

**Subdivided and Reconnected: Community Integrated
Transportation Hubs as a Response to Car-Centric Growth**

by

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Dalhousie University is located in Mi'kmaq'i,
the ancestral and unceded territory of the Mi'kmaq.
We are all Treaty people.

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In memory of my Father, Kim Petersson, who lost his lifelong battle with cancer in November 2021.

While your life may have been cut short, I will forever cherish the memories, stories, and laughs we shared, and I am grateful to be your son. Not a day goes by where I don't count my blessings to have you as my father and role model. Your unshakable optimism, impeccable sense of humor, strength and humility have undeniably shaped the man I am today.

Thank you for all the sacrifices, and constant support which have provided me with the opportunities to pursue my passion for architecture at both undergraduate and graduate levels—making it possible to write this thesis. While this thesis is a culmination of years of studying and hard work, I want to take this opportunity to recognize the lifetime of hard work you have experienced to get me to where I am today, and for that I am forever grateful.

I love you beyond words, may you rest in peace.

-Jay

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Abstract

In little over a century Calgary has gone from pioneer beginnings to an expansive urban area. The City of Calgary's policies have fostered the conditions for automobile-dominated, single-use and low-density neighbourhoods. This ideology has prioritized the construction of freeways over all other forms of transportation. This has isolated those without cars from the city by separating one community from another.

This thesis re-imagines Calgary's public transportation network as a multi-modal system that reconnects neighbourhoods and offers a more vibrant and integrated city. Two design projects—a neighbourhood transit hub and a central city transit hub—explore how such integrated transportation hubs can serve as catalysts for inclusive social interaction and improve quality of life.

Acknowledgements

This thesis could not have come to fruition without all the guidance, support and encouragement that so many have willingly provided this past year, and for that I am forever grateful.

I would like to thank my supervisor Christine Macy for sharing her knowledge of urbanism, urban systems and social placemaking which played an influential role in all aspects of this thesis. Thank you for providing insight on your experiences with suburbia, and for challenging me to explore my ambitious dream to help re-think my hometown. I would also like to thank my advisor Diogo Burnay for his insight into the design of public spaces, and for encouraging me to push the limits of what public programming could be.

Thank you to the City of Calgary for the images, maps, and data that were instrumental to my research. Specifically to Jason Halfyard from The City of Calgary Property Research for granting me authorization to use the drawing set for the former Greyhound terminal which served as the base for the adaptation in my design proposal.

I want to thank my classmates, past and present, for making my experience of architecture school an extraordinary one. The memories we share will last a lifetime and I am so grateful for your friendship.

Thank you to my family, for your belief, encouragement love and unwavering support as I pursue my dreams. I love you.

Finally to Paige, I can't thank you enough for your constant support, encouragement, and patience.

Chapter 1: Introduction

This thesis explores the intersection between transportation systems and urban growth in the context of Calgary, Alberta—a city whose structure is defined by the policies and strategies put in place to respond to periods of rapid city growth. Transportation and urban growth in Calgary have always had a symbiotic relationship, and this thesis analyzes how these interdependent systems have shaped our communities, and the impacts they have had on both the city and the region. Rapid urban expansion characterized by developer driven large-scale, automobile-serving, single-use communities, has created an automobile dependent population that are otherwise isolated within their suburban communities. Calgary's policies toward urban expansion to anticipate and meet demands for post WWII growth saw the city separate surrounding communities from the city to maintain complete, unconstrained control over its future growth by annexing adjacent communities. The following chapters explain how and why these urban conditions were created, their effects on city life, and how architectural interventions might offer a step towards reconciling the damage that has been done.

This thesis asks the question: How might we learn from and adapt the unilateral transportation systems that once segregated our communities to a multi-modal transportation system that implements architectural interventions to integrate these systems and reconnect communities?

To provide solutions for existing problems, we must first understand how they came to be. Chapter 2 introduces the context of the project, the various factors that have established Calgary's urban conditions, and how these

conditions contribute to isolation for residents within their communities. Chapter 3 presents my first architectural design proposal, which leverages positive aspects of suburban community structure to address the lack of modal accessibility for residents, as well as offer a strategy to generate opportunities for social interaction that is currently lacking within many of Calgary's sprawling communities—while simultaneously providing services that are often non-existent or not accessible within these communities. Chapter 4 then analyzes strategies that could generate potential opportunities to remedy issues with Calgary's transportation infrastructure at the city and regional scale by studying related literature and theory. Chapter 5 presents my second architectural design proposal, which responds to the needs of a major growth area adjacent to Downtown Calgary in the community of Sunalta and addresses the gaps within Calgary's regional transportation system by providing an urban transportation hub, where all the city's current and future transportation systems are integrated, and all the regions' diverse populations can interact. The two design proposals are intended to provide a framework for future implementation, with the goal of creating a more accessible, connected, and sustainable future for Calgary.

Chapter 2: Calgary Context

The Historic Role of Transportation in Western Settlement

Calgary began as a Fort for the Royal Canadian Mounted Police located near the confluence of the Bow and Elbow rivers, which was historically a meeting place for Indigenous peoples. With the westward expansion of the Canadian Pacific Railway in the 1880s, the city developed rapidly. The Canadian Pacific transcontinental railroad, a nation-building promise by Prime Minister John A. Macdonald, opened the west for mass settlement and physically united Canadian's coast to coast (Canadian Pacific Railway 2021). With the Dominion Lands Act of 1872, the Canadian Pacific Railway was granted 25 million acres of land for the construction of the railway; on these subdivided parcels the CPR created settlements at intervals along its new track and sold these for bargain prices to attract settlers immigrating west. On the completion of the transcontinental railway, the CPR envisioned a string of lavish hotels across Canada that would draw wealthy visitors to the pristine beauty of the Rocky Mountains, advertising scenic mountain vistas. The Banff Springs Hotel (1888) was a huge success for the company, which led the CPR to continue marketing the western Canadian landscapes for outdoor recreation and tourism (Canadian Pacific Railway 2021).

Calgary and the Canadian Pacific Railway

Calgary's location between the foothills of the Rocky Mountains and the prairies, at the intersection of north-south and east-west trade routes—made it a strategic location for trade and settlement (Sandalack and Nicolai



“Travel the Canadian: the scenic dome route across Canada”
(Couillard 1955).

2006, 6). In 1883 the CPR selected Calgary as its principal maintenance centre for the western prairie provinces, and the city became a hub for several branch railway lines. The railway strongly influenced Calgary’s early urban structure, its growth, and its character. The relationship between the Bow and Elbow Rivers, the railway and topography set the stage for Calgary’s first urban patterns. This included a street grid radiating outward from the railway station which served a central business district from. Further outwards,

residential neighbourhoods were built in a concentric configuration (Sandalack and Nicolai 2006, 8). The city's population increased from 4,000 residents in 1900 to 50,000 at the start of World War I in 1914. The CPR and real estate speculation spurred the city's early growth, with Calgary having subdivided enough land to house a population of half a million people prior to WWI; even though the city would not reach this population until the 1950's. This phase of development up until the 1940's, was characterized by its relation to natural features, patterns of subdivision and incremental changes to grid forms with the introduction of new building and transportation technologies (Sandalack and Nicolai 2006, 12). The Calgary Municipal Railway electric streetcar service, starting in 1909. These early streetcar lines had a significant influence of Calgary's urban form, spurring mixed density residential growth along lines. Residential development was generally compact and linked to the City's transportation infrastructure (Sandalack and Nicolai 2006, 22).



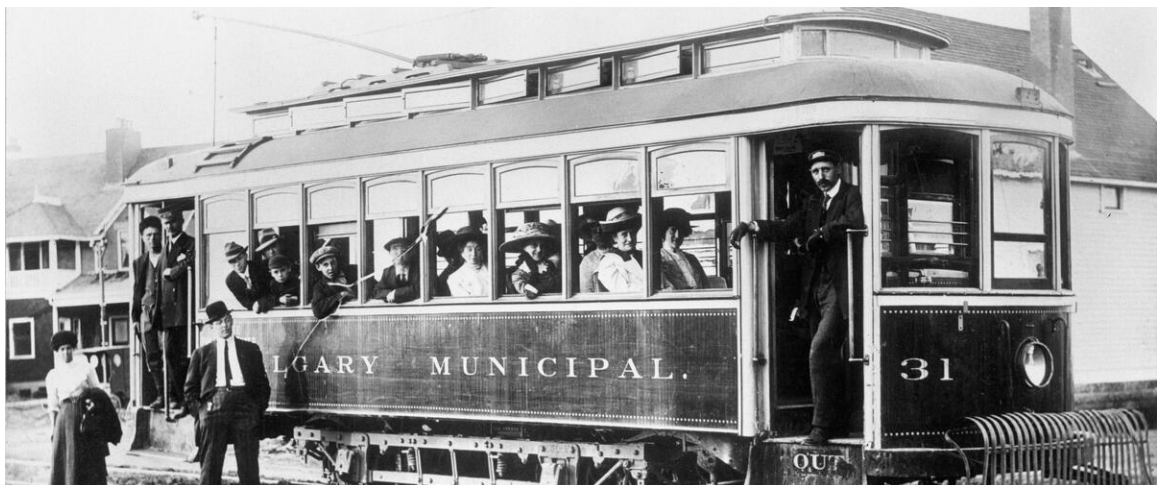
"Plan of the Town of Calgary being parts of Sec's 14, 15 & 16, Tp 24, Rge 1 West of 5th I.M. south of Bow River." Glenbow Archives CU-1105-4205. (Messrs Jephson & Wheeler D.L. Surveyors 1891)

Annexation and the Automobile

Following the discovery of oil in Leduc in 1947, buses began to replace the streetcar system (Stamp 2000, 51), and the rise of the personal automobile had an even greater impact on the future development patterns of Calgary. In the 20 year period from 1944 to 1964, annual transit ridership fell 10% (from 26 to 24 million) at a time when Calgary's population was tripling in size (Foran 2013, 13). A 1962 study from the city of Calgary confirmed that 72 percent of downtown commuters travelled by car, and only 28 percent used public transit (Stamp 2000, 62). This swift transition away from public transportation ushered in the automobile era, which continues to dominate Calgary's transportation system to this day.

Uni-City Growth

As the post-war years ushered in the automobile age, so too did Calgary's planning policies and growth strategies. In 1955, the Royal Commission on the Metropolitan Development of Calgary and Edmonton recommended a car-centered "Uni-city" strategy. The Uni-city approach is



Calgary Municipal streetcar taken at 26th Avenue and 14th Street SW, Calgary, Alberta. Car number 31. Glenbow Archives CU-176-151. (University of Calgary 1911)

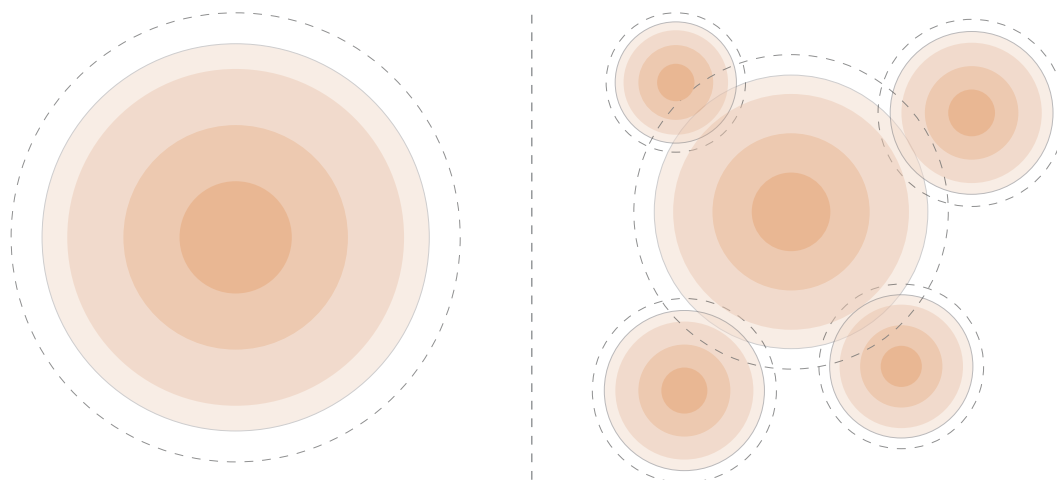


Diagram comparing Calgary's uni-city growth pattern (left) vs. a typical metropolitan growth pattern (right)

different from the traditional growth model seen in many other North American cities; it rejects the metropolitan strategy of incorporating multiple municipalities to create a larger metropolitan area with multiple governing authorities. Instead, the commission's recommendation suggested that the most effective way of controlling development would be to extend the city's boundaries beyond its built-up area, to encompass nearby towns— ensuring that Calgary could operate as a single municipality with control on all aspects of governance (Sandalack and Nicolai 2006, 88). This recommendation was a response to the overwhelming growth after World War II, when the remaining developable land within the city's boundaries was consumed. Conversely, the small towns and undeveloped lands outside the city's boundaries placed few regulations on development, allowing people to build on unserviced lots for cheaper, and at smaller sizes than would have been allowed in Calgary. The city saw this as a threat to orderly development, and a loss of potential tax revenue from growth beyond city limits (Stamp 2000, 135).

Land Annexation

Land annexation was Calgary's primary tool to achieve its Uni-city vision for the future. Anticipating future development, it annexed land far beyond the built-up area and it secured complete control over adjacent and metropolitan development. The newly annexed city-owned land was then sold to developers at discounted prices to create new subdivisions (Foran 2009, 24). Both the city and developers believed that the private sector was best suited to meet

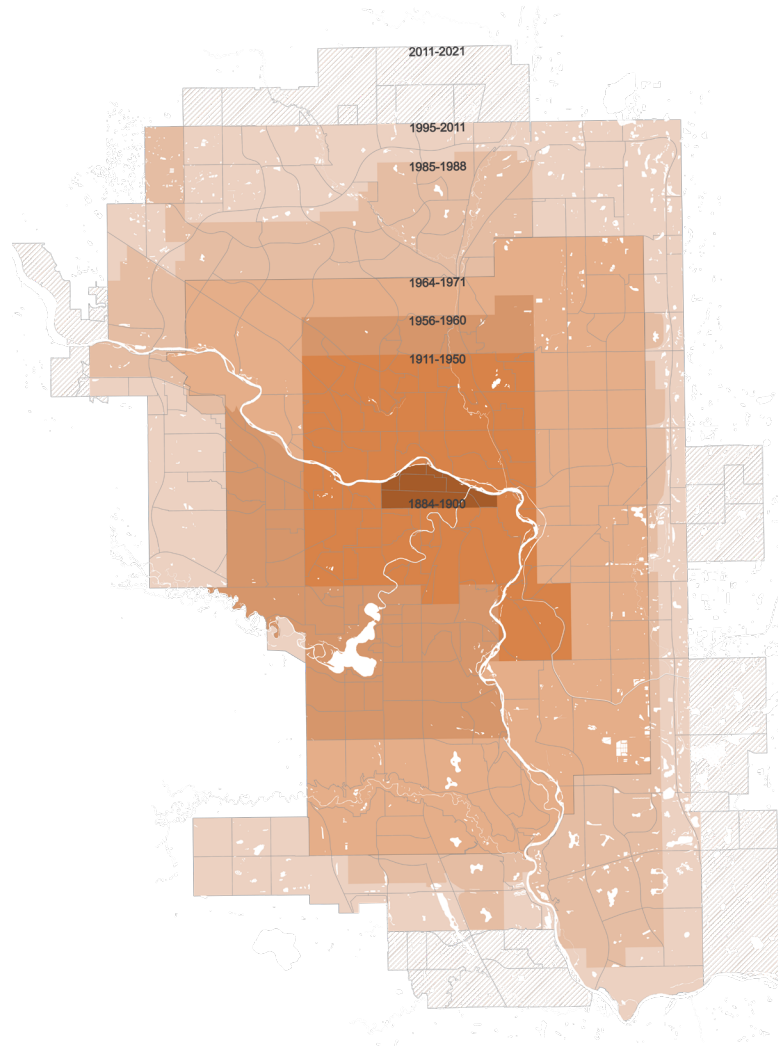
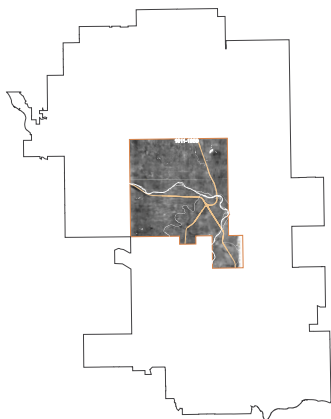
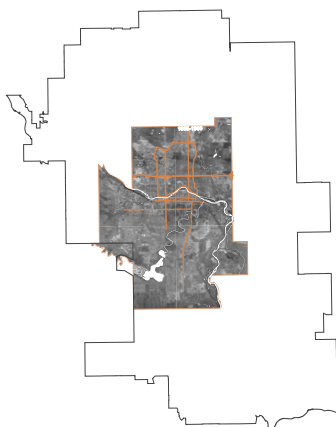


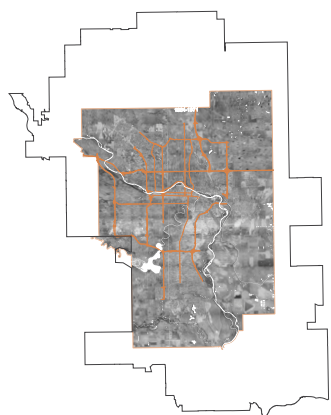
Diagram illustrating some of Calgary's boundary changes via land annexation throughout history, with associated dates (The City of Calgary 2022).



1924-1926: Post CPR growth.



1962: Post WWII growth.



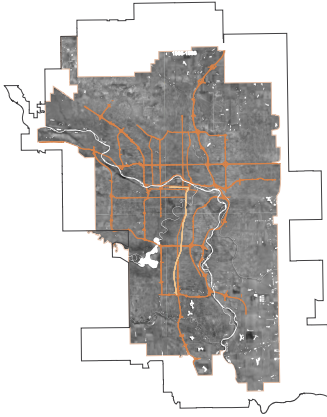
1972: Energy Crisis oil boom growth .

the market-driven consumer demand for housing (Foran 2009, 14). The developer preference for low-density zoning prompted the city produce zoning bylaws that designated virtually all north and northwest Calgary as R2 (multi-family residential), which allowed for the developer preferred R1 zoning for single-family dwellings (Foran 2009, 72).

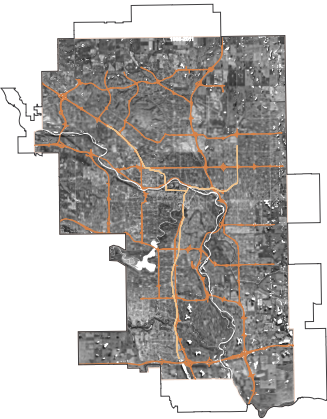
The notion of letting the market demand determine the type and location of housing to build seems like a hands-off capitalist approach to provide the best options to meet the needs and demands of city residents, however, this is far from the case. The city's zoning practices that segregated land uses and reinforced low-density were in the best interests of developers, and as a result, directly shaped consumer demands in the city. The suburbs are therefore not necessarily a reflection of the way people want to live or true market forces but are instead a consequence of the policies that Calgary's municipal government and planning authorities have created (Chakrabarti 2013, 33).

Fostering Automobile Dependency

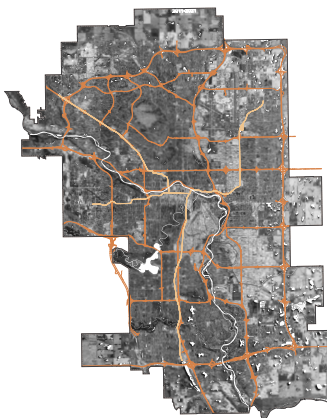
Corresponding with the Uni-city plan and the rise of the automobile, Calgary developed as a continuously expanding concentric ring around its core— radiating out into the vast prairie landscape, with nothing to prevent its relentless growth (Sandalack and Nicolai 2006, 88). This pattern of development required a correspondingly expanding road infrastructure. The Major Thoroughfare Plan of 1954 designated four categories of streets: arterial thoroughfares (provincial highways), major thoroughfares (connecting parts of the city), secondary thoroughfares (collector roads connecting to major thoroughfares) and parkways— roads through scenic areas of the city (Stamp 2000, 69). These



1984: Pre-economic recession growth.



2005: Oil Sands growth.



2020: Present-day growth.

thoroughfares symbolized the modern age. A quote from Le Corbusier perfectly summarizes these modernist ideas: “the new man” needed “a new type of street,” that would be “a machine for traffic” (Stamp 2000, 81).

This technological focus changed the centuries old notion of a street as a public realm for pedestrians, making it instead subservient to the automobile. The old street with its mixture of people, economic classes, businesses, and dwellings no longer had a place in the modern domain of the automobile. All the space which has been allotted for cars induces a greater need to use cars, which in turn drives cities to provide more space for them, and subsequently less space for pedestrians (Jacobs 1961, 351).

Car-Centric Design

Years of planning policies and development strategies that have prioritized the automobile have neglected all other forms of transportation. This impact is even visible at Calgary’s existing transit stations, who often exist as single purpose buildings surrounded by unwalkable parking wastelands which cater to the automobile over people (Lafleur 2011, 10). To offer solutions to these problems, it is crucial to identify how these patterns have developed, and the impact that automobile dominance has had on the rest of the city’s transportation networks.

The Light Rail Transit (LRT) “CTrain” was first introduced in 1981, three decades after Calgary abandoned its municipal railway streetcar. It was first conceived in the early 1970s, when the city decided to scale back roadways and focus on smaller scale rapid transit alternatives (Lafleur 2011, 7). The CTrain provided sprawling suburban communities with a higher frequency transit option that was more energy

efficient than buses and didn't add to road congestion. The success of the CTrain LRT has helped shift the Calgary's stereotype as an auto-dependent city, however the main issues that stemmed from the city's growth policies continue to persist today.

By extending the lines far into the suburbs and offering ample parking at park-and-ride stations, the CTrain system has continued to promote urban sprawl by making it more convenient for families to live further from downtown (Lafleur 2011, 4). These large park-and-ride lots are a result of Calgary having the highest concentration of Central Business District employment of any major Canadian city, but the lowest number of parking spaces per downtown employee. This "hub and spoke" system relies on automobiles and feeder buses to get passengers on rapid transit (Lafleur 2011, 8), and assumes most people will drive to stations rather than walk, bike or bus (Dittmar and Ohland 2004, 6).

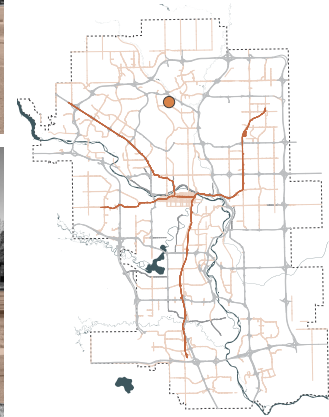
Single Purpose Stations

Most of Calgary's existing LRT stations are single purpose-lacking social spaces or daily services. When stations are close to services, these are typically large shopping centres already designed for the automobile, and again requiring LRT users to cross large parking lots. Bicycle parking is rudimentary, usually non-secure bike racks; only 14 of Calgary's transit stations have secure bike lockers available for rent, and none of them have bike parking garages that would attract bike-and-ride commuters (Calgary Transit 2021).

CROWFOOT LRT STATION



SANDSTONE BUS TERMINAL (PARK AND RIDE)



Existing car-centric transit station design. This series of images compares the existing conditions at a typical suburban light rail transit station (Crowfoot station) and a typical suburban bus terminal (Sandstone Bus Terminal). Areas highlighted show the large areas of pavement dedicated to the automobile for park and ride lots, and roads.

From “The Neighbourhood Unit” to the “Sector”

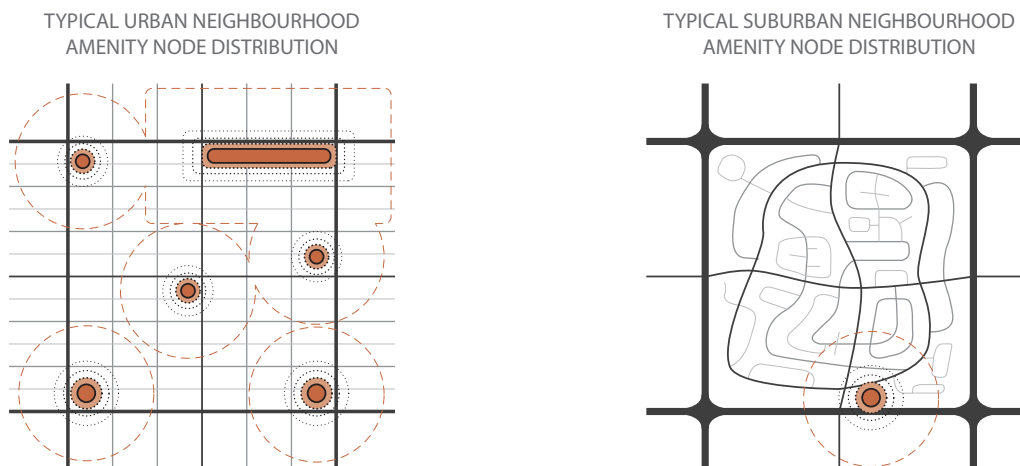
This issue of single use extends to Calgary’s urban fabric as well and has separated single family homes from all other land-uses that are necessary for daily life. Calgary’s implementation of single-use zoning practices which began in the 1950s led to the creation of “the neighbourhood unit” concept as a framework for suburban development (Stamp 2000, 115). Initially proposed as the area served by the average elementary school, and this concept was thought to provide a safe living environment for children, uninvaded by traffic, yet with direct access to major thoroughfares on



Diagram illustrating Calgary’s suburban neighbourhood unit typology. Each neighbourhood contains a school, natural features and parks, and are surrounded by perimeter roads for easy automobile access (The City of Calgary 2022).

the perimeter of the neighbourhood (Sandalack and Nicolai 2006, 80). The automobile infrastructure clearly defined neighbourhood boundaries, and on its interior, a curvilinear internal street system linked schools and shopping— safe from the dangers of automobile traffic.

However, in the haste to meet the demand of post-war growth, private developers undermined the city's plan for utopian neighbourhood units, creating instead large subdivisions that were intersected by large thoroughfares (Foran 2009, 74). By the 1960s, Calgary's city planners shifted their strategies away from the neighbourhood units to larger geographical areas called "sectors" (Stamp 2000, 128). These sectors conformed to the developer's desire for larger scale communities and following the strategies of the neighbourhood unit, were also bounded by major thoroughfares, freeways or natural features (Stamp 2000, 129). The sector strategy allowed developers to assemble huge tracts of land for suburban development. A maze-like pattern of curving streets discouraged through traffic and kept most vehicles on peripheral roads. While the



Diagrams comparing and contrasting the amenity node distribution within a typical urban neighbourhood typology and a typical Calgary suburban neighbourhood typology.

utopian idea of having a neighbourhood separated from vehicular traffic was great in theory, its realization has left deep marks on many Calgary residents, who are isolated in their communities by a daunting infrastructure of high-speed roads. Such roadways isolated residents from the city by separating one neighbourhood from another. These strategies of planned growth and single-use zoning contributed to the destructive practices of urban renewal of the 1960s and 1970s (Sandalack and Nicolai 2006, 78).

Isolated by Infrastructure

Calgary's isolated communities which formed in the 1960s, were also separated by different land use designations, which continue to be enforced by zoning laws. The expansive road networks that were built to serve Calgary's sprawling communities perpetuate the primacy of the automobile over all other mobility systems. The perimeter road surrounding each neighbourhood effectively "wall-in" each community, making movement from one neighbourhood to another impossible unless one has a car (Litman 2011, 12). This condition is described as "borders" by Jane Jacobs, in *The Death and Life of Great American Cities*. She argues

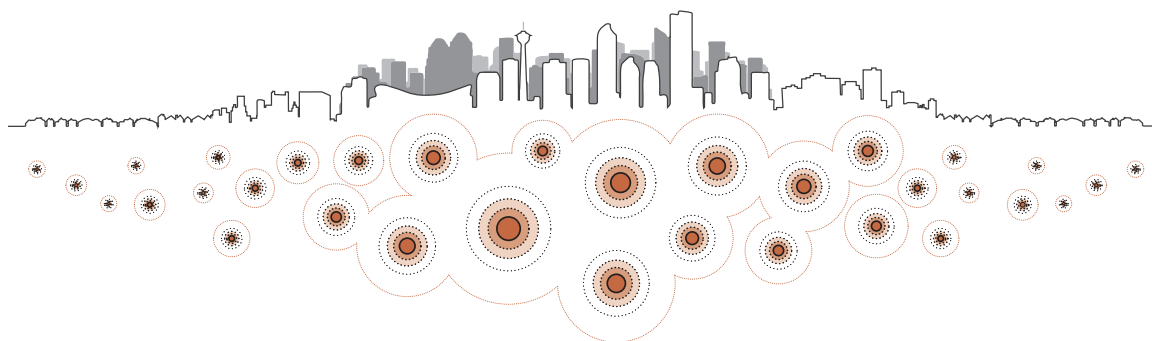


Diagram illustrating the direct relationship between density and social capital. A larger network of social connections in the denser areas, with fewer, disconnected networks in lower density areas.

that single uses create borders which enclose them and make destructive neighbours by prohibiting cross-use between neighbourhoods (Jacobs 1961, 257). These single use neighbourhoods are so vast and lacking in essential services and necessities that one must drive even to buy a newspaper or liter of milk (Frumkin, Frank, and Jackson 2004, 201). In *Urban Sprawl and Public Health*, Frumkin explains the consequences:

If distinct land uses are separated, if the distances between them are great, and if roads are more available than sidewalks and paths, then people shift from walking and bicycling to driving. (Frumkin, Frank, and Jackson 2004, 207)

Another significant consequence of car-centered suburbia is social isolation and loneliness, especially for those without cars. This in turn erodes “social capital”— the civic engagement and mutual trust among residents of a city (Frumkin, Frank and Jackson 2004, 209). When people use automobiles to commute vast distances each day, they spend less time with friends and family and have less time to devote to community activities, such as community association meetings, volunteering or neighbourhood social events. It is estimated that each additional 10 minutes of driving corresponds to a 10 percent decline in civic involvement (Frumkin, Frank and Jackson 2004, 209). Lower density by nature leads to fewer social interactions, and the individualistic mentality often associated to the suburban yards divided by fences has, in Calgary, resulted in suburban landscapes often devoid of people (Chakrabarti 2013, 108). The large size of suburban houses and yards also requires older adults whose children have moved out to relocate to a smaller dwelling, often in a different neighbourhood. Such age segregation undermines community cohesion, contributes to social stratification and again, erodes social capital (Frumkin, Frank and Jackson 2004, 209).

Chapter 3: Neighbourhood Hub Design Proposal

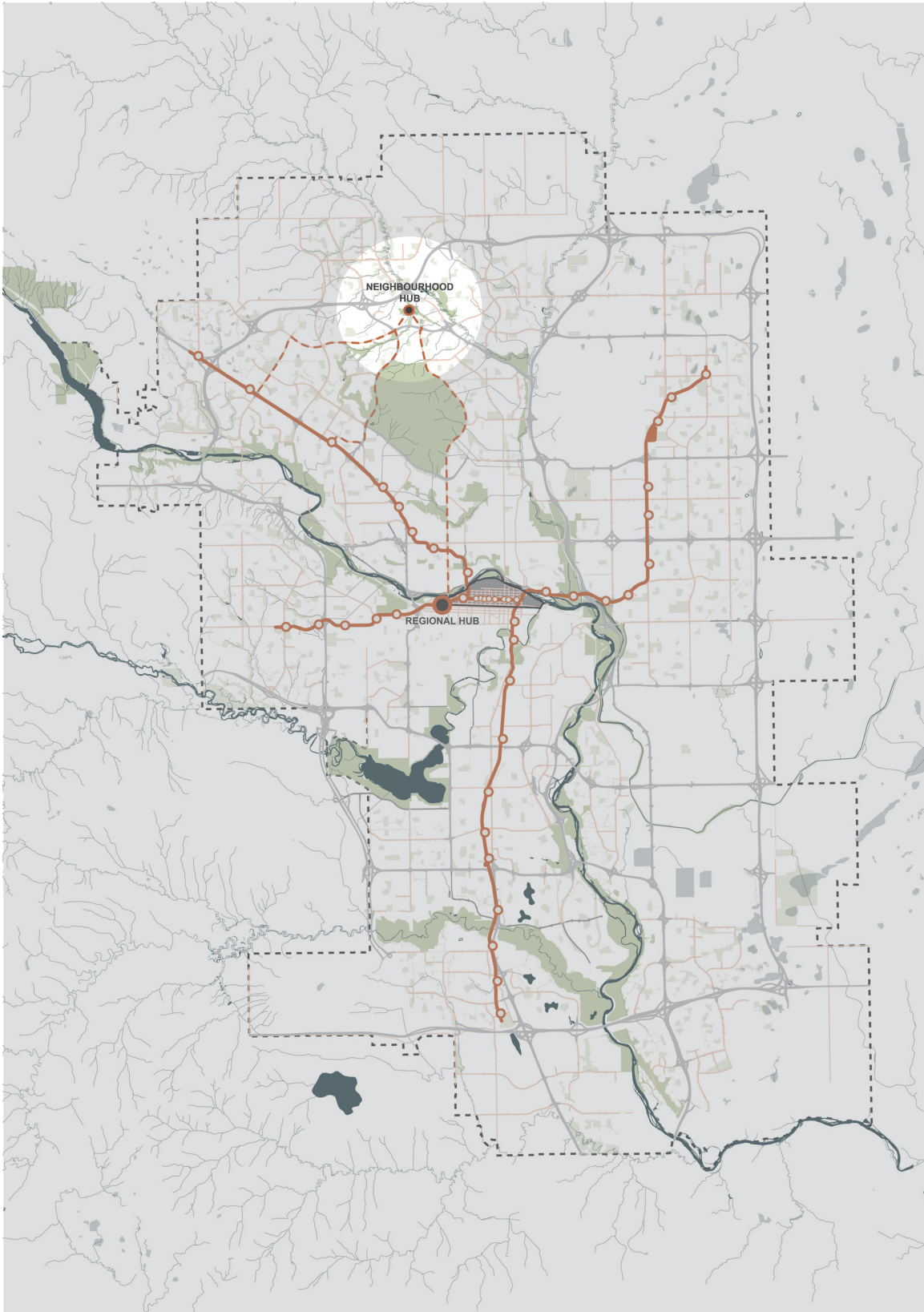


Neighbourhood Hub community plan location in Calgary.

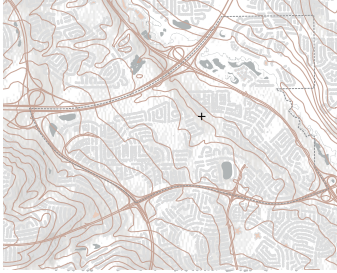
The issues with Calgary's transportation system start at the scale of the community, where cars are often the only convenient transportation option for suburban residents. The Neighbourhood Hub prototype addresses the lack of transportation options available to residents of Calgary's suburban communities.

The widespread implementation of the "sector" typology as a model for suburban development has produced several characteristics that are easily identifiable in most of Calgary's suburban communities. My chosen site to test a prototypical Neighbourhood Hub is the community of Hidden Valley in north-central Calgary. Hidden Valley is an example of a typical suburban community which was designed following the sector typology. These "sectors" are far less compact than their neighbourhood unit counterparts, meaning that the small auto-centric commercial facilities on the periphery of the community adjacent to major roads are often too far of a distance to walk, forcing people to drive, even for small trips within their community. This lack of accessibility and walkability leads to fewer social interactions, and leaves its inhabitants isolated from the rest of the city.

A criterion of 4 selected characteristics from the Sector typology informed my site selection for a prototypical suburban neighbourhood transportation hub and given their widespread use throughout suburban development within the city, these principles can be applied to other communities as well.



Map of Calgary showing the Neighbourhood Hub site location in the community of Hidden Valley in north-central Calgary (The City of Calgary 2022).



Road infrastructure borders encompassing Hidden Valley.

Four Characteristics for Site Selection

Infrastructure Borders

The first characteristic that is typical of Calgary's suburban communities are the isolating effects of communities being bounded by large multi-lane roads. Hidden Valley is surrounded by either arterial roads (such as Shaganappi Trail, Country Hills Boulevard and Beddington Trail) or skeletal freeways (such as Stoney Trail).

Central Location

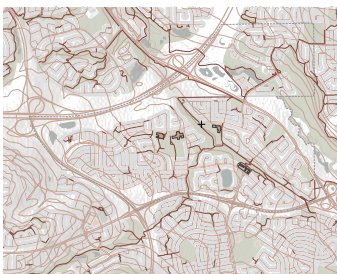
The second characteristic that informed the site selection is locating the main community road, where schools are typically clustered (in this case; Hidden Valley Drive). Hidden Valley Drive is where all the community's bus routes circulate and is thereby a logical place to locate a transit hub. The central location and clustering of schools along the main community road allows the surrounding area to act as a node where most activities and interactions between residents take place; making it the ideal location to bolster these interactions at the Neighbourhood Hub. The central location allows the Neighbourhood Hub to be within a 15-minute walking distance of most houses in the community.



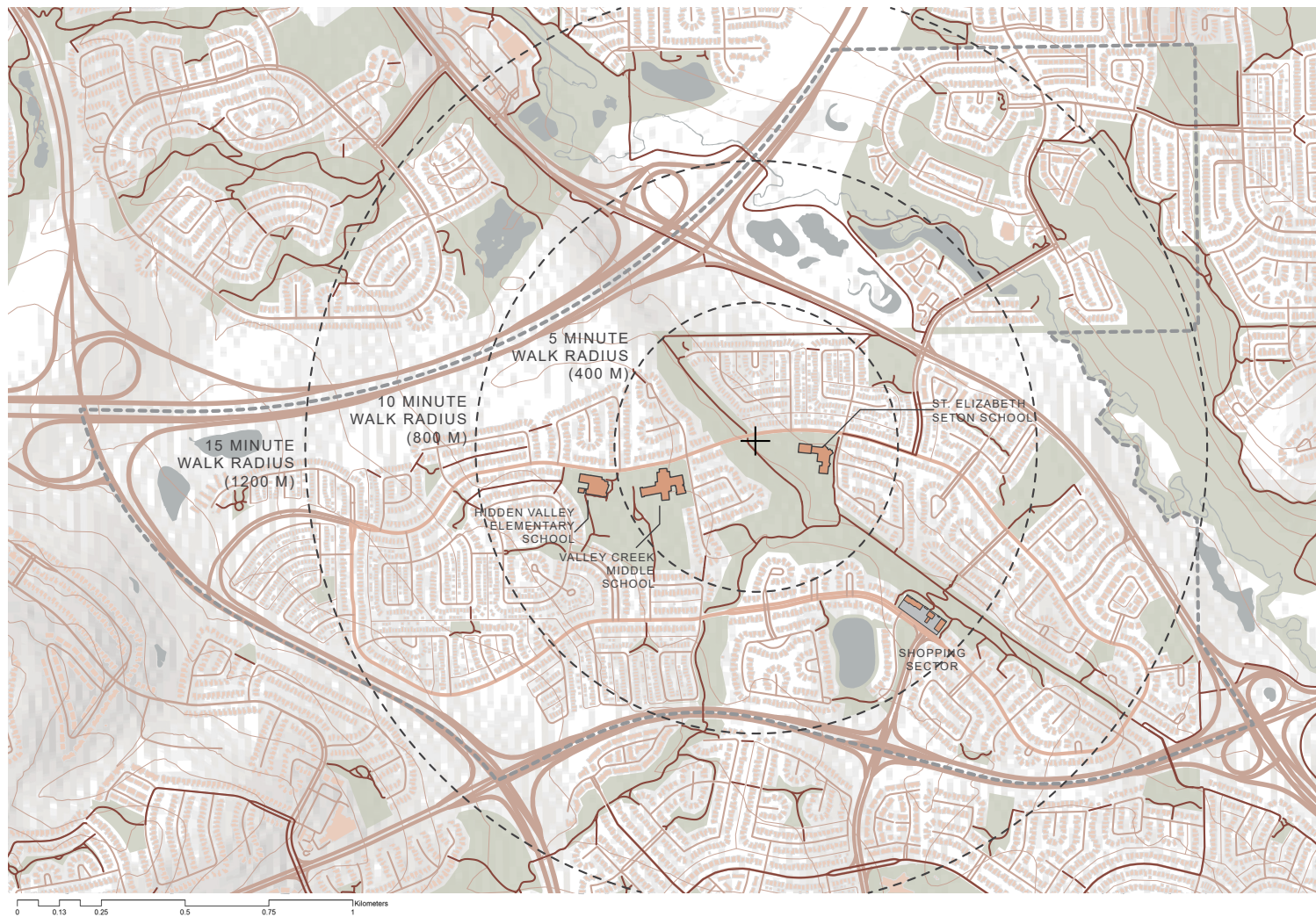
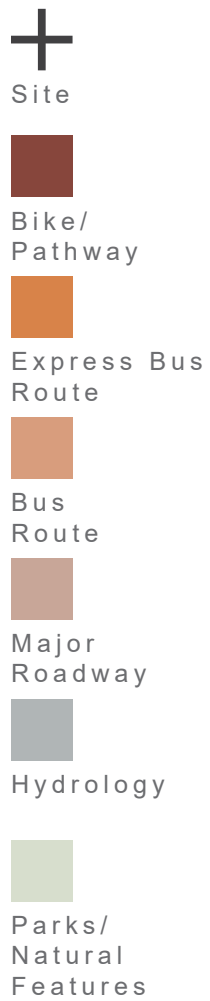
Central location along Hidden Valley Drive in central school cluster.

Pathway Adjacency

The third characteristic is its adjacency to the community pathway system that is also typical of suburban communities, making active transportation a convenient and viable transportation option. Locating the Neighbourhood Hub adjacent to the pathway system expands the pedestrian accessibility and provides the ideal location to provide bike storage so people can seamlessly transfer to a different



Community pathway/greenway system.

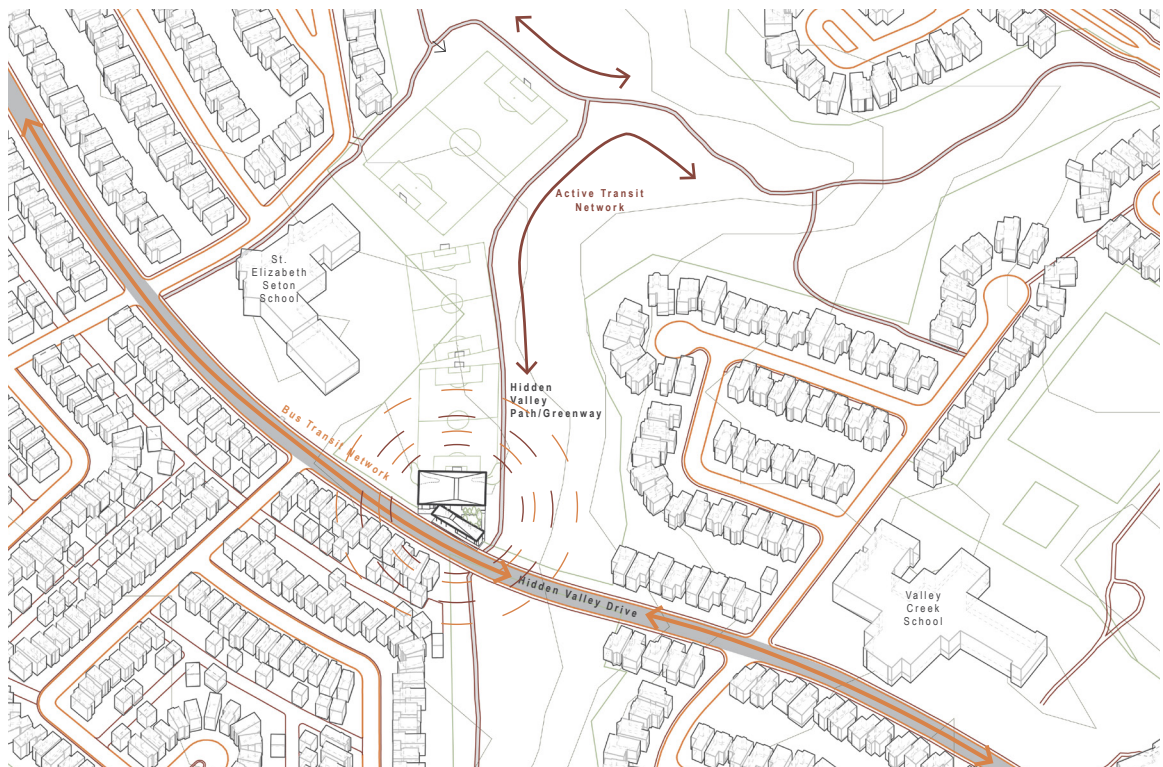


Hidden Valley community plan, highlighting elements that form the characteristics for Neighbourhood Hub site selection (The City of Calgary 2022).

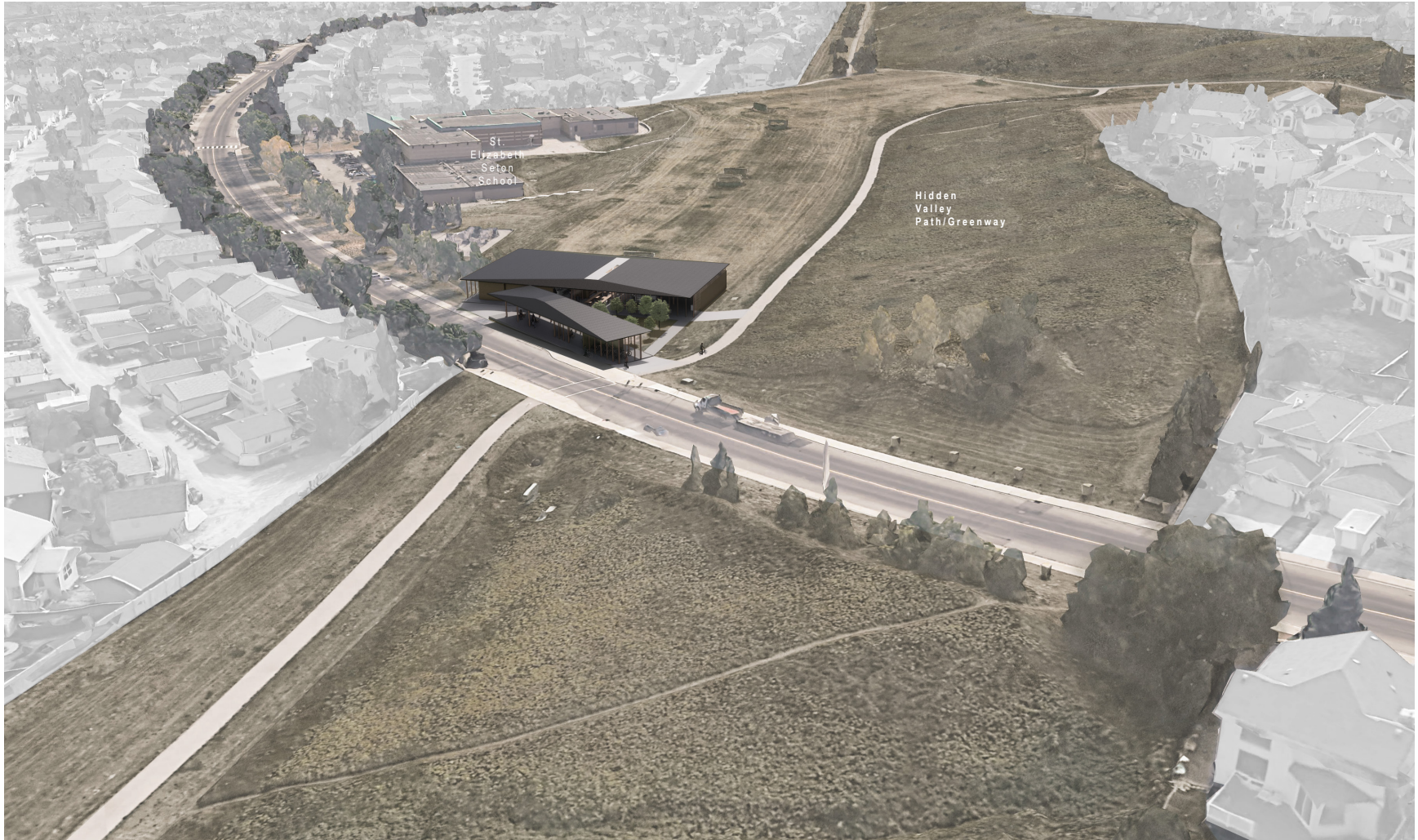
mode of transportation for the rest of their journey or store their bikes securely while visiting the Neighbourhood Hub.

Topography

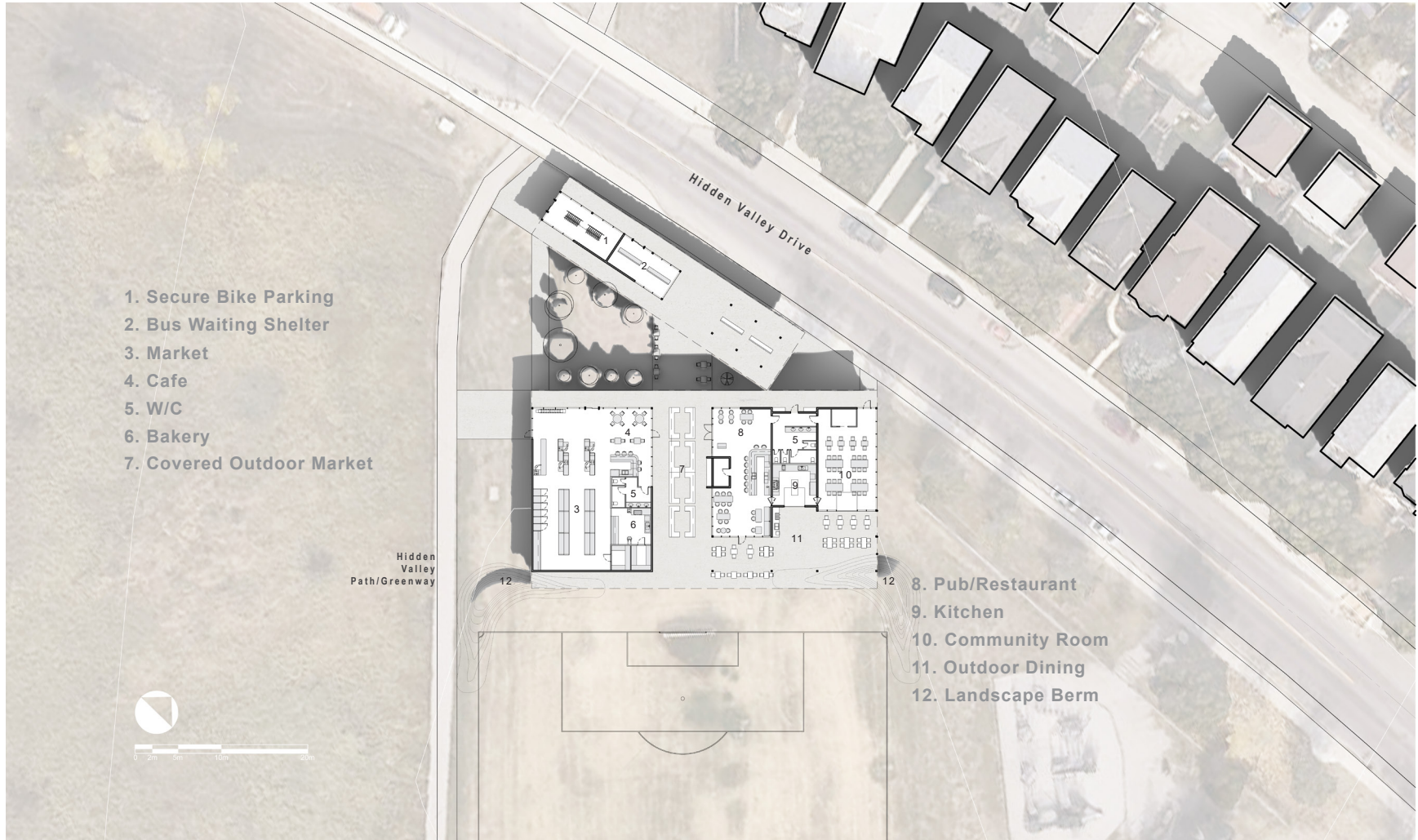
Finally, the fourth characteristic is the consideration of the topography of the community, and the ideal location for the Neighbourhood Hubs is at the lowest part in a community, making it easier for people to bike downhill to the Hub.



Neighbourhood Hub location adjacent to the community pathway system for active transportation and Hidden Valley Drive for transit and vehicular transportation.



Rendered aerial perspective of the Neighbourhood Hub, emphasizing the Hidden Valley Greenway and visualizing the siting in response to the topography (Google Earth 2022b).



Neighbourhood Hub Site Plan (Google Earth 2022a).

Neighbourhood Hub Plan

The plan is divided into two pavilions. The first pavilion is dedicated to transportation and is the building parallel to Hidden Valley Drive in the plan. This includes secure bike parking, bus waiting shelter and covered bus waiting areas. The second pavilion, the rectangular building in the plan, houses the essential and social programming of the Neighbourhood Hub. The Neighbourhood market is on the left, and the Pub, Kitchen and multi-purpose Community Room are on the right of the pavilion. This programming incentivizes active transportation by making it more convenient for commuters by integrating it into a transit stop, and adjacent daily necessities and social spaces.

Transportation Pavilion

Transportation Pavilion- Bicycle parking is crucial for making active transportation effective in a transportation system. Users can store their bikes securely if they are transferring to a different transportation mode for the remainder of their trip. Its location adjacent to the community pathway system and main road makes it convenient for commuters and incentivizes active transport.



Streetscape visualization showing the Transportation Pavilion with situated parallel to Hidden Valley Drive with covered indoor and outdoor bus waiting areas.

Neighbourhood Market and Cafe

The Neighbourhood Market allows community members to shop for groceries within their community, instead of having to drive to a car-oriented strip mall to shop at a large box grocery store. The market also provides local farmers and vendors with a space to sell their goods and extends into the covered outdoor breezeway weather permitting. The cafe located within the market is a spot for locals to meet up with friends. This view taken below the canopy of the transportation pavilion shows how both are near the transit stop, so anyone can grab food or beverage while they are waiting for the bus or ride share.

Neighbourhood Pub

The restaurant and pub further strengthens the social infrastructure of the community by offering a space where locals can eat, drink and meet throughout the day and into the night, when the cafe is no longer operating. It is also a great way for the youth in the community to have a place to meet their friends, instead of having to drive to another community or downtown to grab a drink and socialize.



Market Hall breezeway visualization showing the covered outdoor market with Cafe and Neighbourhood Market on the right of the breezeway and Neighbourhood Pub on the left.

Multi-Purpose Community Room

The community room is designed to be a flexible space that can be used for a variety of events such as community association meetings, birthdays, sports events, classes and culinary workshops.

Outdoor Seating/Dining

The design provides sheltered areas for spectators to watch games on the adjacent soccer field, which further activates the hub programming. Landscaped berms located at the corners of the soccer field create natural spaces for spectators to sit and frame the field.



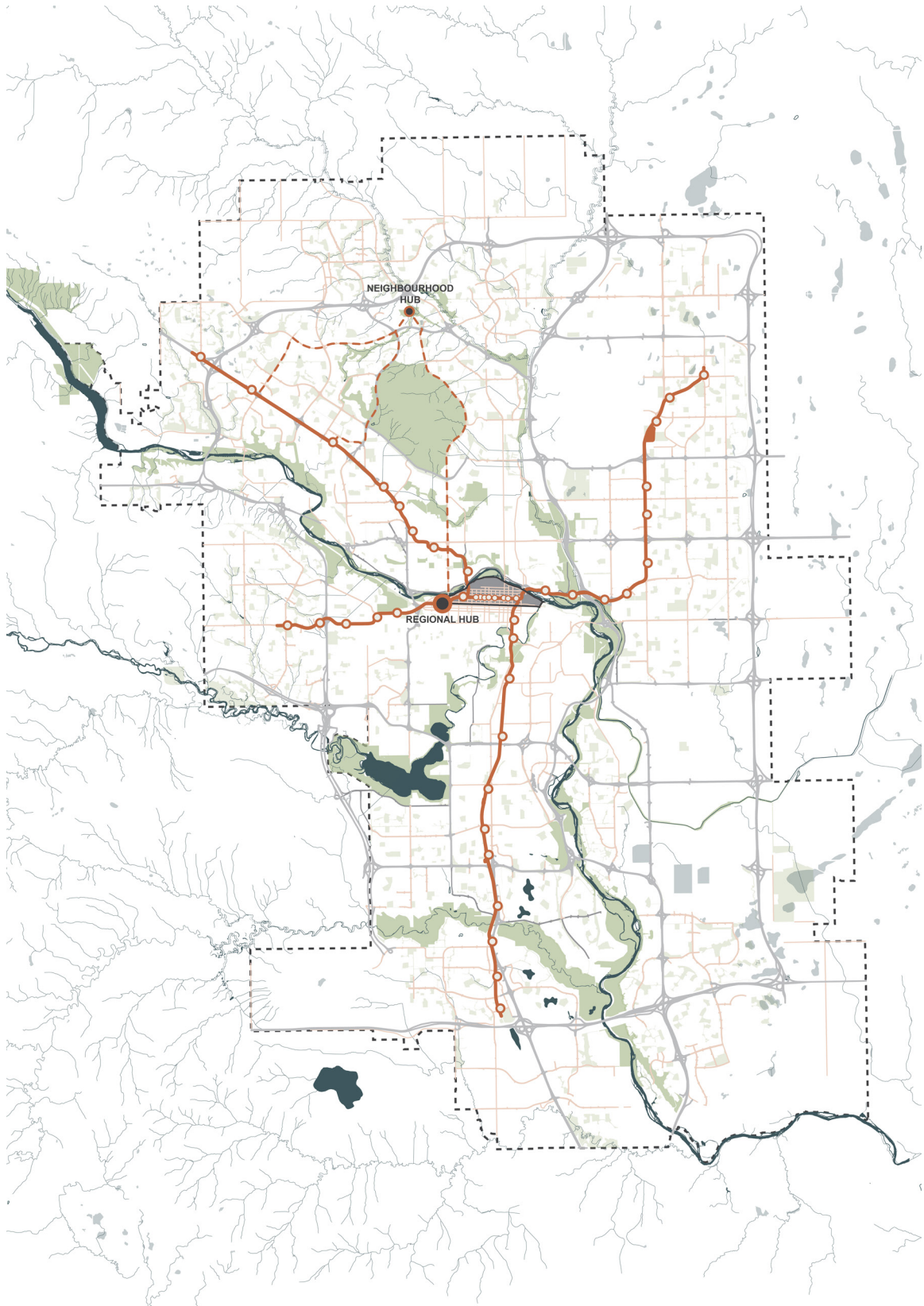
Visualization from the community pathway showing cyclists approaching the Neighbourhood Hub and sheltered areas under the roof canopy and berms for spectators watching soccer matches.

Chapter 4: Transportation as a Solution

System Analysis

To understand the parts of Calgary's current transportation system, and to identify gaps within the network, I will use Kevin Lynch's method from his book, *The Image of the City*. Here, Lynch identifies five elements that constitute a city's image: paths, edges, nodes, districts, and landmarks. According to Lynch, these five elements must coexist in a reciprocal relationship to strengthen the imageability of a city (Lynch 1964, 49). Within this framework, CTrain stations act as nodes within the system— as sites where different transportation modes converge. Because existing stations have not been envisioned as hubs for the community, they are not focal points around which a district can be developed. And since the car is the primary way of arriving at a station, travellers have less opportunity to meet other travellers.

In *The Death and Life of Great American Cities*, Jane Jacobs argues that the point of cities is multiplicity of choice. This multiplicity of choice refers to the various options for living, working, shopping, gathering etc. that cities offer. However, she argues that it is impossible to take advantages of this multiplicity of choice if urban residents cannot get around easily (Jacobs 1961, 340). This means that good transportation and connections between neighbourhoods are basic necessities for urban life (Jacobs 1961, 340). This philosophy should also be applied to Calgary's transportation system as a means of shifting away from automobile dependency. To do this, the first point of access to public transit should be a node where multiple active transit



Map of Calgary showing the existing LRT lines and stations as nodes within the system. Neighbourhood and Metropolitan Hubs are located at gaps within the existing transportation network (The City of Calgary 2022).



Existing divided transportation systems.



Integrating transportation systems.



Proposed integration at Hub

systems intersect, and where community services can be found. This provides users with a multiplicity of choices for transportation options, services and opportunities for social interactions.

Multi-Modal Transportation

Calgary's historical focus on auto-centred planning gave little consideration to travel by other modes, consequently reducing modal diversity (Litman 2011, 7). A successful transportation system must be accessible and offer a variety of mobility options to its users. This is called an "integrated transportation system" — and is predicated on the view that vehicular, active, LRT, and bus transit are all valuable parts of the system and essential to create an accessible and cohesive network. One example of this is a multi-modal system that is designed for walking, cycling, automobile and all available forms of public transit, with well designed connections between modes (Litman 2011, 3). Such an approach provides a high degree of accessibility, especially for non-drivers (Litman 2011, 14) who for reasons related to age, physical ability, economy, or social disadvantage cannot rely on the automobile to meet their transportation needs. According to the Canadian 2009 National Household Travel Survey, this is 20 to 40 percent of a typical community (Litman 2011, 9). This will only get worse with rising gas prices and new national policies for emissions reduction. For these reasons, now is a good time for cities to shift investment away from the automobile and towards multi-modal systems.

Characteristics of Transportation Modes

Each transportation mode has its own characteristics which need to be considered in a multi-modal system. This variety

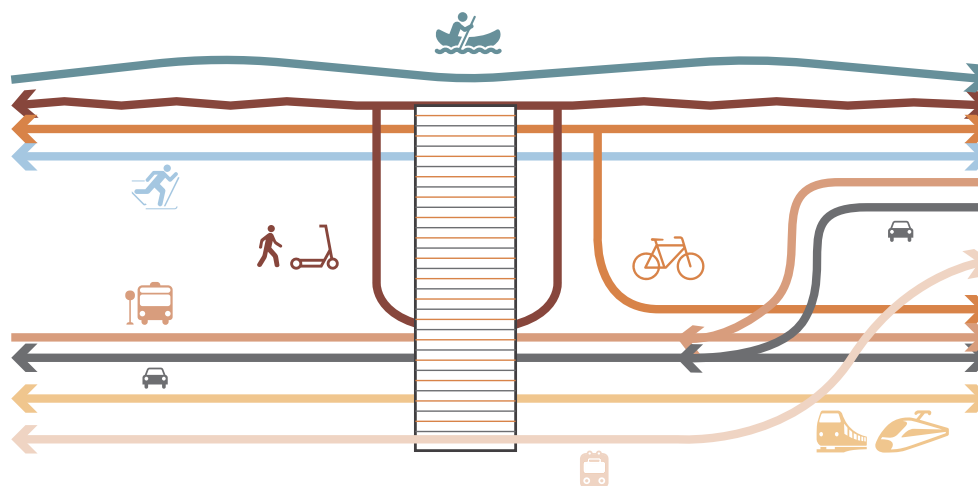


Diagram illustrating multi-modal integration of Calgary's existing and future transportation systems for a Regional Hub.

of strengths is what makes a multi-modal system successful in providing accessible transportation options to users, and understanding these characteristics are helpful when designing to promote their use.

Walking: Nearly universally accessible and free, limited only by physical ability, distance, and adverse weather. Walking (or rolling) will always be part of a journey, so it is the most important transportation mode to design for, and should have first priority. Walking is also a great form of exercise (Litman 2011, 13).

Cycling: Widely available, it is feasible on most roads and paths. Bikes can travel further distances than walking and are very useful for the last legs of a journey. They are often a critical mode for children and teenagers, and use by adults for health and ethical reasons. For these reasons, secure bike parking is crucial to a transportation hub.

Shared Mobility: Shared mobility options include shared bikes, e-scooters, cars and ride-shares. These offer options for trips beyond the scope of linear transit or walking.

Shared mobility is cheaper than car ownership and doesn't necessitate maintenance costs. It is often limited by proximity to services. When integrated into the design of transportation hubs, shared mobility is accessible, reliable and more affordable.

Automobile: Typically convenient and fast, and unparalleled for point-to-point access. Its downsides are cost (of purchase, maintenance, fuel, registration, and insurance), the need for parking on each side of a journey (greatly damaging the urban experience for residents, cyclists and pedestrian), and for its environmental consequences (emissions, etc.) These combine to make automobiles the most unsustainable transportation option.

Bus: Buses serve more passengers than cars, and can offer similar flexibility in choice of routes, since they drive on streets and roads. Calgary has improved bus commute times with its Bus Rapid Transit (BRT) systems, which have their own separated transit lanes, priority at intersections, and specialized bus stops. The downside of this increased efficiency is less flexibility, which means BRT and traditional bus transit are both important transportation options for a successful multi-modal system.

Light Rail Transit: Fast and reliable transit operating on its own designated track and signals, therefore limiting delays caused by traffic congestion. Often preferred by commuters as it imposes less stress and allows commuters to read, rest or work on their commute (Litman 2011, 13).

Passenger Rail: Effective for inter-city and regional connections, as it can travel long distances. Its fixed tracks limit delays and allow service to operate efficiently on a schedule.

Principles for Effective Multi-Modal Integration

Transit Oriented Development

The creation of Transit Oriented Development (TOD) around transportation hubs in Calgary would create walkable high-density neighbourhoods, with easy access to amenities (Richards 2001, 83). TODs can be developed surrounding existing stations and should be a consideration for future station community integration. The ridership base associated with higher density would support high frequency transit service, reducing wait times for users; allowing transit to rival the convenience of the automobile. The higher density and mix of uses that sprouted along streetcar lines in Calgary's past can be re-introduced, offering Calgarians with a diversity in living, social and transportation options that would re-connect isolated populations. As a generator of travel, a transit stop attracts activity and is a desirable place to live, work and open a business. Mixed-use around a predominantly residential neighbourhood is likely to mean customer-serving retail and service businesses (such as restaurants and cafes, food stores, dry cleaners, and day cares) will thrive, and therefore benefit both residents, due to their proximity to services, and businesses benefit from more customers (Dittmar and Ohland 2004, 32). Businesses alone are not enough for a station to become a hub for the community— a great deal of consideration must go into the creation of a livable “place”. Key design considerations are the integration of customer services into the station itself, pedestrian accessibility, the treatment of parking and transfers between other transportation options and the public realm surrounding the station (Dittmar and Ohland 2004, 32).

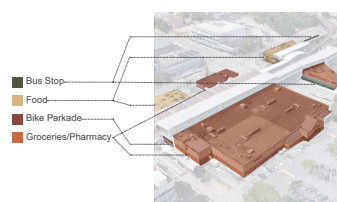
Community Integration and Social Infrastructure

To unravel the mess of Calgary's single purpose stations, we must defy convention and offer solutions that break pre-existing notions. Instead of stations being conceived as a vessel for harboring the automobile while the rest of the journey is completed by another mode of transportation, the station should be thought of as an extension of a community and be designed for the comfort and accessibility of the user (Brandes, Gratz, and Mintz 1998, 116). Meeting people is no longer an automatic part of daily life, and our social interactions have become increasingly sporadic. This paradox is precisely where we must focus our efforts when establishing quality urban spaces that provide opportunities for interaction (Gehl 2006, 14-15). In places such as Copenhagen, Denmark and Stockholm, Sweden, neighbourhood health and day care centres and other social services are located in or around transit stations, reinforcing the station as hubs for the community instead of just being a stop within the network (Cervero 1998, 408). The station as community hub could serve the dual function of creating community gathering spaces as well as encourage public transit usage (Brandes, Gratz, and Mintz 1998, 117). Designing community spaces that foster social interactions will become increasingly important with people working from home because of the Covid-19 pandemic. Working from home will not eliminate travel, as people will continue to crave face-to-face contact, a desire which can no longer be solely met by peer interactions in an office environment (Richards 2001, 83).

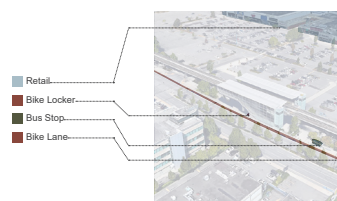
Case Study of Multi-modalism in Vancouver

Vancouver's transportation system is a North American example of how these principles for effective multi-modal integration have been put into practice. This is significant given that Vancouver's settlement history is similar to Calgary's, and it too had to deal with the legacy of automobile dominance. Studying Vancouver's system as a case study might offer strategies by which Calgary can improve its own transportation system.

While Calgary's urban planning patterns are rooted in the automobile-dominated era of the 1950s, Vancouver's planning strategies were reshaped in the mid-1980s, when international investments began to flow into the city after Expo 86. The city had largely avoided the 1960s-era enthusiasm for freeway building and urban renewal, and following Expo 86, Vancouver was becoming an increasingly global city, attracting wealthy investors to its real estate market (Perl, Hern, and Kentworthy 2020, 126). Building on its SkyTrain rapid transit system, built for Expo 86, and flush with foreign investment, Vancouver and British Columbia decided to invest in transportation infrastructure to connect expected growth areas of the Lower Mainland to downtown Vancouver. Rapid transit was now seen as the exciting modern transportation technology that would fuel urban growth in the 21st century.



Multi-modal and community integration surrounding Commercial-Broadway Station, Vancouver, BC.



Multi-modal integration surrounding Landsdowne Station, Richmond, BC.

Since then, Vancouver has continued to invest in transit, and to prioritize non-automobile forms of transportation. One noteworthy strategy is the city's adoption of transit-oriented developments (TODs). This strategy permits much higher and denser mixed-use development in designated areas immediately adjacent to rapid transit stations. The



Urban condition outside of Commercial-Broadway Station; bus shelters and businesses integrated into the station design, making transfers between modes and access to necessities convenient. (Banner 2018; Google Maps 2021)



Secure bike lockers underneath (left), bus shelters and bike lanes (right) adjacent to Lansdowne Station, Richmond. (Google Maps 2021)

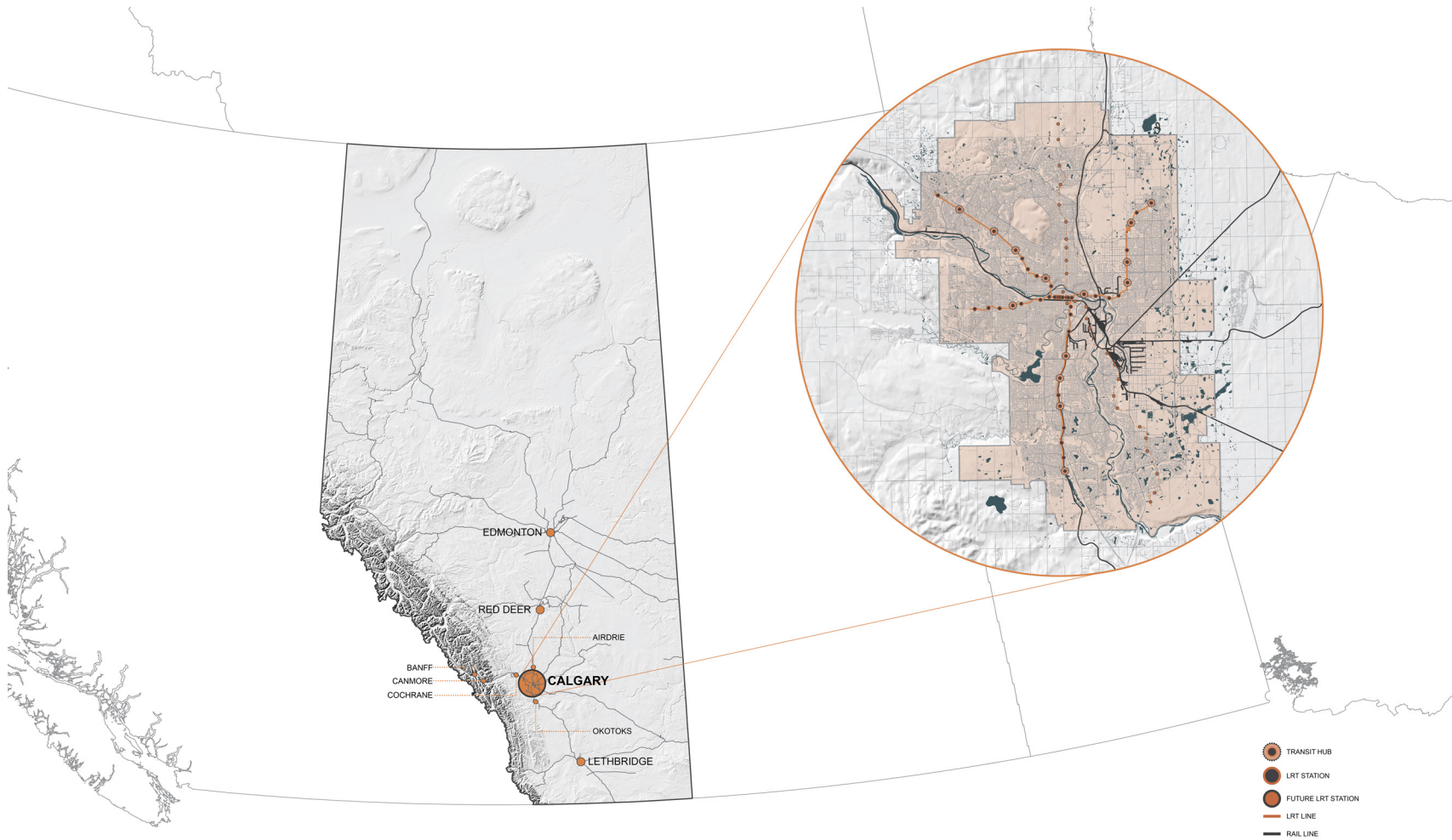
promise of increased densities attracts developers looking for investment opportunities, and this in turn is creating numerous regional hubs that are serving as landmarks and nodes for surrounding suburban areas dating from the 1950s to the 1970s. Examples include Surrey Town Centre; Richmond Town Centre; Metrotown and Loughheed Town Centre (in Burnaby); and Coquitlam Town Centre (in the Tri-City node of Coquitlam, Port Coquitlam, and Port Moody). Transit-oriented developments bring together homes, jobs, services, and civic attractions in one place— a complete departure from mid-century planning model that separated residential districts from commercial and industrial ones. The higher density of a TOD generates the large ridership

base needed to support high frequency transit. Its proximity to transit makes car ownership unnecessary, and links all these regional nodes into the larger system. At each station, Vancouver has also integrated a variety of mobility options into its transit system, providing secure bike parking at most stations, making pedestrian access seamless, and linking into neighbourhood streets, lanes, paths and plazas. Vancouver's strategy aims to integrate all forms of mobility in "mobility hubs", with active transportation infrastructure and shared-mobility options at transit stops and stations. This would allow nearly every city dweller to find the goods and services they need daily within a convenient 1-km walk, bike or roll (TransLink 2021, 25-27).

System Opportunities

Regional Rail

Another opportunity seen in Vancouver that has yet to be capitalized on is Calgary's location as a major hub for rail travel. Calgary's fortuitous setting was the reason for it being chosen as the focal point for the Canadian Pacific Railway's prairie operations and is the reason it is currently the node in which several branch lines intersect. Given that most of the prominent municipalities that surround Calgary are located along CPR lines, Calgary is ideally situated to connect these communities via rail. In response to Calgary's history of land annexation, the city could leverage its opportune location to reconnect the satellite towns it once tried to segregate. As a direct result of Calgary's sprawling growth patterns, the city now borders towns that were previously far outside of its boundaries. This has caused significant growth in these communities, and many residents commute to downtown Calgary for work. For example, Cochrane, Canmore and



This diagram illustrates the rail connection between Calgary and major surrounding municipalities in Alberta, and illustrates how the rail and light rail networks converge around Downtown Calgary (Atlatis 2018; Geofabrik 2018; The Government of Canada 2021).

Banff are all located along the Canadian Pacific Railway to the west of Calgary.

Due to its proximity to Calgary, Cochrane is one of the fastest-growing communities in Canada and is one of the largest towns in Alberta. A significant amount of Cochraneites commute to Calgary, driving the town to rapidly expand commuter bus service to Downtown Calgary. Like Cochrane, both Canmore and Banff have been expanding their transit systems as a result of rapid growth and a growing tourism industry that receives a large amount of vehicular traffic from Calgary visitors.

Banff and Canmore's mountainous settings mean that there is very little space for expanding road infrastructure to accommodate the increasing number of visitors and would benefit and have the ridership potential to feasibly introduce passenger rail from Banff to Calgary (Calgary-Bow Valley Mass transit Feasibility Study 2019). Passenger rail through the Bow Valley would provide visitors with a viable option to leave their vehicle at home—reducing the pressure put on the constrained infrastructure for the mountain towns and connecting communities to outdoor recreation and scenic mountain vistas.

Central Heart of the Network

Like most cities, Calgary's downtown is its heart, upon which the rest of the city depends upon. If the city is viewed a social neighbourhood, then the downtown is the heart that enables the rest of the city to function. In recent years, Calgary's downtown has stagnated, and has seen record high office vacancy rates resulting from a down oil and gas sector and the Covid-19 pandemic. When the heart of a city stagnates, the entire social neighbourhood of the city

suffers because people who ought to meet, and typically do so by chance because of the downtown's central vitality, fail to meet (Jacobs 1961, 165).

Downtown Calgary faced issues of vitality even prior to the pandemic and economic recession— its perception as a workplace made the core vibrant during the day, and quiet at night once office workers retreated to the suburbs at night. This identity has been supported by the transportation system which was designed to efficiently move people in and out of downtown during work hours (The City of Calgary 2021, 24). The economic and workplace changes resultant from the pandemic and recession have provided The City of Calgary with the opportunity to reevaluate the nature of downtown Calgary, prompting them to create the Greater Downtown Plan to outline how the downtown can evolve to become more of a destination with a multiplicity of uses— to revitalize the heart of the city (The City of Calgary 2021, 24).

The key “strategic moves” introduced in the Greater Downtown Plan that I believe are most pertinent and can be addressed in a design proposal for a central transportation hub are as follows: Neighbourhoods for vibrant urban life, improving the green network, and creating transit for all. A central transportation hub should be a hub for community, around which the neighbourhood can thrive.

Addressing the “strategic move” of creating vibrant neighbourhoods, the hub can become a regional destination to attract visitors from all parts of the city, region, and tourists from around the world (The City of Calgary 2021, 31). A design which understands and values the city's role as a social neighbourhood as much as the transportation systems that enable diverse groups of people to access the

regional destination would provide people with a location to make informal connections that are integral to the city's vitality.

Improving the city's green network can be done by expanding and creating more opportunities for recreation along river frontage to promote active transportation by increasing its reach to include those seeking to utilize micromobility options as a form of recreation.

The Greater Downtown Plan also mentions goals to invest in a multi-modal transportation network to improve transit connectivity and improve system efficiency. The plan also states the city's goals of integrating transit with other forms of mobility- which can happen at a central transportation hub that has direct connections to these mobility networks and integrates them in one location. Furthermore, the plan asserts the city's desire to create transit stations that are vibrant community spaces where people are able to meet, linger and interact— which is an important distinction from many of Calgary's existing transit stations.

These strategies would begin to shift Calgary's transportation system away from being primarily designed to efficiently bring commuters into the Central Business District, to a complete network that considers all modes of transportation and destinations within the city— not solely the downtown core.

Chapter 5: Metropolitan Hub Design Proposal

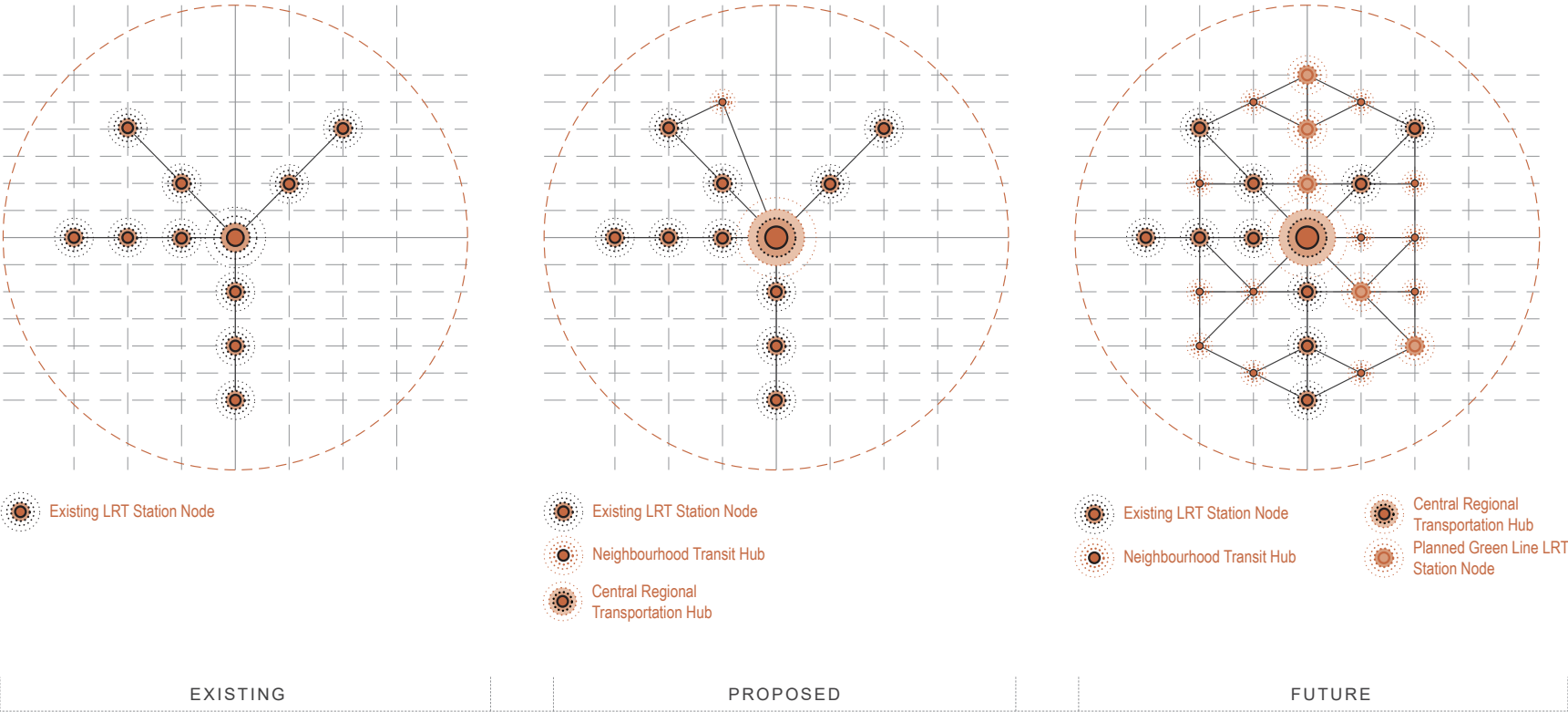
The design for a Metropolitan Hub applies these strategies to a central site next to Downtown Calgary in the West Village district of Sunalta, and here we will see how a transportation hub can be designed to integrate all the different systems and provide a place with the programming that will allow people to develop the social capital they need.

Calgary currently lacks a hub where all the city's transportation modes are integrated- often making

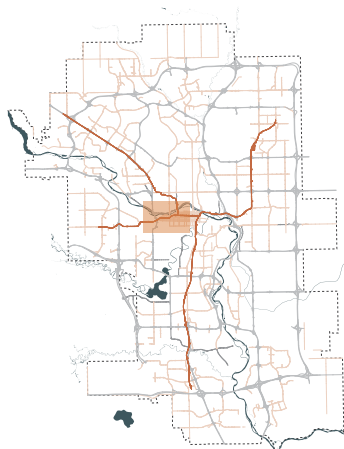


Early conceptual image of a Metropolitan Hub as a gateway to Calgary- communities are connected via Neighbourhood Hubs.

CONNECTING COMMUNITIES (PROJECTION)



This series of diagrams illustrates a projection for how my Hub design proposals relate to the existing transit node network, and how the proposed Hub strategies could act as a framework for future network expansion.

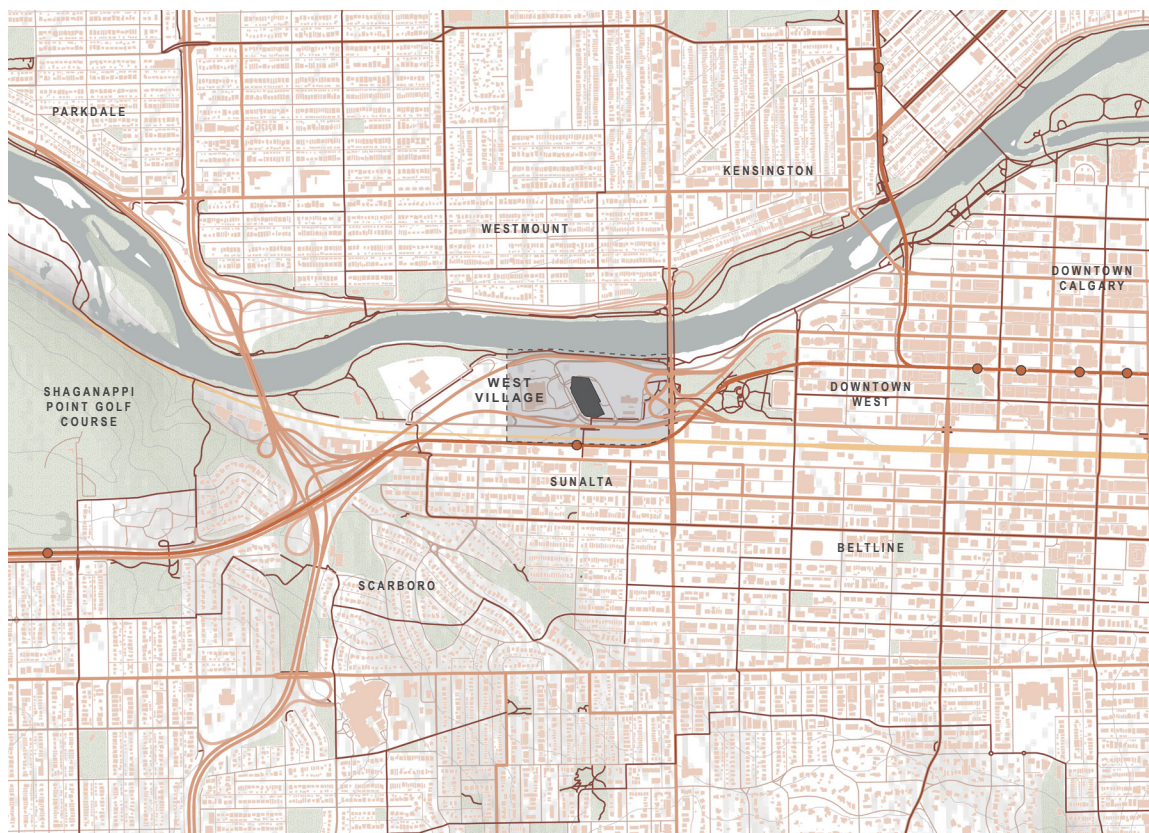


Metropolitan Hub community plan location in Calgary.

connections between modes difficult and decreasing convenience. The metropolitan hub is therefore a pivotal piece within Calgary's transportation infrastructure, connecting suburban communities via the Neighbourhood Hub, to higher order LRT stations, and finally to the centre city where connections between modes can be made.

Site Selection

I identified the site of Calgary's former Greyhound Bus Terminal as the only location where all the city's existing transportation networks converge, as is shown in the site plan. In addition to the opportunities that are offered by these proximities, the site is underdeveloped being currently



West Village site map. Illustrating the transportation networks surrounding the site, as well as the central site's adjacency to Downtown Calgary and the Bow River to the north (The City of Calgary 2022).

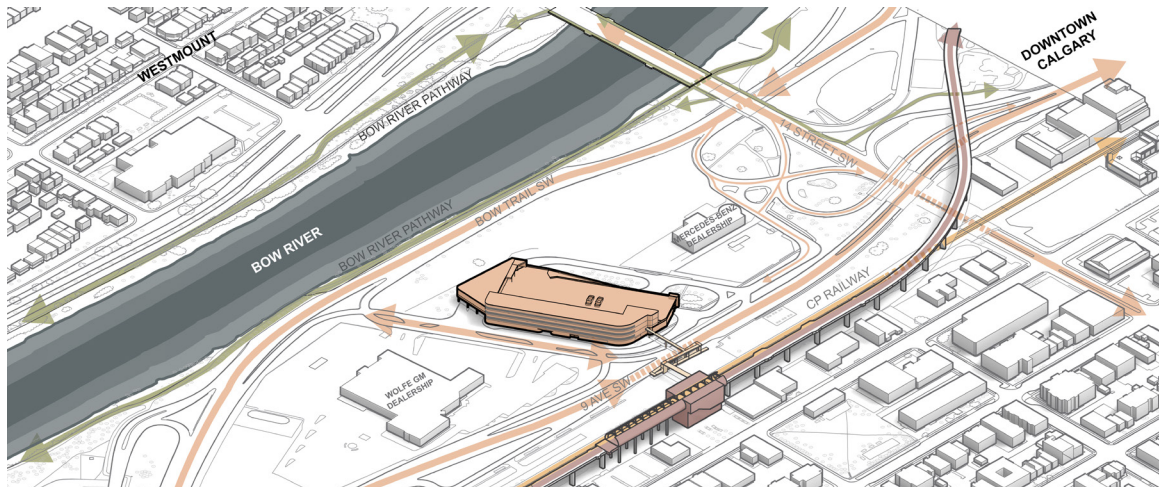


Diagram illustrating the existing West Village site condition with LRT transportation shown in red, Rail shown in yellow, vehicular transportation in orange and active transportation in green.

occupied by 3 car dealerships in addition to the former greyhound building.

Urban Design Strategy

The former Greyhound Bus terminal building will be adapted for this project. The site has a direct connection to the LRT via the existing elevated Sunalta station directly south of the site, is next to the existing CP Rail lines for the addition of commuter rail, is adjacent to 9th Avenue which is the vehicular gateway into downtown and is the main entry point to the city for major Bus Rapid Transit and Express bus lines. It is also within proximity of the Bow River Pathway for cycling, active and recreational transportation. The current location of the Bow Trail freeway along the riverbank only leaves a small area for active transportation and pedestrians along the Bow River pathway.

The CP Rail lines and 9 Avenue freeway have produced a physical divide between the West Village District and Sunalta. The proposed Metropolitan Hub design stitches Sunalta's urban fabric back together, by providing an integrated bridge accessed from Sunalta Station connecting



Existing site conditions in the West Village district of Sunalta.

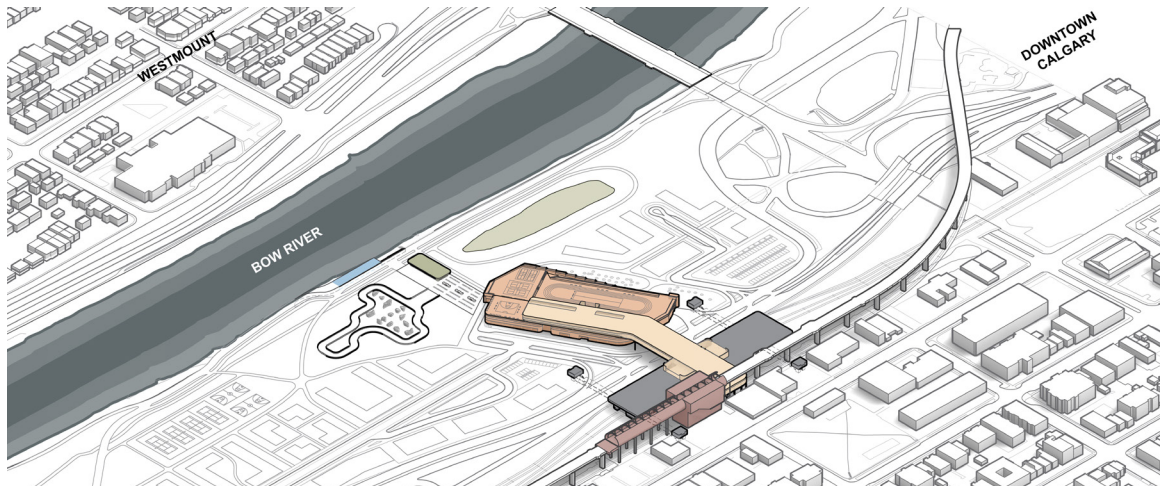


Diagram illustrating the proposed buildings that comprise the Metropolitan Hub. Rail Station is shown in grey, Bridge in yellow, Hub in orange, Recreation Rental Pavilions in green and blue.

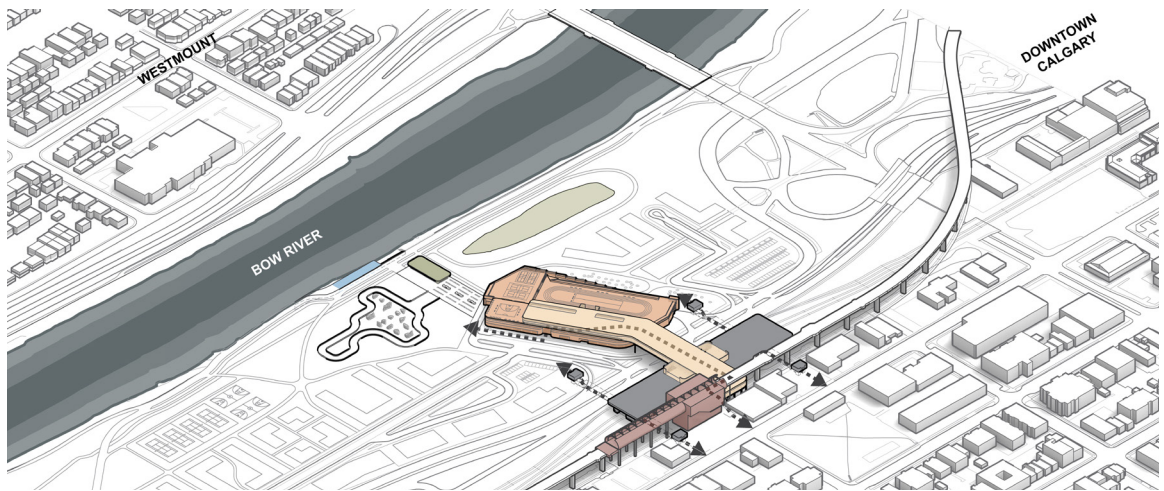


Diagram illustrating how the Metropolitan Hub design connects the West Village District to Sunalta through a series of tunnels and a bridge.

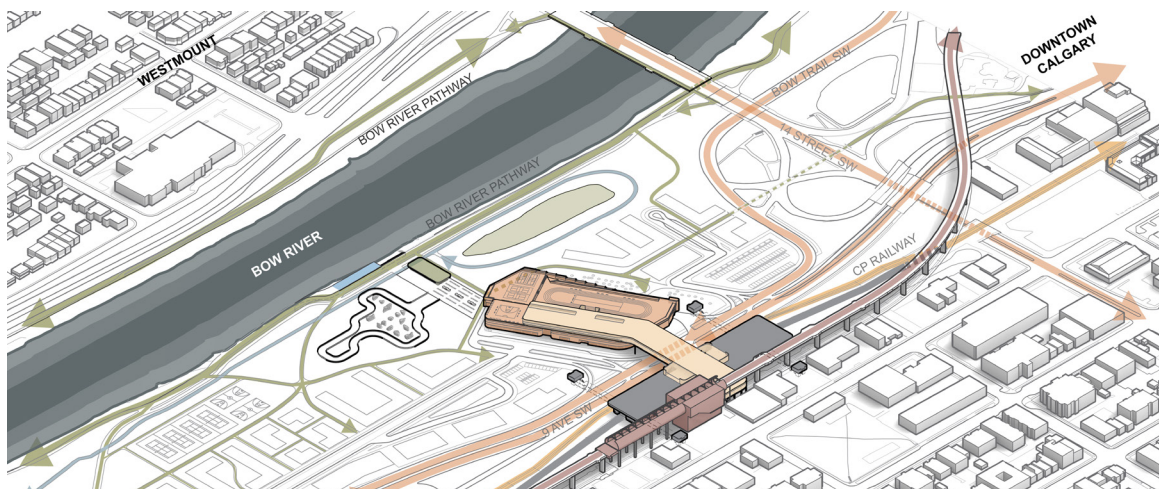


Diagram illustrating how the Metropolitan Hub design utilizes and expands the transportation networks surrounding the site. Bow Trail is re-directed to a 2 way boulevard shared with 9 Ave.

to the former greyhound terminal, as well as two tunnels that connect the two parts of the community underground, and allow residents to easily access the train station. One-way westbound traffic on Bow Trail is re-routed to a consolidated two-way boulevard shared with 9 Avenue to open the riverfront to active transportation and recreation, which is supplemented by recreational programming included in my design proposal.

Existing and Proposed Structure

Much of the existing greyhound terminal structure is retained in my design proposal, adding to the rationality of the proposal. The existing structure is composed primarily of concrete columns and beams, with steel joists spanning between making it easier to adapt the structure and spaces within the building to adapt to the new design and programming. All proposed structure is comprised of steel members, differentiating the new structure from the existing, and allowing the depth of members to be as small as possible to maximize ceiling height on the bridge level in the constrained space below the elevated LRT guideway. The bridge employs a vierendeel truss to span across the road and train tracks below, while simultaneously minimizing the necessity for columns to break up the plan on the bridge level, making the space as flexible as possible.

Design Interventions

The railway station, highlighted in red on the site plan is the first building one passes on their journey to the Bow River from Sunalta station. The former Greyhound Terminal (highlighted in orange on the urban design site plan) dubbed the Hub, acts as a node within the community, where a variety of programming is located, and offers direct Bus connections

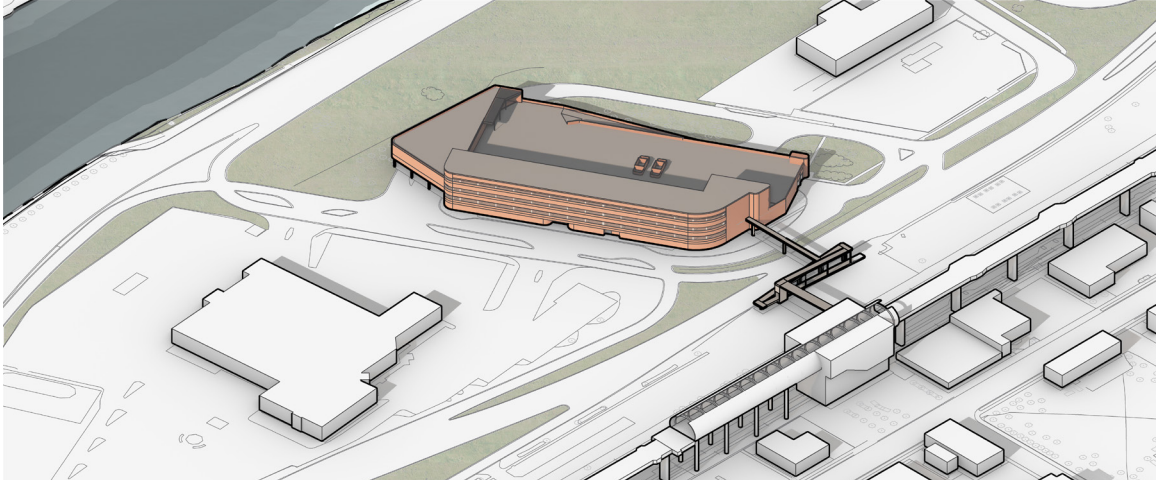


Diagram illustrating the existing site condition.

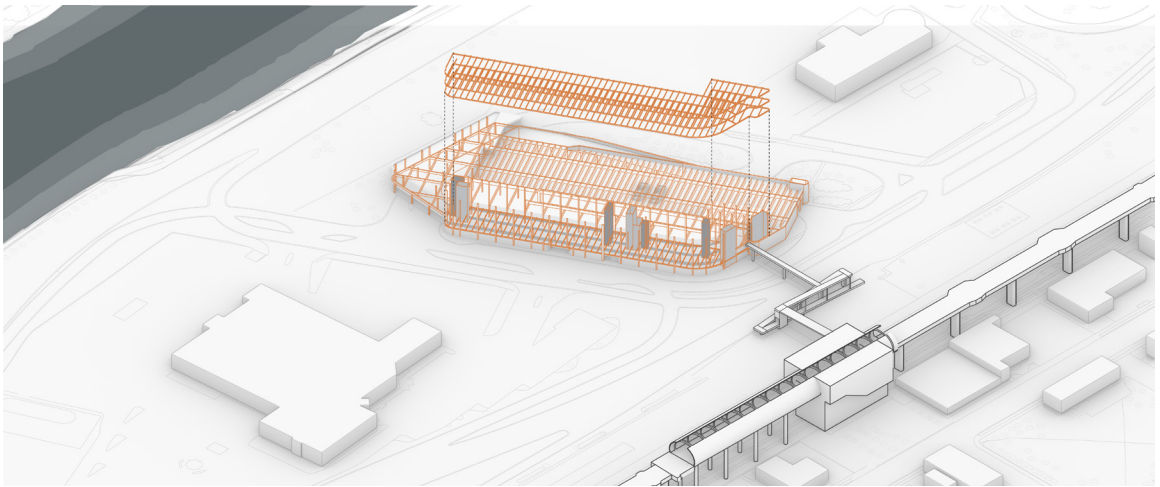


Diagram illustrating the existing former greyhound terminal structure shown in orange, stair cores shown in light grey and elevator cores in dark grey.

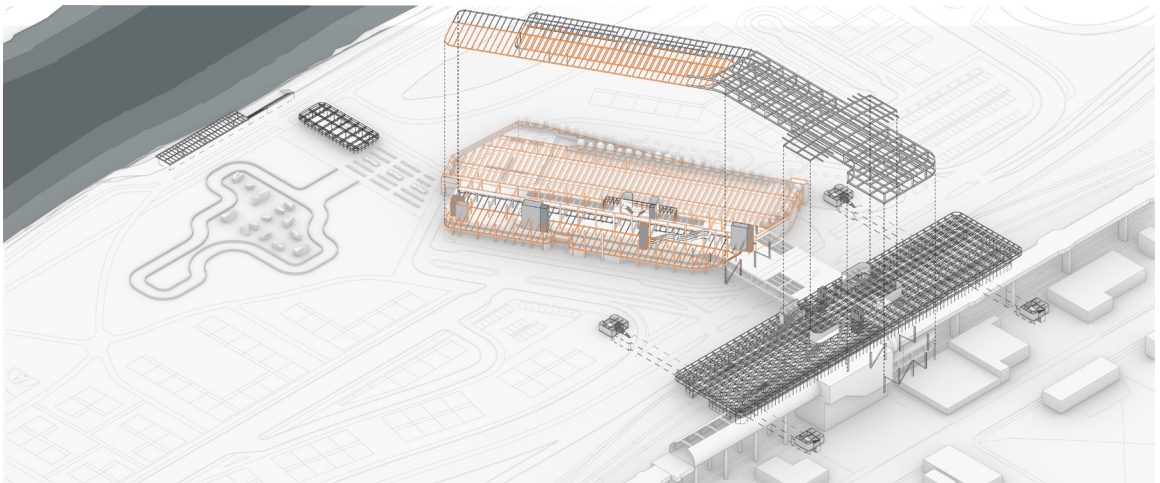
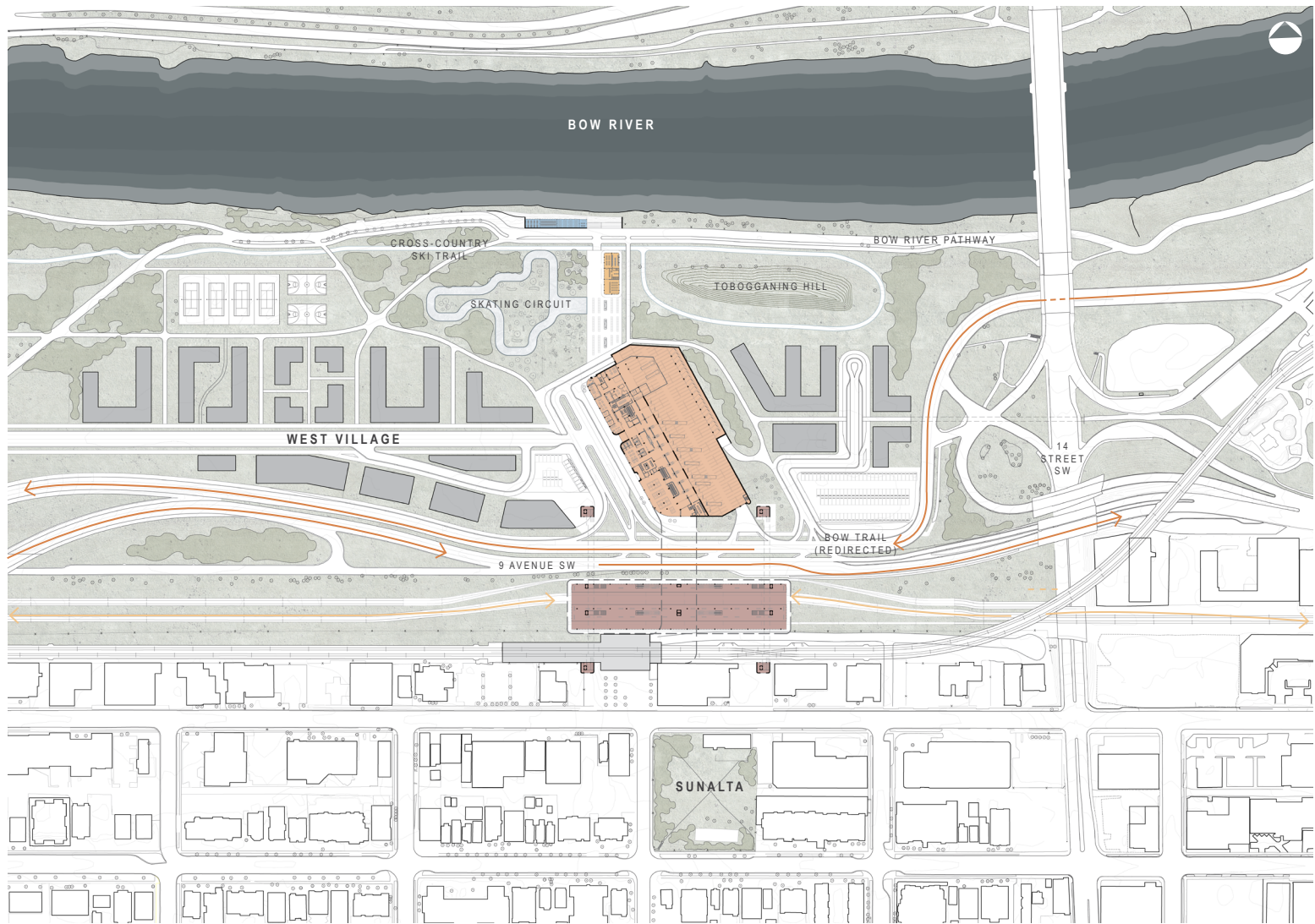
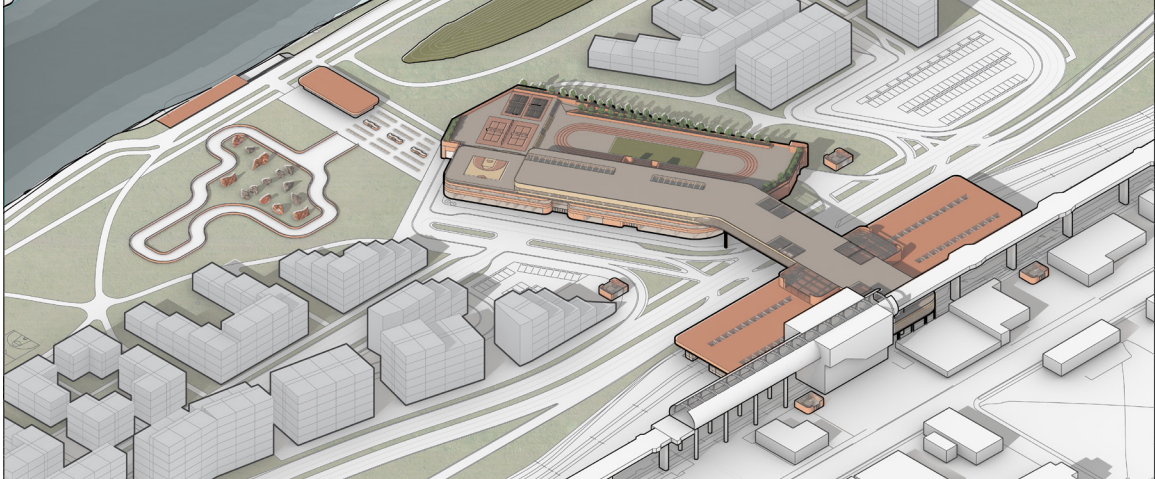


Diagram illustrating how the Metropolitan Hub design incorporates the existing structure and how it integrates with the proposed structure shown in black linework.

- Sunalta Station (Existing)
- Railway Station
- The Hub
- Land Rental Pavilion
- Water Rental Pavilion
- Future Residential Development

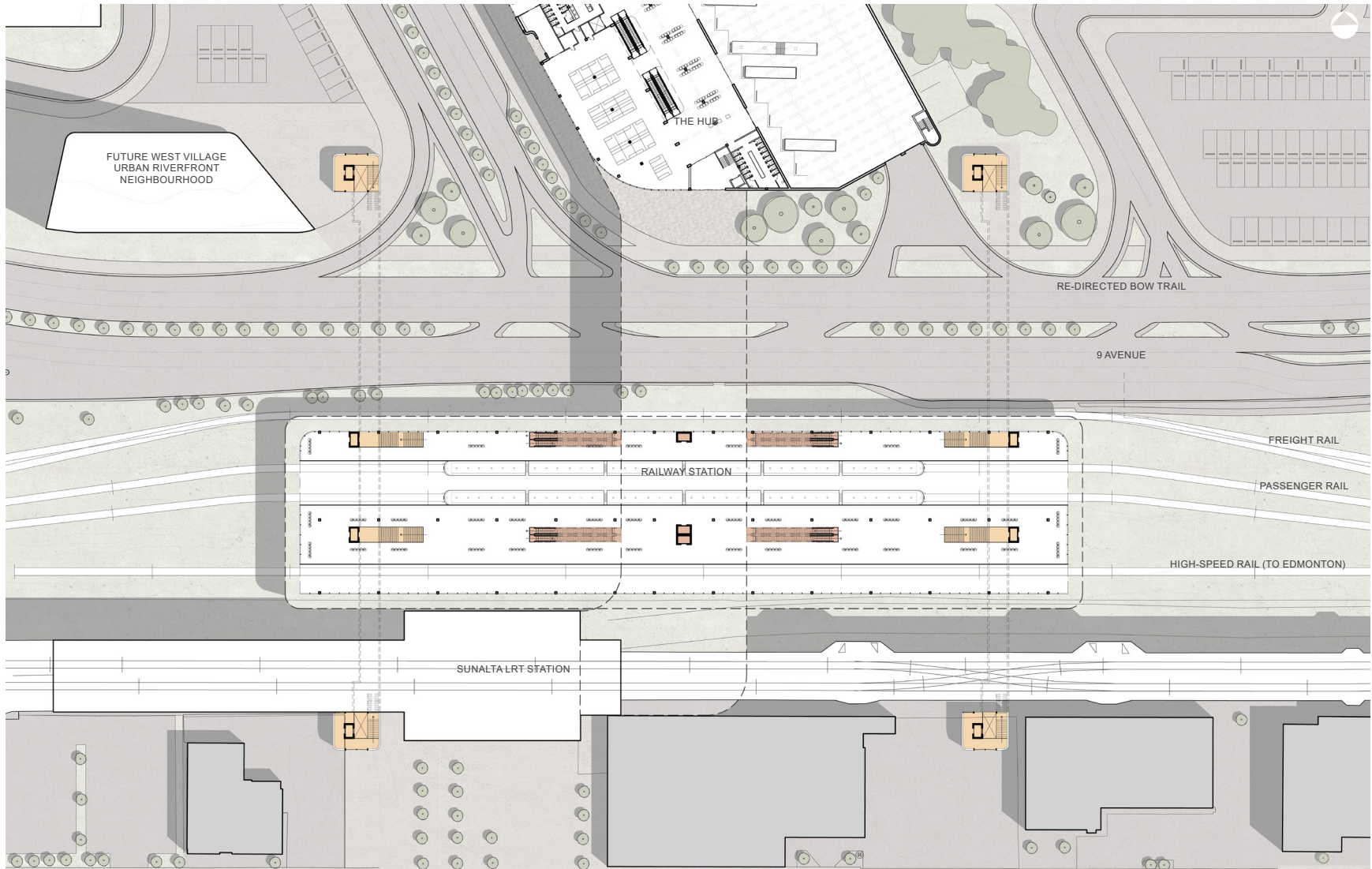


Metropolitan Hub urban design site plan.



Rendered isometric view of the Metropolitan Hub. An indication of the possibilities for future development are shown as white massing on either side of the Hub shown in light grey.

and shared mobility options. North of the Hub are two rental pavilions, one for recreation rentals (highlighted in green on the site plan), and another for water recreation rentals (highlighted in blue). Together, these 4 buildings comprise the Metropolitan Hub. Future residential development is shown in grey on the urban design site plan and as massing in the rendered isometric view of the Metropolitan Hub. This development is crucial for making a vibrant community in and around the Metropolitan Hub and to provide a high ridership base to support frequent and efficient mobility options at the Metropolitan Hub. Both the community and the Metropolitan Hub benefit from their adjacencies, providing convenient transportation options for residents and vibrant social spaces in the community. This “build it and they will come” method of development references the dense development which occurred surrounding Calgary’s first CP Rail station. All of the massing shown in the rendered isometric view above is for mid-rise development under seven storeys, allowing the required density to spread throughout the community instead of being confined to high rise towers directly adjacent to the Metropolitan Hub.

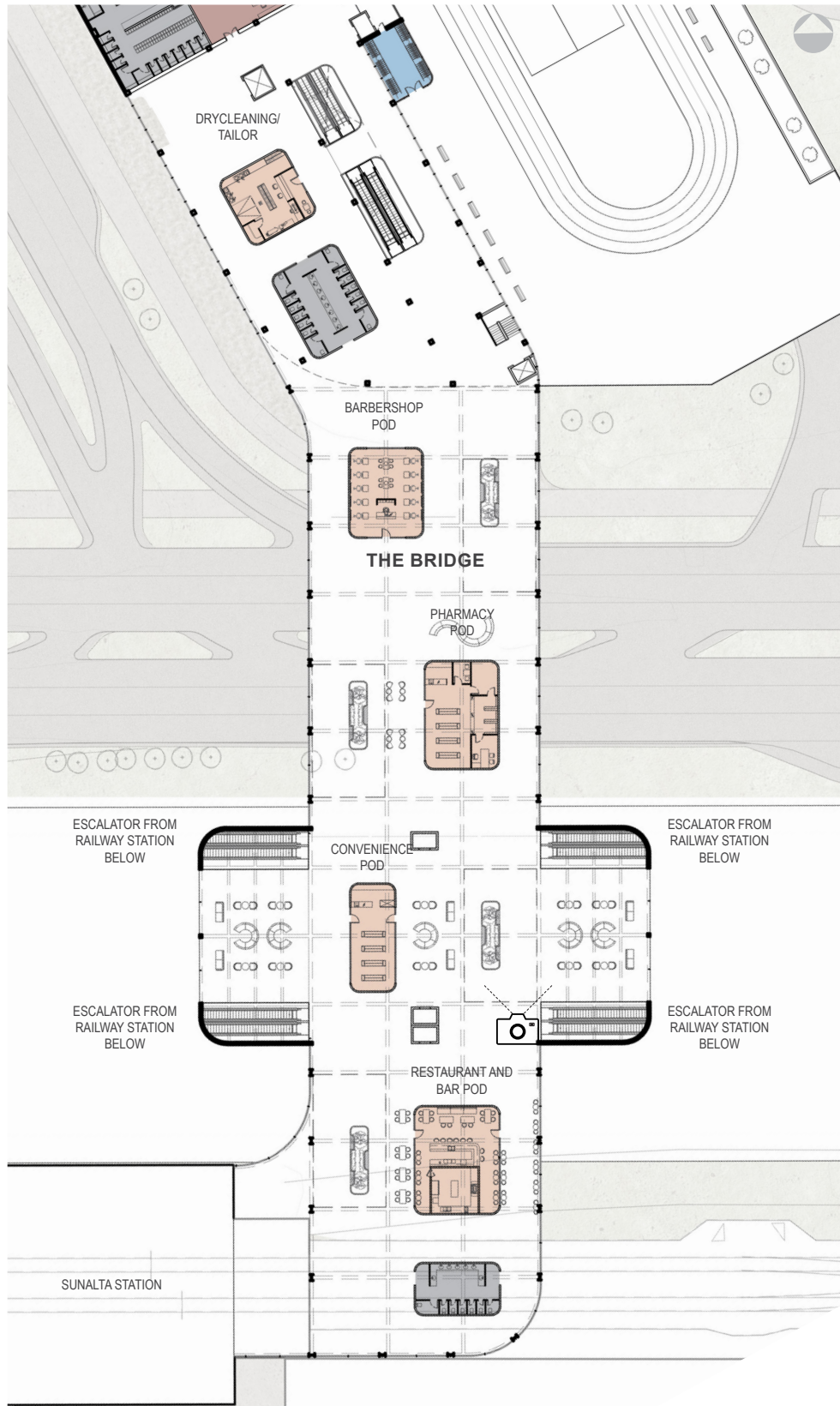


Railway Station plan. Stairs and entrance pavilions to tunnels below are shown in yellow. Escalators to bridge above are in highlighted in red.

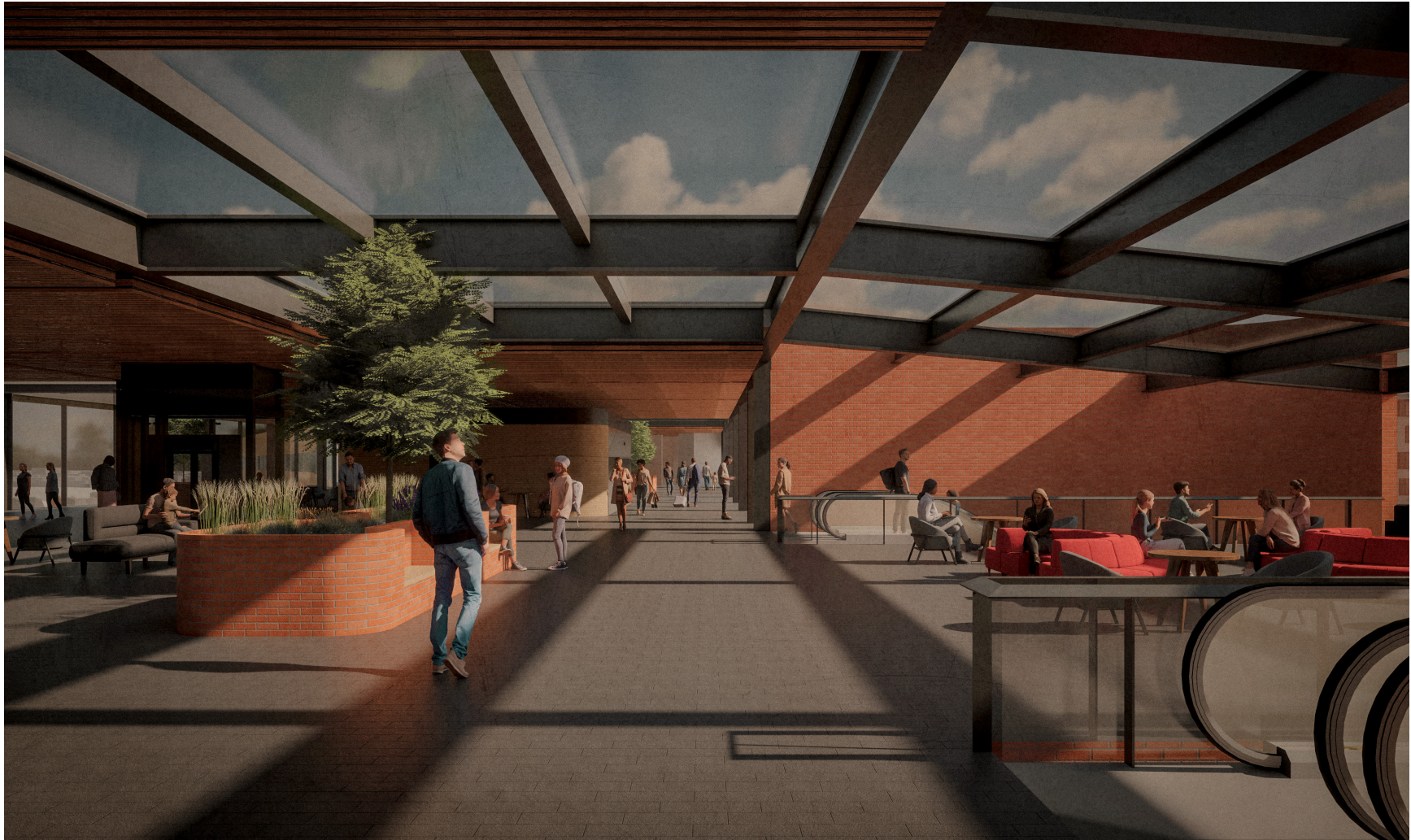
Railway Station

In addition to being a gateway into Downtown Calgary for the city's west side, the site for the Metropolitan Hub is also a gateway for the city to connect through the Bow River Valley to the Rocky Mountains and mountain parks west of the city. Calgary does not currently have any passenger rail, making it difficult for southern Albertans to travel around the region without a car. My proposal incorporates a passenger and high-speed rail station, which would serve to reconnect Calgary to surrounding communities that it tried to isolate, as well as create a more sustainable option for urban residents to access the bountiful mountain outdoor recreation activities that Calgarians cherish. The Metropolitan Hub site was even cited as one of three potential locations for a Downtown Calgary station in a 2018 Calgary-Banff Mass Transit Feasibility Study created for the Town of Banff (Calgary-Bow Valley Mass transit Feasibility Study 2019). In the study, the Sunalta site was identified as a "regional/inter city gateway hub in Calgary's primary transit network" due to its direct connection to the Sunalta Ctrain station, sufficient space for station construction in the CPR right-of-way. Furthermore, the Metropolitan Hub design also includes a terminal platform for the Calgary-Edmonton high speed rail project that has been in discussion since the late 1970's.

The Railway Station connects Sunalta and West Village via tunnels below the station (stairs and entrance pavilions to the tunnels are highlighted in yellow). Escalators from the platform to the bridge above are highlighted in red on the Railway Station plan, which also connects the railway station directly to the Hub and Sunalta Station.



The Bridge level plan with pods highlighted in orange and washrooms highlighted in grey.



The Bridge visualization. Taken from the top of the Railway Station escalators on the east side of the bridge (location is marked with a camera icon on the plan on the previous page). A variety of seating areas flank both sides of the corridor, the blonde-brick clad pharmacy pod is seen in the distance on the left side of the corridor. Skylights double as wayfinding devices and allow vegetation in the planters to bathe in sunlight.

The Bridge

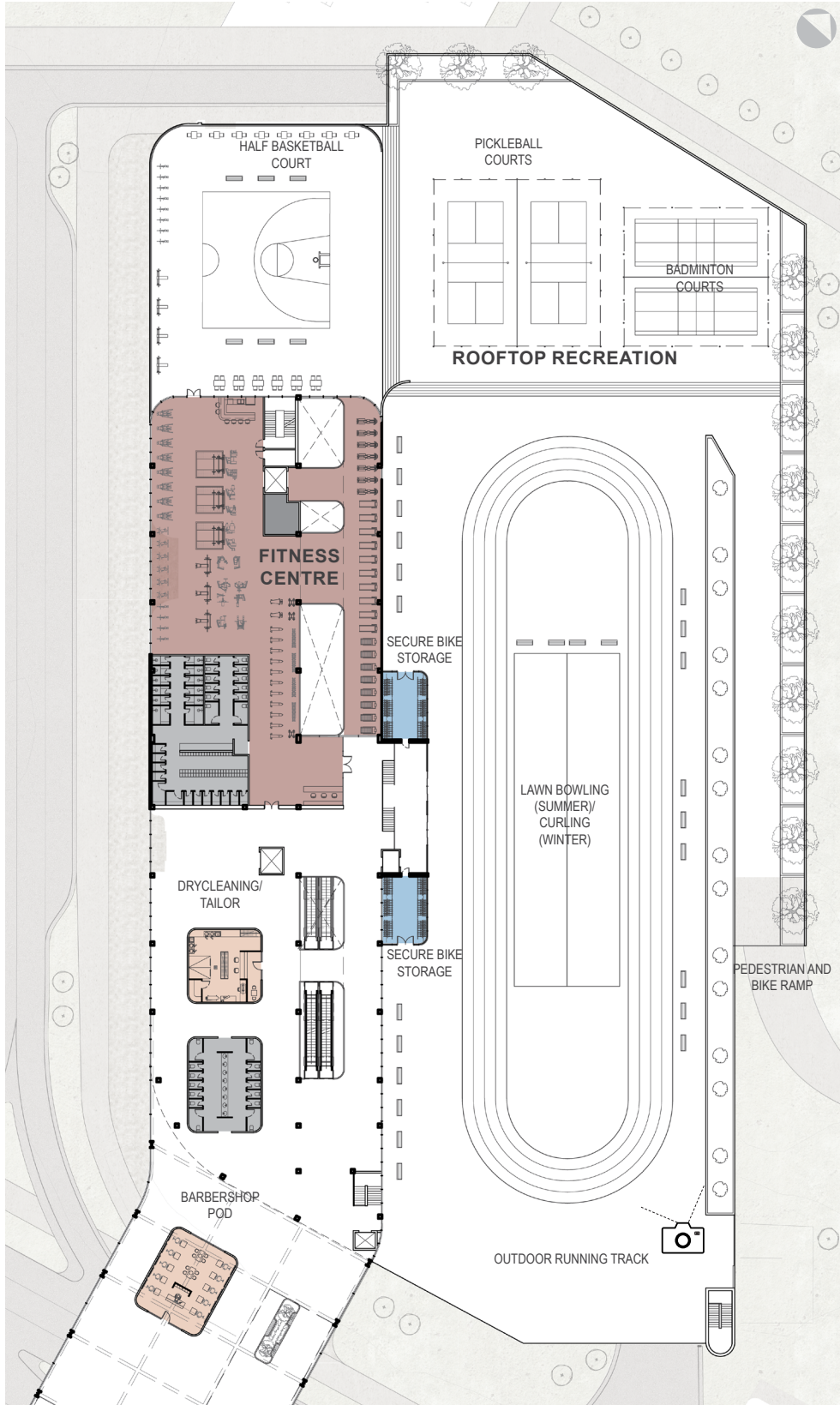
In the bridge located above the Railway Station, nested bridge pods allow for transportation complementary services and amenities to be conveniently located along a traveller's connection between modes. Bridge pods include a tailor and dry cleaning, barbershop, pharmacy, convenience store and restaurant and bar. These program elements offer travelers services that fit conveniently in the waiting period for transfers between modes. The Restaurant and bar acts as a gathering place for travelers and locals alike and will keep activity in the building throughout the night. In addition to the bridge programming, diverse seating options provide users with spaces to gather, socialize and areas of repose in the bustling Hub.

The Hub Bridge Level

The top floor of the Hub, the bridge level, includes a fitness center. By designing a typical weight room with corresponding outdoor fitness courts and recreation space on the rooftop of the mezzanine and bus loading, the recreation space that exists along the Bow River is extended to the Hub, creating a node for activity with all types of recreation clustered in one area. The existing car ramp is re-purposed as a bike and pedestrian ramp, with secure bike storage flanking the rooftop hub entry.

The Hub Mezzanine Level

On the mezzanine level there is an upper-level extension of the farmers' market on the ground floor (which we will be descending to shortly) is shown in green on the plan, which is a flexible space than can also be rented out for events.



The Hub bridge level plan with fitness centre highlighted in red, pods highlighted in orange, washrooms highlighted in grey and secure bike parking in blue.



The visualization is taken from the rooftop recreation space with the rooftop hub entry and secure bike parking on the left (location is marked with a camera icon on the plan on the previous page).



The Hub mezzanine level plan with the farmers' market extension highlighted in green, Co-working highlighted in orange and washrooms highlighted in grey.



Mezzanine level visualization, taken from the corridor overlooking the atrium with fitness centre on the bridge level above. A farmers' market stall is seen on the far left, followed by the co-working area (location is marked with a camera icon on the plan on the previous page).

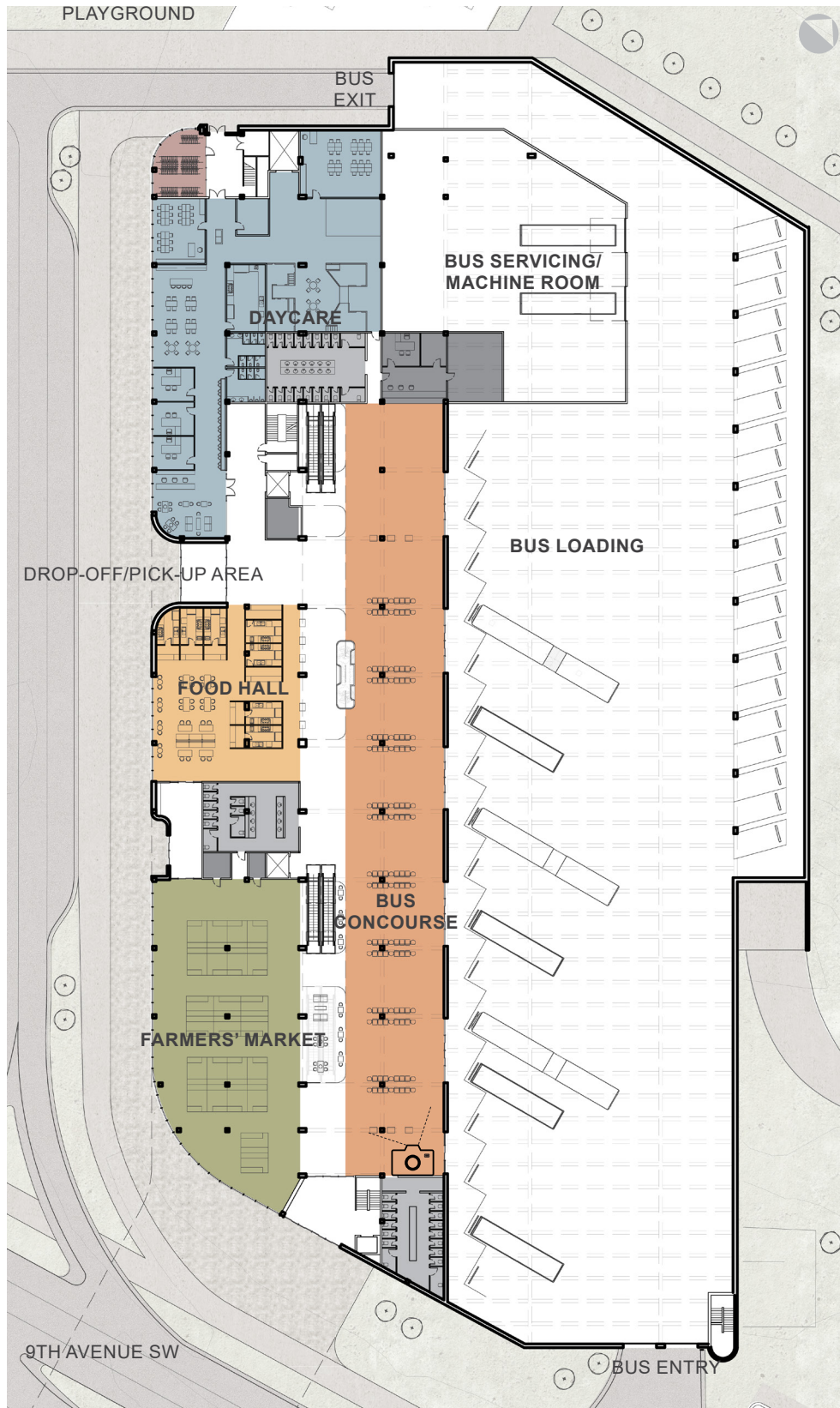
This allows the space to be occupied and vibrant at all hours of the day.

Co-working spaces are also located on the mezzanine level, allowing people to connect virtually as well as physically. Collaborative working spaces will become increasingly important as more people work remotely. If a company does not want to incur the cost of renting office space for the few meetings that will occur in person, a co-working space provides them with an ideal meeting and working space, with all the benefits of making easy connections to all the city's transportation networks at the metropolitan hub.

The Hub Ground Level

On the ground floor, the bus passenger concourse (highlighted in orange on the ground level plan) is located adjacent to the main circulation of the building. Buses are directly accessed from inside the building, making it a more comfortable waiting environment, and offering access to the amenities within the hub while passengers wait. Social programming is conveniently located adjacent to the bus concourse, which includes a local farmers' market, and a food hall.

The market (highlighted in green on the ground level plan) provides fresh local food to urban residents and commuters. Shopping for groceries is a weekly, if not daily ritual for most people. A downtown farmers' market allows urban residents to access locally grown food and buy locally crafted goods, and travellers can do their shopping without the need to make another stop along their journey, further adding to the convenience of taking public transportation.



The Hub ground level plan with the bus concourse highlighted in orange, farmers' market in green, food stalls in yellow, daycare in pale blue, bike parking in blue and washrooms highlighted in grey.



The ground level visualization, taken from the bus concourse looking northwest. Bus loading gates are seen on the right and farmers' market stalls are on the left (location is marked with a camera icon on the plan on the previous page).

The food hall (highlighted in yellow on the ground level plan) offers a variety of food vendor stalls, to provide users with an array of food and beverage options depending on their time restraints.

A daycare (highlighted in blue on the ground level plan) is located on the northwest corner of the building, adjacent to the outdoor playground. Commuters can drop their kids off easily on their way to work and pick them up at the end of the day, making transit more convenient than driving by reducing the amount of stops along one's journey.

Bicycle parking is also conveniently located adjacent to the pathway and daycare at the northwest corner of the Hub, so users also have a ground level option for securely parking their bikes- ideal for those looking to make bus connections or visit the farmers' market.

An outdoor playground is located opposite the daycare to the north of the Hub. Commuters can drop their kids off at the daycare on their way to work and pick them up at the end of the day, making transit more convenient than driving by reducing the amount of stops along one's journey.

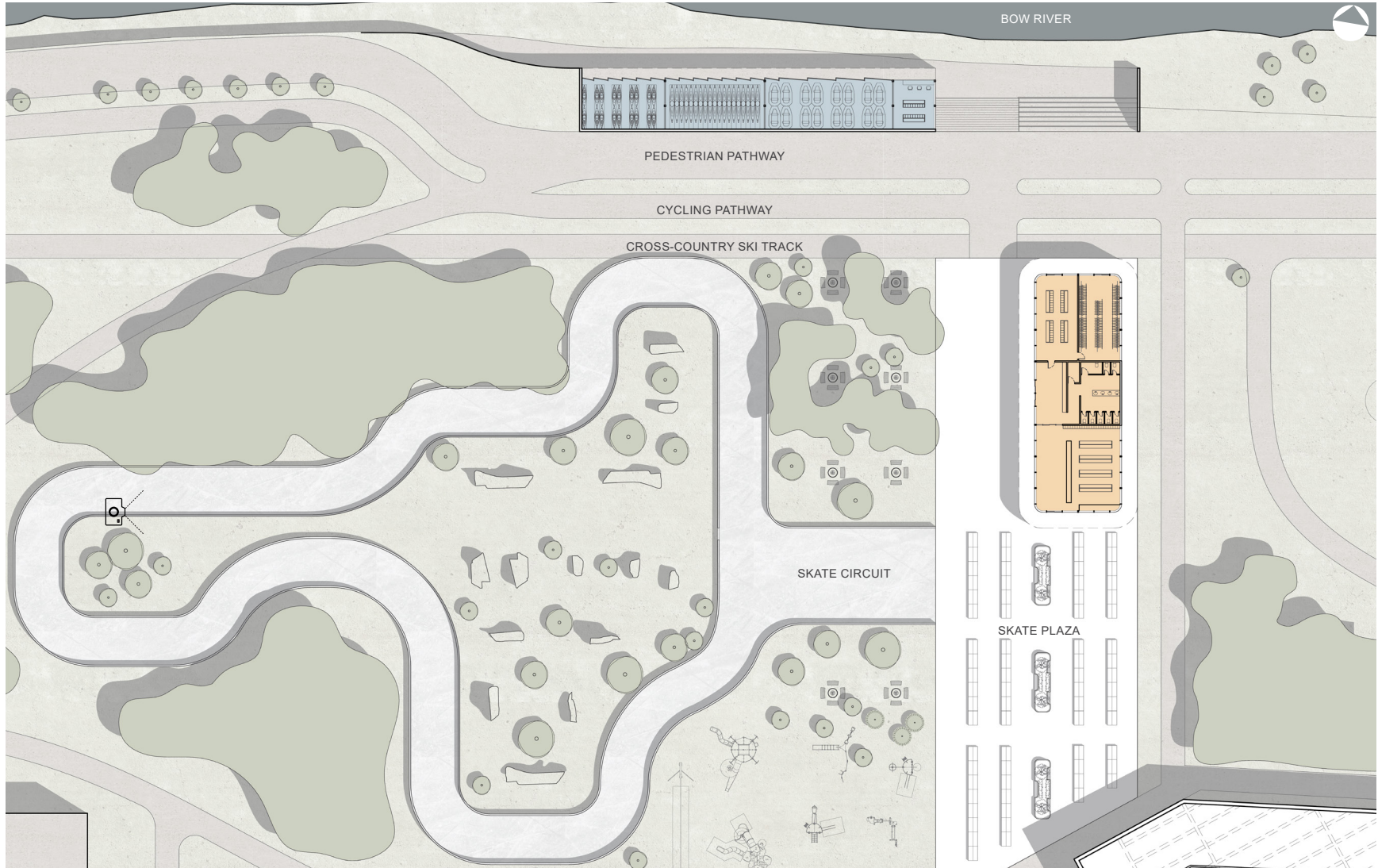
Rental Pavilions

After passing through the Hub and past the playground, the traveller arrives at the rental pavilions. The recreation rental pavilion (highlighted in on the rental pavilions plan) provides patrons with bike, roller skates, scooters, skateboards and other recreational rentals are conveniently located adjacent to the river pathway system to encourage active transportation.

In the winter, roller skates are swapped out for ice skates, and cross-country skis are rented instead of scooters. The



The Hub exterior visualization, taken from the playground to the north of the Hub, looking SE toward the ride-share and kiss-and-ride drop off area, with the bridge and train station behind, and the existing Sunalta station in the background to the right of the photo.



Rental pavilions plan. The Recreation Rental Pavilion is highlighted in yellow and the Water Rental Pavilion in light blue.

winter/summer skate circuit render shows the skate circuit in both seasons, with the Recreation Rental Pavilion in the background, and the downtown skyline behind it.

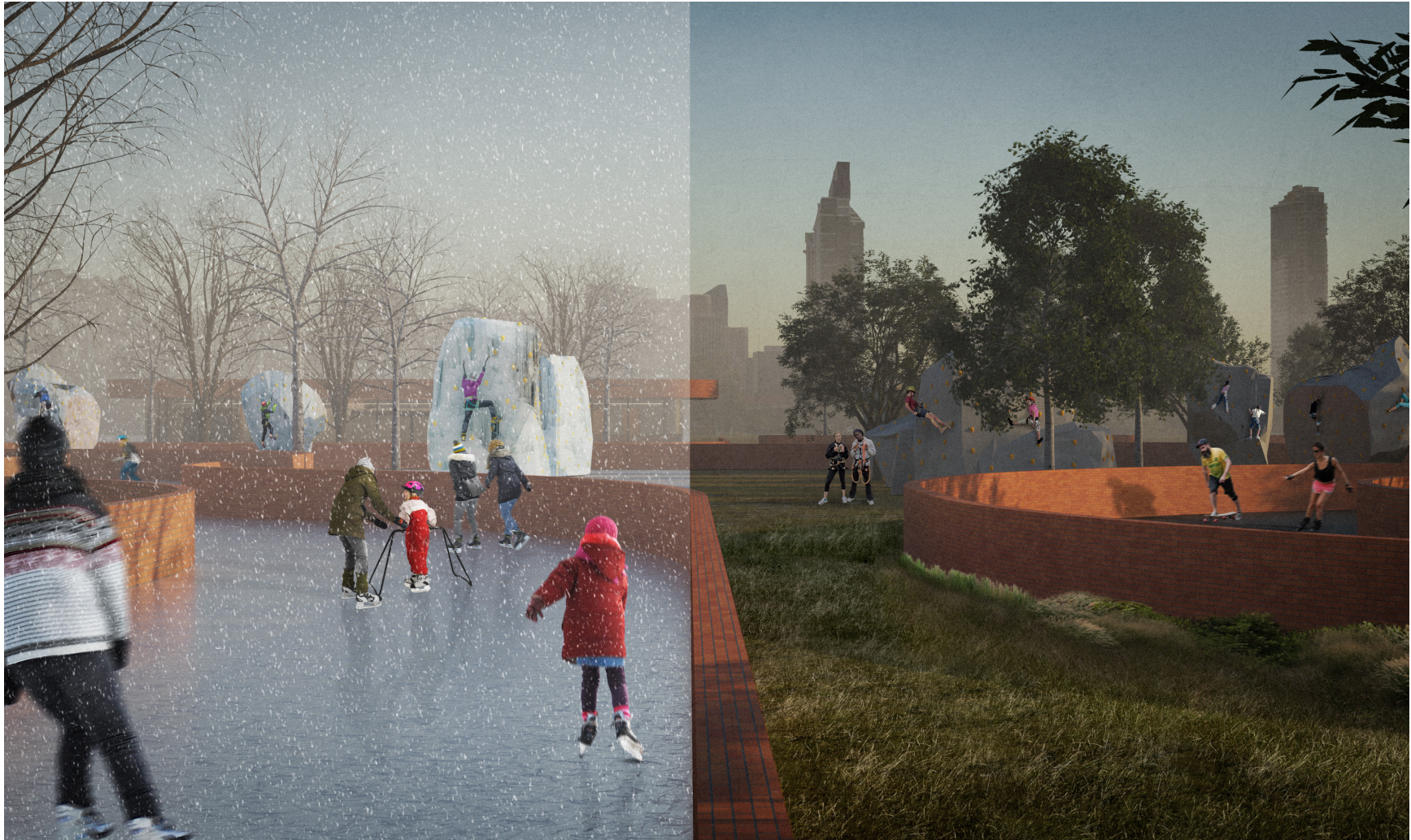
The water rental pavilion (highlighted in blue) offers boat rentals, such as kayaks, canoes, and rafts, and is situated parallel to the Bow River below the pathway above.

Summary

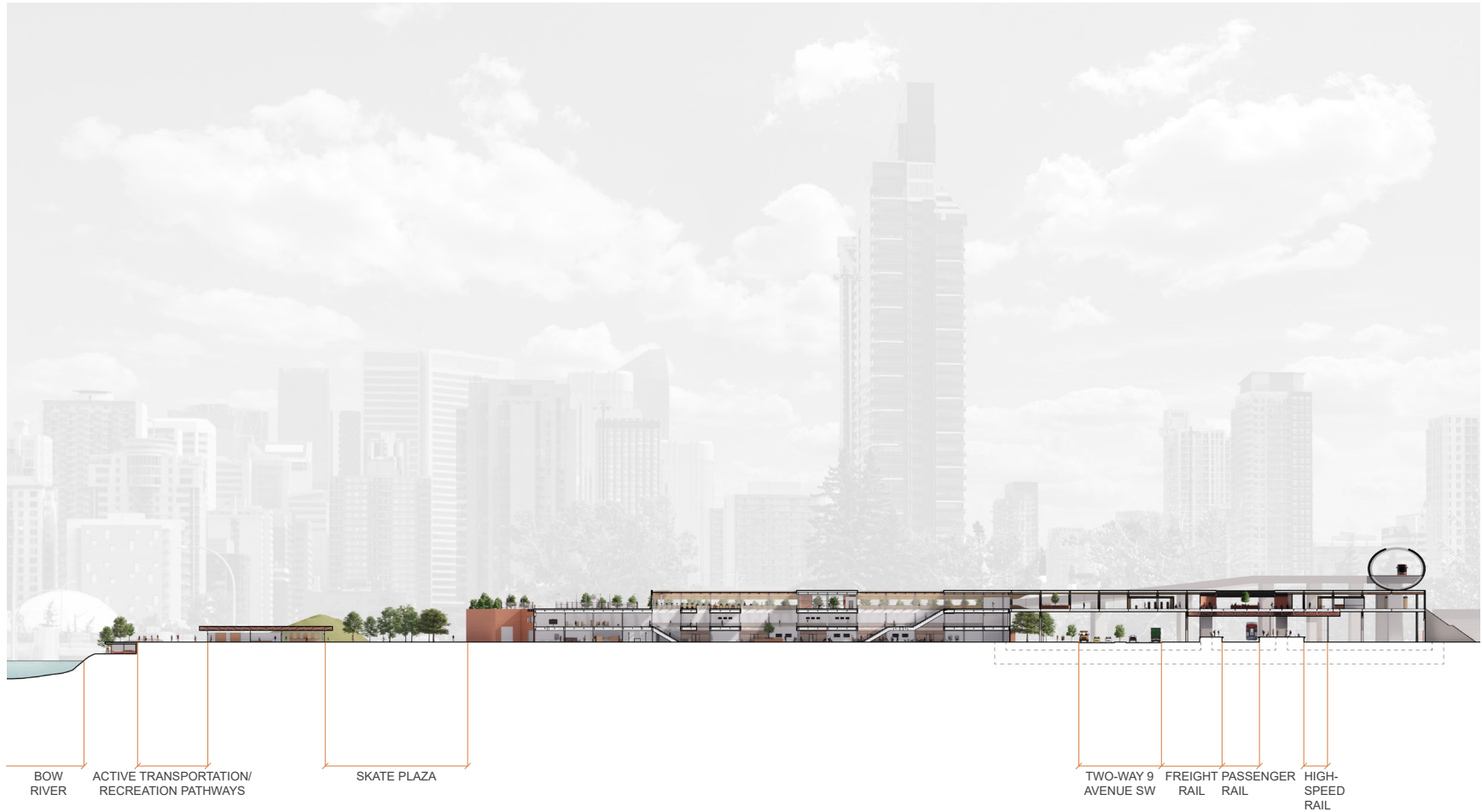
Community services and amenities are located within the Hub, altering the typical station typology by making it a community hub instead of just being a “stop”. The metropolitan hub serves to re-connect communities that were excluded by Calgary’s uni-city growth strategy and land annexation. The station acts as a microcosm of the city, offering the transportation networks, amenities, and possibilities for social interaction that the city promises.



Skating plaza visualization taken from under the cantilevered roof canopy of the Recreation Rental Pavilion. The skating circuit and ice climbing walls are seen in the background.



Skating Circuit visualization showing how the skating circuit uses change with the seasons. Roller skating becomes ice skating in the winter, and rock climbing walls are used for ice climbing in the winter. The view is looking east with the Recreation Rental Pavilion behind, and downtown skyline in the background (location is marked with a camera icon on the plan on the previous page).



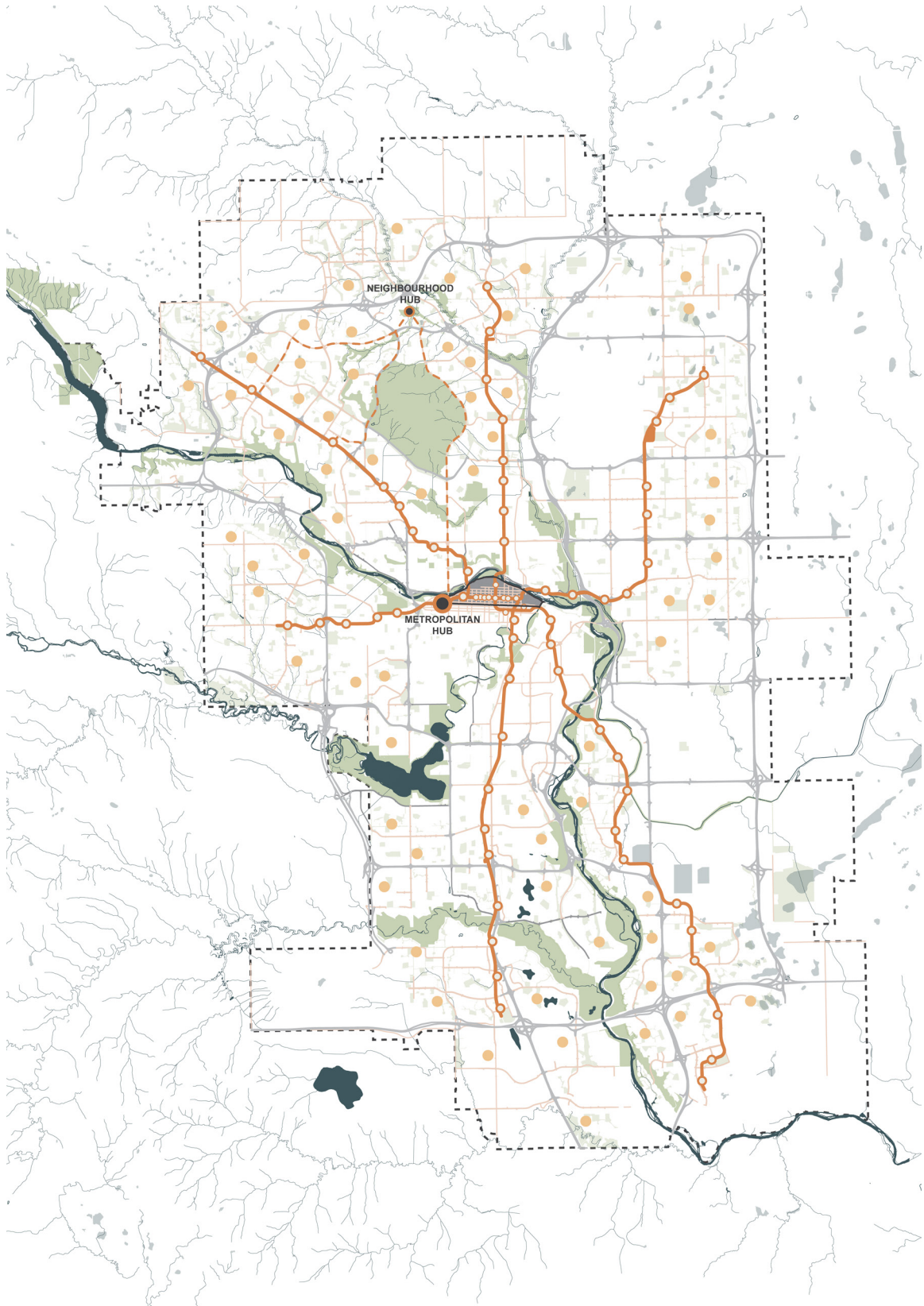
Longitudinal site section through all 4 buildings of the Metropolitan Hub, visualizing the relationships between the different buildings that comprise the Metropolitan Hub design proposal, and the sequencing and procession in which a user might pass through the site.

Chapter 6: Conclusion

In this thesis I examine the interdependence of transportation and urban growth and analyze the conditions that have developed because of these relationships. Given that these relationships have developed deep-rooted land-use and development strategies, the thesis presents interventions which leverage existing conditions, connect communities, and reduce automobile reliance. The two sites investigated in this thesis and the strategies they present are envisioned as prototypes whose strategies can be applied to existing and future transportation hubs— offering a means of reducing Calgary’s automobile dominance on a path towards an inclusive multi-modal transportation network that reconnects communities. These prototypes may differ, program may vary, and specific site conditions may present alternative opportunities and constraints; however, the principles and framework presented in this thesis offer a strategy which can be implemented city wide, and in other cities facing similar issues.

Both the Neighbourhood Hub and Metropolitan Hub provide pivotal pieces within Calgary’s transportation infrastructure to connect the dots between suburban communities and the central city by making it more convenient for Calgarians to shift away from automobile reliance and making transportation more accessible for all, while simultaneously enhancing Calgary’s social infrastructure.

In addition to the social opportunities generated by integrating multiple transportation networks, both sites take advantage of their central locations within their communities to provide various program elements that would bolster social interactions. These program elements would also



Map of Calgary showing how future Neighbourhood Hubs (show as yellow dots) can be introduced into car-dependent communities to complete the system with existing and future LRT lines and stations (The City of Calgary 2022).

provide essential community provisions that are currently lacking in both sites and can serve as the hub around which future development spreads.

Reflections

While out of the scope of this thesis project, it is necessary to state the importance of future development in regard to creating vibrant social spaces and a high ridership base to offer frequent and efficient mobility options that can rival the convenience of the car. Calgary's municipal government would also have to alter its land-use policies within a 10-minute walk radius surrounding transportation hubs. This would allow for a variety of uses to develop and create vibrant communities surrounding the hubs, in addition to the social spaces offered by the hubs themselves. Additionally, this would alleviate the pressure for developers to build tall buildings along the main corridors surrounding the station to maximize the number of units on the small amount of land which is typically up zoned for TOD. This creates TOD areas of tall residential towers which are in stark contrast to the low single-detached homes which are typically found in Calgary—which is typically one of the main concerns for existing residents toward more dense development surrounding transportation hubs.

Policy changes and the implementation of strategies that improve transportation options and introduce essential services must co-exist, otherwise suburban communities will increase density, yet the residents will still be forced to drive to access daily necessities. Future multiplication of Neighbourhood Hubs is also essential in creating an effective multi-modal system, given that over two thirds of the city is single-family suburban communities—most of which do not

have convenient access to efficient public transportation, making car ownership a necessity (Yang 2022). Therefore, if the aim is to reduce automobile dependency, actions must target the source of the issue to improve the system as a whole. Furthermore, this can only be achieved if Calgary prioritizes the construction, connectivity and quality of the city's bike and transit infrastructure over the construction of new roads—such as those discussed in this thesis regarding Vancouver's transportation system. This thesis has shown the consequences of when these design decisions are left in the hands of the developers—where each community is designed with an inward focus, and connectivity between different communities is an afterthought at best. Policies which work with urban designers, architects, planners, and other design professionals to implement city-wide regulation changes are one way in which a higher-quality and connected system could be developed.

I would also like to address the practical method in which I approached this thesis and the design of my building proposals. I set out to create rational proposals which demonstrated how two relatively modest (in the context of the city) design interventions could quickly develop a framework which could improve Calgary's transportation networks. Both proposals use existing vacant land, and in the case of the Metropolitan Hub, even adapts an existing building. I determined this method to be an important way to approach the project, given that often in Calgary, buildings are demolished to be replaced with new development, even if the existing structures on the site can support the proposed programming. More radical architectural interventions could certainly be studied and proposed (notably regarding the Metropolitan Hub and the adaption of the former greyhound

terminal building), however, my intention was to evaluate the issues with current development practices in Calgary and propose sensible interventions which can be developed with minimal changes to city land and systems. These could then be the catalyst that initiates more dramatic changes in the city's transportation systems and development structure. This shows that little interventions can have a huge impact on the quality of life for Calgarians, and that large, expensive developments are not necessary to create superior urban environments.

Urgency of Implementation

In addition to the arguments put forward in this thesis, the proposed strategies are increasingly important as the Covid-19 pandemic has accelerated the adoption of remote work, which could produce a new wave of urban sprawl if not dealt with in a timely manner. With less people commuting less often for work, it has never been easier for people to live farther away from downtown (Shiab and Bouchard 2022). This is compounded by the reduction of transit ridership in response to public health concerns, which have changed people's routines and might shift the public's perception of public transit if immediate actions are not taken to improve service and accessibility. Connecting more people to public transportation hubs could establish a culture that normalizes transit use in communities that have historically been conditioned to favour the automobile (Cervero, Guerra and AI 2017, 30).

Working from home also creates fewer opportunities for social interaction that would typically occur in the office, along one's journey to work, or in a downtown environment with a high concentration of people where impromptu interactions

might occur. As a result, many suburban residents felt an increased sense of isolation during the pandemic when typical daily social interactions were abruptly stopped. Suburban communities that were already suffering from reduced social capital due to being bounded by large roadways, had their feelings of isolation compounded by the Covid-19 pandemic. If one did not have access to a personal vehicle, they were essentially isolated within their home. This further adds to the argument for designing spaces to promote inter-personal connections, especially within suburban communities so that those working remotely still have opportunities for develop social capital.

Recapitulation

Through the strategic selection of sites for interventions, the multifaceted design proposals have utilized and activated potentials within Calgary's transportation network and communities. Vital programs are introduced to fill existing voids, transportation networks are integrated, and barriers are broken. The proposals provide the foundations for and offer a path towards a more connected city and region.

Appendix: Thesis Presentation

Please refer to the supplementary electronic file for an abbreviated presentation of the thesis. The slides as well as the corresponding text descriptions from the June 14, 2022 thesis presentation are included.

References

- Atlatis. 2018. Hydrography. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated March 5.
- Banerjee, Debanjan, and Mayank Rai. 2020. "Social Isolation in Covid-19: The Impact of Loneliness." *International Journal of Social Psychiatry* 66, no. 6: 525-27.
- Banner, Ellen. 2018. "After arriving by SkyTrain at the Commercial-Broadway station, commuters queue up for a bus on the 99 B-Line." Photograph. *The Seattle Times*. <https://www.seattletimes.com/seattle-news/transportation/seattle-struggles-with-growth-and-transit-while-vancouver-b-c-figured-it-out-years-ago/>.
- Bell, John. 2004a. "A northbound train arrives at the platform at Marlborough." Photograph. <http://www.jtbell.net/transit/images/Calgary/MarlboroughPlatform.jpg>.
- Bell, John. 2004b. "Barlow Approach." Photograph. <http://www.jtbell.net/transit/images/Calgary/BarlowApproach.jpg>.
- Calgary Transit. 2021. "Cycling." <https://www.calgarytransit.com/rider-information/cycling.html?redirect=%2Fgetting-around%2Fbikes-transit>.
- Canadian Pacific Railway. 2021. "Our History." <https://cpconnectingcanada.ca/our-history/>.
- Cervero, Robert. 1998. *The Transit Metropolis: A Global Inquiry*. Washington, DC: Island Press.
- Cervero, Robert, Erick Guerra, and Stefan Al. 2017. *Beyond Mobility*. Washington, DC: Island Press.
- Chakrabarti, Vishaan. 2013. *A Country of Cities: A Manifesto for an Urban America*. New York: Metropolis Books.
- The City of Calgary. 1960. "Twenty-fourth Street N.W. looking south from 16th Avenue." Photograph. City of Calgary Archives. <https://albertaonrecord.ca/is-ccg-3552>
- The City of Calgary. 2020. *Buildings*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated November 4.
- The City of Calgary. 2021a. *1:10 Flood Map, 1:100 Flood Map and 1:200 Flood Map*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated November 4
- The City of Calgary. 2021b. "Calgary's Greater Downtown Plan: Roadmap to Reinvention". <https://www.calgary.ca/content/dam/www/pda/pd/documents/downtown-strategy/downtown-strategy-roadmap-to-reinvention.pdf>.

- The City of Calgary. 2021c. *Green Line Alignment and Green Line Stations*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated September 7.
- The City of Calgary. 2021d. *Historic City Annexation*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated August 3.
- The City of Calgary. 2021e. *Hydrology*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated November 1.
- The City of Calgary. 2022a. *Calgary imagery*. Historic orthophotos by year, exported for Adobe Photoshop use.
- The City of Calgary. 2022b. *City Boundary*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated March 31.
- The City of Calgary. 2022c. *Community District Boundaries*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated May 18.
- The City of Calgary. 2022d. *Parks Pathways*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated June 2.
- The City of Calgary. 2022e. *School Locations*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated June 1.
- The City of Calgary. 2022f. *Street Centreline*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated June 1.
- The City of Calgary. 2022g. *Tracks - LRT*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated June 2.
- The City of Calgary. 2022h. *Transit LRT Stations*. Calgary Open Data. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated June 1.
- Couillard, Roger. 1955. "Travel the Canadian: The Scenic Dome Route across Canada." Poster. University of British Columbia Archives. doi:<http://dx.doi.org/10.14288/1.0216117>.

- CPCS. 2019. "Calgary-Bow Valley Mass Transit Feasibility Study." <https://banff.ca/DocumentCenter/View/6308/Calgary-Bow-Valley-Mass-Transit-Feasibility-Study?bidId=>.
- Dittmar, Hank, and Gloria Ohland. 2004. *The New Transit Town: Best Practices in Transit-Oriented Development*. Washington, DC: Island Press.
- Foran, Maxwell. 2009. *Expansive Discourses: Urban Sprawl in Calgary, 1945-1978*. Edmonton, AB: AU Press.
- Frumkin, Howard, Lawrence D. Frank, and Richard Jackson. 2004. *Urban Sprawl and Public Health : Designing, Planning, and Building for Healthy Communities*. Washington, DC: Island Press.
- Gehl, Jan. 2006. *New City Life*. Copenhagen: Danish Architectural Press.
- Geofabrik. 2018. Alberta. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated June 3.
- Google Earth. 2022a. "Neighbourhood Hub Site Plan." Accessed March 28. <https://earth.google.com/web/>.
- Google Earth. 2022b. "Rendered aerial perspective of the Neighbourhood Hub, emphasizing the Hidden Valley Greenway and visualizing the siting in response to the topography." Accessed March 28. <https://earth.google.com/web/>.
- Google Maps. 2021. "Secure bike lockers underneath (left), bus shelters and bike lanes (right) adjacent to Lansdowne Station, Richmond." Accessed December 16. <http://maps.google.ca>.
- The Government of Canada. 2021. *National Railway Network - NRWN - GeoBase Series*. Open Government. Map from GIS data, using ArcGIS Pro as a subset of original dataset and exported for Adobe Illustrator use. Updated May 19.
- Gratz, Roberta Brandes, and Norman Mintz. 1998. *Cities Back from the Edge: New Life for Downtown*. Washington, DC; New York; Toronto: Preservation Press; J. Wiley.
- Jacobs, Jane. 1961. *The Death and Life of Great American Cities*. New York: Random House.
- Lafleur, Steve. 2011. "The 30th Anniversary of the C-train a Critical Analysis of Calgary's Light Rail Transit System." Winnipeg, MB: Frontier Centre for Public Policy. <https://fcpp.org/2011/03/30/the-30th-anniversary-of-the-c-train-a-critical-analysis-of-calgarys-light-rail-transit-system/>.
- Litman, Todd. 2011. *Introduction to Multi-Modal Transportation Planning Principles and Practices*. Victoria, BC: Victoria Transport Policy Institute.

- Lynch, Kevin. 1964. *The Image of the City*. 1st Pbk. ed. MIT Paperback Series; 11. Cambridge, Mass.: M.I.T. Press.
- Perl, Anthony, Matt Hern, and Jeffrey Kenworthy. 2020. *Big Moves*. Montreal, QC: McGill-Queen's University Press.
- Richards, Brian. 2001. *Future Transport in Cities*. London; New York: Spon Press.
- Sandalack, Beverly A., and Andrei Nicolai. 2006. *The Calgary Project: Urban Form/urban Life*. Calgary, AB: University of Calgary Press.
- Shiab, Nael, and Isabelle Bouchard. 2022. *We Used AI to Measure Canada's Urban Sprawl*. Radio Canada. <https://ici.radio-canada.ca/info/2022/03/etalement-urbain-densite-population-villes-transport-commun-changements-climatiques/en>.
- Stamp, Robert. 2000. *Suburban Modern*. Nanoose Bay: Heritage House Publishing.
- Sun, Yang. 2022. *A Visual Guide to Detached House Zones in 5 Canadian Cities*. Data-LabTO. <http://www.datalabto.ca/a-visual-guide-to-detached-houses-in-5-canadian-cities/>.
- TransLink. 2021. "Transport 2050: Draft Regional Transportation Strategy." <https://www.translink.ca/-/media/translink/documents/plans-and-projects/regional-t>.
- University of Calgary. 1911. "First Calgary streetcar, Calgary, Alberta." Photograph. Libraries and Cultural Resources Digital Collections. <https://digitalcollections.ucalgary.ca/asset-management/2R3BF1O6KE5V?WS=PackagePres>.
- University of Calgary. 1920. "Canadian Pacific Railway station, Calgary, Alberta." Photograph. Libraries and Cultural Resources Digital Collections. <https://digitalcollections.ucalgary.ca/asset-management/2R3BF1XKK00X?WS=SearchResults>.
- University of Calgary. 1955. "Show homes, Calgary, Alberta." Photograph. Libraries and Cultural Resources Digital Collections. <https://digitalcollections.ucalgary.ca/asset-management/2R3BF1FQEZBI?WS=SearchResults>.
- University of Calgary. 1975. "Opening of Deerfoot Trail, Calgary, Alberta." Photograph. Libraries and Cultural Resources Digital Collections. https://digitalcollections.ucalgary.ca/CS.aspx?VP3=DamView&VBID=2R3BXZSDNBF2V&PN=1&WS=PackagePres&RW=1536&RH=722.&FR_=1&W=1536&H=714#/DamView&VBID=2R3BXZ76U0N4P&PN=1&WS=PackagePres.
- University of Calgary. 1984. "Aerial view of McMahon Stadium, Calgary, Alberta." Photograph. Libraries and Cultural Resources Digital Collections. https://digitalcollections.ucalgary.ca/CS.aspx?VP3=DamView&VBID=2R3BXZSDNBF2V&PN=1&WS=PackagePres&RW=1536&RH=722.&FR_=1&W=1536&H=714#/DamView&VBID=2R3BXZ76U0RG9&PN=1&WS=PackagePres.

University of Calgary. 1985."Aerial view showing Deerfoot Trail and Memorial Drive looking toward city centre, Calgary, Alberta." Photograph. Libraries and Cultural Resources Digital Collections. https://digitalcollections.ucalgary.ca/CS.aspx?VP3=DamView&VBID=2R3BXZSDNBF2V&PN=1&WS=PackagePres&RW=1536&RH=722.&FR_=1&W=1536&H=714#/DamView&VBID=2R3BXZ76UAZ9K&PN=1&WS=PackagePres.