Autopsy

Redesigning Urban Transportation

by

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AUTHOR'S DECLARATION

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

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

ABSTRACT

According to the United Nations' report, State of World Population 2008, humankind has come to a turning point; more than 50% of the earth's population now lives in urban centres. Along with considerations for housing, employment, and public health, this shift changes the way we design roads and streets; it escalates the number of automobiles in urban areas with finite room for road expansion.

Space constraints, along with intense development of alternative transportation fuels, and the burden of sprawling suburbs on municipal infrastructures suggest the hypothesis that before we run out of energy alternatives for personal mechanized transport, we will run out of space in which to use it.

This thesis explores how Toronto, a city largely designed for automobile use, is being re-adapted into a city wherein public and active transportation can once again be the primary means of urban mobility and the opportunities inherent in the development of interregional multi-modal transit stations for the cultivation of civic space, local commerce, urban form, and commercial transportation.

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DEDICATION

To Don Sr. & Thelma

TABLE OF CONTENTS

LIST OF FIGURES

19	2.5	Persu Hybrid front elevation redrawn by author, 2009, accessed 29 September 2009, <http://www.hybrid.cz/obrazky/persu-mobility/persu-hybrid-01.jpg> Persu Hybrid side elevation, 2009, accessed 29 September 2009, <http://www.hybrid.cz/obrazky/persu-mobility/persu-hybrid-05.jpg>
19	2.6	Nissan Land Glider front elevation, 2009, accessed 28 October 2009, <http://www.blogcdn.com/www.autoblog.com/media/2009/10/04-nissan-land-glider-press.jpg> Nissan Land Glider side elevation, 2009, accessed 28 October 2009, <http://www.blogcdn.com/www.autoblog.com/media/2009/10/03-nissan-land-glider-press.jpg>
19	2.7	Lumeneo front elevation, 2009, accessed 19 July 2009, <http://www.blogcdn.com/www.autobloggreen.com/media/2008/03/fond-ecran-2.jpg> Lumeneo side elevation, 2009, accessed 19 July 2009, <http://www.blogcdn.com/www.autobloggreen.com/media/2008/03/fond-ecran-3.jpg>
20	2.8	Carver One tilting microcar, 2009, accessed 29 October 2009, <http://commondatastorage.googleapis.com/static.panoramio.com/photos/original/23596447.jpg>
20	2.9	by author, Counter-centripetal movement arc of Carver One tilting microcar
21	2.10	by author, Private Transportation Space Requirements
22	2.11	Brink Dynamics, Fuel consumption and carbon dioxide emission comparison of conventional and narrow automobiles, accessed 7 October 2009, <http://www.brinkdynamics.nl/technical/scv.html>
23	2.12	by author, Public Transportation Passenger Economies
25	2.13	SARTRE Consortium, Road Trains Explained, 2009, accessed 11 October 2009, <http://www.ricardo.co.uk/Global/IA/News/Press%20Release%20Listing%20images/2009%20download%20images/SARTRE-launch/SARTRE%20-%20road%20trains%20explained%204%20of%205.jpg>
26	2.14	Vairani, Franco, bitCar 3D rendering, Vairani, Franco. bitCar : Design Concept for a Collapsible Stackable City Car. Cambridge, MA: Massachusetts Institute of Technology, 2009, pp. 175
26	2.15	Vairani, Franco, bitCar transformation modes, Vairani, Franco. bitCar : Design Concept for a Collapsible Stackable City Car. Cambridge, MA: Massachusetts Institute of Technology, 2009, pp. 177
26	2.16	Vairani, Franco, bitCar 3D hinging frame, Vairani, Franco. bitCar : Design Concept for a Collapsible Stackable City Car. Cambridge, MA: Massachusetts Institute of Technology, 2009, pp. 157
27	3.1	Hummer HX Concept, 2009, accessed 19 September 2009, <http://www.seriouswheels.com/pics-2008/ghij/2008-Hummer-HX-Concept-Side-1920x1440.jpg>
29	3.2	Rakowitz, Michael, exterior of P(LOT): Proposition I, 2008, accessed 10 April 2008, <http://michaelrakowitz.com/wp-content/uploads/2008/04/0036_701.jpg>
29	3.3	Rakowitz, Michael, interior of P(LOT): Proposition I, 2008, accessed 10 April 2008, <http://michaelrakowitz.com/wp-content/uploads/2008/04/0082_d11.jpg>
30	3.4	Rebar Art Collective, Walklet, Park(ing) Day street furniture installation, accessed 27 June 2010, <http://www.walklet.org/images/walklet-rebar.jpg, http://www.walklet.org/>

30	3.5	Rebar Art Collective, temporary Park(ing) Day parklet, accessed 14 November 2009, <http://farm3.static.flickr.com/2663/3942359224_ef8c8aa31d_o_d.jpg, http://www.flickr.com/photos/rebarartcollective/3942359224/sizes/o/>
31	4.1	Metrolinx, The Big Move, 2009, accessed 27 January 2010, <http://www.metrolinx.com/Docs/big_move/TheBigMove_020109.pdf, http://www.metrolinx.com/thebigmove/index.html>, pp. 92
33	4.2	by author, Commuting Patterns and the Effluvia of Life
35-36	4.3	by author, Transit City and then Some: a speculative transit map of Toronto derived from the information available from Mississauga Transit and the proposed Transit City plan as of March 2010.
37	4.4	by author, Region Plan of Commerce Station
38	4.5	Google Maps, Commerce Boulevard, Mississauga, Ontatio, Canada, accessed 4 July 2009, <http://maps.google.com/maps?f=q&source=s_q&hl=en&geocode=&q=Commerce+Boulevard,+Mississauga,+Ontario,+Canada&sll=37.0625,-95.677068&sspn=65.557733,50.712891&ie=UTF8&hq=&hnear=Commerce+Blvd,+Mississauga,+Peel+Regional+Municipality,+Ontario,+Canada&t=h&z=16>
39	4.6	by author, Interregional Multi-Modal Transit Station Amenities
40	4.7	Toronto Transit Commission, Eglinton Crosstown Preliminary Planning Open House Display Panels, 2009, accessed 6 February 2010, <http://www.toronto.ca/involved/projects/eglinton_crosstown_lrt/pdf/2009-11-20_display_panels_part1.pdf, http://en.wikipedia.org/wiki/Mississauga_Transitway>, pp. 20
41	4.8	by author, Interlinking of Postal Service and Goods Delivery with Public Transit
42	4.9	by author, Photograph of Highway 401 soundwall as seen from Eglinton Avenue West in Toronto, Ontario, Canada.
42	4.10	harry_nl, Utrecht: Highway with Car Showroom, accessed 9 January 2010, <http://farm3.static.flickr.com/2614/4124058811_78d4d19f37_o.jpg>
43	5.1	by author, six photographs from sculpture entitled Cinæsthesia
44	5.2	NASA, Satellite photograph of a a Kármán vortex street, accessed 11 June 2010, <http://library01.gsfc.nasa.gov/nix/nixImages/screenimage/GL-2002-001600.jpg>
71	6.1	by author, Transit City plan derived from Metrolinx revisions from the subsequent to the release of the “Five in Ten” plan, 2010, accessed 13 June 2010, <http://www.metrolinx.com/Docs/Agendas/May19_10/Five_in_Ten_Board_web.pdf>
73	7.1	Le Corbusier, Les plans Le Corbusier de Paris, Paris: Édition de Minuit, 1956, pp. 38
75	7.2	Le Corbusier, Les plans Le Corbusier de Paris, Paris: Édition de Minuit, 1956, pp. 57
76	7.3	Le Corbusier, The City of Tomorrow and its Planning, London: The Architectural Press, 1947, pp. 206
76	7.3	Le Corbusier, Les plans Le Corbusier de Paris, Paris: Édition de Minuit, 1956, pp. 64
77	7.5	Broadacre City, 1934-35, accessed 12 December 2009, <http://alternations.files.wordpress.com/2008/04/broadacrea.jpg>
79	7.6	Broadacre Masterplan, 1934-35, accessed 14 November 2009, <http://contentdm.unl.edu/fullres/FLW/33468984_02.jpg>
80	7.7	Broadacre Masterplan, 1934-35, accessed 14 November 2009, <http://ecoedility.it/e3news/wp-content/uploads/2009/04/fig_2.jpg>

81	7.8	Ronner, Heinz. Louis I. Kahn : complete works, 1935-74. Boulder, Colo. : Westview Press, c1977.
83	7.9	Kahn, Louis I. Existing Movement Plan of Philadelphia, "Toward a Plan for Midtown Philadelphia." Perspecta (Yale School of Architecture), no. 2 (1953): pp 12-13.
83	7.10	Kahn, Louis I. Proposed Movement Plan for Philadelphia, "Toward a Plan for Midtown Philadelphia." Perspecta (Yale School of Architecture), no. 2 (1953): pp 12-13.
83	7.11	Kahn, Louis I. Proposed Building Plan for Philadelphia, "Toward a Plan for Midtown Philadelphia." Perspecta (Yale School of Architecture), no. 2 (1953): pp 12-13.
84	7.12	Kahn, Louis I. legend to movement plans of Philadelphia, "Toward a Plan for Midtown Philadelphia." Perspecta (Yale School of Architecture), no. 2 (1953): pp 12-13.
85	7.14	Neutra, Richard. Perspective Drawing of Rush City, Reformed, 1920, accessed 20 November 2009, <http://www.lapl.org/newsroom/neutra/RJN_072.jpg, http://www.lapl.org/newsroom/neutra/RJN_072.jpg>
87	7.15	Neutra, Richard. accessed 20 November 2009, <http://www.volume5.com/assets/images/bzrnrush.jpeg>
88	7.16	Boutin, Marc. Richard Neutra: The Idealization of Technology in America. Master Thesis, Art, University of Calgary, Calgary: University of Calgary, 2000. pp.63
88	7.17	Boutin, Marc. Richard Neutra: The Idealization of Technology in America. Master Thesis, Art, University of Calgary, Calgary: University of Calgary, 2000. pp. 60
89	7.18	by author, based on front matter illustration from Caro, Robert A. The Power Broker. New York, NY: Vintage Books, 1975.
91	7.19	Google Maps, 2009, Intersection of Northern State Parkway and Meadowbrook Parkway, accessed 13 November 2009, <http://maps.google.com/maps?f=q&source=s_q&hl=en&q=Northern+State+Pkwy,+Nassau,+New+York&sll=37.0625,-95.677068&sspn=62.829818,50.712891&ie=UTF8&cd=2&geocode=FS8obgId7ZCc-w&split=0&hq=&hnear=Northern+State+Pkwy,+North+Hempstead,+Nassau,+New+York+11020&ll=40.753824,-73.617904&spn=0.015019,0.012381&t=h&z=16>
93	7.20	Caro, Robert A. The Power Broker. New York, NY: Vintage Books, 1975. pp. 262-263

LIST OF ILLUSTRATIONS

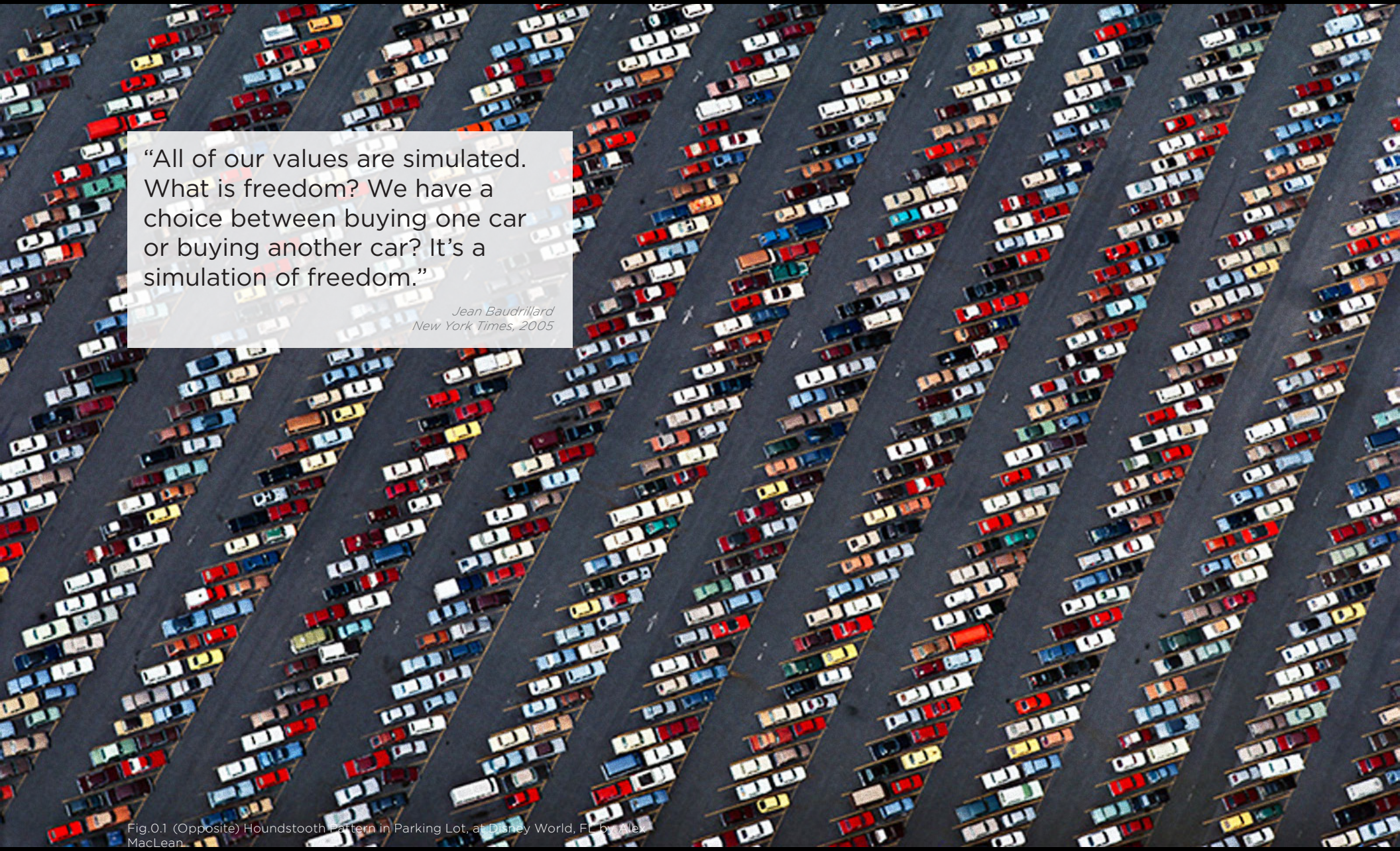
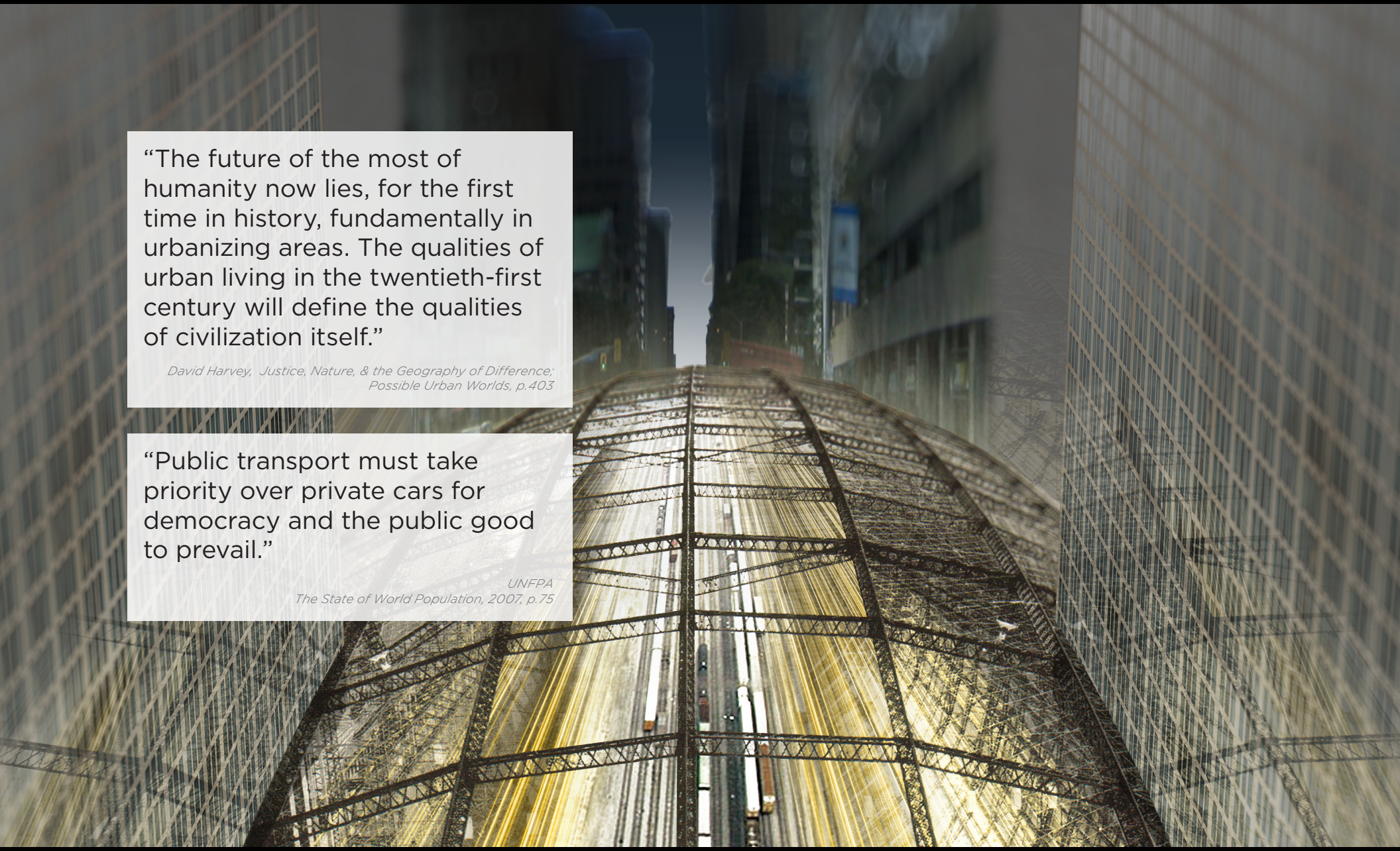


Fig.0.1 (Opposite) Houndstooth Pattern in Parking Lot, at Disney World, FL, by Alex MacLean



"The future of the most of humanity now lies, for the first time in history, fundamentally in urbanizing areas. The qualities of urban living in the twentieth-first century will define the qualities of civilization itself."

David Harvey, Justice, Nature, & the Geography of Difference; Possible Urban Worlds, p.403

"Public transport must take priority over private cars for democracy and the public good to prevail."

UNFPA
The State of World Population, 2007, p.75

PREFACE

Consider that we have another choice, or no choice at all — that the world is ready for an alternative to automobile influenced urban design, that the car has become untenable as an expensive, polluting machine with too many political strings attached — that our world population has grown so large that the minimum density of our urban areas has made the automobile an unbearable experience. Whole populations can no longer afford the high expense attached to combustion powered private transportation and while there are alternative fuels, the high costs involved in their production continue to make their adoption prohibitive: labour costs soar once developing nations reach or exceed the standards of living in current first world countries, the energy input required to produce hydrogen fuel cells cannot justify their production, the range of electric cars limits their use a form of hybrid public/private short range transit, and hybrid biofuels crystallize the idea that automobiles are eating our food. Consider a world without cars.

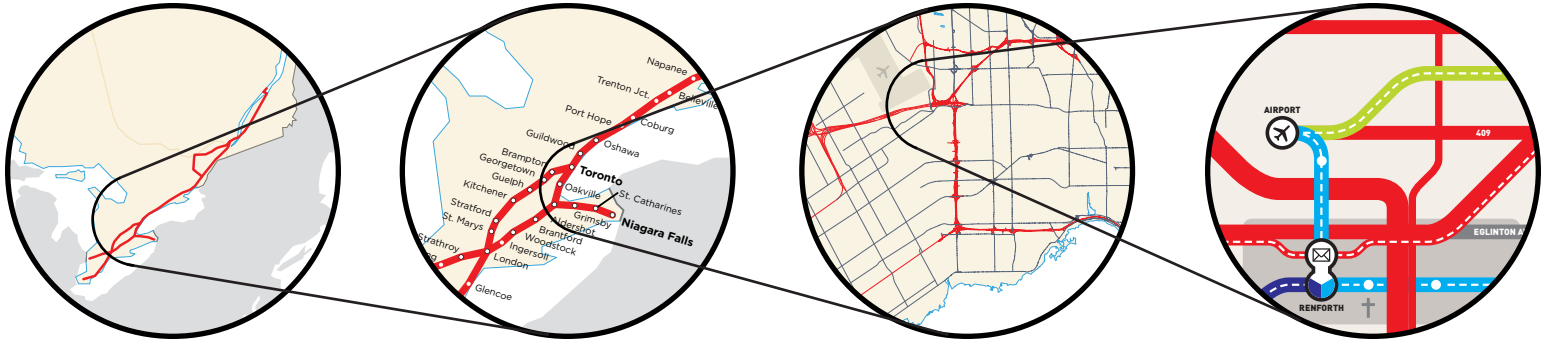
The roads and highways of the once ubiquitous mode of transportation are gradually abandoned, and whole populaces look at the tax dollars still being spent by their governments on building and maintaining these same roads and they begin to question their purpose. As the only remaining users of those roads are those of industry, municipalities are tasked with transforming the city into one which can be traversed without ever setting foot into an automobile. Trains, trams, and buses are everywhere, cycling networks are ubiquitous and often sheltered, and, incredibly, taxes remain unchanged while the independence from car ownership increases excess personal revenue.

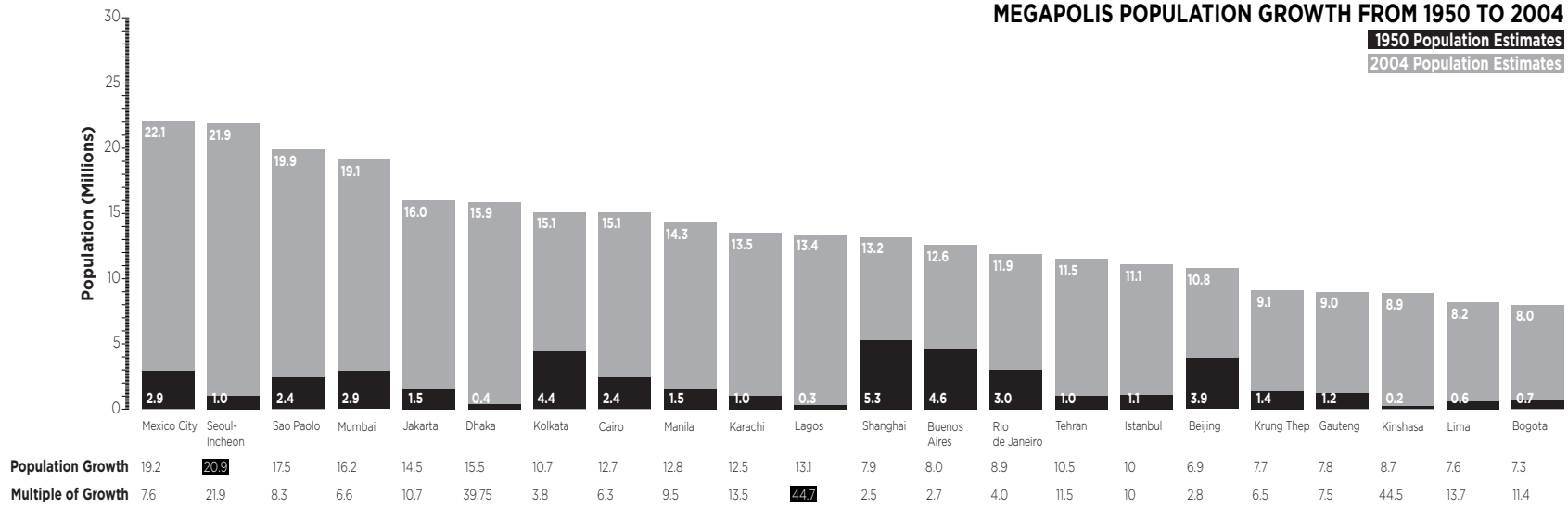
The city has metamorphosed, roadways are given the chance to be taken over as public spaces rather than car-only spaces. Outdoor markets appear where there had been none, lucrative shopping districts evolve along grand avenues, urban farms, communal gardens, and parks develop across broad avenues, children are free and safe to play in the streets; thus announcing the city centre as a desirable place to raise a family. The air is cleaner, the health of the populace climbs from the simple exercise of walking, and the city prospers.

The questions that arise from such a proposition are those of the new functions and culture of reclaimed roads, what form developments will take within this new context, and the resulting hybrid boundary condition of the car-free zone and that of the exurban areas and rural regions.

Perhaps this is a vision that will only see the light of day in a curious exhibit of utopias and paleo-futures. All things considered, however, it remains a distinct possibility given the current climate of the international oil wars and growing urban centres.

Fig.0.2 (Opposite) Oneiria II, by author





	Mexico City	Seoul-Incheon	Sao Paolo	Mumbai	Jakarta	Dhaka	Kolkata	Cairo	Manila	Karachi	Lagos	Shanghai	Buenos Aires	Rio de Janeiro	Tehran	Istanbul	Beijing	Krung Thep	Gauteng	Kinshasa	Lima	Bogota
Population Growth	19.2	20.9	17.5	16.2	14.5	15.5	10.7	12.7	12.8	12.5	13.1	7.9	8.0	8.9	10.5	10	6.9	7.7	7.8	8.7	7.6	7.3
Multiple of Growth	7.6	21.9	8.3	6.6	10.7	39.75	3.8	6.3	9.5	13.5	44.7	2.5	2.7	4.0	11.5	10	2.8	6.5	7.5	44.5	13.7	11.4

Fig.0.3 (Top) Various magnifications of the Québec-Windsor Corridor, not to scale
Fig.0.4 (Above) Third World Megacities population increase estimates from 1950 to 2004 from Planet of Slums by Mike Davis, page 4

INTRODUCTION

The Twentieth century saw the fastest urban growth in history; the development of mass transit, the automobile, and telecommunications coupled with the increased wealth enjoyed by the middle class from mass production technologies and the mechanization of labour-intensive work, allowed urban populations to expand horizontally, away from the traditional city centre. Architects and urban planners addressed these changing conditions by developing Utopian visions and city master plans based on the dramatic increase of personal mobility.

Some, like Le Corbusier, Frank Lloyd Wright, and Robert Moses saw the resources to build these Utopias as endless, with infinite horizons and infinite resources. Others, like Louis Kahn and Richard Neutra approached this new world with a pragmatic sensibility, yet implicitly conceded a faith in an in infinite future growth of automobile use. Without exception, these visions all reflect facets of contemporary, existing automobile-centric planning practices, and yet many of the more virtuous qualities of the designs were either ignored or turned out to be wishful thinking. Ultimately, their flaw was that they predicated far too much on the automobile, never wavering in their conviction that it could sustain itself into the future, never asking whether there would come a time when the resources required to run them could run out, that cities could run out of space to use them, or that the political and social effects of the automobile could destroy the privileges of suburban living that they were intended for(see appendix).

Today we are faced with that same growth, but the challenge it brings is a very different one. In our immediate context, we are faced with increasing the bandwidth of our highways and municipal roadways in order to keep our transportation networks from faltering. The UNFPA(United Nations Fund for Population Activities) announcement that 2008 marked the year that urban populations began to exceed rural populations, globally. This locates over 3.3 billion people in urban areas and indicates a possible growth to 5 billion by 2030. What is particularly important about the 2007 and 2008 Reports on Global Population is that it is expected that the vast majority of this population growth in urban areas will be, to some extent, impoverished. If this proves to be the case it becomes imperative to determine how this additional population will travel in municipalities; for even if private automobiles can be afforded by the poor, the extra burden on automotive infrastructure would be crippling.

Another issue that could prove to be of much greater consequence is the challenge of peak oil and its energy alternatives; natural resources, once considered bottomless, are beginning to show signs of decline. The progress of the Twentieth century was largely powered by easily accessed crude oil and its derivative products, however, it is becoming apparent that the global demand for oil will soon surpass the oil industry's production ability. It may well be that we have already entered the peak oil period as the oil industry is displaying a wavering confidence in its ability to make new oil discoveries and has started to move its resources from declining crude oil fields to areas like the Alberta Tar Sands,

where it costs up to thirteen times[1] more to produce a single barrel of oil from bitumen extraction and refinement when compared to a similar barrel being pumped straight from the earth in places like Iraq and Saudi Arabia. As this transition occurs, new and established energy technologies are being developed and adapted to sustain the continued need for transportation energy. The alternatives are numerous and can be categorized as traditional, polluting fossil fuels and sustainable, renewable energies. The real emerging technologies are the batteries that will largely take the place of the gas tank and enable refuelling via existing, expanded infrastructure. If significant improvements in fuel consumption and renewable energy infrastructure can be achieved, peak oil may not necessarily reduce automobile ownership, however, diversification to more efficient modes of transportation would seem prudent for both energy consumption, road congestion, and land use.

At the heart of urban population growth is how land is occupied by automobiles. Space will pose the greatest challenge in our cities as they grow to future boundaries established by farmland and geographical features such as fresh water. With boundaries such as these, an increase in population density is inevitable, and if car ownership increases in tandem with growing population density, there will not be enough road to accommodate the automobiles. This leaves two alternatives: decreasing the footprint of the automobile and developing private and mass transit systems.

Furthermore, when the municipal public realm of the 20th century is broken down into private and public space, a story of private occupation of public land is revealed. Municipal parking spaces, which are taken for granted as commonplace amenities, are essentially publicly owned land designated for private use and effectively fracture the civic realm with privatized zones. The automobile and how it uses land becomes a multiplicity of privately defended territories, rendering the roadway, as well as the parking space virtual private domains. It can then be inferred that if we have to reduce or, at the very least, halt the growth of automobile ownership and develop vastly improved public and private transit systems, then the civic realm of the city will improve through active participation and personal contributions to the civic realm. With sufficient planning and infrastructure investment, there could be significant cultural benefits to changes in our transportation modes and behaviours rather than the bleak future of blighted favelas presented in Planet of Slums, by Mike Davis.

It is uncertain whether megapolis population growth will be able to sustain the same rate it has since 1950 to 2004, yet it is clear that their growth will continue whether by birthrate or migration. As they do so, reliable infrastructure for food delivery, water supply, electricity, communications, and transportation will be paramount to whether they succeed or fall. Municipalities are now turning to public and active transportation to accomplish part of this feat, and it is the inherent opportunities of such infrastructure that we must consider, such as the public spaces

1. In 2007, average "lifting" costs (all the costs associated with bringing a barrel of oil to the surface) reported to EIA by the major private oil companies participating in the Financial Reporting System (FRS)1 ranged from about $3.87 per barrel (excluding taxes) in Central and South America to about $10.00 per barrel in Canada. The average for the U.S. was $8.35 per barrel (an increase of 18.5 percent over the $7.05 per barrel cost in 2006).
http://www.eia.doe.gov/neic/infosheets/crudeproduction.html
Tar sands synthetic crude oil production

afforded in transit stations, markets that could be fed by adjacent transportation infrastructure, and the amenities that have yet to be integrated into them.

In Drosscapes, Alan Berger identifies the contemporary peri-urban conditions at our municipal limits as the new frontier for urban and social innovation[2] and Mike Davis points out in Planet of Slums, that with the possibility of conurbations that span 600 kilometres, what is key is how we interconnect our cities. David Harvey reinforces this point when discussing urban growth:

> [Networked water flow] is a useful general metaphor for urban growth possibilities: the development of an interrelated and ultimately global network of cities drawing upon a variety of hinterlands permits an aggregate urban growth process radically greater than the achievable for each in isolation.
>
> David Harvey
> Justice, Difference, and Politics, Possible Urban worlds, page 413

Interconnectivity throughout a polycentric megapolis, then, is essential to the future of urban megaregions. It is arguable that highway systems already accomplish this, however, in a world of looming energy crises and land-use restrictions, multi-modal transit and shipping will be invaluable in enabling the whole of the megaregion populace to stay mobile.

In Canada, the Québec City-Windsor Corridor is already recognized as a megaregion. It is such a corridor that will form the backbones of our future cities, permitting the distribution of wealth, resources, and labour along an infrastructural, networked, armature. At an immediate scale, we must develop regional transportation policies and infrastructure to make these corridors more than channels for transit, but also the source of local commerce, local transportation, and civic gateways between centres.

In 2007, the City of Toronto announced Transit City, a plan that will expand the public transportation network of the Greater Toronto Area by adding to and connecting public transportation services with Light Rail Transit lines. The greatest line within the LRT expansion will be the Eglinton Crosstown which, when linked to Mississauga's Bus Rapid Transit network, will join Oakville to Pickering through Mississauga, Etobicoke, York, Toronto, and Scarborough, 50km in each direction. Key to the success of this line, as an inter-regional connector, will be the multi-modal transit hubs between municipalities.

The first of such stations will join the TTC LRT segment to the Mississauga BRT; a connection that occurs near the intersection of two of Canada's busiest highways, the 401 and the 427 and is in close proximity to Toronto's Pearson International Airport. It is precisely where these two systems overlap that the opportunity for new civic typologies exists.

The opportunity inherent in this adjacency is ideal for augmenting the amenities of a multi-modal transit station

2. "The homegenizing effects of the horizontal city (cookie-cutter planning and zoning codes, standardized engineering practices, master planning etc.) and new communication technologies have lead to novel forms of social activities because people do not want to spend 24 hours a day in the same type of designed environemnt. It is easy to understand how these activities take advantage of a city's landscape leftovers because urban open space is increasingly being privatized. In the urbanized world, the in-between landscape should be valued because it provides a threshold, or platform, for liminal cultural phenomena to play out. Thus communitas is cultivated."
Berger, Alan, Drosscapes, page 31

with services that draw from the transport of goods from the highways and the airport. These could improve commuting and travelling experience, proving beneficent to the individual and the city overall, granting the station the status it deserves as an interregional gateway on the border of two cities. Ultimately, this thesis attempts to demonstrate what this multi-modal gateway station could become were it integrated with parallel infrastructural systems and posit the potential benefits to the civic realm.


“We gotta get off oil, America has got to change its habits... It should be obvious to all, demand has outstripped supply, which makes prices go up.”
George W. Bush
at the Washington International Renewable Energy Conference
March 5th, 2008

PEAK OIL

The hoarding of oil reserves in 2008 by energy speculators foreshadowed the effect of peak oil gas prices as oil broke one-hundred dollars per barrel: the world got a taste of the cascading effects of a dramatic increase in the price of oil—Commuting, transit, shipping, agriculture, and commodities were all affected as transportation fuel costs soared and offset their costs to their clients, who then inflated the costs of their goods. While the effects were felt at all levels of society, North Americans, in particular, began to re-evaluate their living conditions.

What this means in the near-term (2030), is that North Americans must re-evaluate the land-use of their suburbs. If energy prices are about to increase significantly, then energy must not only be conserved, but be applied effectively. Single-driver, zero-passenger commuting is gross energy consumption considering the amount of energy expended per trip.

Long hailed as an impossibility, or simply dismissed to the future, peak-oil is becoming a reality that must be faced on a global scale. The North Sea oil operations of the United Kingdom saw peak production in 1999 and have been in decline for the past decade. Saudi Arabia, despite proven oil reserves, second only to Iraq, has constructed oil extraction facilities in remote areas, previously untapped due to the inherent difficulty posed by their unusual geography. And with Prime Minister Stephen Harper structuring the Canadian economy around the Albertan tar sands, bolstered by his general disregard for global ecology, denial of climate change science, and the establishment of a military presence in

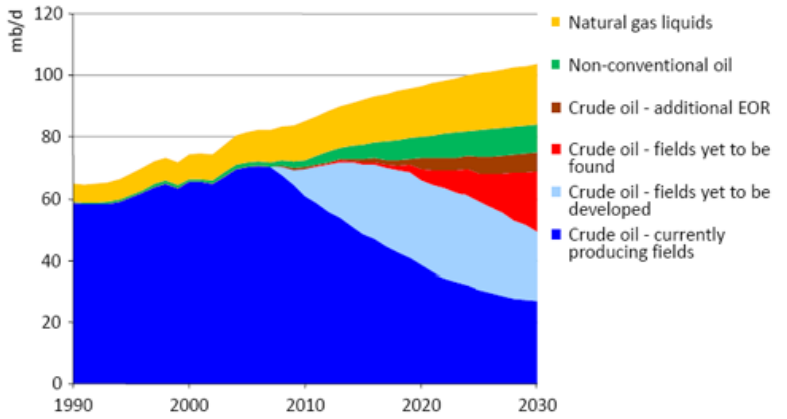


Fig.1.1 (Opposite) Albertan strip-mining of oil sands
Fig.1.2 (Above) Decline of crude oil extraction

the arctic circle (guarding estimated virgin oil reserves now being uncovered as glaciers collapse), it seems safe to say that peak oil has arrived, ushered in with the deployment of high-energy oil extraction programs—the "easy oil" is gone.

Energy alternatives to oil may be on the horizon, yet, in the short term, if an adequate substitute for the energy provided by oil at our current rate of consumption, then we will be at serious odds with the model on which our cities currently function.

The United States hit peak oil in 1973 and have been importing ever since. It is evident in the wars since that time that the United States has been protecting or seeking control of discovered, but untapped oil reserves in Afganistan and Iraq. As other nations reach the same challenges, we will likely see a rise in energy wars, where harder resources than "easy crude" will be disputed. So it is of key importance for every nation's security, to begin to free itself from oil dependency, or befall the consequences of maximum demand and inadequate supply.

"Renewable options make use of the Earth's resources that are not depleted by our energy consumption practices: namely solar, wind, geothermal, geoexchange, hydrology, tidal movements, agricultural products, and municipal wastes. Renewable options also make use of the large stretches of land in America, much of which is owned by the government. These options are available, sustainable, and secure. The affordability of renewable technologies is improving steadily. If the market is pulled by large Army applications, cost reductions could be dramatic. For efficiency and renewables, the intangible and hard-to-quantify benefits (e.g., reduced pollution and increased security) yield indisputable economic value."

U.S. Army Engineer Research and Development Center
Energy Trends and Implications for U.S. Army Installations,
September, 2005

ALTERNATIVE ENERGY

Since the patent of the four-stroke combustion engine-powered motorwagen by Karl Benz in 1886, the concept of personal transportation has not seen a sea change inasmuch as automobiles have generally become larger, more powerful, and replete with luxury features. What is most incredible is that the predominant motive power of the automobile, the combustion engine, did not change over a period of 124 years.

Parallel to Benz' development of the automobile, Frank Julian Sprague was solving the technical issues behind the electric driven trolley, a technology that was intended to replace the horsecart. Social and economic arguments aside, it must be asked why it took over a century for the electric engine to be seriously considered as the motive power for the automobile. Since the electric motor is free of toxic emissions, significantly quieter than the combustion engine, and, with only one gear, is easier to operate, it would appear as though the only reason the combustion engine was not replaced by the qualitatively superior electric engine is the ease of access to oil and gasoline and the incredible flexibility provided by such high embodied energy fuel.

With peak oil becoming a reality, alternative motive power sources for transportation are being sought as replacements or supplements to oil-based fuels. From compressed natural gas, to diesel, to ethanol, to cellulosic ethanol, to gas/electric plug-in hybrid power, to electric battery, to hydrogen fuel cell, the transportation industry is not without options, and these fuel sources also have a variety of sources(Fig.1.5).

PLAUSIBLE LIGHT DUTY VEHICLE MARKET SHARES OF ADVANCED VEHICLES BY 2020 AND 2035

PROPULSION SYSTEM	2020	2035
TURBOCHARGED GASOLINE SI	10-15%	25-35%
DIESELS	8-12%	15-30%
GASOLINE HYBRIDS	10-14%	15-40%
PLUG-IN HYBRIDS	1-3%	7-15%
HYDROGEN FUEL CELL VEHICLES	0-1%	3-6%
BATTERY ELECTRIC VEHICLES	0-2%	3-10%

Fig.1.3 (Opposite) Night Earth by NASA
Fig.1.4 (Top) The Karl Benz motorwagen
Fig.1.5 (Above) Table of plausible light duty vehicle market shares of advanced vehicles.

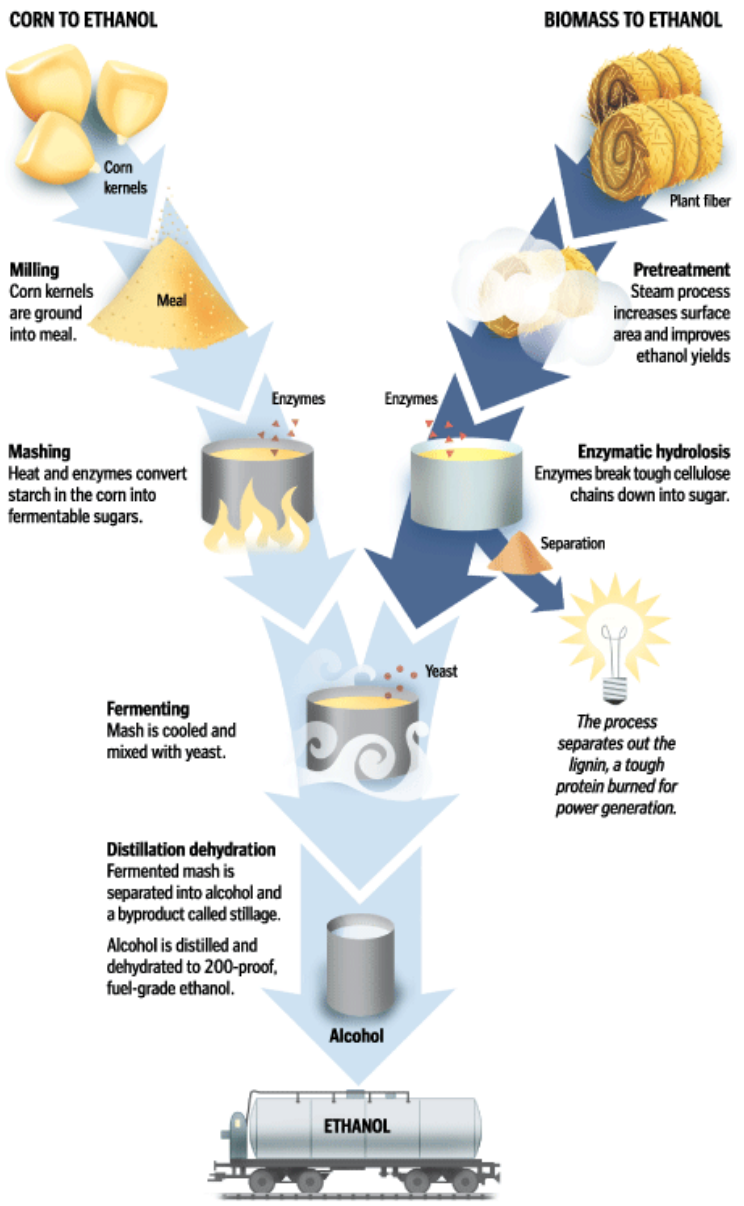


Fig.1.6 Ethanol production processes

ETHANOL AND BIO-DIESEL

Ethanol, derived from the fermentation of vegetable products such as corn, and bio-diesel, derived from the transesterification of similar vegetable and animal oils with ethanol, are both considered renewable resources. However, the fact that the sources of fermentation meal and vegetable oil can be regrown is largely negated by the vast amounts of land required for their growth. Producing enough diesel fuel to fuel the current number of American automobiles with one third substituted by corn-derived ethanol would require more farmland than is currently needed to feed America[1]. Considering this ratio puts vegetable crop fuels at odds with food sources, and given the predictions on population growth, this consequence is unjustifiable. Biomass-derived Bio-diesel produced from organic waste still has potential, but the long-term costs for a food-crop based transportation fuel will compromise the affordability of basic foods by reducing the

1. When considering the advisability of producing ethanol for automobiles, the amount of cropland required to grow sufficient corn to fuel each automobile should be understood. To make ethanol production seem positive, we use Shapouri's (Shapouri, Duffield, and Wang, 2002; Shapouri and others, 2004) suggestion that all natural gas and electricity inputs be ignored and only gasoline and diesel fuel inputs be assessed; then, using Shapouri's input/output data results in an output of 775 gallons of ethanol per ha.
Because of its lower energy content, this ethanol has the same energy as 512 gallons of gasoline. An averageU.S. automobile travels about 20,000 miles/yr and
uses about 1,000 gallons of gasoline per yr (USBC, 2003). To replace only a third of this gasoline with ethanol, 0.6 ha of corn must be grown. Currently, 0.5 ha of cropland is required to feed each American.
Therefore, even using Shapouri's optimistic data, to feed one automobile with ethanol, substituting only one third of the gasoline used per year, Americans would require more cropland than they need to feed themselves! Page 68, Ethanol Production Using Corn, Switchgrass, and Wood; Biodiesel Production Using Soybean and Sunflower, Natural Resources Research, Vol. 14, No. 1, March 2005 (C! 2005)

availability of food dedicated farmland. Therefore, an alternative with a more ubiquitous and less conflicting source must be found.

HYDROGEN FUEL CELL

Still to be proven is the Hydrogen fuel cell, a technology that would allow physical control of the fuel from a several key producers due to the absence of pure hydrogen in nature, an economy much like that of oil and gasoline. Because pure hydrogen has to be separated from more complex molecules, its production is somewhat inefficient. The two main models for its derivation are from natural gas and sea water. The theoretical efficiency of carbon production is 61%[2], this is for natural gas to hydrogen conversion. This same hydrogen then must be converted to electricity in the automobile for a further reduced efficiency similar to that of the electric car. Obviously sea water is a cheaper, more accessible, and much more abundant resource than natural gas, however the theoretical hydrogen separation efficiency of saltwater is only 22%[3], making such a venture even less practical than natural gas conversion, and still far from the current efficiencies of all electric vehicles.

ELECTRIC BATTERIES

Of all the alternative transportation fuels available, electricity has the widest variety of options. It can be generated by steam turbines

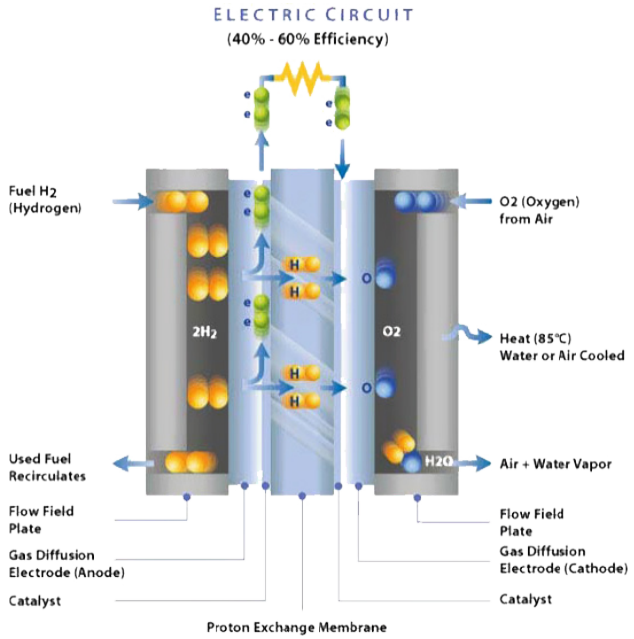


Fig.1.7 Electric circuit of hydrogen fuel cell

2. For new plants, the well-to-tank efficiency of hydrogen produced from natural gas, including generation, transportation, compression, is estimated to be between 52% and 61% efficient. Page 3 from The 21st Century Electric Car http://www.veva.bc.ca/wtw/Tesla_20060719.pdf

3. The well-to-tank efficiency of hydrogen made through electrolysis is only about 22% Page 3 from The 21st Century Electric Car http://www.veva.bc.ca/wtw/Tesla_20060719.pdf

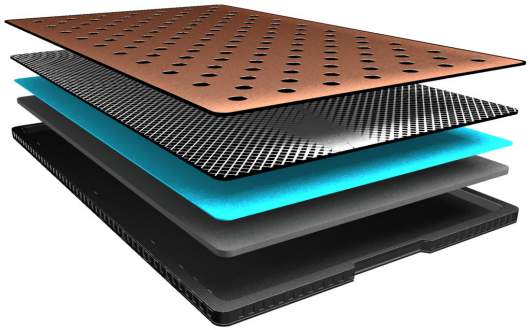


Fig.1.8 Revolt rechargeable zinc-air battery http://www.physorg.com/newman/gfx/news/hires/1-newrechargea.jpg

heated by solar arrays, nuclear reactions, or the burning of fossil fuels such as coal and natural gas. It can be generated kinetically by hydroelectric turbines, wind turbines, and wave turbines. Or it can be generated by photovoltaic cells. What becomes an issue is how the electric vehicle infrastructure, now in its infancy, is deployed.

The qualitative aspects of driving aside, the essential differences between electric automobiles and conventional combustion engine automobiles are refuelling time and range. Gasoline permits the rapid transfer of energy from one tank to another. Batteries, however, require recharging. Current recharging times range from approximately 4 to 8 hours[4] for most hybrid or full-electric vehicles which poses problems when travelling further then the current possible range of 100 to 200 miles[5]. The current limitations have spurred the development of infrastructural solutions to remove the wait time for electric vehicle drivers. While new battery technologies such as liquid zinc-air batteries with very high energy storage efficiency and the ability to be drained and refilled are in the prototype stage, roadside battery-swapping stations are being developed to handle existing lithium-ion battery cell technology and making on-demand recharging available. These systems would employ automated robotic systems for quickly removing a depleted or

4. Recharge time. Fully recharging the battery pack can take 4 to 8 hours. Even a "quick charge" to 80% capacity can take 30 min. http://www.fueleconomy.gov/Feg/evtech.shtml

5. Driving range. Most EVs can only go about 100–200 miles before recharging—gasoline vehicles can go over 300 miles before refueling. http://www.fueleconomy.gov/Feg/evtech.shtml

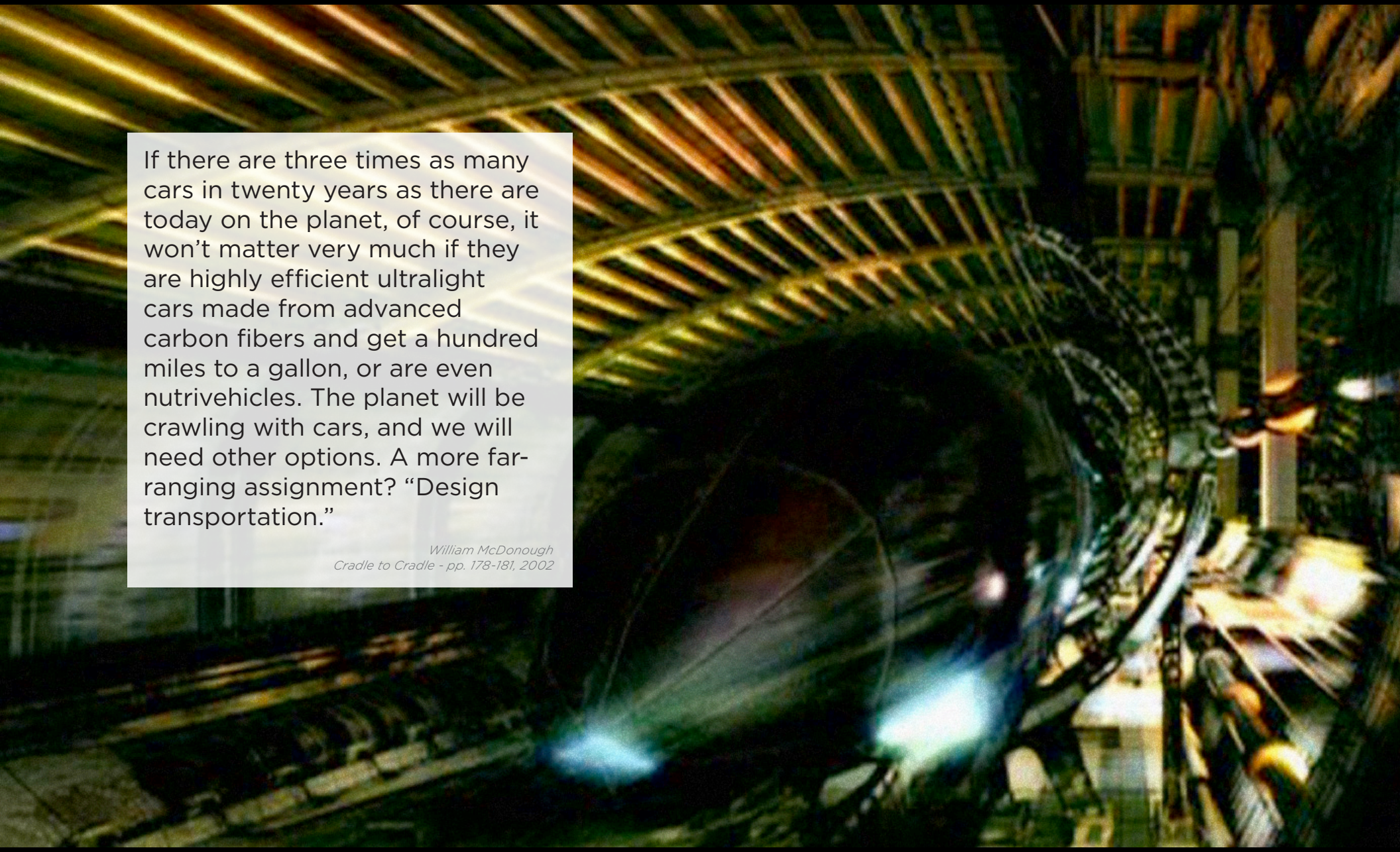
partially drained battery cell with a fresh one[6], entirely changing the model of how we use fuel for transportation while also decreasing recharging time from eight hours to under a minute[7].

There are still other benefits to electric vehicles: zero toxic emissions, a quiet engine, and vastly improved energy efficiency over the gasoline combustion engine[8]. These would vastly improve the quality of the urban environment with cleaner air lower ambient noise. The greatest testament to switching to an electric transportation future is the diversity of the sources available and the existing, decentralized, and integrated electrical grid much of the urban world already possesses. It may not be ideal for long-distance interurban travel, however, electric transportation is ideal for urban travel, where the distances are limited and the recharging infrastructure is ubiquitous.

6. At a Better Place switch station, the driver enters a lane and proceeds along a switch-lane conveyor. The automated switch platform below the vehicle will align under the battery, initiate the battery release process and lower the battery from the vehicle. It will then replace the depleted battery with a fully-charged battery. The depleted battery is placed in a storage room and recharged to be available to other drivers. The process is completed in just a few minutes, while the driver remains in the car, providing a fast and convenient range-extension solution. http://www.betterplace.com/solution/charging/

7. "The goal was to make the switch of a battery faster than filling your tank," Agassi told the audience, which included Denmark's and Israel's ambassadors to Japan. "We have seen this device work in under 40 seconds in our shop." http://www.wired.com/autopia/2009/05/better-place/

8. The most efficient gasoline combustion engine vehicle, the Honda Civic VX, has a distance to energy efficiency of 0.52 km/MJ, while the full-electric Tesla Roadster has an efficiency of 2.18 km/MJ. Pages 1 and 2 from The 21st Century Electric Car http://www.veva.bc.ca/wtw/Tesla_20060719.pdf



If there are three times as many cars in twenty years as there are today on the planet, of course, it won't matter very much if they are highly efficient ultralight cars made from advanced carbon fibers and get a hundred miles to a gallon, or are even nutrivehicles. The planet will be crawling with cars, and we will need other options. A more far-ranging assignment? "Design transportation."

William McDonough
Cradle to Cradle - pp. 178-181, 2002

ALTERNATIVE TRANSPORTATION

> Ford: Didn't you think it was strange I was trying to shake hands with a car?
> Arthur: I assumed you were drunk.
> Ford: I thought cars were the dominant lifeform. I was trying to introduce myself.
>
> *The Hithchhiker's Guide to the Galaxy, 2005*

To consider that in some cities there are as many cars as there are able bodied worker paints an image romanticized in 1950s America as one of individual freedom on a massive scale. However, this quality is being upended as urban populations densify to a point where there is simply no more space available to operate them with any sense of freedom, and our roads succumb to congestion and the promise of freedom sublimates into gridlock. Additionally, the United Nations has estimated the populations of the future megalopolis and the conurbations therof, are expected to be largely impoverished, limiting access to the automobile and thereby limiting mobility to largely automobile-oriented cities. Therefore, over the next twenty years, as our populations rise, it is essential that we plan our cities to keep the less affluent physically mobile if our cities are to remain vital centres of culture and commerce.

While many transportation options are available, it is clear from the post-industrial origins of the majority of its cities, that North America gives priority to the automobile above all other forms of transportation. The United States' Federal Aid Highway Act of 1956, passed by President Eisenhower, ushered in an era of automotive industry-lobbied road building that has resulted in the largest public works project in the world. The Trans-Canada Highway Act of 1948 puts Canada in possession of the longest national highway in the world. These acts, and the many state and provincial freeway acts that followed, largely resulted in the abandonment of train and trolley suburb commuting[1] and made the automobile the most desirable mode of commuting transport with the most ubiquitous network of infrastructure. Now that the automobile is the primary mode of commuter transportation it raises the quandary of how a 71.1% rate[2] of automobile commuting will continue to function in and across municipalities whose populations are expected to grow,

1. Halifax, NS abandoned the streetcar/tram in 1948 followed by Hamilton, ON in 1953, Vancouver, B.C. and Edmonton, AB throughout the 1950s, and Montréal, QC and Ottawa, ON in 1959. Toronto, ON followed an abandonment policy from the opening of the Yonge subway line in 1954 until community activists protested this policy in 1973.
http://transit.toronto.on.ca/streetcar/4002.shtml

2. 63.6% of workers in the Metropolitan Toronto census area commuted in automobiles and 7.5% commuted as automobile passengers. Census Canada, 2006
http://www12.statcan.ca/census-recensement/2006/as-sa/97-561/p33-eng.cfm

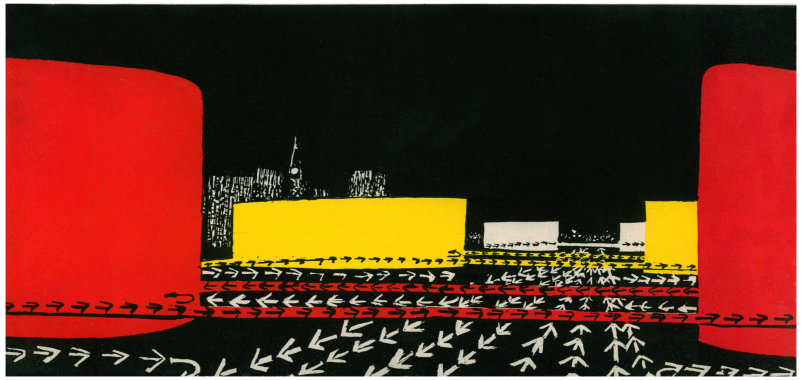


Fig.2.1 (Opposite) The train from the film by Wong Kar Wai, 2046
Fig.2.2 (Above) Perspective sketch of movement plan for Philadelphia; accentuating parking 'coliseums' with coloured illumination, by Louis I. Kahn

NEW URBAN MICROVEHICLES
Increasing commuter bandwidth

Fig.2.5 Persu Hybrid: gas/electric hybrid, tilting, two-seater trike

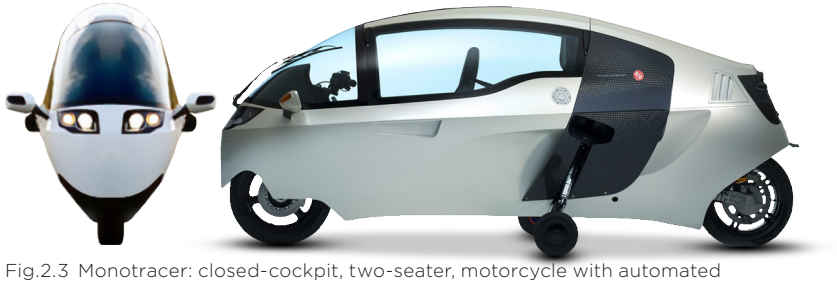


Fig.2.3 Monotracer: closed-cockpit, two-seater, motorcycle with automated stabilizers

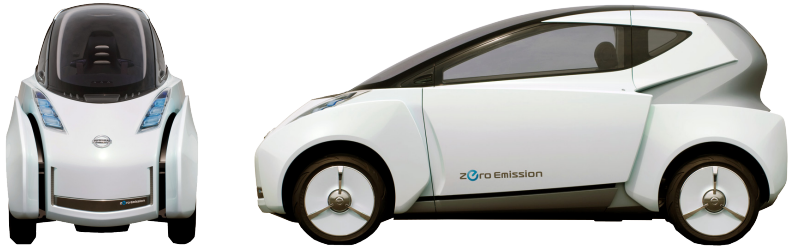


Fig.2.6 Land Glider: electric, tilting, two-seater microcar

Fig.2.4 Uno: electric unicycle based on Segway technology

Fig.2.7 Lumeneo: fixed-axel, low-speed, electric, two-seater microcar

but whose borders will restricted by geographic features, and vital arable zones.

Then, with the goals of increased traffic bandwidth, transportation for the less affluent, and maximization of road land-use, the question then becomes: how do we move more people tomorrow with less space than we have today and with more resourcefully economic means? — Is it a matter of changing the automobile, changing how it uses the road, or opting for another form of transportation altogether?

SLENDER VEHICLES

One approach to this problem is to study commuter behaviours. The most telling statistic being that 75% to 86%[3] of automobile commuters drive alone. This places far more automobiles on the road by volume, mass, and area than is necessary. Some would point to the motorcycle or the bicycle as a logical replacement for all commuter vehicles in order to allow for finer grained roads and a greater density of vehicles over the same area. However, from a practical vantage point, the motorcycle is not an effective year-round vehicle for many North American cities, therefore, an alternate vehicle is required.

Many automobile manufacturers and engineers are investigating this alternative, and several passenger vehicles such as the Carver One/Persu Hybrid/BMW Clever and S.I.M.P.L.E., the Monotracer, the Lumeneo, and the Nissan Land Glider accomplish this by proposing vehicles with aircraft-styled

3. These numbers reflect estimates of between 1-3 passengers per car of 7.5% of workers commuting as automobile passengers and 63.6% of workers driving an autommobile to commute in the Metropolitan Toronto census area. Census Canada, 2006
http://www12.statcan.ca/census-recensement/2006/as-sa/97-561/p33-eng.cfm

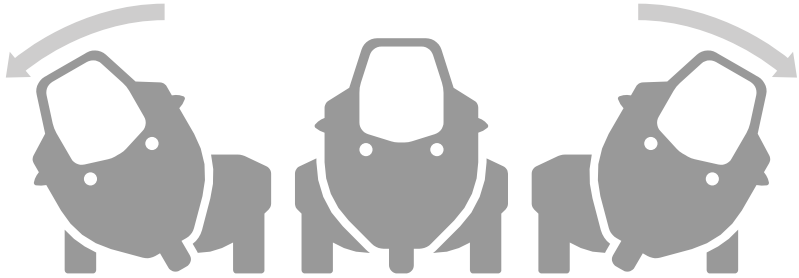
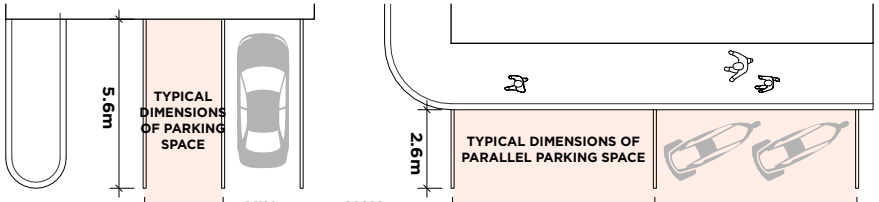


Fig.2.8 (Top) The Carver One, an example of the tilting-microcar, achieves a narrower silhouette to allow for denser traffic flow and better manoeuverability in crowded urban areas.
Fig.2.9 (Above) Counter-centripetal movement arc (Dynamic Vehicle Control system) of cockpit of Carver Engineering-designed tilting microcars.

PRIVATE TRANSPORTATION PARKING

scale 1:250



	2.6m	MIN People/m²	MAX People/m²	6.7m	6.7m	MIN People/m²	MAX People/m²	CONS
PEDESTRIAN		-	-			-	-	ADVERSELY AFFECTED BY WEATHER NOT SUITED TO THE ELDERLY OR DISABLED
BICYCLE		0.55	0.55	44 BICYCLES 44 CYCLISTS		1.26	1.26	ADVERSELY AFFECTED BY WEATHER NOT SUITED TO THE ELDERLY OR DISABLED
UNO		0.13	0.13	13 UNOS 13 RIDERS		0.37	0.37	ADVERSELY AFFECTED BY WEATHER
MISSION ONE		0.20	0.40	17 MOTORCYCLES 17 BIKERS		0.48	0.48	ADVERSELY AFFECTED BY WEATHER HIGHEST ACCIDENT RATE
LUMENEO		0.13	0.26	10 MICROCARS 10-20 MOTORISTS		0.28	0.56	HIGH CENTRE OF GRAVITY LIMIITS SPEED ON-BOARD STORAGE LIMITATIONS
BIT-CAR		0.07	0.13	7 BIT-CARS 7-14 MOTORISTS		0.20	0.40	MUST REMAIN IN MUNICIPAL BOUNDARIES
CARVER ONE		0.07	0.13	4 TILTING MICROCARS 4-8 MOTORISTS		0.11	0.22	ON-BOARD STORAGE LIMITATIONS
AUDI EXO		0.07	0.07	3 AUDI EXOS 3 ELECTRIC-ASSISTED RECUMBENT CYCLISTS		0.08	0.08	ON-BOARD STORAGE LIMITATIONS LOW VISIBILITY
MONOTRACER		0.07	0.13	3 RECUMBENT COVERED MOTORCYCLES 3-6 MOTORISTS		0.08	0.16	ON-BOARD STORAGE LIMITATIONS
APTERA 2E		0.07	0.13	3 HIGH-EFFICIENCY ELECTRIC VEHICLES 3-6 MOTORISTS		0.08	0.16	LOW MOTORIST TO AREA RATIO
HONDA CIVIC		0.07	0.34	2 HATCHBACKS 2-10 MOTORISTS		0.05	0.25	POOR EFFICIENCY SINGLE PERSON VEHICLE
HUMMER H2		0.07	0.34	2 SPORT UTILITY VEHICLES 2-10 MOTORISTS		0.05	0.25	POOR ENERGY EFFICIENCY POOR URBAN MOBILITY POOR EFFICIENCY SINGLE PERSON VEHICLE

cockpits, seating a passenger behind the driver. While this narrow profile creates a higher centre of gravity for the vehicle, this proven a mere technical challenge for the aforementioned Carver One, Monotracer, and Land Glider, as they all employ ingenious leaning systems[4] wherein the chassis tilts in order to compensate for the higher centres of gravity at high velocity. Therefore, it is a given that higher density traffic can be achieved by changing what we drive with emerging technologies.

PARKING OR HABITAT?

Currently, in typical North American suburbs, there is a direct relationship between building area and parking area: 1000 square feet of office space requires 1300 square feet of parking and shopping centres require 990 square feet of parking for every 1000 square feet of retail space.[5] This kind of conspicuous land consumption must be re-examined; as the global population rises, farmland will be of such great importance that areas such as the Golden Horseshoe of Southern Ontario will remain free of urban development and urban areas will expand and densify to to abut these arable zones. This will drive the value of developable, municipal land up as demand for commercial and residential space increases within increasingly limited areas. It will also increase the importance and cultural value of existing public spaces and municipally and provincially-owned land. Priority, then, will be given to housing and commercial building types. Parking will likely be redefined as dropping-off or unloading, for in a world of land-scarce cities, vehicles must remain in motion. If a vehicle must be parked, it should occupy the least amount of space possible or play host to a second function.

As is demonstrated by the private transportation parking chart(opposite), current automobile designs require excessive parking area per passenger. Without changing commuter habits6, and instead changing the vehicle, a more proportionate commuter to parking area-ratio can be met, anywhere from 150-500% more motorized vehicles can be parked in existing parking infrastructure with these narrow automobiles. Not only

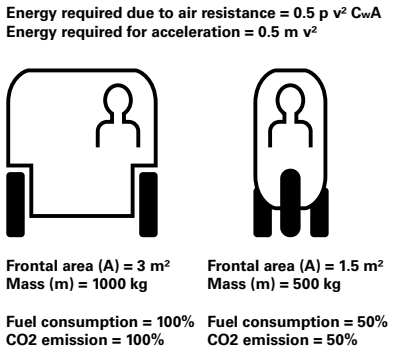


Fig.2.10 (Opposite) Passenger to required area comparison of private transportation vehicles.
Fig.2.11 (Above) 22

4. The Dutch firm, Carver Engineering, licenses its Dynamic Vehicle Control system to numerous automobile manufacturers.
http://www.brinkdynamics.nl/services/license.html

5. page 127, Moshe Safdie with Wendy Kohn, The City After the Automobile, An Architect's Vision

6. page 131, Moshe Safdie with Wendy Kohn, The City After the Automobile, An Architect's Vision "Mass transportation, as well as carpools and other modes of sharing automobiles, tend to add at least one extra "leg" of the commute per person. In the case of carpools, individuals resist coordinating their own timetables and destinations with those of others, and in the case of mass transportation, while the prospect of sharing a cab, a bus, or train with other passengers for a few minutes seems to be a fairly insignificant issue for most people, getting to the station from one's point of origin, and then from the station to one's final destination, entails major inconveniences. Traditional transportation systems — subways, trains, and buses — are generally resisted by all those who have the "luxury" to choose."

PUBLIC TRANSPORTATION PASSENGER ECONOMIES

scale 1:250

do these alternative vehicles offer improved urban mobility, but they require half the fuel of a typical four-door automobile by reducing drag by presenting half the surface area on their front face, half the mass.(Fig.2.39) It is almost a mere convenience that they halve the area they occupy when parked as well, and in some cases, decrease it to one fifth of the conventionally required parking area.

However, even if parking capacity is quintupled, road capacity can only be doubled, and it appears unlikely that all conventional automobiles would be replaced with narrow-chassis automobiles. Therefore, making public transportation a more effective and desirable mode of transportation is key. The area efficiencies inherent in moving commuters by mass public transportation versus single-occupant private automobiles are 12 to 1. And although public transportation requires land concessions for dedicated rights of way, stations, service-yards, and shelters, theoretically, the vehicles need never be parked except for maintenance. They may also run underground, eliminating the land burden of parking altogether.

SHARED PERSONAL TRANSIT

Considering the footprints of various vehicle types, both private and public, it is imperative to encourage and provide the best public transportation possible. The efficiency afforded by public transportation thwarts any other means, thereby increasing existing road capacity. However, there will still be a need for more flexible end-destination-oriented transportation that only the automobile can facilitate. Franco Vairani, of the MIT Smart Cities Group, has approached the paradigm of the automobile as one of specific urban mobility, and through that lens, developed the bitCar concept.

Essentially, the bitCar is a temporary form of personal transit, a hybrid of public and private transportation that takes a hint from existing municipal bike-share and car-share systems. This idea distills the form of the automobile into something akin to a shopping cart by implementing folding and close-packing technologies, thereby allowing denser road-use and permitting flexible, direct transportation without the caveats of private automobile ownership. An ingenious design likely to draw those automobile commuters on the brink of choosing public transportation away from their cars.

The idea that distinguishes the bitCar from historic investigations of personal transit(Fig.1.41), is that the vehicle in question is not owned by the individual. Therefore, the main benefit of the bitCar is that with such a personal transportation option, the vehicle continues to operate after the delivery of its initial occupants. Unlike privately owned automobiles or

Fig.2.12 (Opposite) Passenger occupancies of various modes of public transportation

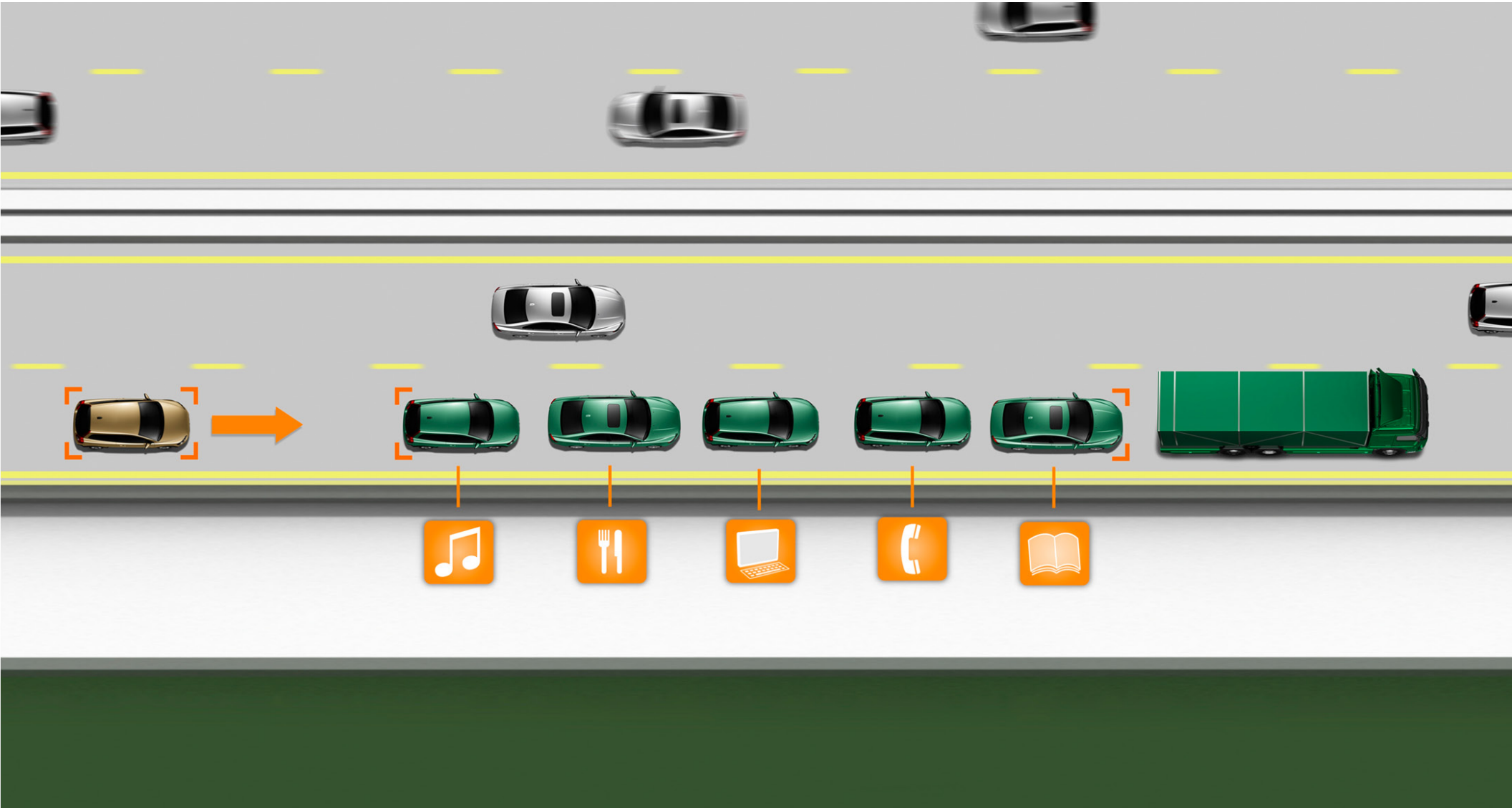
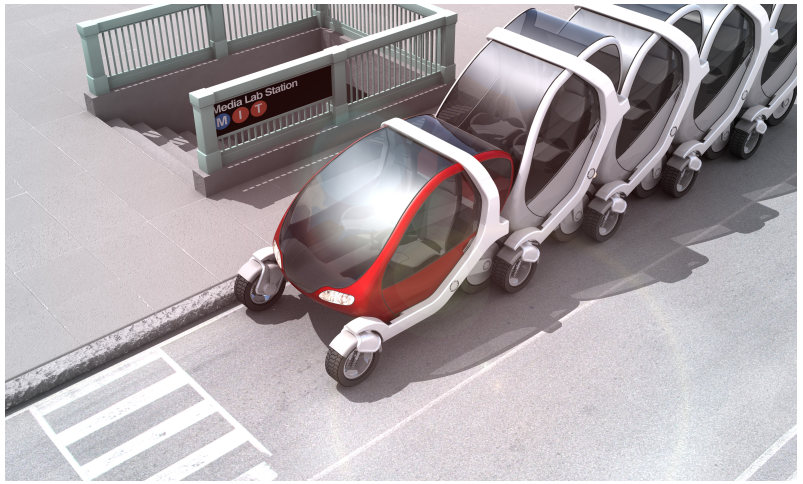


Fig.2.13 (Above) The more conventional approach to private transit, where automobiles join in auto-piloted “trains,” allowing for improved vehicle packing on the road, but failing to alleviate the problem of where those vehicles will be parked at their desitination. SARTRE Consortium press release, 22 October 2009, a

personal transit, the bitCar occupies a fraction of the area of a standard automobile when at rest, and it can remain in active circulation throughout the day, meaning that the storage/parking of the bitCar is almost a non-issue because it can function much like a taxi, and only has to remain at rest long enough for the occupants to disembark. It is not unlike a taxi, yet affords much greater flexibility to the commuter, allowing them to stop and take on cargo as they please.

This brings us to the other private commuting statistics, distance and duration of journey. 90% of automobile commuting does not exceed 40km. Given this number, it is feasible to replace most trips with mass transit and car-sharing. The transfers could be minimal, and the combined mode of transit could rival automobile commuting for duration in that there would be little concern for parking, which typically adds five to ten minutes to each trip.

Ultimately, what is gained in a hybrid solution is a greater democratic use of roads, stations that can serve as civic spaces, and additional urban land to be freed for development or simply freed for public use, and more people moving in a denser cities with more options on how to move through it, regardless of their social status or income.



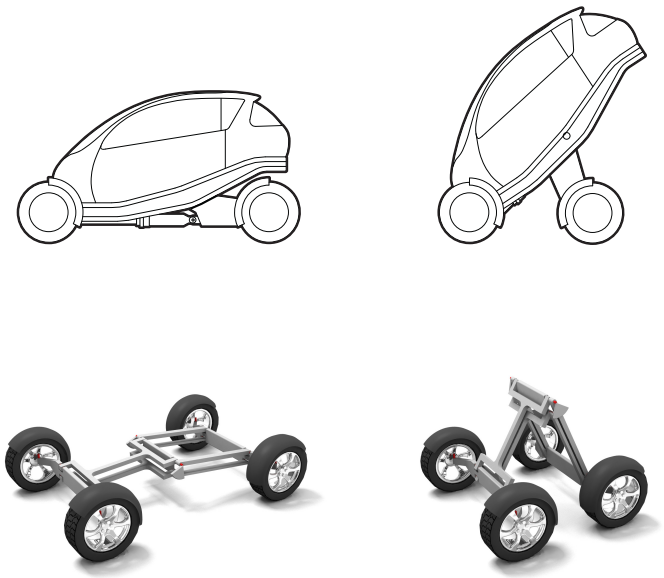


Fig.2.14 (Top) The folding frame of Franco Variani's bitCar concept automobile.
Fig.2.15 (Above) Perspective of the bitCar shown as an end-of-trip supplement to public transportation.

“The car has become the carapace, the protective and aggressive shell, of urban and suburban man.”

Marshall McLuhan
City Aphorisms, Twelfth Selection, New York (1993)

CIVITAS, AND THE POLIS

The polis was not built on the separation between nature and artifice, or the countryside and the walled town. Its basis was the distinction between the private and the public, the household and the civitas. This differentiation of the polis into two radically separate domains, marked not only by a city gate, but by the threshold of any dwelling, articulated and clarified the relationship of an individual's personal affairs to his civic responsibility and the manifold concerns of the community.

Robert Jan van Pelt & Carroll William Westfall,
Architectural Principles in the Age of Historicism, page 176

...The Soviet example: the worker, the cadre, the engineer and the party member have a flat which does not belong to them: whether rented or granted for life, it is accommodation which goes with the job, tied to the social status of worker and active citizen, not to the private person. This good is a social service, not a piece of property, nor even less a 'consumable'. On the other hand, the secondary residence, the dacha in the country with its garden, is something which belongs to them. Neither is this a lifetime possession, nor is it revocable, and it can survive them and become hereditary. Hence the 'individualistic' infatuation attaching to it: all efforts are directed towards the acquisition of that dacha (for want of automobiles, which to some extent play this same 'second home' role in the West). The dacha has a prestige value and a symbolic value: it is the 'something more'.

Jean Baudrillard, The Consumer Society, page 45

Considering that the dwelling is a distinct and essential part of the polis, and that its threshold is key in articulating this relationship, the threshold crossed when entering a private vehicle is of the same class of threshold as that of the dwelling; it is one in which the owner reigns. The idea of the car as private space versus its occupation of public space is unquestionably a profound political challenge. The car, more than any other modern invention, has transformed the public roadway into a transient multiplicity of privately defended territories.

The car, perceived as such, and based on numerous principles — it is privately owned, it can move and rest on public land, it has security features such as locks and alarms, and, due to its mass and travel velocity — can be considered a weapon when driven recklessly. Rather than a place that must be shared by equally vulnerable human bodies, the road is now occupied by a force of armoured individuals that see the roadway as an extension of their 'second home'. This is more demonstrably the case in North America where motorists enjoy larger cars on average than Asian or European motorists. From the domesticated transportation device perspective, the fact that cup-holders held such high rank in American motorists' desired automobile features speaks for itself.

Fig.3.1 (Opposite) HUMMER H2 sport utility vehicle, a civilan vehicle adapted from a military transport

Fig.3.2 (Top) Exterior of (P)LOT, an installation by Michael Rakowitz in 2007.
Fig.3.3 (Above) Interior of (P)LOT, demonstrating the reappropriation of parking space as housing.

DEFENSIBLE SPACE

In North America the automobile takes on many dimensions, it can be a means of commuting, a means of recreation, a mobile dwelling, a storage locker, a place to change ones car, a place to watch a movie from, a place to eat, and a place to converse, a place of privacy, and last, but probably most significantly, a place to feel safe. That the automobile can serve so many requirements of daily life has undoubtedly eroded the perceived importance of civic spaces; if a driver's destination need only ever be a few metres from his car, then why should he be tempted to venture beyond it?

The Oxford Dictionary's definition of suburb is, "an outlying district of a city, especially a residential one," this can be further defined as typically having a greater ratio, per square metre, of private land ownership per individual than the urban city centre. With that in mind, if the car is indeed considered a 'second home', then modern urban centres are being occupied by private, commuting, suburban territories on a daily basis, and hence, reducing the public realm, the 'civitas', to narrow bands of sidewalks.

When this condition is reversed at the end of the workday, when the automobile leaves its parking space, the occupied portions of the public realm are sometimes returned. However, they are little more than empty spaces that are only rarely activated by civic functions, for their symbolic value remains that of a private territory intended only for the occupation of 'second homes'.

PARK(ING)

A number of activist groups, such as REBAR, in the San Francisco Bay area, and Michael Rakowitz's P(LOT) project, from Brooklyn, New York, have begun redefining the use-designation of parking spaces by building temporary interventions that 'rent' the space in unforeseen ways. The campaign put forth by REBAR, in September, 2006, transformed parking spaces across the San Francisco Bay area into small, temporary parks, complete with sod, outdoor furniture, and small trees. Michael Rakowitz took a different approach, occupying the parking space with a tent made from a car cover, which would seem to make any legal opposition to the rental of the parking space, as a space of inhabitation, moot, as the structure was safe, and the dwelling envelope did not exceed that of a small automobile. Beneficent and benign, these interventions politely demonstrate alternatives to the use-designation of parking spaces as "storage surfaces for vehicles."

Upon the advent of the death of the civilian automobile, public roadways will be restored to their ancient symbolic function in the polis. Public transit will take the place of the personal automobile as a means of preserving rapid transit as a basic function of the modern city. Since public transit belongs to the polis, it therefore re-articulates and clarifies, "the individual's personal affairs to his civic responsibility and the manifold concerns of the community." Even when complimented by public/private car-sharing programs, the term of land occupation is not imposed by a single user and therefore parking can become as transient an event as driving. The cultural void left by the diminishment of the automobile as a 'second home' could then be filled by an awareness and responsibility to public spaces.

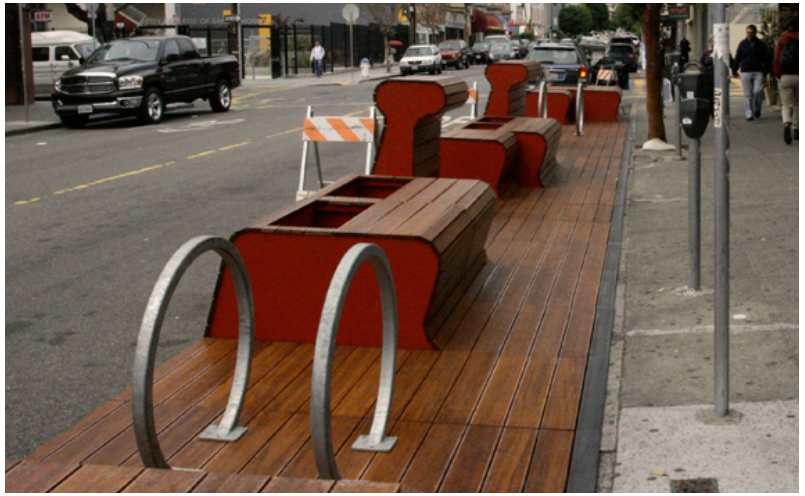


Fig.3.4 (Top) Walklet, a street furniture installation featured in Park(ing) Day 2009.
Fig.3.5 (Above) Sod and greenery parklet installation from Park(ing) Day 2009.


"Three quarters of all car trips are not commutes to work. They involve attending to the effluvia of life."
Joel Garreau, Edge City
15-Year Plan for the Regional Rapid Transit and Highway Network
Regional Rapid Transit
Express Rail
Regional Rail (full-day, 2-way)
Regional Rail (peak)
Subway
Other Rapid Transit (BRT / LRT / AGT)
BRT on Controlled-Access Expressway in Mixed Traffic with Congestion Management
Possible Regional Rail Extensions Beyond the GTHA
Mobility Hubs
Anchor Hub
Gateway Hub
Controlled-Access Expressway
New Transportation Corridor
Approved 2006 Settlement Area (Conceptual)
Greenbelt Area
Urban Growth Centre
International Airport
Proposed International Airport
Major Port
Guelph
to Cambridge
Kitchener-Waterloo
Georgetown
Brampton
Bolton
Newmarket Centre
Aurora Road
Lincolnville
Stouffville
Vaughan Corporate Centre
Richmond Hill / Langstaff Gateway
Markham Centre
Toronto Pearson Airport
Downtown Milton
Mississauga City Centre
Etobicoke Centre
North York Centre
Yonge-Eglinton Centre
Scarborough Centre
Seaton
Downtown Pickering
Midtown Oakville
Downtown Toronto
Ancaster
Downtown Hamilton
Downtown Burlington
Downtown Oshawa
to Niagara
401
403
404
407
410
427
400
QEW

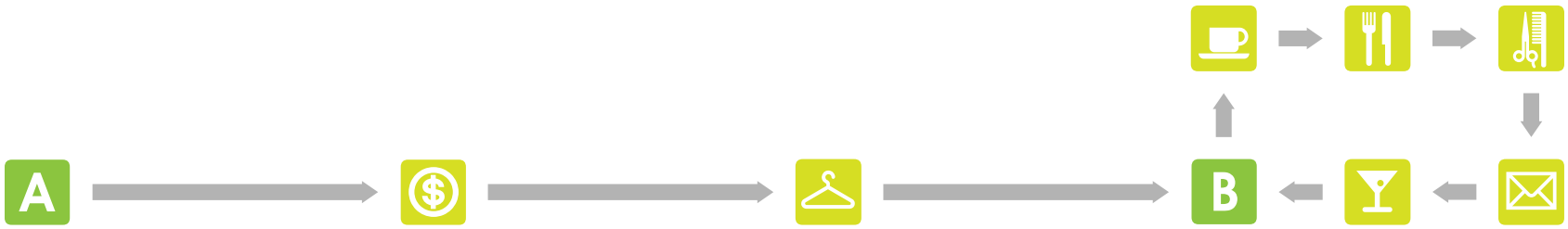
THE BIG MOVE

Through 2006 and 2007, the City of Toronto, the City of Mississauga, and Metrolinx, the provincial transit authority for the Greater Toronto Area, announced plans to expand and interconnect the transit systems of the Toronto Megaregion through the municipal regions of Hamilton, Halton, Peel, Toronto, York, and Durham. In 2007, Metrolinx published a series of goals in a white paper entitled The Big Move. These included Sustainable Transportation, Mobility Hubs, Active Transportation, Transportation Demand Management, Moving Goods and Services, Roads and Highways, and Transit. Under this regional umbrella, independent municipal transit projects would be coordinated to overlap and integrate with one another, creating near seamless transfers from one municipal transit system to the next.

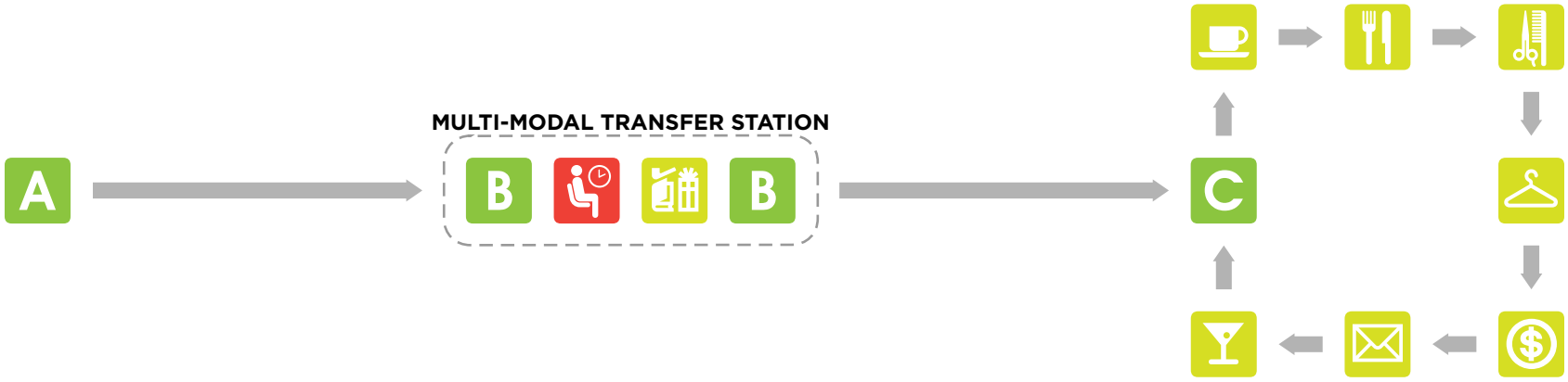
Currently, the outer lying regions of Toronto are of a population density that cannot support more substantial transit systems such as light rail transit or metro lines. Instead, they rely on cheaper and more flexible bus rapid transit systems coupled with provincial passenger rail. This creates a situation at the municipal border of Toronto where its subways, streetcars, and LRTs must transfer to the lighter order systems of the outlying regions if they don't happen to intersect with the provincial passenger rail lines. This necessitates a series of peripheral interregional, multi-modal, transit hubs that will require more profound amenities than simple waiting platforms if the overall network is to be a success; the immediate surroundings of these areas are typically more industrial or commercial in nature, adjacent to development prohibited by public utilities or highway systems, and where they are residential, the neighbourhoods tend to be designed for automobile transportation. This creates the dilemma of a higher order transit station that is not necessarily a highly desired destination. Therefore, from the perspective of the passenger in this interregional network, the delay caused by transferring from one mode to the next will detrimentally affect ridership if the interregional hubs do not provide a substantial destination in and of themselves.

Fig.4.1 (Opposite) 15-year master plan for transit in the Greater Toronto area, diagram by Metrolinx.

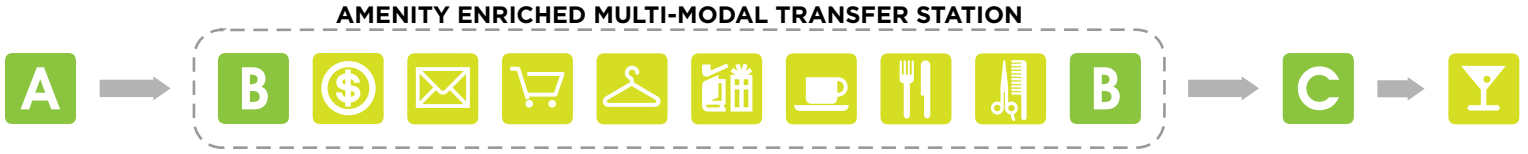
COMMUTING PATTERNS AND THE EFFLUVIA OF LIFE



AUTOMOBILE COMMUTE



TYPICAL COMMUTE THROUGH MULTI-MODAL TRANSFER STATION



AMENITY-ENRICHED COMMUTE THROUGH MULTI-MODAL TRANSFER STATION

THE EFFLUVIA OF LIFE

Considering daily commuting patterns across regional municipal borders and the errands and trips currently made by car as what Joel Garreau describes as the, "effluvia of life," in his book Edge Cities, the new interregional transit hubs will enrich and streamline this commute by taking advantage of the inevitable delay while transferring from one transit mode to another by incorporating amenities and services that would typically only be accessible before or after a commute.

These typically external amenities could include post offices, grocery markets, bank terminals, car share facilities, dry cleaners/tailors, cafes, restaurants, and in some instances day-care facilities for children. The two exceptions to this are Pearson airport and Union station which both present a transfer to a mode of a higher order of magnitude through air travel and high-speed rail and can therefore support hotels(figure 1.3). These amenity enriched hubs will allow commuters to save more time out of their days had they been commuting by car. The inefficiency of multiple car trips to satisfy everyday needs will be reduced substantially, and the hubs themselves will serve as lively civic meeting spaces.

Not only will the integrated amenities relieve commuters of additional travel time, but they will also relieve traffic congestion on the roads from excess automobile commuting, package delivery, and goods distribution. The benefits would significant to transit commuters as well as highway-bound drivers. Five trips could be reduced to one, failed delivery attempts could be eliminated, and point-to-point commuting could still be achieved with the car-share systems similar to the bitCar, proposed by Franco Vairani.

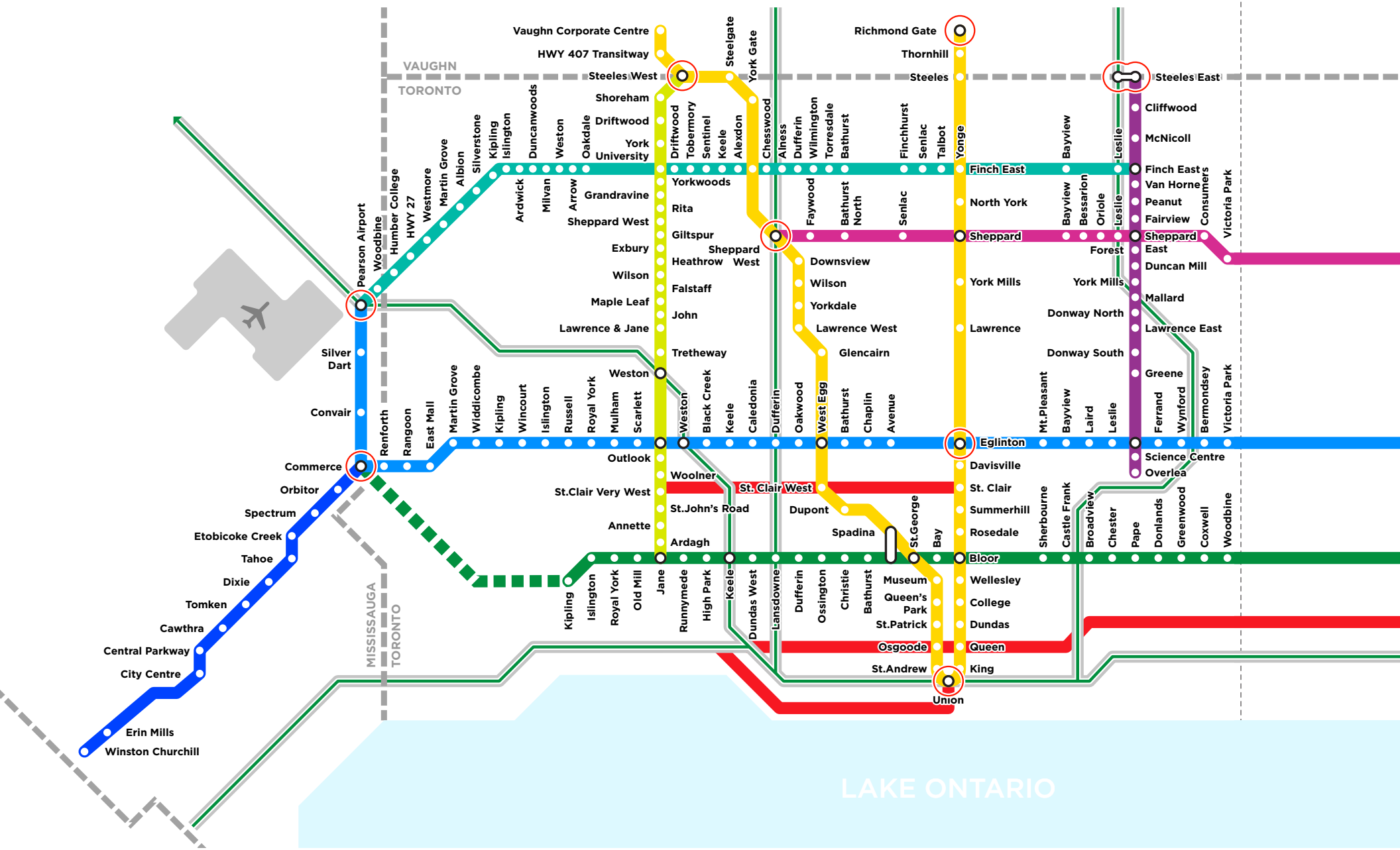
The road area occupied per hour would be significantly reduced for if one car-share can remove between 6 and 23 cars from the road per day[1], that means that a minimum of 6 fewer parking spaces are required and 6 fewer cars are on the road.

If personal package deliveries fail to be delivered they often make multiple attempts to deliver the package before storing it at the local post office. With secure pack centres distributed at transit stations around the city, the extra trips for failed deliveries would be reduced substantially and further road area would be freed, reducing congestion further.

This logic also applies to banking, grocery purchases, and even 'picking up the kids'. Such multi-modal gateway hubs bring amenities to commuters without the sterility of private shopping malls, but of markets and amenities in a civic space.

Fig.4.2 (Opposite) Examples of amenity way-point locations in typical automobile and transit commutes.

1. Shaheen, Susan A; Cohen, Adam P. *Transportation Research Record: Journal of the Transportation Research Board, No. 1992 Growth in Worldwide Carsharing : An International Comparison*, Table 1


VAUGHN
TORONTO
MISSISSAUGA
TORONTO
LAKE ONTARIO
Vaughn Corporate Centre
HWY 407 Transitway
Steeles West
Steelgate
York Gate
Richmond Gate
Thornhill
Steeles
Steeles East
Shoreham
Driftwood
York University
Yorkwoods
Grandravine
Rita
Sheppard West
Giltspur
Exbury
Heathrow
Wilson
Falstaff
Maple Leaf
John
Lawrence & Jane
Tretheway
Weston
Outlook
Woolner
St.Clair Very West
St.John's Road
Annette
Ardagh
Jane
Runnymede
High Park
Keele
Dundas West
Lansdowne
Dufferin
Ossington
Christie
Bathurst
Museum
Queen's Park
St.Patrick
Osgoode
St.Andrew
Union
Kipling
Islington
Royal York
Old Mill
Pearson Airport
Woodbine
Humber College
HWY 27
Westmore
Martin Grove
Albion
Silverstone
Kipling
Islington
Duncanwoods
Weston
Oakdale
Driftwood
Tobermory
Sentinel
Keele
Alexdon
Chesswood
Alness
Dufferin
Wilmington
Torresdale
Bathurst
Finchhurst
Senlac
Talbot
Yonge
Bayview
Leslie
Ardwick
Milvan
Arrow
Faywood
Bathurst North
Senlac
Bayview
Bessarion
Oriole
Leslie
Cliffwood
McNicoll
Finch East
Van Horne
Peanut
Fairview
Consumers
Victoria Park
Finch East
North York
Sheppard
Sheppard West
Downsview
Wilson
Yorkdale
Lawrence West
Glencairn
Forest
Sheppard East
Duncan Mill
York Mills
Mallard
Donway North
Lawrence East
Donway South
Greene
Silver Dart
Convair
Commerce
Orbitor
Spectrum
Etobicoke Creek
Tahoe
Dixie
Tomken
Cawthra
Central Parkway
City Centre
Erin Mills
Winston Churchill
Renforth
Rangoon
East Mall
Martin Grove
Widdicombe
Kipling
Wincourt
Islington
Russell
Royal York
Mulham
Scarlett
Weston
Black Creek
Keele
Caledonia
Dufferin
Oakwood
West Egg
Bathurst
Chaplin
Avenue
Mt.Pleasant
Bayview
Laird
Leslie
Ferrand
Wynford
Bermondsey
Victoria Park
Eglinton
Science Centre
Overlea
Davisville
St. Clair
Summerhill
Rosedale
St. Clair West
Dupont
Spadina
St.George
Bay
Sherbourne
Castle Frank
Broadview
Chester
Pape
Donlands
Greenwood
Coxwell
Woodbine
Bloor
Wellesley
College
Dundas
Queen
King

TRANSIT CITY AND THEN SOME

This map identifies the key interregional, multi-modal transfer stations within the context of the Transit City and Mississauga BRT developments with further line extensions posited on proximity and linking transit circuits.

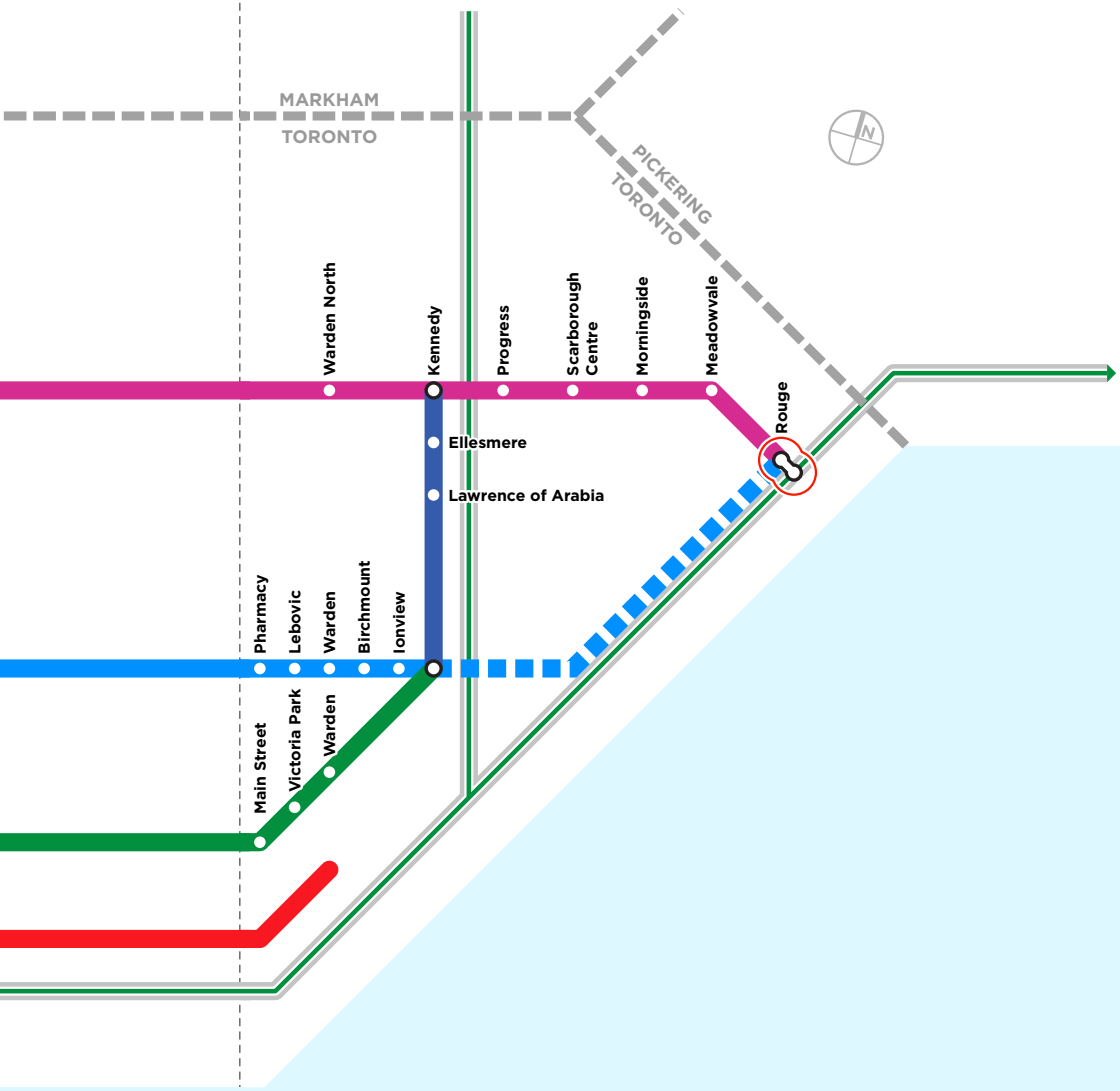
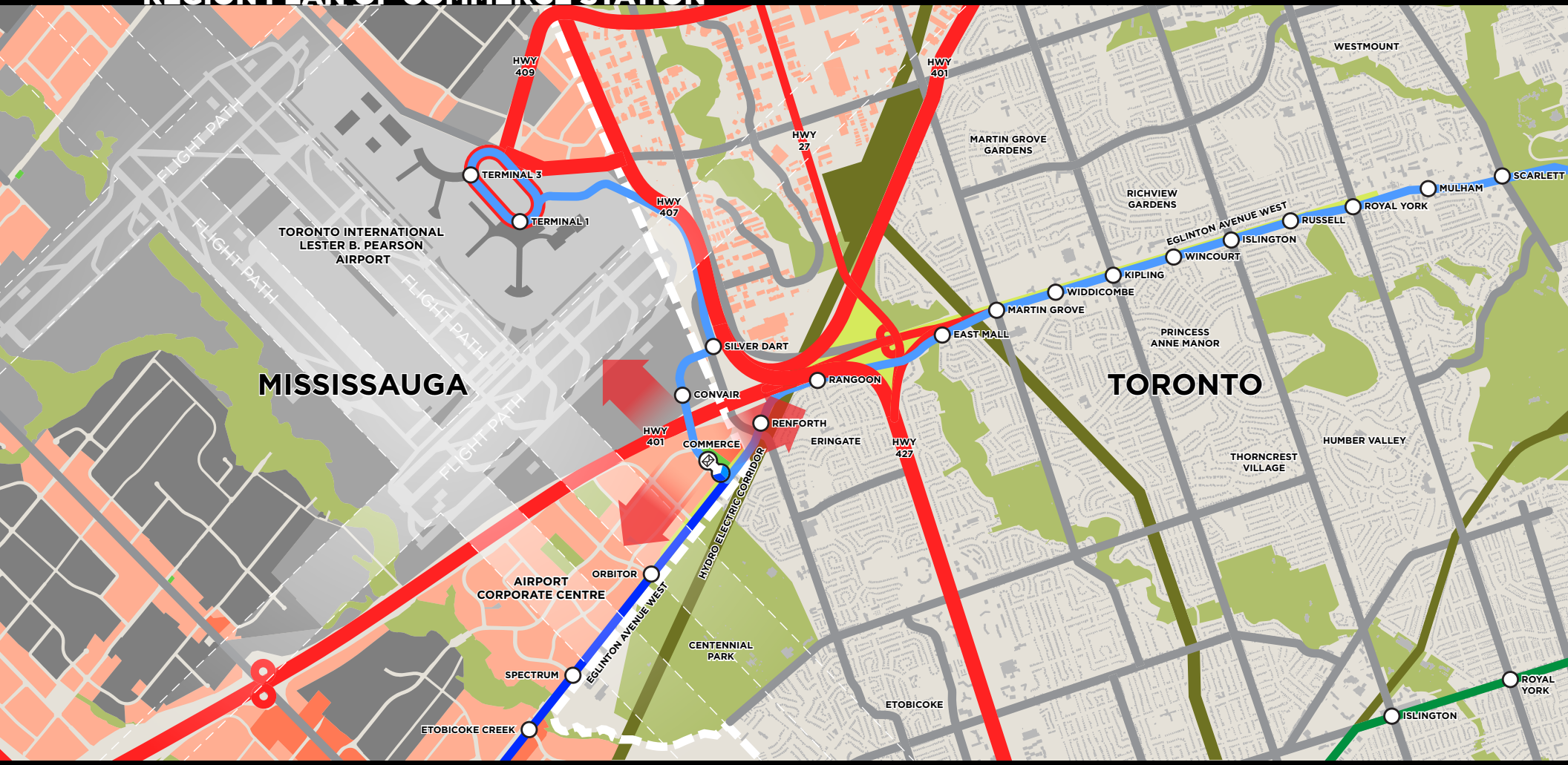


Fig.4.3 (Spread) Map by author, derived from City of Toronto Official Plan, Map 4, Higher Order Transit Corridors, June 2006: http://www.toronto.ca/involved/projects/kingston_road_ea/pdf/open-houses-mtl/p6_official_plan_maps.pdf, Transit City Open Public Consultation presentations from June 2009, Toronto Transit Commission existing subway plan, and Mississauga Transit BRT plans: http://www.mississauga.ca/portal/residents/brt

- INTERREGIONAL MULTI-MODAL TRANSFER
- TRANSFER
- STATION
- YONGE-SPADINA
- BLOOR-DANFORTH
- SHEPPARD
- EGLINTON-CROSSTOWN
- MISSISSAUGA BRT
- SCARBOROUGH RT
- DON MILLS LRT
- JANE LRT
- FINCH LRT
- QUEEN, QUEENSWAY, QUEEN'S QUAY
- GO BUS & VIA RAIL

REGION PLAN OF COMMERCE STATION



LEGEND

- PARKS + GREENBELT
- UTILITY + RAIL CORRIDORS
- PARKWAYS
- PUBLIC OPEN SPACE
- HIGHWAYS
- COMMERCIAL + RETAIL
- BUSINESS PARKS
- PEARSON INTERNATIONAL AIRPORT
- INDUSTRIAL
- RESIDENTIAL

HIGHWAYS

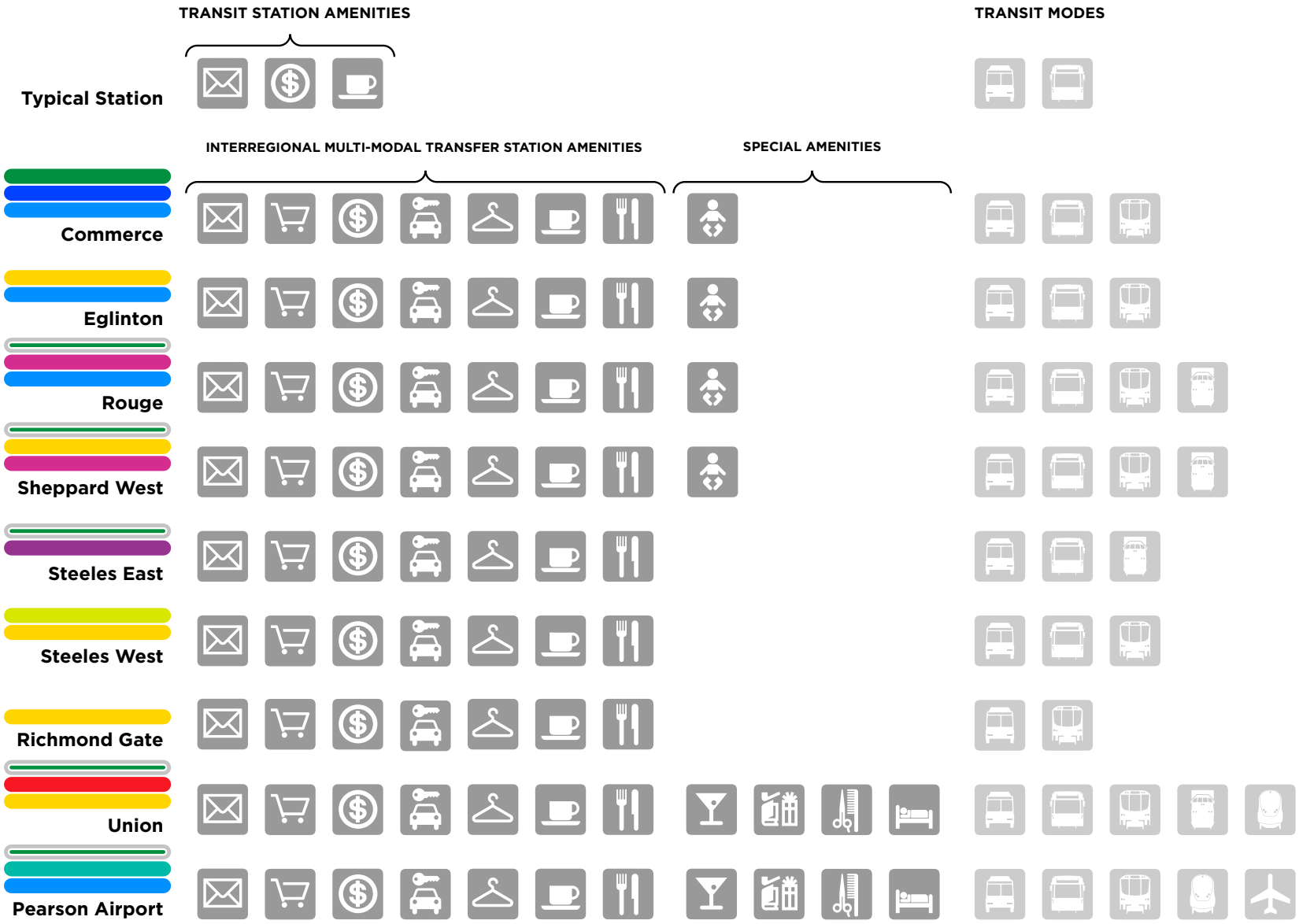
Mississauga Transit is currently building a dedicated right of way for a bus rapid transit system, replete with stations and GO bus connections. In 2007, the Toronto Transit Commission announced the extension of the Spadina arm of the TTC subway system, a general fleet increase, and the addition of several light rail transit lines. Of all the LRTs, the line expected to receive the heaviest traffic is the Eglinton Crosstown line, with a projected ridership of 52.8 million people by the year 2021. It is the longest line of the Transit City LRT projects which, when linked to Mississauga's Bus Rapid Transit network, will join Oakville to Pickering through Mississauga, Etobicoke, York, Toronto, and Scarborough, 50km in each direction. Consequently at the Mississauga connection it also intersects with the GO Bus service now helmed by Metrolinx. It is this intersection that demands the most attention from Metrolinx's supervisory authority, as it will be the transfer hub that routes to Toronto's Pearson International Airport and lies adjacent to two of the busiest highways in Canada, Highway 401 and Highway 427.

The specific site under consideration is one designated in the Renforth study area at the intersection of Eglinton Avenue West and Commerce Boulevard. It is near the Toronto-Mississauga municipal border and remains largely tabula rasa. The original plan for the LRT-BRT link to Toronto Pearson International Airport was to cross highway 401 via the existing overpass at Renforth Drive, however, the TTC evaluated the structure of the bridge to be inadequate to support the additional lanes that would be required for the LRT right-of-way.[1] Therefore the LRT-

1. From a meeting with Toronto Transit Comission engineer Frank Altomare, the author was informed that it would be more costly to reinforce the existing

Fig.4.4 (Opposite) Region plan, indicating important adjacencies to station.
Fig.4.5 (Above) Aerial of site and context, Photographs by Google Maps 2009

INTERREGIONAL MULTI-MODAL TRANSIT STATION AMENITIES



BRT transfer station was relocated to Commerce Boulevard, where it can take advantage of an undeveloped lot between Matheson Boulevard East and highway 401.

Unfortunately, the current plans shown by the TTC in November and December, 2009, and those of Mississauga Transit show two distinctly separate BRT and LRT stations, joined only by proximity and disregarding the need for higher order facilities or consideration for the climate of southern Ontario. The are separated by a change in grade and force riders to negotiate traffic while proceeding to or from the LRT. This condition ignores the goals set out by Metrolinx in the The Big Move documents, and does little to make the transition between transit systems smooth or integrated and ignores an opportunity for improved rider safety. A much more ambitious building type is required if commuters are to be coaxed from their personal vehicles to ride public transit.

As the greater area of the site contains industrial and commercial building types and land uses restrict residential development due to close proximity to Toronto Pearson International Airport flight paths, this Gateway Transfer Station faces yet another serious challenge, due to a low local population density within walking distance other means must be pursued to keep the station viable. Amenities such as those outlined previously must be incorporated into the station in order to make it as much a desirable destination as a point of transfer.

With two of Canada's busiest highways within close proximity, Commerce Station can take advantage of the goods delivered via highways 401 and 427 to provide grocery markets

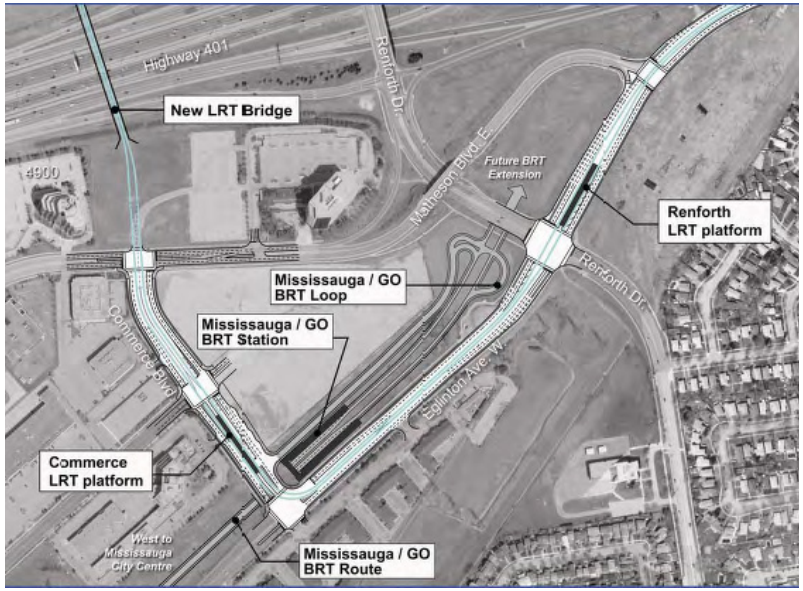
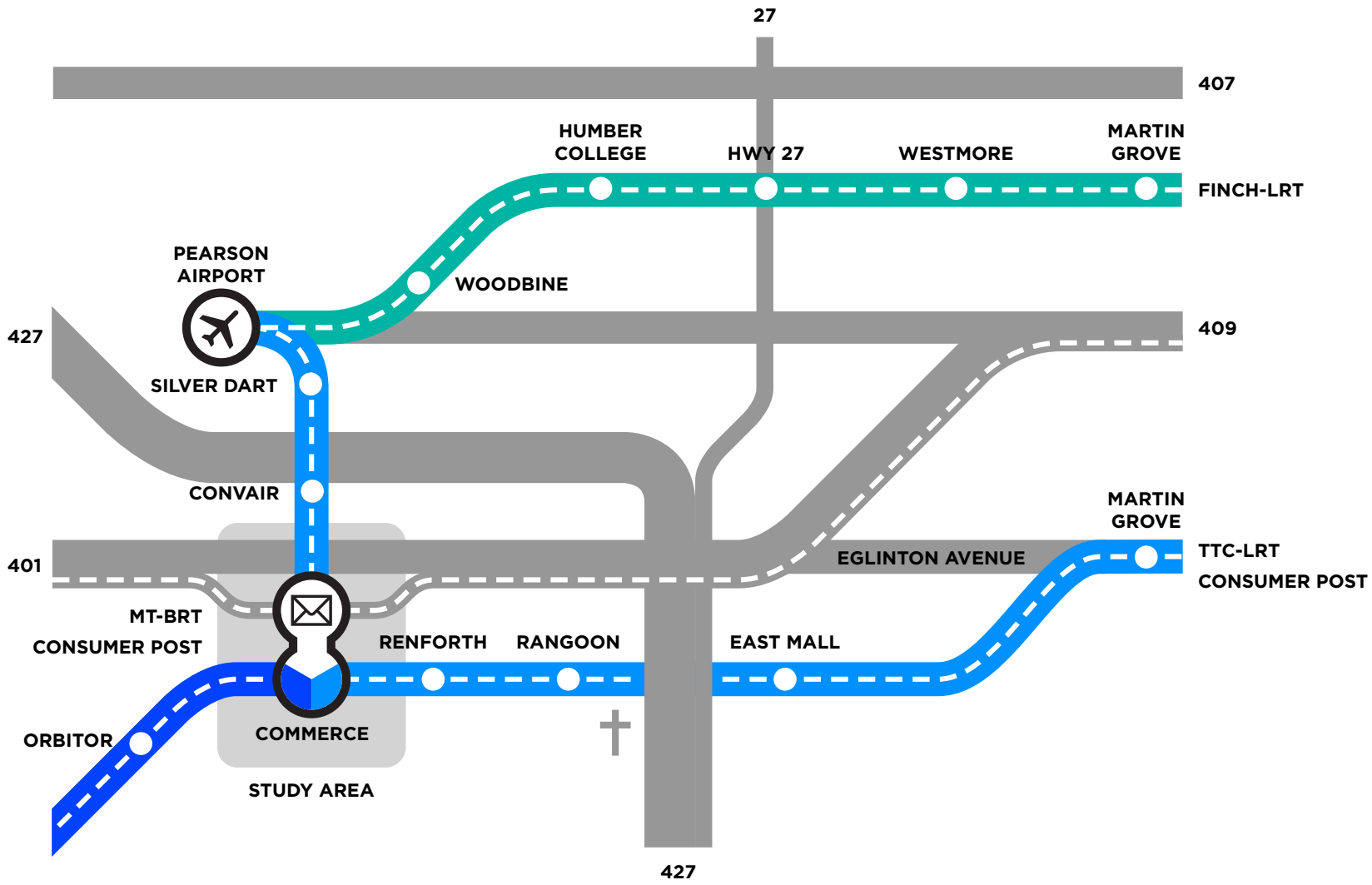


Fig.4.6 (Above) Aerial plan for Eglinton-Crosstown LRT connection to Toronto Pearson International Airport from display panels at November 2009 public meeting. http://www.toronto.ca/involved/projects/eglinton_crosstown_lrt/pdf/2009-11-20_display_panels_part1.pdf
Fig.4.7 (Opposite) Possible amenities to associate with several multi-modal, interregional transfer stations.

and postal services. This connection also establishes the car-share facilities at highly connected transit node, therefore, the station will help grow the area in terms of offices and local business by drawing a population to it that will be highly mobile, whether on car or by foot.

overpass at Renforth Drive than to construct a new LRT-only bridge from Commerce Boulevard to Convair Drive

INTERLINKING OF POSTAL SERVICE AND GOODS DELIVERY WITH PUBLIC TRANSIT



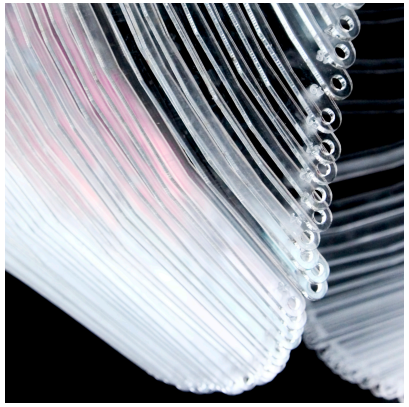
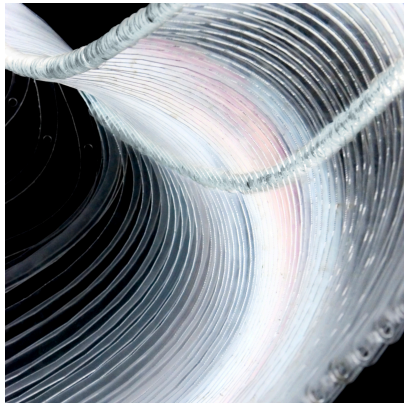
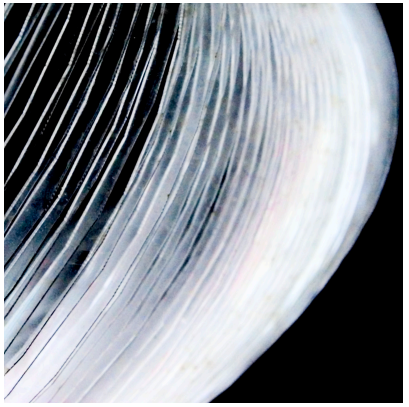
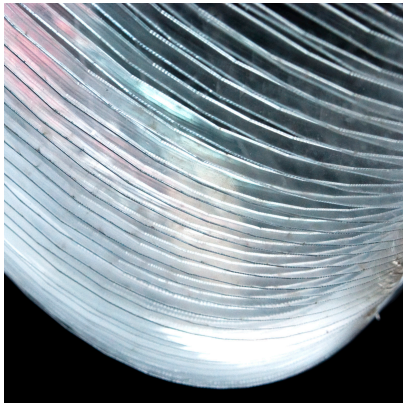
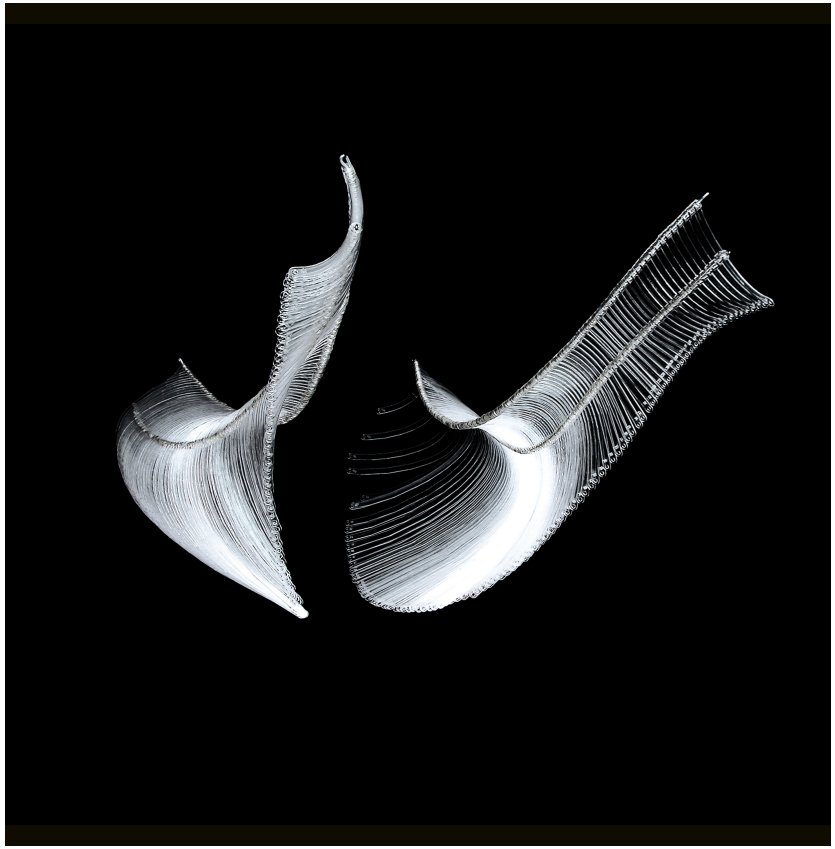
GATEWAYS

On the border of Mississauga and Toronto, Commerce station has the opportunity to serve as a transitional gateway allowing Eglinton Avenue West to develop some of the urban qualities of its length from east of Martin Grove Avenue. The jog where Eglinton Avenue West was routed to the historical Richview Sideroad is where Eglinton degrades into a series of berms, underpasses, sound-walls, and undeveloped fields, adjacent highway off-ramps. Commerce station will act as a physical beacon to redefine Eglinton Avenue West as an urban avenue rather than the throughway that it has become. It will act as the milestone to record where Eglinton returns to a human scaled street from a highway scaled road.

On the Northern end of the station, the connection to Toronto Pearson International Airport poses the physical challenge of bridging Matheson Boulevard East to Convair Drive. However, this grants the station additional prominence as an important interregional connector by declaring its presence both at Eglinton Avenue West and at Highway 401, where it can learn from examples such as the Hessing Showroom in Utrecht, the Netherlands, where the monotony of the highway sound-wall is used to great effect by integrating the showroom into regionally scaled infrastructure and creating an impressive distortion to the repetition and a spectacular gateway to the city.

Commerce interregional transfer station will not only provide amenities to commuters transferring from one mode of transportation to another, it will negotiate changes of scale in the built environment along highway 401 and Eglinton Avenue West.

Fig.4.8 (Opposite) Diagram of the TTC Transit City plan and the Mississauga BRT plan in context to the surrounding highway system by author.
Fig.4.9 (Top) The uninspired soundwall of highway 401 in Toronto, as seen from Eglinton Avenue West, Photograph by author.
Fig.4.10 (Above) Photograph of Hessing showroom integrated into the soundwall of the A2 Highway in Utrecht, the Netherlands.


DESIGN

The challenge of incorporating such an array of amenities into a station is met by adopting a large, bisected canopy as the organizing design idea for the program of Commerce Gateway Station. The LRT line and subway provide a spine to arrange the program, the circulation space remains clearly within the public realm, and the structure imbues the space with a monumental quality.

Sculpturally, the twin canopies of the station are a notional model of a fluid dynamics Kármán vortex street, expressing the form of air passing around a train as it speeds through a railway corridor. Metaphorically, the eddies shed by such a vortex street represent the multiple amenities integrated into the station. This form also accommodate the intersection of the BRT with the LRT and subway lines, allowing a kind of hinge where the canopy swells at the south end, tapering toward the north, and the far end of the LRT and subway platforms.

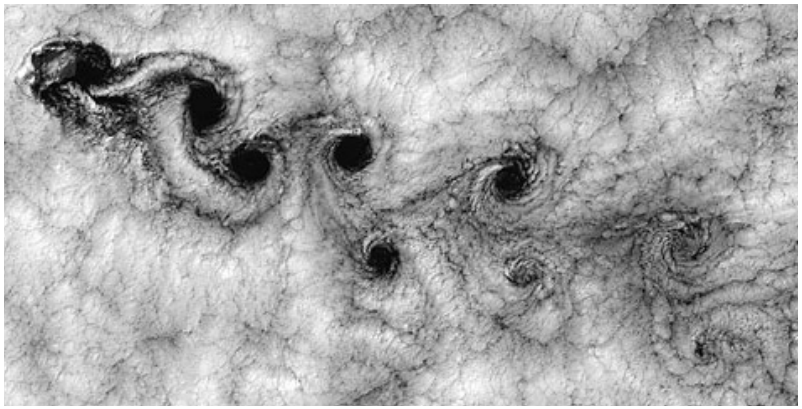


Fig.5.1 (Opposite) Photos of sculpture entitled Cinæsthesia, by author.
Fig.5.2 (Above) a Kármán vortex street a seen from a Nasa satellite.

The ground level incorporates services and fresh goods such as the café, bakery, post office, dry cleaners, convenience store, and includes a market. It is mainly oriented towards people passing through the station.

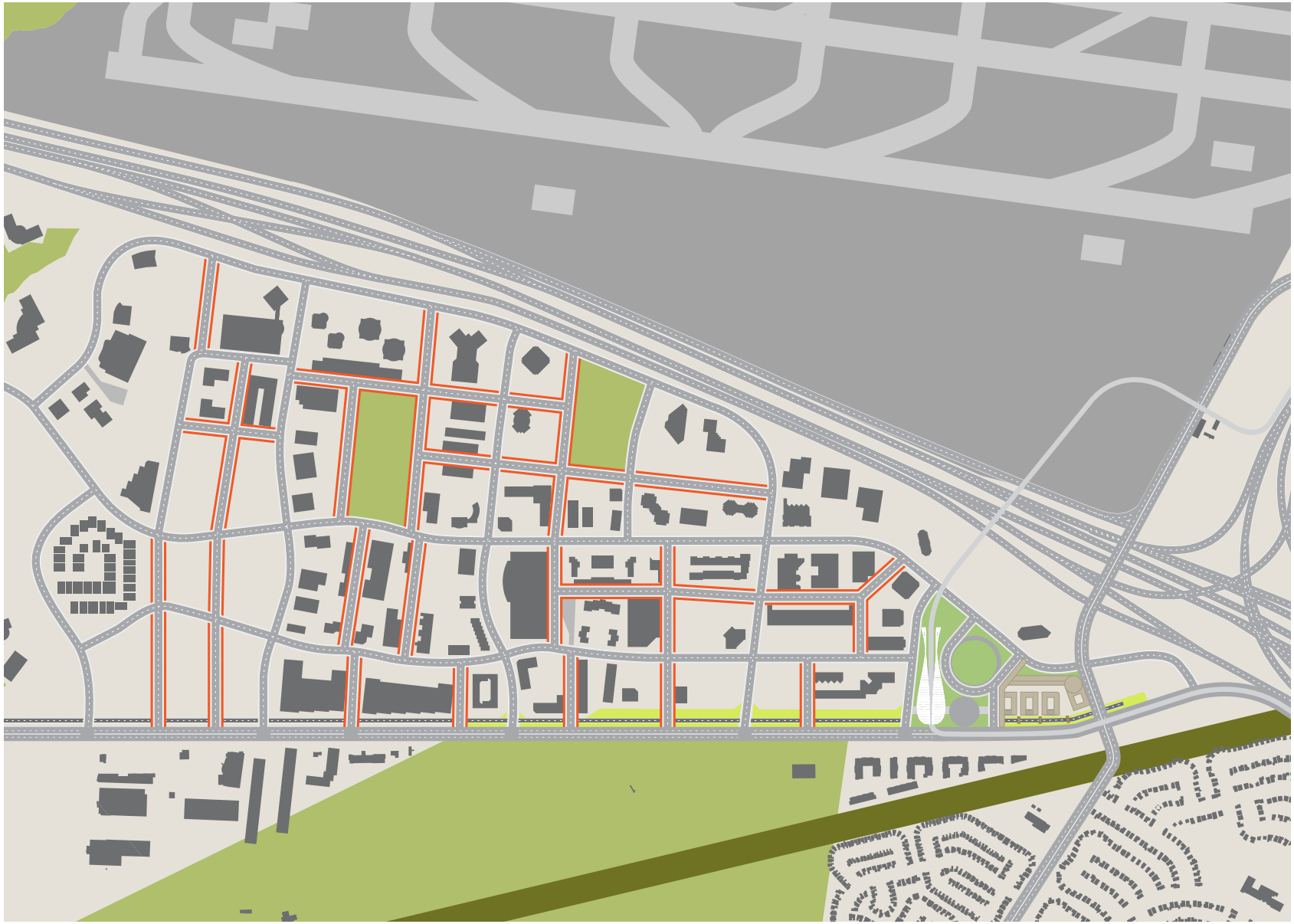
The first floor provides more destination oriented facilities such as a restaurant, day-care, dynamic social workspace, and several professional offices.

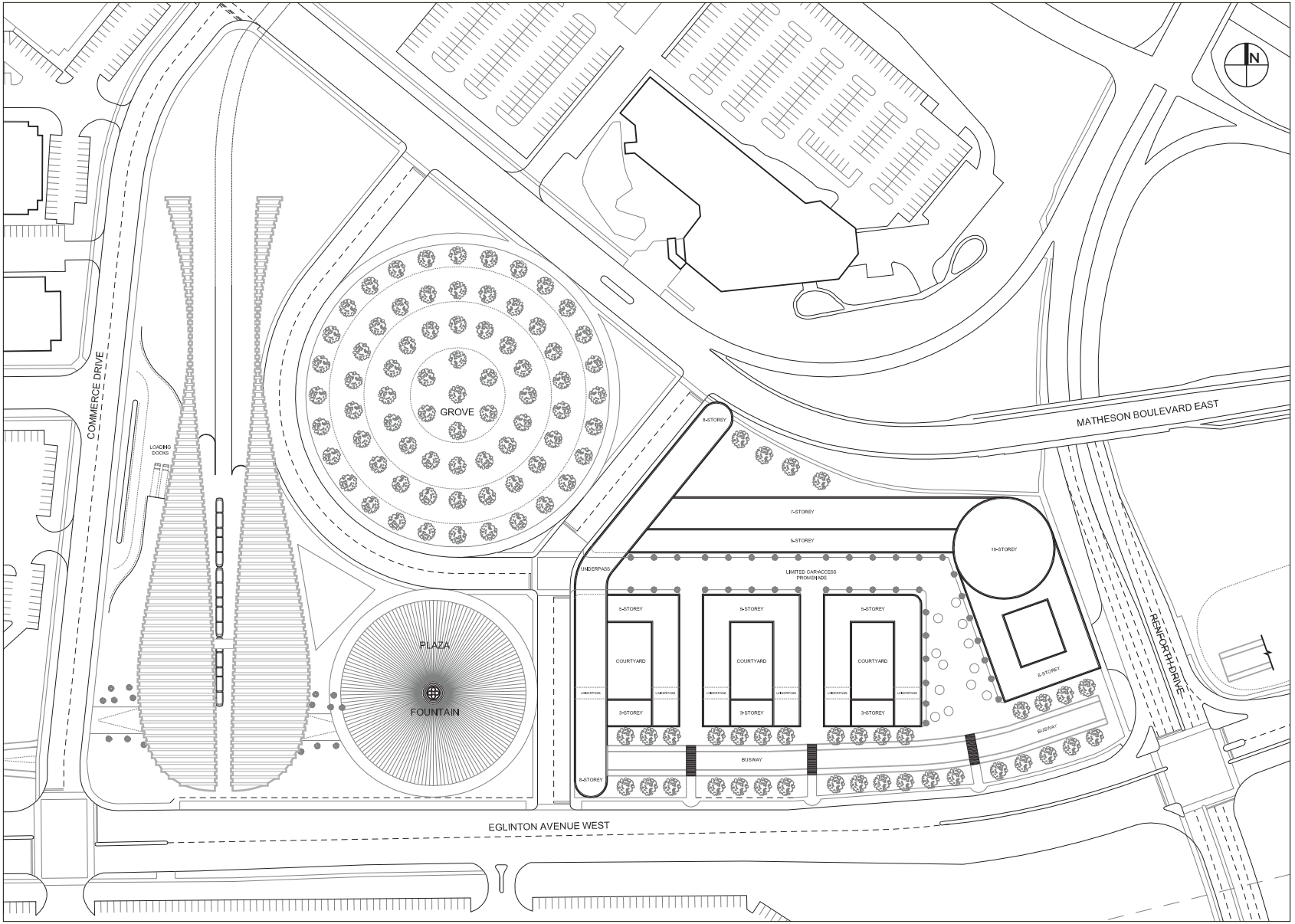
The first basement provides access to car-sharing services and sorting facilities for postal services and their adjoined loading docks. The top level of a grocery store is also located on this level one west side. The north end provides a second entrance and access to a small park.

The Second basement or BRT level is a continuation of the previous level's postal services and grocery store, and also houses the car-share recharging and maintenance systems.

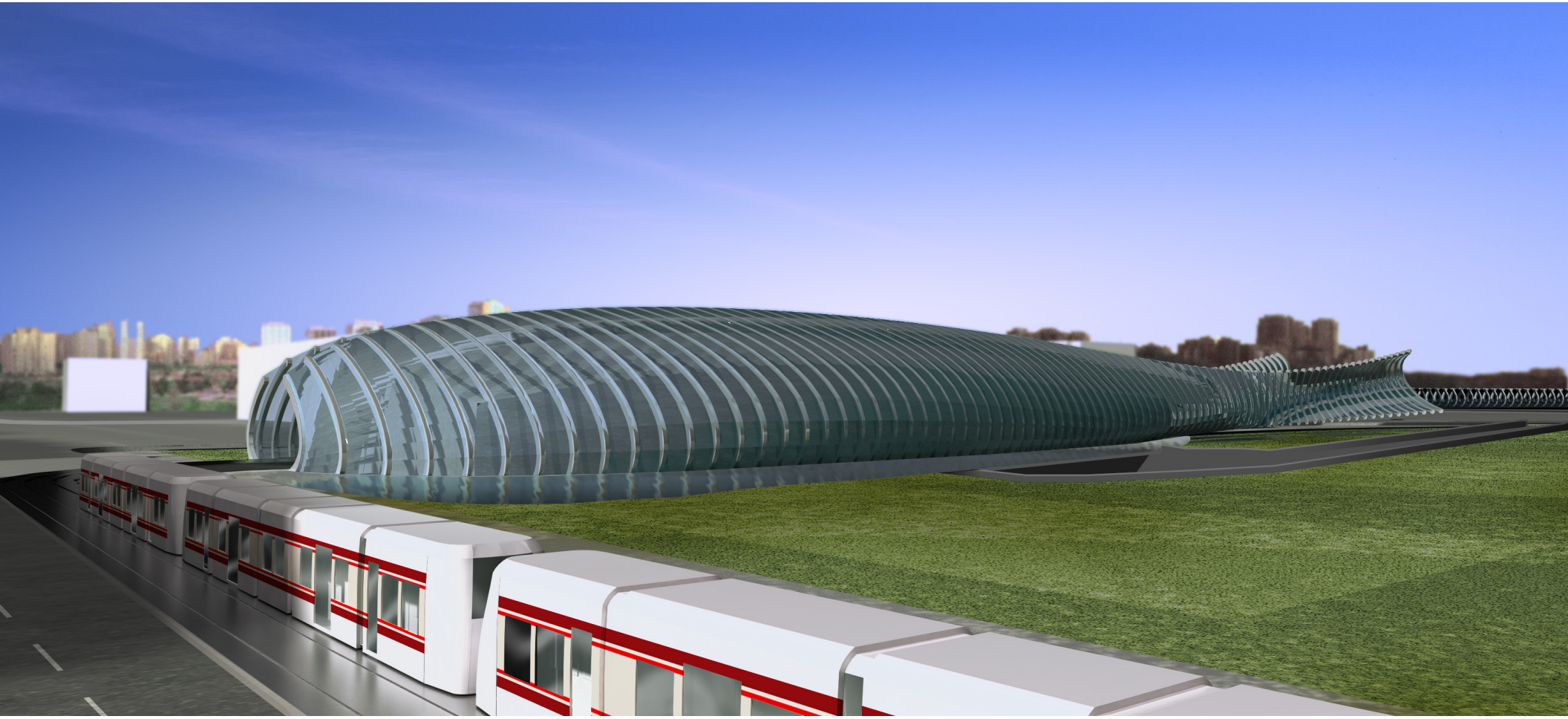
At the level of the site, a series of additional roads are proposed to the West of the station to cut through existing parking lots in the Airport Corporate Centre in order to make the area more inviting and accessible by active transportation and automobiles alike. The smaller blocks will allow for more street frontage and decrease average block size by fifty percent, vastly reducing automobile dependence.

To the East, a mixed use development is knit to the station by a civic piazza and a raise grove of trees. The development will provide retail and dining opportunities as well as access to courtyards and a promenade, these will keep the outdoor spaces viable destinations during winter and summer months.



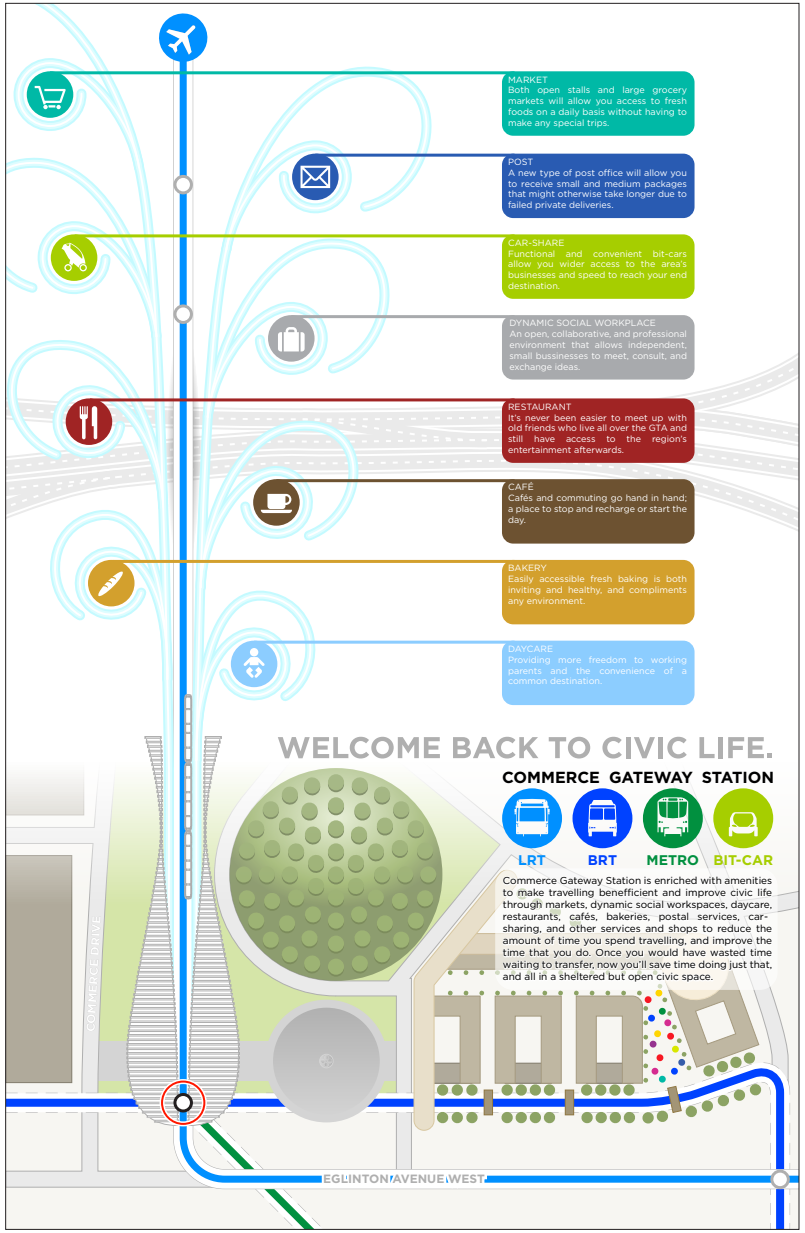


III.5.3 (Opposite)Site context plan showing proposed new streets in the Airport Corporate Centre highlighted in red
III.5.4 (Above) 1:2500 site plan of Commerce Gateway Station and adjacent area



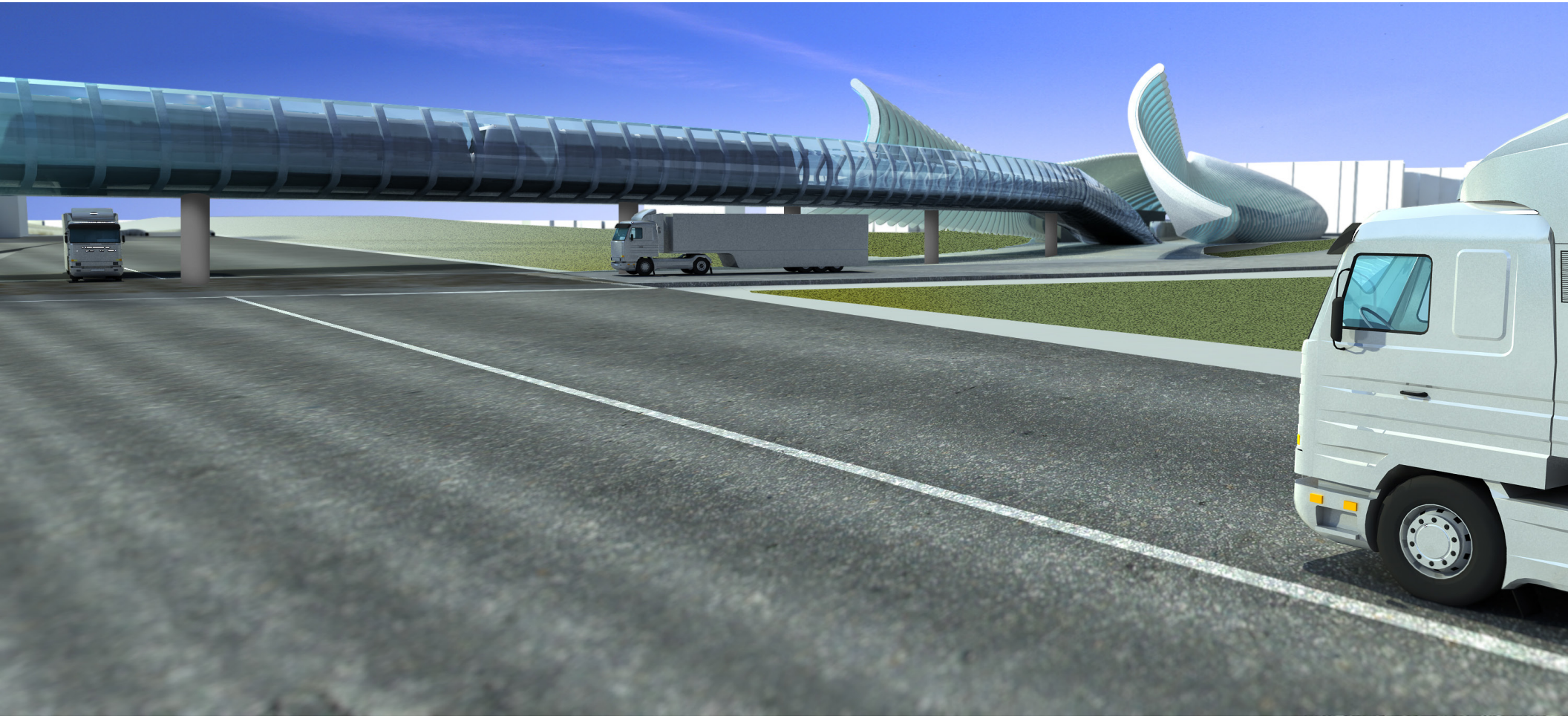
JUNCTION

After crossing Highway 407, Passengers on the LRT will arrive from the south end of Commerce Gateway Station where they will have the choice to transfer to the Bloor subway line, Missauga Transit BRT system, or continue to the Toronto International Pearson Airport.



III.5.5 (Above) Promotional poster mock-up for Commerce Gateway Station, by author.

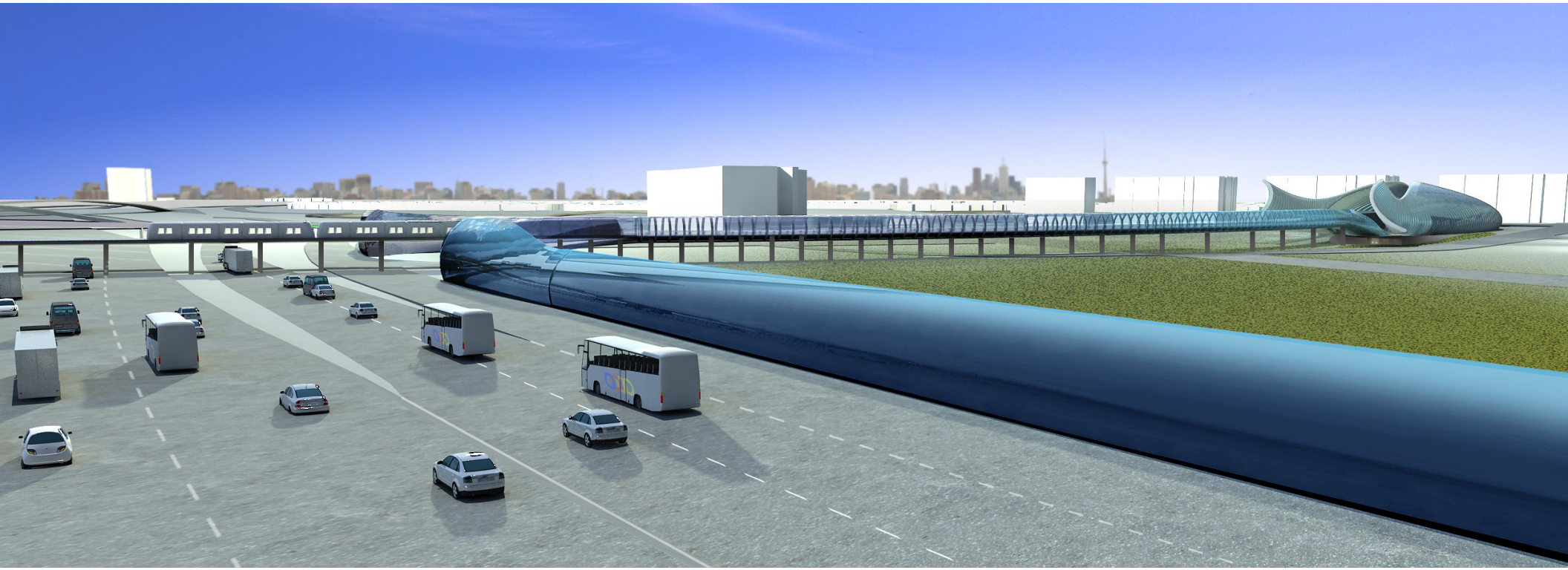
III.5.6 (Opposite)3D rendering of Commerce Gateway Station from south-east



FREIGHT

Postal and goods deliveries for the post office, markets, and restaurants will be made at the west side of the station, via Commerce Drive where tractor trailers and delivery vans will turn onto a service lane to access the loading docks, below grade.

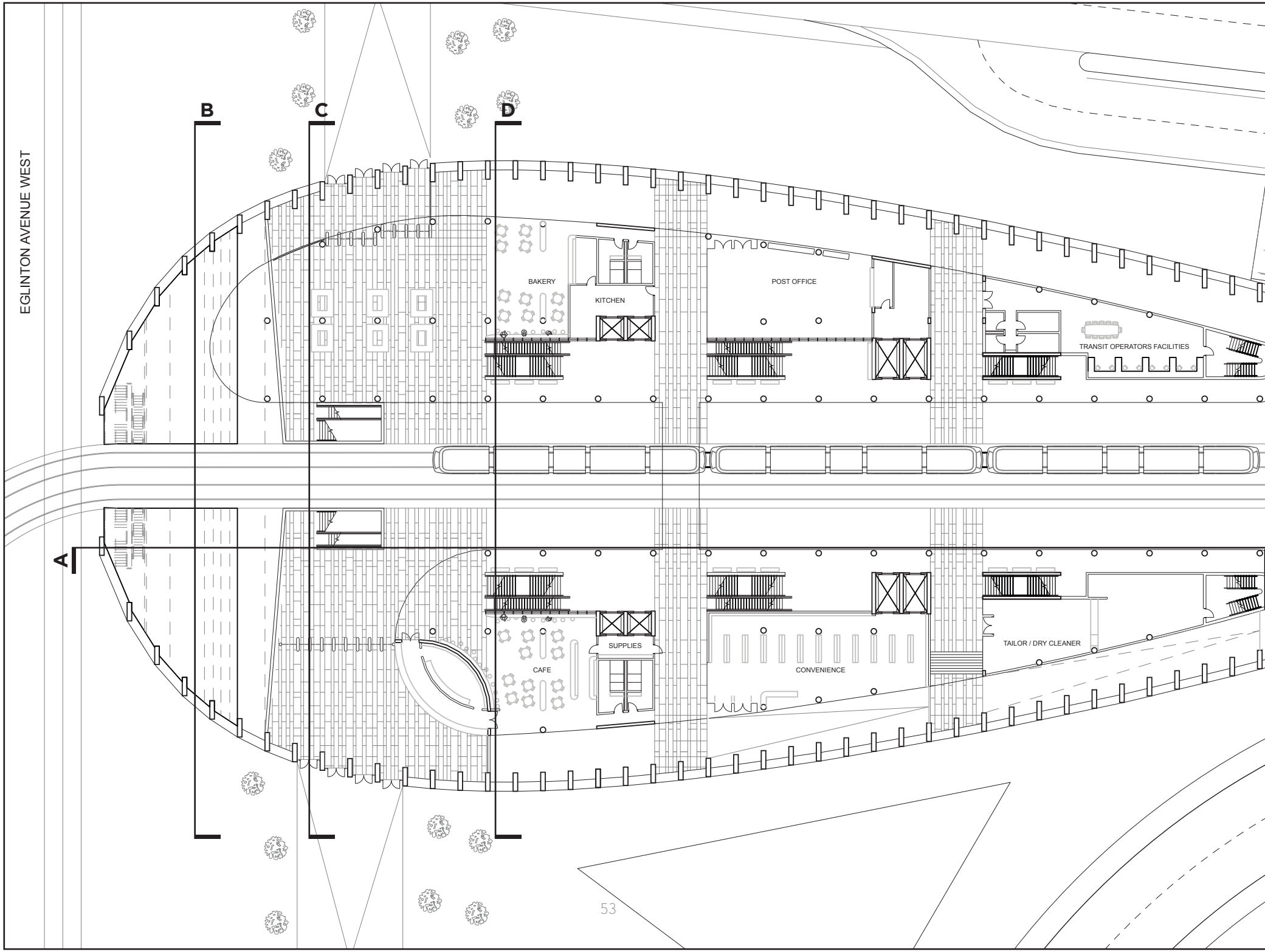
III.5.7 View of Commerce Gateway Station from Matheson Boulevard East

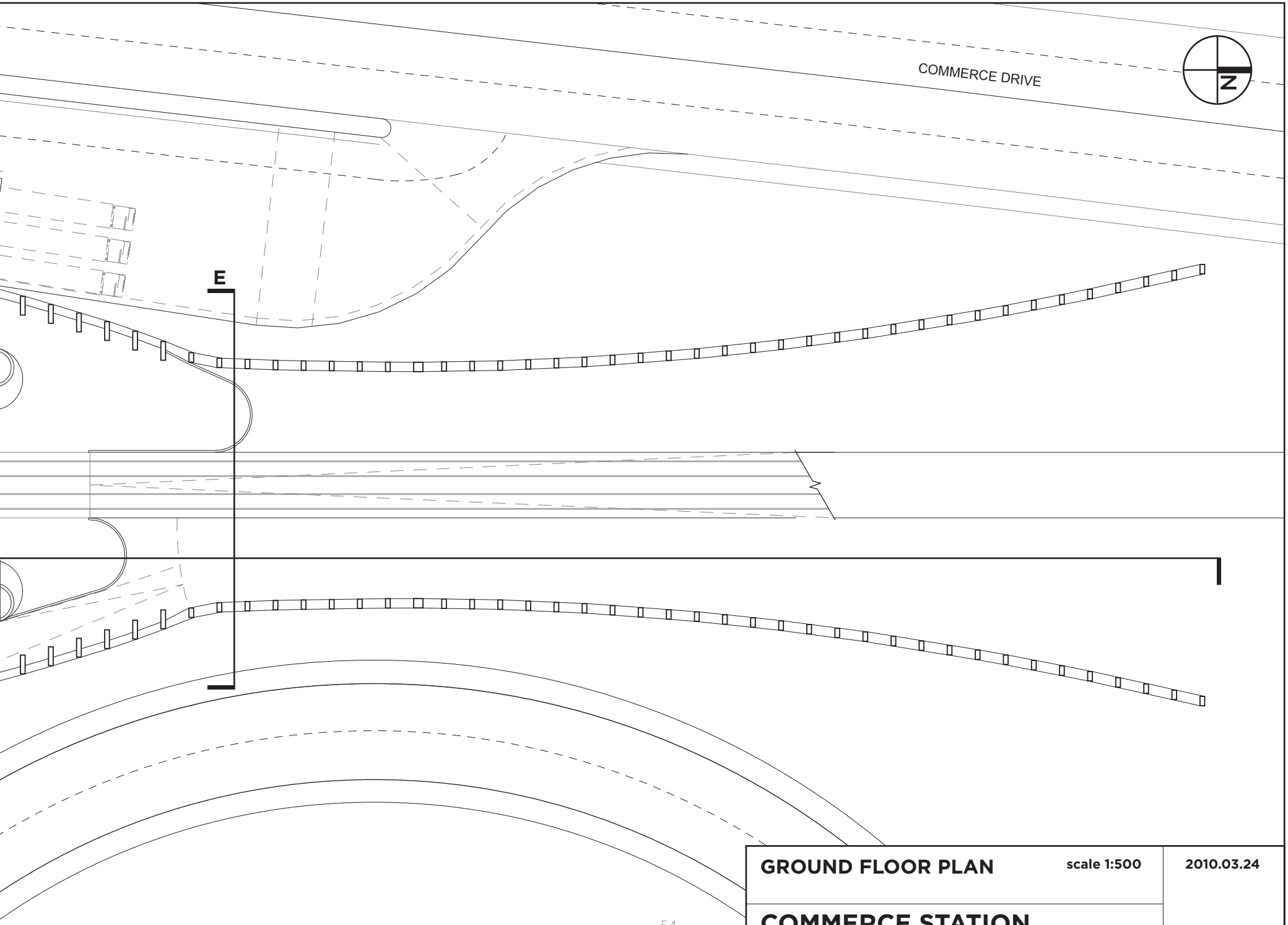


LANDMARK

In order to establish a gateway of sorts between Toronto and Mississauga, the soundwall allong the elevated segment of the LRT between Commerce Gateway Station and Highway 401 is integrated into that surrounding the Airport Corporate Centre.

Ill.5.8 View of Commerce Gateway Station and adjoining sound barrier from Highway 401


EGLINTON AVENUE WEST
A
B
C
D
BAKERY
KITCHEN
POST OFFICE
TRANSIT OPERATORS FACILITIES
CAFE
SUPPLIES
CONVENIENCE
TAILOR / DRY CLEANER



GROUND FLOOR PLAN

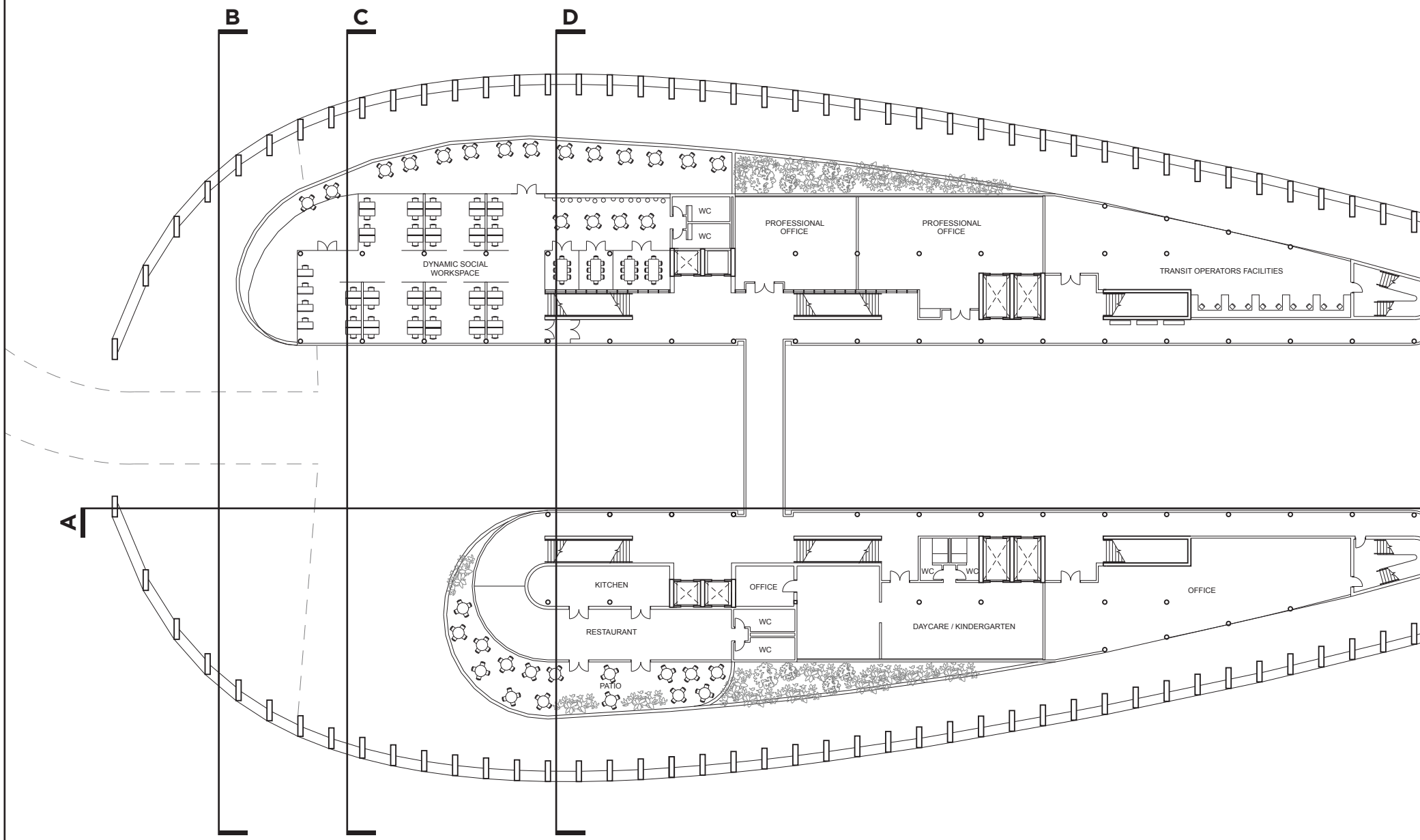
scale 1:500

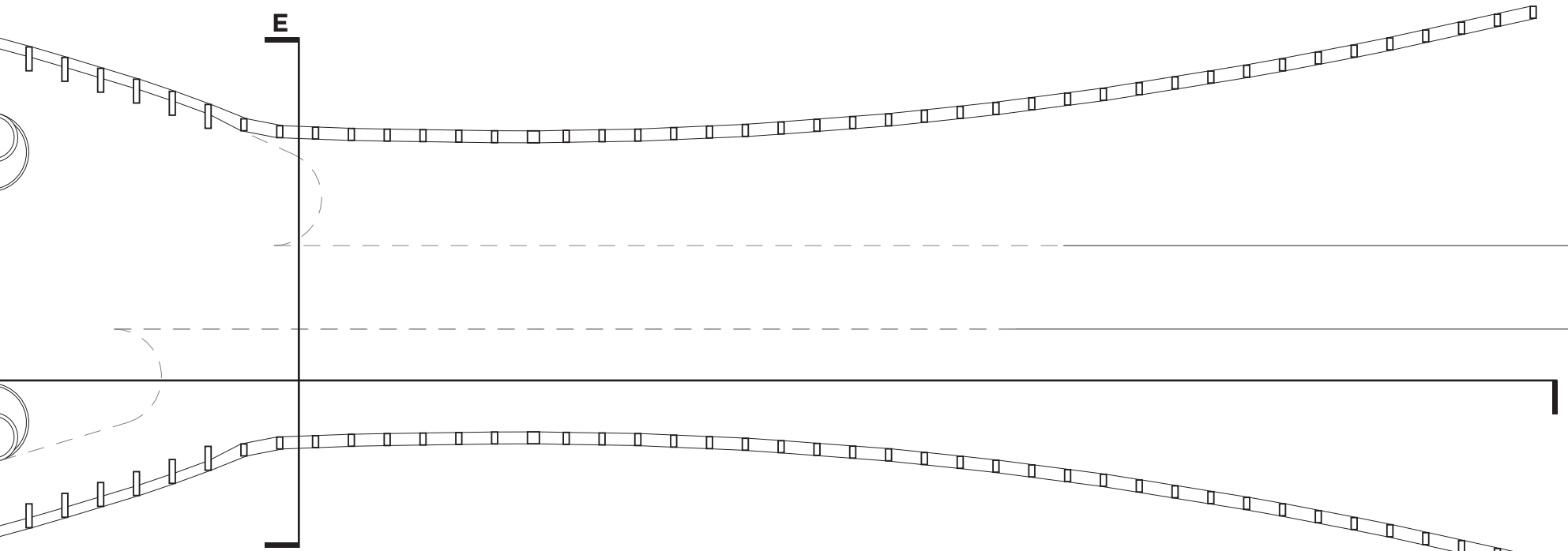
2010.03.24

COMMERCE STATION

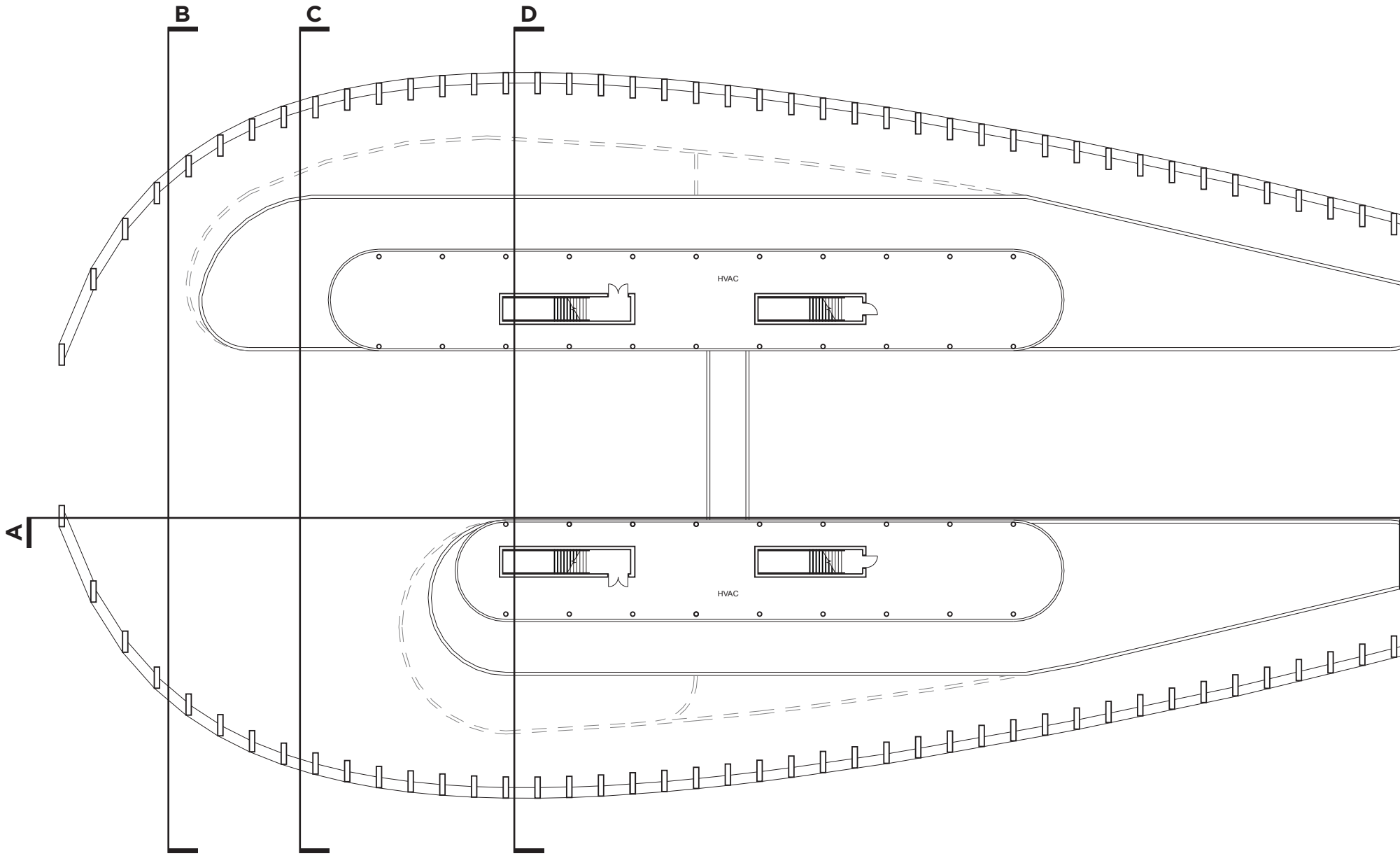
5555 COMMERCE BOULEVARD
MISSISSAGA, ONTARIO

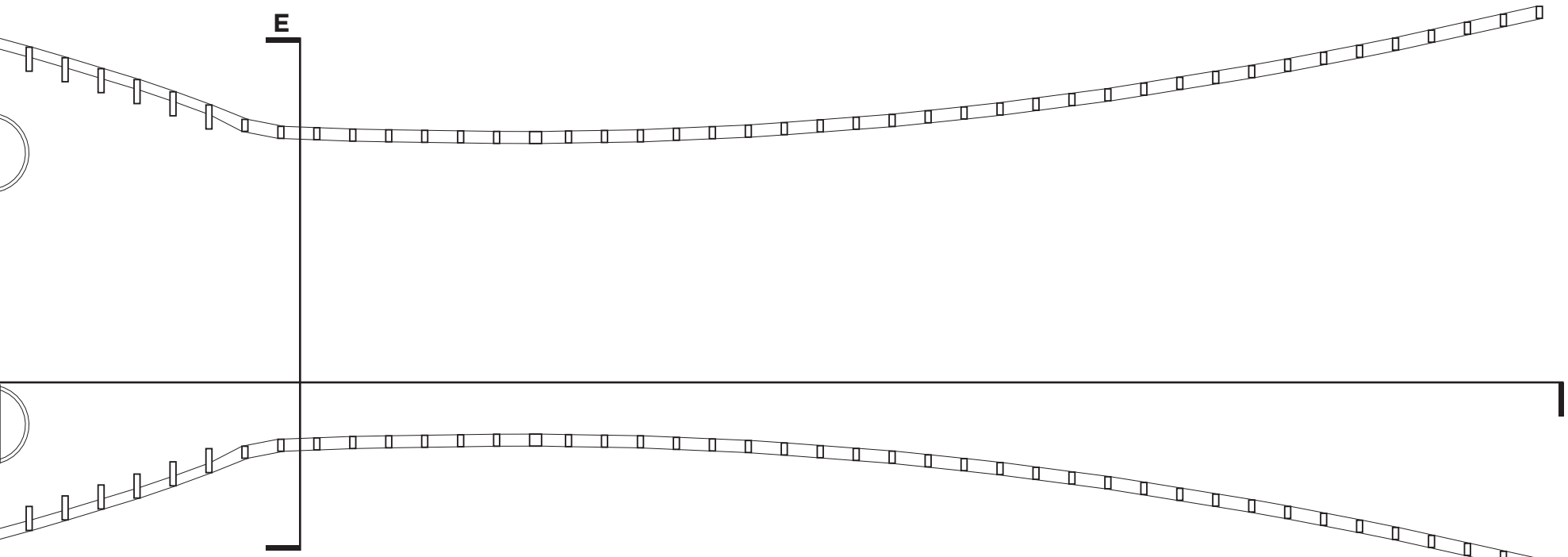
A100


B
C
D
A
WC
WC
PROFESSIONAL OFFICE
PROFESSIONAL OFFICE
DYNAMIC SOCIAL WORKSPACE
TRANSIT OPERATORS FACILITIES
KITCHEN
OFFICE
WC
WC
OFFICE
WC
WC
RESTAURANT
DAYCARE / KINDERGARTEN
PATIO



FIRST FLOOR PLAN	**scale 1:500**	**2010.03.24**
COMMERCE STATION **5555 COMMERCE BOULEVARD** **MISSISSAGA, ONTARIO**		**A101**


B
C
D
A
HVAC
HVAC



SECOND FLOOR PLAN

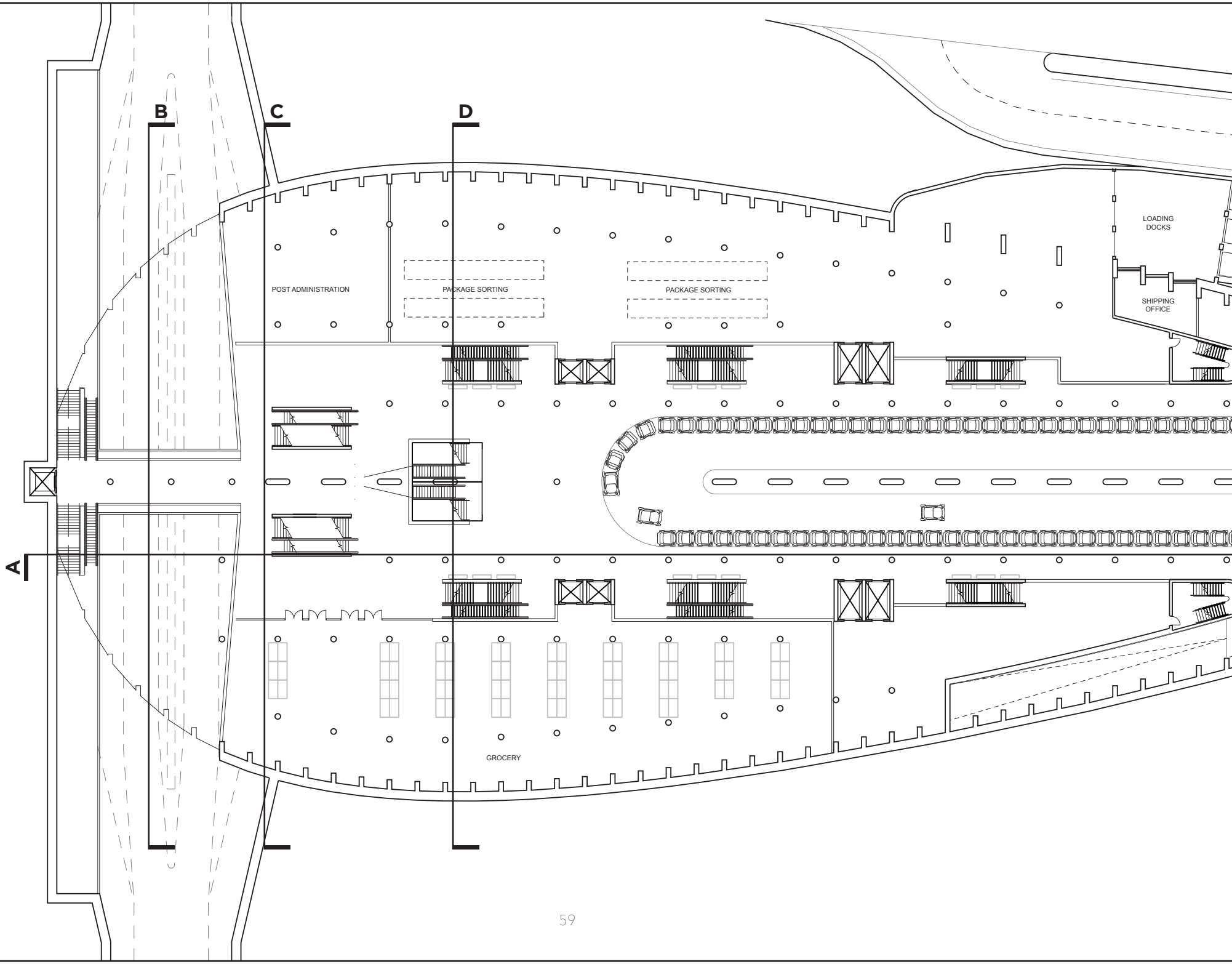
scale 1:500

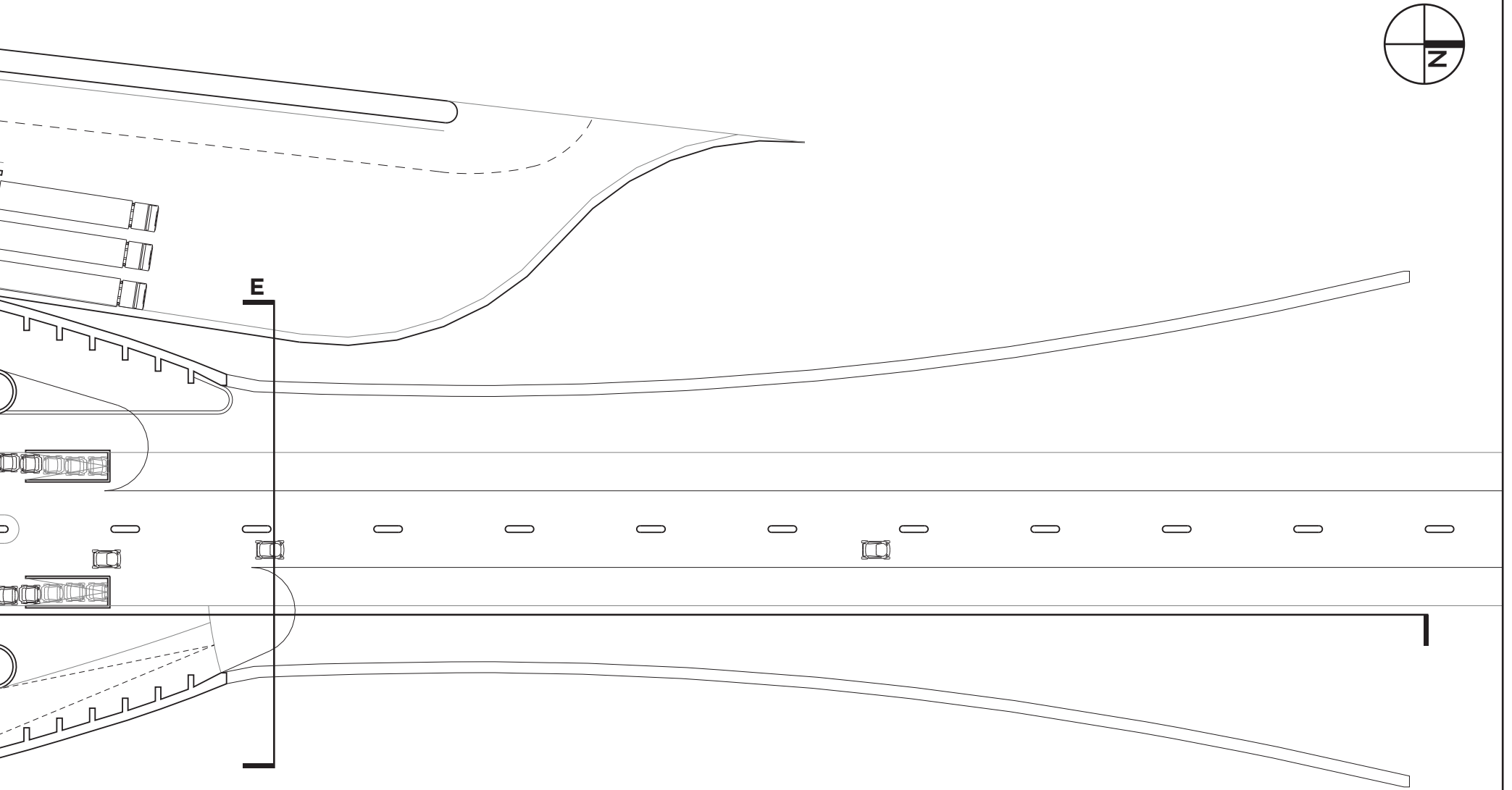
2010.03.24

COMMERCE STATION

5555 COMMERCE BOULEVARD
MISSISSAGA, ONTARIO

A102


B
C
D
A
POST ADMINISTRATION
PACKAGE SORTING
PACKAGE SORTING
LOADING
DOCKS
SHIPPING
OFFICE
GROCERY



CAR SHARE FLOOR PLAN

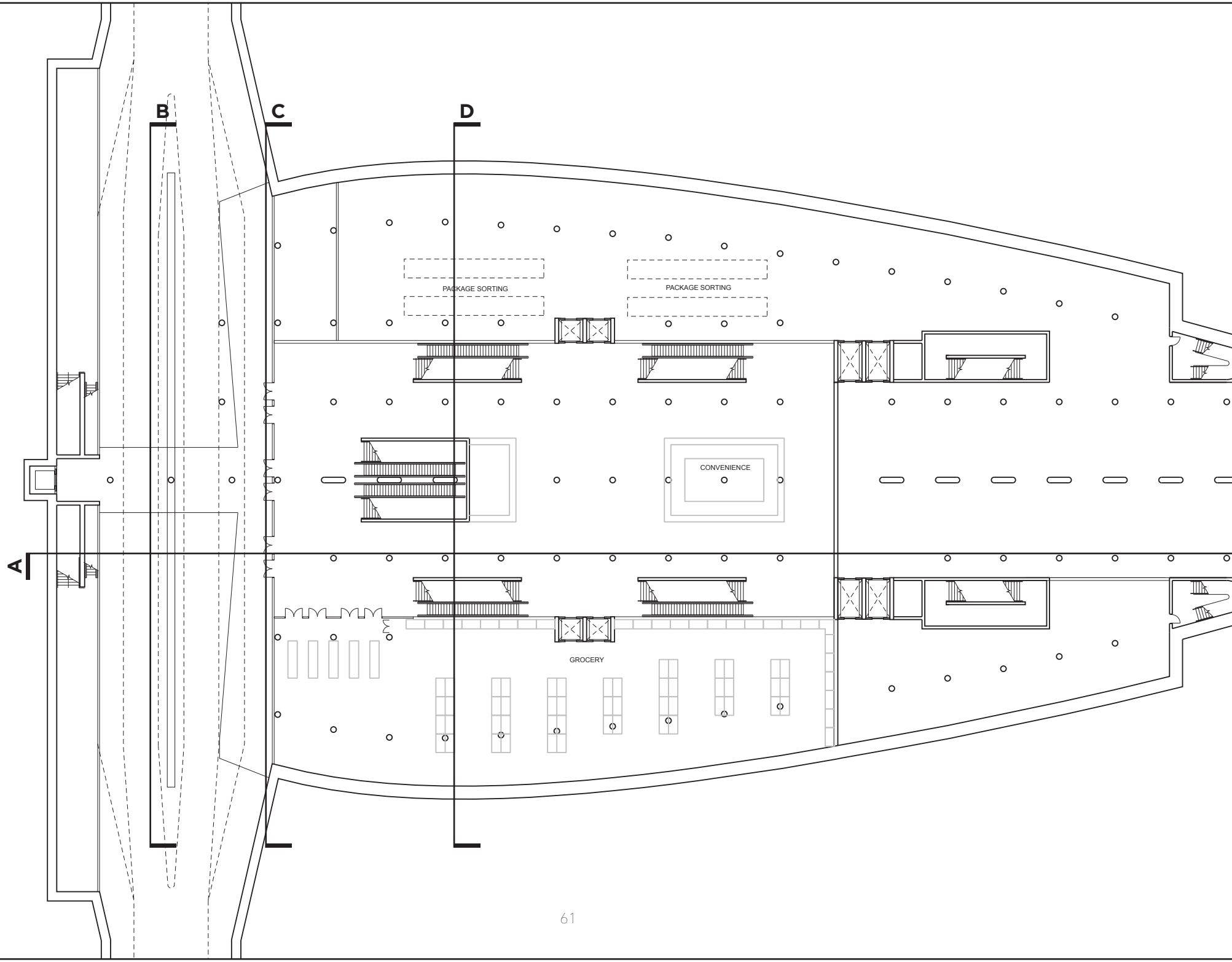
scale 1:500

2010.03.24

COMMERCE STATION

5555 COMMERCE BOULEVARD
MISSISSAGA, ONTARIO

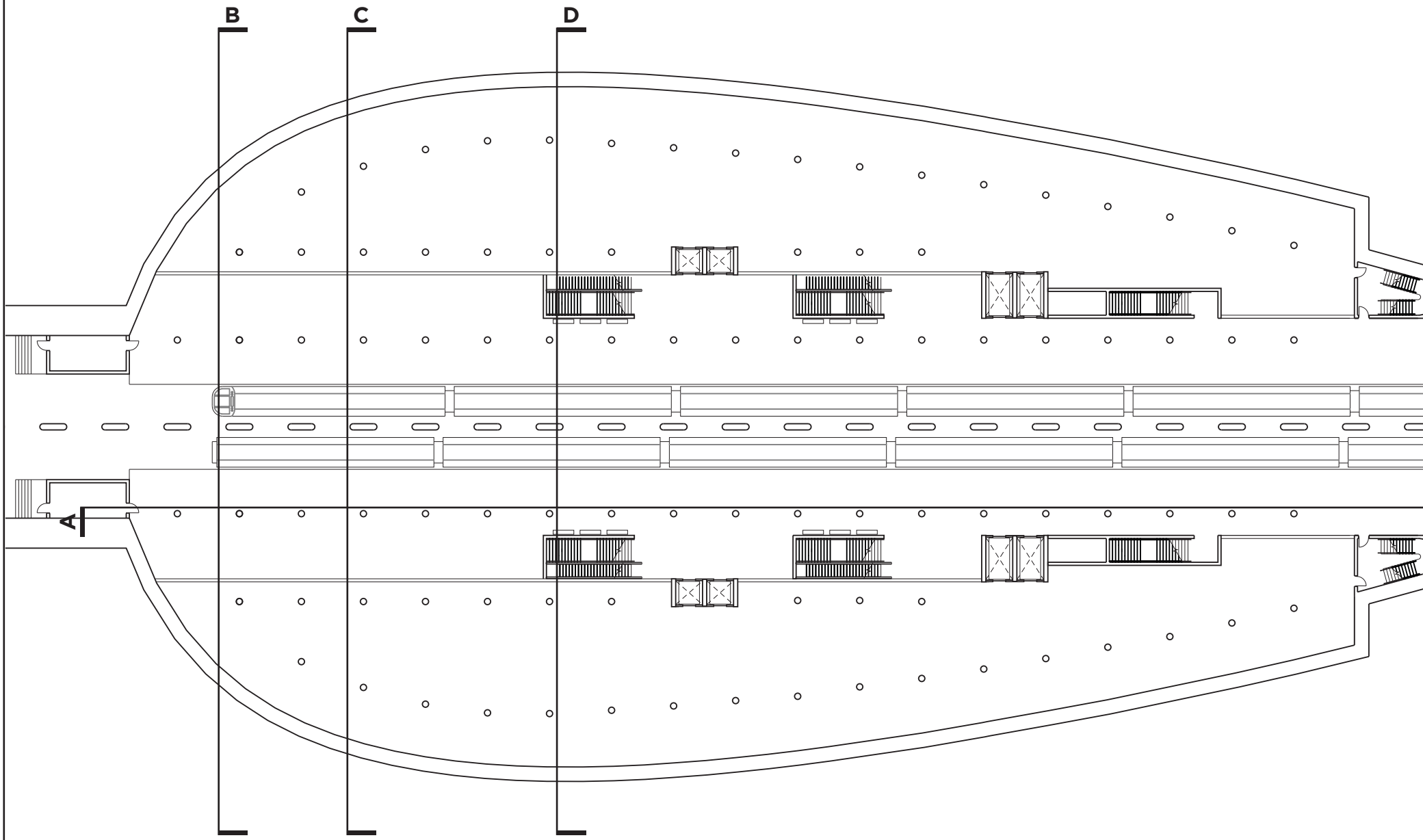
A111

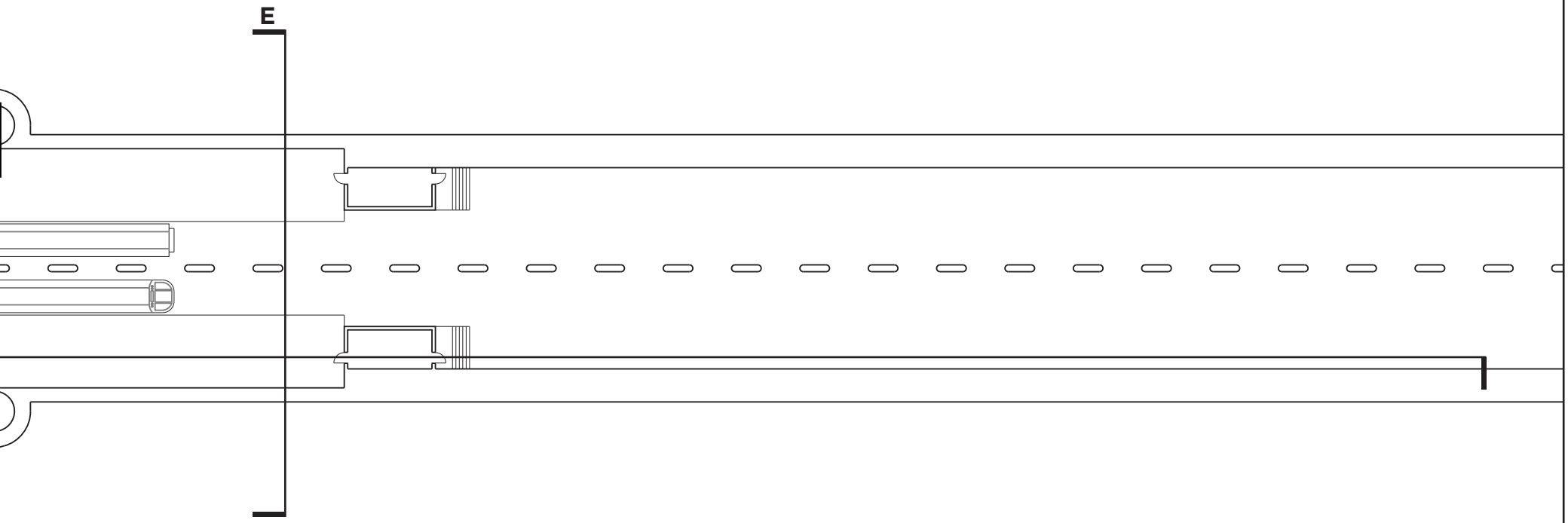

B
C
D
A
PACKAGE SORTING
PACKAGE SORTING
CONVENIENCE
GROCERY

BRT FLOOR PLAN scale 1:500 2010.03.24

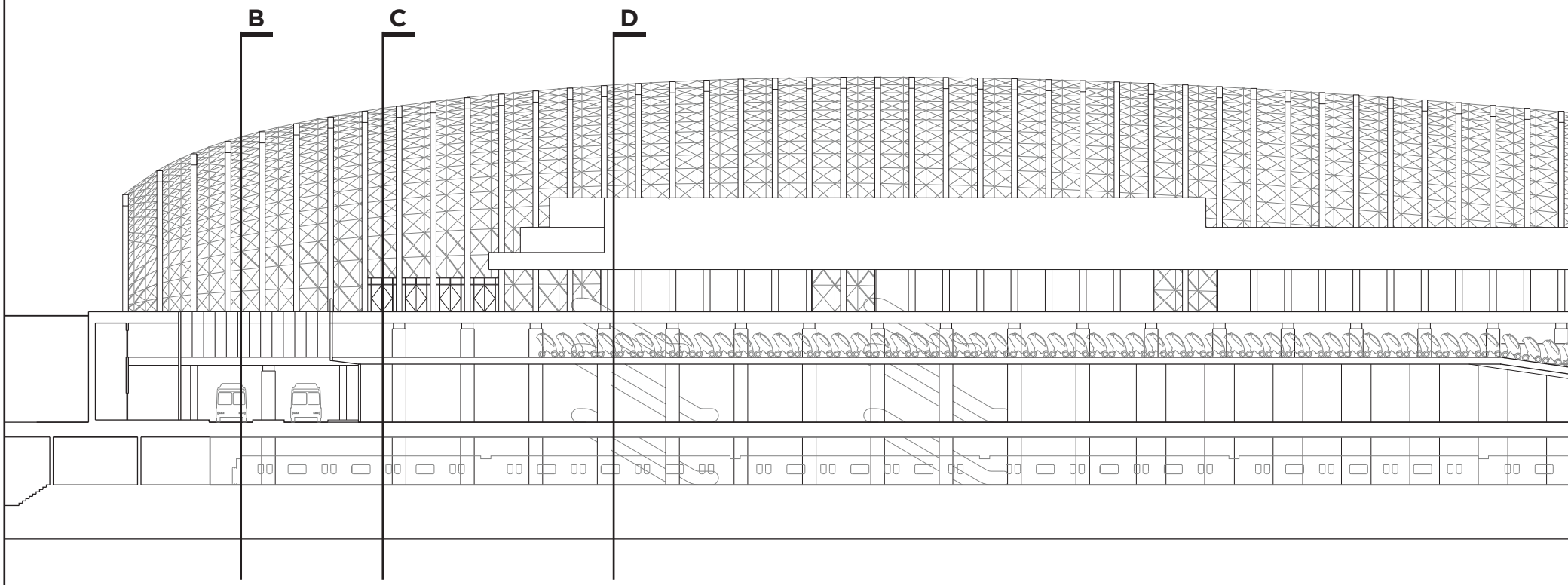
COMMERCE STATION
5555 COMMERCE BOULEVARD
MISSISSAGA, ONTARIO

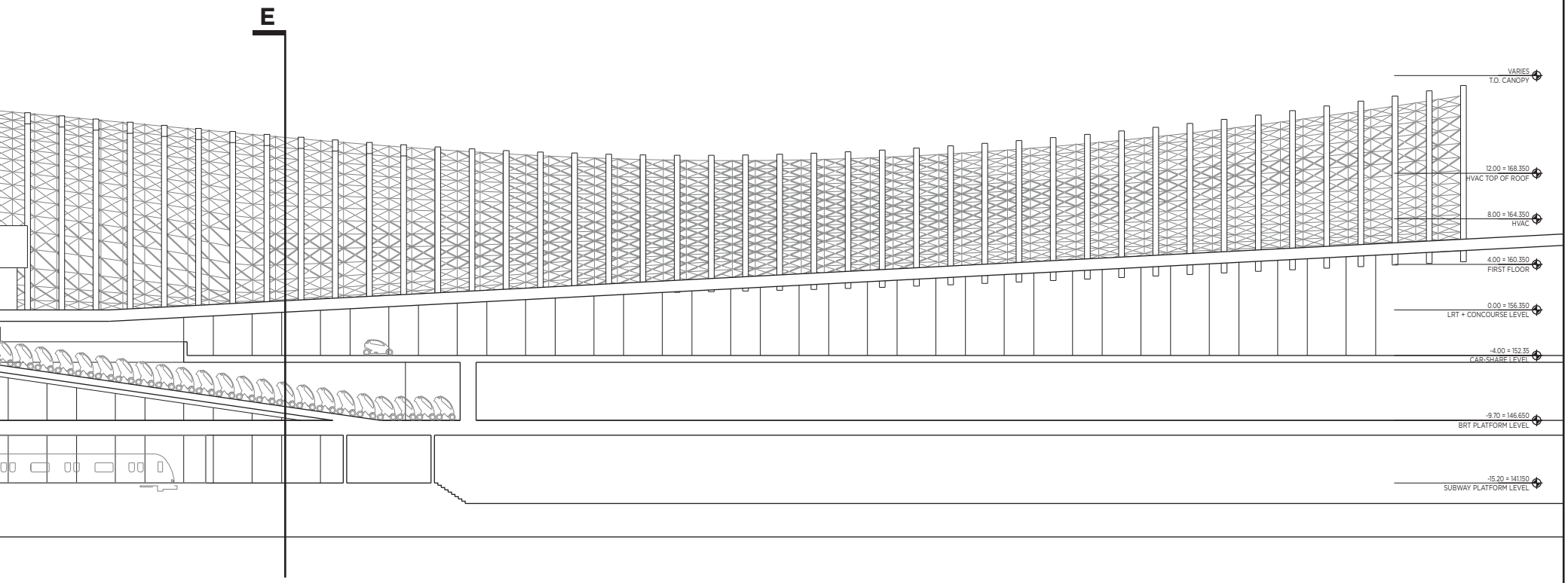
A112


B
C
D
A



SUBWAY FLOOR PLAN	scale 1:500	2010.03.24
COMMERCE STATION 5555 COMMERCE BOULEVARD MISSISSAGA, ONTARIO		**A113**


B
C
D

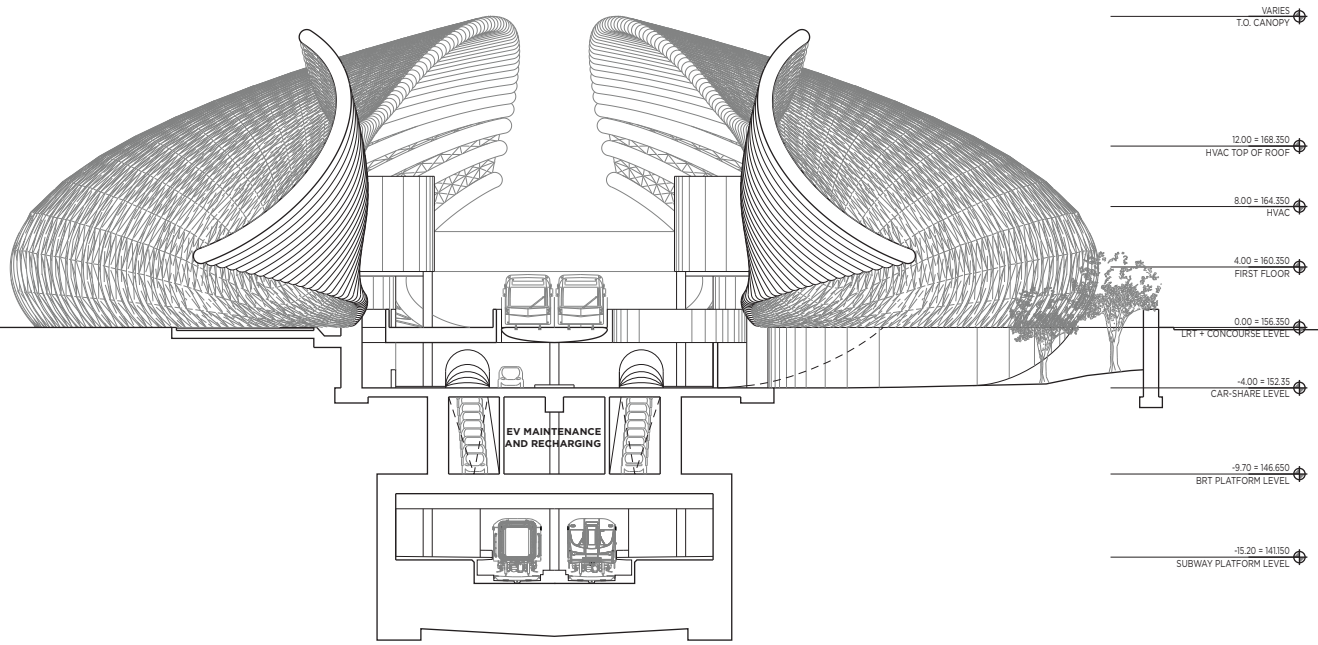


BUILDING SECTION A scale 1:500 2010.03.24

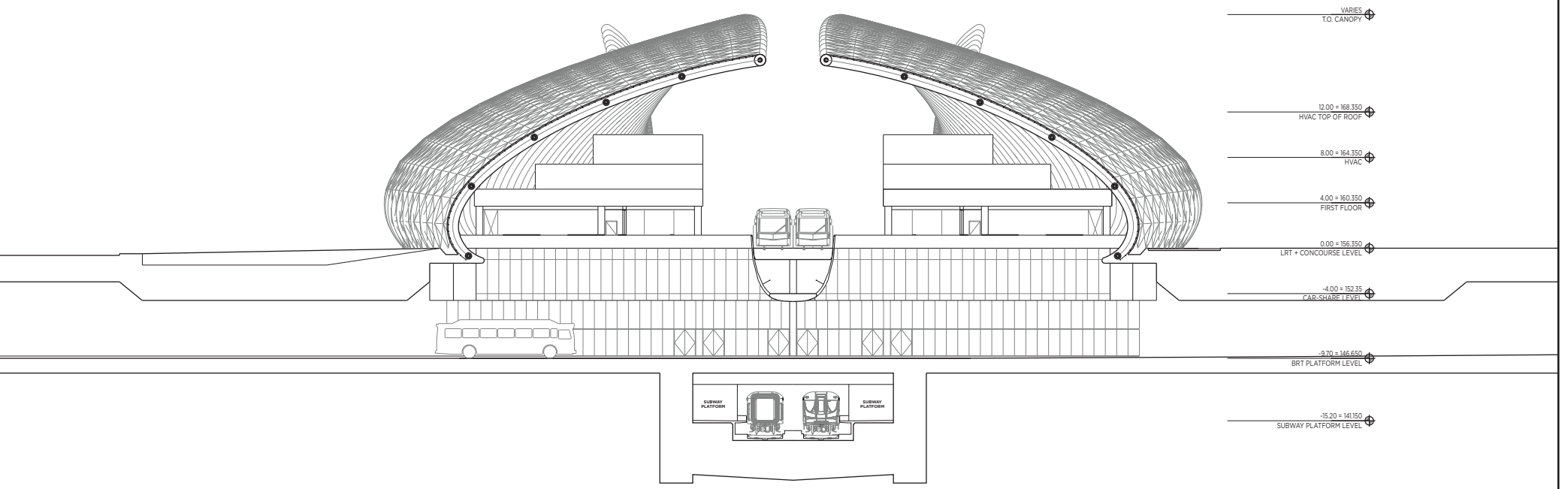
COMMERCE STATION

5555 COMMERCE BOULEVARD
MISSISSAGA, ONTARIO

A400



1/401 **BUILDING SECTION E**



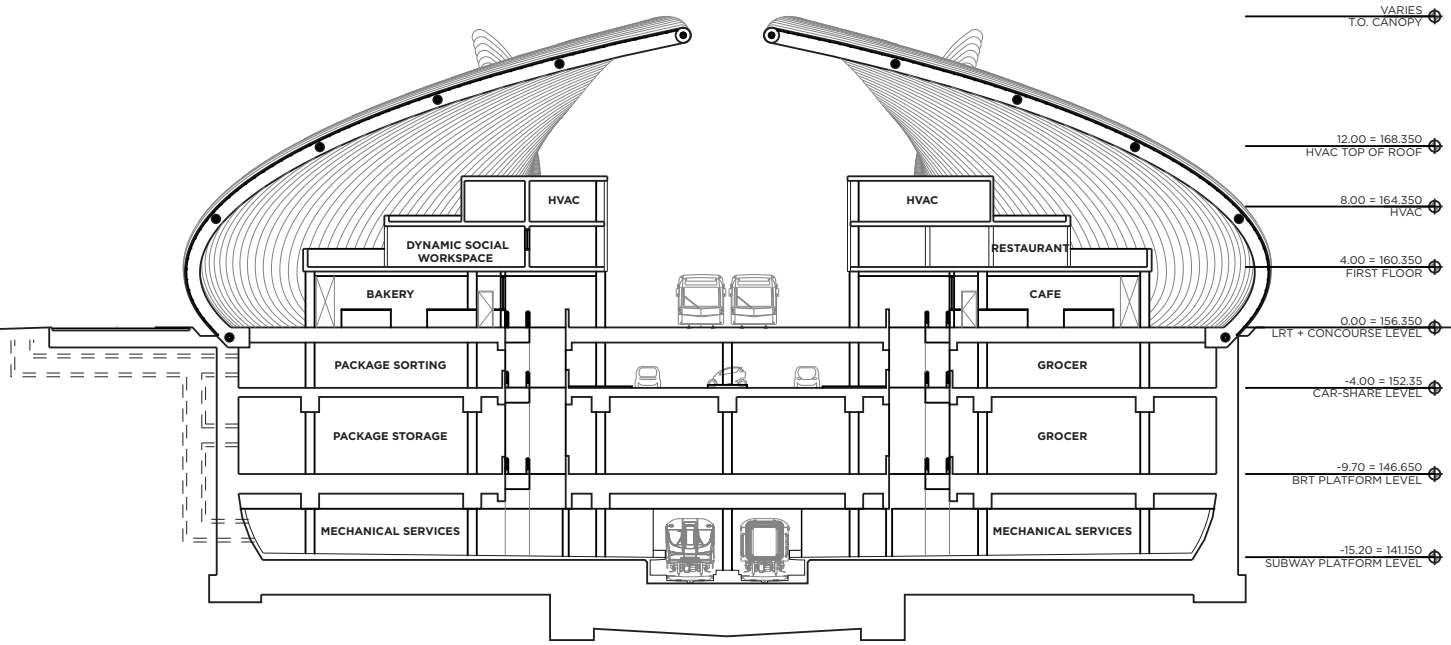
2/401 **BUILDING SECTION B**

BUILDING SECTIONS scale 1:500 2010.03.24

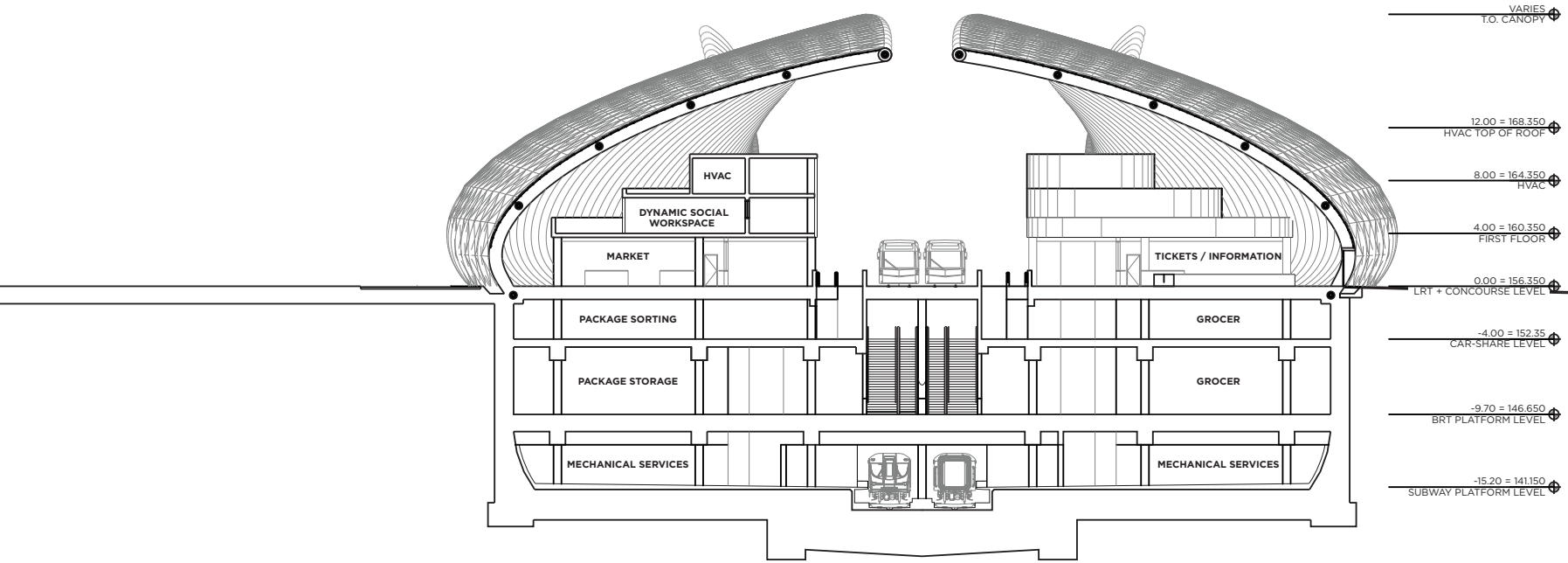
COMMERCE STATION

5555 COMMERCE BOULEVARD
MISSISSAGA, ONTARIO

A401



1/402 **BUILDING SECTION D**



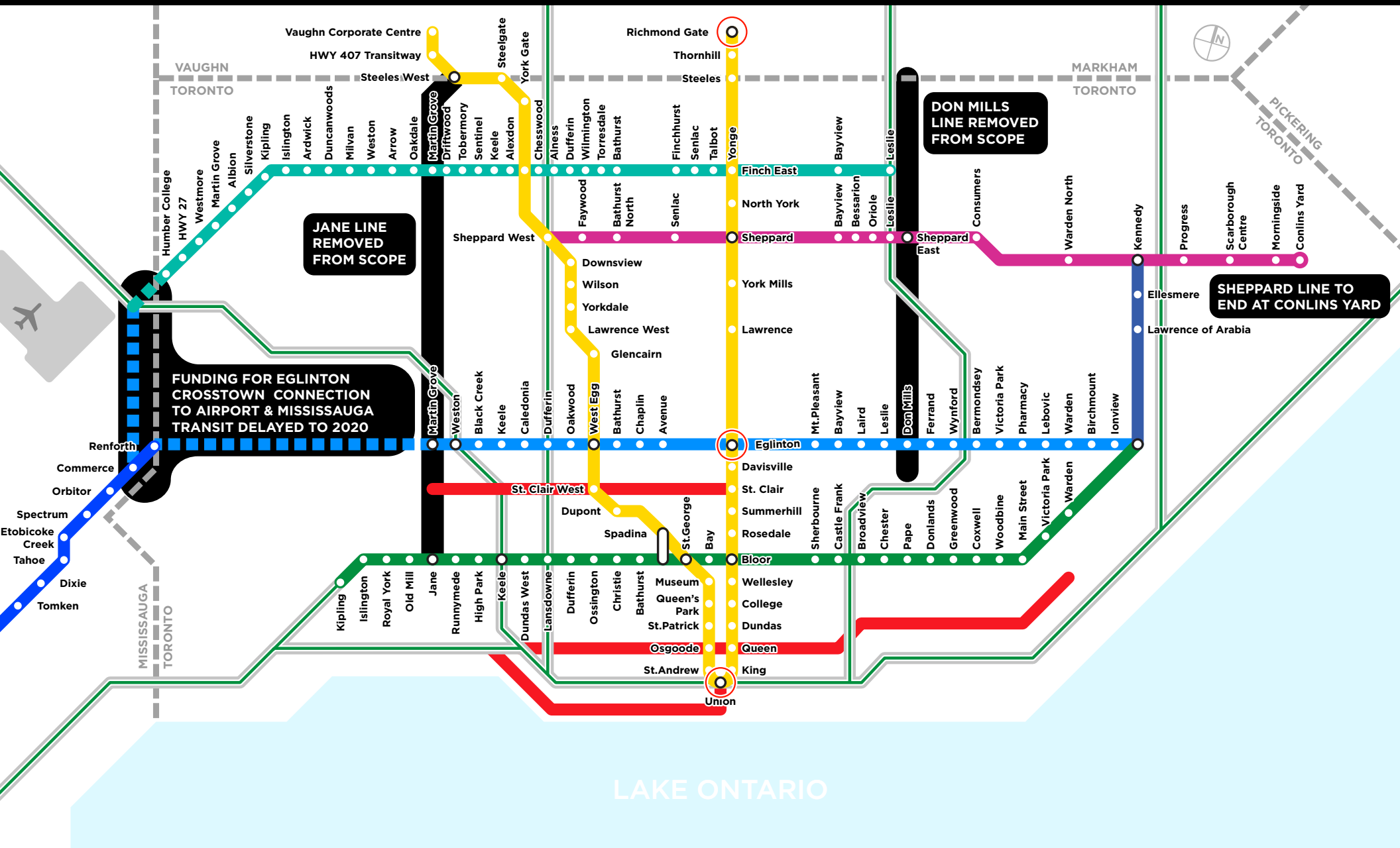
2/402 **BUILDING SECTION C**

BUILDING SECTIONS scale 1:500 2010.03.24

COMMERCE STATION

5555 COMMERCE BOULEVARD
MISSISSAGA, ONTARIO

A402


Vaughn Corporate Centre
HWY 407 Transitway
Steeles West
Steelgate
York Gate
Richmond Gate
Thornhill
Steeles
VAUGHN
TORONTO
MARKHAM
TORONTO
PICKERING
TORONTO
DON MILLS
LINE REMOVED
FROM SCOPE
JANE LINE
REMOVED
FROM SCOPE
Humber College
HWY 27
Westmore
Martin Grove
Albion
Silverstone
Kipling
Islington
Ardwick
Duncanwoods
Milvan
Weston
Arrow
Oakdale
Martin Grove
Driftwood
Tobermory
Sentinel
Keele
Alexdon
Chesswood
Alness
Dufferin
Wilmington
Torresdale
Bathurst
Finchhurst
Senlac
Talbot
Yonge
Bayview
Leslie
Finch East
Faywood
Bathurst
North
Senlac
North York
Bayview
Bessarion
Oriole
Leslie
Consumers
Warden North
Kennedy
Progress
Scarborough
Centre
Morningside
Conlins Yard
Sheppard West
Downsview
Wilson
Yorkdale
Lawrence West
Glencairn
Sheppard
York Mills
Lawrence
Sheppard
East
Ellesmere
Lawrence of Arabia
SHEPPARD LINE TO
END AT CONLINS YARD
FUNDING FOR EGLINTON
CROSSTOWN CONNECTION
TO AIRPORT & MISSISSAUGA
TRANSIT DELAYED TO 2020
Renforth
Commerce
Orbitor
Spectrum
Etobicoke
Creek
Tahoe
Dixie
Tomken
Martin Grove
Weston
Black Creek
Keele
Caledonia
Dufferin
Oakwood
West Egg
Bathurst
Chaplin
Avenue
Mt.Pleasant
Bayview
Laird
Leslie
Don Mills
Ferrand
Wynford
Bermondsey
Victoria Park
Pharmacy
Lebovic
Warden
Birchmount
Ionview
Eglinton
Davisville
St. Clair West
St. Clair
Dupont
Summerhill
Spadina
St.George
Bay
Rosedale
Sherbourne
Castle Frank
Broadview
Chester
Pape
Donlands
Greenwood
Coxwell
Woodbine
Main Street
Victoria Park
Warden
Bloor
Kipling
Islington
Royal York
Old Mill
Jane
Runnymede
High Park
Keele
Dundas West
Lansdowne
Dufferin
Ossington
Christie
Bathurst
Museum
Queen's
Park
St.Patrick
Wellesley
College
Dundas
Osgoode
Queen
St.Andrew
King
Union
MISSISSAUGA
TORONTO
LAKE ONTARIO

CONCLUSIONS

In April 2010, the Ontario Provincial Government announced a four billion dollar cut-back to the Toronto Transit City budget as part of a strategy to reduce the provincial debt, which had been escalating in the wake of the 2008 global recession. What this means is that the Ontario Provincial Government, along with Metrolinx, the Provincial body that had assumed control of Go Transit interregional buses and trains, have chosen to phase Transit City over a longer time period. Unfortunately, this jeopardizes the connection of Eglinton Avenue West to Toronto International Pearson Airport. Rather than being completed by the year 2020, this section of the Greater Toronto Area transit network will only just manage to break ground. However, in light of the plans currently laid by the TTC and Mississauga Transit, this extended development period will allow for a reassessment of the site at Commerce Boulevard, where the Eglinton LRT will connect to the Mississauga Transit BRT and branch northwards to the airport.

From details diclosed to me in an interview with TTC engineer Frank Altomare, the plans for this station so far show a physical disconnect between the two municipal transit services. This disconnect is manifested in two distinctly separate stations at the same intersection. This should be amended and steered by Metrolinx, whose role it is to integrate transit services across the region.

While Metrolinx is currently only staffed by upper level policy makers, in five or six years time, they may have the engineering and architectural design staff capable of integrating the two services under one roof and making the interregional transfer station the destination that it needs to be in order for interregional transit to thrive.

What this means for Toronto is that the city just might be in a position to attract a significant number of people away from single occupant commuting and into public and active transit as their primary means of commuting by 2030.

Much of the Central Business District is already moving towards pedestrian oriented streets and crossings with the installation of “scramble” intersections and the continuing development and demand for condominiums within and around the Central Business District and Toronto Waterfront. This is indicative that Toronto could be moving away from +70% automobile commuter model, to something more sustainable from a city building perspective where land for housing and commerce should be given priority over land for vehicle storage.

The slight delay in the schedule of Transit City could very well put Toronto at an advantage by allowing enough planning and coordination time between transit organizations, to harness the potential of our future multi-modal transit hubs as more than transfer points, as more than amenities, and as restorers of civic life to the fringes of our suburbs and loci of our city-centres.

Fig.6.1 Transit City map amended subsequent to the release of the “Five in Ten” plan proposed by Metrolinx

“Alors, dira-t-on, quel intérêt y-a-t’il a conserver les lieux de travail au centre de Paris?

Admettons l’impossible, le bain-fonde de la théorie: les villes satellites prospèrent. Elles absorbent une grande partie des habitants de la ville.

Paris se vide, Paris devient un trou vide. Les maisons sont vides; répaires de truands ou écroulement des maisons abandonnées. Il faudra les démolir.”

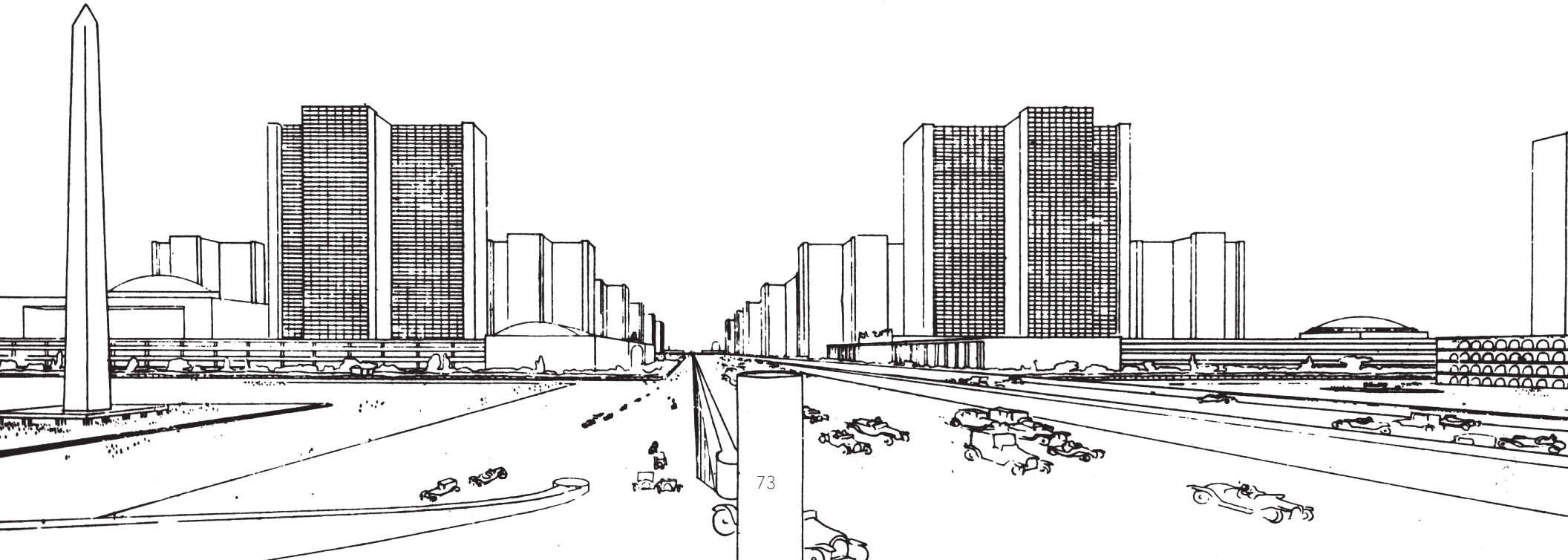
Le Corbusier, Les Plans de Paris, 1922-1956

“So, what good is it to continue to locate the workplace in the centre of Paris?

Let’s admit the impossible, the basest theory: that bedroom suburbs are thriving. They’re absorbing the majority of the population of the city.

Paris is emptying, Paris is becoming an empty pit. The houses are empty; hideouts of gangsters or victims of collapse. We must demolish them”

Le Corbusier, Les Plans de Paris, 1922-1956



VILLE RADIEUSE

The Swiss modern architect, Le Corbusier, centred his aesthetic and pragmatic concerns around the building as a machine for living. Having been inspired by the post-industrial mechanization of daily life, Le Corbusier developed one of the most unapologetic visions of car-centric city planning in his "Ville Radieuse," "Plan Contemporaine," and "Plan Voisin," proposed for Paris, France in 1922. All of these visions presume the demolition of the historic city centre in favour of high density residential towers surrounded by green space and interconnected by freeways. Le Corbusier argues that his plan must be implemented in order to save his beloved Paris from the imminent crisis of 'museification' and the inevitable exodus of Parisians to new, "satellite suburbs." His proposals outline a method of bringing the desirable qualities of suburbia to the city centre by situating high-density population towers within massive parks interconnected by freeways. These revolutionary schemes, however, have historically met with great criticism for their total disregard for the conservation of history, as they would see the city centre demolished in favour of an array of cruciform, high-density towers, a series of parks, and, most evidently, expressways laid-out in a regular, repeating pattern.

What is interesting about Le Corbusier's Paris master plans is that they all aim to provide large green spaces sheltered from traffic. However, Le Corbusier never asks the question of how much green space is enough. The irony is that the vast green expanses between towers would likely only encourage more driving as the inhabitants would seek less laborious and circuitous routes to their destinations. It is the limitless separation of

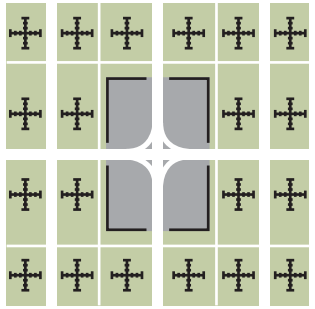


Fig.7.1 (Opposite) Perspective drawings of the Ville Radieuse, by Le Corbusier

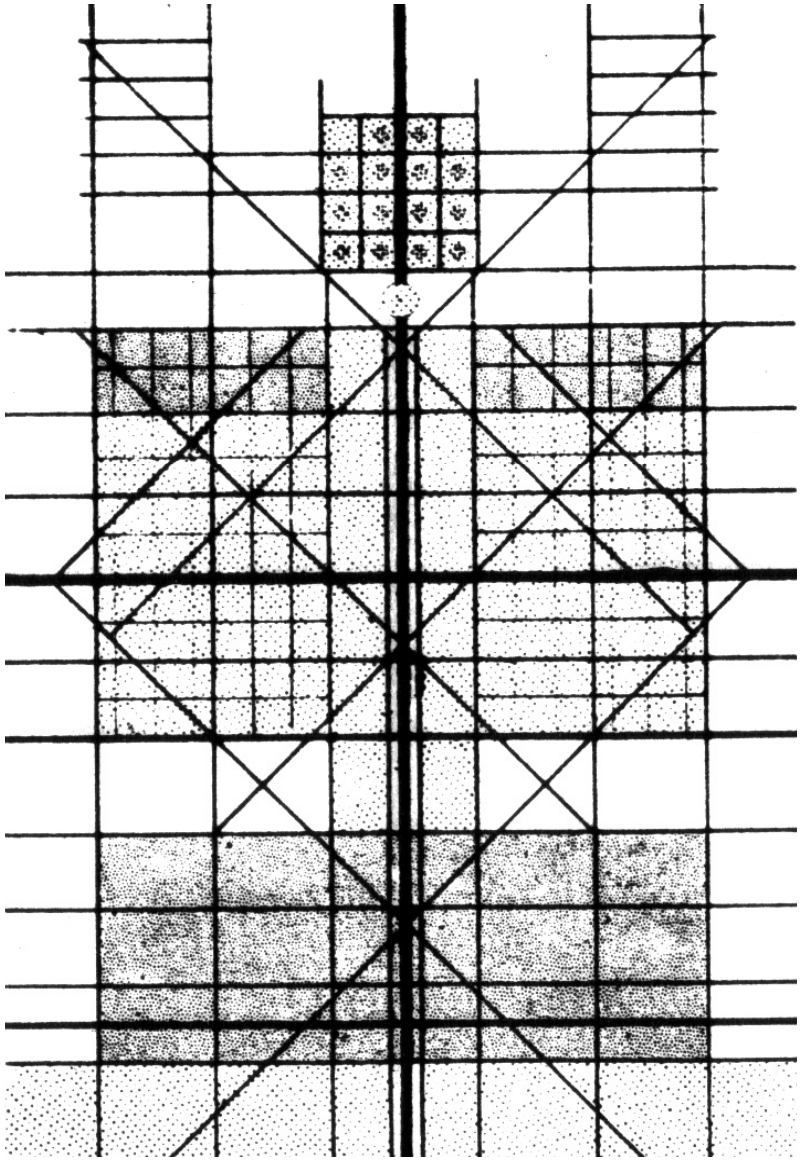


Fig.7.2 Road plan of the Plan Voisin, by Le Corbusier

programme that causes Le Corbusier's Paris to fail; the separation of road from park allows the park to become an oasis, however, it is the oasis that requires more driving of the Parisian, as he must drive around it to reach his destination.

The vibrancy of the city centre of Paris lies in its heterogeneity of street forms and wealth of culturally significant edifices which can be enjoyed at the very basic level of the pedestrian. In Baron Haussmann's restructuring of Paris starting in the 1860s, it was ensured that the vistas down the streets and boulevards were terminated by public monuments and squares. This made for an excellent pedestrian and coach transit city, however, this particular urban design strategy later lead to the automobile congestion problems around L'Arc de Triomphe, around which twelve streets terminate and caused congestion throughout the city. Le Corbusier, with Haussmannian zeal, envisioned this rich urban fabric replaced with a regular, predictable grid of uniformly constructed towers bisected by expressways, and often pointed out the contrast between the existing medieval urban fabric of Paris and the Descartian rationality of his proposals in drawings delightfully accentuated the difference in juxtaposition. It would appear that his intentions were not only to confront the exodus to the suburbs, but confront the conditions of early twentieth century industrial Paris, this he did by creating spaces which he simply described as, "vert." We understand the meaning of green spaces, but the renderings that Le Corbusier offered to describe these spaces leave much to be desired. He seems, unfortunately, to have designed space and not place.

If transit is the design of systems of movement, then the greatest flaw of Le Corbusier's "Plan Contemporaine" and "Plan Voisin" is that the systems of movement are entirely segregated

from one another. In some cases the civilian car traffic rides above the commercial traffic, and pedestrian traffic is forced through underground passages. In other cases, pedestrian traffic flows over the highways in the form of inter-linked concourses while all forms of car traffic move along the ground plane. The great danger of this strategy of design is that the pedestrian, while seeing where he wants to go, cannot perceive a means to arrive there. Furthermore, he is trapped in a roadscape that is built at the scale of the car, leaving the pedestrian to travel greater lengths to reach his destination. Ultimately it creates spaces that cannot become places. In either case, pedestrians are removed from the ground plane, implicitly declaring the greater value of the automobilist.

What is genuinely striking about this modern vision is that Le Corbusier recognises the importance of the city-centre, and suggests that he would rather see the historical demolished in order to save the centre itself, than see Paris, "Museified." Whether this is what he desired or whether he was bluffing is hard to determine, however, it is with the design of his Paris master plans that Le Corbusier was warning his contemporaries that if steps were not taken to ameliorate the sociological and environmental conditions that had been aggravated and accelerated by the advent of the mass use of the automobile, the vibrant Historical city-centre would be lost and automobile-centric city form would dictate the segregation of urban forms stemming from recreational automobile use to inescapable automobile-use.

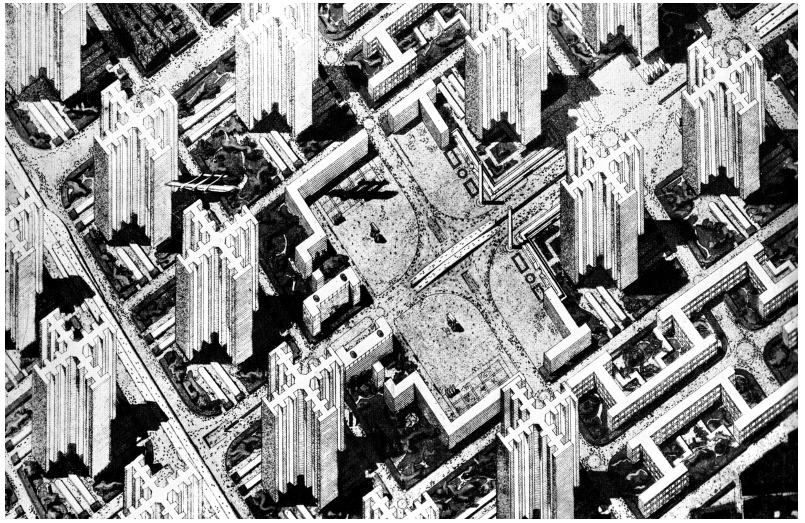


Fig.7.3 Axonometric rendering of the Ville Radieuse, by Le Corbusier

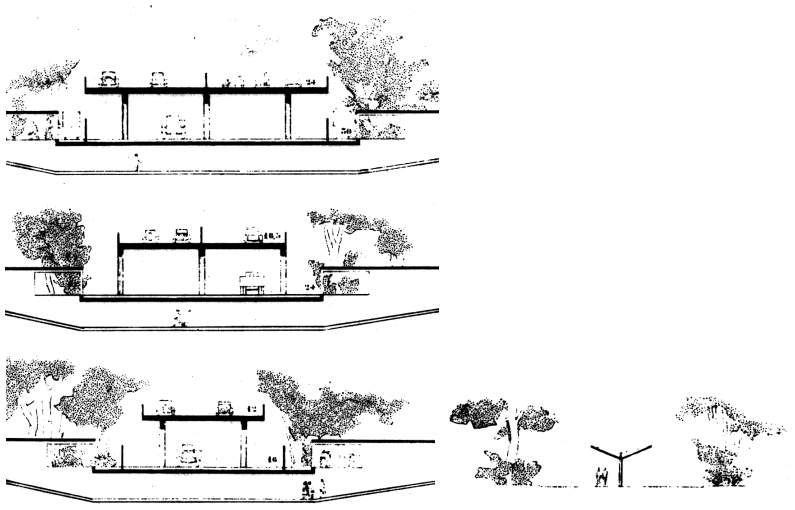
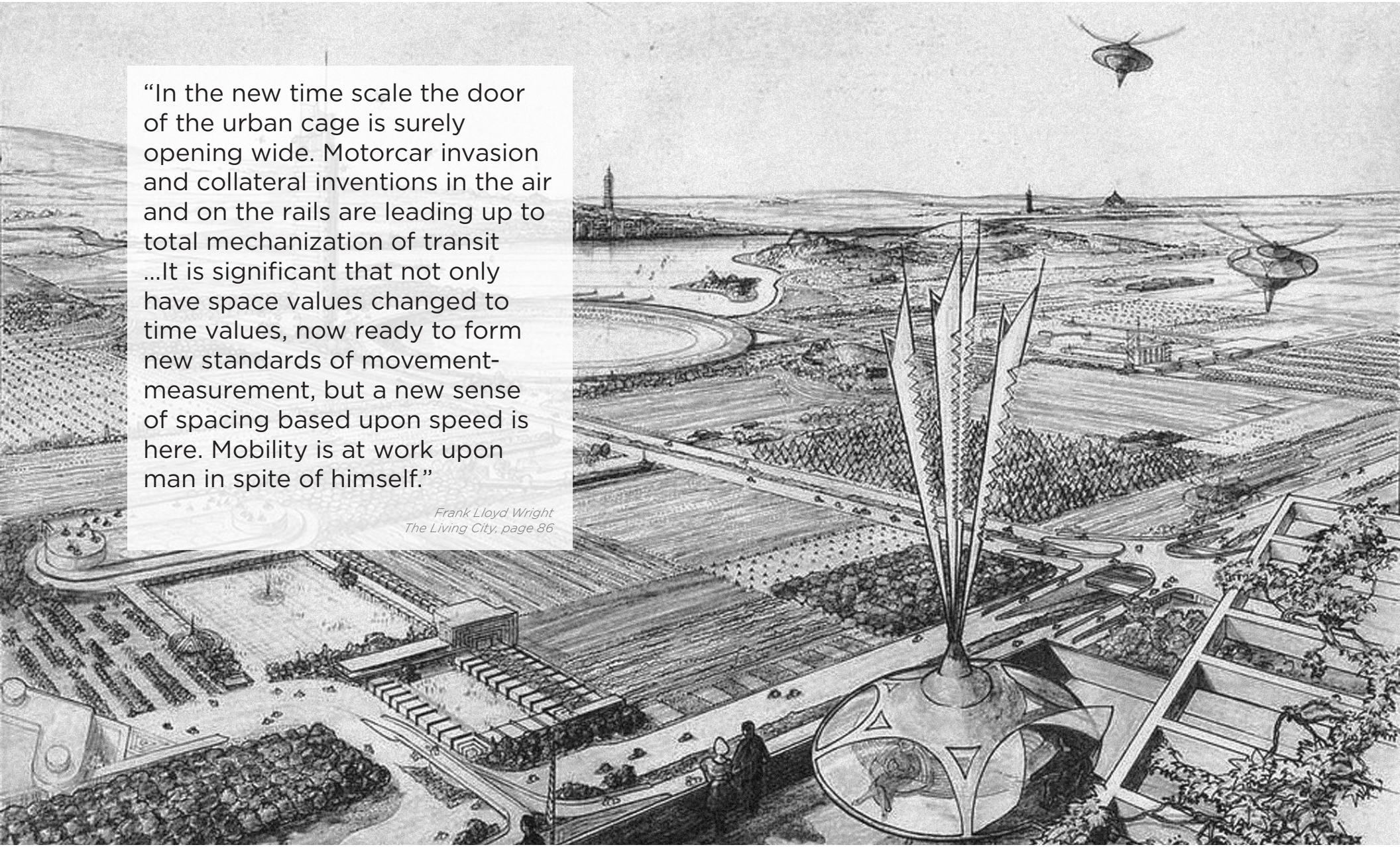


Fig.7.4 (Above) three sections illustrating the grade separations between civilian and commercial traffic, and one depicting a covered pedestrian walkway



"In the new time scale the door of the urban cage is surely opening wide. Motorcar invasion and collateral inventions in the air and on the rails are leading up to total mechanization of transit ...It is significant that not only have space values changed to time values, now ready to form new standards of movement-measurement, but a new sense of spacing based upon speed is here. Mobility is at work upon man in spite of himself."

Frank Lloyd Wright
The Living City, page 86

BROADACRE CITY

In theoretical opposition to Le Corbusier's infinite grid of high-density point towers networked to a park system was Frank Lloyd Wright's vision for Broadacre City. They both perceived the same social and industrial problems of crime, traffic congestion, smog, and noise inherent of the metropolis. They also both saw the automobile as the catalyst for these master plans. However, Wright's answer to the urban condition was not to gut and re-inhabit the city centre but to spread out across America's vast landscape in pursuit of a low-density, pastoral grid of American settlement, eliminating polution, over-crowding, poverty, and the, "scaffolding of a civilization defacing every countryside,"(broadacre thesis pg.17) in his famous Broadacre City master plan.

> "Throughout our amazing civilization the citizen is already going "afield" because the machine that brought him to the city is as able to take him back again. When he wakes to a larger and better sense of himself he is free to go out and—prophetic—build the new city. Machine power subjected to man's own proper use will enable him as a citizen to live in a better city in a better developed countryside because he is no longer conscript either by or for the agencies now keeping him at least available as one."
>
> Frank Lloyd Wright
> The Living City, page 86

Fig.7.5 (Opposite) Perspective drawings of Broadacre City from The Livable City

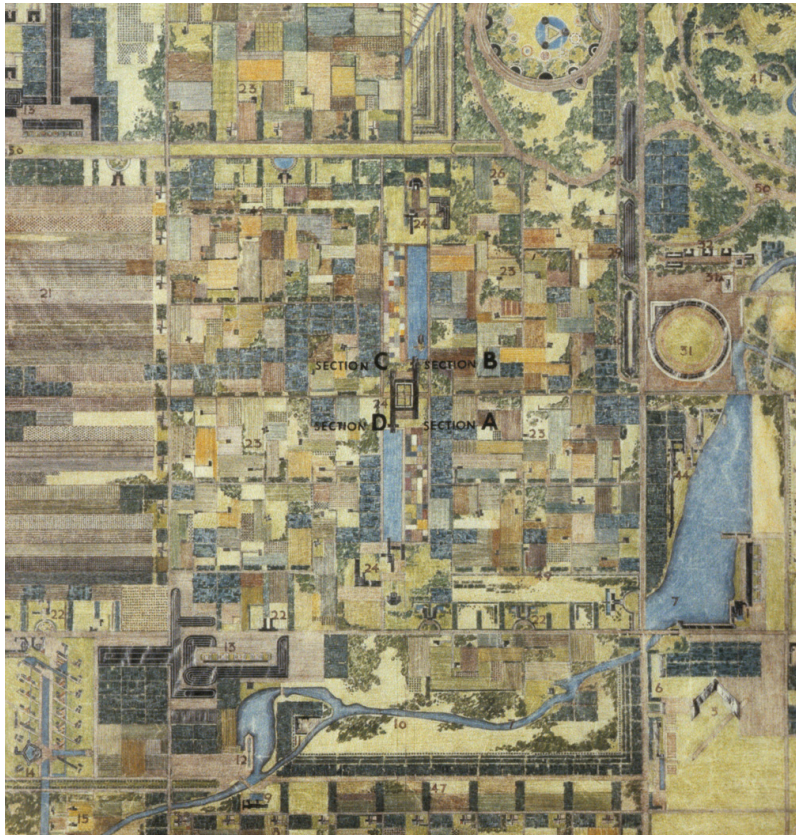


Fig.7.6 (Above) Broadacre Masterplan

Broadacre was conceived as a system of granting every American in the United States one acre of land, and through careful design, it was proposed that a vast, horizontal city could be sustained through private agrarianism and automobile facilitated transit, while the use of electricity, oil, and gas in place of coal, would cure the country of smog. The principles of Broadacre City were outlined thus by Frank Lloyd Wright:

> In Broadacres all is symmetrical but it is seldom obviously and never academically so… Sociologically, Broadacres is a release from all that fatal "success" which is after all, only excess. So I have called it a new freedom for living in America.
>
> A New Freedom For Living in America:
> No Private ownership of public needs
> No landlord and tenant
> No "housing." No subsistence homesteads.
> No traffic problems. No back and forth haul.
> No railroads. No street cars.
> No grade crossings.
> No poles. No wires in sight.
> No ditches alongside the roads.
> No headlights. No light fixtures.
> No glaring cement roads or walks.
> No tall buildings except as isolated parks.
> No slum. No scum.
> No public ownership of private needs.
>
> Wright, The Living City, fold-out inside cover

In Wright's printed guide to Broadacre City, he further emphasized the mass decentralization of society by specifying smaller building footprints, "little school," little cinema," "little factories" and "little farm units," while emphasizing, "commodious dwellings.

The proposed density of Broadacre City would likely be scoffed at by contemporary and historical developers alike, however, it can't be denied that much of suburban America has developed according to a less idealistic brand of Broadacre City. It would seem that Wright's Utopian ideal of a suburban, neo-agrarian field, attempting to exist in organic harmony with

the landscape has been subverted for the Levittowns[1] and Alan Berger's drosscapes. Ironic, considering that Wright's vision for Broadacre was largely an attempt to free residential living from the pollution of industrial processes. Today, the current peri-urban conditions of North America are mainly composed of constellations of large industrial citadels, quite the antithesis of Broadacre.

Broadacre City proposed that American land should be developed to a minimum density. It also recognized the importance of the agrarian factor in terms of its near absolute settling over the land, however, because this was incorporated as a social aspect rather than one of laissez-faire, capitalist gain, it has yet to be realized in contemporary suburbia. The variable that allowed Broadacre to be envisioned remains the automobile, as Wright understood that it was the tool that would allow for decentralization above all others. It is curious that Wright sought to achieve an organic relationship with the landscape through the use of the automobile. Had Broadacre been implemented and the automobile failed, we can speculate that Broadacre City might have remained amenable as a field of quasi-isolated sustainable communities, however, to propose such a project today, with the automobile as its linchpin would invite ruin.

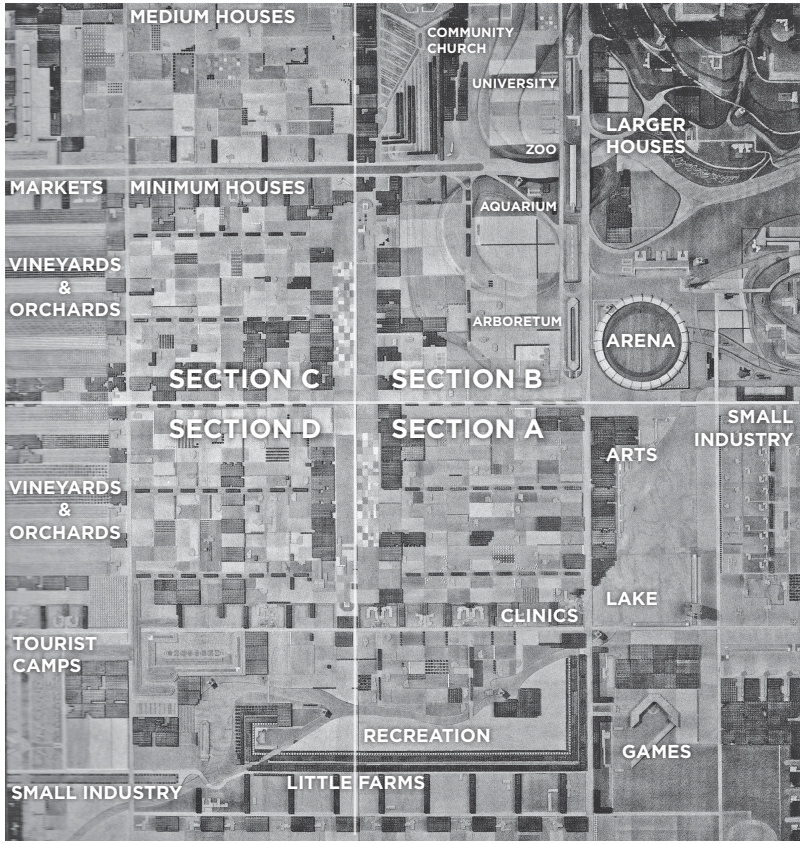


Fig.7.7 (Above) Broadacre Model

1. Levittown was the first truly mass produced suburb, it was developed by the Levitt Brothers on Long Island, NY. The Politics of Place

Architecture is also the street.

Louis I. Kahn,
Toward a Plan for Midtown Philadelphia, 1953

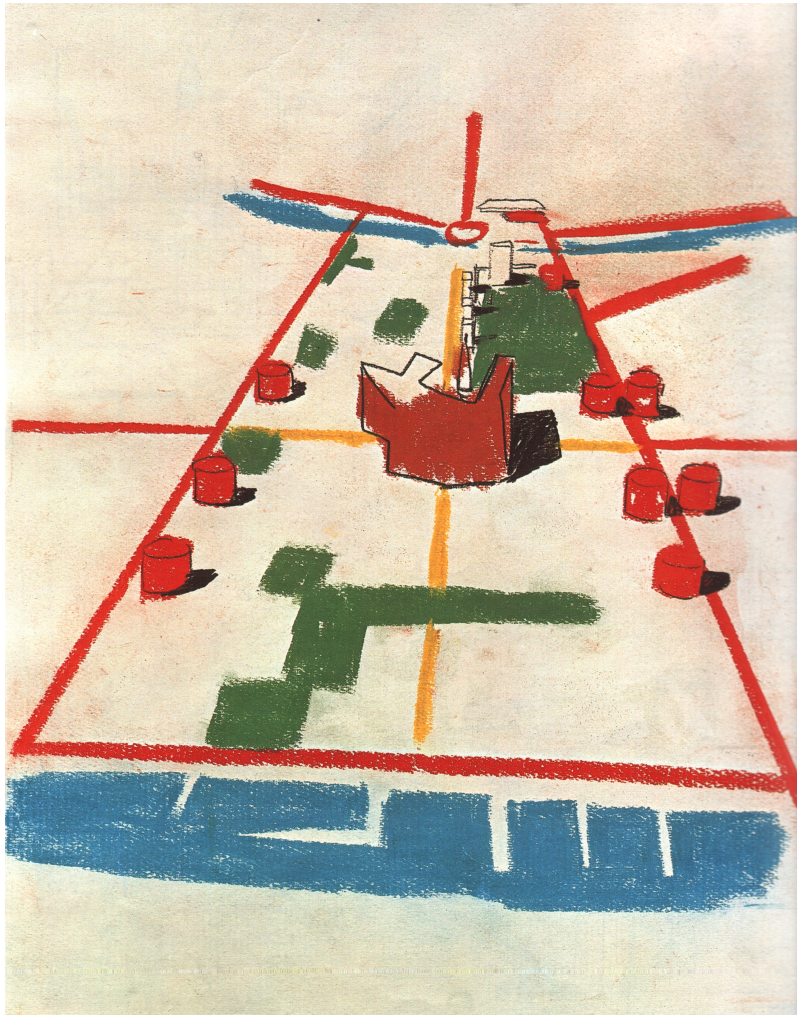
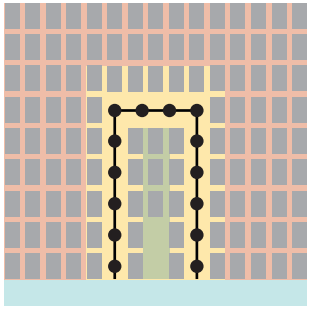


Fig.7.8 (Above) Perspective sketch of movement plan for Philadelphia, by Louis I. Kahn

NEW PHILADELPHIA



Seeking solutions for automobile congestion in the city centre between 1951 and 1953, the Philadelphia City Planning Commission and the Pennsylvania Railroad formed a board of appointed design consultants. Among them was architect, Louis I. Kahn, who made a series of "movement" studies for the city centre which gave a hierarchical order to the streets which had earlier been treated as equal in function. In a refreshing contrast to the iconoclastic designs of Le Corbusier, and one which did not abandon centralization like Wright, Kahn proposed working with the existing city fabric.

Kahn's movement studies elegantly apply order to the streets, not by demolishing and rebuilding them, but by assigning them functions; the "Through" streets connote expressways, "Go" streets, provided direct access to the city centre, "Staccato" streets, allowed for public transit and services, and pedestrian ways, which bar automobile traffic altogether.

Kahn explains that, "this system of movement is not designed for speed but for order and convenience." Going further, Kahn applied the poetic metaphors of "River" to the expressways, "Harbors" to the parking towers, canals to the "Go" streets, and "Docks" to the cul-de-sacs as a way of expressing what he saw these orders performing: the medieval defense of the city centre with the encircling "Rivers", and coincidentally the prevention of further citizens' escape to the suburbs.

Ultimately Kahn romanticized a pedestrian oriented city centre that could support markets, restaurants, theatre, parks, events, and generally foster civic life in a similar fashion

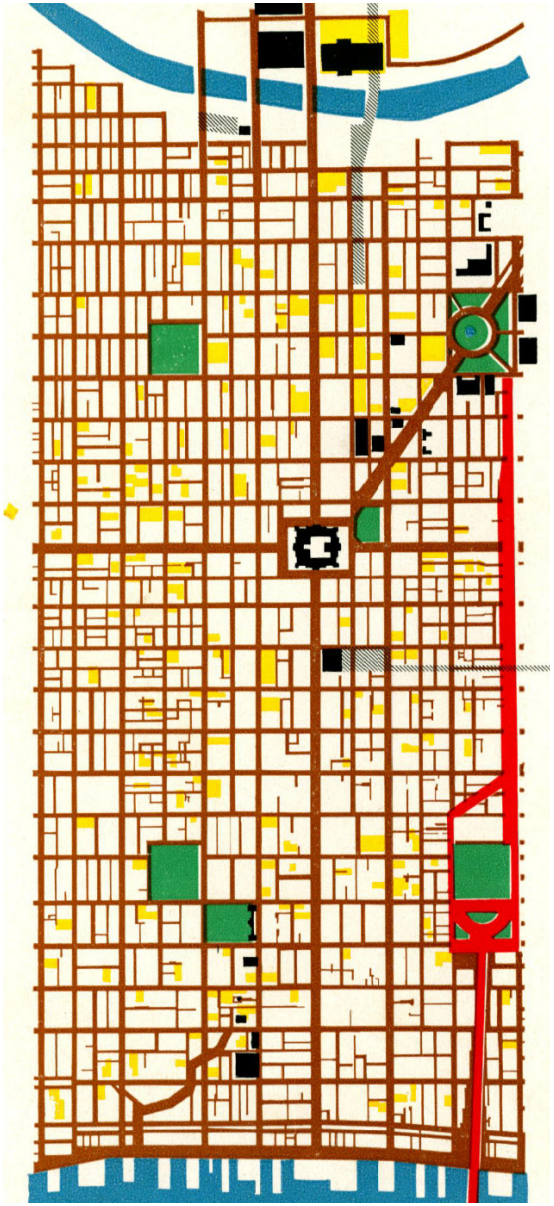


Fig.7.9 Existing Movement Plan of Philadelphia in 1951

Fig.7.10 Proposed Movement Plan for Philadelphia

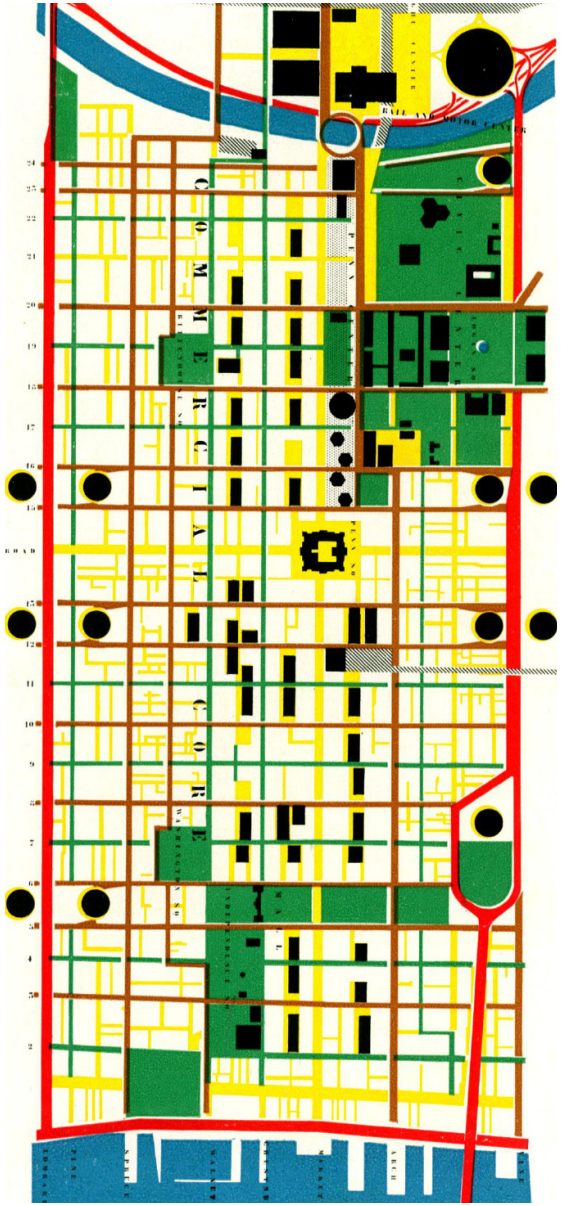


Fig.7.11 Proposed Building Plan for Philadelphia

as a modernized European styled city. However, on a grander, American scale. Hinting at this quality are the coliseum-like parking garages that he envisioned encircling the city centre. He went further and imagined in what qualitative way they could be enhanced at night with coloured lighting, transforming them into giant, monolithic beacons of the motor age.

Kahn's urban studies are commonly seen as a means to pedestrianize the city centre of Philadelphia, they don't do so outrightly, but there are some admirable considerations taken, such as that the, "...distinction of types of movement could also give rise to new building and merchandising ideas." However, the perimeter boundary of expressways and parking towers he proposed is problematic to a city centre that wishes to expand or that must do so. Much like medieval cities (such as Carcasonne, the medieval French city Kahn referenced) the fortress wall and moat restrict their growth to the confines of the walls. The parking towers that Kahn saw as gateways become a new suburban no-man's-land between the traveler and the city centre. So while admirable for its core goal of a civic urban centre, the megastructures proposed create a hollow where there could be vibrant interaction between the central business district and the residential periphery. Ultimately the conflicting goal of enabling Philadelphia to be a motor city while trying to inhibit automobile use at the center is what causes this concept to lose to more pragmatic concerns.

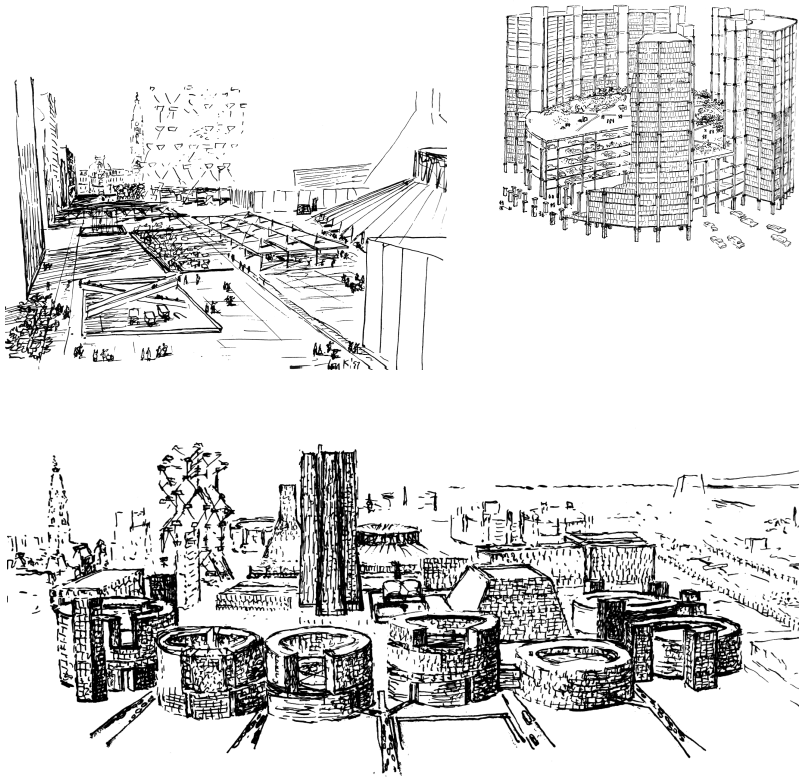
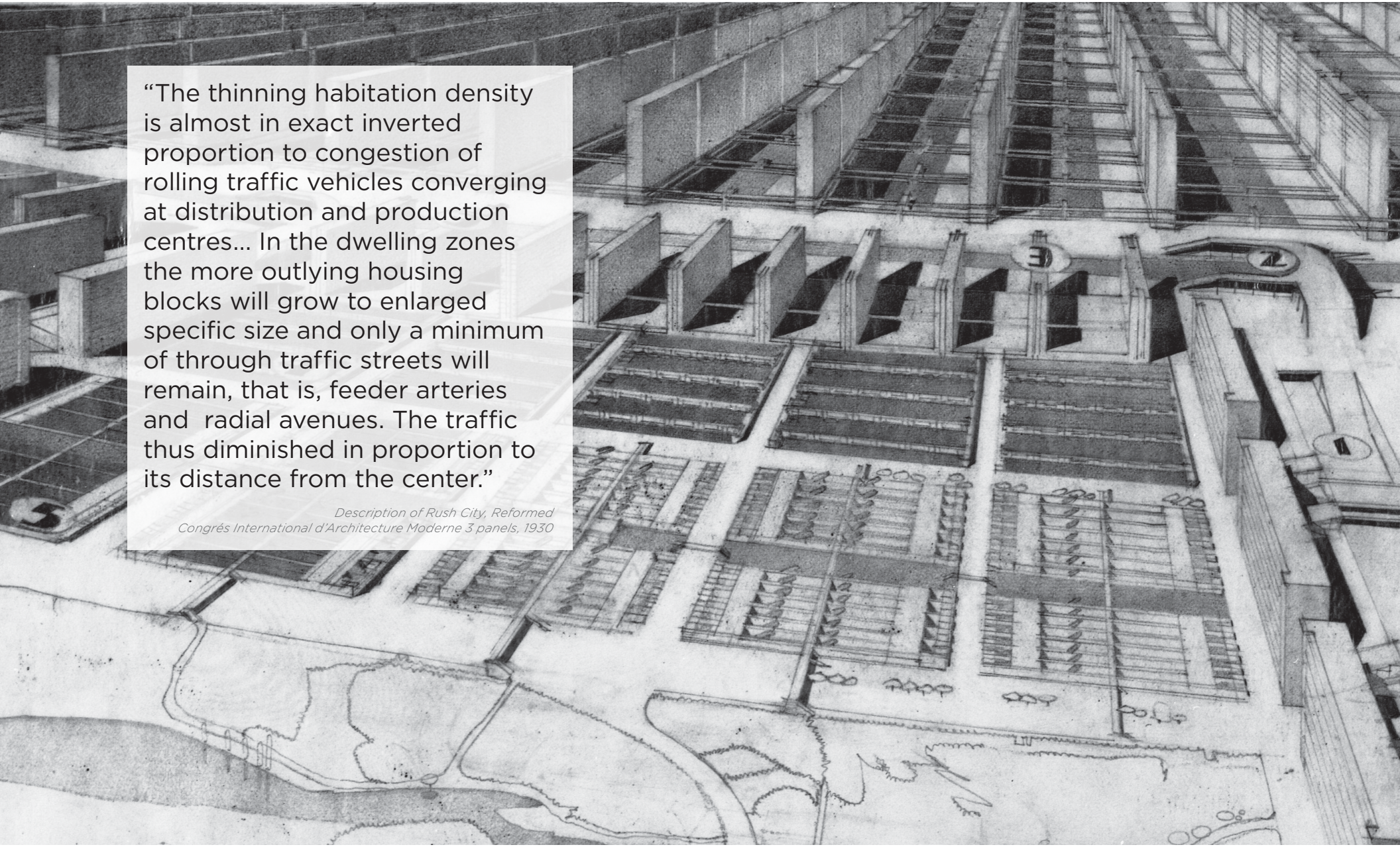
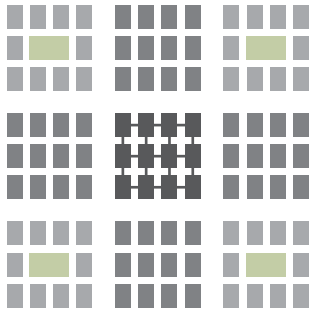


Fig.7.12 (Above) Accompanying legend to movement plans (Opposite) from Perspecta 2, 1953, pages 12 and 13
Fig.7.13 (Top) Monumental perimeter parking garages and pedestrian city centre with proposed city hall in background



"The thinning habitation density is almost in exact inverted proportion to congestion of rolling traffic vehicles converging at distribution and production centres... In the dwelling zones the more outlying housing blocks will grow to enlarged specific size and only a minimum of through traffic streets will remain, that is, feeder arteries and radial avenues. The traffic thus diminished in proportion to its distance from the center."

Description of Rush City, Reformed
Congrés International d'Architecture Moderne 3 panels, 1930



RUSH CITY, REFORMED

To further add to the Amongst the ideas for the model automobile city was one by the Austrian-born American architect, Richard Neutra. He approached the city from a much more pragmatic perspective, one of the constructor and developer. During the 1920s and continuing through the rest of his life, Neutra's theories for new city building were less concerned with aesthetics than Le Corbusier or Wright, and more with the how, the technology at hand: how could city be developed with existing and emerging technologies in order to reduce conditions of over-crowding and traffic jams. Neutra was not particularly original in his adoption of a residentially decentralized, suburban design philosophy, however, some of his ideas resembled a lower-density distribution of Le Corbusier's *Ville Radieuse* with the exception of there being a clearly defined central business district and particular attention paid to the configuration of the housing in the residential zones.

Neutra distinguished his central business district by stating that he believed business transactions occurred when people moved on foot, between office towers, and therefore connected them with pedestrian bridges.[1] He did this, because he still believed that the roadways adjacent the office towers should be restricted to vehicular access, allowing traffic to flow as freely as possible while pedestrian traffic would occur above, much like the grade separations between transportation modes proposed by Le Corbusier.

1. Page 23, Richard Neutra: The Idealization of Technology in America, a thesis by Marc Boutin for the Department of Art at the University of Calgary. Calgary, Alberta, Canada, October 2000

Fig.7.14 (Opposite) Perspective drawing of Rush City, Reformed, 1920s

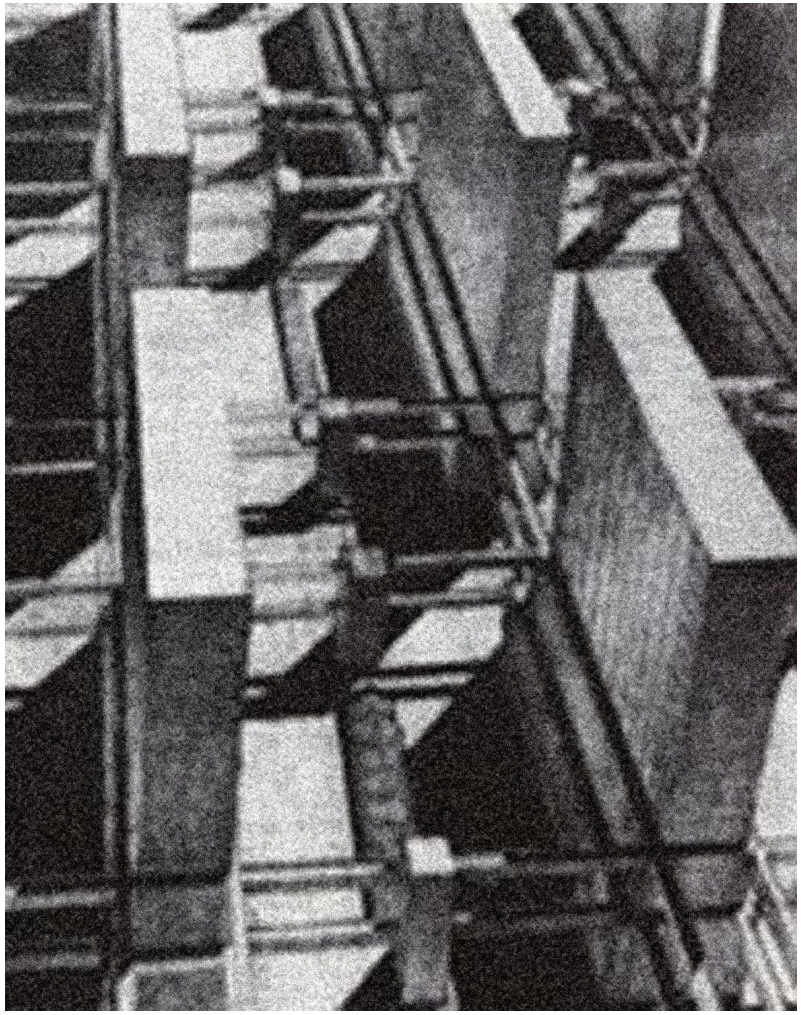


Fig.7.15 (Above) Perspective rendering office towers in the central business district of Rush City, Reformed interconnected via pedestrian bridges and access towers.

The network of pedestrian bridges he proposed is quite extensive and rigorous in its dependency on the Cartesian grid, however, while clearly offering some efficiencies in movement between clusters of related businesses, it would appear to be a hindrance to unrelated adjacencies and still largely rely on automobiles or transit to hold meetings. The underlying idea of expansive pedestrian bridges is counter-intuitive to the technological motivators for the surrounding development, second among them being telecommunications — were people actually expected to navigate the system of bridges from one end of the district to the other? Neutra clearly valued face-to-face relationships in business yet only provided for passageways to do so rather than civic meeting spaces.

The residential zones of Rush City, Reformed are where Neutra broke away from Le Corbusier's philosophies and he populated them with a grid of low to medium density developments that would connect to a community centre through an elongated commons. They were low lying, and the pedestrian was alway connected to the ground, Neutra even went so far as to propose sheltered arcades running between the backyards of the suburban row-homes. These were Neutra's "Division 3" and Division 4" housing types, that were modelled on inhabitation by families and families with adolescents, respectively. These were then surrounded by Divsion 1 and 2 developments which consisted of mid-rise apartment blocks suited to the needs of, adult individuals living alone," and, "Adult in couples: before kids or after kids leave."

The other building types he designed to address various amenities and services shared some common principles, a layering of various orders of traffic, segregated to distinct rights-of-way,

and a cellular relationship when it came to travelling between these amenities. The automobile or other form of mechanized transportation was intended to facilitate trips between, "link[s] within a well-arranged transportation system," but once disembarked, the cellular zones such as the CBD, the suburban units, the schools, and the "Transfers"(Neutra's term for multi-modal transit hubs), it was suddenly expected that the traveller would navigate these typologies on foot. The one exception to this system is apparently Neutra's proposal for a drive-thru market, "I have been able to incorporate a number of important features which are of direct appeal to the busy motorist who is anxious to make his purchase in attractive surroundings and with the greatest speed." This system, while envisioned as a single building type, is not so different from the "franchised strips" of mid-sized cities wherein the driver is presented with a number of billboards advertising the stores' wares at the scale appropriate to the speed of the motorist. The greatest difference being that reality has seen the development of massive parking lots behind these billboards rather than cues of automobiles accepting their purchases as they pass in front of merchandising windows.

The social engineering aspects of Rush City, Reformed were clearly too prescriptive to effect serious consideration of the his scheme. However, Neutra clearly understood the importance of the grid throughout the city. Although his drawings appear overwhelming in the repetition of their monolithic parts, the interconnectedness afforded by such a system would be valuable. If Neutra had incorporated some markets into his suburban zones, it might not have been such an isolating environment for those unable to drive, however, his total separation of movement modes in the Central Business District cannot but be seen as an error.

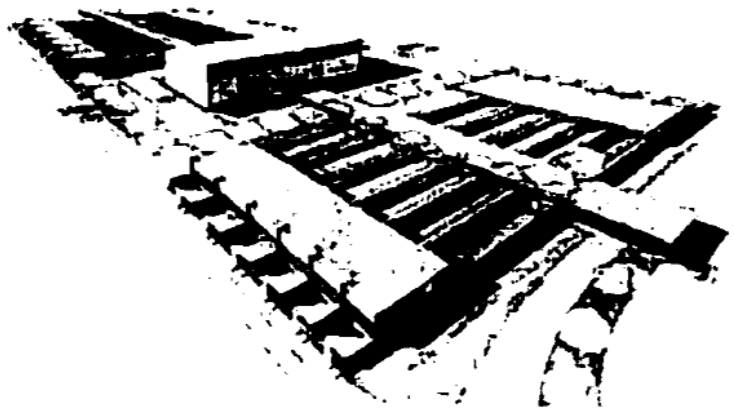


Fig.7.16 (Above) Perspective sketch of movement plan for Philadelphia, by Louis I. Kahn

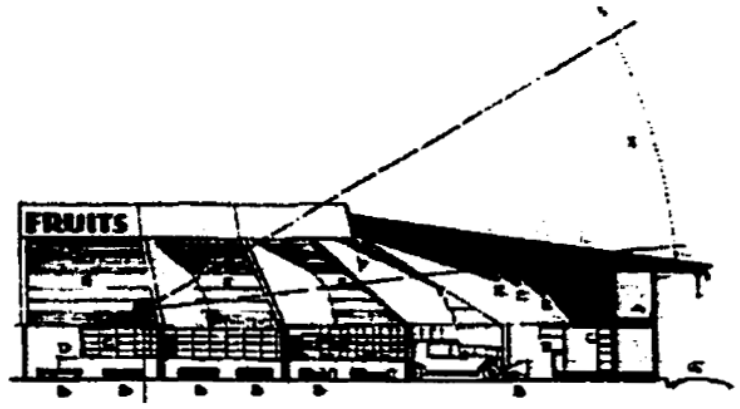


Fig.7.17 (Above) Perspective sketch of movement plan for Philadelphia, by Louis I. Kahn


"If more cars are inevitable, must there not be roads for them to run on? If so, they must be built somewhere, and built in accordance with modern design. Where? This is a motor age, and the motorcar spells mobility."
Robert Moses
The Atlantic, January, 1962
CALUMSETT STATE PARK
SUNKEN MEADOW STATE PARK
WILDWOOD STATE PARK
LONG ISLAND
THE BRONX
MANHATTAN
JERSEY CITY
QUEENS
BROOKLYN
HEMPSTEAD LAKE STATE PARK
VALLEY STREAM STATE PARK
BETHPAGE STATE PARK
BELMONT LAKE STATE PARK
CONNETQUO STATE PARK
BAYARD CUTTING ARBORETUM
HECKSCHER STATE PARK
GILGO BEACH STATE PARK
ROBERT MOSES STATE PARK
JONES BEACH STATE PARK

JONES BEACH

While not an architect, Robert B. Moses was one of the greatest builders in history and undoubtedly the greatest builder in North America, with thousands of miles of parkways, thousands of acres of parks, and many bridges, reservoirs, and dams to his credit. During his lifetime, Robert Moses held incredible influence over the city and state of New York, and simultaneously held up to twelve posts in municipal and state government. His vision of the city was one that was intensely urban, yet permitted the middle class to escape to developed parks and rural areas for recreation via the automobile. This vision of middle-class oriented recreational parkways connecting urban and rural areas is most evident in his first and arguably most successful project, Jones Beach State Park, on Long Island, New York wherein he connected and inverted existing infrastructure in order to provide function and amenity in a picturesque setting.

Preceding his appointment as president of the State Parks Commission by State Governor Alfred E. Smith, Moses became obsessed with planning a state park on Long Island. His aim was to satisfy the recreational needs of the average New Yorker who found it increasingly difficult to find space for leisure as the population of New York grew by the millions. To do this, Moses had to challenge the established rich and powerful of Nausau County who protected their many-acred estates with privately hired security and political influence. Previous public park advocates and government reformers had thought that land appropriation by the state was the only method to develop any form of park. Moses, however, took a physical approach, and

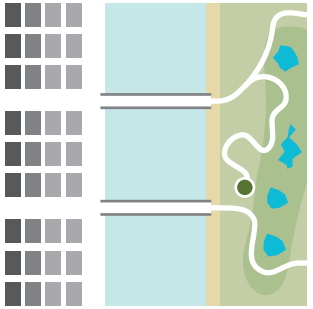


Fig.7.18 (Opposite) Plan of Robert Moses commissioned parkways interconnecting state parks from Manhattan to Long Island


NORTHERN STATE PARKWAY
MEADOWBROOK PARKWAY
PLANTED TREES, SCENIC BLIND
STONE CLAD OVERPASSES
SCENIC, INTEGRATED STORMWATER MANAGEMENT POND
WOODED BURMS

during personal trips to Long Island, he observed large tracts of undeveloped forest that piqued his curiosity. He inquired as to their ownership and discovered that they were municipally owned:

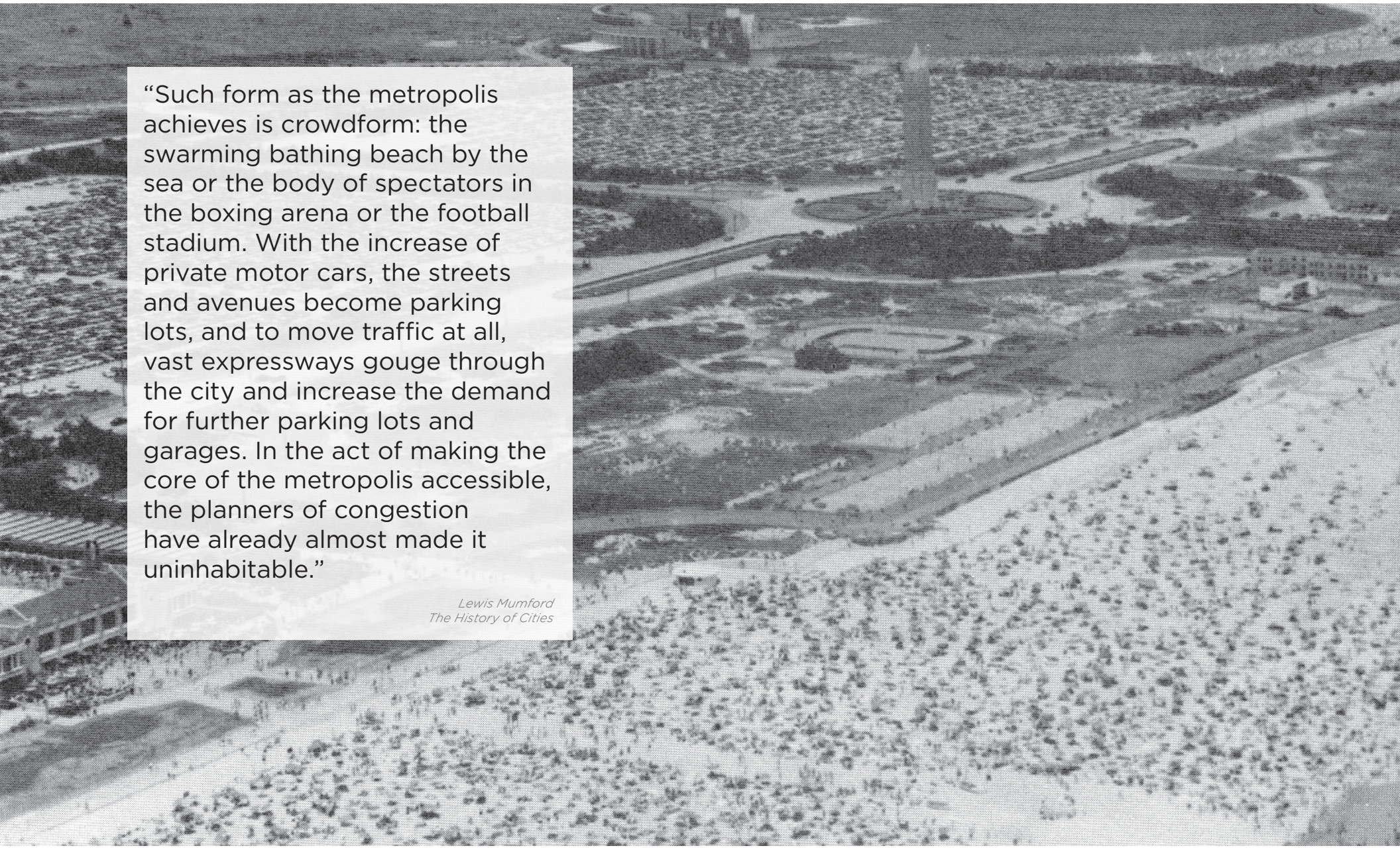
> Add together the acreage of the various tracts of woods, Moses could hardly believe the figures. [The Brooklyn water supply properties] totalled 3,500 acres. Three thousand five hundred acres just sitting there empty and unused.
>
> And ideally situated. All five tracts were within thirty miles of Manhattan, within eleven miles of the city line. The woods between Valley Stream and Lynbrook, infact, were only two miles from that line.
>
> And what you could do with those acres! There could be hiking trails through the woods, of course, and picnic sites in the clearings. But there could be more. When reformers, when park planners in general, talked about large parks they talked in terms of keeping them unspoiled and rustic, as close to nature as possible. Even Central Park contained relatively few facilities for any sports other than walking.
>
> But Moses saw a different vision. He had noticed meadows back in those woods that seemed just made to order for baseball diamonds, and the level spaces with only a few trees that could be cleared for tennis courts. Why, a portion of the biggest tract, the one between Lynbrook and Rockville Centre, seemed almost made to order for a golf course. And why should people be restricted to looking at the ponds and lakes? Why couldn't they swim in them? That great reservoir alone could cool thousands of sweating youngsters from the city! And there were so many acres available that even after all the facilities were laid out, there would still be vast stretches of woods that could be left untouched except for rustic hiking trails.
>
> The Power Broker, page 159

His epiphany came when he realized that by chaining the ponds and lakes together with roads, he would be able to open the water supply properties up to the public while appropriating very little land for a right-of-way through the private estates. In this idea was born the series of parkways that provide public access to Jones Beach State Park amongst many more.

It is the parkways in particular that explain much of Moses' vision of the recreational commuter. Designed for recreational escapes, freight trucks and buses having been legally barred from their use, Moses' parkways were more than channels to carry traffic, they were meant as a destination in and of themselves — landscaped with high, wooded berms in order to blind drivers from the flanking communities and immerse them in a romanticized, rural landscape. The Parkways were also constructed in such a fashion that infrastructure was treated as a luxury, Moses having personally awarded contracts to the engineers that specified the most expensive stone in their tenders. The Parkways were meant to encourage automobile driving by enhancing the experience and making it the exclusive privilege of the middle and upper classes.

The State Parks and Parkways of Long Island were seen as a way to allow the city of New York to breathe during its period of rapid growth in the 1920s and 1930s. It was a hugely popular undertaking, however, hindsight has revealed a possible hidden agenda, as public transit was prohibited from taking the Parkways and did could not extend to the State Parks. It is apparent that the Parkways were implemented with a mind to exclude the less

Fig.7.19 (Opposite) Aerial photograph of intersection of two of Moses' Parkways on Long Island. The landscaping incorporated into their design provides the driver with scenic vistas and keeps him unaware of the flanking communities; recreational driving design at its peak.



"Such form as the metropolis achieves is crowdform: the swarming bathing beach by the sea or the body of spectators in the boxing arena or the football stadium. With the increase of private motor cars, the streets and avenues become parking lots, and to move traffic at all, vast expressways gouge through the city and increase the demand for further parking lots and garages. In the act of making the core of the metropolis accessible, the planners of congestion have already almost made it uninhabitable."

Lewis Mumford
The History of Cities

affluent and indigent New Yorkers from leaving their urban centres.

The implicit exclusivity of the Parks created by Moses is not the only flaw in his legacy. The the network of parkways from the city centre provided amenities to those who could possess a car, but it also caused people to move further and further from the business centres to low-density suburban and exurban locations. The automobile was once a symbol and physical means of accessing freedom to these very suburbias, however, since the United States hit national peak oil in 1973, the automobile has become a necessary burden. Necessary due to the automobile-oriented urban planning that it spawned, and a burden because now it is the best way to navigate these same urban planning policies become manifest.

In his attempt to free his fellow New Yorkers from congestion and gridlock, he fuelled the automobile dependency, exacerbating the very condition he was fighting.

Fig.7.20 (Opposite)Jones Beach State Park, sometime before the publishing of The Power Broker, by Robert A. Caro

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