Re-Stitching the Canadas:

Great River Station and Prince of Wales Bridge Rehabilitation

by

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ABSTRACT

This thesis offers an architectural intervention that would reinforce the unification of Upper and Lower Canada. As we know it today, Canada began with an amalgamation of French and English North American settlers, in alliance with the First Nations. Our history is replete with the tension and mutual interdependence of these peoples. Trade and travel have always been among the threads that bound the peoples of Canada together, with a prominent early role played by the canoe. The building of railroads in the 1880s was a key event that helped unite and hold Canada together. Today, 140 years later, the Prince of Wales Bridge, a railway bridge that once united Quebec and Ontario, stands abandoned and rejected by our governments. And yet, the populations desire more connections and inclusivity. The thesis offers the design of a unifying station and museum on the Ottawa River, and rehabilitation of the bridge. The proposal integrates pedestrian and cycling routes along with the heritage of the iconic canoe and railroad. This contemporary architectural strategy addresses the social desires and concrete transportation needs of the people in the local and broader region.

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CONCEPTUAL
ORIGINS &
RESEARCH PROCESS

Figure 5 - Bridge Scheme 3

INTRODUCTION: CONCEPTUAL ORIGINS

This project began with the idea of exploring the relation between transportation and city growth, and how city expansion might change in this new digital age. Cities have greatly expanded since rail travel was enabled by the industrial revolution, with automobile travel soon following. The conjecture was that with digital connections, physical proximity will become less important, and our cities will once again undergo a previously unimaginable transformation. As the reader will see, the project that started from a hypothesis would chase the problems as they arose, address concrete needs, and morph into a design project related but distant from the initial ideas.

One of the first tasks of the project was to study Ottawa's road network. Figure 6 shows an approximation of the shortest routes by car of commuters. This was generated based on census data, population density, and workplace density, overlaid onto Ottawa's road network. Digital analytical software was used to calculate the shortest routes, taking speed limits into consideration. In figure 6, the routes are shown, with roads that should

Figure 6 - Shortest paths of commuters

be more traveled in brighter colour. Approximating the daily commutes of citizens of the greater Ottawa area led to the highlighting of areas of traffic density. This revealed that the bridges between Ottawa and Hull are some of the biggest bottleneck routes, a problem that would be addressed later in the project.

OTRAIN

As an alternative to the automobile, the advantages of public transportation were studied. Figure 7 shows Ottawa's two train lines. The north-south Trillium line has run since 2001, with diesel trains on main line track. Ottawa's new light rail transit (LRT) line, the Confederation line, opened September 14th, 2019. GPS was used to map the speed of both lines. See Appendix A for the data. While the maximum speed of the trains is 80km/h, the average speed is only about 20km/h due to the frequency of stops. This means that on

Figure 7 - Otrain map courtesy of OCTranspo. [Otrain Map]. 2018. <https://www.octranspo.com/en/ready-for-rail/transforming-the-service/expanding-o-train-service/>

a bike path with few stops, a moderately fit cyclist is faster than the train, a disappointing result. The Confederation Line is faster than the buses running through downtown which it replaced. This is because of the buses' even higher stop frequency and the fact that they are subject to congestion and traffic lights. However, the LRT is not a good competitor to the car in terms of speed, except perhaps through the downtown core and during rush hours.

In order to greatly ameliorate the speed of commuter trains, relay train systems were briefly explored (see Appendix B). Besides speed, another issue with Ottawa's LRT is its failure to address trans-river transportation, one of the biggest sources of bottlenecking, as revealed in the road network study. There are five bridges across the Ottawa River, all of which experience congestion at rush hour. The only way for commuters to circumvent bridge traffic is by foot or by bike, which are less viable options during the winter. At this stage, the focus of the project turned to the Prince of Wales Bridge, a disused train bridge across the Ottawa river. The bridge is located a few hundred meters north of Bayview station, the Trillium line's terminus and intersection with the Confederation line. The bridge was, until

Figure 8 - Bayview Station

recently, connected to what is now the Trillium line, and would be a logical continuation of it. The old bridge is ripe for rehabilitation as part of an LRT expansion connecting Gatineau and Ottawa, and is ideally situated to integrate with the existing LRT system.

RESEARCH PROCESS

Having settled on the Prince of Wales Bridge as a topic for this thesis, research moving forward took four angles of approach:

1. History of the bridge, of the urban context, and of railroads in Canada.
2. Exploration, photography, and measurements of the bridge.
3. Precedents—related and inspirational projects.
4. An architectural intervention.

HISTORY & CONTEXT

Figure 9 - Context Plan

THE CHAUDIÈRE FALLS REGION

Over the ages, the Chaudière Falls region has undergone countless geological transformations. The earth's crust has sunk under seas and risen up again as many as four times.¹ Ice ages have come and gone. Rock has sheared upward into mountains and has subsequently been worn down into hills.² Eventually the falls were formed. When the ice left, in came plants and animals. When at last humans moved into the area, perhaps ten thousand years ago,³ the falls became an important meeting place for the Algonquin. They performed sacrifices to the god of the sacred waterfall, throwing tobacco into the whirlpool. This was depicted by painter Charles William Jeffreys in his 1930 painting *Offering of tobacco near the main Chaudière Falls* (see figure 10).

The French word *Chaudière*, meaning kettle, is a translation of the aboriginal word *Asticou*, their name for the falls. The falls were first seen by Europeans in 1613, when French explorer Samuel de Champlain, with an aboriginal guide, paddled up the river and gave them their name. At that time, the primary mode of transportation was by canoe, and the aboriginals and fur traders bypassed the waterfall, using a portage trail on the north bank. This trail ran through what is now Hull.

In the unwritten Algonquin code of land use, each family had its own hunting territory, but the islands were held in common. The Algonquin would gather together to hunt on the islands, driving game to the shore to be caught by hunters in canoes.⁴ Lemieux Island is one such location, where communal hunting doubtless took place. Despite this code, conflicts over territory and trade were common. The great rival of the Algonquin tribes was the Iroquois confederacy to the south.⁵ The two sides both sought to expand their spheres of influence, and control trade, as the European settlements took hold.

FRANCOPHONE-ANGLOPHONE RELATIONS

The English and French have been in tension since at least 1066AD, when William, Duke of Normandy, a Frenchman, invaded England. Even before this time, the ancestors of these peoples, the Anglo-Saxons and the Franks, no doubt clashed with one another as barbarian tribes on the frontier of the Roman Empire. A few centuries after William's exploits, the English struck back and launched the Hundred Years' War. This victory-studded failure lasted from 1337 to 1453, and it was the attempt by the English monarchs to rule France. Although the conflict was an enormous waste of lives and resources, it helped build national identities for both peoples, in opposition to one another. The English and French would find themselves at one another's throats off and on throughout the centuries. The two nations opposed each other in about twenty different wars, with some periods of alliance. It is to be expected, then, that this epic rivalry should translate to the New World, and that its ripples should be felt today.

New France began as a French colony in 1608 with the founding of Quebec (city). The French became allies and trading partners with the local Algonquin tribes.⁶ At about the same time, the English founded their first American colonies to the south. The English formed an alliance with the enemy of the enemy, the Iroquois.⁷ Inevitably, the English and French colonies went to war, and after the Seven Year's war, New France was lost to the great rivals, the English in 1763. The British colonial government was lenient on its new French subjects, who continued to speak French, practice the Catholic faith, practice French civil law, and were granted representative government. Furthermore, France did not seek to regain New France by diplomatic means, leading to a sense of abandonment by the colonists.⁸ As a result, there was little nationalistic resistance to British rule. Nonetheless, there was tension between the English-speaking merchant and ruling classes, and the French-speaking clergy and lower classes.⁹ Until the mid-20th century, the Catholic Church had

nearly total control over the lives of French Canadians, discouraging education, coercively encouraging large families, and forcefully opposing conversion to Protestantism. The church helped to preserve the French language and culture.

After the 1763 conquest, English-speaking settlers, mainly American Loyalists, moved into the undeveloped western frontier of the Province of Quebec. In 1791 under the Constitution Act, Quebec was divided into Lower Canada in the east and Upper Canada in the West.¹⁰ Upper and lower here refer to the colonies' locations on the Saint Lawrence river, the backbone of early Canada. Lower Canada would develop into today's province of Quebec, and Upper Canada into today's Ontario. The Constitution Act, in reaction to the American Revolution, established non-democratic colonial governments which answered to the British crown.¹¹ This eventually led to the 1837 rebellions in both Lower and Upper Canada. In Lower Canada, French-Canadian nationalists demanded less control by the Catholic church and the crown, and they wanted a more democratic government. In Upper Canada, the rebellion consisted of anglophone settlers, who opposed the control by British elites, and favoured American-style democracy. Both groups engaged in armed conflict with soldiers loyal to Britain, and both were quickly defeated.¹² The 1837 rebellions were an early example of Francophones and Anglophones uniting (albeit loosely) for a cause. The cause here was rebellion against overreaching government.

Britain's response to the rebellions was the 1841 Act of Union. The British colonies of Lower Canada and Upper Canada were merged to create the Province of Canada, an attempt to dilute French-Canadian unrest with an English-speaking population.¹³ The result, however, was the establishment of two equal but distinct groups within a single political framework,¹⁴ a situation which endures today. Despite the failure of the 1837 rebellions, Canadians continued to push for responsible, democratically elected, government, which was granted in 1848.¹⁵

Quebec Nationalism re-emerged in the 20th century, after the post-war decline of the British Empire and the simultaneous loss of control by the Catholic Church. This led to the separatist movement with the referenda of 1980 and 1995, narrowly-failed attempts by Quebec separatists to secede from the Dominion and form a separate state. Today, the two peoples are highly integrated economically, and benefit from peaceful cooperation. However, there is a certain amount of mistrust and resentment. Some Québécois feel oppressed by the historical language-based social stratification, and the current Anglophone majority in Canada. In turn, the Quebec provincial government has acted in ways that are protective of its language and culture, to the point of oppressing Anglophones and other minorities with illiberal language laws. As individuals, we come together and benefit from diversity, yet as rival collectives, we butt heads.

Figure 10 - Jeffreys, Charles William. *Offering of tobacco near the main Chaudière Falls*. c. 1930. Watercolour. Encyclopedia of French Cultural Heritage in America. 2007. Accessed October 2019. [http:// www.ameriquefrancaise.org/en/article-719/Chaudi%C3%A8re_Falls_in_the_Outouais_Region.html](http://www.ameriquefrancaise.org/en/article-719/Chaudi%C3%A8re_Falls_in_the_Outouais_Region.html)

Figure 11 - Chaudière Falls 2019

Figure 12 - Ring Dam 2019

HULL

Hull, named for the city of the same name in England, was settled by Philemon Wright and several American pioneer families in 1800. It was the first permanent white settlement in the region. Logging was an important industry, beginning early in the 1800s. Lumberjacks upriver would assemble felled trees into rafts and float them downriver. Lumber was in high demand by the British navy for shipbuilding, to support the Napoleonic wars, Britain's then-current spat with the French. A lumber chute was built through Hull, allowing logs to bypass the falls. The river was dammed in 1910, and the power of the river harnessed by a pulp-and-paper mill, a match factory, and a power plant. In 2002 Hull was merged with several other neighbouring cities. Since Gatineau had the largest population, the merged city kept the name *Gatineau*.

Figure 13 - Hull 2019

LEBRETON FLATS

Lebreton Flats was a mixed-use neighbourhood just west of Ottawa's downtown area. It took form around the lumber business and other industries powered by the Chaudière Falls. The western portion accommodated large train yards, connecting to the Prince of Wales Bridge and the rail network.¹⁶ Lebreton Flats developed organically, servicing the city with industry and low-cost housing.¹⁷ However, it was viewed as blight by the National Capital Commission (NCC). The NCC decided the neighbourhood should be demolished and used for government buildings. Property owners were forcefully evicted, beginning in 1962, and compensated according to the appraisals of the NCC's contracted realtors.¹⁸ Unfortunately, due to soil contamination from the previous industrial activity, the land has for the most part remained undeveloped (see figure 14). It is traversed by several transportation arteries—the Sir John A. Macdonald Parkway, the Trans-Canada Trail, Albert Street, which is used as a bus transitway, Booth Street, leading across the Chaudière Bridge to Hull, and the new LRT Confederation line, which follows a similar path to the

Figure 14 - Lebreton Flats

rail that was demolished in the 1960s. The Canadian War Museum was built in the area in 2005.

LEMIEUX ISLAND

Lemieux Island is located on the Ottawa river, on the Ontario side of the provincial border. The Prince of Wales Bridge traverses the east end of the island, with a 330 m section of track running along a manmade bank. The island is also connected to Ottawa for cars via a second bridge. The northeastern part was once a separate island, called Lyons Island, but the two were merged with the construction of the railroad bank, and subsequent fill has been added.¹⁹ A water purification plant was opened on the island in 1932, one of two plants supplying tap water to Ottawa to this day. A siding, or a branch off of the main line, was added from the railroad, to supply the plant.²⁰ Parts of the island, which have never been disturbed or filled, have archaeological potential.²¹ Any findings would be of

Figure 15 - Prince of Wales Bridge

cultural interest to this project. To the south of the purification plant, along the shore, is a large parklike clearing. Although not officially a municipal park, it is popular among dog owners. The fact that many people seem unwilling to keep their dogs on a leash there has caused some controversy. But on site, it was observed that the many large playing dogs were well-trained, unaggressive, and were kept under voice control by owners. This is a concrete example of how people presently negotiate their differences on Lemieux Island, and how problems on paper can sometimes disappear on the ground when there is face-to-face dialogue and compromise. This thesis incorporates Lemieux Island as a central node which pulls Canadians together. Ontarians, Québécois, and First Nations, can celebrate

Figure 16 - Traces of Railways

a common desire to negotiate their differences in a civil and mutually beneficial way. Among other things, we can celebrate together the importance of water. Transportation infrastructure is a vital thread that sews us together.

BUILDING OF RAILROADS

Wagonways with wooden rails have been used since antiquity. By the 16th century, they were commonly used in Europe for mining.²² Iron rails began to be used in England in the latter half of the 18th century, when the industrial revolution made iron widely available. James Watt made use of the steam engine in 1769, and built a steam locomotive in 1784. Commercial railroads first opened in England in the 1830s.²³ The first Canadian public railway was the Champlain and Saint Lawrence railroad, built in 1836. It served as a portage route, providing overland travel between the two water bodies, and facilitating travel between Montreal and New York. By 1860, the Grand Trunk Railroad had connected Montreal and Sarnia.

Gauge, the distance between the rails, was a hotly debated measure for early railroads. While a wider gauge allows higher speeds and more comfort, it is also more costly to lay the track, and requires more land.²⁴ Gauge was standardized early in England, but the question arose around the world as new railways were built.²⁵ In Canada, after a few decades of debate between standard gauge (1435 mm) and broad gauge (1676 mm), the railway companies adopted standard gauge. This allowed compatibility between the rolling stock and tracks of the different companies, and also with the USA. Nearly all tracks had been converted to standard by 1881.

In 1867, Confederation united the colonies of Canada (Quebec and Ontario), Nova Scotia, and New Brunswick. The British North America (BNA) act of 1867 called for a

railway to connect the provinces. Various sections of the inter-colonial railway were opened in the 1870s, connecting the major cities of the East. In 1871, when British Columbia joined Canada, prime minister Macdonald promised a railway that “would stitch the scattered provinces and empty territories of the West together, as the government-owned Inter-colonial was intended to do in the East; it would be a means of colonizing the prairies; it would forestall American expansion; it would be the spine of the empire, and Imperial highway linking the British Isles with the Orient...”²⁶ This was an incredibly ambitious project, called “insane” by the critics of the Conservative party. An all-Canadian route required traversing the difficult Canadian Shield terrain north of Lake Superior, acquiring land from the First Nations, and finding a pass through the mountains. However, without the railroad, BC would likely secede, and American railroads would soon reach up into the prairies, bringing in American settlers, and siphoning their produce away from the British Empire. After acquiring Alaska, the US was eager to expand into the “empty” northwest.

Figure 17 - Berton, Pierre. *The Line in the East* 1885. p. 280, *The Last Spike*. Toronto: The Canadian Publishers, 1971. Print.

Andrew Onderdonk, an American contractor, began construction in the West in 1880. Starting at Port Moody (now in the suburbs of Vancouver), he began blasting tunnels and building trestles through the mountains.²⁷ The dangerous work cost the lives of hundreds of workers. In the east, construction began in earnest in 1881 when the contract was awarded to the newly formed Canadian Pacific Railway (CPR) company. The company acquired the Quebec, Montreal, Ottawa & Occidental Railway (QMO&O), which included the brand new Prince of Wales Bridge, and the Canadian Central Railway.²⁸ This gave them a corridor running from Quebec to Hull along the north shores of the Saint Lawrence and Ottawa Rivers, then to Ottawa via the Prince of Wales Bridge, and up to Lake Nipissing along the south shore of the Ottawa River. Where the Canadian Central Railroad ended, the Canadian Pacific began. The original plan was for the route to follow the fertile belt of the North Saskatchewan River, going through Battleford and Edmonton, and through Yellow Head Pass. However, the CPR executives decided on a more southerly route, most likely in order to cut out American competition. By doing so, they controlled where cities would develop and where they would stagnate.²⁹

The wilderness north of Lake Superior, a patchwork of cliffs and muskeg, proved extremely costly to tame. In contrast, the prairie was traversed in only 15 months,³⁰ though not without causing upheaval. The Blackfoot and Cree nations had enjoyed a golden age, with the European horse and rifle proving tremendously useful in the bison hunt. However, by the 1880s, the bison had been hunted to near extinction, and the old way of life was in crisis.³¹ The Indian Department's approach was to feed the starving Aboriginals in return for their lands, and move them to reserves where they would be encouraged to take up farming. Understandably, this strategy was met with some resistance. When the rail reached his lands, chief Crowfoot of the Blackfoot threatened to attack the invaders with 700 braves if construction through his territory didn't stop. Albert Lacombe, a Catholic missionary and friend of Crowfoot, negotiated, bearing gifts. In return for allowing the

railroad, the Blackfoot were given extra land elsewhere.³² Crowfoot and Lacombe each received a lifetime pass on the CP railroad.

In the winter of 1885, before the railroad was complete, it proved useful in keeping the new nation unified. The Métis and First Nations peoples of the prairies were dissatisfied with the rapid changes to their way of life. The influx of white settlers and increasing government presence caused well-founded fears regarding land ownership.³³ Louis Riel, Métis leader and founder of Manitoba, led a rebellion in the Northwest Territories. In order to put down the rebellion, the Canadian government was faced with the challenge of transporting troops and supplies to the West. William Van Horne, a CPR executive, boasted that he could get troops there in just ten days. Although they had to march across the uncompleted gaps in the line north of Lake Superior, the men arrived on time, and quickly put down the North-West Resistance.

Figure 18 - bridge framing Parliament

In the Rockies, Kicking Horse and Rogers Passes had been chosen for the route through the colossal mountains. Sections of rail in these passes were so steep, with a gradient of 1 in 22,³⁴ that extra pusher locomotives had to be used to get trains up the mountains. Avalanches claimed many lives over the years, so snow sheds were added over sections of track prone to avalanche or snow buildup. Rogers Pass continued to be a problem for CPR until a tunneling feat in the 1980s. In 1885, CPR's rails going west joined Andrew Onderdonk's rails coming east. Company executives and workers gathered for the ceremonial hammering of the last spike. Canada was finally united by rail. The following summer, the first train traveled from Montreal to Vancouver. It crossed the Prince of Wales bridge on June 28th, 1886 en route from East to West.³⁵

PRINCE OF WALES BRIDGE

The Prince of Wales Bridge was built by the QMO&O in 1880. The bridge crosses the Ottawa River via Lemieux Island, connecting Ottawa and Hull. It is composed of 13 Pratt trusses on stone piers. QMO&O's line ran from Quebec City to Hull along the north shore of the Saint Lawrence and Ottawa Rivers. In order to reach Ottawa, the QMO&O began construction of the bridge in 1877. The earthwork and piers were carried out by the lowest bidder Horace Beemer, for \$112,873.10.³⁶ Construction of the 11 piers was done using coffer dams and boats. Several accidents were caused by the river's swift currents. Two separate incidents involved an empty boat going over the falls, and the death of a workman.³⁷ Boats had to stay off the river during high water in the spring of 1880, causing delays. The superstructure was prefabricated and assembled by Pennsylvania company

THE CHAUDIERE BRIDGE, OTTAWA RIVER, CANADA.

Figure 19 - *The Chaudiere Bridge, Ottawa River, Canada*. c.1881. in-text wood engraving, Accessed January 2020. <https://www.periodpaper.com/products/1881-wood-engraving-prince-of-wales-railroad-bridge-ottawa-river-canada-ysa4-236273-ysa4-062>

Clark, Reeves & Co. for \$200,000.³⁸ In order to construct the Whipple trusses, a temporary wooden bridge, or falsework, as it was called at the time, was constructed over each span. Over this, the wrought iron (tension) and cast iron (compression) members were erected. The falsework was then removed, and the span tested prior to opening. The 48 m spans all performed very well, with the maximum deflection under heavy loading being 12 mm. The 76 m span performed even better, with only 3 mm deflection.³⁹

The Prince of Wales Bridge was the first rail bridge to cross the Ottawa River, and was joined by the Alexandra Bridge in 1901. By the 1920s, new locomotives had become heavier, and the iron Whipple trusses were replaced with heavier steel Pratt trusses in 1926-27.^{40 41} Trains continued to use the bridge until late-century, with the last regular passenger train running on November 15th, 1981, a hundred years after the opening of the bridge.⁴²

The city of Ottawa purchased the bridge in 2003 with the purpose of using it for

Figure 20 - [*Steam Train on the Bridge*]. Accessed September 2019. <http://www.capitalgems.ca/prince-of-wales-bridge.html>

the Otrain. However, Canadian law distinguishes between ownership and right of use of rail corridors. Going back to the act of parliament under Queen Victoria, the corridor was intended to serve Canada, and the present owners have a duty to allow use by other rail companies.⁴³ Moose Consortium has been pushing a proposal to run a private-sector commuter rail network. The bridge would serve as an integral link in their lines connecting the greater Ottawa-Gatineau region. They proposed to rehabilitate the bridge and tracks at their own expense.⁴⁴ Their 45 million-dollar proposal involved work on the piers and abutments, minimal restoration to the steel structure, replacing the railroad ties and rails, adding cantilevered multi-use paths on both sides of the bridge, overpasses for the paths, and a rest area on Lemieux Island.⁴⁵

Figure 21 - Moose. [Moose Plan]. 2015. Accessed October 2019. <https://www.letsgomoose.ca/maps/>

In 2016, Moose Consortium filed a lawsuit, complaint that Ottawa had illegally dismantled a section of tracks between Bayview Station and the south end of the bridge, which would have allowed them to run trains between Quebec and Ontario. The issue was brought to court, but was quashed by the Liberal government, releasing the city of Ottawa from the obligation to repair the tracks and make the corridor usable.⁴⁶ Moose then planned a bypass around Bayview Station and the demolished tracks, with a tunnel under Albert Street. This also was blocked by the city of Ottawa.⁴⁷ A further point in Moose's favour is that the Algonquin nation has claimed that they never ceded the rail corridor to Canada. From an Algonquin perspective, provincial borders can be seen as superficial. Moose has approached the tribal leadership, and the Algonquin nation is in support of the corridor's shared use by rail companies, and of Moose's plan to run trains across the bridge.⁴⁸ According to Wojciech Remisz, a civil engineer and member of the board at Moose,

Figure 22 - Remisz, Wojciech. *Feasibility Study – Option ‘2B’ North Bridge Elevation and Section – 1*. 2015. The Moose Consortium, Accessed September 2019. <https://www.letsgomoose.ca/>

the mayors of Ottawa and Gatineau have been discussing the possibility of linking their cities by rail, but seem to have no intention of actually doing this. He postulates cultural friction between Quebec and Ontario as a cause, saying “residents of Kanata don’t want the French coming to their town.” The view that transportation is exclusively a matter for government to manage has caused resistance to private-sector initiatives, which could meet the needs. In September 2019, the two mayors announced that the bridge may someday be used for pedestrian and cyclist use, but never for light rail, as it would overwhelm Bayview station.⁴⁹ Interestingly, the only transit system that ever truly linked Gatineau and Ottawa in an integrated way was the electric railway of the 1890s and early 1900s. Like Moose, this was a private-sector initiative.⁵⁰

SITE DOCUMENTATION

Figure 23 - Prince of Wales Bridge

SITE EXPLORATION

The Prince of Wales bridge is actually two bridges, with an island in the middle, that together cross the Ottawa river. It is composed of 13 Pratt trusses on stone and concrete piers, which carry a single railroad track. Photography was a method used to probe and discover the site. Photography is not simply passive observation, but an active means of exploration. These photos are an attempt to tell a story, and show a reality not readily apparent.

Figure 25 (next page) is a wood engraving that was published in an 1881 newspaper, showing a perspective from the south end of Lemieux Island. Figure 26 (next page) was a photograph taken on January 11th, 2020. Because the landscaping and vegetation have changed over 139 years, it was difficult to get an unobstructed similar image from the exact same point. A comparison of the two images shows that the structure has been replaced with heavier members, but follows the same geometry.

Figure 24 - Purple Mouth

Figure 25 - *The Chaudiere Bridge, Ottawa River, Canada. c.1881. in-text wood engraving, Accessed January 2020. <https://www.periodpaper.com/products/1881-wood-engraving-prince-of-wales-railroad-bridge-ottawa-river-canada-ysa4-236273-ysa4-062>*

Figure 26 - Photo taken January 2020

Figure 27 - Bridge Entirety

The bridge is almost a kilometer long, and the clearance envelope is about 5 m wide by 7 m tall. This means that it has a very human scale in width and height, while being bewilderingly immense in length. When walking across, what at first appears an easy stroll can become a psychological odyssey, because of the repetitive task of finding secure footing on the spaced wooden ties of the aging structure. It is difficult for the human eye to grasp this kind of distance.

Figure 28 - Looking Down the Tunnel

Over the decades of its existence and disuse, the 254 mm x 356 mm (10" x 14") wood ties have started to decompose, becoming host to mosses, grasses, and weeds. It is beautiful to see new life taking root on what was conceived as a sterile engineering feat. The low sun's golden light plays beautifully on the long dry grass and the rusted steel in figures 32-35, making the bridge a powerful place to experience a sunrise or sunset.

Figure 29 - Sunrise Over Ottawa

Figure 30 - Piano Keys

Figure 31 - A Panicle of Grass on the Bridge

Figure 32 - Golden Mouth

Figure 33 - Nuts and Bolts

Figure 34 - Grassland

Figure 35 - Picture Frame

Figure 36 - Cross-Breeze's Traces

Figure 37 - Corollary Cities

Figure 38 - Bridge Rhythm...

...Figure 69 - Bridge Rhythm

Figures 38 - 69 (previous page) compose a series of photographs looking out the side of the bridge, and moving along. This shows the rhythm of diagonal and vertical supports along the bridge path. This must have been an interesting sensory experience when the bridge was in use. And rhythm should play an important role in interventions dealing with the bridge.

Long exposure images offer views of the motion of heavenly bodies through time over the site. Figure 70 is a three-month exposure, taken with an analogue pinhole camera mounted to a fencepost. It shows the bridge in the foreground, with the path of the sun across the sky in the background. Figure 71 (next page) is a two-hour exposure, showing the arcs of the stars as the earth rotates. When the photo was taken, light pollution from the cities restricted what was visible to the eye to only four stars. However, a camera on a tripod can reveal hidden realities. Due to its position, sprawled out across a body of water, between two cities, the bridge serves as a viewing frame, offering excellent panoramic views of Ottawa and Gatineau.

Figure 70 - 3-month solargraphy

Figure 71 - 2-hour star trails

Figure 72 - Reflections

Figure 73 - Cityscape Frame

SITE MAPPING

Due to safety issues, site documentation and specific measurements were somewhat restricted. Wherever possible, the sizes of the members of typical spans were measured, and extrapolated to the overall structure. The parts of the bridge that could not safely be accessed presented a problem. But Moose Consortium, an engineering firm, had done work on the bridge, and made their drawings available, which supplemented the measured data. And so a digital model of the bridge and site was constructed. Figure 75 shows laser-cut wood models, which were built at 1:100 of two typical spans making up the bridge (it is made up of 13 such spans). These models gave a good understanding of the tectonics of the structure. Figure 76 shows a 1:1000 model representing the bridge, Lemieux Island, and some context. This scale gives a good understanding of the site, and the model measures 24" x 48". Finding the right scale has proven difficult for this kilometre-long site, but the 1:1000 model showing the entire site works well, together with detailed models of components at larger scales.

Figure 74 - Bridge Render

Figure 75 - 1:100 Typical Span Models

Figure 76 - 1:1000 Site Model

PRECEDENTS

Figure 77 - In the Presence of a City

HIGH LINE

The High Line is a linear park in New York City built on abandoned train tracks. In the 1800s, tracks ran at street level, and the ensuing collisions caused more than their share of deaths. In the 1920s, the tracks were elevated for safety reasons. The High Line was used to transport freight items, such as meat, dairy, and produce.⁵¹ By the 1980s, the line was no longer used, and was taken over by wild vegetation. Although there were calls for demolition, the High Line was eventually developed into a linear park, with the first section opening in 2009.

Figure 78 - James Corner Field Operations and Diller Scofidio + Renfro. [*High Line Render*]. Accessed April 2020. <https://inhabitat.com/new-yorks-high-line-park-in-the-sky-opens-today/>

Architects James Corner and Diller Scofidio + Renfro worked with planting designer Piet Oudolf on developing the project. The rails, gravel, and everything on the steel structure were removed, and the structure itself needed some minor repairs. Then the precast concrete pavers were placed along the path, the landscaping work was done, and portions of the rail were returned to their original location. It was important to the architects to preserve the plant life that had taken over the abandoned tracks, and therefore, plantings are a key element of the design. The project is a good example of using urban plantings to fight the urban heat island effect. The designers successfully incorporated plantings with paths and benches, using an architectural vocabulary that speaks of linearity. This project is relevant to the intervention on the Prince of Wales Bridge because it is a conversion of an unused railway into a contemporary pedestrian space. The integration of plantings, to create a dynamic linear pedestrian space is a good example for this thesis to follow.

Figure 79 - Baan, Iwan. [*High Line Overhead*]. [2017?]. Accessed October 2019. <https://www.thehighline.org/photos/by-photographer/iwan-baan/>

BRENTWOOD SKYTRAIN STATION

Brentwood Station was completed in 2002 in Burnaby, BC. It was designed by Perkins & Will Architects. It is an elevated train station with an elliptical, canoe-like form, and was praised for its innovative use of wood. The moment frame structure features curved steel and glulam beams.⁵² Because bent wood is under stress, the curvature of

Figure 80 - Perkins and Will. [*Brentwood Station Exterior*]. Accessed February 2020.
<https://perkinswill.com/project/brentwood-station/>

structural glulam members is limited to a radius of about 3 m.⁵³ Because of this, and also because of fears of vandalism and fire, Perkins & Will opted to use steel for the accessible lower and more curved segments of the structural ribs, with glulam for the upper, less curved segments. The two segments were bolted together, with a steel tension strap for reinforcement, in a continuous sweeping curve.

There are a few points about the Brentwood Skytrain Station that serve as inspiration for the Prince of Wales Bridge intervention. The egglike overall shape of the station is similar to the canoe-inspired roof canopy of this thesis' proposal, the Great River Station. The innovative use of rhythmically repeating glulam beams to support the canopy of Brentwood Station is inspirational. The acknowledgment of the limitations of glulam led to interesting details combining wood and steel. Such details were of symbolic and conceptual interest for the Prince of Wales Bridge project as additional ways of addressing and amalgamating the rich heritage of both of the canoe and the railroad.

Figure 81 - Perkins and Will. *Wood and Steel Structural Components*. Accessed February 2020. Precedents Page 46

MATTHIAS PLIESSNIG'S WORK

Sculptor Matthias Pliessnig designs and builds twisting wood furniture and sculptures inspired by his study of traditional boat-building in university. He designs the forms using state-of-the-art software, and then uses hardwood steam-bending techniques to construct the intricate shapes.⁵⁴ The impressively twisting forms are intriguing, and evoke the sweeping flow of air currents and watery waves. Additionally, they recall the movements of heavenly bodies as previously seen in the site documentation (figures 70 and 71).

The process of using modern digital software to conceive the forms, and the construction technique of using larger curved cross-ribs with thinner but more closely-spaced longitudinal members, can be applied very well at a larger scale into habitable spaces, offering the experience of movement, flow, and fluidity, deeply related to the overall project theme. The next precedent offers such a possible example.

Figure 82 - Pliessnig, Mattias. [*Sinuous Bench*]. Accessed February 2020. <http://www.matthias-studio.com/>

Figure 83 - Pliessnig, Mattias. [*Matthias at Work*]. Accessed February 2020. <http://www.matthias-studio.com/>

Figure 84 - Pliessnig, Mattias. [*Bench Underside*]. Accessed February 2020. <http://www.matthias-studio.com/>

CENTRE POMPIDOU-METZ

Figure 85 - [*Glulam Shell Structure*]. Detail. "Centre Pompidou-Metz." Detail 06 2010: 610-615.

Designed by architect Shigeru Ban, the Centre Pompidou-Metz was completed in 2010 in Metz, France. The building features a series of boxes containing exhibition and programmed spaces, with a flowing roof draped over them. The grid shell structure, supporting the roof is composed of hexagonally woven glulam members, inspired by the tradition weaving of straw hats.⁵⁵ These flat members are joined with bolts at their intersections,⁵⁶ and are doubled in order to increase their structural moment capacity. Building on Matthias Pliessnig's work, and taking it to the building scale, this is a beautiful example of a structure that uses a flowing weave of timber.

The Centre Pompidou-Metz has inspired a similar and related design strategy for the roof canopy over the Great River Station on the Prince of Wales Bridge. Designing and fabricating such a structure, once a near-impossible task, has become feasible because of digital tools. The use of a three-way structural system allows such a complex form to become a rigid shell that is visually pleasing. Because of its rigidity, the three-way system was selected for the Great River Station over the two-way structure of traditional canoes and of Pliessnig's work.

Figure 86 - [*Double Weave Detail*]. Detail. "Centre Pompidou-Metz." Detail 06 2010: 612.

DESIGN

Figure 87 - Model - station scheme 11

DESIGN

The initial design explorations primarily involved possible interventions engaging the bridge itself. Eventually, this led to focusing much more on the design of a station on Lemieux Island, celebrating the meeting place, on the Ottawa River, where the two portions of the bridge coming from Gatineau and Ottawa unite. The bridge revitalization, alterations, and possible additions were simultaneously addressed to be in harmony with the design of the station.

The early analysis of the transportation systems of Ottawa and Gatineau revealed that trans-river routes are insufficient. The Prince of Wales Bridge is ideally situated to alleviate a portion of this current situation by resuming its role of public rail service, in addition to providing pedestrian and cycling routes. Rail, and specifically this rail bridge, played a key role, as previously discussed, in uniting the new nation 140 years ago. The possibility of re-stitching and reinforcing this unity from an even broader perspective is offered through the thesis. Despite years of cooperation, there is still tension and mistrust between Canada's founding peoples. And yet there is also a great desire for unity and interconnection through cooperation. The broader goals of the thesis are therefore not only to create a practical and functional connection between the two sides, but to meet the broader social needs for improved cross-cultural relations. This desire led to the proposal of reopening the bridge to commuter trains, of adding lanes for pedestrians and cyclists, and symbolically creating a unifying node - a station recalling the original canoe route - as a meeting place on Lemieux Island.

THE BRIDGE

The initial bridge design explorations (figure 89) were centred around the metaphor that the paths of travelers are like strings, and that the bridge is like a bundle of strings ‘braided’ together. Pedestrian and cycling lanes on the surface of the overall path were seen as strands ‘woven’ together. Simultaneously, tension cables and compression members, structurally comprising those initial bridge designs, were envisioned as ‘woven’ or ‘braided’ together, recalling tensegrity structures. The work of the French engineer Robert Le Ricolais (1894-1977) was inspirational in the early bridge schemes. Of particular interest was his structural concept of the stiff, hollow rope, where bridges were supported by tensile elements being held apart by compression members.

Figure 88 - Model - Bridge Scheme 2

Figure 89 - Bridge Scheme 1

Figure 90 - Bridge Scheme 4

Figure 91 - Bridge Scheme 5

Figure 92 - Bridge Scheme 6

Figure 93 - Bridge Scheme 7

Figure 94 - Bridge Scheme 8

Figure 95 - Bridge Scheme 9

Figure 96 - Bridge Scheme 10

Leaving the bridge as a single track, and doubling the track on the island would allow commuter trains to run in both directions and pass one another on the island. This would keep costs low, eliminating the need to add an extra bridge for the second track. This thesis proposes restoring the existing single-track bridge, and adding a new pathway alongside the old, to carry pedestrians and cyclists.

The existing bridge offers interesting views of the city skyline. As such, it is popular with photographers and sunset-watchers. A key consideration of the design intervention is to enhance the bridge's role as a frame through which to view Ottawa and Gatineau. The location of the pedestrian bridge changed several times over the course of the project, with implications on the views. The instinctive first choice was to place the pedestrian bridge to the east of the existing bridge, allowing direct views of Downtown. However, this led to difficulties connecting with the park on the west side of the tracks on Lemieux Island.

Figure 97 - Bridge Render

Rachel Dionne, an eco-advisor, who provides municipal environmental education, offered valuable consultation on the thesis. She warned of environmental problems with building a pathway and retaining wall along the eastern shoreline of the island. Natural shoreline vegetation absorbs some of the storm water runoff before it reaches the river, filtering it and mediating flooding. Root systems also prevent erosion along river banks. Interfering with the vegetation by building too close to the water's edge can have disastrous consequences in the long run. So the pathway was moved away from the shore to the west side of the tracks. The new pedestrian bridge was also placed on the west side, so that the primary east-facing views toward the city could be mediated and framed by the existing bridge, whereas, the west facing views of the sunset are seen in the context of the natural path of the river and its banks.

Another experiential consideration was the rhythm of the bridge as seen and felt by a train passenger. This rhythm is perhaps even more impactful to a pedestrian or cyclist moving at slower speeds and more immersed within the bridge. The regular 6 m spacing of vertical structural members, alternating with diagonals running up and down, will be a distinctive characteristic of the traverse. The new bridge will mimic the rhythm of the old, with its own repeating structure in alignment with the existing structural grid. As the project progressed, the bridge extension became a curving glulam extension of the original structure, as first seen in bridge scheme 8 (figure 94).

Figure 98 - Bridge Plan

Figure 99 - Bridge Axonometric

Figure 100 - Section 1

Figure 101 - Section 1a

Since the piers of the existing bridge are in need extensive repairs, they can be enlarged to under-gird the bridge extension at intervals. The upstream faces of the piers will be curved to improve water flow around them, and to protect against impacts of ice and other objects carried by the swift current. Inspired by the High Line's use of planting, the opportunity was taken to incorporate planter boxes into the pier design. The above-water portions of the piers curve back outwards, accommodating large pockets of soil to sustain moderately sized plants. In addition to the large planter boxes on the piers, small planter boxes and trellises are incorporated into the bridge railing. Grass species native to the area will be planted in these planter boxes. This will recall the hardy grasses presently growing on the neglected bridge structure. The grasses will be supplemented with nitrogen-fixing climbing pole beans, which over time will grow up the trellises, providing shade and wind protection for the users of the bridge, as well as healthy snacks. These plantings alternate with Pliessnig-inspired, stainless steel benches built along the west edge of the bridge.

Since the timber railroad ties on the bridge will need to be replaced in order for today's trains to run safely and smoothly, many of them can be reused, and supplemented with new ties, to build the deck of the pedestrian bridge. The old rails also need to be replaced, and can be used as handrails in the new pedestrian bridge. Despite its contemporary organic design, the new bridge will be an extension of the old, manifested by its materiality.

GREAT RIVER STATION

The initial bridge explorations led to what became the focus of the design, a destination for both parts of the bridge coming from the Ottawa and Gatineau sides. The rail station on Lemieux Island became the main crux of the thesis as a celebratory place to bring together the local population at a historically significant location on the Ottawa River. Therefore, more than just a train station, it will be an edifice to remember our history, and to come together and celebrate our common goals. It offers a significant intersection of a major waterway (the Great River, the translation of the Algonquin name for the Ottawa River, Kichi Sibi or Kichissippi) with a re-vitalized major railway initially associated with Canadian Confederation.

Additionally, the central location on the Great River celebrates the local area's rich history as a major trading hub. The city name *Ottawa* was initially determined by acknowledging the local Ottawa River, a name derived from the Algonquin word *Odawa*, meaning "to trade." This trading waterway gave the canoe critical importance as the main means of transportation, until it was replaced by the 19th century railroad. Both of these means of trade-related transportation have served as inspiration for the design of the station. In Canada, the First Nations adapted the invention of the boat to the local waterways, eventually perfecting the canoe for their needs and way of life. The traditional construction of the iconic canoe has inspired the design of the station, honouring the First Nations peoples and recalling a time before industrialization. This reference can be seen in the inverted canoe-hull-like shape of the roof canopy, and in the prominent wood ribs.

The structural implementation of glulam and steel in these ribs was inspired by Perkins & Will's Brentwood Skytrain Station. Like the Brentwood station, the thesis project uses a series of moment frame ribs. The 6 m rhythm of the bridge was continued across Lemieux Island and throughout the station. These ribs modulate incrementally, changing

shape to perform different functions such as supporting the bridge extension, carrying a roof over the station's platform, and supporting a three-storey museum.

The design features wood prominently, a renewable and locally available material. The building will honor the fertility of Canadian forests by giving wood a prominent role. Glulam can be used in exterior applications if pressure-treated, and a clear, honey-colour finish will be selected for this treatment against rot. Where necessary, steel will supplement the structural timber. Steel is often imported internationally. The use of steel in buildings is a testament to the incredible development of the ongoing industrial age, of which the railroad is a symbol. Steel can be brought in by boat and rail, and its use conveys the importance of international trade to the wellbeing of the local population.

Although keeping the bridge to a single track makes the bridge rehabilitation relatively straightforward, It has implications on train scheduling. The tracks can be doubled on Lemieux Island, but trains need to be timed such that northbound and southbound trains arrive at the Great River Station simultaneously, like they do some 4 km south at Carleton Station. The 125 m turning radius of the tracks, and the required continuity of the multiuse path suggested a geometry with multiple strands being held in bundles at the ends by the two sections of bridge, and flaring out in the middle, on the island. The tracks split in two, open up to allow for a platform between them, and then merge again. The multiuse path follows the sweep of the bending tracks (See figure 102). This expanding and contracting grid works well with the canoe-hull geometry of the roof.

Figure 102 - Site Diagram

Parametric form generation software was used in the station design. This allowed the design to be adjusted and levels of complexity to be accommodated as the project advanced. Figure 103 shows the script used for the design of the Great River Station. Almost everything, from the overall shape to the depth of the beams, can be adjusted continuously by moving sliders or changing profile curves. This digital flow of information and its implications can be likened to the flow of trade by canoe on the Great River, the flow of the heavenly bodies in the sky, and the flow of transportation on rails. As the design progressed, thanks to inspiration from the work of Matthias Pliessnig, attempts were made to break up the symmetry, better conveying flow in the sinuous form of the canopy. It took a few iterations before the form developed into something satisfactory, but the flexibility of a parametric approach allowed incremental improvements on a concept.

Figure 103 - Grasshopper Script

Figure 104 - Station Scheme 2

Figure 105 - Station Scheme 5

Figure 106 - Station Scheme 7

Figure 107 - Station Scheme 9

Figure 108 - Station Scheme 11

Figure 109 - Station Scheme 12

Figure 110 - Station Scheme 15

Figure 111 - Latest Station Design

Throughout the development of the station, one of the main program elements was a public viewing platform framing semi-panoramic views of the interrelated cities of Ottawa and Gatineau. The final design features an elevated observation deck allowing visitors to cross over the tracks and enjoy the view unobstructed, as depicted in figure 112. In addition to this primary, east-facing, viewing aperture, other views toward significant historical landmarks were identified, expansions were made in the skin pattern to facilitate such viewing. A portion of the viewing platform will hold an outdoor café terrace, attracting people from both sides of the river to mingle and enjoy views of the surroundings.

Figure 112 - Observation Deck

As the historical research progressed, it became apparent that a unifying station should highlight Canada's history, with an emphasis on the transportation technology that has united us in the past. So the thesis proposes a museum dedicated the history of transportation, on Lemieux Island, on the Ottawa River, or Great River, as the Algonquins once called it. The museum will be dedicated primarily to waterways and railways, and will display artifacts such as reconstructed canoes and legacy trains. A Theatre in the museum will host lectures and dialogues on local history and culture. Since the site was once used as an Algonquin hunting ground, it may contain archaeological artifacts.⁵⁷ A survey of the site will be done, and any findings can be integrated into the museum, or perhaps left in the landscape to be viewed from the multiuse path, which traverses the site. To facilitate the entry of large artifacts, such as railroad cars, and to emphasize the connection between past and present infrastructure, a dead-end siding, or branch off the main track, has been added, entering the first floor of the museum through a prominent entry. This will allow trains to be transported on the main lines and brought in for display.

Figure 113 - Bird's Eye Render

Given the project's aim of celebrating both the canoe and the railroad, with their material vocabularies of wood and steel respectively, it showcases prominent details of the coming together of the two materials. Inspired by the Brentwood Station, steel is used low to the ground, in places where the greater curvature of the members could possibly cause structural failure of glulam. This has the additional benefit of preventing vandalism of softer and more vulnerable wood in areas easily accessible to the public. Inspired by Shigeru Ban's Centre Pompidou-Metz, a secondary weave of glulam has been added as webbing between the primary ribs. Together, they form a three-way grid shell. The project is a hybrid grid shell, with one primary axis reinforced as a moment frame, accentuating the desired structural rhythm. Upon this hybrid structure is laid a series of aluminum vanes, tilted to allow precipitation runoff, yet spaced to allow views and light, while shading the high sun. The porous layer of vanes will serve as a second skin over the museum, and a shelter over the public outdoor spaces.

Figure 114 - Bike Path

The outdoor space to the west of the Great River Station will continue to serve as a public park. This park will be an extension of the museum and station, a place for cross-provincial urban explorers to gather and celebrate shared objectives. It will be provided with washrooms and an outdoor café within the station. Archaeological displays could possibly grace the land or be within the museum. With improved accessibility via the bridge and the station, the Great River Park will be better integrated with the Sentier des Voyageurs and the Trans Canada Trail, Quebec's and Ontario's two mirror-image pathways running along the north and south shores of the river. With the addition of mediating infrastructure, the two park systems will merge into one, as the two provinces are stitched together.

Figure 115 - Station Model

Figure 116 - Site Plan & Section

Figure 117 - Site Plan

Figure 118 - Ground Floor Plan

Figure 119 - 1st Floor Plan

Figure 120 - 2nd Floor Plan

Figure 121 - 3rd Floor Plan

Figure 122 - Mezzanine Plan

Figure 123 - Section 1

Figure 124 - Section 2

Figure 125 - Section 3

Figure 126 - Section 4

Figure 127 - Section 5

Figure 128 - Section 6

Figure 129 - West Elevation

Figure 130 - East Elevation

Figure 131 - Column and Beam Details

Figure 132 - Great River Museum

Figure 133 - Ground Level

Figure 134 - Museum Interior

Figure 135 - Station Platform

Figure 136 - Sectional Perspective

CONCLUSION

From before the time of Confederation until the present, the English, the French, and the First Nations have been cultures in tension. However, where there has been free travel and commerce, the peoples have prospered together, with the age-old enmity fading into irrelevance. Historical research has shown the important role that the canoe and the train once played in unification. The Prince of Wales Bridge, in particular, was part of the thin line holding the nation together. To honour our history, and to address current problems, this thesis proposes the reopening of the railway bridge to better connect the local provinces of Quebec and Ontario, and beyond. The addition of a pedestrian and cyclist path across the bridge will foster connection at the individual level.

For the eventual realization of this project, more work would need to be done in several areas. Considering the historical complexity, the political and social situation, the heritage and structural condition of the bridge, including the archaeological and environmental realities of the site, the proposed thesis project is highly charged. Experts in each of these fields would need to be consulted for further project development. An initial step would be to generate much more interest regarding the site and project through public awareness of what has been accomplished. In this regard, a project fly-through [video](#) has been made available on and can be found by searching on Youtube for [Great River Station](#). The landscape development and design on the island would be further expanded, while reinforcing the intentions of the project.

Despite its goal towards unification, an architectural project clearly cannot solve social problems that go back hundreds of years. It can, however, initiate steps in the right direction. Awareness of the history of an area is required in order to build a better future. This project is dedicated to building a sense of continuity with the history of its location. The roots of social divisions lie within the minds of those involved, and healing will come from a meeting of those minds. This project is an attempt to create spaces for people to come together, learn about each other, and engage in dialogues. It is through such everyday negotiations of differences and the formation of unlikely friendships that old feuds will be resolved.

ENDNOTES

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APPENDIX A - OTRAIN DATA

GPS was used to map the speed of the new line, as well as the older Trillium line. An Android app was used to record location and speed while aboard the trains. The data is shown in figure 139, below. While the maximum speed of the trains is 80km/h, the average speed is only about 20km/h due to the frequency of stops.

Figure 139 - Otrain Speeds

APPENDIX B - HERON FLY-TRAIN SYSTEM

As shown in figure 140, a schematic proposal, the Heron Fly Train system, would have two trains running in each direction. A connector train would stop at every station just like a regular local train. An express train would run from one end of the line to the other without stopping. It would link up with the connector trains between stations, running on parallel tracks at high speeds, allowing riders to transfer between train cars while moving. Riders would thus ride the express train for long distances, transferring to connector cars at their stop. This would allow urban rail transportation to reach or exceed highway speeds, and better compete with the car. The drawbacks of such a system are that it would require four sets of parallel rails rather than two, longer and more uniform station spacing, and precise timing.

Figure 140 - Heron Fly Train System