WATERFRONT TRANSPORTATION STRATEGY





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1. Introduction



1.1 Purpose of Strategy

As part of the overall strategy to revitalize and transform the District of Mission's Waterfront, the transportation network must be designed and built to allow for existing and new intakes of every form. Outlined in the Master Transportation Plan, the new network will adhere to the hierarchy with pedestrians at the highest priority. This strategy incorporates the requirements and hierarchy for the new network and provides reasoning and advises on how to proceed in future planning opportunities. In addition, environmental concerns are highlighted and directed towards the appropriate sections for consideration.

1.2 Waterfront Context

The Mission Downtown Waterfront district is an approximately 290-acre (117 hectares) area located at the Southern Point of Mission B.C, along the North bank of the Fraser River. Historically a culturally meaningful site used for recreation and important industry alike, the Waterfront has seen a slow decline in recent years. Contamination and land fragmentation combined with municipal servicing requirements have created a lot of uncertainty. Since the early 1990's, the District of Mission has identified the need to revitalize the area, and unlock its cultural and economic potential. There are currently three distinct uses of land: The Eastern region is predominantly industrial, with a mix of wood processing and manufacturing, as well as automotive services making up the majority of businesses. The Western region is the location of the Mission Raceway Park, an iconic local establishment that has hosted national car club racing events since 1951. In between is approximately 82 acres (33 hectares) of mostly undeveloped and unused land. Collectively, the Waterfront District offers exciting opportunity for investment and redevelopment.





Engagement Example: City of Vancouver

1.3 Engagement Plans to Consider

This report could be used to facilitate idea workshops in coordination with the District of Mission to further refine and develop the transportation infrastructure in the Downtown Waterfront.

• Open House Event

A relatively informal presentation of the report plan to the public would introduce a wide range of local residents to the transportation development potential of the Waterfront. This would increase awareness of future plans, and give the public the opportunity to discuss pros and cons amongst each other, and potentially raise issues or ideas with local officials.

• Draft Plan Consultation

This would allow groups of professionals to work with local residents to brainstorm ideas that address specific concerns and expectations. Using this report as a plan model, residents would be introduced to concepts by knowledgeable experts, greatly enhancing their understanding. Furthermore, local insights to potential effects of development models would be extremely useful feedback for planners and developers to make further adjustments and enhancements going forward.

2. Pedestrian Plan

2.1 Existing Walking System

A successful transportation system is not only to encourage people to use public transit more, but also to encourage people to walk more and cycle more.

The waterfront in Mission has been identified as a top priority for many years and is expected to be a vibrant and successfully revitalized area to attract people to transit, entertain, and work. As a key part of transportation, the pedestrian system is critical to the revitalization. Existing planning and studies about the pedestrian system are broadly on a large scale of the whole district of Mission instead of focusing on the waterfront area specifically, but these could still be used as references to how to improve the pedestrian system in the waterfront area.

Pedestrian facilities in Mission consist of sidewalks on collector or arterial streets, as well as trails in local parks. Walking in Mission is primarily for leisure or recreation and accounts for approximately 7 percent of all trips in the District. Shopping and errands are the second common reason for walking, followed by commuting to work and school.

A survey in 2015¹ showed residents had low priority towards walking. To improve the situation, the Transportation Master Plan proposes measures to build more and safer sidewalks and crossings, especially more trials and paths along the waterfront, as well as to enhance better connectivity to destinations and more mixed-use development in residential areas. To develop these measures in the waterfront area to achieve the highest pedestrian priority, the following strategies and principles focusing on accessibility, safety, convenience, and attractiveness, and culture, are suggested to be applied to future planning and development.





2.2 Planning Strategies

Needs Analysis

Analysis should be done to estimate the increasing traffic and their destinations, e.g. when and how many people use sidewalks the most, how many people are estimated to use trails to exercise and entertain in the Waterfront, or for what reasons and how many pedestrians are coming from outside the Waterfront and whether the traffic changes seasonally. By doing this, pedestrian facilities can be better designed and distributed based on people's needs.

Except for the current three main purposes mentioned prior², transit will be another important factor that will contribute to the increasing pedestrians. The Abbotsford-Mission Transit Future Plan (2013) forecasts that compared to 2011, there would be a six-fold increase in annual ridership in Central Fraser Valley and would result in an 8 percent transit mode share. Estimations should be done to analyze how many people are willing to stop and go outside of the Waterfront Transportation Hub and what facilities should be provided to attract traffic.

Land Use

Land use is tightly associated with the pedestrian system. Proximity from residential uses to commercial, retail, institutional (schools), entertainment, and parks use generates the needs of high walking rates for the general population. Except for specific uses, mixed-use is also very supportive of walkability because of the accessibility of various destinations. Density is another factor that impacts pedestrians³. Research has shown that higher density underpins walkable neighbourhoods, especially for transportation.

Recommendations to future OCP amendment are to group the uses to create relatively compact (medium rise) and mixed-use neighbourhoods, and/or to designate mixed-use lands, which also have other benefits such as natural surveillance preventing crimes and keeping streets safe.

 $^{\rm 2}$ Exercise /entertainment, shopping / errands, and commuting to walk and school

³ Udell, T. Daley, M. Johnson, B. Tolley, R. "The Role of Density in Creating Walkable Neighbourhoods" (2014). https://www.heartfoundation.org.au/images/uploads/publictions/Heart_Foundation__Does_density_matter_FINAL2014.pdf



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Connectivity

A well-connected pedestrian system should be planned. Rather than sidewalks and trails, public spaces, either small street parks or larger destinations like parks and public buildings, are the nodes of the linear system and should be rhythmically distributed. They play an important role in the system to attract pedestrians and let them rest.

Of all the nodes, the 9 metres high flood protection wall will be an important one. It is suggested to be designed to satisfy the function of flood protection and in the meanwhile to be a riverside promenade that offers generous public spaces for pedestrians, joggers, street performers, food stalls and cafes.



Figures 1-4: Niederhafen Flood Protection Barrier Hamburg, Germany. Niemann, P.

The upgraded 625-metre-long Niederhafen Flood Protection Barrier in Hamburg, Germany⁴ could be used a reference. It is 8.60 metres above sea level in its eastern section and 8.90 metres above sea level in its western section to protect the city from maximum winter storm surges and extreme high tides. It re-connects its river promenade with the surrounding urban fabric of the city; serving as a popular riverside walkway while also creating links with adjacent neighbourhoods. The linear structure was designed by Zaha Hadid Architects and has the esthetic value itself, which can attract people from different places and contributes to the revitalization of the area.

The Transition Hub is another important node in the pedestrian system. Because of the complexity of transportation, convenience and safety are the basic requirements to be considered, i.e., pedestrians should be conducted easily and safely to sidewalks which should be well-connected to their destinations. Public squares might also need to be designed at the entrances of the Transition Hub, depending on the location and the volume of pedestrians.

Except for the large nodes, small public spaces (e.g. street parks) also play an important role in connectivity. They make trips more interesting and offer spaces to rest.

Space Usage

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Spaces can be multiplied. In the area around the Transition Hub, spaces might have to be used vertically, which might be sidewalks either underground, on the ground and in the air, also depending on the volume of pedestrians and the complexity of the transportation.



Figure 5: Burnside Skatepark, Portland, OR.



Figure 6: The Bentway, Toronto, ON.

The space under the viaduct of Hwy 11 can also be used as sidewalks or even interesting destinations. The Bentway in Toronto, ON⁵ and the Brunside Skatepark in Portland, OR⁶ are good examples of how to use spaces under the expressways for the public.

In 2016, Anders Berensson Architects proposed a skywalk concept in Downtown Stockholm, which could be a good idea of how to use spaces for pedestrians in high density area⁷.





😳 Skywalk Concept in Downtown Stockholm

Figure 8: Pedestrian Scramble, Shibuya, Tokyo.

enssonarchitects.com/work/klarastaden/







2.3 Envisioned Designs

Safety

Safety is one of the reasons why people show low priority towards walking in Mission. Except for lighting mentioned in the Transportation Master Plan should be improved, other principles can also be used to improve safety. From the perspective of crime prevent design, mixed land use can offer better natural surveillance than pure residential use to keep an eye on sidewalks. As for intersections especially in the high pedestrian flow area, a pedestrian scramble is recommended to be applied to improve efficiency and safety. Examples can be found in Tokyo, Toronto, London, and Los Angeles.

Plantings and Facilities

Plantings along sidewalks have both esthetic and environmental effects. Trees, shrubs, lawns, and flowers can be designed to enrich sidewalk spaces, provide permeable surfaces, and offer canopies in summer. Facilities such as benches and waste bins should be set regularly along the pedestrian system.



Figures 9-11: Left: Lighting Art in Sydney, Australia.

Top Right: Musical Swings in Montreal, QC.

Bottom Right: Musical See-saws in Montreal, QC

Public Art & Indigenous Culture

Plantings along sidewalks have both esthetic and environmental effects. Trees, shrubs, lawns, and flowers can be designed to enrich sidewalk spaces, provide permeable surfaces, and offer canopies in summer. Facilities such as benches and waste bins should be set regularly along the pedestrian system.

From a perspective of large scale, iconic architectures and structures are also arts which are always important destinations for pedestrians. The Niederhafen Flood Protection Barrier mentioned above has already become an attraction.

Mission has the First Nations reserves and indigenous culture should also be included in public art designs as an important characteristic of local communities.



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3.1 Existing Cycling System



Figure 12: Mission Cycling Network

The existing cycling network in Mission is a series of local and collector shared-use designated roads with shared-lane pavement markings and signage. These implementations were introduced in 2010 with the intent of basic north-south and east-west connections (District of Mission, 2016). Currently, this network is insufficient to support the population of potential cyclists in Mission. Shared-use cycling can be intimidating for non-experienced and low confidence riders due to the high volume of traffic on major routes, and the lack of separation between driver and cyclist. This also increases the danger for both driver and rider, and contributes to a heightening of congestion. The district also does not currently have any requirements for bicycle parking or other end-of-trip facilities such as showers, washrooms and lockers for new commercial, business or industrial development (District of Mission, 2016).



3.2 Planning Strategies

The District of Mission Official Community Plan (OCP) has identified the enhancement and expansion of a local cycling network and facilities connected within city districts and with neighbouring communities as a key component of achieving the City's comprehensive transportation objectives (District of Mission, 2017⁸). There are some biking trails and routes that support cycling in Mission, but there is no functionally connected network between municipalities nor within the District. Not surprisingly, cycling trips currently make up less than 1 percent of daily journeys, with the majority of trips made by car (District of Mission, 2016⁹). According to public open house feedback, Mission residents' cycle for exercise and recreation more than commuting and cited the lack of safety and dedicated bicycle facilities as reasons for not cycling more often (District of Mission, 2016). The design of the new Downtown Waterfront Development Project must incorporate an inclusive, interconnected, safe and useable cycling route in coordination with the OCP and neighbouring districts as part of its transportation plan.

Community Responses

1.a. We need connectivity for all modes of transportation including walking to all areas of Mission, the Junction mall needs a walkway over the tracks that is wheelchair and stroller friendly to many close calls for pedestrians on current sidewalk

3.a. I would like to see better sidewalks, trails, and pathways in the suburban and downtown area of Mission. Jogging trails / loops & interconnecting bike paths. Walking to and from would be beneficial for the wellness of our community in the long run. Specifically from the downtown area, such as the Library, to the Leisure Center. I would love to see a trail network with wheelchair & stroller access on the lane creek trail, as well as a trail connection to Lane Creek & the Welton Stairwell.

Figure 13: Questionnaire Responses from Mission Master Transportation Plan

Public open house respondents highlighted the need for the following changes/ additions in the cycling network and infrastructure to increase cyclists in the District (District of Mission, 2016):

- More bike lanes and better dedicated bicycle facilities
- Additional trails or paths (specifically along the river)
- More bicycle parking
- Improved safety (eg. Facilities and crossings) and awareness (eg. Share the road)
- Improved connectivity to destinations
- Concerns regarding safety of children, especially around schools



3.3 Envisioned Designs

The District of Mission Park, Trail and Bicycle (PTB) Master Plan has acknowledged a series of propositions to create a better bicycle network. Similar to the Pedestrian Plan, the Cycling Plan is guided by the principles of improved safety, connectivity, and the building of a complete network of bicycle routes in order for residents to better access popular destinations and services. Recommendations include (District of Mission, 2009¹⁰):

- Improve safety and awareness
- Increase the number of bike lanes and dedicated bicycle facilities
- Increase the number of trails or paths
- Increase bicycle parking facilities
- Improve the connectivity of bicycle routes
- Promote and encourage cycling



Figure 14: Proposed Bicyle Routes. District of Mission

Connectivity

The PTB Master Plan has proposed an interconnected route network within the District that establishes new dedication requirements. It states that future bike lane development should incorporate multi-modal transportation for bike routes, such as multi-use pathways. These pathways should be hard-surfaced, using concrete or asphalt, which will allow accommodation to all non-motorized users including in-line skaters, persons in wheelchairs and cyclists with narrow tires (District of Mission, 2009). For environmentally sensitive areas, soft-surface may be preferable, but should be used only when necessary (District of Mission, 2009). The western half of the Waterfront neighbourhood is primarily undeveloped natural land, and as such a multi-use cycling trail should be designed to maintain as much of the natural landscape as possible, while still allowing for safe and comfortable travel by bike.

The Waterfront area has a partially paved walking trail along the east end of the river that connects to Jack Poole Harbourside Park. An upgrade and extension to the trail along the rest of the riverbank could create a multi-use path/cycling trail. Ideally this trail would be designed in to the natural landscape. However, consideration should be taken to ensure the trail surface is smooth and flat enough to embolden any level of cyclist. The plan encourages adopting a "Riverfront to Mountaintop" approach for the design that connects cycling routes to walking paths and trails as part of the network (District of Mission, 2009), which should include connection to a route that runs along the river. The plan also encourages the creation of a community dirt bike park at Mission Rotary Sports Park and other sites that is connected to the cycling network (District of Mission, 2009). The possibility of a new bike park along the west side of the Waterfront area should be taken in to consideration when designing the riverfront multi-use/cycling trail. The undeveloped landscape would be ideal for such a development, and could increase the visibility of bike users in the community, in turn could encourage more residents to cycle as it helps to establish a bike friendly image of Mission.



Figure 15: Cophenhagen Parking Facility

Facilities Upgrades

In order to encourage cycling as a means of alternative transportation, establishing amenities to facilitate frequent use, carrying of groceries and other items, and availability of features must be incorporated in to the design. Creative solutions to these problems can be gleaned from other cycling heavy cities around the world. For example, parking availability issues for cargo bike users who frequently transport children, food and most everything else in Copenhagen were addressed with a pilot project that built bright pink car-shelters for local residents. Lit with solar powered lights, four cargo bikes fit inside each one, users get a key, and they and can store extra equipment inside. E.1 E.2 E.3 E.4 E.5 E.6

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In accordance with the OCP and PTB objectives, identifying destination points along the cycling route where facilities such as washrooms and lockers could be established should be a priority for cycling route development in the Waterfront area. Ideal locations include:

• Mission City Station

As part of the transit hub development at the north end of the Waterfront area, and in conjunction with the existing West Coast Express train station. These facilities should include showers, toilets, and lockers that could be used for multi-modal transportation users, as well as bike specific amenities such as bike parking/locks.

• Jack Poole Harbourside Park

As part of the multi-use walking/cycling trail development along the river waterfront, and potentially in conjunction with the existing Mission Harbour Authority marina. These facilities should include bike parking/locks as well as washrooms.



Figure 16: China's Rapid Bus Transit Bike-Share System

Public Transportation Integration

Incorporating an integrated cycling route network in to Mission's public transportation system could incentivise cycling as a means of transportation to and from the Waterfront area. Adding safe and convenient bike-parking facilities and lockers at transit stations would encourage residents to use public transportation and help decrease vehicle traffic overall.

Innovative integration systems have been increasing throughout the world, most notably in major European cities such as Amsterdam and Malmo, Sweden. Guangzhou, China has invested heavily in cycling infrastructure in their city transportation plans. Their Rapid Bus Transit (RBT) Bike-Share system is an ambitious coordination of cycling routes being used as part of the Rapid Bus structure. Riders can use a pre-paid transit card to acquire one of the 5,000 bikes available along the network. There are designated lock up parking areas at each of the Rapid Bus stations as well as major commercial districts and residential neighbourhood hubs that are serviced by the RBT network.



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4. Road Network

4.1 Existing Road Network



Figure 17: District of Mission Truck and Road Network

As part of the new redesign for the District of Mission's Waterfront, a road network must be capable of providing social, economical, and environmental success. Guided and supported by the Official Community Plan and Transportation Master Plan policies, the Waterfront transportation strategy / road network will support and contribute to a sustainable community and go above and beyond for years to come.

The Waterfront road network currently acts as a "connector" from highway 11 from the west to bypass the downtown core towards the east to highway 7. In the middle of this "connector" is an interruption area situated near the center of the neighbourhood that expands and connects to local roads before going back to the highways. Railway lines intersect local roads from south to north and surround the neighbourhood from the west to east on the northern boundary.





4.1 Planning Strategies

Expected Future Population and Employment

Waterfront Area (Zone 9090) Population and Employment Forecast		
2011 Population	380	
2045 Population	2660	
2011 Employment	6260	
2045 Employment	6610	

Table 1: Waterfront Area Population and Employment Forecast

The District of Mission is estimated to grow and expand in both population and employment. As expressed in the Transportation Master Plan, the forecast for employment and population in the Waterfront neighbourhood by demographic is shown below for 2011 to 2045. There is a need for the neighbourhood to change and accommodate the demand with a sustainable supply including expected road networks for people and goods



Figure 18: Waterfront Area Population and Employment Forecast

Road Safety From Highway to Local Roads

Historically the two highways into and out of the District of Mission face a mix of vehicle types and uses in a small area. For Highway 7, the portion near Mission's downtown includes the main bus loop and has a large intersection with highway 11 to the northwest of the Waterfront. These factors have contributed to a hotspot for accidents.

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Truck Route

The Waterfront neighbourhood will need to include how we plan for goods movement. This will involve the truck routing focused on the provincial highway 11 within the area. To ensure swift movement and maximum safety, the routing must be designed to be as efficient and direct as possible with minimal disruptions to the neighbourhood.

Pedestrian Oriented Design

As part of envisioning a great Waterfront catered to pedestrian priorities, there is a need to ensure that design and policy reflect pedestrian focused direction even in road design. The neighbourhood will be expected to have high pedestrian usage as well as vehicle traffic. Roads will be required to facilitate pedestrians first while having key arterials or collectors keep traffic in check.

Waterfront as Mobility Core

The north part of the Waterfront is connected to the downtown core of the District of Mission. There are opportunities to build for public transit connections to the neighbourhood as for both BC transit and translink converge onto the downtown core. To better serve the community for safety and efficiency, exploring options to shift the connection hub for the various transportation options would benefit safety for pedestrians and vehicles.



Figure 19: Waterfront Road and Train Dedications

The Waterfront requires consideration for the rail lines that connect east to west that are home to the West Coast Express and the south line joining into a T. Unable to be moved, the challenges facing the road network will be on how to design to compliment these tracks and mitigate noise as much as possible. The tracks are also a barrier to creating connections to the downtown core and western pastures of the neighbourhood.

Train Rail Lines





4.3 Envisioned Designs

Highway Bypass

As an eventuality, the bypass connecting the two highways will have to come through the Waterfront neighbourhood. It will cut through the core of the neighbourhood and relieve congestion as they enter the downtown core and beyond. To that end the design of the bypass will be critical in shaping the resulting pathing of the road network and how it connects to the neighbourhood. Keeping as a pedestrian first network and to be efficient is an inclination to build an overpass. Designing with this in mind, there are relatable solutions in both aesthetic and function from other cities to provide different usages / designs for the community.



Figure 20:

Buffalo Bayou Park

Built harmonizing pillars and nature together to create a unique aesthetic for nature and park usage.

Houston, TX.



Figure 21:

Underpass Park

Aesthetically pleasing park used for both art and leisure enjoyment.

Toronto, ON.



Figure 22:

The Underline

Linear Park area designed for outdoor community usage while being a great shelter from the elements.

Miami, FL.



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Public Transportation Hub

The transportation area will most likely accommodate the West Coast Express station. To alleviate traffic and congestion issues, designs that separate the hub into the Waterfront would be ideal in the north end of the neighbourhood.



Figure 23: Robson Square

Figure 24: Akihabara Main Street

Waterfront Pedestrian Zone

Within the Waterfront neighbourhood is a chance to offer a pedestrian centered area with minimal vehicle activity. A design that incorporates pedestrian friendly times where the roads are fully closed off to vehicle traffic near the waterfront would allow for pedestrians, traffic and goods movement. Examples such as Japan's Pedestrian paradises where streets are closed off on certain days and times as well as a more local example of Robson street in Vancouver until they made it permanent.

Road Network Designs

For the general design, an envisioned network would work with a hieratical order of roads and streets. Designing in line with thinking pedestrians, two potential designs can be considered with advantages to each.

General Design Advantages:

• Public transit placed in the north area next to downtown core arterials allows for efficient and safe access.

- Allows for pedestrian safety and efficient goods movement.
- Arterials are made surrounding local roads instead of intersecting
- Arterials and highways can connect from edge of neighbourhood maintaining hierarchy and safety

Bypass Barrier Overpass Design



Bypass Barrier Design Advantages:

• The bypass and rail line acts as a physical indicator of where vehicles are less prioritized and walking / cycling would be the primary mode to the water area in the southeast

• Traffic from highways are minimized and separated from the actual neighbourhood with connections based on west and north edges

• Connection to downtown core uses James St. and Stave Lake St. for vehicle exits avoiding direct vehicle traffic to downtown core

• Pedestrian crossings can be made to connect to downtown proper

Intersecting Overpass Design



Intersecting Bypass Design Advantages:

- Infrastructure could be built near the center and use bypass for community amenities
- Transportation Hub can be built under bypass with arterials to maximize space usage
- Connections to Grand St. and Stave Lake St. avoid vehicle traffic directly to downtown core

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Environmental Concerns

E.1 GreenHouse Gas Emissions

2.2 Conduct the greenhouse gas reduction actions outlined below.

Land Use and Transportation

Recommendations in the Environmental Charter that are Elsewhere in the OCP	Policy Number
Maintain an urban growth boundary (UGB)	5.1.1
Limit the subdivision of land outside the UGB	8.1.12
Continue to promote local agriculture	4.3.1 - 4.3.16
Improve transit service and amenities	6.5.1 - 6.5.12
Enhance the pedestrian environment	6.3.1 - 6.3.7
Enhance the cycling environment	6.4.1 - 6.4.7
Create buffer zones around ALR	4.3.13, 8.1.42

Figure 25: Akihabara Main Street

As part of the District of Mission's environmental goals, the design and role of transportation is vital in cutting down emissions across all types. As part of the Official Community Plan (OCP), the city has initiatives that would fit the Waterfront neighbourhood and embrace sustainable design as part of section 4.2.2 planning for climate change concerning all aspects of transportation.



The neighbourhood itself is a great focal point to expand public transit, and in turn affect all other modes of transportation, as most transit lines converge yet spread apart near the downtown core. Being able to build a central transportation hub and connect it by efficient roads would reduce the distance, traffic, and idling used by vehicles and emit less greenhouse gases. Pedestrian pathing would be improved as well, allowing for cycling / pedestrian crossings to the downtown core from public transit. Incentivizing shorter trips by foot will also allow for less car trips being in line with policies to enhance the pedestrian environment. Cycling tracks that are enjoyable within the neighbourhood will also incentivize less gas vehicle usage as the network design will focus on destinations cyclists will want to reach.

E.2 Road / Material Design

Road design for the Waterfront neighbourhood will follow policy 4.2.5 of the District of Mission's Official Community Plan to "explore the adoption of a Complete Streets Policy". How to build for that is to incorporate a "complete street" for the Waterfront neighbourhood.

"Complete streets" is generally defined as streets everyone / all modes of transportation can use safely¹¹. Efficiently building roads for all forms of transportation will allow for less reliance on gas powered vehicles which contributes to the sustainability of the environment. In order to advocate for the neighbourhood to build for this, education and considerable community engagement on what complete streets are is required. Pre-planning roads and designs, indicating which mode of transport goes where, and how they are built will determine a "complete street" design. Recommendations that will benefit the neighbourhood using complete streets then is to research and plan locations where "complete streets" are going to have the most effect. Prepare budgets that will include these designs and ultimately ensure to incorporate the designs as best as possible.

More directly, exploring and planning how to build roads sustainably will protect the environment. Knowing what materials are used and using best construction practices ensure that runoff or undesired situations are minimized. Building roads that also consider drainage and how runoff will affect the area should also be considered. Recommendations then are to reward industries following sustainable practices when building for roads if private and provide a guideline to build in the case for public works. Researching and adopting guidelines / receiving certification from prominent transportation sustainability organizations should be considered. An example for such an organization is the Greenroads Foundation. The organization has a system that measures multiple aspects to ensure the roads built are sustainable.

GREENROADS SCORECARD

THE GREENROADS RATING SYSTEM V2 INCLUDES: • 12 Project Requirements • 45 Voluntary Core Credits • 4 Voluntary Extra Credits

() PROJECT REQUIREMENTS		
		TYPE
PR-1	Ecological Impact Analysis	REQUIRED
PR-2	Energy & Carbon Footprint	REQUIRED
PR-3	Low Impact Development	REQUIRED
PR-4	Social Impact Analysis	REQUIRED
PR-5	Community Engagement	REQUIRED
PR-6	Lifecycle Cost Analysis	REQUIRED
PR-7	Quality Control	REQUIRED
PR-8	Pollution Prevention	REQUIRED
PR-9	Waste Management	REQUIRED
PR-10	Noise & Glare Control	REQUIRED
PR-11	Utility Conflict Analysis	REQUIRED
PR-12	Asset Management	REQUIRED

LE ENVIRONMENT & WATER		
		POINTS
EW-1	Preferred Alignment	1-3
EW-2	Ecological Connectivity	1-3
EW-3	Habitat Conservation	1-3
EW-4	Land Use Enhancements	1-3
EW-5	Vegetation Quality	1-3
EW-6	Soil Management	1-3
EW-7	Water Conservation	1-3
EW-8	Runoff Flow Control	1-3
EW-9	Enhanced Treatment: Metals	1-3
W-10	Oil & Contaminant Treatment	1-3

A CONSTRUCTION ACTIVITIES		
NO.		
CA-1	Environmental Excellence	1-3
CA-2	Workzone Health & Safety	1-2
CA-3	Quality Process	1-3
CA-4	Equipment Fuel Efficiency	1
CA-5	Workzone Air Emissions	1
CA-6	Workzone Water Use	2-3
CA-7	Accelerated Construction	1-2
CA-8	Procurement Integrity	1
CA-9	Communications & Outreach	1
CA-10	Fair & Skilled Labor	1-2
CA-11	Local Economic Development	1

MATERIALS & DESIGN			
NO.	TITLE	POINTS	
MD-1	Preservation & Reuse	1-5	
MD-2	Recycled & Recovered Content	1-5	
MD-3	Environmental Product Declarations	2	
MD-4	Health Product Declarations	2	
MD-5	Local Materials	1-5	
MD-6	Long-Life Design	1-5	

NO.	TITLE	POINTS	
UC-1	Utility Upgrades	1-2	
UC-2	Maintenance & Emergency Access	1	
UC-3	Electric Vehicle Infrastructure	1-3	
UC-4	Energy Efficiency	1-3	
UC-5	Alternative Energy	1-3	
UC-6	Lighting & Controls	1-3	
UC-7	Traffic Emissions Reduction	1-3	
UC-8	Travel Time Reduction	1-2	

ACCESS & LIVABILITY		
AL-1	Safety Audit	1-2
AL-2	Safety Enhancements	1-2
AL-3	Multimodal Connectivity	1-2
AL-4	Equity & Accessibility	1-2
AL-5	Active Transportation	1-2
AL-6	Health Impact Analysis	2
AL-7	Noise & Glare Reduction	1-3
AL-8	Culture & Recreation	1-2
AL-9	Archaeology & History	1-2
AL-10	Scenery & Aesthetics	1-2

★ CREATIVITY & EFFORT		
NO.	TITLE	POINTS
CE-1	Educated Team	1-2
CE-2	Innovative Ideas	1-5
CE-3	Enhanced Performance	1-5
CE-4	Local Values	1-3

CERTIFICATION	LEVEL	POINTS
CERTIFICATION	Bronze	40
LEVELS	Silver	50
	Gold	60
	Evergreen	80

Figure 27: GreenRaods Score Card

E.3 Stormwater Infrastructure



Figure 28: Rain City Strategy, City of Vancouver

Road system including sidewalks, trails and cycling lanes, takes up a considerable percentage of impervious surface in cities. The stormwater system is mainly distributed underneath the road system, to have more sustainable stormwater infrastructure therefore, is highly related to the design, construction and upgrades of the city transportation system.

The current Mission stormwater system is challenged by both significant pollutants (heavy metals, hydrocarbons, and fecal matter) and increasing flows (caused by increasing impervious surfaces) that can damage waterbodies and wildlife due to water quantity, velocity and quality. The growth in importance of environmental protection has prompted the necessity to consider a sustainable stormwater system. The waterfront area may implement the strategies below as a paradigm of Mission.

• Permeable paving is recommended to reduce runoff and enable infiltrification. It includes pervious concrete, porous asphalt, paving stones and interlocking pavers.

• As mentioned in the Social part, planting is suggested to enrich the landscape of streets and in the meanwhile to protect the environment. Plants can not only balance the air quality, but also absorb rainwater.

• Stormwater that is collected and treated should be reused for watering street planting, lawns etc.

E.4 Traffic Noise Prevention

The waterfront area has complex transportation with Hwy7, Hwy 11 and railway which make noises and have negative impacts on human activities and wildlife in the area. Road pavements, traffic volume, vehicle velocity and tires are all related to traffic noises. Further research and analysis should be done to determine specific strategies, but combinations of the following common mitigations are suggested as broad guidelines to address the issue:

• Quieter pavements such as porous asphalt instead of louder ones should be used as road surfaces, which are good materials for rainwater infiltrification too.

• Noise Barrier walls are an option to reduce noise transmission. They can also reduce the concentration of pollutants in the near-road areas. The costs vary depending on materials.

• Landscaping with plantings also helps prevent sound transmissions.

• Noise-compatible land uses should be applied to near-road areas in planning in order to protect residents especially during night.

E.5 Infrastructure Sustainability

Providing a combination of rail, transit buses, cycling infrastructure provides the ability to create a sustainable system of infrastructure that can continually be redeveloped. From an environmental point of view, if we reduced carbon transportation, this provides the continuation of upgrades which would further reduce carbon issues which is vital to the environment and air quality. Examples would increase station capacity for rail or a more integrated transit network linking improved transit service or cycling infrastructure. However the continuation to accommodating vehicles by improving road infrastructure and capacity of the road may lead to negative impacts to the environment as there is difficulty to come up with the upfront costs of the mass transportation if there is not a system in place already that is designed to add capacity or add other modes of transportation.

E.6 Transit Oriented Development

The urban development and working with local transit authorities around the stations plays a key role in order to provide transit oriented development. This transit oriented development is beneficial to the environment because there would be a reduction of vehicles over a period of time and the use along with promotion of walking and using transit in the area would integrate and enhance the use of the West Coast Express Rail.