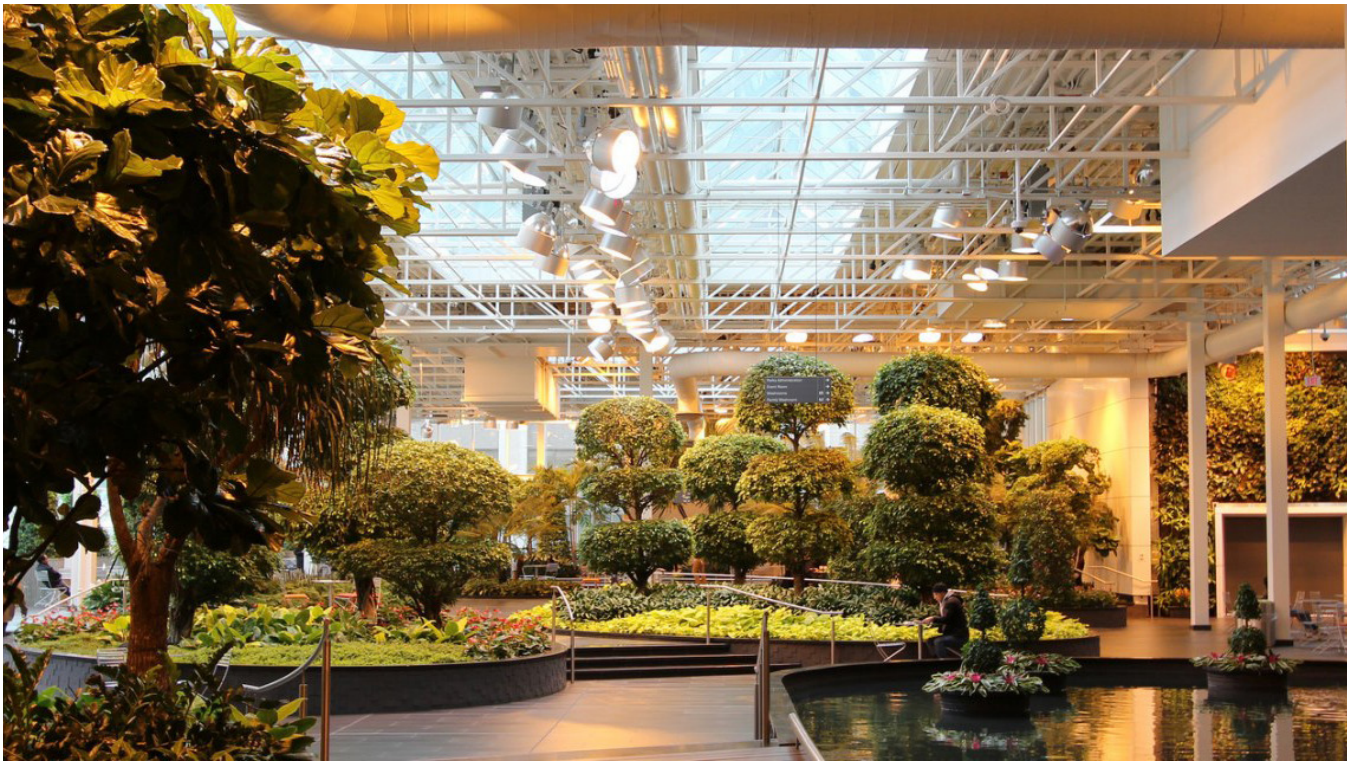
> *"The Japanese are masters of substitution of one sense for another. In the summer the householder likes to hang a picture of a waterfall, a mountain stream or similar view… and enjoy from its contemplation a feeling of coolness."*[4]
>
> *– Tetsuro Yoshida*

The Devonian Gardens allow Calgarians to make the substitute in reverse - immersing themselves in memories of heat while winter may rage metres away. The Gardens are wholly given to the city as a refuge where public life may function while the environment would make it impossible. There are event spaces available for reservation, a playground, meeting rooms, abundant public seating, water features, and educational programs. The Gardens contribute greatly to their parent city, providing space to gather and socialize, to learn or relax, all the while stimulating the eyes and senses.

Pedway - Edmonton, 1974:

The Edmonton Pedway emerged as a hybrid between the PATH and +15. While the downtown core of Calgary is located on a floodplain, the majority of Edmonton's downtown is safely located 60 metres above the North Saskatchewan River. As such, the LRT subway line that runs through downtown is below grade with stair and tunnel systems connecting the stops to either the street above or neighbouring buildings. Once the users have been brought above ground, the system shifts to +15 style bridges connecting buildings together with shop lined promenades on the interior - the shift being largely attributable to prohibitive excavation costs. Exactly like the previous examples the primary function is improvement of mobility while adding economic stability and direct, or at least short, connections to the existing public transportation networks. Sections tailored more to shopping areas pay notably more care towards aesthetics, but planned upgrades to the LRT stations also account for civic art. The northern edge of the downtown is to become a new ICE District with additional retail, services, and public spaces. At present, the only building in the ICE District

4 Zardini and Schivelbusch, 95



http://www.thousandwonders.net/Devonian+Gardens

fig. A.4 Calgary + 15

http://www.rogersplace.com/welcome-to-your-rogers-place/

https://theemchallenge.wordpress.com/author/ejstolte/page/3/

fig. A.5 Edmonton Pedway

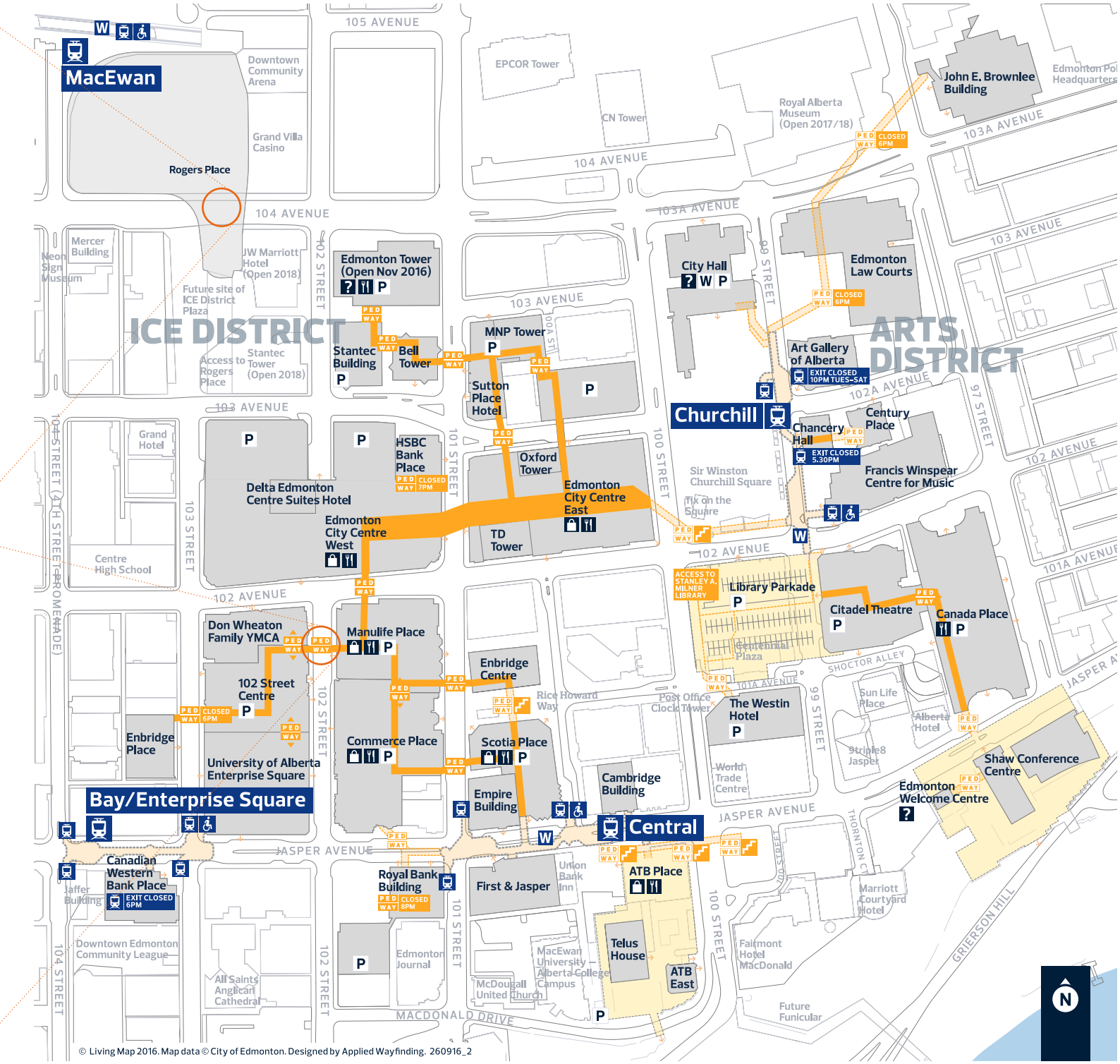


fig. A.6 Edmonton Pedway

completed is the new Rogers Arena, but the entryway is officially open public space, and will be directly connected to the Pedway as new projects are completed.

Housing Union Building (HUB) - Edmonton, 1969:
The HUB on the University of Alberta campus was an innovative attempt at designing student housing with extensive services and re-imagining campus circulation. Designed by Diamond and Myers Architects, the HUB was intended as a central space for campus life, both students, staff, and public. The building is laid out as a double loaded pedestrian "street" with multiple access points from the exterior, and a completely enclosed acrylic ceiling. The HUB mall comes as close to a public street as any enclosed space on campus, which at the time of design was a completely unprecedented approach[5]. The HUB supports a small economy within its confines, with 40 retail outfits, a daycare centre, game areas, lounges, health offices, restaurants, and other common services for 1,000 residents, and does act as a gathering space for a large portion of the campus populace[6]. Students and staff can freely move between nine other campus building while remaining completely protected from the elements, and is directly connected to the LRT station below grade, and the south entrance opens to the University bus terminal. While a great deal of function is provided by the HUB, the quality of the spaces it contains leaves something to be desired and it falls short of being an influential node on campus. There is minimal glamour or decoration, and other campus priorities have left renovations infrequent leaving the interior space feeling heavily dated. The majority of building expansion has occurred on the farthest edges of the main campus, and connection to these new developments simply doesn't exist. However, the HUB has become a neighbourhood in itself, allowing for a close approximation of urban activity to occur within its protective walls.

5 Capital Modern Edmonton. "Housing Union Building (HUB) 1969-1971)", Source: http://capitalmodernedmonton.com/buildings-by-area/hub/
6 Barton Myers. "Housing Union Building - Edmonton, Alberta," Source: http://www.bartonmyers.com/hub_01.htm

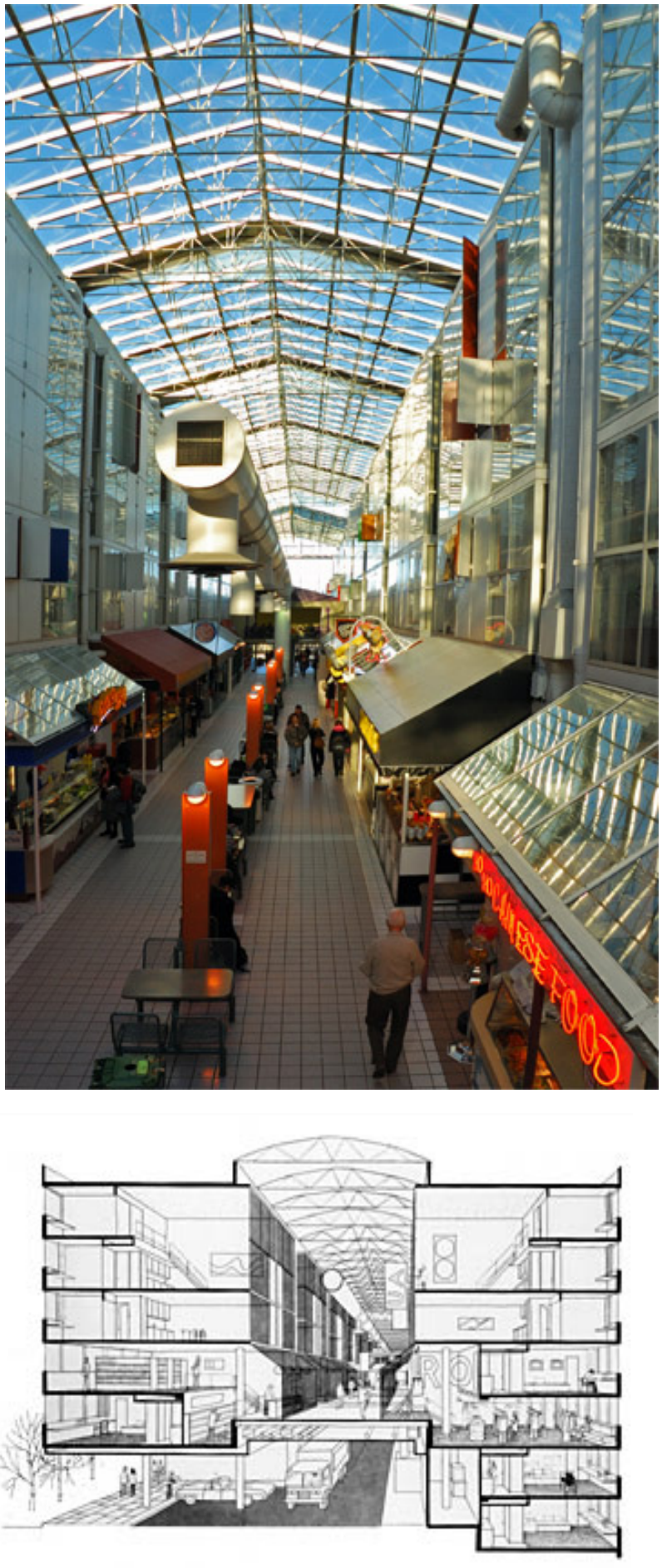


fig. A.7 Housing Union Building - University of Alberta

Rideau Centre - Ottawa, 1984:

In an effort to preserve balance between the newly constructed Rideau Centre mall and the existing shops on adjacent streets, a full canopy system was installed on Rideau Street, complete with transit stops, operable glass elements, and radiant heaters bringing variable climate control to the outdoors, intending to pull the benefits of the indoor shopping centre outwards. Economy was the driving factor once again, preserving economic stability within the area - not only during the onset of winter, but also from the threat of more "comfortable" competition[7]. Public transportation is encouraged by offering complete environmental control, and the sidewalks of Rideau Street would no longer have snowbanks or ice patches threatening a pedestrian's footing, and elevated bridges would extend the protected walkways to adjacent building clusters.

7 Mänty and Pressman, 48.

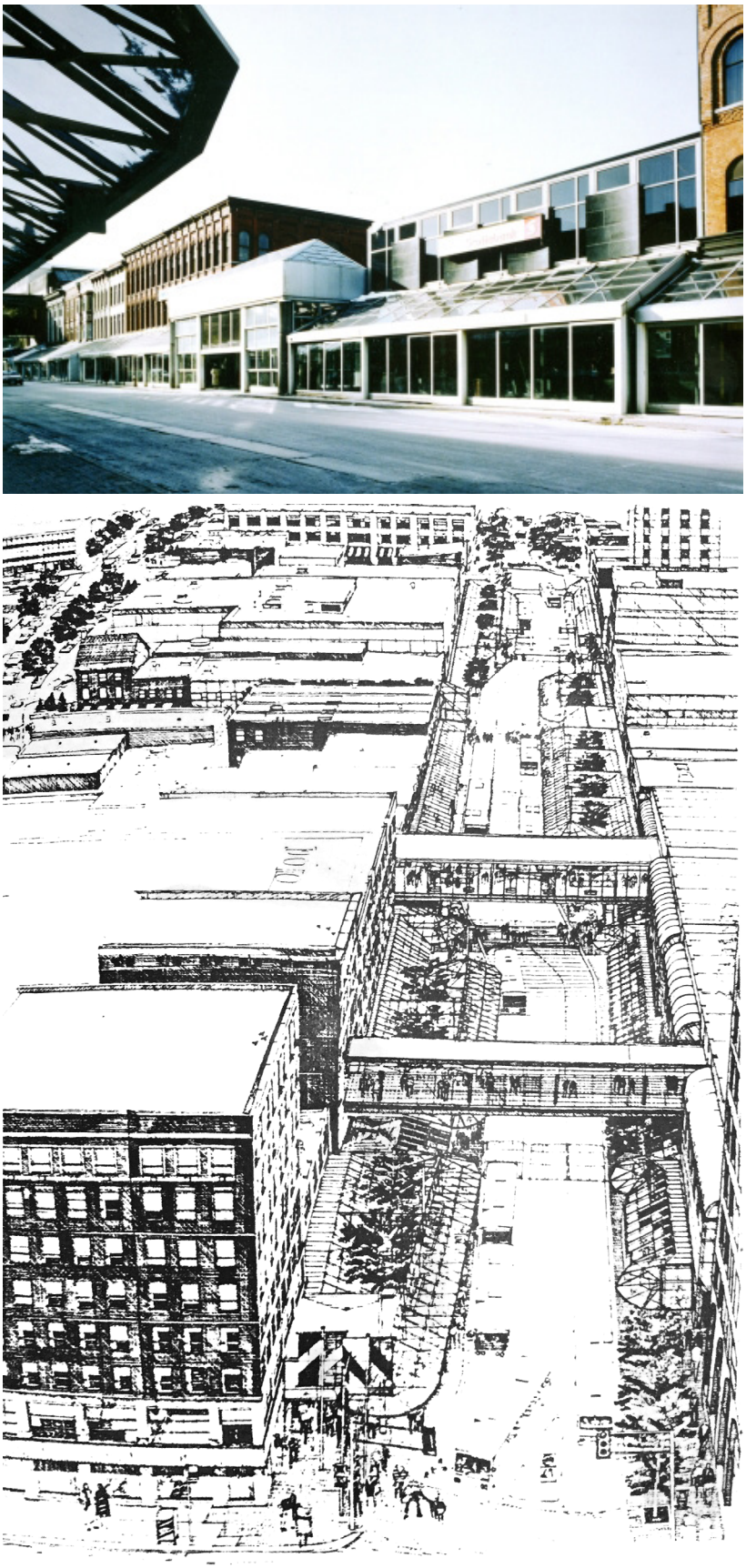


fig. A.8 Rideau Centre - Ottawa

Tactical Urbanism Precedents

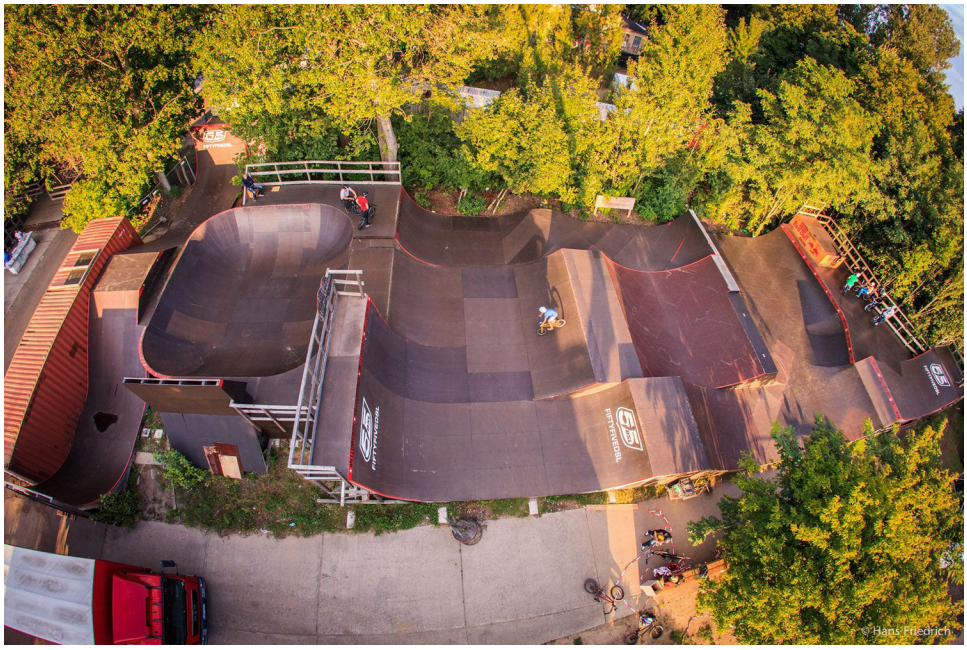
Monbijoutheatre & Strandbar Mitte - Outdoor Theatre and Beach Bar (1993)[1]:
The Hexenkessel Hoftheater group began performing at various outdoor venues throughout Berlin. Building upon an existing relationship with the Local Authority, the traveling troupe eventually settled in the Monbijou park in 1998 by setting up an annually recurring "exceptional use" agreement with the Parks and Recreation Department, and district council. The initial small stage has now evolved into a full amphitheater and adjoining beach bar along the Spree river and the production is financed through ticket and bar sales, and also through a catering service which finances artistic productions.

Mellowpark - Sports Park (1999)[2]:
Following a design competition, the youth group located next to a former cable factory was permitted to convert the yards into a youth sporting site and leisure park. The land was still owned by the TLG Immobilien GmbH corporation, but a legal framework was set up whereby the youth organization was allowed to use the land under a temporary lease (which could be revoked at any time), and as long as the youth group assumed all public liability costs. In this instance the Local Authority granted planning permission, provided funding through municipal programs to the youth centre itself, and acted as guarantor for the contractual agreements. Revenue is generated through sponsorship and ticket/food sales, and receives between 3,000-4,000 visitors per month.

Sandsation GmbH - Sculpture Garden (2004)[3]:
The Sandsation project began in 2003 when a Danish artist approached the Berlin government for permission to host an international sand sculpture festival on the grounds owned by the Federal Ministry of Finance. In the intervening years ownership of the land has changed to the DSK German town and land development company, but the festival has continued using "cooperation contracts" and ongoing permits issued by the Public Works Department until its final iteration in 2010. The financing for the Sandsation festival is quite straightforward; revenue is gathered from ticket sales, company sponsorship, and food/beverage sales on site.

1 Denton, 71.
2 Denton, 60.
3 Denton, 77.

Monbijoutheatre, https://www.mydestinationberlin.com/things-to-do/monbijou-theater-ampitheatre



Mellowpark, https://www.mellowpark.de/

Sandsation, By RHaworth - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=7421009

fig. A.9 Urban Pioneering

Appendix B – Urban Strategies

8 Strategies of Drosscape

1. Dross is understood as a natural component of every dynamically evolving city. As such, it is an indicator of health urban growth.

2. Drosscapes accumulate in the wake of the socio- and spatio- economic processes of de-industrialization, post-Fordism, and technological innovation.

3. Drosscapes require the designer to shift thinking from tacit and explicit knowledge (designer as the sole expert and authority) to complex interactive and responsive processing (designer as collaborator and negotiator).

4. The designer does not rely on the client-consultant relationship or the contractual agreement to begin work. In many cases a client may not even exist but will be searched out and custom-fit in order to match the designer's recent discoveries. In this way the designer is the consummate spokesperson for the productive integration of waste landscape in the urban world.

5. Drosscapes are interstitial. The designer integrates waste landscapes left over from any form or type of development.

6. The adaptability and occupation of drosscapes depend upon qualities associated with decontamination, health, safety, and reprogramming. The designer must act, at times, as the conductor and at times the agent of these effects in order to slow down or speed them up.

7. Drosscapes may be unsightly. There is little concern for contextual precedence, and resources are scarce for the complete scenic amelioration of drosscapes that are located in the declining, neglected, and de-industrializing areas of cities.

8. Drosscapes may be visually pleasing. Wasteful landscapes are purposefully built within all types of new development located on the leading, peripheral edges of urbanization. The designer must discern which types of "waste" may be productively reintegrated for higher social, cultural, and environmental benefits.

Berger, Alan. "*Drosscape: Wasting Land in Urban America*." New York: Princeton Architectural Press, 2006, *fig. A.10 p 239*.

5 Strategies of Tactical Urbanism

1. Empathize: Understand for whom you planning or designing
A design solution may seem apparent, but for the project to be truly effective one must understand who the true audience is. Contact people in the neighbourhood, and better familiarize yourself with the area. Who will benefit from the intervention, and who will not? Can this be leveraged to gather additional resources, or modify the design to reach a greater proportion of people?

2. Define: Identify specific site and define the root causes of the problem
It is essential to understand the needs of the community when selecting a site. If possible reduce the scope of both the site and project, at least in the beginning, to be able to more comprehensively respond to the project demands - if successful the project can always be scaled upwards at a later time. Determine if the identified problem occurs elsewhere, and if there is any specific site history which may affect the future development.

3. Ideate: Research and develop ways to address the defined problem
Determine whether the project will be developed by a small team or a larger group, but bear in mind a larger network is beneficial at any stage of the process. This is the stage where the toughest questions will be asked, such as valuating if the project will in fact raise the status quo, will it be understood by all, can it be repeated, and what are the challenges to be faced before completion? This is also when the decision to be sanctioned or unsanctioned needs to be made. Better knowledge of the landowners and authorities is crucial here: will they tolerate unsanctioned use and under what conditions, will they be willing partners, or will they oppose the plan?

4. Prototype: Plan a project response quickly and inexpensively
At this stage what makes the project tactical is the intent: it is not a stop gap, it is searching for a response. Ensure the long term goal of the project and the means of continuation to achieve it is apparent to better communicate your intent to the public, and also to appeal to potential partners in the process. Additional people can be brought on for financing, production, material supply, coordination, permit acquisition (if sanctioned), and for communication with the public.

5. Test: Putting the build–measure–learn process to good use
This is the point where the project is finally implemented - the potential for failure is high, but that is one of the major strengths of the process. With fast turnaround and low expenses, solutions for complex issues can be derived through an iterative process, learning and improving with each cycle until a final, potentially permanent solution is resolved.

Lydon, Mike, and Anthony Garcia. "*Tactical urbanism: short-term action for long-term change.*" Washington, DC: Island Press, 2015, p 171-207.

Appendix C – Bus Shelters

Just as Tactical Infrastructure is a first step, so too are the artifacts. With the potential for rapid turnover in each site the generation cycle can be deliberately shortened, accelerating the evolution of the forms, functions, and artifacts. Initially simple, the experiments undertaken by the Urban Pioneers will reveal specific demands and hidden niches which may require innovative design solutions and the artifacts should be no means be forced to remain generic. By way of example, a speculative design is for the tactic of snow forms in the terrain vague to be reinforced with mobile, programmed, and temperature controlled bus shelters.

Edmonton's public transit is adequate, but it is definitely underused compared to other major Canadian cities: comparing 2014 statistics, Edmonton averaged 101.7 ride per capita[1] compared to Toronto's 187.5 as stated by the TTC website. There is a silent, losing battle occurring: of course citizens would rather drive downtown full of ample parking instead of standing outside, using a pittance of shelter waiting for a bus (fig. C.1). Using shipping containers as a familiar placeholder, the experience of waiting for a bus can be completely transformed by varying the program each bus shelter provides according to the local demands: one in a downtown location is leased by a Tim Horton's, while another in the River Valley can double as a snowshoe/ski rental shop. Placed in front of a vacant lot their programming may spill out and temporarily reclaim the available space (fig. 5.30). Shipping containers turned bus stops are a distant generation of artifact and are not illustrated to represent a goal but to highlight one potential direction they may evolve.

1 Edmonton City Management, "*Our Progress on The Way Ahead,*" Report for City of Edmonton (2014), 19.

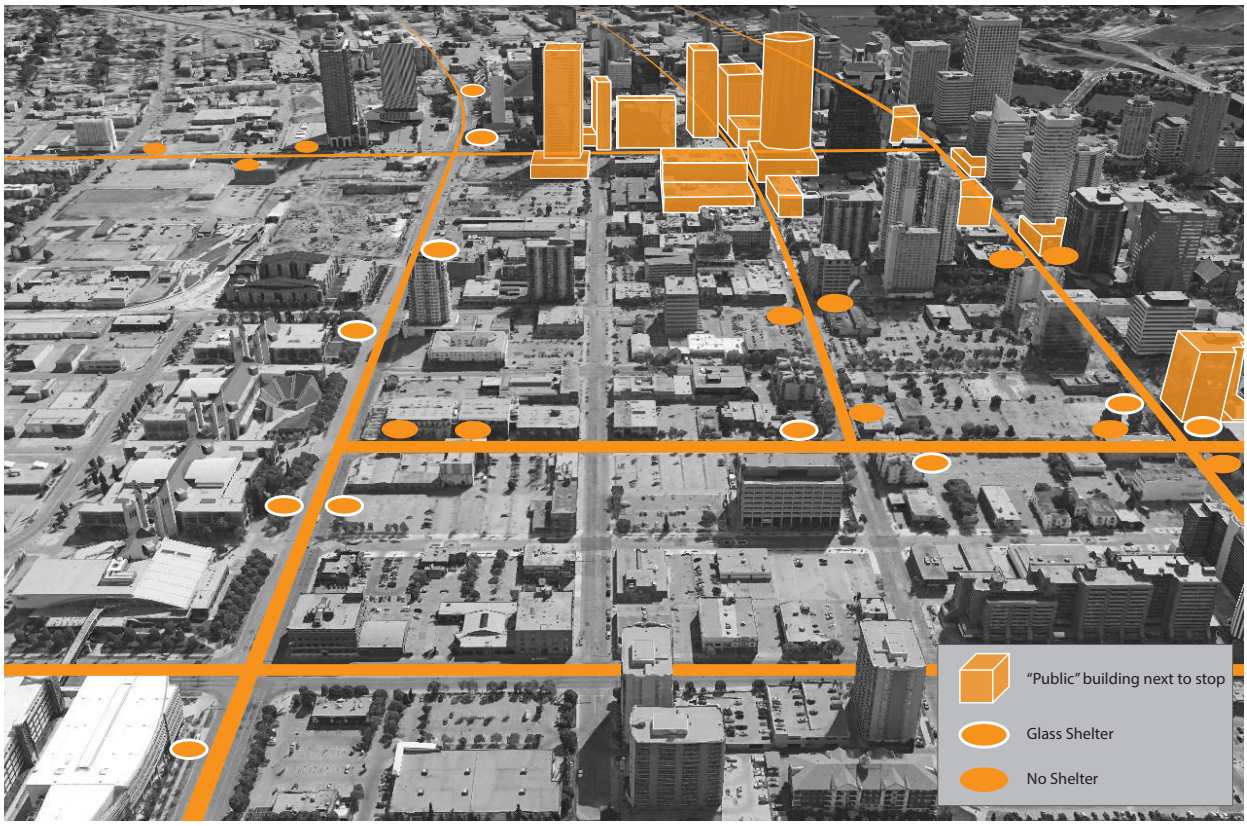
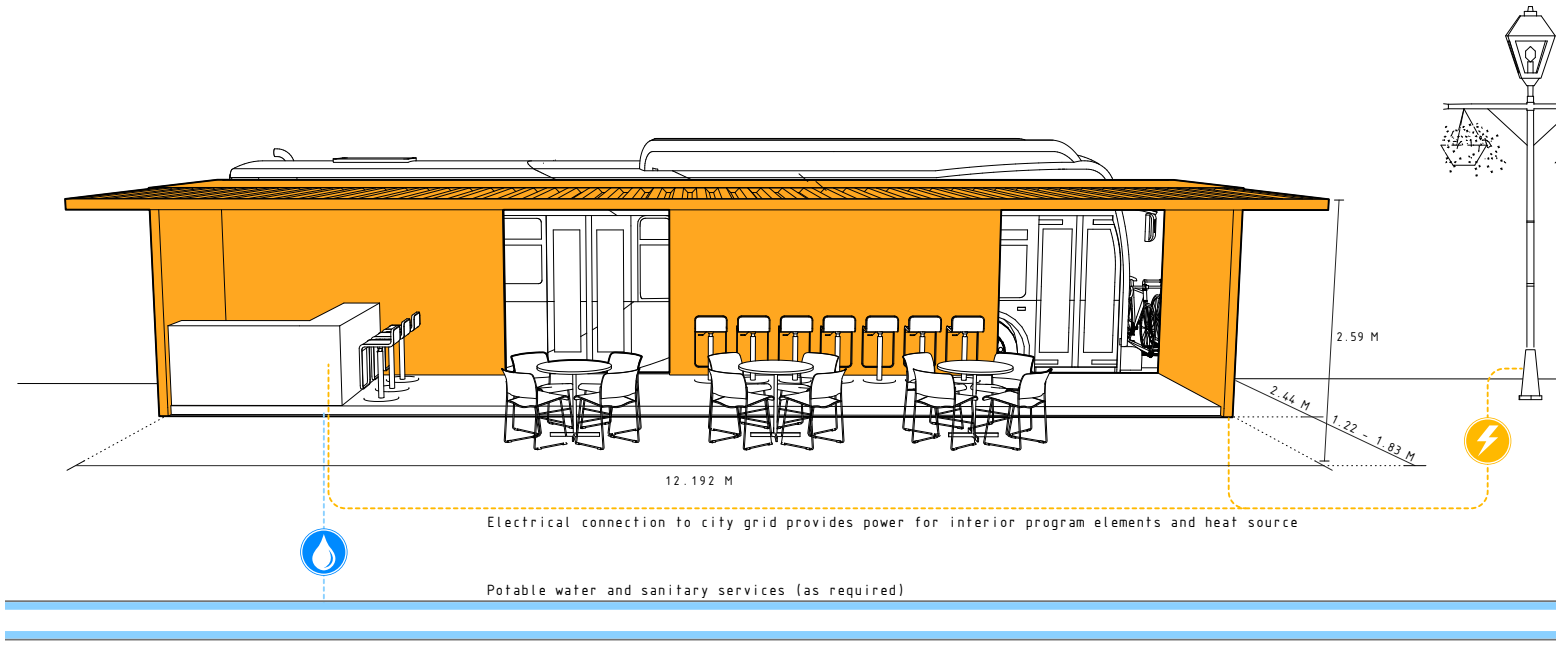


fig. 5.42 Downtown-West Bus Stops

fig. C.1 Bus "Shelters"



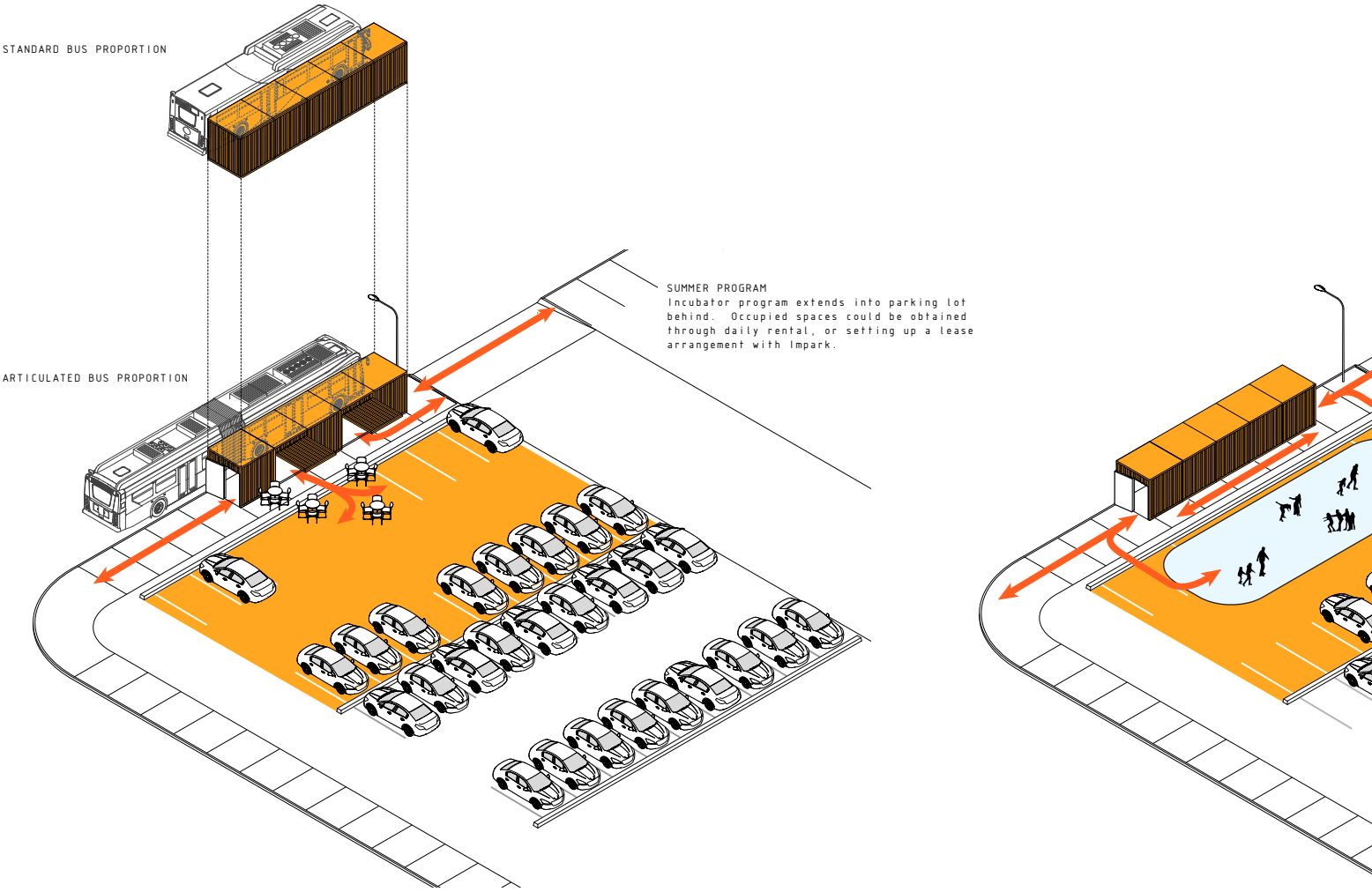
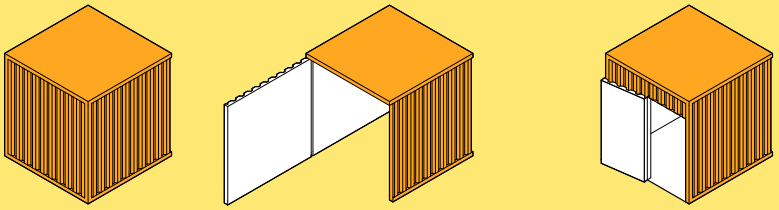
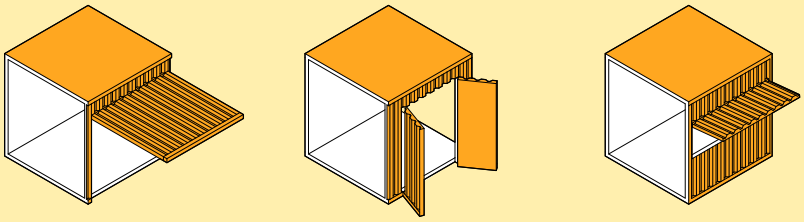


fig. C.2 Bus Shelters – Urban Incubators

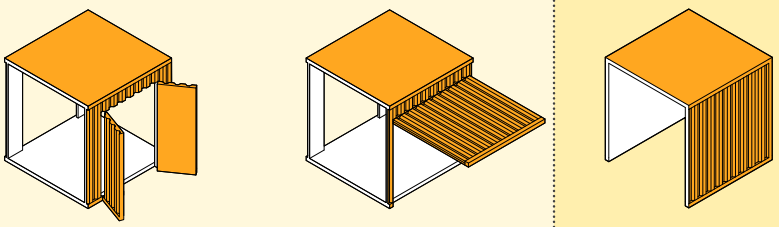
END COMPONENTS
Capped
Full Aperature
Partial Aperature

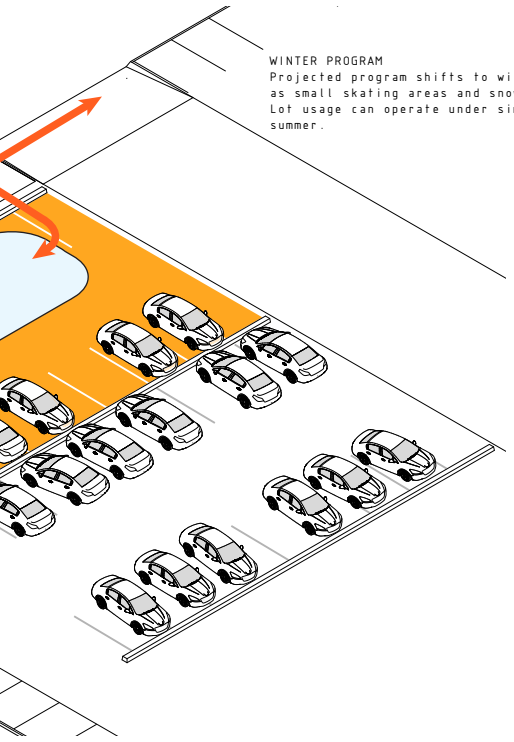


FILL COMPONENTS
Awning
Double Hinged Exit
Vendor Window
Through (Below)

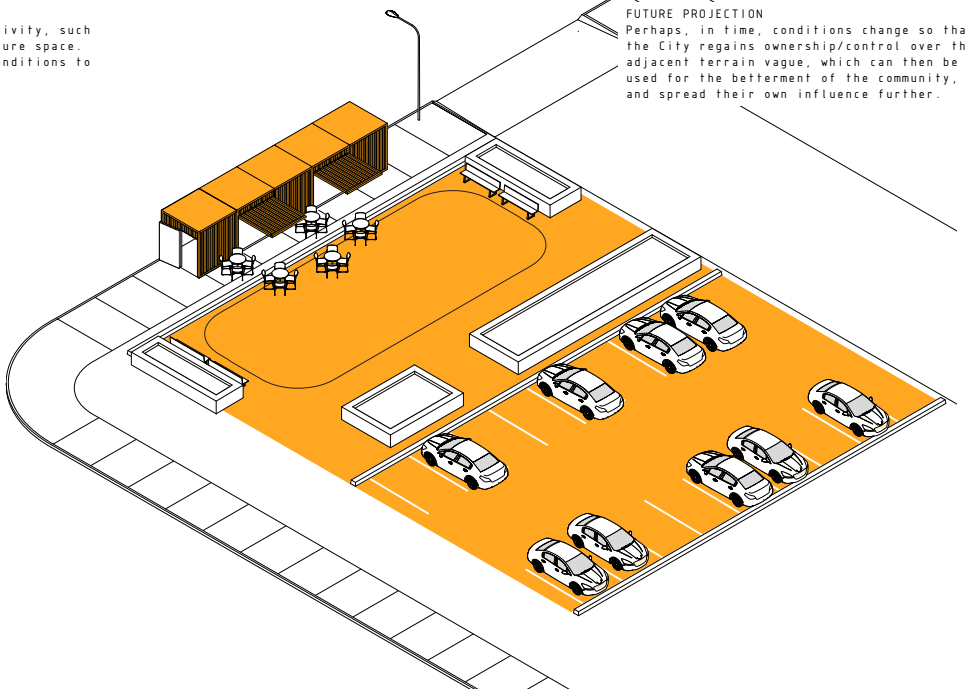


BUS COMPONENTS
Double Hinged Exit
Awning Exit





WINTER PROGRAM
Projected program shifts to winter activity, such as small skating areas and snow sculpture space. Lot usage can operate under similar conditions to summer.



FUTURE PROJECTION
Perhaps, in time, conditions change so that the City regains ownership/control over the adjacent terrain vague, which can then be used for the betterment of the community, and spread their own influence further.