



Urban Transit

CANADA
TODAY / D'AUJOURD'HUI

Moving Experiences

Public transportation in Canada is clean, comfortable and pretty fast.

It is also popular. Last year, while transit systems in Chicago, Boston and New York lost 6 to 10 per cent of their riders, Toronto, Montreal, Edmonton and Calgary gained between 6 and 12 per cent.

Toronto and Montreal have modern subways, buses and commuter rails; Calgary and Edmonton have fast, fuel-efficient electric light rail systems; and Vancouver has buses on both land and sea.

Some Canadians ride double decker trains, some can Dial-A-Bus from home, and many of them can still spend jolly hours on a trolley.

In this issue of CANADA TODAY/D'AUJOURD'HUI we take a look at urban life on the fast track.

Sic Transit

Modest, horse-drawn omnibuses came to Toronto in 1849. W. Williams, a Toronto cabinetmaker, built four, six-passenger carriages, hitched up his horses and carried passengers between the St. Lawrence Market and the Red Lion Hotel for six pennies.

Montreal had its first horse-drawn cars and six miles of track in 1861. Seven years later it had 400 horses, 62 cars, 41 sleighs and 21 omnibuses, and its system was carrying 2 million passengers a year.

Torontonians were also moving ahead. The Toronto Street Railway Co. began business with a thirty-year franchise, seventy horses and eleven cars. The speed limit for horses and cars was set

by law at six miles an hour. When the franchise ran out in 1891 the city took over. It paid the proprietor, Alexander Easton, \$1.5 million in cash and a \$600,000 mortgage and then sold the system the same year, for the same price, to William Mackenzie. Fares were set at 5 cents.

Electric cars followed the horses. By 1900 both Montreal and Toronto had trams and people were standing in line to get aboard—Montreal's system carried 43 million passengers that year.

Today cars still run on rails and electricity provides the basic power, but much else has changed. There are a lot more passengers. Last year Toronto carried almost 400 million. Mr. Williams would be surprised.



The newest advances in transit technology will be demonstrated at Expo '86, a world transportation exposition sponsored by the governments of Canada and British Columbia, to be held on Vancouver's waterfront from May 2 to October 13, 1986. The exposition, with the theme of "Man in Motion," will be part of the celebrations marking the centennials of the City of Vancouver and the arrival of the first transcontinental passenger train on the West Coast.

Montreal

Both Montreal and Toronto have close to 3 million people, but Montreal's 144-square-mile metropolitan area is the more compact. It has more than 18,000 persons to the square mile, almost twice as many as Toronto, and this makes moving people easier.

On the other hand, Montreal has a mean annual winter temperature of 26°F and an average annual snowfall of 120 inches, and that makes it more difficult.

The city has a dazzlingly beautiful subway, backed up by buses and suburban trains. The system is run by the Montreal Urban Community Transit Commission.

The subway, called the Métro, is part of an elaborate, sixteen-year-old underground/overground complex that allows Montrealers to use the downtown part of their cold city in February almost as easily as in August.

It began taking shape in the early 1960s when the Canadian National Railways asked developer William Zeckendorf to cover up twenty-two acres of ugly, open, elevated tracks in the heart of the city. Zeckendorf hired architects I.M. Pei and Mies van der Rohe, and together they built multi-leveled complexes, the first called Place Ville Marie.

Place Bonaventure (a typical complex) begins with the subway lines far below the ground. Above them is a five-acre arcade with shops, a movie house and restaurants. Above that is an exhibition hall which can hold 12,000. Then come the CN tracks and above them is a merchandise mart. Above the mart is the 400-room Bonaventure Hotel.

The subway opened in October, 1966. It has three lines numbered, somewhat oddly, One, Two and Four.

Line No. Four, the shortest, opened first, in time for Expo '67, Montreal's World Fair. It goes under the St. Lawrence River to St. Helen's Island and Ile Notre Dame (the Expo sites) and to the suburb of Longueuil.

Line No. Two, the longest, followed, first stretching 8.6 miles from Place Bonaventure to Henri Bourassa Street at the northern edge of town. It was later extended through three other districts, and a third leg will open in 1984.

Line No. One runs parallel to the river. It opened with ten stations, and a second leg opened in 1976. Place des Arts, the city-owned complex of theatres, is on this line, some ten minutes from the Bonaventure station.

The three major lines meet at the Berri-de Montigny station downtown, a few blocks from the St. Lawrence. Line No. 5 is being built across the north end of the city. The long-range plan calls for a total of fifty-one miles of track and ninety-four stations.

There is no Line No. Three. One was planned, to tie into the CN railway tunnel, but it was dropped.



Montreal's subway lines are fed by extended bus routes. The city has 131 routes over some 550 miles of street. Seventy-seven of the bus routes connect with the rail system at one of twenty-eight rail stations.

The downtown part of the system—including storage space for off-duty cars—is underground, allowing it to operate without delay through the heaviest snows and deepest freezes.

The Métro's cars are fifty-six feet long but only eight feet, three inches wide. This permits them to run on parallel tracks within a single tunnel, twenty feet, four inches wide, greatly reducing the cost of tunneling.

The cars are mounted on rubber tires which roll on concrete tracks. This gives smoother, quieter rides and much better traction, allowing gradients of up to 6.3 per cent. A backup steel track and flanged steel wheels can be used in emergencies. The cars are linked in three-car groupings, in nine-car trains.

The greatest excellence of Montreal's Métro is the beauty of everything that meets the eye. The cars, designed by Jacques Gillon, are of a blue enamel. Each station was designed by a different architect. Peel Station has brilliant abstract murals, Bonaventure's high vaulted walls give the vast domed chambers a cathedral quality and the Crémazie Station has a multi-coloured ceramic bas-relief, entitled "The Poet in the Universe."

Toronto

Metropolitan Toronto was born in 1954 when the city and twelve neighbouring suburbs became a single municipality. About 3 million people are clustered over 244 square miles. They move around in a variety of ways—on subways, buses, trolley buses and street cars. This system—run by the Toronto Transit Commission—is tied neatly to GO Transit, which has buses and four main rail lines carrying some 40,000 commuter fares daily in and out of metropolitan Toronto. Two lines run along the shore of Lake Ontario, one from Oakville in the west, one from Oshawa in the east. The third begins at Georgetown to the northwest and the fourth and newest (it opened in 1978) starts at Richmond Hill in the north.

GO—which is operated by the government of Ontario—connects with bus lines along the route and with the subway and other bus lines at the city's Union Terminal.

The Subway

Toronto's subway, Canada's first, began operating in 1954 with 104 cars and 4.6 miles of track. Ninety of the first cars were of steel, six aluminum. The latter, which were longer, weighed 73,400 pounds, some 11,000 pounds less than the steel, needed less power and saved money. Since then the TTC has bought only aluminum cars. They are connected in pairs with a driving cab at each end, and can be arranged in trains of up to eight.

The first line, north and south under Front and Yonge Streets, had twelve stations, each 500 feet long (the length of an eight-car train), with glass-faced masonry walls and terrazzo floors. A new exit was soon added at King Street, thirty-six more cars were purchased, four more escalators were installed and a new spur track was added. In its first five years the line carried 360 million riders.

After several extensions the Yonge-University-Spadina line runs in the shape of a U from



Rush hour in 1905.



Digging up Yonge Street to build the subway, 1950.

*Photos, pages four and five:
The evolution of public
transit in Toronto.*

The Yonge Street subway.*One of the city's new light rail cars.*

Spadina to the northern suburbs. The first leg of the east-west Bloor-Danforth line opened in 1966, and it was extended in 1968 and 1980. The entire system is now 33.8 miles long, with fifty-nine stations.

Toronto's cars and stations are neat, clean, pleasant and well-lighted but not, on the whole, as glamorous as Montreal's. Yorkdale Station, however, is in a class by itself with a spectacular 570-foot rainbow of neon tubes called "Arc en Ciel." When a train enters the station the lights go on and off in coloured patterns. It was paid for by the province and private donors.

Suburban Growth

Subways are for downtown and in the opinion of the people who run Toronto's, it has gone about as far as it can go.

Metropolitan Toronto's master plan, designed to encourage growth in the suburbs, emphasizes light rail transportation. The name is somewhat misleading—some light rail cars are as heavy as subway cars and often more expensive. Light rail systems are cheaper to install and maintain, how-

ever, since the cars can run singly, on exclusive rights of way or twisting city streets, and they use overhead trolleys for power. They can be combined in trains of varying lengths to accommodate loads from 5,000 to 20,000 passengers an hour. Toronto's first light rail cars were put into service in September, 1979.

Streetcars and Buses

Toronto once had 744 streetcars, the largest fleet in North America. When other cities abandoned them in the 1950s, Toronto did not, but they are now coming to the end of the line. New light rail cars, running on the streetcars' old tracks, will replace 170 of them this year.

Toronto has trolley buses, standard buses, mini-buses and intermediate buses (thirty feet long) too. Fifty per cent of Toronto's buses are less than ten years old. The mini and intermediate buses carry passengers on feeder routes and pick up handicapped people at their homes. This year the city is testing twelve articulated buses, sixty feet long, that bend in the middle, and one articulated streetcar.

Ottawa

Almost everyone in the Ottawa-Carleton region takes a bus. The area has sixty-three regular routes and forty-four limited stop and rush hour ones serving some 500,000 people.

Seventy per cent of the residents take a bus when they go downtown in the morning and the average man, woman or child takes 150 bus rides a year.

Early bird service is from 4 a.m. till 6:30 a.m. Ottawa was one of the first cities to have a service where mini-buses pick up passengers at their doors and take them to a centre of fixed route buses. It provides yearly passes for senior citizens.

Vancouver

Vancouver has buses on land and sea.

The Seabus is an aluminum, double-ended catamaran with two propulsion/steering units at each end. Since it is double-ended it need not turn around. People enter on one side and leave by the other. The buses were developed by Case Existological Laboratories, Ltd. and a single one can carry 400 passengers a trip, two miles across Burrard Inlet between North Vancouver and the city. One leaves either dock every ten minutes.

The city will also have a computer-driven system of elevated light transit cars, developed by Ontario's Urban Transportation Development Corporation. The system, which will cost \$710 million, will run between downtown Vancouver

and New Westminster in the suburbs. It will be called Advanced Light Rapid Transit and will be in place in time for the city's Expo '86.

Edmonton

Edmonton was the first city in North America with less than a million people to have a light rail subway/surface line. It opened in April, 1978, with fourteen articulated, or hinged, cars with rubberized steel wheels. It was 4.5 miles long, cost \$66 million and was soon carrying 20,000 riders a day. It is mostly surface—a one-mile section of downtown tunnel connects with old CNR tracks going to the northeast suburbs. It was extended at both ends in 1981 and another extension is under construction. The system now has seventeen cars, six stations and almost six miles of track, and carries 25,000 riders daily.

Calgary

Calgary opened a \$167 million, 7.9-mile light rail line in May, 1981, the first of five lines planned for the city. Less than a mile of it is underground. It carries over 40,000 riders a day, through residential, business and industrial areas. The city has a fleet of twenty-seven cars with fifty-six more on order. It has begun construction of the second line and by 1985 plans to have 17.5 miles of track.

Passengers who get on and off within the eleven-block downtown section ride free.



Light rail in Calgary.



Building the Finch extension of the Toronto subway.

Financing

In Canada all transit systems are supported by public funds.

Alberta, for example, pays up to 100 per cent of the cost of new lines and up to 50 per cent (but no more than \$3 per capita) of their operating deficits.

It was not always so. In the nineteenth and early twentieth centuries, transit companies were private and designed to make profits.

They did, since the people who used them, workers, lived close in and systems could be built and maintained at relatively low cost. When the early lines were extended, the limits of the city were too, and the arrival of the automobile in the 1920s extended city limits further so that the profit basis began to erode. As people bought more cars, new, less densely populated subdivisions appeared. The companies could not afford to extend the rail systems into them and though they did develop bus routes, most people in the suburbs preferred to use their cars and profits dwindled.

Toronto

Toronto was one of the first cities in North America to grapple with the problem of diminishing service. In 1921 the Toronto Railway Company's thirty-year franchise ran out and the city took over. The system was no longer expected to make a profit, but it was intended to pay its own way.

The city's Transportation Commission unified nine separate systems, set a single fare with free

transfers, and ordered 250 new, all steel streetcars. Traffic increased and the Commission soon was able to buy 325 more cars.

The once rapid expansion in the number of autos slowed down in the Depression, and in World War II the gasoline shortage and the absence of new cars brought a record number of passengers to the transit system. Since there was no new equipment to be had, the service could not be expanded, and money accumulated faster than it could be spent.

It was spent when the war ended. By 1953, Toronto had 715 new streamlined streetcars and the next year the Toronto Transit Commission, which had replaced the Toronto Transportation Commission and taken on regional responsibilities, bought four privately owned bus lines and opened its new subway.

The philosophy of financing continued to change. Public transit was no longer expected to be self-supporting, and the TTC paid for 80 per cent of the capital costs, with the province paying the rest. As the system expanded the city also chipped in; in 1959 it used general revenue funds to pay for 55 per cent of the costs of the new east-west line.

It was clear now to both the municipality and the province that transportation lines that didn't pay for themselves were still good public investments when they raised land values and permitted energy conservation. In 1963 they agreed to share costs and made the sharing retroactive.

The Province of Ontario now funds 75 per cent of approved capital transit expenditures and 50 per cent of operating deficits. It also pays the deficits of the GO-Transit commuter rail and bus service.

In the old days, as the TTC's Jack T. Harvey told *Railway Age*, "If a run wasn't going to make money, it didn't go in."

Times changed, and the north-south Spadina line, the first that was not along an established traffic corridor, was built even though it was clear that it would not be immediately self-supporting.

Montreal

Montreal's system of financing had a similar evolution. It had 327.5 million fares in 1954, but by 1960 the number had dropped to 248 million, a decline of 13 per cent.

The several municipalities involved decided to take over.

Money for the \$214 million subway system, which opened in 1967, was raised by the sale of forty-year general obligation bonds bearing 6 to 7.5 per cent interest. In 1973 the Montreal Urban Community approved a plan for financing the long-term extension of the system.

In the summer of 1976, the province put a moratorium on much planned construction but it was lifted partially in 1978, and last year the province and the federal government agreed to spend \$800 million on Montreal's urban and commuter transit system by 1986.

Who Builds the Cars



The Illinois Central Gulf Railroad has bought thirty-six of these cars from Bombardier.

Canada has three major rapid transit car manufacturers, one in Quebec and two in Ontario. All three have been remarkably active.

Bombardier, of La Pocatière, Quebec, a branch of the Montreal company that originated the snowmobile, began building subway cars with an order from the Montreal Métro. It delivered 423 heavy cars costing \$100 million in 1978. It has also sold thirty-six self-propelled gallery commuter cars (with seating on two levels) to the Illinois Central Gulf Lines in Chicago, leased two locomotives and ten LRC (Light, Rapid, Comfortable) cars to Amtrak and sold twenty-two locomotives and fifty cars to VIA Rail Canada. The Tri-County Metropolitan Transportation District of Oregon has ordered twenty-six articulated light rail vehicles to connect Portland with its suburbs.

Bombardier's biggest order will be 825 subway cars for the Metropolitan Transportation Authority of New York City. Bombardier won the contract by outbidding Francorail of France and the Budd Company of Troy, Michigan, a subsidiary of Thyssen A.G. of West Germany.

Richard Ravitch, MTA chairman, said the decision was based on the degree to which each bid met four goals: "First, to get the highest quality car in the fastest possible time; second, to

pay the lowest possible price; third, to attract the best possible financing terms; and fourth, to ensure the greatest amount of New York State-manufactured content in the order. Bombardier won on all counts."

The Bombardier bid set a price of \$798,770 for each car and the Canadian government offered to finance 85 per cent of the entire contract at 9.7 per cent interest. Bombardier committed itself to the purchase of \$104 million worth of components in New York State.

Mr. Ravitch said the choice of Bombardier meant a saving of at least \$100 million in capital costs and \$90 million in financing.

Hawker Siddeley's Canadian Car Division, of Thunder Bay, Ontario, is the Toronto Transit Commission's basic manufacturer. It built 190 light rail vehicles (designed by the Urban Transportation Development Corporation and costing \$40 million) for the city in 1980. Since then it has sold subway cars to the TTC and eighty bi-level commuter coaches to GO-Transit. It does a brisk business abroad, and has recently sold 190 subway cars to the Massachusetts Bay Transportation Authority, 44 rapid transit cars for New York's PATH system and 200 passenger cars (60 first class and 140 second class) to the Mexican National Railways.

The Urban Transportation Development Corporation is a research and development and manufacturing operation owned by the Ontario government and run by a board drawn from business and industry.

Its purpose is to develop new and better ways to move large numbers of people around and in and out of cities.

It has recently begun building cars, although originally it did only the basic planning and left the manufacturing to private companies. For example, it had the SIG Company of Switzerland build it six light rail prototypes. After revisions the corporation gave Hawker Siddeley the contract to build 190.

UTDC has also produced designs for suspension and propulsion systems, for flywheel energy storage and for articulated rail vehicles.

Its consultants have worked with transit planners in San Francisco and have helped the Brazilian government to coordinate services in five state capitals.

Montreal R & R

Transport Canada, the federal government's department of transportation, has a Transportation Development Centre in Montreal. It funds basic concept research and the building of prototypes. It has been instrumental in developing a design for a thoroughly modern taxicab and magnetically levitated transportation systems, among other things.

Two-way Transit

"There isn't a single vehicle running in Canada now which doesn't have a very significant U.S. element. Bombardier's cars for Chicago have 80 per cent American content and Hawker Siddeley estimates U.S. content of the Massachusetts Bay Transportation Authority at 55 per cent."

Carl Mawby, a Bombardier executive and former chief of the Urban Transportation Division of the Canadian Ministry of Industry, Trade and Commerce.

Some Amazing Cars

The LRC—Light, Rapid and Comfortable

The LRC passenger train carries people from city to city. It was designed over a twelve-year period by Bombardier, Alcan and Dofasco. Because of its banking system, its lightweight construction, advanced suspension and low centre of gravity, it can go around curves on a standard track faster than any other train in the world.

The banking system is built into each coach.



The unique banking system of Bombardier's LRC trains allows them to negotiate sharp curves at high speed.

As the coach enters a curve, an accelerometer senses the added lateral thrust and sends the information to a small electronic "black box." This sophisticated device then signals hydraulic cylinders on each truck, instructing them to bank the coach. The banking movement continues until the lateral force declines. Passengers have no sense of curving.

The LRC uses existing tracks, which makes it much cheaper than the special high-speed trains used in some countries. It is also relatively cheap to operate. Its travel time is less than that for autos, buses or conventional trains. Its fuel consumption is lower than all three. It takes an estimated four hours to travel 335 miles, consuming four gallons of diesel fuel per passenger during the trip.

Advanced Light Rail

The UTDC has developed a design for an intermediate capacity transit system capable of carrying between 5,000 and 25,000 passengers an hour. It replaces human operators with computers. Several cars can operate on a track since a central computer keeps them spaced, and stop and start commands are executed automatically by two linear induction motors beneath each vehicle. The cars ride on an electromagnetic field created between the motors and a broad strip of aluminum-coated iron down the middle of the track. The train is pulled along or braked by magnetic attraction or repulsion. Prototypes for vehicles and

major components have been built and tested.

At a cost of \$181 million, the system will be put in place in Toronto in late 1984, with twenty cars running between the end of the Bloor-Danforth subway line and the suburb of Scarborough Town Centre.

Vancouver has ordered the system to be in operation by late 1985, and the State of Michigan has also selected it for its three-mile "people mover" in downtown Detroit.

GO Double Deckers

GO-Transit has eighty new bi-level commuter cars built by Hawker Siddeley. They are double-decked and tapering with two levels of passengers in the middle and single levels at the ends. Each car seats 162, 70 per cent more than conventional cars. They are air-conditioned and have a public address system, high-backed seats, carpeted floors, a washroom and a drinking fountain.

Waiting in Style

Ottawa is the second coldest capital in the world, right after Ulan Bator, Mongolia.

It is a painful place to wait for a bus in winter, but since last November some 28,000 Ottawa-Carleton transit riders can wait at home.



An Advanced Light Rail car on the UTDC's test track in Kingston.



The Montreal Métro.

The potential passenger can dial 560, followed by the number of the bus stop, and a pleasant anonymous voice will tell him when the next bus is due to arrive at his stop.

The service was an immediate success; by February it was averaging 15,000 calls a day. It also had a positive effect on business; in four months the number of passengers climbed 3 per cent.

The system relies on a \$560,000 computer network and was first tested in Mississauga, Ontario, six years ago. It will grow increasingly sophisticated. It is presently based on printed schedules adjusted by current information on traffic conditions, but in two years a radio network linking buses to the main computer will give phone callers arrival times accurate to thirty seconds. Guelph and Brantford are planning to introduce similar systems.

Dial-A-Bus

Six Canadian cities offer minibus services that pick up passengers at home and carry them to short-haul destinations.

The services in Calgary, Alberta; Winnipeg, Manitoba; and Kingston, Ottawa-Carleton, Pickering and Stratford, all in Ontario, work like this:

A rider phones ahead of time, in some places an hour ahead, in some thirty minutes or less. The bus picks the passenger up on schedule and takes him to a regular transfer point or to a shopping plaza or other standard destination such as a church, school or medical centre.

Some systems take regular reservations, such as every workday morning at eight. Most of the buses carry seventeen passengers in a club car setting with room for ten standees.

Safety on the Subway

The Montreal and Toronto subways have carried billions of passengers without a fatal accident.

This fortunate fact reflects much planning.

Montreal, for example, has a complex network of safety devices:

- Permissible and actual speeds are shown on the motorman's control panel. If the actual exceeds the permissible, an alarm sounds and the driver can brake to reduce speed to the appropriate level in four seconds. If he fails to do so, an emergency braking system automatically halts the train.
- A radio-telephone system with battery backups connects the trainmen and supervisors to a Central Control, even during a power failure.
- Motormen can talk to passengers through a public address system and passengers can talk to motormen by depressing a button on an intercom.
- Each car has four emergency brake switches which can be pulled by passengers who feel it is necessary.
- Two doors on each side of each car can be opened by hand from inside. Diagrams on the wall show how. The doors can also be opened from without.
- There is a fireman's ax, a crowbar and a service key on each car under a double seat. A diagram tells how to get them out.
- Each car has two accessible fire extinguishers.
- Each car has four intake and three outtake fans in the roof.
- Each of the initial station platforms has one emergency niche and the newer ones have two. Each one contains an emergency power cutout, a powder-type fire extinguisher and a telephone connected to the system's communication Centre.
- In all extension stations there is an anti-suicide ditch between the rails, a greater than usual clearance between the bottom of the train and the floor.



Vancouver's Seabus.

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