Canada

Canadian Urban Transit Systems

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I

THE CANADIAN EXPERIENCE READY FOR ANY TRANSIT CHALLENGE

The population of Canada, the second largest country in the world, is 25 million. That is roughly equivalent to those of the States of New York and Florida combined.

And yet in a country of over 9 billion square kilometres, there are only two metropolitan areas with 3 million inhabitants. And only one with 1 million. Add them together, and that's still 2 million less than the population of Los Angeles/Long Beach!

The sheer vastness of the country has forged a unique breed of urban transit professionals - from concept to implementation. For each city and town has, by its very nature, demanded its own requirements in terms of transit systems, know-how, and equipment.

From para-transit to articulated buses. From monorails and people movers to advanced light rapid transit systems. From world-renowned subways and rapid transit cars to light rail vehicles.

And for the past 150 years, give or take a few, these requirements have been met by Canada's own transportation industry.

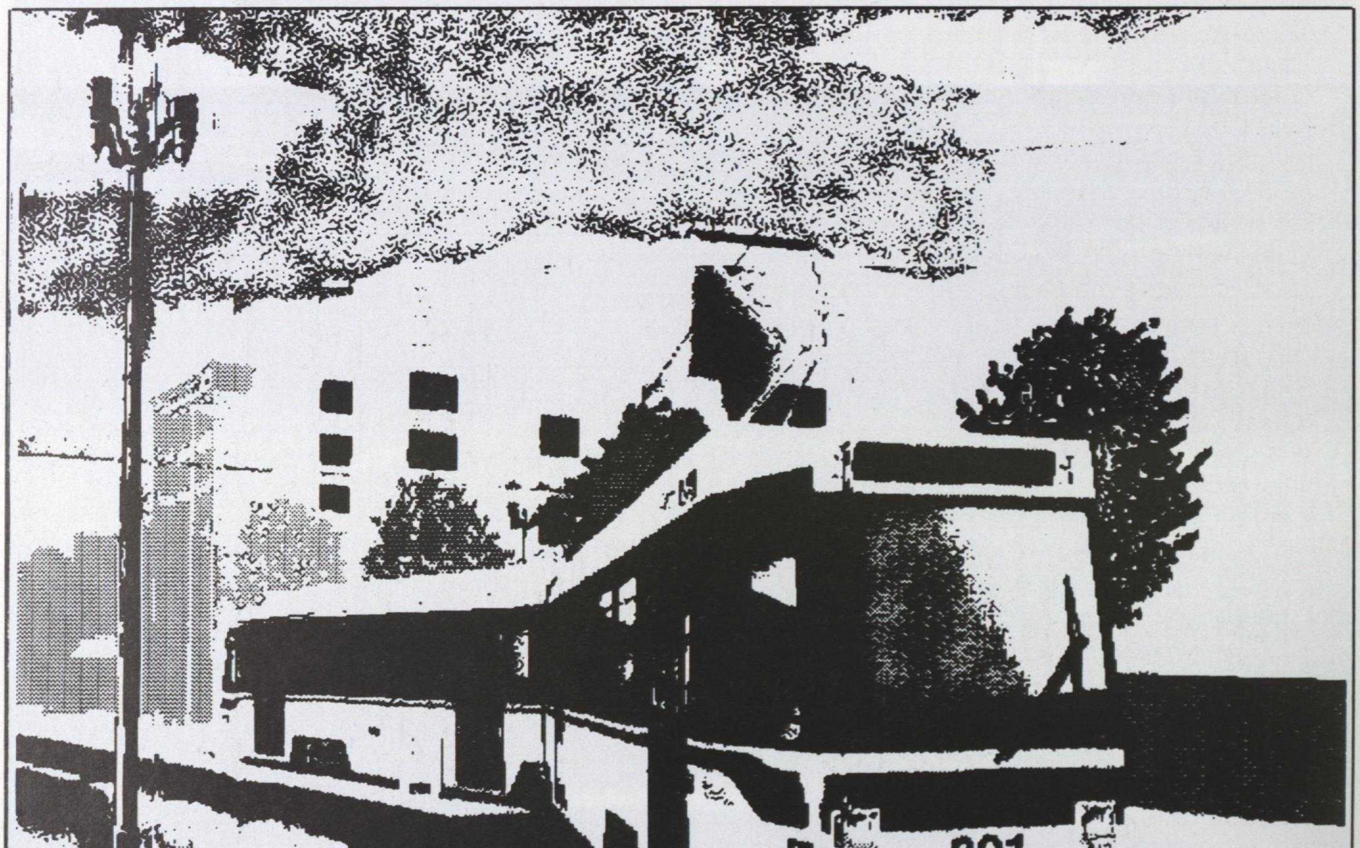
An industry that has grown from horse-drawn buses to a multi-faceted, multi-billion dollar force in the international world of mass transit.

An industry that continues to amaze and impress North American and foreign transit decisionmakers by its sheer diversity. Its professionalism. And the fact that it works.

An industry with a proven track record. Not only on its home ground with all its challenges. But also, ever increasingly, with its closest trading neighbour, the United States.

It is an industry that has introduced major innovations, having worked particularly closely with the cities of Toronto, Montreal and Vancouver in literally custom designing and building efficient transit systems; systems respected world wide. It is no accident that these systems work. For they were not built merely to spec. But rather from exploration of concepts to design to building. A partnership in its truest sense.

And having proven themselves at home, with all its demands, Canada's own mass transportation manufacturers are more than well equipped to meet the challenge of urban transportation virtually anywhere in the world.



Recent order and deliveries confirm it:

- An 825 rapid transit car order from New York City's Transit Authority. The most expensive contract ever in the history of the mass transit industry For Bombardier.
- An Advanced Light Rapid Transit (ALRT) system in Vancouver. From the Urban Transportation Development Corporation (UTDC), designer and developer of the system. The city's SkyTrain, as it is known, represents the full expression of systems technology in that it is not only a people mover in the downtown core, but it is also intended to serve as the back-bone of the city-wide mass transit system. In creating SkyTrain, UTDC also conceived of the concept of intermediate capacity transit for 20,000 - 25,000 people per hour per direction, offering half the capacity of a subway at 1/3 the cost.
- 700 commuter coaches to NJ Transit Bus Operations Inc., the largest single order of commuter coaches in history. From Motor Coach Industries. Also, a recent contract for 28 coaches from the Commonwealth of Massachusetts. Six are equipped with an elevator-style wheelchair lift - a first in the U.S.
- By the end of 1987, over 200 aluminum push-pull commuter cars will be in service at the Metro-North Commuter Railroad, the Metropolitan Transportation Authority, the Connecticut Department of Transportation, and the New Jersey Transit Corporation. More vehicles will be added to these fleets with repeat orders from NJ Transit and Metro-North. Again from Bombardier.
- The first ALRV streetcar, designed and developed in Canada, to be exported by a Canadian manufacturer to the U.S. was delivered earlier this year to Santa Clara County Transit District. It is the first of 50 in a contract worth about $65 million. From UTDC. An extended version of the six axle ALRV designed and developed for the Toronto Transit Commission, the Santa Clara model is capable of carrying a crush load of over 250 passengers. Built at Can-Car Rail, UTDC's manufacturing facility in Thunder Bay, it was shipped to another UTDC operated plant in San Jose, California, for final assembly.

FROM ANCIENT OMNIBUSES TO MONORAIL

In the following pages, we shall zero in on these and other specific examples of accomplishment throughout North America incorporating Canadian expertise, systems and hardware.

But to place these achievements in perspective, it is important to turn the pages and go back in time. Back to the mid 1850s. For this was when the Canadian transit industry put down its first real roots.

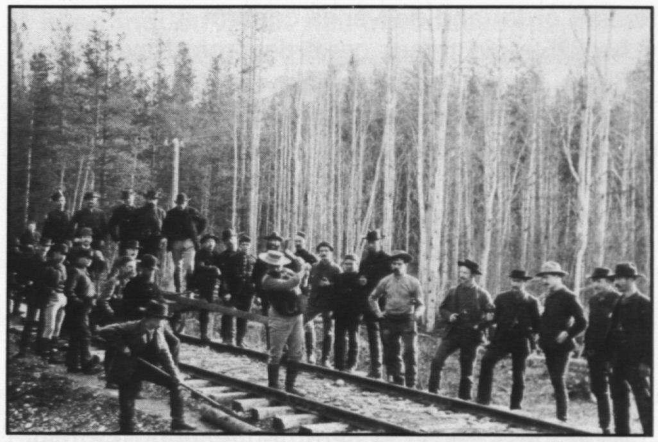
Today, in an era when we are accustomed to a subway train passing every 90 seconds carrying up to 1,200 passengers compared to a buggy back then passing every 30 minutes with five people aboard, it is difficult to believe that omnibuses were once heralded as a major breakthrough in mass transit.

These horse-drawn buses travelled at only four to five kilometres an hour. And they had to compete with other traffic and operating conditions which were unfavourable, to say the least.

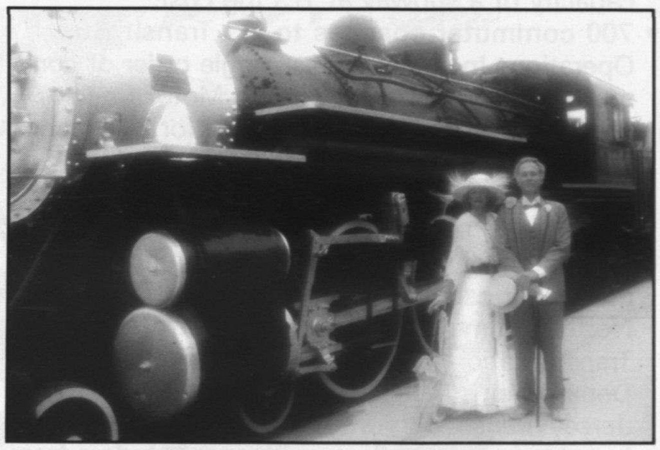
In the early 1890s, they were replaced by horse-drawn trams. And with their iron wheels, on iron rails, they not only increased the speed and capacity of transit service, but they also expanded the potential area of operation.

Commercial and residential development mushroomed along, and around, the lines. Suburban areas sprang up in response to this new transit service. And ridership grew steadily.

The days of the tram lines were numbered, however. And when the electric streetcar was introduced in Ottawa, the industry was never to be the same again. The reason was simple. It represented a 50% - 70% saving in travel costs. Its superior speed permitted longer and faster trips. And streetcar tracks soon became a permanent fixture in many urban areas.



Laying the first ribbons of steel



The "Iron Horse" long before subways

Short-lived renaissance

In turn, these inventions, combined with the impact of World War 1, generated a renaissance in public transit. As lines were added, existing ones extended, and urban areas expanded, ridership increased beyond all realistic expectation. But the expansion boom was to collapse with the declaration of peace in Europe.

The expanding Canadian economy following the War and the resultant increase in affluence made the automobile an affordable and viable alternative for a growing segment of the population. By the early 1920s, downtown streets in urban areas were congested. Transit ridership began to decline. And operators were forced to reduce the level of service.

The introduction of the motorized bus in the mid-1920s failed to halt the drift away from public transit, despite the fact that its increased reliability and speed represented a major advantage.

As the public transit industry cautiously entered the 1930s, the already struggling operators were dealt an almost fatal blow. The Great Depression was to almost destroy the industry. Some public takeovers of private bus companies resulted and due to political pressure, fares went unchanged. Indeed, in some cities fares were even reduced. There was little capital available for the purchase of new vehicles and maintenance suffered.

The increased economic activity brought about by World War II produced extraordinary increases in ridership. And the rationing of gasoline and rubber during the war years forced many to abandon their cars and switch to public transit. Ridership doubled over a five-year period and, at the end of the war, the industry seemed poised to make a breakthrough in the transportation of urban populations.

It was not to materialize. For more than ever before, the industry was hard-pressed to stave off the growing popularity, affordability, and flexibility of the private car. Reduced ridership led to decreased revenues which, in turn, forced transit operators to cut costs by curtailing service. Ridership declined despite a modernization of the industry, including the introduction of the PCC streetcar in the 1940s and the construction of subways in Toronto (1954) and Montreal (1966).

Montreal mass transit in the 1940s

Expansion again

It was not until the late 1960s that the industry began to expand again. It was boosted by the growing congestion in urban areas, the escalating cost of owning and operating a car, the OPEC oil embargo. These factors, combined with a number of other social, political, and economic developments, led to the public takeover of the industry and the introduction of subsidies.

With public support, transit systems continue to be implemented, expanded and improved throughout the country. And in 1984, according to the Canadian Urban Transit Association, some 1.3 billion revenue passengers and 1.5 billion total passengers were carried, serving a total urban population of 13 ¾ million. To achieve this, it took just over 13,000 vehicles running over 665 million revenue vehicle kilometres.

Busing it in Montreal in the 1950s

And in the 1980s in Ottawa

Fare recovery ratios tell the story

But even more impressive is the fare recovery ratios experienced by Canadian cities - the true measure of the efficiency of any system. Indeed, they are a constant source of wonder for American and foreign transit planners and operators, who have been known to shake their heads in disbelief!

But the figures tell the story.

Toronto, with its fully integrated system, reported 71% in 1984, carrying 418 million revenue passengers in a population area of just over 2 million.

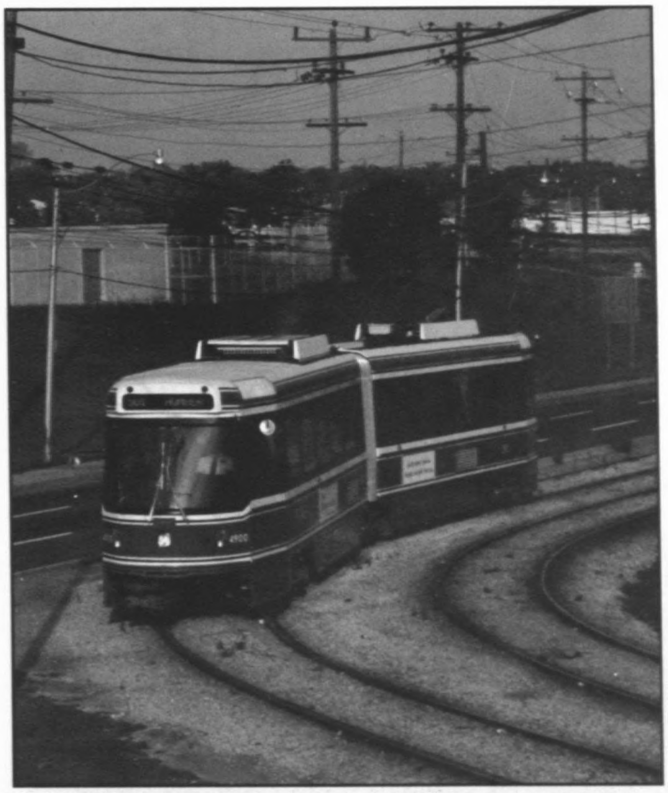
Ottawa-Carleton, with its all-bus system and a population of 506,000, reported 59% for 87 million passengers carried.

Montreal, with 1.8 million population and one of the most beautiful subways in the world, reported 44% for almost 400 million revenue passengers.

By comparison, multi-modal systems in the United States averaged a 41% fare recovery ration in 1984, with bus systems coming in at an average of 27.64% according to the American Public Transit Association (APTA).

The message is clear. Transit systems are expensive and encompass a broad range of considerations. But there is one simple truism: you only get out if you are prepared to put in.

Another extremely significant lesson that can be learned from the Canadian experience is that wherever there is an effective, efficient transit system, there is a strong regional government with the courage and political will to make it work!



Above ground in Toronto

And underground in Montreal's Métro

THE TRANSIT CONSUMER

In the final analysis, transit users throughout North America have one common denominator. They expect transit fares to be low. After all, in their mind, it is considered to be a public service.

They are not really concerned with whether the system, in its entirety, is regarded as being convenient and efficient. But rather whether or not the service is suitable for their specific needs, at a price which seems fair and appropriate.

In both Canada and the United States, they are concerned with personal costs, not overall costs. This is true whether they are using an internationally-acclaimed subway system in Montreal, SkyTrain in Vancouver, or a cable car in San Francisco.

The system is virtually meaningless to them if it doesn't get them where they want to go, in the fastest time possible, and with the minimum of aggravation.

And despite all the talk about energy conservation, congestion and environmental pollution, the individual user will not easily be swayed into using public transportation merely for the good of the general public.

It should also be stressed that many of the problems expressed by consumers really exist only in their minds, with no basis whatsoever in fact. Clearly, it is not cut and dried.

These Canadian Light Rail Vehicles (CLRVs) are extensively used in Toronto's transit system.

Nor is defining the actual, or potential user, an easy task. For it is complicated by many variables, personal lifestyles and preferences. It is generally agreed, however, that the two major market segments may be categorized as *captive* and *non-captive*.

The captive user

This segment comprises people who must travel without the use of a car. In essence, those who are too young, too old, too poor, or too ill to drive or own a car. It is this segment which establishes the market for base transit service at all times of day. And it is regarded by some as the basis for justification of part of the subsidy allocated to transit.

The GM Classic

Having said this, however, it should also be remembered that truly efficient mass transit systems do not rely on captive users for the majority of their fares, but rather from all income brackets and walks of life.

On any Canadian subway, it is not unusual to see an affluent three-piece-suit business executive sitting next to a less well-to-do pensioner and university students. They are there because, for them, the system works.

It must also be remembered that this segment includes temporary captive users; those whose cars are temporarily off the road for one reason or another. Also that they may be captive by choice in that they actually prefer to live in the downtown core or close to their work, shopping, or social services, without being obliged to buy a car.

The MCI model 102A3

The non-captive user

This type of user does have freedom of choice. He, or she, is in a position to choose other options but instead decides in favour of public transit. They do have access to a car, but they use transit for one of three reasons. It is:

- more convenient
- cheaper
- faster

In doing so, they resolve the problems and expense involved in fuel costs, traffic congestion, parking costs, or the requirements of other family members for the car. It is important to note that this group's use of transit is almost exclusively for work-oriented trips. Also that the following factors play a large part in their decision to leave the privacy and relative comfort of their car.

- reliable and frequent service
- convenience of getting from point A to point B
- acceptable travel time
- minimum transfer difficulties
- safe and comfortable ride
- reasonable cost

The 60-ft ORION-Ikarus articulated transit bus

Special category users

Great strides are being made in Canada to improve service for the handicapped. The obvious goal for both operators and their sponsoring agencies is greater productivity to decrease unit cost, and thus provide better service to the disabled with the funds available.

In an effort to improve efficiency and quality, operators running parallel transportation services for the elderly and disabled have adopted computerized scheduling.

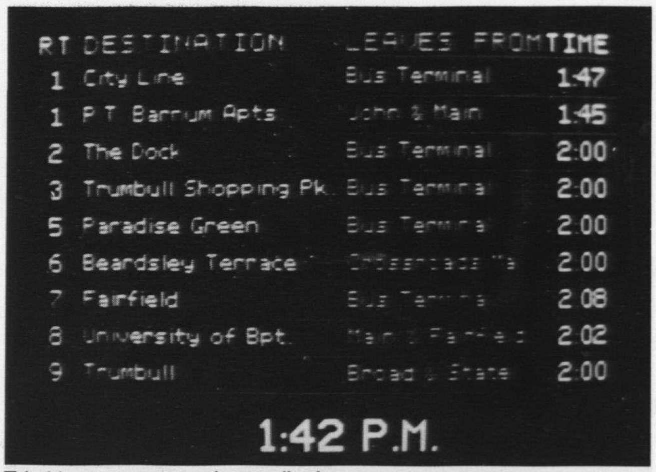
CANADIAN INNOVATIONS & ACHIEVEMENTS IN MASS TRANSIT

Whatever their category, however, it is agreed that Canadians enjoy the most technologically advanced, efficient, and cost-effective mass transit systems in the world.

At the forefront are several Canadian achievements and innovations that are helping to change the face of urban transit throughout the entire continent.

Transit systems are normally categorized by vehicle:

Buses:	These include standard 21, 25, 35 & 40 ft. models, articulated, and other special vehicles such as para-transit buses.
Light rail:	This includes conventional and advanced light rail systems' people movers, and monorails.
Rapid transit:	Subways or, as it is known in Montreal, the Métro. Vehicles are custom designed to a tight user specification.
Commuter rail:	Canadian commuter rail in single, bi-level and gallery cars, is found in Chicago, New Jersey and Toronto.
Computer systems:	TeleRIDE, Mississauuga's C.I.S. system, and SELTRAC are examples.



Teleride computer read-out tells the story

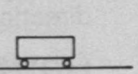
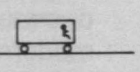
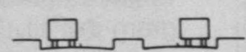
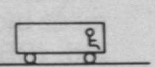
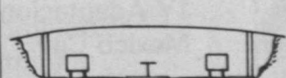
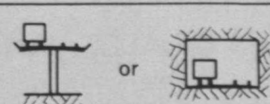
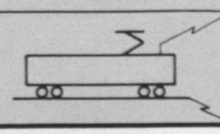
BUSES

ORION 11

Manufactured by Ontario Bus Industries, this heavy duty, low-profile transit bus is smaller than its 'big brother' ORION, one of the most popular buses in North America.

Built in 21 ft. and 25 ft. lengths, it features a full kneeling function for easy access for disabled and wheelchair passengers in that an integral front door swing-out ramp permits them to propel themselves into the bus unaided. An optional rear door and integral ramp, with the same ready-access features as the front, is also available.


The ORION II

Step no.	Description	Sketch	Major improvements	Corresponding real world system
1	Paths, walking		—	Walking-pedestrians
2	Private motorized cabins		Speed Comfort Convenience	Private automobiles
3	Common carrier (rental) cabins		Service available to all people	Taxis
4	Widening of the paths		Capacity L/S	Arterials
5	Introduction of large cabins		Capacity Cost Comfort	Bus transit
6	Separation of modes		Capacity Reliability Speed of transit	Transit R/W category B
7	Guided technology		Capacity Electric traction Comfort Operating cost	LRT
8	Grade-separated paths		Capacity Speed Safety Convenience	Freeways
9	Fully controlled common carrier R/W		Capacity Speed Reliability Area impact	R/W category A, rapid transit
10	Automated common carrier cabins		Frequency Operating cost Performance	Automated guided modes: AGT, RRT

URBAN PASSENGER TRANSPORT MODES

Key:
AGT Automated guided transit
L/S Level of service
LRT Light rail transit
RRT Rapid rail transit
R/W Rights of way

Credit: Urban Public Transportation Systems and Technology

The evolutionary development process illustrated shows that with increasing density of travel, each new modal feature results in:

- Higher system performance, including capacity, speed, and service quality.
- Greater passenger attraction (consequence of the preceding result).
- Higher initial investment.
- Lower operating costs per unit capacity — unless a drastically higher quality mode with better performance replaces a functional but obsolete system.

Thus low travel volumes are best served by low-investment/low-capacity modes. With increasing volumes, higher-investment/higher-capacity modes become superior in terms of both performance and operating costs.

ORION Peoplemover

This is a new 75-ft. tractor-trailer vehicle for use in shuttle service at airports, at amusement parks, as a tour bus, or regular transit vehicle.

URBAN RAIL

ALRT

Designed and developed by UTDC, the Advanced Light Rapid Transit System is now in full revenue service in Vancouver. A small people mover version is currently under construction in Detroit, and a system links the end of the Toronto subway with Scarborough Town Center.

In creating the system, UTDC became the first transit systems manufacturer in the world to integrate linear induction motor propulsion, steerable axle trucks, elevated guideways, automated train control, and lightweight car bodies into a revenue transit system.

A system which permits smaller stations with its shorter headways and 3-4 car trains has minimized visual obtrusion and virtually eliminated what many would consider to be noise pollution of any competing system.

Moreover, despite the fact that it is a much smaller system than a subway' it is capable of carrying virtually up to 30,000 vs the 40,000 passengers per hour of a subway.

In its first year of operation after Expo 86, it is predicted that the 22-km Vancouver SkyTrain will account for some ... rides. During rush hours, the figure of 20,000 passengers per hour per direction is only limited by its total of 114 vehicles.

LIGHT RAIL

For the first time, a Canadian light rail vehicle will operate on the streets of a European city. The modern 6-axle articulated street car, designed and built by UTDC will operate in a number of Northern England cities on a six month demonstration program in Fall, 1986.

This demonstration is the direct result of an agreement by UTDC licensing British Rail Engineering Ltd. (BREL) to manufacture and market this light rail vehicle throughout most of Europe and is some parts of Africa. The 88-ft. (26.8 metres) streetcar is the same vehicle design purchased by Santa Clara County.

Cooperation on a Mexican transit project has led to a licence agreement between Mexican and Canadian transit manufacturers. Namely UTDC and Motores 1Y Adaptaciones Automotrices (MOYADA) of Mexico City.

PRINCIPAL FEATURES OF ALRT VANCOUVER

Length:	22 km - 13 km elevated 7 km at-grade 2 km underground double track	This has eliminated some 36 street crossings with traffic lights, etc.
Stations:	15 - 9 elevated 2 at-grade 4 underground	This prevents any disruption to flow of existing traffic at street level resulting in maximum, smooth operation.
Vehicles:	114 cars, 41-ft. long, supplied by Venturtrans, Kingston, Ontario, with a capacity of 90 passengers (40 seated). Operated in married pairs in 2, 4 or 6 car trains.	
Operations:	Seltrac Train Control. Planned minimum headway 1.75 minutes and schedule speed 72 km/hr. Passenger capacity, initially 10,000 passengers per peak hour direction. Passenger capacity-design, 21,600 per peak hour direction. This moving block system can permit the addition of trains to a point where 30-second headways are achieved - a theoretical limit which would provide capacity equal to any subway system.	

The project: to take worn-out streetcars out of storage and put them back on the streets as modern articulated light rail vehicles.

MOYADA has signed an initial contract with Mexico City's transit authority to supply 16 of the 8-axle, double-articulated units, with an option to supply an additional 16. These rebuilt vehicles, capable of carrying almost 400 passengers each are operating on a 5 1/2 km system servicing Azteca Stadium, the principal site of the 1986 World Cup of Soccer. Transportation technology Ltd., a UTDC subsidiary, is providing extensive technical support.

The two companies have also reached agreement on a second project, confirmed in early 1986. MODAYA is licensed to sell and manufacture UTDC's ALRV design. This six-axle ALRV has a walk-through articulation unit and is capable of operating singly or in trains of up to four units.

The company is currently negotiating to supply an initial order of 18 of these cars to Guadalajara. Carbodies will be built in Canada at UTDC facilities.

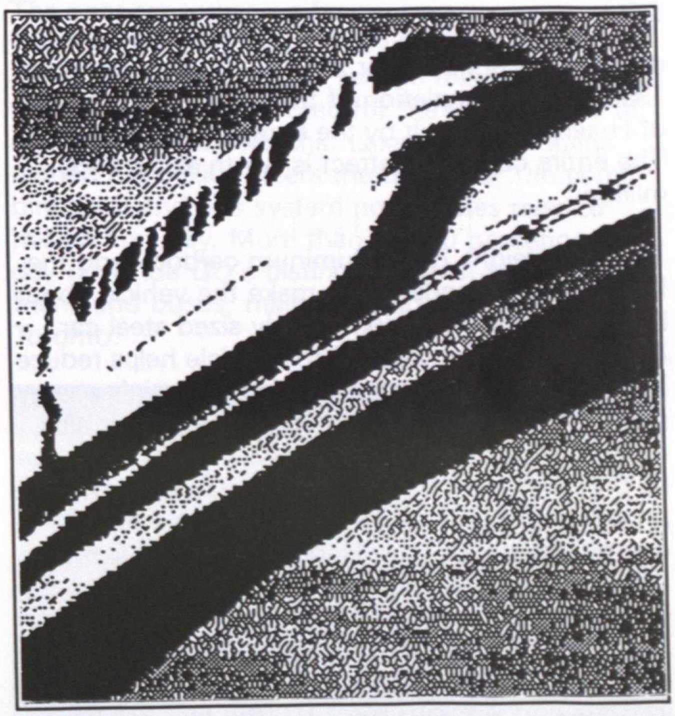
MONORAIL & WEDWAY PEOPLEMOVERS

These technologies, pioneered by Bombardier, have major environmental and construction advantages, particularly for operation in areas with limited space or which are already developed. For instance, highly attractive systems for airports, congested downtown areas, fairgrounds and other applications can be implemented relatively quickly and with minimum disruption to existing infrastructures.

Bombardier Articulated Light Rail Vehicle in Portland

Bombardier's Peoplemover and Monorail passenger systems are the responsibility of the Transportation Group Inc. (TGI), a wholly owned subsidiary in Orlando, Florida. A licensing agreement to manufacture and market these vehicles was signed in 1984 with Walt Disney Productions.

The Disney/TGI systems, incidentally, are operating at Disney World and at Houston International Airport where they have each notched up millions of passenger miles.



CONVENTIONAL LIGHT RAIL

Light Rail Transit vehicles, such as the 26, six-axle cars manufactured by Bombardier for Portland, Oregon, cost less to build than a rapid transit system, have lower operating costs than buses, and can later be upgraded to a full subway if required. They permit vehicle operations in mixed traffic and can board passengers from high-level platforms, or from simple, street level stations.

They have also had significant impact upon land use and real estate development, particularly around new stations, which can favourably affect a community's ability to fund an LRT service.

RAPID TRANSIT

Canadians have acquired a broad range of rapid transit experience which spans the steel wheel/steel rail in Toronto and the rubber-tire technology of Montreal.

The first of 126 H-6 subway cars that will eventually complete the replacement of the TTC's original red Gloucester cars, rolled off the assembly line earlier this year at Can-Car Rail Inc., Thunder Bay, a member of the UTDC group of companies.

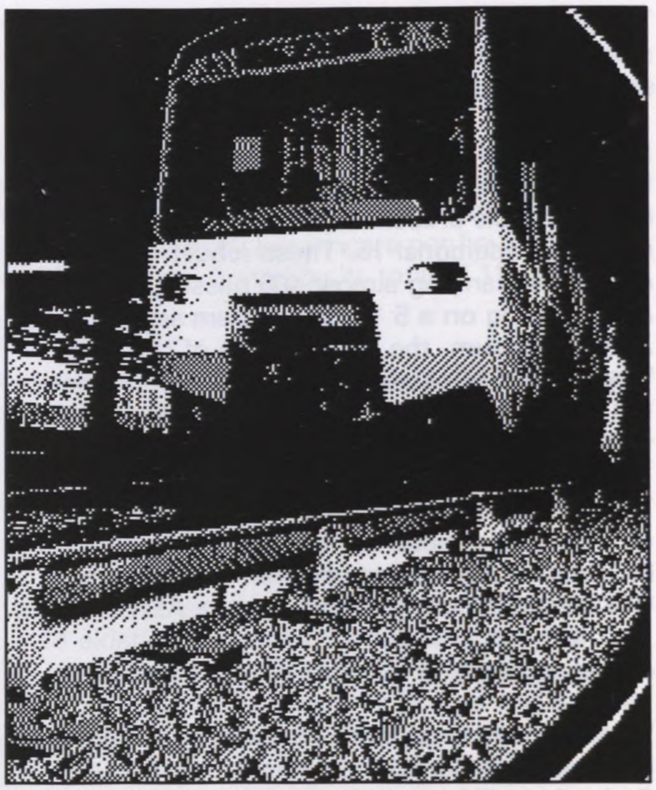
The new air-conditioned H-6 is the fifth generation of subway cars built for the TTC by Can-Car since 1966. Upon completion of the order, the TTC fleet of H-series cars built by the company will total 586. The entire current contract is worth about $160 million.

The lightweight 75-ft. aluminum carbody and the low alloy steel underframe make the vehicle about half the weight of a comparably sized steel car. Moreover, the lightness of the vehicle helps reduce TTC's operating costs by lowering the train's energy requirements. Additional energy savings are also realized by the modern propulsion equipment. Like its predecessor the H-5, the H-6 also employs a propulsion system which harvests some of the energy generated in braking. Other trains can then use this power for accelleration.

The UTDC Group is also building 52 articulated light rail vehicles (streetcars) for the TTC. Designed in close concert with the TTC, the first will be delivered by the end of 1986.

By the end of 1987, Bombardier will have delivered over 1,428 rapid transit cars to operating authorities in three major metropolitan areas. And each is offering efficient, reliable and safe service to between 20,000 and 47,000 passengers per hour in each direction.

In addition to Montreal, Mexico City operates the company's rubber-tired vehicles in nine-car trains comprising three trailer and six powered cars. The Mexican operating authority (STC) reports a high degree of satisfaction with the performance and reliability of the 180 cars built in 1981.



New York City's Transit Authority opted for the stainless steel high-capacity, steel-wheeled design built by Bombardier. This 825-car order represented the highest value contract in the history of the mass transit industry.

Both designs use service-proven on board sub systems to assure reliability under extremely harsh operating conditions. For example, short schedule headways, heavy usage, as well as grades up to 8%, and an extremely demanding climate in Mexico City.

Melamine and fiberglass interiors in the rubber-tired vehicles, and stainless steel interior and exteriors in the steel-wheeled design, reduce maintenance costs while providing an attractive environment for daily riders.

COMMUTER RAIL

GO Transit is the first interregional transportation system in Canada created and funded by a Provincial Government. The theory was that, by attracting motorists off the highways, such a service would reduce the need for multi-million-dollar expressways that would otherwise have to be built.

Since its beginnings in 1967, GO — with stands for Government of Ontario — has proven that theory many times over. It has become one of the finest commuter services in the world, carrying millions of passengers every year. It is a comprehensive rail and bus network, serving an area up to 90 kilometres (55 miles) from Toronto. Its ridership keeps increasing steadily.

What are the reasons for the success of what began as an experiment given three years to prove itself?

One is the rapid urban growth of Toronto and the surrounding communities. The area which GO services covers more than 3,000 square miles and has almost 4 million inhabitants, a population which is expected to be at least 6.5 million by the year 2000.

The other is the Toronto Area Transit Operating Authority, the Crown agency responsible for running GO Transit. Formed in 1974, it is a voluntary association, empowered by legislation, of the Regional Municipalities of Peel, York, Durham, Hamilton, and Hamilton-Networth, the Municipality of Metropolitan Toronto, and the Province of Ontario (which appoints the presiding chairman). Until then GO had been under the Ministry of Transportation and Communications and was just one small, although significant, part of a ministry which had an entire province's transportation demands to look after.

With the creation of the authority, the interregional transit needs of the Toronto area gained a strong voice because the regions involved play an active role in GO's decision-making. No less than the chairman of each region serves on the Authority's board, ensuring strong representation of regional interests.

GO specifies the type of service and sets the fares and schedules, while contractors look after the day-to-day running of service under its direction. CN Rail and CP Rail are the contractors for rail service, which operates on the railways' rights-of-way, and Gray Coach Lines and Charterways for much of the bus operation; GO began providing bus service with its own drivers in January 1984 and is now gradually assuming direct operation of the whole bus system, corridor by corridor, from its contractors.

The network today is a far cry from the original GO train service launched in May 1967. A single line along Lake Ontario, that service reached the passenger volumes projected for the second year of operation within months. Lakeshore GO Trains carried 2.5 million riders the first year; the combined rail and bus system now carries over 25 million annually. More than 89,000 passengers a day now ride GO's distinctive green-and-white trains and buses, mainly to and from work in Toronto.

Free parking for nearly 16,000 vehicles is available on the sytem, but despite this large number of spaces, parking lots are often strained to the limit. Over the year GO has expanded most of the lots to improve the situation and, to encourage commuters not to drive and park, has provided kiss & ride lanes for passenger drop-off and pick-up at most stations, as well as special access loops for buses only. These improvements, however, were not enough, and GO sought other ways to relieve parking lot congestion.

One solution was to give commuters and incentive to take local transit by integrating fares with local systems, letting passengers transfer between the local bus and the GO Train either free or at a considerable discount off the combined fare. The fare integration program has been an encouraging success in Brampton, Oakville, Mississauga, Burlington, and Pickering, and is available to any municipality which wants to take part.

GO fares are charged by distance, are much less than the cost of commuting by car, and yet do not undercut the prices set by local transit. The goal is to recover 65 per cent of the operating costs through farebox revenue, with the Province making up the balance and paying all the capital costs as well.

Like any transit system, GO has had its difficulties, especially with peak-period service. It faced its first capacity crisis in the mid-1970s, when it had become obvious that the Lakeshore rail line needed major improvements to cope with demand.

A twofold plan was eventually reached: replacing the original single-level coaches with double-deckers to increase capacity throughout the system, and introducing rail service between Milton and Toronto to ease the strain on the Lakeshore West.

Eighty innovative bi-level coaches designed by UTDC specially for GO were introduced in 1978 in the first stage of the plan. They were built in Ontario with passenger comfort a prime feature of the design and proved instantly popular with the commuting public. Each coach has a full upper deck, a first for commuter rail equipment in North America, and seats almost twice as many passengers as the single-level. The nucleus of the GO fleet is now bi-level with the acquisition of 71 new, second-generation coaches in 1983.

As for buses, today they not only connect with the GO Train on many routes but also link numerous communities throughout the GO Tansit service area. The network has been refined and streamlined into major trunk corridors to bring service where it is most needed, with emphasis shifted from downtown Toronto to sub-urban subway terminuses to eliminate duplication with the Toronto Transit Commission and cut the high cost of operating downtown.

The fleet has expanded over the years and is over 12 times its original 19780 size of 15 buses. It includes the most modern highway coaches and the Orion buses designed and manufactured in Ontario.

Go Train goes

A new track should see bi-level trains operating into Whitby in late 1988. Service to Burlington is to increase this year and should reach full service level by the early 1990s. Milton line service will increase form three to five round trips in 1988. And further expansions of service will take place as the need arises.

GO Transit is rolling into the demanding era of the 21st century in a new partnership with the railways, with efficient, proven bi-level trains capable of handling the challenges facing them.

COMPUTER SYSTEMS

TeleRIDER

Designed by Teleride Corp., this phenomenally successful computer system is currently in operation, or is being installed, in numerous North American cities. It is maximizing operating efficiencies, reducing costs, and increasing revenues.

Operating around the clock, it automatically answers telephone enquiries giving the time of arrival of bus or commuter train at the caller's bus stop or terminal. This service also results in increased ridership and, therefore, revenue, particularly in low density areas and at offpeak periods.

TeleRIDER systems come in a number of packages enabling transit systems to add capabilities according to need. Two other innovations comprise TeleDRIVER, an automatic vehicle location and control system, and TeleVIEWER, a public information display system.

UTDC bi-levels seating almost twice as many as singles

THE COMMUNITY & GOVERNMENT PERSPECTIVE

Transit decision makers and influencers have a tough rail to ride.

For in determining any major expansion, or even minor modifications to their existing system, they must take into account a myriad of complex factors. For example.

- The relationship between population density and people moving requirements.
- Which equipment technology is best suited to their needs - both in the immediate and long term?
- What is the bottom line in terms of capital and operating costs?
- How can they generate private sector participation in "corridor" versus "scatterized" urban environments?

In brief, how can they justify their decision!

But perhaps even more basic, is the multi-faceted question of effective land use - a problem shared by all North American urban centres, and one that is going to become even more critical by the end of the century.

For according to a recent United Nations study, more than half the world's population will be living in cities by the year 2010.

Almost 42% are already city-dwellers, up from 37% in 1970, states the report by the UN's Fund for Population Activities. It predicts increases to 48.2% in the year 2000; 53.8% in 2010; and 62.5%, or nearly two-thirds, by 2025.

Most of the growth in urbanization is occuring in the world's developing nations which include all countries outside of North America, Japan, Europe, Australia, New Zealand, and the Soviet Union. But it is evident the need for urban transit solutions and effective use of land has never been more critical in both Canada and the United States.

In recent years, this realization has changed the very concept of transportation in that, not too long ago, it was considered to be a justifiable land use in its own right. And with substantial investments made on its behalf, businesses and private developers tagged along to take advantage of the new stations.

Today, however, urban transportation has come to be considered for what it really is. Namely, a service aimed at supporting or serving the use of land to complement broader objectives. These include:

- improving the vitality of the downtown core as an engine for economic development and improving the quality of life of its inhabitants
- reduced congestion
- reduced energy consumption and/or better management of energy.
- less pollution
- creating jobs
- improved housing

This doesn't mean to say that desirable land use should totally dictate the provision of transportation facilities. But rather that land-use objectives and desirable urban form should be paramount in any negotiations which must inevitably occur.

And it is in this spirit, that investment in transportation systems and facilities is now seen as a vital and extremely effective tool in shaping or controlling urban development.

Toronto proves it

In Canada, this is perhaps nowhere more evident than in Toronto. Whereas the city's earliest rapid transit lines were created to solve operational problems such as overcrowding, slowness of service and poor reliability of streetcar lines, more recent planning has concentrated on meeting municipal objectives related to urban growth and development.

A leading factor in this regard is the Metropolitan Toronto Official Plan (Metroplan), which was adopted in the mid-70s. And perhaps the most important element in this plan is the objective to decentralize employment activity from downtown and to create transit-oriented suburban sub-centres.

Two such major centres are currently under development. They are Scarborough City Centre, the terminus of the Scarborough Rapid Transit line, and North York Centre, on the Yonge subway line. Several minor nodes are also planned.

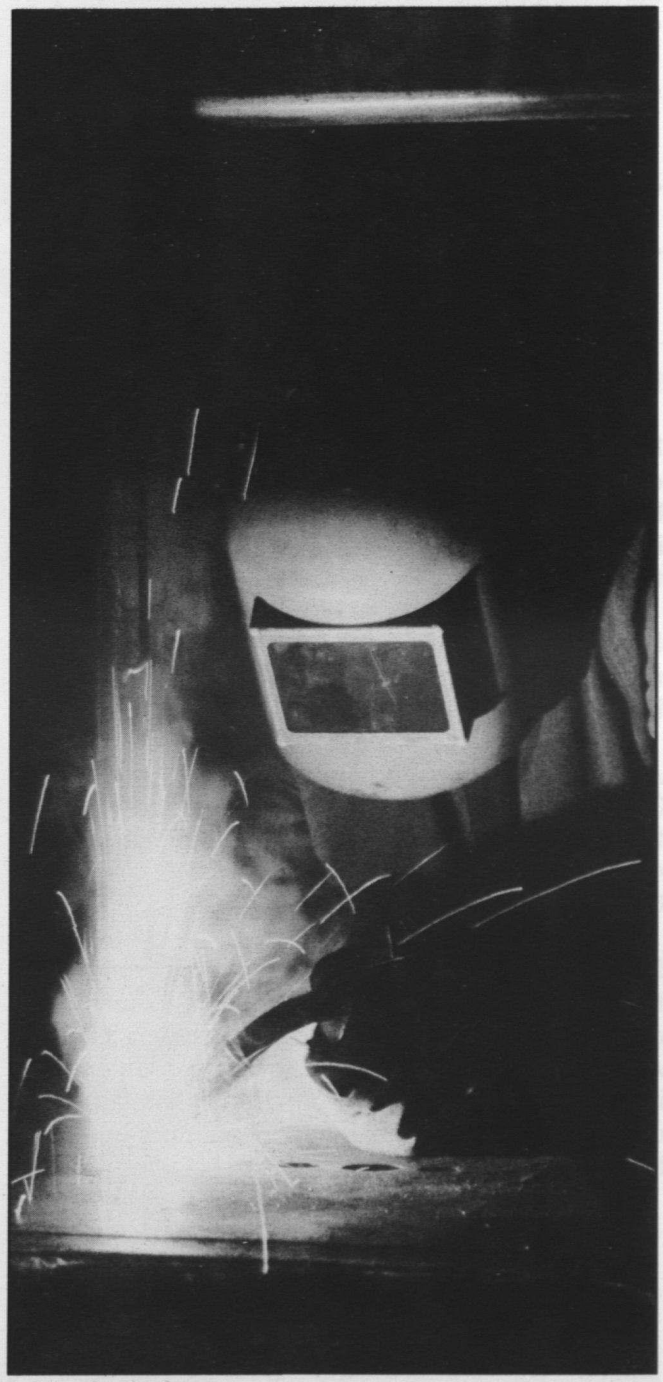
The formula is obviously working.

Scarborough City Centre currently has approximately 7,500 jobs (including the Scarborough Municipal Offices). It has a target of 40,000 jobs by 2011, with an ultimate potential as high as 63,000. Developments already under construction, or with approved zoning in place, could add a further 15,500 jobs to the Centre. It is estimated that, in order to achieve the targeted employment levels, transit must carry 55% of all peak period trips due to limited road and parking capacity.

And it is this same rapid transit system currently in operation that will meet these future needs because of its inbuilt, advanced technology.

Also as a result of advance planning, commitments have been secured from several organizations to construct high density developments at the City Centre.

In addition, the Kennedy-Eglinton intermediate centre, at the southern terminus of the RT, is expected to provide another 10,000 job opportunities. And some 17,500 industrial jobs are expected to be within walking distance of the transit corridor.



Building for the future

Ottawa's unique busway system

Rapid transit of another kind is found in Ottawa, the nation's capital with an urban population of some 500,000. Its busway, unique in North America, seeks to achieve a true rapid transit system based entirely on the motor bus!

Completion date for the 22-mile system is 1991. It comprises 19.5 miles of two-lane roadway and 2.5 miles of operation on the existing Ottawa River Parkway, plus 26 stations. If necessary, the downtown section can be "tunnelized" should population growth demand it, perhaps in 25-30 years when it is expected to reach 750,000.

This section is expected to carry about 12,000 passengers in 179 buses in the peak direction during the peak hour of service - equivalent to a bus about every 20 seconds.

OC Transpo currently runs a fleet comprising 25-ft., 40-ft. and articulated buses to fine tune its system to accommodate peak people moving demands. Ontario Bus Industries is supplying 34 Ikarus articulated buses for a total fleet of 275 by 1991, in addition to 728 regular buses for the same year. The mainstay of the fleet is supplied by General Motors, Diesel Division.

Financial estimates indicate that in 1991 alone, the transitway system will reduce capital and operating costs by approximately $55 million compared to what would have been required if the system were not built. Moreover, with construction costs currently estimated at about $300 million, there is every chance that this unique system will pay for itself.

In the interim, it has come in for glowing praise from Bus World Magazine in the United States. States a recent cover page feature:

> *"Ottawa-Carleton and OC Transpo are creating a true rapid transit system at a relatively low cost.*
> *"What is happening here should be studied very carefully by political leaders, transit advocates, urban planners and others in the United States concerned with the quality of life in our cities... the Canadians are on to something."*

Tunneling under the heart of the city

But never in a vacuum

Canada has also learned, however, that any major urban transit innovation cannot be conceived, or operated, in a vacuum. It takes more than selecting the right system, the right equipment, and finding adequate funding.

It demands the full support of local government in terms of:

- transit-oriented zoning by-laws
- parking restrictions
- official plans relating to urban planning and surface coverage
- value capture programs

It must also be remembered that joint land development is not an automatic product of transit improvements. Private developers and public agencies must work together to obtain optimum results and growth. And there is no question that such co-operation does pay dividends.

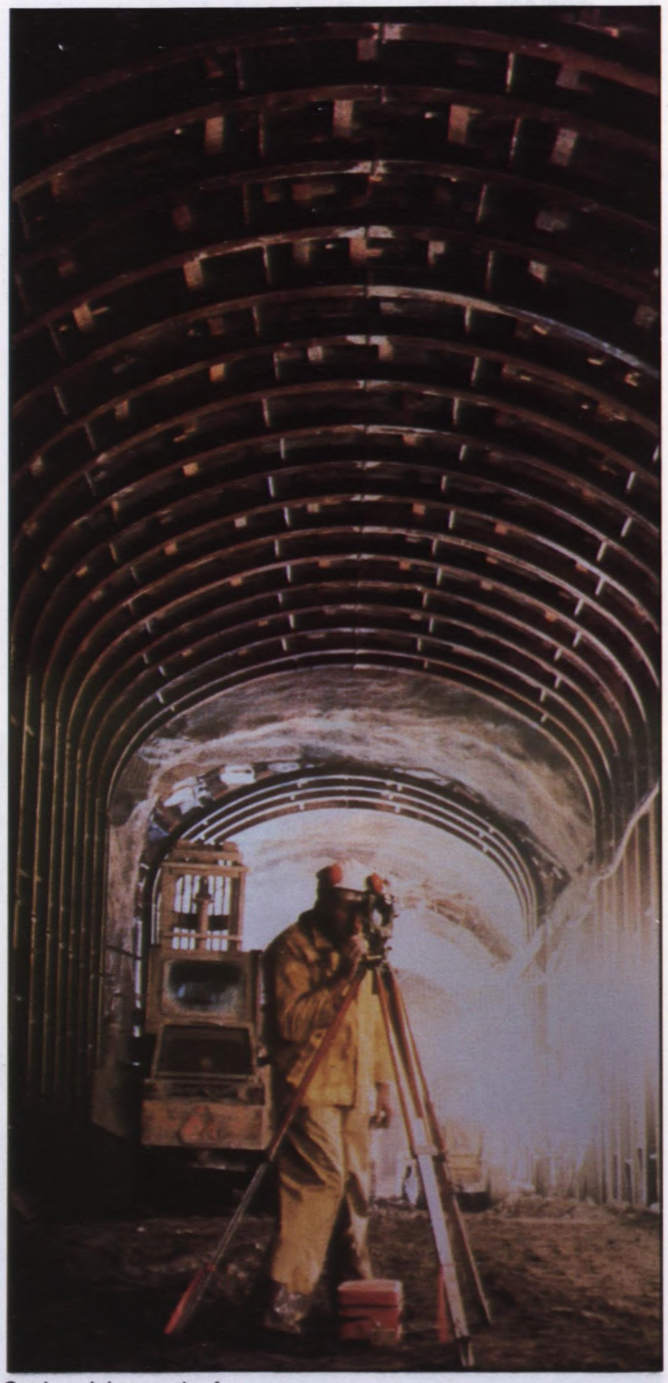
In Toronto, for example, the city's subway system has resulted in a significant increase in business and property tax assessments along its routes.

From 1952-1962, these increases in the districts adjoining the Yonge Subway line were 45% in the downtown core and 107% between College Street and Eglinton Avenue. During this period, the city as a whole averaged an increase of 24% in land values. Reinforcing this, is the fact that past real estate surveys have shown that 90% of all office building and half of all apartment construction was occuring within a five-minute walk of the subway system.

In Toronto, Montreal and Vancouver, private developers have even contributed substantially to the cost of building stations and, thereby, attracting ridership, in return for physical access to the system and its passengers.

It goes without saying, of course, that developers are reluctant to show the same interest for a standard bus system where routes may be here today and gone tomorrow.

If one is to attract and encourage this type of private sector investment, it is imperative that the system will remain for decades to come.



Setting sights on the future.

THE FOUR FACTORS

In more general terms, it may be stated that volume of travel, length of trip, and mode of travel appear to be affected by four main components of land use. They are:

- size
- density
- design
- land-use patterns

Each may be defined as follows:

Size elements include total population, total employment, spatial size, or number of households. Longer internal trips are associated with communities of larger populations.

Density is the measure of the intensity of land-use activity. Population densities are usually measured as persons (or households) per square kilometre. And residential development densities are often measured as units per hectare.

Public transit is primarily dependent upon the size and density of the non-residential (employment, commercial, cultural) destination, and only secondarily dependent upon the residential density at the origin.

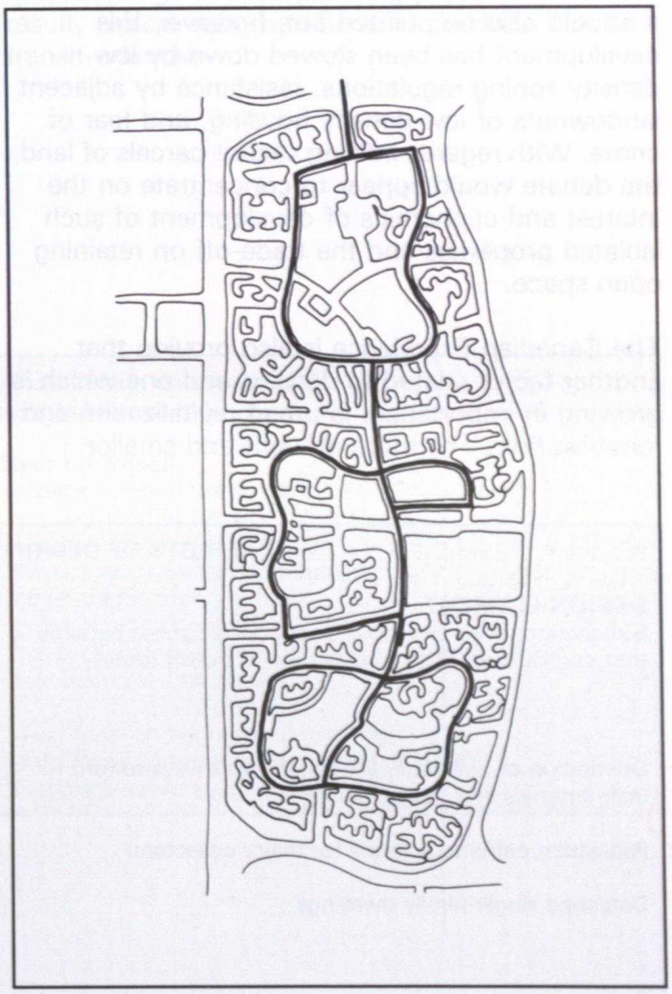
This is a most important fact and suggests that, on balance, initiatives which increase densities of activity at trip destinations tend to be more supportive of transit than those which increase density of the origin or residential end.

Reasons for this are not difficult to find.

a) Historically, transit facilities have been physically oriented to downtown cores.
b) Initiatives which tend to restrict automobile usage are usually taken at the destination through fewer parking spaces, higher parking rates, and parking at more distant locations.
c) Trips originating from residential densities are multi-purpose, while trips destined to employment densities are, by their very nature, work trips.

It is also a proven fact that increased density can result in:

- less time spent walking to bus-stops and waiting for buses.
- reduction in the scale of the grid of transit routes.
- an increase in the attractiveness and usage of public transit.
- a more efficiently run transit system.
- lower operating deficits.
- reductions in the number of vehicle trips.
- increased accessibility for lower income households.



Transit route in new subdivision

At the local level

Here, the density debate invariably encompasses the following concerns: mixing densities, apparent crime relationships, efficient use of scarce land space, potential revenues available to the municipality, and the cost of providing services, including transit. Because it obviously helps to reduce the costs of services, improve the tax base and, in general, develop a more energy-efficient urban form, higher density development is winning significant support.

It should also be pointed out, however, this development has been slowed down by low-density zoning regulations, resistance by adjacent landowners of low-density housing, and fear of crime. With regards infilling vacant parcels of land, the debate would appear to concentrate on the interest and economics of development of such isolated properties and the trade-off on retaining open space.

The Canadian Experience is also proving that another factor related to density, and one which is growing in importance, is urban revitalization and rehabilitation. The more affluent and smaller households are moving back into the downtown core and renovating older houses.

With car ownership still tied very closely to income, this move back to the cities, coupled with a resurgence in bicycling and walking, has tended to reduce the demand for public transit service in the central area. As a result, and because of the recognition of latent suburban public transportation demand, transit systems are reaching out more than ever before into the lower-density communities bordering Canada's cities.

The lesson to be learned is that planning which serves to discourage through traffic, but which makes for convenient and more direct access to transit services, helps to discourage automobile trips. In doing so, it contributes to a quieter, safer, and more energy-efficient residential community.

EFFECTS OF DESIGN ELEMENTS ON TRANSIT

DESIGN ELEMENT	EFFECT ON TRANSIT
Subdivisions with circuitous or cul-de-sac street patterns that do not have pedestrian access to transit routes	• longer walking distance to transit stop • longer transit routes • higher transit operating costs • longer time spent travelling
Orientation of buildings, streets and walkways toward main arterials and transit routes	• reduces walking access time to transit stop • transit more convenient for door-to-door trips
Pedestrian paths to arterials (or major collectors)	• permits good access to transit operating on the main grid
Detached single-family dwellings	• longer walking distance to transit stop due to large frontages and low densities, which result in a low demand for public transit
Limited parking in downtown areas	• promotes the use of transit to downtown activities and employment • some diversion of trips to suburban shopping centres
Grid pattern arterial layout	• promotes through-traffic • improved flow of surface transit

CREDIT: Canadian Urban Transit at a Glance

Land use patterns

Of considerable importance when contemplating any land-use initiative to support transit are three basic rules:

- It should not merely be concerned with increasing transit ridership. But also with supporting general transportation, energy-efficiency and conservation, stimulating local and economic development, promoting a desirable urban form, and maximizing the use of resources and infrastructure.
- It should recognize there are areas where transit is not convenient or inexpensive within the municipal transportation system.
- It should incorporate complementary social, operational and administrative programs in an attemp to make transit more useful.

Toronto, Montreal, Vancouver and Ottawa are excellent cases in point. There, the important link between successful transit and land use is incorporated into the regional plans by the adoption of a series of standard and special development conditions. These set out in general terms how new projects should be developed, and their transit orientation.

Experience to date has proven that developers are more than willing to agree to these conditions in most instances, providing they are introduced at an early stage in their planning process. As a result, typical suburban housing densities can be transit oriented.

Land-use patterns have a significant effect on transit.
They may be summarized as follows:

Pattern Element	Effect on Transit
Dormitory suburbs with no match of jobs and labour force.	• increases travel time to work • less likelihood of transit service or use
Large areas of uniform zoning (industrial parks, residential neighbourhoods)	• encourages cross-city commuting • longer transit trips • increases transit operating costs • increases dependence on vehicles to reach local and frequently-used facilities
Major activity centres scattered throughout the community	• fewer focal corridors for transit service • lower levels of transit service to each facility • inefficient transit system

CREDIT: Canadian Urban Transit at a Glance

THE TRANSIT CHOICE

Basically, there are three clearly distinguishable transit modes from which to choose.

Transit bus:	Ottawa being the perfect example of a bus-only system.
Light rail/ALRT, conventional rail	With Vancouver and Scarborough pioneering the way in ALRT. And outstanding conventional systems found in Portland, Toronto, and Santa Clara.
Subway/rapid transit, commuter	From the steel wheel/steel rail system in Toronto to the rubber-tired Métro in Montreal, rapid transit has more than proved its validity for large cities.

Each is characterized by its respective people moving capacities, which may be determined as follows:

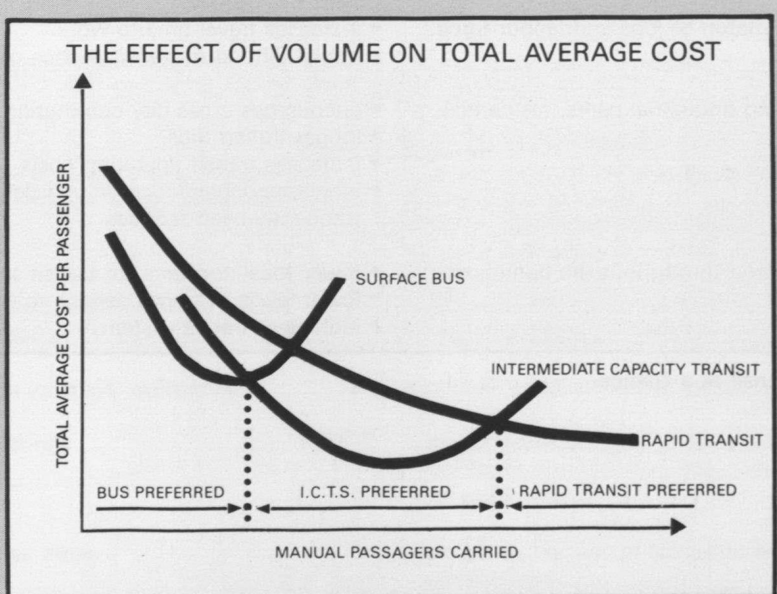
Bus	± 6,000	people per hour/per direction
ALRT	± 10,000-25,000	people per hour/per direction
Rapid Transit	± 40,000	people per hour/per direction

Conventional light rail systems varying from on the street use to exclusive guideways provide people moving capability from the upper range of buses to the lower ranges of intermediate capacity systems.

As proven by OC Transpo, transit buses offer the lowest initial capital costs and the highest system flexibility but with high operating costs.

Higher capital investments in hardware and infrastructure in the rail systems offer increased moving capacity and a lower total cost per passenger mile.

The relationship among the three modes, in terms of operator total average costs, is shown in the following graph:



Source: Canadian Transit Handbook — 1980

COSTS: THE BOTTOM LINE

Costs are obviously an important measure of system performance that effects the:
- selection of transit routes
- choice of technology
- type of service provided

They should also be, and usually are, an important determinant of pricing or fare policy.

These transit costs can be divided into:
- fixed costs or capital costs
- variable costs for systems operations and maintenance

ELEMENTS OF PUBLIC TRANSIT FIXED COSTS						
Cost Element	Diesel Bus	Electric Trolley	Street Car	Commuter Rail	LRT	Rapid Transit
Engineering		•	•	•	•	•
R.O.W. Acquisition	1	1	1	•	•	•
Construction						
loading bays	•	•	•			
shelters	•	•	•			
preparation of road bed			•	•	•	•
structures				•	•	•
stations				•	•	•
parking				•	•	•
access roadways				•	•	•
substations		•	•		•	•
garages	•	•				
shops	•	•	•	•	•	•
storage yards			•	•	•	•
utility relocation					•	•
Plant						
track			•	•	•	•
electrification		•	•		•	•
signal system				•	•	•
communications				•	•	•
ventilation						•
station equipment				•	•	•
maintenance equipment	•	•	•	•	•	•
shop equipment	•	•	•	•	•	•
Vehicles						
powered vehicles	•	•	•		•	•
unpowered vehicles				•		
locomotives				•		
maintenance vehicles	•	•	•	•	•	•

[1] Limited right-of-way acquisition for loading bays and storage facilities.

Credit: Canadian Transit Handbook.

Fixed costs

Because of the wide variability in factors influencing fixed costs, generalizations are difficult to make. It may be stated categorically, however that:

- surface bus systems have relatively low capital costs as, apart from the cost of buses, bus shelters, and maintenance facilities, there is basically no capital cost for construction or fixed plant.
- subway systems involve substantial fixed cost for construction of underground stations and structures. Also for supply and installation of track work, electrification, and train control systems. The capital cost of vehicles is also much higher at about $1 million per unit than for about $150,000 for conventional buses.

Capital costs

These are obviously dependent upon the system selected and the prevailing conditions at the time. They may be sub-categorized, however, as follows:

- construction
- plant
- electrification
- vehicle

Construction costs

These depend primarily on:

- geometric design standards (cross section, horizontal, and vertical alignment standards).
- availability of right-of-way.
- degree of segregated operation.
- inter-section treatment (whether at grade or grade separated).
- soil conditions and topography.
- the nature of abutting land-use.
- fleet size, because of the need for maintenance and storage facilities.

Obviously, where right-of-way opportunities exist, at-grade facilities are less expensive to build than grade separated facilities such as tunnels or elevated structures. Also, station costs will be considerably higher for grade separated facilities than for surface operations in protected rights of way.

Station design concepts, fare collection methods, feeder service, and pedestrian access facilities also affect construction costs to a large extent.

In the case of rail systems, for example, platform height (whether street or high level), and the use of central or side platforms, affect costs as well as the requirements for pedestrian circulation facilities.

Enlarging tunnels to form stations

Plant costs

Transit systems requiring track, electrification, and train control, are probably subject to less variability than construction costs.

With trackwork, for example, rail requirements are usually standardised within a fairly narrow range of type and weight. For surface operation, the rails are supported on conventional tie and ballast substructures, the major variable being the choice between wood and concrete ties and the size of rails.

With elevated or underground facilities, however, direct fixation methods may be used to attach the rail to a concrete bed. And the method of fixation may influence installation costs significantly. Special trackwork at approaches to terminals, intermediate turnbacks, and yards and shops, can also be a significant cost factor.

Electrical costs

Here, costs are influenced by the choice of power supply (AC or DC), voltage, as well as the size, frequency and performance of vehicles. Obviously, more sophisticated electrification systems may also lead to higher capital costs in order to achieve reductions invariable costs.

In general terms, electrification requirements and their associated costs will be determined by the density of traffic, vehicle acceleration requirements, the basic source of energy supply, and the nature of the power distribution system.

Vehicle costs

These depend to a great extent on vehicle dimensions, performance specifications, special features such as air conditioning and, in most cases, on the quantity ordered and delivery schedules.

Order size and delivery schedules are particularly important factors for rail equipment such as streetcars, subway cars, or commuter rail vehicles, where there is generally much less standardization than in buses.

Special orders of vehicles usually involve higher unit costs than in cases where only minor modifications to "off the shelf" equipment is required.

Final assembly of ALRT cars at UTDC

Variable costs

These costs are spent on operating and maintaining a transit system. They can, in turn, be divided into **direct costs** (i.e. fuel) and **indirect costs** (i.e. management costs).

In general, variable costs can be related to fleet size, vehicle hours of operation, vehicle km of service provided, and total system size (route-km). They will depend upon such factors as:

- the number of vehicles to be maintained
- bus washing
- tires
- the number of passengers carried

The precise definition of individual cost elements varies among different transit authorities in Canada and is often influenced by the classification of accounts used. In Ontario, for example, the provincial government agency responsible for transit subsidies recommends the classification of accounts shown below.

Transportation Costs: Operators and inspectors salaries, wages, fringe benefits, supplies, uniforms, and other expenses. Licences and rental charge for equipment (direct).

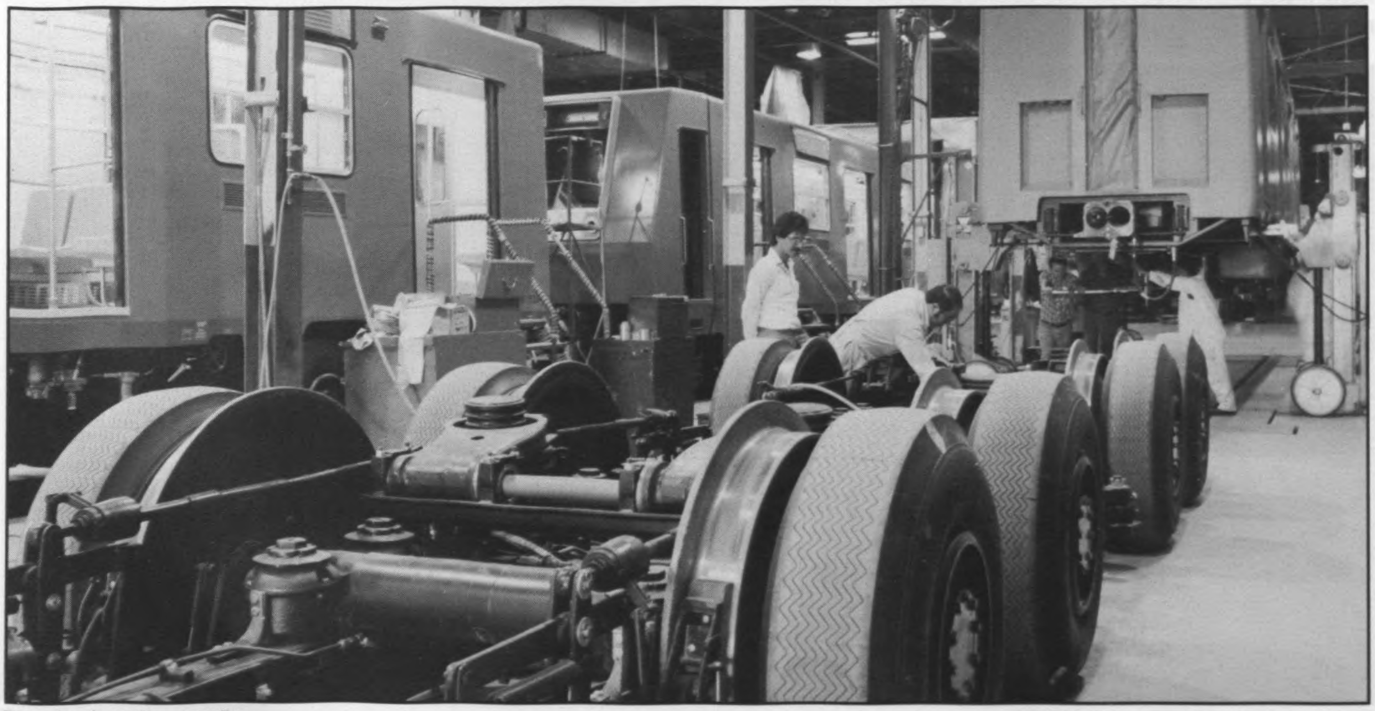
Operating Costs: Fuel or other energy sources including taxes (direct).

Vehicle Equipment and Maintenance Costs: Mechanics salaries, wages, fringe benefits, and miscellaneous expenses; parts and supplies; purchased repairs and services.

Premises and Plant Costs: Maintenance workers salaries, wages, fringe benefits and miscellaneous expenses. Light, heat, and water. Maintenance supplies. Purchased maintenance services. Passenger shelter maintenance. Municipal taxes. Rental charges for buildings (indirect).

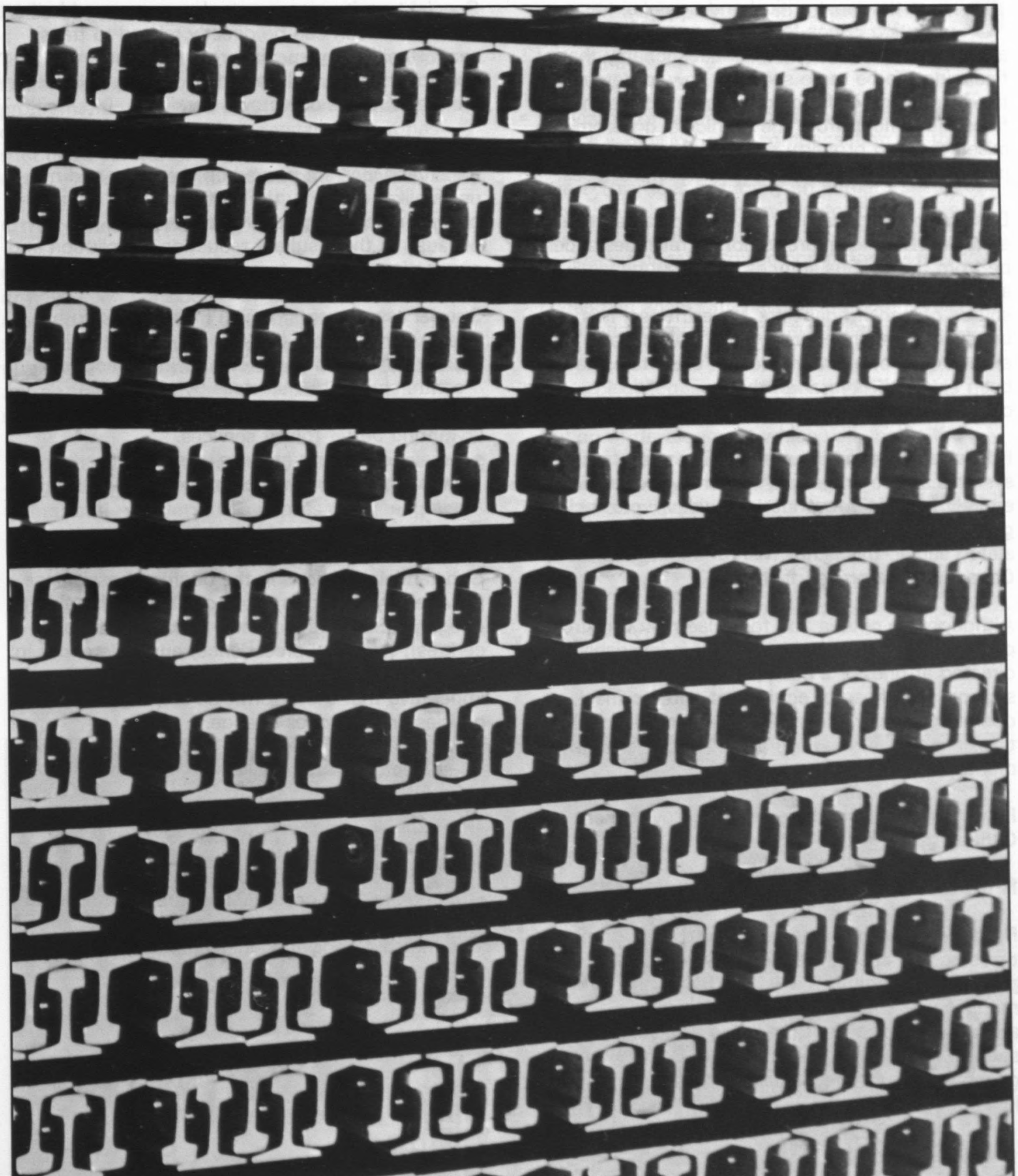
Administrative and General Costs: Administation salaries, wages, fringe benefits and miscellaneous expenses. Insurance. Claims and damage charges. Office supplies, telephone, telegraph charges. Professional fees (indirect).

Depreciation Charges: (or debenture expenses). Equipment, vehicles, buildings, or other assets (fixed).



Big wheels at Bombardier

FINANCING: THE CRITICAL QUESTION



One of the most critical and complex transportation issues facing urban municipalities and the provinces today, is unquestionably that of financing. To be more specific: how to determine the percentage of funding to come from transit fares; how much from the municipal government raised through property taxes and special assessment levies; and how much from the provinces.

Despite the fact that there is considerable debate as to what the ideal proportion of revenues should be from the various sources, it is now generally agreed that fares should not be the exclusive source of transit financing. Nevertheless, it is not unusual for revenues from fares in Canada to exceed 60% of operating costs - these fares having been established through the local political process.

It follows, therefore, that since Canadian transit systems are no longer paying for their operations entirely from fare revenues, municipal, provincial government financial support is essential. As stated earlier, this is not wishful thinking in Canada. It is a proven fact.

Although the criteria and formulae may vary from province to province, this support is invariably directed at one, or a combination of, capital support (purchase of equipment and facilities), operating support (financing operating deficits), or transit studies in the form of research and development.

Participation by the three levels of government in Canada comprise:

Municipal

Revenues towards transit are raised from property taxes and/or special transit assessments. The **property tax** mechanism is used exclusively at the municipal level and revenues realized are placed in a general fund rather than being allocated for any specific purpose such as transit. Just how these general revenues are allocated is determined by local budgeting priorities.

Special transit assessments, however, provide revenues which can be directly related to transit services either by special property or business taxation in areas well served by transit, or by other charges such as downtown parking.

This may be justified by the fact that benefits from transit services are passed on the users and non-users alike, either by the fact that there are alternative modes of transportation available, or because of the resultant reduction in pollution and congestion.

Special assessments, which have proved to be effective in Canada, include:
- contributions to downtown or inter-shopping centre shuttle bus services by merchants.
- local improvement taxes for neighbourhoods wanting better transit services.
- increased parking charges or surcharges for premium-space downtown parking.

Provincial

Substantial variations in the degree of assistance provided by Canada's provinces are attributable to geographic factors (size and number of urban centres), historical precedence, and differences in priorities and economic circumstances. It is imperative that these formulae are negotiable as policies and priorities change.

The objectives, however, remain the same. Namely:

- to transfer some private automobile travel to public transit so as to reduce congestion, pollution and fuel consumption.
- to guarantee an acceptable degree of mobility for those unable to use private automobiles - the young, the poor, the elderly, and the disabled.

Federal

Traditionally, the federal government's contribution to transit has supported studies, industry programs, transit research and development, and demonstration projects. Understandably, it has supported several innovative projects which have a direct application in more than one Canadian city.

Other revenue-raising innovations

Other revenue-raising means that have been used, or have been considered by several Canadian municipalities, fall into the category of transportation-related value capture. This refers to public sector recovery or control of the benefits arising from transportation construction and related joint development projects.

In general, these value capture strategies are designed to provide public benefits in three ways:

- **financial recovery**: this implies recovering additional revenues generated because of transit improvement. In other words, the transit system be given the opportunity to recover the financial benefits of its investments as opposed to becoming part of general city revenues

- **provision of facilities or services** by the private sector in partial compensation for the benefits it derives from joint development ventures. This does not imply an actual transfer of funds. Instead, the private sector builds amenities beneficial to the public as revenue-equivalent benefits to the community. This may take the form of commuter parking lots or special pedestrian access tunnels linking commercial or residential complexes to transit stations.

- **control over transit system viability**: this means encouraging a concentration and distribution of development which will enable the transit system to operate as efficiently as possible. Or even, in some cases, the entire station would be provided to the transit operator free in return for access and other considerations such as rezoning.

Ottawa: the nation's capital

TRANSIT SYSTEMS OPERATIONS

Fact: As is evident in these pages, urban transit is playing, and will continue to play, a major role in the future of towns and cities throughout North America.

Fact: With rising expectations on the part of different parties involved, and the rising set of needs that each has for their interpretation of the project's success, it is increasingly evident that even the most simple of improvement efforts requires:
- performance targetting
- a strong management mandate to improve efficiency, increase ridership, and lower costs
- and ideally, consensus prior to initiation

The Canadian Experience has also proven that, at the heart of any urban transit "solution" there must be - as mentioned earlier - the **political will** necessary to begin and complete the project. And that a comprehensive transit program must identify innovative approaches to technical, administrative, and financial issues which make for a better, faster, and more comfortable service at the lowest reasonable cost.

The importance of consensus and agreement between these groups cannot be emphasized strongly enough. They form the nucleus of any transit system. From its conception, to planning, to funding, to implementation, and to its successful operation in revenue service for many years to come.

These groups comprise the community in its broadest sense: transit planners and decision-makers, operators, consultants, manufacturers and suppliers, independent business interests and the private sector, and politicians at all levels of government.

But overall, any new transit system or improvement is best done if directed by a regional government structure created to study the best interests of the entire urban area. This umbrella organization must then:
- Identify the needs and determine the most appropriate transit system for the population it serves.
- Establish a regional plan which will include municipal services, a zoning and economic plan, financing and administration.
- Ensure the political will to implement that plan.

In simple terms, it is imperative that one gets one's act together if there is to be any hope of introducing a viable transit solution!

"Prebuild" proves value of consensus

One of the most recent examples of constructive consensus in Canada has to be that of the decision to build and implement the Advanced Light Rapid Transit System in Vancouver. Indeed, it could serve as a role model for any North American urban centre contemplating major transit innovations. Here is how it worked.

After defining the appropriate configuration of the regional transit system, and a potential supplier, in 1980, BC transit began analyzing the risks associated with introducing different technologies from earlier studies and the magnitude of the task.

These risk factors were defined as:
- technology
- design and construction
- project management (including operations)
- community relations

While significant attention was paid to each in the final contract, in co-operation with the supplier UTDC, the major result of the analysis was the decision to go ahead with a short section of the guideway shortly after the contract being signed.

This "Prebuild" section, as it was to become known, involved the construction of a 1.2 km of elevated guideway, one station, and delivery of two prototype vehicles only 14 months after the project being given the green light. For five months, the two vehicles shuttled forward and back along the guideway making over 13,000 trips and carrying more than 300,000 passengers.

Although it was carried out with a premium price tag, "Prebuild" was aimed at dealing with the four areas of defined risk. And the successful completion of the major portion of the system - the remaining 20 km of guideway, 14 stations, and the maintenance facility - both on time and under budget, is due to the lessons learned and the support gerenated at all levels.

The benefits were enormous. For example:

• The production of the precast beams had a number of potential difficulties which were easily resolved before a significant problem arose.

• The tracking of component failures and maintenance procedures provided refinements that were incorporated into the final production vehicle.

• The operation of "Prebuild" by engineering and technical staff from the manufacturer/designer permitted the fast and efficient flow of technical feedback to the design group in head office.

• The design of the final cross heads, at alternate columns, was ultimately changed in response to testing.

• Utility and communications companies satisfied themselves that the system would not interfere with their adjacent facilities.

From the institutional standpoint, "Prebuild" allowed the participating agencies and principals to develop working relationships and practices that would carry on throughout the project. It also permitted the establishment of the more mundane aspects of the approval process, work order authorization, and billing payment practices.

From the BC Transit point of view, it provided the opportunity to show the utility companies and others that ALRT was a serious project and that business arrangements would be made and respected, with invoices paid on time. Also, much of the red tape, often associated with mobilizing agencies, was eliminated.

Unquestionably, however, the most significant impact of "Prebuild" was felt in exactly the constituency for which it was initially targetted. Namely, the public in Vancouver and British Columbia in general. The experience of riding the two vehicle shuttle was enjoyed by more than 250,000 during the five months.

Moreover, information presented at Vancouver's "Prebuild Centre" was conveying two messages:

• ALRT was an improvement on previously recommended technologies and this improvement meant that travel times would be reduced by almost 30% and service levels would be higher. The result of an integrated bus/ALRT system would mean more convenient travel for users.

• The risks associated with new systems was being dealt with. In addition, technical explanations of linear motors and automated train control systems, for example, were translated into terms that could be understood by everyone. The objective: to diffuse the critics who might use the apparent mystery of the technology to pose future problems.

Following the closure of "Prebuild" and in order to keep the project in a positive attitude in the public's mind during major construction, a communications model was established. This reinforced past messages, stressed the economic benefits of the project, and defined the remainder of the program.

It met with resounding success. And today in Vancouver, ALRT is clearly identified by both the

public and business community alike as being the viable transit solution. Moreover, the impact of the positive relationship developed between the project team and the various constituents is excellent proof of the value of the concensus building process. Lessons learned can be summarized as follows:

• The program must deal with the needs of all constituent groups.
• Before a project is launched, consensus must be well established on a broad base.

• Any program aimed at consensus building will cost money. It should be administered by the most senior levels of organization,
• The process of obtaining consensus is an ongoing one and is not simply related to simple projects.

The Canadian Experience has proven the numerous problems inherent in designing and operating an effective urban transit system — a unique blend of business and public service — can be resolved.

The transit operator's mandate is to provide a certain range of transportation services, always under a budgetary and fare level constraint. The system, on the other hand, is asked to operate as efficiently as possible and yet is denied the freedom to adjust services and fares. It is also asked to keep costs down, while at the same time providing uneconomic service into the suburbs.

There are eight administrative factors which have a particular significance to encourage efficiently-run transit services. These are:

• service improvements
• new technology
• greater priority for transit on roads
• land use and transit
• new sources of revenue
• fare structure
• automobile disincentives
• parking policies

Obviously, the emphasis or priority for each will vary substantially from system to system, depending upon size and type of operation and also on the extent to which each aspect requires remedy.

It must be remembered at the very beginning, however, that the operator has only limited control over decisions taken in regard to service improvements, new technology and fares. Also that any initiatives relating to transit priority, land use, parking, auto disincentives, and other financing, are made through the political process.

Let us now spotlight some of these factors in turn.

Service improvement

Many cities could profit from trying to increase service on specific routes where demand and headways justify it.

Another service worthy of consideration is the **express bus,** which has proven to be attractive and efficient whenever limited circulation within a residential area is followed by a line-haul trip to a common destination or a limited set of destination points.

These are particularly helpful in peak periods to carry suburban residents to work downtown. A more infrequent operation can also be successful in off-peak hours.

The Regional Municipality of Hamilton-Wentworth, serving some 421,000 resident west of Toronto, plans to launch such an express bus service in the Fall of 1986. The limited stop east-west express connecting two high traffic generating centres will use only articulated buses.

This service is expected to cut travel time to the downtown by more than 50% and it does not involve a premium fare.

The municipality intends to monitor the progress of the express very closely with the help of new Automated Passenger Counters providing up-to-date ridership statistics.

Installation of such systems has contributed tremendously to improving adherence to schedules, reducing queues of buses, and facilitating

timed transfer-type operations — all of which have resulted in increased widerly, most notably in ''off-peaks''.

Articulated buses, such as the 34 Ikarus vehicles being supplied to Ottawa by Ontario Bus Industries, are also increasing productivity while reducing operating costs per passenger carried. This technology, which is also being adopted by Montreal and Toronto, increases the system's capacity while presenting no real problems for operations although it may involve some modification to maintenance facilities.

Greater priority for transit on roads

This can range from providing **signal priority** for buses, to reserved lanes in shared traffic, to establishing exclusive rights-of-way for use by buses or LRT trains.

Reserved lanes have proven to be successful, particularly during peak hours. It is obviously dependent, however, upon the political acceptability of increasing bus capacity at the expense of auto capacity and also the availability of road space to implement such a program.

Another improvement which has been made with some success is timed tranfers, whereby surface routes are timed so that transfers from one route to another can be made with little or no waiting.

In large cities with subway systems, the best application would be for off-peak periods on long suburban routes which connect to the subway. In smaller or medium-sized cities, a feeder bus which circulates to collect passengers can have its route timed to coincide with fixed interval line-haul service at transfer points.

Careful consideration should also be given to **loading standards,** which often insist upon heavy per bus passenger demand in order to justify the service or additional buses. While this approach can result in reduced costs of operation, it can also lead to a decline in comfort and subsequent decline in ridership.

New technology

In more elaborate and extensive transit systems, Automatic Vehicle Monitoring (AVM) systems can also result in improved efficiency.

An ultimate priority, and definitely one of the most problematical, is dedicating **exclusive rights of way** to transit. This involves giving over entire streets to transit or creating other rights of way — and this is easier said than done. For the problem with using existing streets is the political, and often commercial, resistance to eliminating or re-routing automobile access. The problem with creating or using other rights of way (i.e. abandoned rail rights-of-way, green belts, etc.) is that while costs may be lower, the routing may be unsuitable.

In the final analysis, all of these factors are very much dependent upon the **political will** made on behalf of public transit, not only in terms of financial and regulatory support, but also in public relations.

Land use & transit

As stressed earlier, this is one area where the transit system must look to the municipality, and sometimes the provincial and federal governments for active support. For development and redevelopment, local planning and approval controls can be particularly effective in the long term to support not only transit, but also energy and environmental management objectives.

In large cities where land is at a premium, the emphasis should be on redevelopment oriented to existing transit services. Smaller cities, still under pressure to expand into the surrounding areas

should opt in favour of a more energy efficient compact urban form in order to keep down costs of providing transit and other municipal services.

New sources of revenue

Many of the value capture methods or recovering revenue for transit have already been explored.

Another one, however, is parking surcharges whereby the surcharge, or that level of the fee above the basic rate, would actually be given over to the transit system as another source of revenue.

Such surcharges are collected from employers of a certain size in Paris. And in Singapore, a toll charge for vehicles entering the downtown area is collected daily. Transit vehicles, taxis and cars with four occupants are, however, exempt.

Toronto: a formula that works

When all of the above factors are studied and successfully dealt with, there is no denying that the formula works.

Such is the case with Toronto where, although the Toronto Transit Commission was established as a quasi-public body in 1921, transit — as in most other North American cities — still remained self-financing until the end of World War II.

When the Bloor-Danforth-University subway project was authorized in 1959, the Commission was, for the first time, relieved of a portion of the cost of capital expenditures. Under a subway construction cost sharing arrangement, the municipality of Metropolitan Toronto was to bear the full cost of right-of-way and to share all other subway construction costs equally with the Commission. This resulted in Metro assuming approximately 55% of the total cost of the subway and the Commission the remainder.

In 1963, a new cost sharing arrangement was adopted for future rapid transit projects whereby those costs which would not be incurred in the case of surface operation on public thoroughfares (right-of-way costs) would be borne by the municipality. The remaining costs (operating equipment costs) would be borne by the Commission.

This formula, which resulted in a 70% Metropolitan share, was applied to the Bloor-Danforth extensions and retroactively to the payment of unmatured debentures to finance right-of-way costs of the Yonge subway.

In 1964 the Province of Ontario became involved in subway construction, offering a 33⅓% subsidy associated with the construction of subway trackbed. In 1970, the Province increased its subsidy share to 50% and in 1971 expanded the scope so that a 50% subsidy on virtually all costs of building and equipping a subway were provided to the municipality. In 1972, the Provincial share went up to 75%, a formula which has been the rule for all rapid transit projects since that time.

The Metropolitan Corporation meanwhile was also expanding its financial support for subway construction. In 1968, it exempted the Commission from municipal taxes on all lands, buildings, yards and shops used for rapid transit purposes. This new formula was applied to the first North Yonge extension from Eglinton Avenue to Sheppard Avenue. When the Yonge Subway second extension was approved from Sheppard Avenue to Finch Avenue, the Metropolitan Corporation undertook to pay full costs of this extension.

The current basis for capital contributions is as follows:

1. For additions and major improvements to the subway and light rail systems and equipment, the municipality of Metropolitan Toronto makes a capital contribution equal to the total cost and recovers 75% of this amount from the Province of Ontario.

2. For other asset additions, including buses, the Commission receives from the Province a 75% capital contribution that is paid through the municipality.

Operating subsidies are set according to a formula developed in 1977, and amended in 1980 to require riders to contribute 68% of the operating costs through the farebox. The remaining 32% is split roughly 16% percent each by Metropolitan Toronto and the Province of Ontario. From its Operating Budget, the TTC funds that portion of capital expenditures not covered by Metro and the Province. In 1984, the Commission contribution to this end was $2.5 million out of a total capital expenditure of $123 million.

These statistics indicate the strong commitment of both the Metropolitan and Provincial governments to transit in Metropolitan Toronto. Both have taken the point of view that transit should be fostered because of its inherent operational efficiencies and because of the significantly reduced impacts on the natural and social environments compared to road building. Thus, the early sharing formulae recognized that government could build roadways for automobiles, or they could build roadways for transit vehicles, even if they might be subterranean.

CONCLUSION

The key ingredient to developing and implementing any transit system is the ability of all parties to work together (planners, developers, politicians, operators, suppliers, etc.).

Each organization and agency must respect the other and be able to make the kind of accommodation necessary for successful project implementation. An integrated approach to system implementation requires not only the appropriate operating considerations, but also the financing, zoning and public policy commitment to deliver a comprehensive, co-ordinated package.

In Toronto, Vancouver and Montreal, this kind of co-operation exists. As well, the driving force for the transit operator and the municipalities is to provide the best service within the available resources for the transit rider.

MONTREAL: THE ULTIMATE USER-FRIENDLY TRANSIT SYSTEM

Montreal's dazzlingly beautiful subway, known as the Métro, is the transit system's pivotal element.

Fed directly by 116 of the city's 146 bus routes and its two suburban trains, it is part of an elaborate underground/overground complex which allows Montrealers to enjoy their city, despite torrid summers and Siberian winters with an annual snow fall of 120 inches.

The Métro began to take shape in the early 60s when the Canadian National Railway decided to cover up 22 acres of unsightly open elevated tracks in the downtown area.

The Montreal Urban Community put together a team of architects and engineers to oversee the massive project, the Metropolitan Transit Bureau (BTM).

The first two lines opened in 1966, and a third in time for Expo 67. A fourth is currently under construction, part of wich opened in June 1986 for completion in 1987.

Underground at Du Collège

Jean Talon Métro station.

Rubber-tire, small gauge

Unlike Toronto's subway, the Métro, a rubber-tire, small gauge sytem, operates entirely in two-way underground tunnels. Except for the initial series, the subway cars were manufactured by Bombardier Inc., Mass Transit Division and marked that company's remarkably successful diversification into the transit industry.

The units provide a smooth, quiet, and comfortable ride. Since they are smaller, only 50 ft. long and 8 ft. 3 in. wide, they can run on parallel tracks within a single tunnel (20 ft. 4 in. wide). They transmit minimal noise and vibration to surrounding buildings and structures so no soundproofing is needed in tunnels and stations.

In the completely closed environment of the Métro, rubber-tire suspension permits safe, reliable acceleration and breaking on grades of up to 6.5%.

Métro trains are composed of three-car elements with each element consisting of one unpowered car between two powered units. Depending upon passenger demand, they use from one to three elements. Trains are closely spaced and make frequent stops. Cars are equipped with four double doors per side to allow rapid passenger exchange. Stopping time at stations is approximately 10 seconds.

Different architects

One of the most notable features of the subway system, from an aesthetic point of view, is that each station was designed by a different architect. In addition, the city has constructed a network of pedestrian passages linking the parallel stations and the subway to downtown department stores.

Many of the passages, built with public, private and joint-venture funding, are lined with retail stores and provide hundreds of thousands of city residents and visitors with year-round shopping in a controlled environment.

Many large scale downtown developments, such as Place Bonaventure, Alexis Nihon Plaza, Complexe Guy-Favreau, were built with direct access to the subway. And the "Underground Montreal" holds 250,000 people and links railway stations, hotels, cinemas, theatres and office buildings promoting the success of the downtown core.

"Cities should be for people, not automibiles," states the Montreal Urban Community Transit Corporation. Ridership figures speak for themselves.

In 1985, the Montreal transit system carried 372 million passengers. The Métro alone was used by 205.9 million. Overall, this represents a ridership increase of close to 4%.

Lionel-Groulx: a work of art

OTTAWA: THE MODERN BUS SYSTEM

The national capital of Canada, with the surrounding municipalities which make up the region of Ottawa-Carleton, is one of the most transit conscious areas in the country. Indeed, its bus system has the highest ridership of any city in North America.

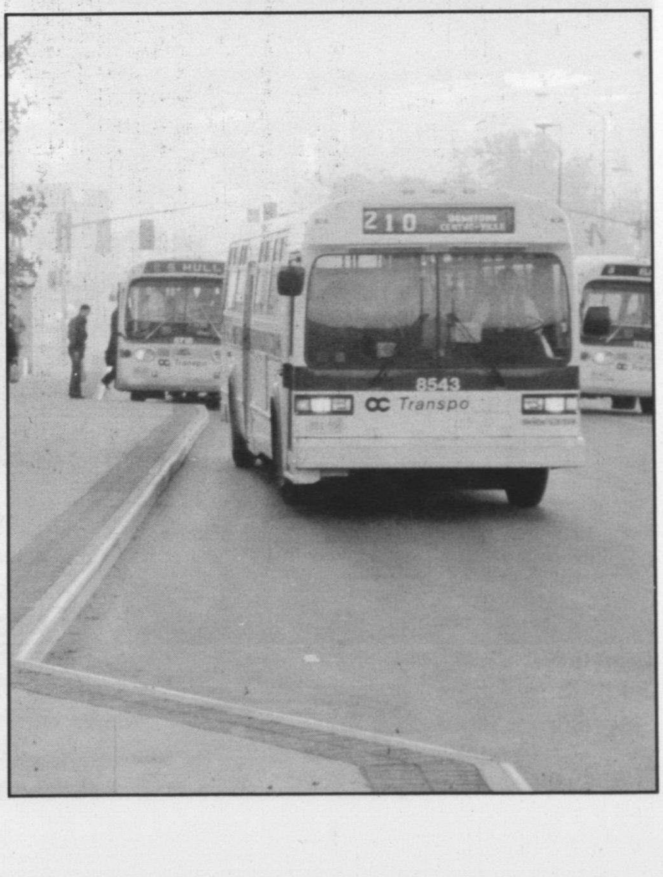

Temporary shelters

Area residents take the bus on average 175 times a year as compared to a per capita ridership of 99 just 15 years ago, immediately prior to the regionalization of transit in the area.

Since OC Transpo's implementation as a regional authority, service is provided to five cities, one village, and the urbanized portion of one township.

In 1986, OC Transpo serviced a population of just over 1/2 million with 760 buses. Ridership in the past 15 years has grown from 35 million to almost 90 million.

The rapid growth in transit in Ottawa-Carleton has many causes, not the least of which is good political and public support. OC Transpo is convinced that increased ridership comes with good service. This conviction underlies the philosophy of transit in the region which was defined in Ottawa-Carlton's official plan.



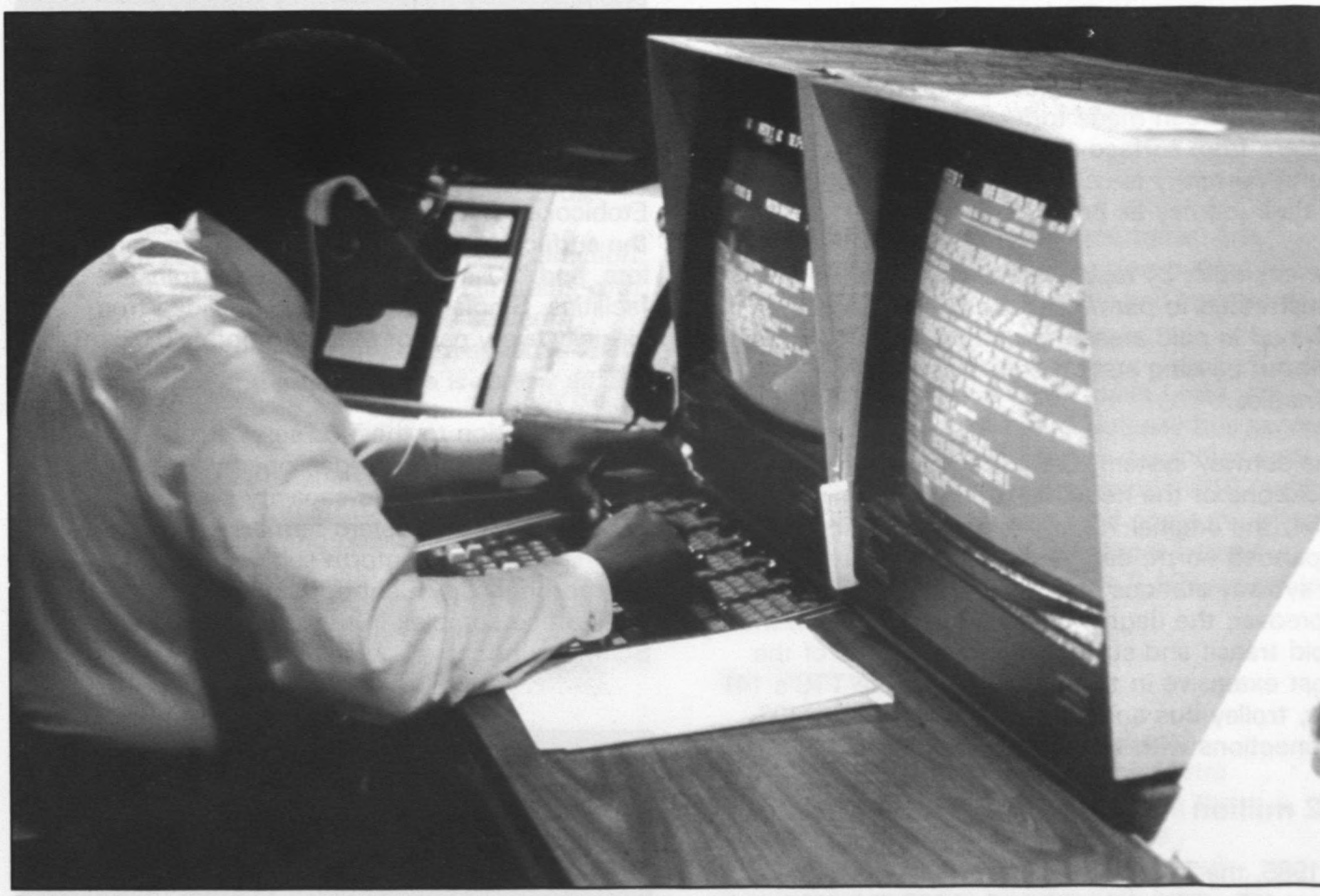
Its major transportation policy gives precedence to public transit and/or commuter service over all forms of road construction or road widening.

In the early years of regional transit, the Commission moved quickly to implement priority measures such as bus - only lanes, contraflow service, priority turns and bus malls. New service types were introduced including express services from outlying areas and dial-a-bus and para transpo services. Flexible working hours were introduced throughout the region, exact fare and bus passes were implemented, and new systems of public information were introduced.

Continuing leadership

OC Transpo is continuing its leadership in transit techniques and technology. Within the last few years, the Commission has introduced: its "560" computerized telephone information system and a video component, using Telidon technology; a computer-based communications and service control system; a proof-of-payment system on its articulated buses; and is making on-roads into improved service analysis, passenger counting and vehicle location techniques.

The winter of 1983 saw the opening of the first pieces of OC Transpo's Transitway. Designed as a busway, the grade-separated roadway will, by 1991, include 31 kilometres of roadway with 26 stations. Already in operation are 12 kilometres of Transitway and 10 stations. By the end of 1987, an additional 3 km and two stations will be in use.



Control centre

TORONTO: ONE OF THE BEST IN THE WORLD

Cited as a "shining model for mass transit" in the Detroit Free Press, Metro Toronto's public transit system is regarded as one of the finest in the world. Safe, clean and reliable, the TTC enjoys a world-wide reputation for operational excellence.

Over the years, this reputation has attracted hundreds of journalists and officials from other transit operations and governement agencies throughout the United States and as far afield as Sweden, Singapore, Egypt and France.

The success of Metro Toronto's 1,338 km surface and subway network is largly due to the fact that the system is fully integrated. And a conscious effort has been made to feed the rapid transit system from surface routes providing riders with the opportunity to use the faster mode for as much of their journey as possible.

For example, 34 rapid transit stations are constructed to permit surface lines to load and off-load in paid areas, permitting riders to transfer without passing station collectors or through turnstiles.

The subway system, Canada's first, is the backbone of the network. Since its opening in 1954, the original 7.2 km Yonge Street line has expanded north, east and west into a network of 59 sybway stations and 54.4 km of route. Moreover, the degree of integration between the rapid transit and surface networks is one of the most extensive in the world: 132 of the TTC's 141 bus, trolley bus and street car routes make 196 connections with the rapid transit system.

432 million

In 1985, the TTC's 2,600 passenger vehicles carried some 432 million riders a total of 185,919,488 km. It is anticipated that the number of passengers will increase to 437 million in 1986 and reach 450 million by the 1990s. Per capita ridership is the highest in North America, equal to 200 rides for every one of Metro Toronto's 2.14 million residents.

Scarborough RT train on elevated portion of 6.5 km line

Extending from the core of the downtown business and financial district out into the centres of the surrounding cities of Scarborough, North York and Etobicoke, the rapid transit system is supported by the surface feeder network, commuter parking lots, and "Kiss 'n' Ride automobile transfer facilities. Single service fare is provided from virtually every part of Metro Toronto's 632 km^2 area.

A new addition to the TTC service, the 6.5 km Scarborough RT line began operation in March, 1985. This intermediate-capacity system links Kennedy Station, eastern terminus of the crosstown Bloor-Danforth subway line, to the Scarborough City Centre, a large administrative-retail-office complex in the suburban city of Scarborough.

Scarborough City Centre

TTC CLRV Street car by day

In effect, it is a mini subway operating above ground on its own right of way, part of which is elevated on concrete supports to permit uninterrupted travel over busy city boulevards. The line has a potential maximum carrying capacity of 20,000 riders per hour in each direction. The system currently operates two-car trains with each vehicle capable of carrying 30 seated passengers and 70 standing. Cruise speed is about 72 km per hour and interior noise is as low as 65 decibels.

Designed and built by the Urban Transportation Development Corporation (UTDC), the system is computer controlled and powered by quiet linear induction motors. Noise and vibration levels are reduced by the advanced-design truck, which permits axles to swivel and follow the rails through curves with less noise and wear than conventional rail vehicles.

And by night

Magnetically-encoded transit pass readers are also on order to enable monthly pass holders to enter the system without showing their passes to the station collector.

Planning for the future is an important priority for the TTC and in May, 1985, it unveiled an ambitious and far-reaching rapid transit master plan for the 21st century. Called "NETWORK 2011", the strategy calls for the spending of $2.7 billion over a 27-year period to build three new rapid transit lines in five separate stages. The plan is designed to maintain economic growth and employment opportunities in the cities of North York and Scarborough. Each stage of the plan would be constructed in segments of five to seven years and construction will begin in 1989.

Also in 1985, The Metropolitan Toronto Council approved the spending of $43.9 million for construction of a new light rapid transit line to service the city's fastest-growing central waterfront area. The 1.8 km line will operate on a private right-of-way.

The TTC also operates Gray Coach Lines, an interurban and long distance highway bus service to approximately 300 Ontario communities and western New York State. Beginning in 1927 with a single route to Niagara Falls, the company offers charter services, sightseeing, parcel express, and airport express buses over a 2,100 km route system.

Go-Transit

In addition, inter-city commuter buses provide an essential service to the Metro region, supplementing and extending the Province of Ontario's GO Transit rail and bus commuter lines. This combined system has proven a popular rush hour alternative to private automobiles and is attracting many commuters who work in downtown Toronto.

VANCOUVER
100 YEARS YOUNG & STILL GROWING

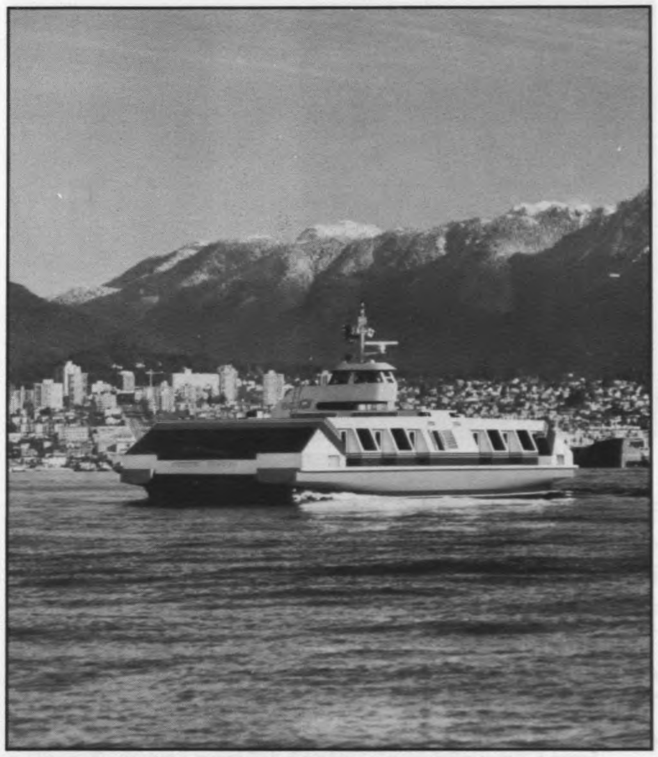
Vancouver, synonymous with firsts in urban transportation, celebrates its 100th birthday this year. And in celebration, the city hosts Expo 86, the international transportation and communications exposition, which is expected to attract some 20 million visitors from throughout the world.

The exposition also serves as a showcase for the city's new automated rapid transit system which commenced regular passenger service on January 3 and which has proven to be a phenomenal success.

Today, the Vancouver Regional Transit System is again well into an ambitious renewal process, a process that began in the mid-1970s. The aim is to build a modern, fully-integrated bus/SeaBus/rapid transit system that will serve the region's 1,150 square kilometres and 1.2 million people, efficiently and economically, into the 21st Century.

The two SeaBuses, introduced in 1977, have proven to be an unqualified succes. The all-aluminum, catamaran-hulled vessels each seat 400 passengers for the 3.2 km., 12-minute harbour crossing and connect with buses at the North Vancouver Terminal and SkyTrain at the Waterfront Station. Service reliability has been an amazing 99.98% and ridership has exceeded expectations.

The fleet of 245 new trolleybuses, with sophisticated features such as chopper control and regenerative braking, is the largest in Canada. After some early teething problems, they have become the backbone of the 921-bus fleet. Indeed, although representing less than 30% of the total fleet, the Flyer trolleys last year carried almost half of the region's 94.5 million transit riders.



SeaBus: 99.98% of trips on schedule

SkyTrain soars

The most exciting innovation, however, has been SkyTrain, the 22-km, 15-station ALRT system. Although operating at an introductory level of service, it carried its first million revenue passengers in less than three weeks and with remarkably few problems. Largly as a result of the popularity of SkyTrain as being the most favourite means of getting to the Expo site, the total number of passengers on the integrated system is expected to increase this year by 11% to 105 million.

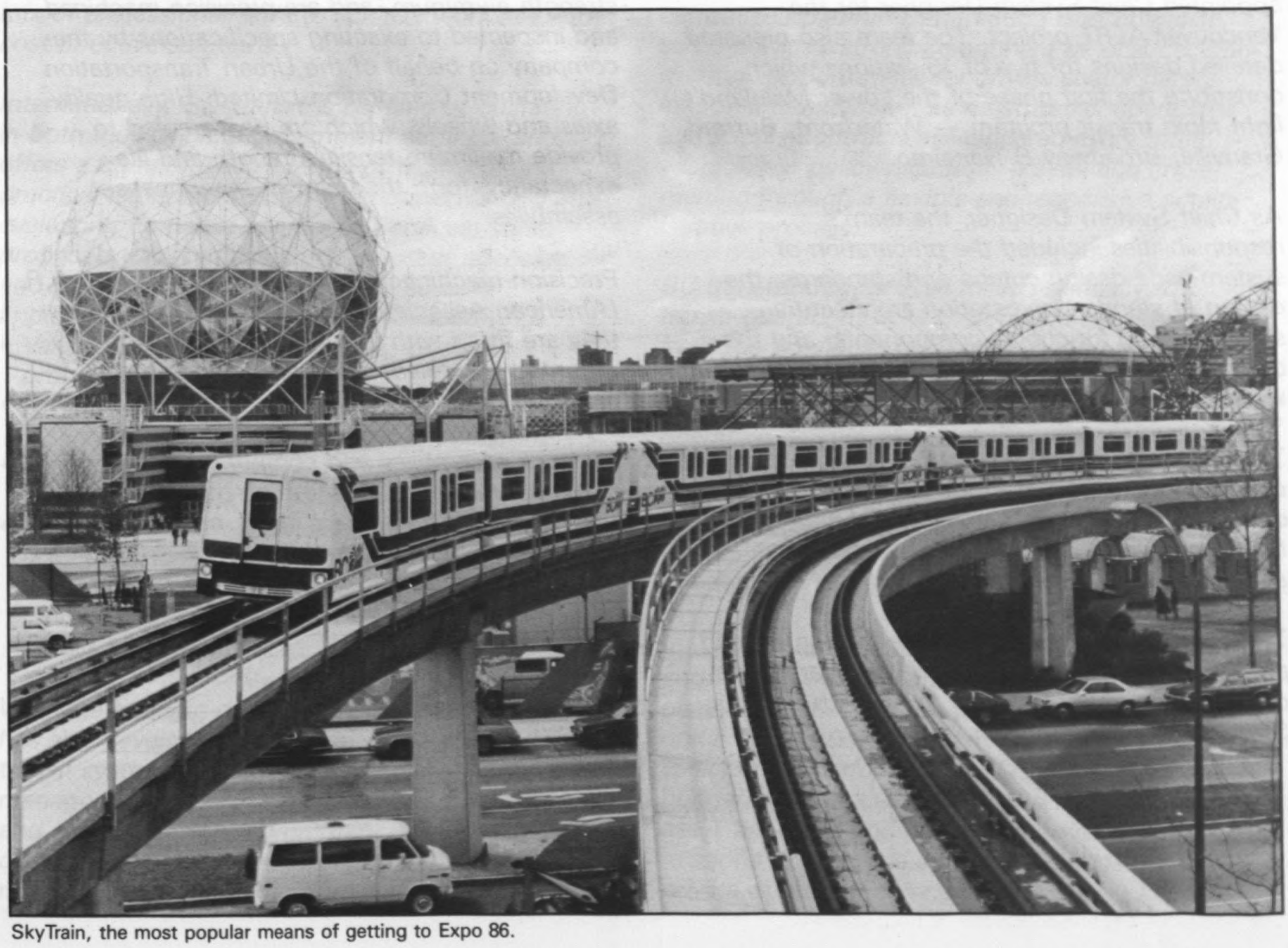
The SkyTrain, bus and SeaBus routes and fares are fully integrated. In fact, it is estimated that as many as 80% of SkyTrain's passengers begin or end their journeys on a bus or SeaBus. It is also totally accessible to wheelchair passengers, with elevators at 14 of the 15 stations, and a handyDART system (convenient Dial-A-Ride Transportation) provides some 400,000 trips annually for almost 11,000 handicapped and elderly users. Moreover, a $170 million, three-km. extension will cross the Fraser River by bridge and begin serving Surrey passengers directly, early in 1990.

The Vancouver Regional Transit System serves 14 municipalities with its integrated services. BC Transit, the crown corporation responsible for planning, funding and implementing transit services in British Columbia, works, with the Regional Transit Commission, a body composed of elected municipal officials, to prepare an annual service plan and budget. These are submitted to the BC Transit Board for approval and to the provincial government for funding approval. 45.6% of the cost of operating the system comes from the farebox. The remaining cost is shared two-thirds by the provincial government and one-third by the Commission.

BC Transit also operates the SeaBuses and buses in the region, except for 33 diesel buses operated by the Municipality of West Vancouver.

All B.C. transit services outside Greater Vancouver are the responsibility of the Victoria Division of BC Transit. Besides the regional bus service of the Capital Regional District, there are 22 conventional bus systems in small communities which carry over 1.2 million people annually, handyDart services in nine communities, and paratransit services in 10 communities.

BC Transit operates the 105 diesel buses in the Capital Regional District carrying 13 million people annually. The systems in the small communities are, for the most part, operated by private companies under contract to BC Transit.


SkyTrain, the most popular means of getting to Expo 86.

ALLEN PARKER & ASSOCIATES LTD.

775 Jervis Street
Vancouver, British Columbia
V6E 2B1
Tel.: (604) 683-2629

Allen Parker & Associates Ltd. is a Vancouver-based design/management firm with extensive experience in urban design, planning, and transportation design.

It is a multidisciplinary consulting firm, currently providing a wide range of inhouse services including public transit planning and design, urban redevelopment and revitalization, urban design, architectural design, land use planning, policy regulation formulation and industrial design.

In March of 1982, the firm and its joint venture partners, Architektengruppe U-Bahn, were appointed Chief System Designer for the Vancouver ALRT project. The team also prepared detailed designs for five of 15 stations which constitute the first phase of the Lower Mainland's light rapid transit program — Waterfront, Burrard, Granville, Broadway & Nanaimo.

As Chief System Designer, the team's responsibilities included the preparation of system-wide design criteria and standards, the design of standardized station architectural, structural and functional components, and the development of an architectural "aesthetic" which would establish the system's image and identity.

The architectural strategy that evolved — the "Kit of Parts" concept — is a modular meccano set — a collection of structural, architectural and functional elements from which stations can be assembled, and if required, altered and expanded.

The company is currently involved in the second phase of the ALRT project and is preparing the contract document package for the 4th Street Station, New Westminster.

BATA ENGINEERING

Division of Bata Industries Ltd.
Batawa, Ontario
K0K 1E0
Tel.: (613) 398-6106
Telex: 06-62255

Utilizing advanced machine-shop technology and quality-control methods, Bata Engineering plays a vital role in the manufacturing of truck components, and assemblies for urban-transit vehicles.

With a full range of Numerical Control Equipment — duplicated in many cases — the company has one of the largest N.C. facilities in Canada.

The load carrying frame and bolster for I.C.T.S. (Intermediate Capacity Transit System) self-steering vehicle trucks are die-forged in light-weight high strength aluminum, and are precision-machined and inspected to exacting specifications by the company on behalf of the Urban Transportation Development Corporation Limited. High quality axles and wheels, which are heat-treated to provide maximum tensile strength and life expectancy, form the heart of the wheel-set assemblies.

Precision-machined and inspected to meet A.A.R. (American Association of Railroads) standards, they are fitted with spherical roller bearings mounted in resilient housings, assuring true rotation and rider comfort.

All truck assemblies and components are manufactured to the same high-quality offered to the company's customers in the nuclear-energy, aircraft and military industries.

BC TRANSIT

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British Columbia has met varied transportation needs with both proven technologies and new solutions, in settings that range from large and sophisticated metropolitan systems to small resource towns and distinct constituencies within those communities.

In the process, the transit professionals of the province - architects, engineers, planners, management consultants - have attained a high level of expertise in solving urban transportation issues. For the similar transportation challenges faced by cities elsewhere, the corporation can act as a catalyst and facilitator, advising on the appropriate mix of professional skills to achieve workable and cost-effective solutions.

Internationally, BC Transit is capable of operating in both industry and government settings, and offers a comprehensive range of technical and practical expertise derived from implementing and evaluating domestic solutions. Services, some proposals under active study by other agencies and governments, or projects in the early implementation stages, include the following:

- Vancouver's marine transit link, SeaBus, proposed for New York City and Istanbul, Turkey.
- Facilities design of maintenance and operations centres for conventional transit systems.
- Opportunities in the integration of transit services and commercial projects.
- Joint venture arrangements associating the respective strengths of London Transport International or the Toronto Transit Consultants, representing two of the world's best urban transit systems.

With the building of SkyTrain, British Columbia has also developed skills relating to advanced rapid transit systems, including engineering and project management expertise, architectural treatment and graphic design, community relations, joint development, rehabilitation and multiple use of rights of way.

The corporation has acquired a proficiency in solving the particular transportation problems of British Columbia, but the practical and affordable solutions derived for domestic use will undoubtedly find applications in other communities. The British Columbia resource base and the skilled professionals are available.

BC TRANSIT - THE TRANSIT PARTNERSHIP

BC Transit is a government corporation whose 3,500 employees operate transit service in the two metropolitan regions of Vancouver and Victoria. In the smaller communities, BC Transit contracts with private operators and in several cities, the local municipality maintains an historical arrangement as the transit operator.

It is a co-operative partnership, combining centralized planning, marketing and financial services with a strong component of local decision-making. Opportunities for private sector participation and extensive, as most transit operations, and supply contracts are tendered every three years. Clear policy directions are set and implemented through a flexible and responsive administrative process.

BC transit budgets $194 million annually for transit operations, $74 million as a subsidy from the provincial government and some $36 million as a contribution from local governments (1985 figures). BC Transit pays two-thirds of operating deficits and local governments one-third; a 60/40 split applies in the Vancouver system. Capital costs of vehicles and facilities are amortized as annual lease fees and form part of annual operating budgets. Passenger fares and user fees raise varying amounts.

In close co-operation with local governments, the corporation initiates and carries out comprehensive planning and marketing programs. It manages a unified provincial fleet of 1,400 buses and transit vehicles and performs central financial functions — budgeting, financial control and reporting, capital asset financing and cash management. In labour relations, it acts in a consultative capacity to private operating companies.

BBC BROWN BOVERI CANADA INC.

4000 Trans Canada Highway
Pointe Claire, Quebec
H9R 1B2
Tel.: (514) 694-6220
Telex: 05-821542

The Traction department of BBC Brown Boveri Canada Inc., is a supplier of all types of electric traction equipment to Canada's railway and transit industries. The scope of activity in the traction field includes both DC and AC electric propulsion equipment for transit vehicles (including trolley buses), AC propulsion equipment for railway vehicles (especially locomotives), and wayside power supply equipment (including overhead catenary) for both AC and DC systems.

Working with other members of the BBC Group, BBC Canada has supplied propulsion equipment for light rail vehicles (LRV) in Cleveland and Portland, and also is currently engaged in supplying such equipment to the Urban Transportation Development Corp., for LRV's being built for San José. In trolley buses, BBC Canada was prime contractor to the City of Edmonton for a series of 100 trolley buses with chopper control, the last of which was deliverd in 1983. Catenary equipment has been supplied by BBC Canada for light rail systems in San Diego and Edmonton. In addition, BBC-supplied traction substation equipment is in service in Vancouver (for the ALRT system), Edmonton, Calgary, Toronto, and Montreal.

In cooperation with CP Rail, BBC Canada recently completed the retrofit of a CP locomotive with a set of BBC-developed three-phase AC propulsion equipment. This locomotive, which is now running successfully in service, is the Western Hemisphere's first application of this new and advanced form of railway drive technology.

BG CHECO INTERNATIONAL LIMITED

110 Crémazie West
Montreal, Quebec
H2P 1B9
Tel.: (514) 382-3030
Telex: 05-827615

BG Checo International Limited, a Canadian company with its head office in Montreal, has, for the past 57 years, been offering manufacturing and construction services to industry and public as well as private utilities in North America.

Over the last 25 years, it has become heavily involved in major projects in mass transit and power transmission in other regions of the world.

Formed through the union of two Canadian companies founded in the 1920's, it today has sales of over $100 million per annum. Moreover, its technology has advanced dramatically in order to fulfill large demands for mass transit infrastructure in its domestic market.

It is this proven experience which places the company in a strong position to offer this high level of technology and expertise to other markets of the world.

The company is very active in many mass transit related fields such as magnetic fare collection equipment, ticket vending machines, vehicle lighting fixtures and electronic ballasts and also rectifier sub-stations along with low and medium voltage switchgear.

Furthermore, in collaboration with CGEE Alsthom and other Alsthom divisions, automated train control and sophisticated signalization equipment can also be supplied by BG Checo, whose long list of satisfied customers includes General Motors of Canada, Montreal and Mexico City metro systems, Calgary LRT and many bus transit operations.

BOMBARDIER INC.

1350 Nobel Street
Boucherville, Québec
J4B 1A1
Tel.: (514) 655-3830
Telex: 055-61576

Few companies anywhere can match Bombardier's remarkable achievements, its growth — and the capabilities it now offers in the provision of mass transit vehicles and technology.

Entering this arena in 1974, Bombardier embarked on a strategic plan so successful that the company has become the largest manufacturer of rail passenger vehicles, with state-of-the-art fabrication and assembly plants.

The Mass Transit Division offers urban transit authorities a complete range of equipment and operating options, which span from high-speed inter-city trains, to subway and commuter vehicles for high-capacity applications, to medium and lower density transportation equipment and systems, such as articulated light rail vehicles, monorails and people movers.

In the forefront of Bombardier's track-record are the fundamental philosophies, policies and initiatives aggressively pursued by management teams — the bottom line of which, for customers, is an unyielding commitment to excellence and value in equipment and customer services delivered. This has been achieved by a disciplined process of corporate expansion, acquisition, licensing arrangements, joint ventures, state-of-the-art technology and a blend of application engineering and R & D expertise.

Central to the company's philosophy is innovation and customization, but always tied to tested and proven technology. In other words, working solutions. Bombardier's management recognizes, and has an oft-stated sensitivity to, the economic climate and the challenges transit authorities face today in the management of public funds.

In plotting a course to respond to these issues, the company has written an effective formula for productive, cost-efficient transportation technology demanded by communities and in so doing, has forged its own success and destiny.

North American Facilities

With a management and skilled labor force totalling some 5,000, Bombardier has four manufacturing/assembly plants in North America, two in Canada and two in the U.S.A., with a combined floor area of 1,500,000 sqft (457,200m²).

Canadian plants are at La Pocatière and Montreal, Quebec, and can handle a variety of product lines simultaneously, including new vehicle construction, or refurbishment.

U.S. plants in Barre, Vermont, and Auburn, New York, have over 500,000 sqft (152,400m²) of capacity with complete fabrication, assembly and finishing operations.

Monorail and PeopleMover systems' marketing, design and system engineering is handled by the Transportation Group Inc., a wholly owned Bombardier subsidiary created in 1985 and located in Orlando, Florida.

Mass Transit Division marketing, engineering, R & D and customer service operations are centralized in a Montreal suburb, just 20 minutes southeast of the City. The Division's U.S. headquarters is in New York City.

The company operates on a fully co-ordinated, yet decentralized management structure, permitting local management to flourish through the exercise of divisional authority and responsibility, while carrying out the policies of the corporation.

International Facilities

Outside North America, Bombardier has a light rail vehicle plant in Vienna, which has supplied hundreds of vehicles for Austria's major cities.

The company is also the principal (45%) shareholder in BN (Constructions Ferroviaires et Métalliques, formerly La Brugeoise et Nivelles) of Belgium, one of the leading European manufacturers of railway rolling stock including a variety of urban and suburban transit equipment. With five plants, employing some 2,500 people and a strong engineering and R & D base, BN's advanced technologies, including guided light transit and automated urban transit vehicles and systems — are combined with the company's resources to offer international markets everywhere, a world class capability.

Manufacturing facilities
La Pocatière, Quebec

In 12 short years Bombardier has created a 450,000 square foot manufacturing facility which houses the most modern equipment available for the streamlined production of rail cars and is considered one of the most advanced, and efficient of its type in the world. Located 90 miles east of Quebec City on the south shore of the St. Lawrence River, the La Pocatière plant can draw upon a pool of skilled labour with a long tradition of fine craftsmanship.

As a prime contractor Bombardier is responsible for the full range of system integration and customer support from the time of contract signing to vehicle delivery until the fleet meets operational targets and performance.

The Division possesses a number of advantages arising from its proprietary manufacturing techniques and capabilities which enable it to meet these responsibilities productively. Significant among these are its forming and finishing processes to produce high quality stainless steel, LAHT steel, aluminum alloy structures and composite materials for exterior and interior application. These include low maintenance and graffiti resistant finishes, and customer specified fire retardant materials.

Equipment inventory at La Pocatière includes numerically controlled machinery which has significantly reduced parts machining time, and sophisticated computer-controlled automatic welding machines which ensure high quality welding on the full range of rail car materials. CAD/CAM design systems and efficient material handling processes also facilitate the production process. Most importantly, extensive in-house testing facilities and an 8,000 foot standard gauge test track assure Bombardier customers of the quality, reliability and maintainability of their vehicles before they leave the plant.

Barre, Vermont

Built in 1981, Bombardier's 65,000 square foot assembly plant in Barre, Vermont, represents an enormous corporate investment in manufacturing facilities and demonstrates its commitment to the U.S. rail car industry. The plant's capabilities include shell erection, diverse car-building techniques, final assembly and testing.

To ensure high quality standards, full manufacturing technology was transferred to the U.S., so today the Barre plant has the same modern, streamlined production processes as developed at La Pocatière. It also has responsibility for assembly of Bombardier's Light Rail Vehicle orders for the United States market.

Responding to Market Needs

A keen appreciation of the challenges facing its customers and a determination to meet their needs is the driving force behind Bombardier's approach to its markets.

Urban congestion, limited capital funds, aging fleets, environmental concerns and other public issues all require viable solutions and technologies which are up to the task. This requires the highest levels of productivity in every phase of a contract, not only in the selection and construction of appropriate vehicles, but throughout their operating life cycle.

Bombardier's strength lies in its ability to blend new with proven technology and to integrate the many complex on-board vehicle sub-systems, thus enabling the company to meet the market demand for reduced operating and maintenance costs as well as improvements in performance and reliability.

BTM INTERNATIONAL

2 Complex Desjardins
Montreal, Quebec
H5B 1E6
Tel.: (514) 280-4014
Telex: 05-562377

Having over 20 years of experience, the Metropolitan Transit Bureau holds the necessary expertise to design, build, equip, put into service and operate an urban transit system.

Created by the Montreal Urban Community, BTM International has a team of experts who can supply services related to urban transit systems all around the world.

To be more specific: 1. evaluation of displacements inside an agglomeration; 2. determination of the needs of transportation; 3. planning of procedure, prior to construction, servicing and operation; 4. financial recommendations to consider; 5. provide all aspects of civil works prior to construction; 6. produce all architectural projects; 7. control and supervise works at construction sites; 8. elaboration, preparation of specifications and plans, calls for tenders, supply and supervision, quality control and servicing of mechanical, electrical and electronic stationary equipments; 9. elaboration, preparation of specifications and plans, installation and supervision of works needed for the track lay-out; 10. elaboration, preparation of specifications and plans, ordering, supervision, testing and servicing the rolling stock.

Further to supplying technical know-how, BTM International can offer administrative services to carry out these projects along with the management capacity necessary to bring such projects to a successful ending. Thanks to its priviledged liaisons with the many concerns related to the different aspects of such projects, the company is able to offer to eventual clients the experience and knowledge gained in Quebec, such as the operation of integrated systems, the training of personnel or a complete turnkey project.

CANAC CONSULTANTS LTD.

700 Dorchester West
5th Floor
P.O. Box 8100
Montreal, Quebec
H3H 3N4
Tel.: (514) 399-3500
Telex: 05-560753

CANAC Consultants Limited, the Consulting Division of Canadian National Railways, has been in existence since 1971, providing world wide professional transportation and communications consulting services to a variety of clients both private and governmental.

Some of the fields of activities in which it specializes are: Passenger handling facilities, signalling and communications systems, transit line capacity planning and analysis, dispatching technology, traffic simulations, integration of transit systems in association with existing freight operations. Also coach and locomotive maintenance facility planning, non-destructive testing of components such as wheels, axles and rail, provision for testing of new equipment, project management, quality control, long-term strategic planning of facilities and vehicles plus the design and implementation of management structures.

The company successfully participated in the planning of Toronto's "GO Transit" operation and organization commuter system, and continues to provide expertise in track design and equipment maintenance.

Canadian National presently operates and maintains the equipment for an electrified suburban commuter system for the City of Montreal.

CANADA WIRE AND CABLE LTD.

250 Ferrand Drive
Don Mills, Ontario
M3C 3J4
Tel.: (416) 424-5000
Telex: 06-524120

Canada Wire and Cable Limited is a leading North American manufacturer of wire and cable products. A subsidiary of Noranda Inc., the company is involved in the manufacture of electrical, electronic, communication wires and cables, magnet wire, optical fiber cables and power and control cables. Portable cords, electronic, appliance and equipment wires are produced by Carol Cable Company Inc., a wholly owned subsidiary.

Over the past 75 years Canada Wire has pioneered many specialty cable designs to serve the construction, power, control, and signal circuitry markets. In response to research conducted into fatalities attributed to fire and the release of toxic gases, it has also developed a new safety engineered electrical cable for mass transit applications.

This product, known as FLEXOR 2 MT produces minimal toxic emissions during a fire and retains fire resistant qualities and dielectric strength necessary for good cable construction. FLEXOR 2 MT cables are designed to limit flame spread with low acid gas emissions. They have been approved for use in mass transit vehicles by the Toronto Transit Commission and the Urban Transit Development Corporation (UTDC).*

** FLEXOR 2 MT is a registered trademark of Canada Wire and Cable Limited.*

CANADIAN URBAN TRANSIT ASSOCIATION

CUTA
Suite 1105
55 York Street
Toronto, Ontario
M5J 1R7
Tel.: (416) 365-9800

The Canadian Urban Transit Association (CUTA) is a nationally chartered, voluntary organization committed to a strong, innovative, effective Canadian transit industry. It has been the national voice of the transit industry for more than 80 years, and is well-known for its effort to develop and promote public transit.

The Association gathers and distributes technical and operational transit information; is a clearing house of transit skills and information; provides a forum for transit-related issues; promotes the development of government programs and policies that will benefit transit; encourages transit research and development; communicates and promotes Canadian transit developments.

Members include: transit operators, suppliers, consultants, and government agencies. Through CUTA, these members pool their skills, experience and resources to build and maintain a healthy, respected, professional Canadian public transit industry. Through CUTA, they also have access to industry-wide data, statistics and other information. The Association produces a number of regular publications on transit statistics as well as providing the public transit industry with an industry data base, a reference library, conferences and seminars on transit-related topics; trade shows, results of surveys, training programs, a forum for an exchange of ideas among transit operators and suppliers, publications and newsletters, and the national bus roadeo.

CUTA Committees and Task Forces bring together representatives of all parts of the transit industry to discuss the challenges facing public transit in Canada. It also provides a variety of transit-specific training programs, developed in response to the industry's needs. As the national co-ordinator for transit-related research and development, it monitors industry research efforts and identifies needs.

DAYTECH MFG. LTD

675 Petrolia Road
Downsview, Ontario
M3J 2N6
Tel.: (416) 661-2696

Daytech, since 1907, has been a progressive, innovative manufacturer. In 1978, the company began designing, manufacturing and installing transit shelters for the Toronto market and Daytech shelters are now to be found coast to coast in Canada.

By 1982, the company had expanded into the United States and is now servicing it's U.S. customers from Buffalo, New York. Today over 3500 shelters enhance locations throughout North America.

Moreover, they have an established reputation as attractive, high quality, durable, vandal resistant structures, that require little maintenance. They are engineered to be suitable for all climatic conditions and are offered in a variety of sizes and configurations to meet customer needs.

An important option offered with each, is a double sided, illuminated, advertising display case which is extremely durable and allows efficient copy change. Many communities have chosen units with this option, as part of a contract developed with a shelter advertising company.

One of Daytech's special large, domed shelters for the Vancouver ALRT SkyTrain.

There are many successful shelter advertising programmes using the company's shelters with displays, including Halifax, Nova Scotia; Toronto, Ontario; St. Paul, Minnesota; and Vancouver, British Columbia. The shelters are designed to provide a comfortable, well lighted, protected environment for waiting transit users and an attractive medium for shelter advertising.

Currently, the company's shelter experience has expanded into Special Design Shelters, to compliment unique architectural projects. For example, special, large shelters have been designed for the Calgary LRT; special shelters for Go Transit Commuter Rail; large, domed shelters for the Vancouver, ALRT - Sky Train; and large, domed shelters for EXPO '86. Special Design units have also been integrated into downtown improvement programmes such as in Indianapolis, Indiana.

During many years of working with transportation authorities, the company has developed other transit products in response to their needs. These include the INFOPOST, a sturdy, versatile schedule holder and the INFOPANEL, a large free standing display.

Daytech's goal is to offer high quality transit products, backed by expert service.

Daytech's Infopost, a sturdy schedule holder.

DELCANDA INC.

133 Wynford Drive
North York, Ontario
M3C 1K1
Tel.: (416) 441-4111
Telex: 06-966689

Delcanda Inc. provides planning, design and economic and architectural services for all forms of public transportation including bus and urban rail, commuter rail and technology evaluation.

From the firm's early involvement in the design and construction of Canada's first subway in Toronto in 1953, it has been continuously involved in a wide range of transit planning and design activities worldwide.

It has been involved in urban rapid transit development projects in 20 cities including the Calgary and Edmonton LRT Systems and the Ottawa Busway in Canada and the London Docklands and Manchester and Birmingham Rapid Transit Studies in the United Kingdom.

The company is currently providing technical advisory and administration services for the Kuala Lumpur Rapid Transit project in Malaysia.

Its transit facilities design group specializes in transit garage facilities including projects such as a 260 vehicle bus garage in Toronto and a combined bus and LRT maintenance facility in Calgary.

Commuter rail studies have been undertaken in Toronto, Montreal, Birmingham and Dublin. The company has also developed urban bus transit improvement programs in over 30 Canadian cities ranging in size from 10,000 to 400,000 residents and in Dominican Republic, Nigeria, Nicaragua and Costa Rica.

The company's permanent staff includes professionals involved solely in public transportation assignments who combine comprehensive transit experience with knowledge of the most recent technology and current research and developments in the industry.

DELLNER COUPLERS INC.

446 Hazelhurst Road
Mississauga, Ontario
L5J 2Z7
Tel.: (416) 823-9200
Telex: 06-982343

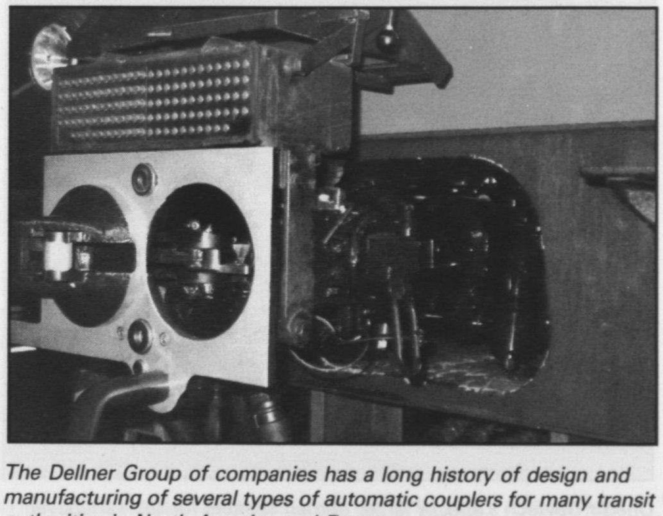
Dellner Couplers has been supplying couplers to the railway industry for over 50 years throughout the world. Their designs emphasize safety, reliability and reduced maintenance through steady innovation over the years.

The company supplied its first couplers to Canada 20 years ago in Montreal and these couplers are still in operation today.

More recently, it is supplying couplers with the most sophisticated energy absorption systems available. These are in use in Vancouver and Scarborough in Canada and they will soon be in operation in Detroit and in Sacramento in the U.S.A.

In addition, Dellner Couplers equipment is used in Calgary in Canada and in Philadelphia, Buffalo and Portland in the U.S.A.

Operating from branch offices in Canada, U.S.A., Netherlands, Germany and Australia, with the main manufacturing facility in Sweden, the company, with its constant innovation and experience, is becoming a leading coupler manufacturer in the world.



The Dellner Group of companies has a long history of design and manufacturing of several types of automatic couplers for many transit authorities in North America and Europe.

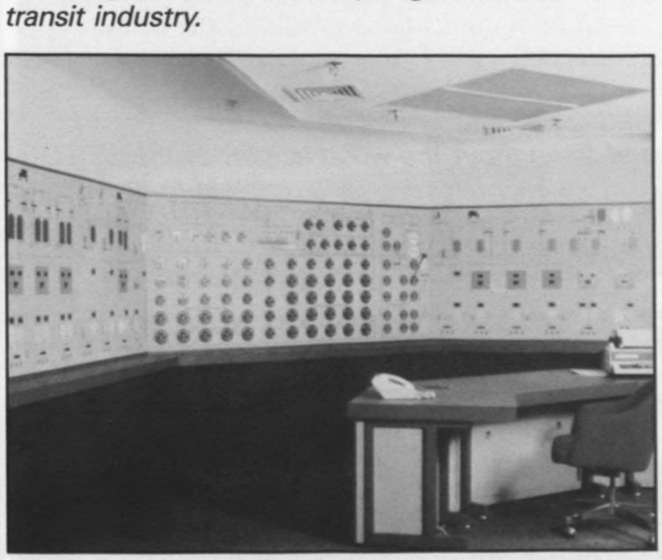
ELECTRO-MOSAIK

Division of Monitronik Ltd.
519 Curé Boivin
Boisbriand, Quebec
J7G 2A8
Tel.: (514) 430-9770
Telex: 05-835566

The product that Electro-Mosaik manufactures is a mosaic graphic type display panel. This type of control panel can be used in most any industry including the railway and transit industry. The company's version of the mosaic concept was totally developed by its researchers in Boisbriand, Quebec. The product has an impressive Canadian content of 98%.

In brief, the mosaic type display boards add versatility to your panels and hence to your control room in that changes can be made to panels by simply removing or adding polycarbonate tiles. These tiles, which make-up your board, are 24x24mm in size and are also manufactured by the company. Lights, push-buttons, etc. can be placed directly into your panel rendering it a totally functional system.

Customers in the railway industry include: Santa Fe Railroads, Norfolk and Southern Railways, Chicago & Northwestern and Burlington Northern. In addition, the company is in the process of acquiring some substantially large contracts in the transit industry.



An example of an Electro-Mosaik main control panel, designed for a large American transit company.

FAIVELEY (CANADA) INC.

376 Guimond Boulevard
Longueuil, Quebec
J4G 1R1
Tel.: (514) 651-3310
Telex: 05-267341

Incorporated in 1982. Faiveley (Canada) Inc. is the most recent Faiveley subsidiary. Backed by a team of specialists involved mainly in pantographs-doors and air conditioning for over 50 years, Faiveley Canada can offer the complete line of Faiveley products, being the state of the art in the industry and adapted to North American requirements.

The main projects realized are the door operators and pantograph to Bombardier for Portland ALRV, and the access and vestibule door operators to Bombardier for the LRC trains.

More recently, to Metro Canada (UTDC) for Scarborough, Vancouver and Detroit, door operators have been manufactured with 80% Canadian content.

Faiveley Canada has now in place both mechanical and electronic engineering and after sale support to meet the requirements of the Canadian transit industry. The company's electronic team is currently involved in the development of a sophisticated electronic monitor system to assist operator and maintenance of transit vehicles. Their latest achievement is a compact Microprocessor Monitor system mainly used for Hot Box surveillance on rail cars.

FERRANTI-PACKARD ELECTRONICS LTD.

6030 Ambler Drive
Mississauga, Ontario
L4W 2P1
Tel.: (416) 624-3020
Telex: 06-961432

Ferranti-Packard Electronics Ltd. of Mississauga, Ontario, pioneered the design and development of electronic light reflecting displays and is one of the world's leading manufacturers of these products, with installations and customers in more than 30 countries.

This type of display has excellent visibility in all light conditions, has high reliability and is very economical to operate (only 1 to 2% of the power to operate an equivalent light bulb system is needed.)

The company is represented internationally by sales offices under the name of FP Displays, and by distributors, agents and service centers in over 20 countries.

The product is used for bus destination signs, passenger terminal information displays, railroad platform signs, motorist advisory signs, and other applications where a changeable message facility is required.

More than 1,000 buses in 25 major U.S. cities are using Ferranti-Packard components in their signs. In addition to supplying display components, the company has an engineering capability which can produce complete turnkey display control systems utilizing the latest in computer technology.

Light reflecting displays are also widely used in stock and commodity exchanges, convention centers, sports stadiums, and telephone and utility management centers.

G.E.C. CANADA

5112 Timberlea Boulevard
Mississauga, Ontario
L4W 2S5
Tel.: (416) 624-8300
Telex: 06-961280

1986 is the Centenary Anniversary of GEC around the world. In Canada GEC is represented by GEC Canada Ltd., a leading company in the new technologies of transit communications, supervisory control and data acquisition systems, automation systems, as well as the industry leading line of «Transidrive» Power Conditioning Units.

Over 150 «Transidrive» DC to AC power conditioning units have been built for the UTDC and are now on line with the Toronto Transit Commission's RT line and Vancouver's SkyTrain line. These units were built in GEC Canada's Mississauga plant.

The company has enjoyed a long history with Canadian transit authorities and utilities. The company supplied much of the DC power distribution and control equipment on Canada's first subway, the TTC's Yonge line, commissioned in 1954. GEC Canada also developed the «Clear Call» communication equipment for the TTC, a carrier type two-way system, which is still in service with new orders still being received, transit communications products still being developed.

GEC Canada Ltd., with offices across Canada and throughout the world as part of the GEC international network, is committed to providing engineering excellence with progressive products for the transit and transportation industries.

GENERAL MOTORS OF CANADA LTD.

DIESEL DIVISION
P.O. Box 5160
London, Ontario
N6A 4N5
Tel.: (416) 452-5000
Telex: 064-7231

Diesel Division, General Motors of Canada Limited, introduced the Classic bus in 1983. This 40-ft. diesel powered bus was designed, engineered and built by Diesel Division. Before it became a new industry standard, it was performance tested for thousands of gruelling miles at G.M.'s Milford Proving Grounds.

Passenger features in the transit model include a spacious comfortable area with expanded dimensions of 102" wide - a full 6" wider than standard buses. This combined with a 26" aisle encourages riders to move to the rear of the bus without jostling other passengers. Other features available include Detroit Diesel 6V-92 power, air conditioning, air start, high capacity seating, dual stream entry and exit doors, wheelchair lifts, plus many more customized to your needs.

Interior shot of Classic Suburban featuring package racks, personal reading lights, fully upholstered extra wide seats with headrests and room for 53.

Three-quarter front view of the Classic Suburban now in revenue service with New York Bus Services.

Salt Lake City, Utah, has one of the largest Classic fleets in service in North America.

Diesel Division also builds Classic Suburbans, a heavy duty highway bus designed for commuter operations. The Suburban model is proven and in production for suburban transit and charter operators. It features forward facing seating for 53 in the comfort of fully upholstered seats with headrests, kneeling feature for ease of entry, picture window visibility and 20 ton capacity air conditioning, to list a few.

G.M. builds the Classics and the Diesel Division supports them with informative manuals that guide them through every aspect of operating and servicing the Classic fleet.

Ten G.M. zone warehouses, strategically located throughout North America, back the fleet with nearby service and repair parts, allowing reduction of on site parts inventory for improved economy.

The Classic. G.M. Backed & Built. The newest statement of G.M.'s continuing evolutionary refinement for your transit fleet.

The Classic serves the City of Halifax, Nova Scotia.

HAWKER SIDDELEY CANADA INC.

Canadian Steel Wheel Division
1900 Dickson Street
Montreal, Quebec
H1N 2H9
Tel.: (514) 255-3605
Telex: 05-828603

Canadian Steel Wheel Division, Hawker Siddeley Canada Inc., is a fully integrated manufacturer of wrought steel wheels for all types of railway and rail transit equipment.

Established in 1959 at Montreal, Quebec, the plant has furnished wheels for nearly all transit systems in Canada, the U.S.A. and Mexico.

Manufacturing equipment includes 2 x 60 N.T. electric arc furnaces, forging presses up to 6,000 N.T., a horizontal wheel rolling mill, heat treatment furnaces, and an extensive range of high production machine tools to meet special machining requirements.

Transit, commuter and passenger car wheels are manufactured to A.A.R., A.S.T.M. and A.T.A. specifications and to a variety of designs from 18" diameter for light rail vehicles (LRV) to 36" diameter for railroad passenger cars with either tread or disc brakes.

Steel auxiliary safety wheels are also manufactured for the Montreal and Mexico City subway cars. In addition, wheels for heavy rail equipement range from 26" diameter for commuter cars to 51" diameter for high speed passenger locomotives.

The Division also manufactures circular steel forgings, rolled steel sheaves, and plain carbon and alloy steel ingots in sizes up to 50 tons for heavy forging applications.

B. HELM ASSOCIATES LTD.

Victoria Tower
Suite 1610
44 Victoria Street
Toronto, Ontario
M5C 1Y2
Tel.: (416) 862-7742
Telex: 06-219666

B. Helm Associates Ltd. is a small firm of management and engineering consultants specializing in transportation, industrial and institutional development.

The scope of the practice covers all phases of feasibility and investment planning studies, including: policy evaluation, market research and forecasting, functional planning, cost/benefit analysis, organizational development, and operational reviews.

The firm has undertaken a wide range of projects in Canada, Asia and Europe, including:

- *the financial evaluation of proposals for a new rapid transit system in Asia.*
- *the development of a long-range marketing and community relations plan for a major Canadian metropolitan transit commission.*
- *an international review of procedures for funding the capital purchases and transit operation deficits on behalf of a European metropolitan transit authority.*

The company has close working relationships with complementary engineering, economic and management consulting firms in Canada, Indonesia, Spain, Thailand, and the United Kingdom.

THE HEWLYN CORPORATION

6 Lansing Square
Suite 209
Willowdale, Ontario
M2J 1T5
Tel.: (416) 495-0076
Telex: 06-966889 CMSTOR

The Hewlyn Corporation is probably Canada's newest name in 'state of the art' rail fastening devices, manufacturing through a patented process, a screw spike which offers superior holding power and a longer life than the normal 'drive' or lag bolt fastener.

This product is particularly effective in high stress applications such as curves, bridges and switches. It substantially reduces maintenance costs and increases safety margins.

Over the past year the Hewlyn screw spike has been exposed to extensive laboratory testing by Canadian National Railways as well as actual field tests which have proven its superior physical properties. It is currently used extensively in Africa, South America and will soon be introduced to main line test sites across Canada and the United States.

The product is produced by the most sophisticated cutting process in North America and is all Canadian from design, to raw material, to technology through manufacturing. Its development reflects current trends in North American rail thinking towards heavier loads and higher speeds.

The main selling features are its strength and holding power combined with the ease with which the product can be installed, removed and returned to its original position without loss of holding power.

INSUL-8 CORP. (CANADA) LTD.

4610 Burgoyne Street
Mississauga, Ontario
L4W 1G1
Tel.: (416) 624-6525
Telex: 06-961268

Mobile Electrification Systems, produced by Insul-8 Corp. (Canada) Ltd., are used in monorails, cranes, shiploaders, streetcars, and Light Rail systems.

The company also designed and manufactured the Third Rail power system for Canada's first linear powered ICTS (Intermediate Capacity Transit System) in Kingston, Ontario.

The success of this installation led to the installation of similar designs in Toronto, Ontario and Vancouver, British Columbia. The company provides a complete service, design, supply and testing.

KLOHN LEONOFF LTD.

Consulting Engineers
10180 Shellbridge Way
Richmond, British Columbia
V6X 2W7
Tel.: (604) 273-0311
Telex: 04-355520

For over 35 year Klohn Leonoff Ltd. has been providing consulting engineering services and project management to builders and owners of urban transit systems including civil, hydraulic, geotechnical and mechanical designs for surface and underground structures. These services have encompassed investigations, design, testing and quality control during construction, and construction supervision. Projects have included tunnels in soil and rock, tunnel ventilation systems, highways and bridges, and foundations for heavy reinforced concrete structures.

The company is currently participating in the design and construction of the Calgary LRT (Light Rapid Transit) and the Vancouver ALRT (Area Light Rapid Transit) systems, and has ongoing design commitments for highway and railway tunnels varying from 100 m to 10 km in length. These tunnels include single and dual-track railroads, two and four-lane highway tunnels for single and opposing traffic, where modern lighting and ventilation standards are most demanding.

Engineering services include: construction management, investigations for geotechnical, hydraulic, meteorological and environmental requirements; design of project components; construction supervision, and quality control testing for soil, rock, concrete and asphalt.

The company operates internationally from corporate offices at 10180 Shellbridge Way, Richmond, B.C. V6X 2W7, with regional offices in Alberta and the U.S.A. and subsidiary companies including KPL Hydropower Systems, and KLH Inc. for projects in the energy sector. Klohn Leonoff Ltd., and its subsidiaries, are wholly owned by the employees.

Many American and other decision-makers from around the world, charged with the responsibility of solving urban mobility problems in their cities, are seeking guidance from urban transit operators in cities such as Montreal, Toronto, Ottawa and Vancouver. And also from the supporting Canadian urban transit industry, which has established a unique reputation for excellence in mass transit.

LOVAT TUNNEL EQUIPMENT INC.

441 Carlingview Drive
Toronto, Ontario
M9W 5G7
Tel.: (416) 675-3293
Telex: 06-989167

Lovat Tunnel Equipment was founded in 1973 and operates a modern 45,000 sq. ft. manufacturing facility in Rexdale, Ontario, only minutes from Toronto's Pearson International Airport.

To date the company has designed and manufactured 70 machines and has mined over 400 km. (250 miles) of tunnel on three continents. The three basic components of the TBM include the forward shell which contains the cuttinghead and drive, the stationary shell which contains the operating console and power plant and finally the tail shield which supports the tunnel while the lining is being set in place.

While the cuttinghead rotates and digs through the face, hydraulic jacks push the mole forward. The excavated material passes through patented, hydraulically-operated, flood doors into the machine. The material then is fed onto the conveyor which in turn dumps it into waiting muck cars. When wet soil conditions are encountered the flood doors almost completely eliminate the previous need for compressed air to control water ingresion. This speeds up production and is a very desirably safety feature.

The articulated cuttinghead is another Lovat patented device that provides improved steering control in any direction.

For total safety, machines are equipped with a horizontal sensing device which shuts the machine down if the roll reaches 10 degrees. All moles are also equipped with a methane gas detector that continuously monitors the tunnel face and sounds an alarm when hazardous gas is encountered. It shuts down the machine automatically when dangerous levels of gas are detected.

The staff of engineers and technicians designs each TBM according to the special criteria of the project, taking into consideration the type of material to be excavated, the length and diameter of tunnel and most appropriate lining method for the specific requirements of that particular tunnel project. All detail drawings are finalized and approved, and the in-house manufacturing process begins.

The company has facilities for fabricating TBM's up to 30' in diameter. The machine shop has a comprehensive array of equipment for machining cylinders and specialized hydraulic equipment, pins, gears, shafts, cutting teeth and conveyor components. This equipment includes CNC and standard engine lathes, milling centers, bending and band sawing machines.

Huge vertical boring mills and drill presses are utilized for machining the main drives, forward and stationary shells, trailing shields and sealing systems.

The welding and fitting shop has a 50 ton crane to aid in the final assembly operation. 80% of all components of a TBM are manufactured for fabrication at the Lovat plant. The company also manufactures specialized components and machinery on a contract basis, some of which not related to tunnel boring equipment.

Over the years Lovat Tunnel Equipment has met the many challenges of tunneling with mechanical inventiveness. Innovative features that are designed to meet the most challenging job conditions make the Lovat mole an important part of an integrated system of machines, material and men.

MOTOR COACH INDUSTRIES LTD.

1149 St. Matthews Avenue
Winnipeg, Manitoba
R3G 0J8
Tel.: (204) 786-3301
Telex: 07-57578

Motor Coach Industries has over five decades of design, development and manufacturing experience in mass producing coaches which are extensively used in the inter-city, suburban, commuter, charter, tour, transit and other markets throughout North America and in several countries around the world.

Presently, there are several thousand employees involved in every aspect of coach production including engineering, manufacturing, warehousing, quality control, administration and after delivery parts and service. Substantial investments have been made to provide the latest in equipment, machinery and modern manufacturing techniques.

The present MCI family of coach models includes the model MC-9, North America's most popular inter-city coach in history with over 9000 built, together with four new models: the 96A3 a three-axle 96 inch wide coach and the 96A2 a two-axle 96 inch wide coach; the 102A3 a three-axle 102 inch wide coach and the most recent introduction the 102A2 a two-axle 102 inch wide coach. The present family of coach models is preceeded by a number of earlier models including the MC-5, MC-7 and MC-8.

Continuous refinements in each of these succeeding models has resulted in the proven systems that are the foundation of the present MCI family of coaches. Underneath MCI's beauty and aerodynamic design are all of the proven systems, durability and dependability which owners have come to expect from the predecessor models.

Present models include an unprecedented number of features that satisfy the passenger, the driver, the mechanic and the owner alike. With a vast array of options available the coaches can be configured for a variety of operations, with basic design maximizing passenger comfort and convenience from the entry way to the travel environment assuring the passenger of a pleasant journey.

The efficient cooling, heating and ventilation provide for utmost passenger comfort year round in any climate.

A series of human engineering studies has resulted in an environment that minimizes driver fatigue while maximizing driver comfort and efficiency. The design of the coach also considers ease of maintenance and serviceability

The reputation for quality and reliability have earned MCI coaches the highest resale value of any inter-city coach available today and together with excellent after delivery parts and service support, and the industry's finest warranty, provides the owner with the highest return on investment.

The reliability and acceptance of these coaches are evident by the estimate that fully two-thirds of the inter-city coaches currently on the highways of North America are MCI models. In 1982, 1983 and 1984, the company successfully completed on time delivery of 700 model MC-9 commuter coaches to NJ Transit Bus Operations Inc. - the largest single order of commuter coaches in history.

More recently, it was awarded a contract by the Commonwealth of Massachusetts for 28 coaches, 6 of which are equipped with an elevator-style wheelchair lift - a first in the United States.

The "MCI" model 102, similar to the 102A3 in a two-axle version.

NYAB VICOM

A Division of General Signal Ltd.
675 Development Drive
Kingston, Ontario
K7M 4W6
Tel.: (613) 389-4660
Telex: 066-3255

NYAB Vicom of Kingston, Ontario, together with New York Air Brake of Watertown, N.Y., designs and manufactures pneumatic and hydraulic braking systems for rail-guided transit cars.

Recent projects include braking systems for VIA Rail's LRC cars (Bombardier) and Vancouver, Toronto, and Detroit ICTS cars (UTDC).

With extensive manufacturing facilities only 40 miles apart in the United States and Canada, both U.S. and Canadian content requirements can be met without affecting quality, price or delivery.

Extensive laboratory testing includes dynamometer and track simulation, prototyping and short run capabilities as well as production.

Eight sales and service offices are located in major transportation centres in the United States. Canadian sales and/or service offices are located in LaPocatiere, Montreal, Kingston and Vancouver. Parts distribution offices are in Kingston, Watertown, Little Rock and Cheyene.

"The sheer vastness of Canada has forged a unique breed of urban transit professionals — from concept to implementation. For each city and town has, by its very nature, demanded its own requirements in terms of transit systems, know-how and equipment."

"What is happening here should be studied very carefully be political leaders, transit advocates, urban planners and others in the United States concerned with the quality of life in our cities... the Canadians are on to something."

"It is an industry that continues to amaze and impress... by its sheer diversity, its professionalism. And the fact that it works."

"...Canada's own mass transportation manufacturers are more than well equipped to meet the challenge of urban transportation virtually anywhere in the world."

ONTARIO BUS INDUSTRIES INC.

5395 Maingate Drive
Mississauga, Ontario
L4W 1G6
Tel.: (416) 625-9510
Telex: 06-960148

Ontario Bus Industries Inc. of Mississauga, Ontario, was incorporated in 1975 for the purpose of manufacturing ORION heavy-duty buses for the transit industry. ORIONS are currently available in 30-foot, 35-foot and 40-foot lengths for transit, coach or airport applications. Specially-built ambulances, motorhomes and vehicles for sporting events have also been produced at O.B.I.

To satisfy a continuing demand for a vehicle to better accommodate wheelchair occupants, a new low-profile bus was designed and is now in full production. This front wheel drive bus, the ORION II, features a stainless steel structure and is powered by a Cummins Diesel 4BTA 3.9 liter 122 h.p. engine in the 21-foot model and a Detroit Diesel 8.2 liter, 145 h.p. engine in the 25-foot model. An integral front door swing-out ramp permits wheelchair passengers to propel themselves into the bus without requiring assistance. An optional rear door and integral ramp, with the same ready-access features as the front door, is also available.

The ORION Peoplemover, a 75-foot tractor-trailer combination, designed and manufactured in 1984, is now in operation transporting tourists around the Niagara Falls area. The drive engine is a propane-powered Ford V-8, producing 190 h.p. at 4000 r.p.m. Two auxiliary propane-powered, 4-cylinder Ford engines, one in each vehicle, provide power for the air conditioning system. The vehicle is fully carpeted throughout and has closed-circuit TV, enabling the driver on his built-in monitor, to view the interior of the trailer.

Orion-Ikarus articulated transit bus.

Another newer vehicle manufactured at the O.B.I. plant is the ORION-IKARUS, a 60-foot articulated transit bus which is now operating in Ottawa. Power is supplied from a 6-cylinder Cummins Diesel engine, producing 300 h.p. at 2100 r.p.m. Ontario Bus Industries has added easy-to-obtain North American components to the well-known and reliable Ikarus frame, resulting in a quality product capable of transporting up to 150 passengers during peak travelling times.

Ontario Bus Industries Inc. is also the exclusive Canadian distributor for Eagle 10 motorcoaches.

As well as its present status as a major manufacturer of transit and coach vehicles, O.B.I. is well-known in the industry as a major bus and truck repair facility. It has one of the largest bus repair plants in Canada.

Bus Industries of America Inc., a wholly-owned subsidiary of O.B.I., was opened in Oriskany, New York in 1982 to increase production and sales to the United States market. O.B.I. and B.I.A. have manufactured over 1200 ORION buses for more than 150 North American properties.

To satisfy a continuing demand for a vehicle to better accommodate wheelchair occupants, Ontario Bus has designed a new low-profile bus which is now in full production.

OTACO SEATING CO. LTD.

P.O. Box 2310
Orillia, Ontario
L3V 6S2
Tel: (705) 325-7052
Telex: 06-875588

Otaco Seating Company, one of Canada's leading manufacturers of seats for public transportation, manufactures the popular Innovator 850T Stainless Steel seat. This model is used in operations at Toronto Transit Commission Massachusetts Bay Transportation Authority, Tri-Met Portland, S.E.P.T.A. Philadelphia, Scarborough I.C.T.S. Cars, and New York City Transit, and many other cities throughout North America.

Otaco Model 850T Seating features individual contoured passenger seating with either padded or thermo plastic cushion and back inserts. Complete interchangeability between padded or plastic inserts, color co-ordinated for passenger comfort and interior car appeal.

850T stainless steel seating, with curved edges and contours prevents on-board accidents. The contrast between brushed stainless steel and upholstery creates an elegant and pleasing interior. This model of seat with the combination of stainless steel and low smoke Neoprene and fabric covers provides the best flammability and low smoke standards available to the transit industry.

The company also manufactures a complete line of transit seating products. Fibreglass and fully upholstered seats are all manufactured at the Orillia Ontario Plant.

Fibreglass seats, Otaco Model 6468T with individual cushion and back inserts, either padded or hard plastic, are made for city transit properties and have proven to be most suitable for this type of service. Semi-surburban seating, fully upholstered for passenger comfort, is also manufactured by Otaco. This type of seating is multi-purpose and used for city service and suburban work. Buses with this type of seating may be used for sightseeing operations or charter work.

The company has recently introduced a complete line of inter-City recliner seats, for 96" or 102" highway buses. Model 6682 is the top of the line recliner, offering deep layered foam and tufting to give a modern loose pillow look. Features include full length back panels in color and teak or rosewood finish, two position footrests, aisle lights, ash trays and cup holders.

Other special products include bus driver's seats, both air ride or mechanical; subway car operator's seats; as well as railway cab and caboose seats.

Innovator Model 850, with low maintenance, impervious to graffiti, vandal and fireproof stainless steel shells, with tamperproof padded or hard cushion inserts. In service in Toronto, soon to be in Boston.

PAN-ACC

Division of Kaufel Group Ltd.
1811 Hymus Boulevard
Dorval, Quebec
H9P 1J5
Tel.: (514) 685-2270
Telex: 05-822557

Pan-Acc Transit Systems, a division of Kaufel Group Ltd., which started in 1975 with its Emergi-Lite division, was created to supply engineered systems to the transit market.

The rapid and continuous growth of its emergency lighting business led the Kaufel Group to contemplate the U.S. market and enter into a licensing agreement with a Connecticut corporation. The Tenelux division, acquired in 1985, further decreased Kaufel Groups' production cost with its plastic molding facilities.

The addition of Pan-Acc Transit Systems division and the purchase of GFI Inc., a leader in Quebec's metal stamping industry, then became a natural acquisition. The first, bringing the quality control discipline and sales potential, and the second achieving a greater vertical integration and internal production capability.

The Kaufel Group joined the Montreal Stock Exchange in 1985 and has since added the Landmark division which specializes in commercial and industrial exterior lighting with an exclusive licensing agreement for manufacturing and distribution in Canada.

All of Pan-Acc systems are designed, engineered and manufactured to suit the specific needs of transit authorities and to meet individual and environmental conditions:

Pan-Acc lighting systems are complete systems of interior and exterior lighting designed to meet all existing and new construction of mass transit requirements in buses, subways, trains and trolleys.

Pan-Acc electronics include ballasts — a complete range of ballasts from 12 to 129 Volts DC designed to meet all requirements to today's transit systems, — converters, DC to DC converters designed and manufactured to comply with all space, environmental and voltage needs.

Pan-Acc air distribution systems include linear extruded and regulated air diffusers manufactured to meet various lengths, heights and depths in modern transit construction.

Emergi-Lite Div., — total emergency lighting systems engineered and manufactured.

Tenelux Div., — specialized in injection and moulded plastics required in the commercial lighting and transit industries.

Landmark Div., — commercial and industrial exterior lighting manufactured under license.

GFI Inc., — specialized in metal stamping, cabinetry and fabricated assemblies.

Plastic moulding facilities at the Tenelux Division

PHILLIPS CABLES LTD.

100 Consillium Place
Suite 300
Scarborough, Ontario
M1H 3E3
Tel.: (416) 296-0250
Telex: Telecopier #296-0262

Phillips Cables was established as the first electrical wire and cable company in Canada in 1889 and is a major electrical wire and cable supplier throughout North America and the international marketplace.

The company designs, engineers, manufactures and markets a complete line of cables for power, controls, communications and data process systems including composite fibre optic cables.

Metallic conductor and optical fibre cables for control, signalling, train to wayside communications and station to station communications as well as cable for the basic power supply for these systems have been supplied to major urban transit systems in Canada and the U.S.

The most recent supply was a 48 fibre data and voice communication cable for the length of the new Vancouver Light Rapid Transit System, the most modern transit system in North America.

To service the U.S. market a wholly-owned subsidiary, Phillips Cables Incorporated, Atlanta, Georgia, was established in the U.S. in 1982.

The LRT system connects Toronto's extensive transit network with the outlying Scarborough Town Centre and Civic Centre. Here, Philips' cable is pulled between Midland and Kennedy Stations.

PIRELLI CABLES INC.

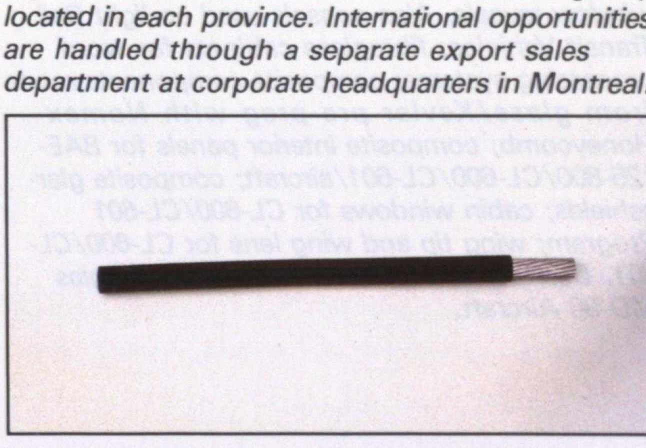
1981 McGill College Ave.
Suite 1040
Montreal, Quebec
H3A 2X6
Tel.: (514) 282-1540
Telex: 05-561392

For over 30 years, Pirelli Cables Inc. has been supplying Canadian industry and the international marketplace with a broad range of premium quality power cable, building wire and telecommunications cables. More recently, company capability has been expanded to include the manufacture of fiber optics, and exciting new technology in the communications field.

The company has gained widespread recognition in the railroad equipment business as an important supply source for high performance cable used in power and control circuitry of diesel-electric locomotives. These products also serve as general purpose wiring for railroad and transit cars.

Pirelli is also noted for its technical support of specialized customer requirements, made possible through an extensive commitment to product design and development, and advanced manufacturing methods. It is this versatility in production and engineering expertise that has enabled the company to participate in numerous major projects in Canada and around the world.

The complete line of electrical cables for all end-use areas is available through an extensive network of regional sales offices and warehouses, strategically located in each province. International opportunities are handled through a separate export sales department at corporate headquarters in Montreal.



Pirelli's durable, high performance diesel locomotive cable, specially designed to withstand the rigors of demanding operating environments.

PLASTAL INC.

460 Edouard Street
P.O. Box 324
Granby, Quebec
J2G 8E5
Tel.: (514) 378-8439
Telex: 05-832579

Plastal, a Canadian company formed in 1952, has become a prime producer of specialized plastic components using materials and fabricating techniques that reflect the latest advances in plastics technology.

It offers experience and expertise in the manufacture of products made from composite plastic, transparencies, thermoformed plastic and engineered reinforced plastic. And its design team works with customers to find innovative, cost-effective solutions to fabrication problems.

With a 22,000 sq. ft. factory and office, and in support of the manufacturing techniques required by the production processed, the company offers: tool manufacturing; air conditioned and humidity controlled lay up area; cold storage for prepreg and other shelf life materials; quality control and inspection facilities calibrated to National Standards; approvals to DND-1016, United States MIL-1-45208, Nato AQAP-4. Civil Quality control manual is approved by Transport Canada.

Products comprise: front and rear fibreglass end caps used on light Rail Transit Vehicles; fibreglass electrical junction boxes used on light Rail Transit Vehicles; Miscellaneous fibreglass corner trims and window reveals. Also consols used on light Rail Transit Vehicles; fibreglass cabinets for word processing systems; composite components made from glass/Kevlar pre-preg with Nomex Honeycomb; composite interior panels for BAE-125-800/CL-600/CL-601/aircraft; composite glareshields; cabin windows for CL-600/CL-601 Program; wing tip and wing lens for CL-600/CL-601, De Havilland Dash-8, McDonnell Douglas MD-80 Aircraft.

PROTECTIVE PLASTICS LTD

50 Passmore Avenue
Scarborough, Ontario
M1S 3B2
Tel.: (416) 291-9581
Telex: 06-525258

The Mass Transit section of Protective Plastics Limited, Toronto, Canada has been supplying Fiberglass Reinforced Plastic (F.R.P.) components since 1953, under the trade name of Protectolite.

Utilizing many of the processes available to produce F.R.P. components, the company specializes in vacuum bag molding, hot & cold compression molding, transfer molding and open contact molding with its many off shoots, such as filament winding and RTM molding.

To complement the processes, its fully qualified Tech Centre is equipped to aid in the design and testing of F.R.P. requirements.

Protective's total commitment to the transit industry has seen success with clients such as General Motors, Prevost, SEL Canada I.T.T., Bombardier, U.T.D.C., International Harveter, Westinghouse, T.T.C., Montreal Metro and many others.

Products include electrical components, brackets, seating, access cover panels, nose cones, interior decorative panels, exterior panels, step wells, battery boxes and third rail insulators. Related industry products such as architectural cladding and furniture are also manufactured for stations and waiting areas.

PREVOST CAR INC.

35 Gagnon Boulevard
Sainte-Claire, Quebec
G0R 2V0
Tel.: (418) 883-3391
Telex: 05-12257

For over 60 years Prevost Car Inc. in Ste. Claire, Quebec is renowned as a leader in the charter and intercity bus industry.

The introduction of the "XL" series 102-inch wide highway coaches available in both "Prevost XL" and "Le Mirage XL" has set a new state of the art in the field of passenger transportation.

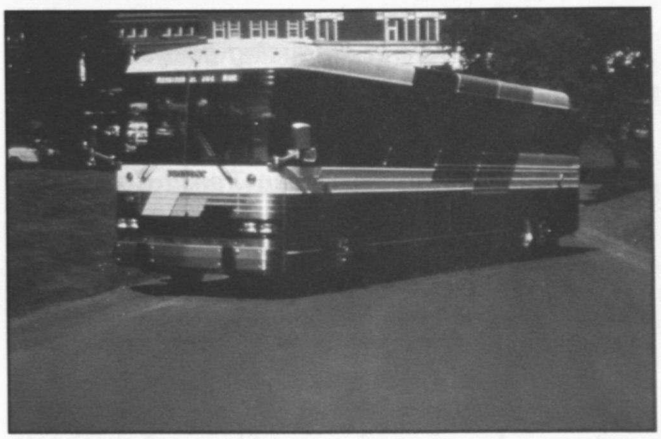
The "Prevost XL" is the intercity route and charter coach engineered to emphasize economy and ease of maintenance designed as a result of extensive wind tunnel testing to achieve the maximum ease of penetration in the air thus low fuel consumption.

The "Le Mirage XL" is the favorite among tour operators due to large wrap-around side windows and a double height windshield for unobstructed view that makes it so attractive to travelers. Its appeal not only comes from the exterior design but also from its pleasant, comfortable interior. The "Astral XL" version incorporates 19 sky-view windows making it one of a kind for sightseeing.

Prevost Le Mirage XL

Extremely reliable and well road tested, built for millions of miles with extensive use of stainless steel and standard North American components for ease of maintenance and service, all of these new wider coaches offer greater passenger comfort provided by wider seats available in different styles. Large underfloor baggage compartments and greater road stability are some of the features that makes the company's line the choice of tour and sightseeing as well as linehaul operators.

In the fall of 1985, the Prevost H5-60 prototype 82-passenger articulated coach was introduced to the market and the future looks bright for this revolutionary mode of transportation.


Prevost XL

QUEBEC GEAR WORKS LTD

2525 Halpern Street
St. Laurent, Quebec
H4S 1N9
Tel.: (514) 334-5943
Telex: 05-825645

Quebec Gear Works has been manufacturing gears and gear units for all types of industry since 1972, and is an active member of the American Gear Manufacturers Association employing the latest in technology and engineering skills.

Now considered one of the major gear manufacturers in Canada, the company's efforts over the last few years have been concentrated on the supply of gears to the transportation industry. It is playing a major role in producing gear sets for some of North America's most advanced mass transit systems such as the New York and Washington subways and others. It is also a major supplier to the Montreal Urban Transit Commission.

These high quality, high precision hardened and ground gears are mass produced to meet the specification demanded for this critical application and are subjected to the most rigid quality control and inspection.

The company's main objective during the coming months is to increase its presence in the mass transit field and to this end it recently moved to newer and larger facilities at 2525 Halpern St., St-Laurent Québec H4S 1N9. With added machinery and equipment and increased personnel, the company hopes to reach its goal in better serving customers.

REID CROWTHER INTERNATIONAL LTD.

350 Sparks Street
Ottawa, Ontario
K1R 7S8
Tel.: (613) 234-1334
Telex: 053-3623

Reid Crowther & Partners Limited, has a staff of more than 350 operating from 12 offices across northern and western Canada. Head offices are in Calgary, Alberta. Project offices are also maintained abroad during overseas assignments.

The company provides services from concept development and planning, and advocacy through the approval process, to detailed design, construction completion, commissioning, operations and maintenance. The firm's clients represent a broad cross-section of the public and private sectors. It received its first significant railway assignment in 1952, stimulating a keen interest in railway engineering which still exists today.

The firm's knowledge, the scope of projects undertaken and the diversity of its skills have increased steadily, as the experience gained on earlier assignments has been applied to subsequent larger and more complex projects. The firm's staff has matured into an effective, multi-disciplined group of professionals with capabilities in railway engineering and related fields.

Typical of this evolution is Reid Crowther's current involvement in public rail transit projects in Vancouver and Calgary. These assignments resulted from previous railway work done by the firm and its ability to function effectively within the physical and social constraints of an urban environment.

In Vancouver, company engineers are working on B.C., Transit's ALRT project. The company is responsible for ALRT work worth $32 million, including substructure and foundation design for a four-kilometre section of elevated dual guideway and relocation of a one-kilometre section of B.C. Hydro heavy rail and yards. In Calgary, it is responsible for project management and design of a four-kilometre, $40 million extension to one of the city's light rail transit lines.

RMS INDUSTRIAL CONTROLS INC.

1100 Lansdowne Street
Port Coquitlam, British Columbia
V3B 5E2
Tel.: (604) 464-2315
Telex: 04-353612

RMS Industrial Controls supplies communication equipment and fare collection products to the transportation markets.

RMS designs and manufactures "Data-Radio" systems for transit applications. The "Bus-Market" uses data communication for automatic vehicle monitoring (AVM) to optimize the location of passenger-revenue miles against the supply of buses. The Light Rapid Transit market purchases the Comsyst product to operate as an audio P.A.B.X. with a radio onboard the mobile vehicle. The P.A.B.X. maintains data communication with the central office for vehicle health monitoring, destination sign control, digital voice announcers and set-up for voice calls.

RMS is in partnership with Union Switch and Signal to supply A.T.O. and A.T.P. on rail projects. Fare collection equipment products cover fareboxes, ticket issuers and cancellers. Customers to date include Toronto Transit, B.C. Transit and Hamilton Street Railway.

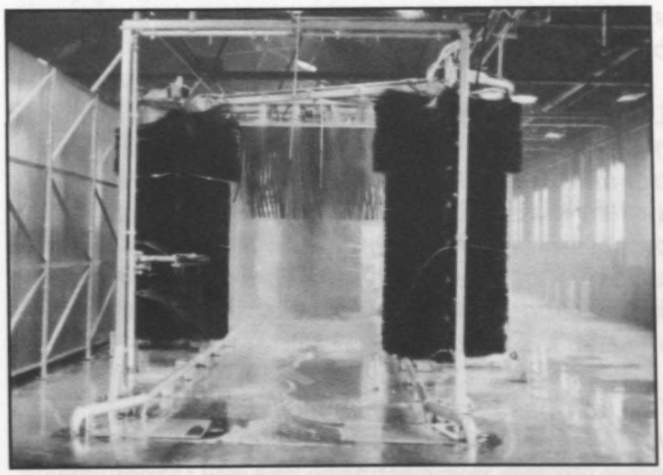
SHERMAN SUPERSONIC INDUSTRIES LTD.

3133 Orlando Drive
Mississauga, Ontario
L4V 1C5
Tel.: (416) 678-1700
Telex: 06-968696

Over 35 years of experience is what made S.S.I. Corp. a leader in Automatic Vehicle cleaning systems. Producing "state of the art" equipment is what keeps it there. Equipment such as: fully automated bus and train washing systems, Bellow type bus vacuuming units, water reclamation systems, as well as a replacement parts inventory and a skilled technical staff.

S.S.I. Corporation's engineering department utilizes computer aided designing (CAD) systems in order to better satisfy the custom manufacturing and specialized needs of today's transit industry. Recognizing those needs has enabled the company to deal with transit authorities of all sizes — their in house architects and engineers as well as consultants and general contractors — to design and produce turn key systems that allow smooth coordinated installations.

Over 75 transit installations throughout North America, are proof of the company's high standards for quality manufacturing. A complete source for all transit vehicle cleaning needs.



Sherman Supersonic Industries' fully automated bus wash system.

SEL CANADA

Division of ITT Industries of Canada Ltd.
180 Duncan Mill Road
3rd Floor
Don Mills, Ontario
M3B 1Z6
Tel.: (416) 445-8600
Telex: 06-986112

SEL Canada, a division of ITT Industries of Canada Ltd., has demonstrated its capabilities in the field of innovative computerbased signalling systems. Revenue service systems in Vancouver and Toronto utilize the automatic control and protective capabilities of the SELTRAC system, which provides constant monitoring of traffic flow and allows for continuous modification of train operating parameters to adjust for changing needs and performance.

Short headways can readily be accommodated, since SELTRAC is based on the moving block principle. Continuous communication between the wayside safety system and the on-board safety equipment ensures that all trains are allowed to proceed at maximum allowable speed until they are only separated by a minimum safety zone. This separation can take place anywhere on the track and not only at pre-defined "Blocks".

It is a cost-effective, computer-based train control system designed for maximum operational flexibility and throughput.

Less demanding requirements can be met with the microprocessor-based electronic interlocking control unit called INTERSIG. This is an interlocking system that provides the benefits of a microprocessor-based system. It can be applied as a replacement of existing hardware or as the interlocking system for new signalling and control installations.

The unit has proven its capabilities in a demonstration installation at San Diego, California. In this demonstration the SELC Vital Axle Counter System provides for a highly reliable train detection system. No rail bonding or insulated joints are needed when axle counters are implemented, thereby also providing a significant installation and maintenance saving.

SEL Canada's inductive communications system, ICOM, is particularly beneficial when local train to wayside communication is required. This very flexible and economical system provides for either unidirectional or bidirectional data flow between the on-board equipment and local wayside equipment. Economical implementation of these capabilities is accomplished with single card microprocessors and proven communications methods.

Data formats and communication security techniques are similar to those used for SELTRAC and INTERSIG. In this system it is usual to exchange limited amounts of information, however, on occasion the application requires that this capacity be extended. ICOM can accommodate larger message lengths, when required, through a change of the microprocessor firmware.

These highly effective computer-based systems are combined with conventional relay technology to provide cost effective implementations for each application in the wide ranging needs of the transit industry.

The Central Control Room of the Vancouver ALRT.

SIGNARAIL CANADA INC.

5650 Dessiant
St-Laurent, Quebec
H4S 1A6
Tel.: (514) 332-6890
Telex: 05-824507

Signarail Canada Inc., a Jeumont-Schneider company, is responsible for the manufacture, design and sales of train control systems and signaling equipment in North America.

The products manufactured and sold are oriented to be used on modern transit systems. The complete range of products includes: Automatic Train Control, Automatic Train Protection, Automatic Train Operation, Signaling (wayside or cab), Magnetic Train Stops and Inductive Train Control.

The centralized traffic control offered by Signarail is one of the most modern systems available, giving the customer the possibility of full software control.

H.A. SIMONS LTD.

Consulting Engineers
425 Carrall Street
Vancouver, British Columbia
V6B 2J6
Tel.: (604) 664-4315
Telex: 04-51150

Simons is one of Canada's largest consulting engineering firms and has provided engineering, architectural and project management services for a wide variety of projects in over 60 countries, including the Vancouver Regional Rapid Transit project.

As members of the Principal Engineering Consultant Joint Venture, the company's staff performed preliminary and final detail design and construction engineering for fixed facilities, including a 1 km demonstration section with temporary maintenance facilities, at-grade and elevated guide-way including rail and road overpasses, and three stations.

In addition it contributed to the development of system-wide design guidelines, standards and specifications; and co-ordination and review of the project's section design consultants and other consultants.

Simons' personnel also had considerable input in the following system-wide activities: DC power distribution; communications, security and supervisory systems; station electrical systems; architectural design and structural engineering; preparation of specification guidelines and contract documents; document control; co-ordination and review of other consultants; preparation of construction cost estimates; development of a computer modelling system for the "best fit" rail installation; assistance for testing and commissioning and provision of computer aided design and drafting (CADD) services.

The company's services are available from offices at Vancouver, Toronto, Montreal and Atlanta, Georgia.

SPAULDING FIBRE OF CANADA LTD.

130 The West Mall
Etobicoke, Ontario
M9C 1B9
Tel.: (416) 622-3524
Telex: 06-967500

The Transit Products section of Spaulding Fibre of Canada is responsible for the technical sales of insulating components of power rail systems. The major items supplied are third-rail support insulators, (moulded fibreglass) protection cover-board, (pultruded fibreglass) insulating blocks and other non-metallic components.

Installations include Montreal Metro (1966) and Mexico City (1969), both rubber tired systems. Various steel rail installations include Toronto-Spadina, Stockholm, Chicago, Amsterdam, Helsinki and Oslo. The U.T.D.C. light rail test track, (Kingston), Toronto-Scarborough, Vancouver ALRT, and Detroit C.A.T.S. were all users of the company's third rail supports.

Insulators for Montreal's rubber-tired transit system.

STANLEY ENGINEERING GROUP INC.

Mayfield Business Centre
10512-169 Street
Edmonton, Alberta
T5P 3X6
Tel.: (403) 483-4777
Telex: 03-741432

Stanley Engineering Group Inc. has in the order of 500 personnel working in some 20 domestic offices in western and northern Canada and overseas. In 1984, Stanley was presented with the coveted Canada Export Award for the highest relative increase in the export of engineering services.

The company offers an experienced staff of specialists in urban transit systems, transportation planning and economics, traffic operations, urban and rural roadways and bridges, railways and airports. Its services include a full range of planning, design and project and construction management in the public transportation area.

Specific areas of expertise in urban transit systems include demand forecasting, routing, performance evaluation, costing, financial feasibility, marketing, bus and light rail transit (LRT) operations, maintenance facilities, LRT track and yard facilities, commuter rail systems, vehicle technology, visitor systems and para-transit systems.

The company is the prime-managing consultant and track, signalling system, mechanical and electrical (tunnels) designer for the south extension to the Edmonton LRT system.

It also undertook the track and bridge design, construction supervision and coordination for Calgary's northeast LRT extension, and is track designer for their northwest extension.

Other projects include: Canada's first, comprehensive on-board passenger survey and evaluation study for Edmonton's bus and LRT system; and prime consultant services for Edmonton's modern LRT maintenance facility.

STATICON LTD.

390 Tapscott Road
Unit 5
Scarborough, Ontario
M1B 2Y9
Tel.: (416) 291-3723
Telex: 06-525211

Since 1965, Staticon Ltd. has been a Canadian manufacturer of high quality solid state constant voltage rectifiers and chargers for traction, communication and stationary applications.

Staticon-designed AC UPS systems, line regulators, rectifiers and low noise communication. DC powered plants are used world wide by rail transit companies, the communication industry, utilities, the petro chemical, oil and gas industries.

The company has also supplied under carriage mounted DC to AC inverters and battery chargers for the TTC in the past.

STONE - SAFETY CANADA LTD

1361 Huntingwood Drive
Scarborough, Ontario
M1S 3J1
Tel.: (416) 298-1700
Telex: 065-26252

Established in 1975, Stone-Safety Canada Ltd. is part of Stone International, a broadly based group specializing in advanced electrical systems and energy related engineering.

The original company can trace its pedigree back to 1831. By the late 19th century, it was providing safe and reliable electrical lighting for railway passengers. This led to heating and then air conditioning, Stone being one of the first to provide this luxury on trains in the mid-30s.

In 1976, the company acquired the Safety Electrical Equipment Corporation, established in 1887, also one of the leaders in safe electrical lighting. More recently it acquired PLC Peters Ltd., a leading supplier of door operating systems for bus, rail and rapid transit vehicles.

The Ontario plant specializes in the production of passenger comfort systems and supplying a broad range of air conditioning, heating and solid state environmental controls to transit vehicle builders and operating authorities.

The company also offers a range of signals, lights and message signs for highway, rail, airport and marine applications.

STORM-TITE INC.

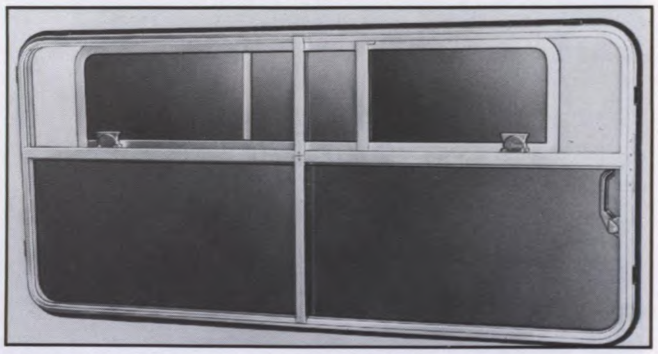
404 Egesz Street
Winnipeg, Manitoba
R2R 1X5
Tel.: (204) 633-4808
Telex: 07-55417

Over the past six years, Storm-Tite Inc. has developed a high quality line of transit bus windows and components which have made a significant impact in the bus window industry.

Carefully conceived designs, coupled with a high standard of quality and service have allowed the company to be a successful manufacturer of residential and motorhome windows for 20 years. This same formula for success has been applied to its transit bus products.

Window contracts to Flyer Industries for the cities of Chicago, Toronto, San Fransisco, and Winnipeg, have proven that the product will meet the highest and most stringent industry standards.

Storm-Tite also caters to the bus retrofit market supplying not only entire replacement window assemblies, but numerous related window components such as slider window sash locks. Sash locks have been supplied to transit authorities throughout North America for their ongoing retrofit and replacement requirements.



Storm-Tite transit bus window, model MVII, upper slider sash and lower picture window.

SWAN WOOSTER ENGINEERING CO. LTD.

1190 Hornby Street
Vancouver, British Columbia
V6Z 2H6
Tel.: (604) 684-9311
Telex: 04-51275

Recently merged with Sandwell Inc. to form Sandwell/Swan Wooster Inc., Swan Wooster is one of Western Canada's foremost design consultants in the field of transportation and transportation systems.

Established in 1925, the company has rapidly expanded its activities to encompass all aspects of transportation systems from planning and economic analysis through design and construction.

The company's extensive involvement in the planning of ports, industrial facilities, and passenger transportation systems has required it to integrate these facilities with local, urban and regional transit systems encompassing road, rail and ferry modes.

As a result of these activities, the company has developed an impressive expertise in the fields of operations, research and simulation together with economic and financial analysis. Currently, it handles traffic and transportation impact studies, capacity analysis, road and rail layouts, rapid transit systems and Sea Bus passenger ferry systems. In addition, its participation in joint ventures such as International Rail and Sea Bus International has further enhanced the range of services offered.

Recently completed projects include sections A & C of the Vancouver Light Rapid Transit system, a feasibility study of the Istanbul Sea Bus Transit System, a dangerous goods transportation study for B.C.,and consulting assistance to the Southern Africa Development Coordination Conference.

SYDNEY STEEL CORPORATION

P.O. Box 1450
Sydney, Nova Scotia
B1P 6K5
Tel.: (902) 564-5471
Telex: CN-CP 019-35197

Since 1905 when Sydney Steel produced its first rail, the company has maintaned a position of leadership in the rail industry, and has been responsible for many industry firsts.

For example, the controlled cooling process for eliminating shatter cracks in rails was developed at Sydney in 1931. The company was also the first mill in North America to produce rail from vacuum degassed steel on request; the first mill in North America to manufacture 78-ft. and 25-metre rails on a production basis; and the first in North America to use a roller straightener to straighten all rails produced.

Sydney rails and tie plates are supplied to railroads and transit systems to over 20 countries around the world and have a proven operating performance record over a complete range of operating, climatic and geographic conditions. The company's metallurgists and engineers have met the challenges of producing rails for such extremes as searing desert heat, the severe sub-zero winters of the arctic regions and 50 million ton-per-year lines through the Rocky Mountains.

Rails are manufactured to all major national and international specifications, including A.R.A.E., A.S.T.M., B.S.S., C.N.R., C.P.R., I.S.O., and U.I.C.

They are produced in carbon, intermediate strength and premium alloy grades. Sections range from 70 to 136 pounds per yard (37 to 70 kilograms per metre) and lengths are supplied up to 82 feet (25 metres).

TELERIDE / SAGE

156 Front Street West
5th Floor
Toronto, Ontario
M5J 2L6
Tel.: (416) 596-1940

Teleride Corporation is committed to providing realistic solutions to the spiralling costs of operating major transit systems. They do this with computer systems designed to maximize operating efficiencies, reduce costs and increase revenues.

Founded in the '70s by Dr. Josef Kates, who pioneered computer applications for all modes of transportation, Teleride continues to develop much needed solutions for today's diverse transportation field, with a sophisticated combination of computer hardware and software, backed up with on-site installation, training, monitoring and service.

The company's three primary products are TeleRIDER, which is an automatic telephone information system; TeleDRIVER, which is an automatic vehicle location and control system; and TeleVIEWER, which is a public information display system.

For nearly a decade, the company has built an enviable record of successful installations in a growing number of major metropolitan centers throughout North America. And it is now recognized as a world leader in computer communications systems for transportation.

Teleride schedule information is totally current and easy to read. The light background on this screen is designed to make the data easily readable in areas exposed to bright sunlight.

TT CONSULTANTS

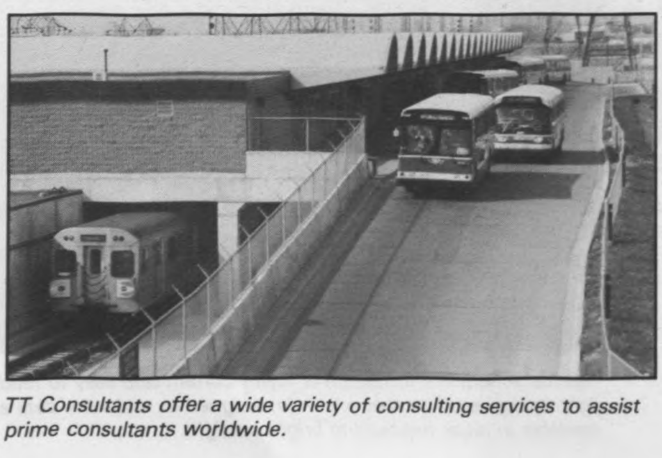
1900 Yonge Street
Toronto, Ontario
M4S 1Z2
Tel.: (416) 393-4000
Telex: 06-524670

Toronto Transit Consultants Ltd. (TTCL) is a subsidiary of the Toronto Transit Commission (TTC), the largest public transit operator in Canada.

The TTC is a multi-modal, fully integrated system which is second only to New York City in North America in terms of total ridership. During 1985, it operated over 2,500 buses, trolley buses, streetcars, intermediate capacity cars and subway cars and carried more than 430 million passengers. TTCL draws on the operating experience and staff of the TTC to provide consultancy services in all areas of public transit with emphasis on the following:

- Policy development and overall system management
- Short and long range planning
- Operations and maintenance of all transit modes
- Rail system design, construction and implementation
- Training
- Performance monitoring and evaluation

The overall approach of the company is to work with other firms in completing national and international projects while at the same time working directly with transit properties and government agencies responsible for transit in addressing their specific needs and concerns.



TT Consultants offer a wide variety of consulting services to assist prime consultants worldwide.

THE UMA GROUP

1479 Buffalo Place
Winnipeg, Manitoba
R3T 1L7
Tel.: (204) 284-0580
Telex: 07-57562

UMA Engineering Ltd. offers a complete range of consulting services for public transit systems including planning, design, construction management, project management and operations studies. The firm has participated in a number of public transit projects including bus facilities, light rail transit and commuter rail systems.

It has also been involved in public transit projects throughout Canada, in the United States and in South America. Projects include the light rail transit system in Calgary, Alberta; the light rail transit system in Edmonton, Alberta; the exclusive bus transitway in Ottawa, Ontario; the Spadina rapid transit line in Toronto, Ontario; a BUS/HOV transitway system in Orange County, California; the GO commuter train in Toronto, Ontario, the automated light rail transit system (GO ALRT) in Toronto, Ontario and a rapid transit system in Valencia, Venezuela.

With offices across Canada and in the United States, UMA Engineering is able to meet the needs of its clients by providing comprehensive services on a wide variety of public transit projects.

URBAN TRANSPORTATION DEVELOPMENT CORPORATION UTDC

2 St. Clair Avenue West
Toronto, Ontario
M4V 1L7
Tel.: (416) 961-9569
Telex: 06-22805

The Urban Transportation Development Corporation (UTDC) is one of North America's leading suppliers of transit systems, equipment and services.

Established by the Ontario government in 1973 as a publicly-owned company with a mandate to design, develop and market transportation systems and equipment, it has more than met its original mandate - as documented elsewhere in this issue.

In essence, the corporation's role is to assume commercial developments associated with improvements to conventional ground transportation technology and the innivation of new systems. It also conducts prototype development and testing programs at its Transportation Development Centre near Kingston, Ontario.

In addition to research, development and marketing activities within the framework of the Canadian transit industry, the company is also active internationally, marketing both its own technical developments and capability plus Canadian transit operating expertise.

Since its establishment, UTDC has built and equipped a comprehensive Transportation Development Center; amassed a staff of experienced ground transportation specialists; concluded research and development projects for a variety of clients; and has developed three major rail products.

The three (CLRV, ALRV and ALRT) incorporate the expertise of Canadian transit operators, planners and manufacturers in addition to UTDC transportation specialists. Development of the Canadian Light Rail Vehicle (CLRV), for example, was closely coordinated with officials of the Toronto Transit Commission, one of the world's leading authorities on light rail vehicle operation.

Although the CLRV was developed initially for Toronto, the corporation provides similar vehicles incorporating the same basic design and components, for a wide range of applications and markets throughout the world.

To meet the requirements of many North American cities for a higher capacity light rail vehicle capable of operating on small radius curves, it has also developed an articulated six-axle version of its CLRV, called the Articulated Light Rail Vehicle (ALRV).

The ALRV prototype ran in revenue service in Toronto with the TTC from September 1982 to February 1983 and 52 units were subsequently ordered.

In October 1983, despite stiff competition from suppliers in the United States, Japan and Germany, UTDC signed a contract worth $50 million to supply 50 longer version ALRVs to Santa Clara Country south of San Francisco. The vehicles are needed for a new 32 km light rail system to serve the needs of the historic city of San Jose (the 4th largest city in California) and the rapidly growing Silicon Valley area known for its concentration of high technology firms.

The first vehicle was delivered in Spring 1986, and the last is scheduled for delivery in August, 1987.

The corporation's most ambitious program conducted over an eight-year period starting in 1975, has been the development of the Advanced Light Rapid Transit system described in detail earlier.

UTDC is confident this new transit technology will find application in many cities throughout the world because of its technical and price advantages over both conventional technology and competitive advanced technology systems.

Compared with conventional subway, bus and downtown circulation systems, the ALRT design permits urban planners greater flexibility to implement high quality transit in a wide range of sensitive urban environments. In addition to the revolutionary suspension, propulsion and automatic train control equipment, which make it highly reliable under all environmental conditions, the system also requires generally lower operating and maintenance costs.

Since its acquisition of Can-Car Rail in Thunder Bay, Ontario, UTDC has won a number of contracts for vehicles to be manufactured at that plant. These include: 52 ALRVs for Toronto; 50 ALRVs for Santa Clara Country; 126 subway cars for Toronto; and 58 subway cars for Boston. Moreover, as the designer of the largest bi-level commuter car in the world, it is also filling a third order to meet Toronto's regional needs.

Recognizing a need in many cities for strategic planning or urban transportation, the corporation provides a totally integrated approach to planning, design and implementation of new transit services and systems. These services have been successfully marketed in the United States and Latin America.

In addition, the UTDC Transportation Development Centre, which opened in 1978, ranks as one of the largest facilities of its kind in the world. This unique facility provides complete testing for a variety of ground transportation systems.

The 192-hectare TDC is the nucleus of the corporation's technology development programs, providing a base of operation for over 700 specialists and support staff. Laboratories, engineering and administrative offices plus maintenance facilities and test tracks are located at this site.

VAPOR CANADA INC.

3955 Courtrai Avenue
Montreal, Quebec
H3S 1B9
Tel.: (514) 342-3210
Telex: 05-560642

Vapor Canada Inc., with headquarters and manufacturing facilities located in Montreal, has been an integral supplier to the transit industry in Canada since the turn of the century. It is a subsidiary of Vapor Corporation of Chicago, and a member of the Brunswick Corporation family of companies.

The company helps keep the bus industry on the road with products that have increasing impact on customer safety and productivity for the operating properties. These products include: complete door operating systems, steering columns, air comfort systems, and bus priority systems, passenger counting systems and LCD destination signs. The known names in transit buses look to Vapor Canada for high quality reliable components and equipment, and dependable service.

Among the products manufactured for rail transit applications are: automatic doors sytems, solid state temperature control systems, air comfort and air conditioning systems, health monitoring systems, speed controls, reset safety controls and recorders.

Vapor Canada's product line includes complete door operating systems.

VERSATILE VICKERS INC.

5000 Notre Dame Street East
Montreal, Quebec
H1V 2B4
Tel.: (514) 256-2651
Telex: 05-828735

The most visible products manufactured by Versatile Vickers Inc. are probably those that move goods and people.

The company's involvement with public transportation began in 1963 with the supplying of the first 369 passenger cars for Montreal's Metro (subway) system. Since then, other majors contracts have been carried out in Canada, the United States and overseas. For instance, it has built double-decker commuter trains for Canadian Pacific Railway, high-speed commuter cars for the Delaware River Port Authority in Philadelphia, and railway passenger cars for Mali in Africa.

Other realizations include the manufacturing of stainless steel car shells for the New Haven rail road commuter system, the retrofitting of RDC coach cars for British Columbia Railway and miscellaneous mechanical and electrical repairs to Montreal Metro cars.

The company's rolling stock facilities have a total manufacturing area of 234,000 square feet including a fabrication section and a sub and line-assembly sections. This facility has the capacity to manufacture one car per day when in full production.

Self-propelled, electric suburban rail cars built for the Delaware River Port Authority, Philadelphia, by Versatile Vickers.

WABCO

Division of Wabco Standard Inc.
P.O. Box 2050
Hamilton, Ontario
L8N 3T5
Tel.: (416) 561-8700
Telex: 061-8483

WABCO has been manufacturing brake equipment in Canada since 1897. In 1975, the company moved to a new modern facility in Stoney Creek, Ontario and by 1985 it had become the 14th largest user of numerically controlled machinery in Canada.

This modern plant with it's integrated engineering development, and manufacturing capabilities allow WABCO to provide brake and brake control equipment for all forms of steel wheel transit vehicles.

In Canada, the company has supplied equipment on the T.T.C. subway cars, Go-Transit commuters coaches and VIA Rail mainline passenger service. In addition, equipment has been produced for export on projects in the United States and Mexico.

The company has facilities in France, Italy, Germany, Brazil and Japan and can provide access to worldwide markets. It also provides a full maintenance, repair and renewal parts service in the Stoney Creek facility and an additional facility is opening in New York.

The company's line of equipment includes both pneumatic and hydro-pneumatic equipment along with electronic based control systems.

WASHTRONICS LTD.

866 King Edward St.
Winnipeg, Manitoba
R3H 0P7
Tel.: (204) 775-8126

For over 30 years Washtronics has been doing business with transit companies and fleet operations throughout North America, earning a reputation for manufacturing dependable, efficient servicing equipment for large vehicles.

The company introduced front-and-back drive through bus washing and, in 1967, conveyorized bus washing. The latter is still the only system of its type available in the world. The bus washing systems are designed to suit the customer's needs, and are available in two brush, four brush and four brush conveyorized models, all incorporating a unique water recirculating system.

The Washtronics Automatic Wand Door Actuating Switch allows vehicles to enter and leave garages without attendant to operate the doors, resulting in lower heating, air conditioning, labour and maintenance costs. The Wand is easy to install, and can be used with electrical or pneumatic door operators.

The Washtronics Transpolift is a portable vehicle lifting system designed to make the repair and maintenance of large vehicles faster and safer. Completely mobile, operable by one person, it can be used whenever adequate power supply is available, obviating permanent installations. Transpolift systems are available to handle four and six-wheel vehicles, with weight capacities between 24,000 and 96,000 lbs.

DIRECTORY OF EQUIPMENT AND SERVICES.

BUS SYSTEMS

VEHICLES

Commuter Buses
General Motors of Canada Ltd.
Ontario Bus Industries Inc.
Prévost Car Inc.
Transit Buses
Flyer Industries Ltd.
General Motors of Canada Ltd.
Ontario Bus Industries Inc.
Trolley Buses
BBC Brown Boveri Inc.
Flyer Industries Ltd.

BUS COMPONENTS

Chassis
General Motors of Canada Ltd.
Ontario Bus Industries Inc.
Electrical Wire and Cable
Protective Plastics Ltd.
Phillips Cables Ltd.
Pirelli Cables Inc.
Environmental Control
Automatec, Div. BG Checo Int'l.
Propulsion Components
BBC Brown Boveri Canada Inc.
Seats
Otaco, Div. Redlaw Industries Inc.
Protective Plastics Ltd.
Traction Power
BBC Brown Boveri Canada Inc.
Washing Systems
Washtronics Ltd.
Windows and Doors
Protective Plastics Ltd.
Storm-Tite Inc.
Miscellaneous
Plastal Inc.
Protective Plastics Ltd.
Vapor Canada Inc.

COMMUNICATIONS AND VEHICLE MONITORING

Bus Monitoring
SEL Canada, Div. ITT Ind. of Canada Ltd.
Signarail Canada Inc.
RMS Industrial Controls Inc.
Communication Voice & Data
RMS Industrial Controls Inc.
Teleride/SAGE

Signalling
Electro-Mosaik Ltd., Div. Monitronik Ltd.
Ferranti-Packard Electronics Ltd.
Wayside Equipment
Teleride/SAGE

INFRASTRUCTURE

Maintenance Facilities
Sherman Supersonic Industries Ltd.
Shelters
Daytech Mfg. Ltd.

MISCELLANEOUS

BBC Brown Boveri Canada Inc.
Daytech Mfg. Ltd.
Ontario Bus Industries Inc.
PAN-ACC Transit Systems

RAIL SYSTEMS

VEHICLES

Commuter
Bombardier Inc.
General Motors of Canada Ltd.
Hawker Siddeley Canada Inc.
Urban Transportation Development Corporation Ltd.
Light Rail
Bombardier Inc.
Hawker Siddeley Canada Inc.
Urban Transportation Development Corporation Ltd.
Metro (rubber-tired)
Bombardier Inc.
Hawker Siddeley Canada Inc.
Subway (steel-wheeled)
Bombardier Inc.
Hawker Siddeley Canada Inc.
Urban Transportation Development Corporation Ltd.
People Mover
Bombardier Inc.
Hawker Siddeley Canada Inc.
Urban Transportation Development Corporation Ltd.
Monorail & High Speed Train
Bombardier Inc.

VEHICLE CONTROL & COMMUNICATIONS

Automatic Train Control
Automatec, Div. BG Checo Int'l.
SEL Canada, Div. ITT Ind. of Canada Ltd.
Signarail Canada Inc.
RMS Industrial Controls Inc.
Automatic Train Protection
Automatec, Div. BG Checo Int'l.
Signarail Canada Inc.
Communication Voice & Data
Automatec, Div. BG Checo Int'l.
G.E.C. Canada
RMS Industrial Controls Inc.
Teleride/SAGE

Wayside Equipment
Automatec, Div. BG Checo Int'l.
SEL Canada, Div. ITT Ind. of Canada Ltd.
Signarail Canada Inc.
Teleride/SAGE

PASSENGER DISTRIBUTION

Collection
Automatec, Div. BG Checo Int'l.
Signarail Canada Inc.
Signs
Daytech Mfg. Ltd.
Ferranti-Packard Electronics Ltd.
Signarail Canada Inc.
Stone-Safety Canada Ltd.
Ticketing Turnstiles
Automatec, Div. BG Checo Int'l.
Signarail Canada Inc.

VEHICLE COMPONENTS

Bogies
Hawker Siddeley Canada Inc.
Brakes
Wabco Ltd., Westinghouse Air Brake Div.
NYAB Vicom
Brake shoes
Wabco Ltd., Westinghouse Air Brake Div.
Castings
Hawker Siddeley Canada Inc.
Control Consoles
BBC Brown Boveri Canada Inc.
Electro-Mosaik Ltd., Div. Monitronik Ltd.
Couplers
Dellner Couplers Ltd.
Hawker Siddeley Canada Inc.
Doors
Faiveley (Canada) Inc.
Electrical
BBC Brown Boveri Canada Inc.
Canada Wire and Cable Ltd.
Insul-8 Corp.
Phillips Cables Ltd.
Pirelli Cables Inc.
Protective Plastics Ltd.
Signarail Canada Inc.
Staticon Ltd.
Spaulding Fibre of Canada Ltd.
Environmental Control
Automatec, Div. BG Checo Int'l.
BBC Brown Boveri Canada Inc.
Stone-Safety Canada Ltd.
Gears
Quebec Gear Works Ltd.
Heating and Cooling
BBC Brown Boveri Canada Inc.
PAN-ACC Transit Systems
Seats
Otaco, Div. Redlaw Industries Inc.
Protective Plastics Ltd.
Traction Motors
Automatec, Div. BG Checo Int'l.
BBC Brown Boveri Canada Inc.
Signarail Canada Inc.
Traction Motor Components
Automatec, Div. BG Checo Int'l.
BBC Brown Boveri Canada Inc.
GEC Canada Ltd.
Signarail Canada Inc.
Wheels/Axles
BATA Engineering
Hawker Siddeley Canada Inc.
Miscellaneous
BBC Brown Boveri Canada Inc.
Hewlyn Corporation
Plastal Inc.
Vapor Canada Inc.

INFRASTRUCTURE

Rail and Guideway
Sydney Steel Corp.
Lighting/Venting
Automatec, Div. BG Checo Int'l.
Stone-Safety Ltd.
Third Rail
Insul-8 Corp. Canada Ltd.
Spaulding Fibre of Canada Ltd.
Sydney Steel Corp.

MAINTENANCE

Sherman Supersonic Industries Ltd.

MISCELLANEOUS

Daytech Mfg. Ltd.
PAN-ACC Transit Systems

TRANSIT CONSULTANTS

Allen Parker & Associates Ltd.
BC Transit
B. Helm Associates Ltd.
BTM International
CANAC Consultants Ltd.
Delcanda Inc.
Reid Crowther Int'l Ltd.
H.A. Simons
Stanley Engineering Group
Swan Wooster Engineering Co. Ltd.
TT Consultants
The UMA Group
Urban Transit Development Corporation Ltd.

U.S.A. Trade & Investment Development Bureau,
External Affairs
Canada