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DISCUSSION PAPER

THE URBAN TRANSPORTATION EQUIPMENT INDUSTRY IN CANADA

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SECTOR PROFILE

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THE URBAN TRANSPORTATION INDUSTRY IN CANADA

DESCRIPTION OF SECTOR

In Canada, urban transportation equipment is not identified individually or collectively by S.I.C., because it includes products from many current groupings. Included in the range are mini-buses, buses, trolley-buses, streetcars and intermediate capacity systems, support systems for vehicle monitoring and control, computerized traffic signals, passenger and management information and communication equipment. A brief description of each type of system is given in Appendix A.

As urban transportation systems have become more complex, so the relative importance of vehicle manufacture in terms of total industry activity has declined. Although different systems vary in cost, current guided system expenditures are normally divided among vehicles (15 per cent — 30 per cent), control and communication (15 per cent — 30 per cent) and infrastructure (50 per cent — 60 per cent).

Electrical and electronic equipment associated with urban transportation systems is increasing in importance as non-vehicular solutions to movement problems are developed.

ENVIRONMENT

Social and economic pressures are accelerating the provision of urban movement facilities and the development of new and improved urban transportation systems.

Of the ninety urban transit systems now serving Canadian cities, only two (Toronto and Montreal) include guided systems. As is the case throughout the world, no major transit system in Canada now generates enough fare income to be financially self-sufficient. Governments which, for reasons of social or other policies, have accepted small operating deficits in transit systems are now finding that transit operating costs and deficits are skyrocketing. Current pressures are therefore for an increase in the cost-effectiveness of existing systems and the development of low-cost alternatives.

As an example, labour currently consumes more than 70 per cent of the operating cost of almost all transit systems, and the cost of labour is increasing at a rate considerably higher than that for other costs. Some degree of automation and increase in vehicle or line capacity must therefore be economically attractive.

In addition to these economic pressures, congestion, energy concerns and the adverse environmental effects of existing transportation modes — emission, pollution, noise levels, and visual obtrusion — are increasing the need for new urban transit systems. These pressures suggest that in many cities of more than 250,000 inhabitants the trunk elements of the public transit systems should move off the roads on to separate right-of-way.

Of equal importance is the need for optimizing use of the existing transportation infrastructure by improving traffic flow. Computer-controlled systems to regulate road movement can decrease journey time and will eventually afford priority to public transit, police, fire and ambulance vehicles.

Despite recognition of these needs, development is characterized by evolution rather than innovation. Risk-taking is inhibited by operating losses, shortages of capital and an over-riding concern for safety and dependability. The most important single parameter governing the selection of transit systems or equipment is the safety requirement.

Whether or not advanced technology is used, no single transit system is, or will be, capable of accommodating the varied requirements of urban movement. In Canada and elsewhere public transportation requirements can be expected to range from mini-buses to the high capacity rapid rail systems currently found in Montreal and Toronto.

Although existing subways will be expanded and some new subway systems may be built, emphasis will be placed on policies that limit or deter the use of the automobile in city centres, that improve existing transit systems and introduce intermediate capacity transit systems. The bus fleets will become more diverse, with larger, articulated buses for high volume routes and smaller buses for feeder or low-volume applications.

In response to these trends there is a requirement for improvement of existing vehicle components, development of intermediate capacity transit systems, and design and development of more effective movement control. For vehicle systems, increased emphasis on fuel conservation, safety and comfort will inspire continued development of propulsion, suspension and control systems. For all systems, the provision of electronic control and communication means will be of prime importance.

These requirements are of particular relevance to Canadian capabilities, as the development of urban transportation equipment provides one of the few technical opportunities which Canada can meet without major foreign systems input.

THE INDUSTRY IN CANADA

As urban transportation equipment has in the past been supplied by elements of many industries, little or no relevant historical data exists. To differentiate between the two major sub-sectors, the industry is discussed under the following headings:

Vehicle Systems
Electric and Electronic Systems

VEHICLE SYSTEMS

Industrial Organization

Eight Canadian companies produce, or have produced, the vehicles used in Canadian transit systems (first tier). Another twenty companies produce the major components or sub-systems for these vehicles, as well as the major stationary equipment required for complete transit systems (second tier). About 240 companies provide materials and sub-components for these 28 companies. At least 36 major civil works contractors have infrastructure expertise.

Of all the companies forming the industry sector, only three are entirely devoted to the production of urban transportation equipment. All the rest have varying degrees of involvement differing in importance in relation to total corporate activity.

In most cases the necessary production expertise had already been developed to meet other production requirements. The manufacture of urban transportation equipment was therefore, and to some extent remains, a sometime activity competing with other corporate priorities. This fragmentation of effort continues to inhibit industry reaction to the need for a systems approach to current and potential market opportunities.

The geographic distribution of first and second tier manufacturers is:

TABLE I

	No. Plants	No. Employees
Prairies	4	616
Ontario	15	1,390
Quebec	9	1,140
Canada	28	3,146

Source: Industry Survey

Vertical integration in the car building industry is low as none of the companies do anything more than pull materials and equipment together in the assembly of guided ground vehicles. Value added in the assembly of subway cars is estimated at 40 per cent. There is some horizontal integration.

The majority of components used by the car assemblers are sourced domestically. It is estimated that the Canadian content in subway and commuter cars manufactured in Canada for the domestic market is approximately 80 per cent of the value, with the balance being primarily from United States and British sources.

As the Canadian urban transportation equipment capability was initially based on foreign technology, most of the major companies now involved are foreign-owned. However, Canadian-owned companies are entering the industry (e.g., Bombardier) and there are few artificial restraints on the freedom to export vehicles or components of vehicles built in Canada. Some vehicle sub-system and component manufacturers and some manufacturers of stationary equipment are inhibited by licences or foreign ownership when providing components for foreign built vehicles, but these circumstances seldom exclude Canadian goods from foreign markets.

Production

Some production data for vehicle assembly has been provided by the vehicle manufacturers. However, other production data for urban transportation systems and equipments is not available.

TABLE II
CANADIAN VEHICLE PRODUCTION

	Subway Cars	Commuter Rail Cars	Buses		Total value (in millions of $)
			Diesel	Trolley	
1964-75	697	234	5,145	185	443

Source: Vehicle Manufacturers

Production orders now in hand entail delivery of guided vehicles valued at more than $340 million in 1977/78. Probable bus production will bring total Canadian vehicle production to more than $430 million in the two-year period, including more than $150 million in exports of guided vehicles to the U.S.

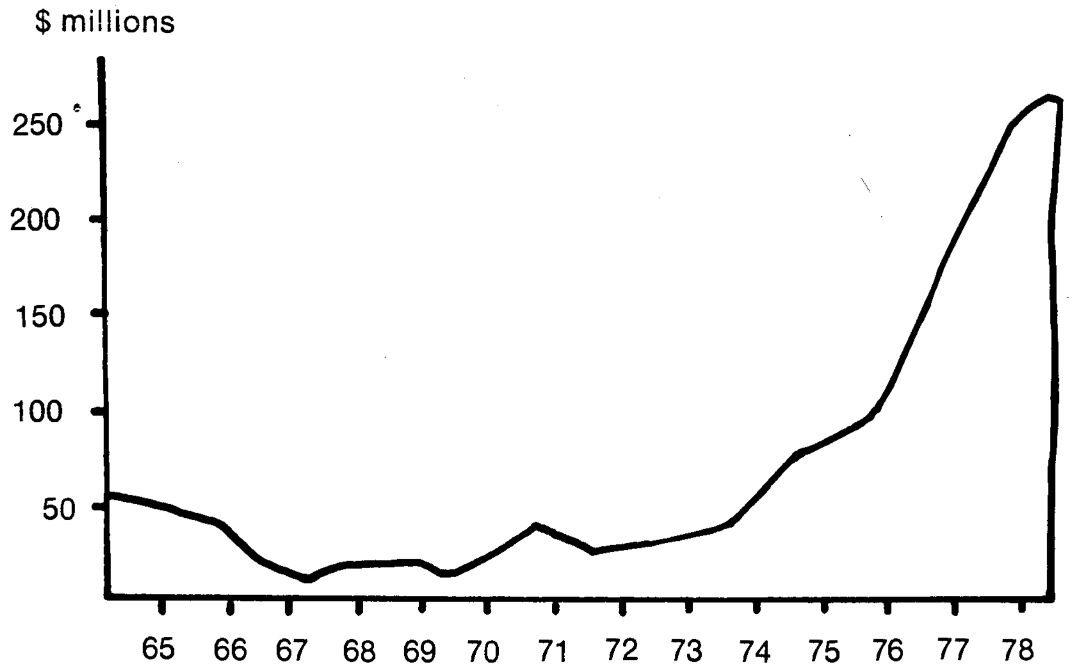
All products have been built to North American standards, which are among the most exacting in the world. There is essentially no difference between Canadian and U.S. buses and many infrastructure components, and all vehicle manufacturers are capable of meeting current U.S. specifications. The proven capability to meet North American standards places Canadian industry in an excellent position to meet the standards required in many other world markets.

The increasing capability to manufacture components in Canada should add to Canadian content in vehicles built in Canada and provide further opportunity for the export of components as such (e.g., recent $1.3 million sale of bus seats to Denver, Colorado). However, foreign (component) content is sometimes necessary to effect vehicle sales. Although U.S. federal Buy America policies are not applied to financing in this sector, local U.S. governments frequently demand the use of U.S. sub-systems wherever economic and practical.

Significant excess capacity exists in all sub-sectors except the truck castings (part of guided vehicle undercarriage) industry. However, a shortage of truck castings is not likely to justify the substantial investment which would be needed to increase existing production levels. Deficiencies can be overcome by import or the use of welded trucks. In all other sub-sectors, production capacity is adequate to meet anticipated demand in the short to medium term (5-10 years).

TABLE III

VEHICLES — PRODUCTION/FIRM ORDERS



Source: Vehicle Manufacturers

Employment

Total direct employment by first and second tier manufacturers exceeded 3,100 in early 1977, having risen from 1,500 in 1974 (source: manufacturers), and is increasing at an uneven rate determined by production commitments. No data related to other employment generated is available.

Technology

In terms of conventional equipment, Canada now has the capability to supply complete systems incorporating the most advanced sub-systems proven in revenue service.

Using a technology base developed elsewhere, Canadian companies have established a world lead in a number of selected technical areas. New vehicles include the Hawker Siddeley double-decker commuter car and the Ontario Urban Transportation Development Corporation (UTDC) streetcar. Advanced Canadian design capability has already produced such components as OTACO's successful Innovator I passenger seating. Major advances in electrical and electronic components are discussed later in this paper.

Perhaps the most important current Canadian urban transportation development program is the $55.5 million (3½ year) intermediate capacity transit system (ICTS) and test track project of the UTDC. Offering a systems application for a wide range of technological developments, the project could provide a continuing and effective stimulus for Canadian development of relevant technology.

Investment/Profitability

In the period 1965-74, the annual average investment in construction and machinery and equipment was negligible, if only because of a lack of market justification for plant expansion.

In the time period 1975-76, the average annual investment of first and second tier companies (in total) in construction was $3.5 million and in machinery and equipment $4.8 million. Further capital injection is now being provided by the UTDC investment of approximately $17 million in the construction and equipping of a new test facility (Kingston, Ontario).

For guided vehicle manufacturers, the current steady flow of work, together with the considerable experience of established manufacturers in pricing vehicle orders, serves to increase the profitability of vehicle production activity.

Urban bus manufacture in Canada has not been highly profitable. Contributory factors include short production runs, the cyclical nature of the market and provincial content requirements. Flyer Industries Limited, for example, lost approximately $20 million in the 4½ year period from 1970 to 1974. Because Flyer commenced bus and trolley bus production in 1968, much of this loss can be attributed to start up costs, management problems and other costs associated with entering a new market. The company operated at break-even levels in 1975 and was profitable in 1976.

General Motors on the other hand produced buses in London for many years, and had an advantage in producing several other product lines. This allowed burden costs to be shared. In 1978, this situation will change when the company commences operating a single bus plant in the Montreal area to not only meet Quebec's need for 40 per cent content, but to provide a single efficient operation for the whole of Canada. Because of the guaranteed Quebec market for the next four years, and a larger share of the balance of the market in Canada, General Motors should continue to have lower production costs than Flyer Industries.

Domestic (Vehicle Systems) Market

TABLE IV
DOMESTIC MARKET ESTIMATES — GUIDED VEHICLES
($000,000)

	Subway	*Commuter*	*Streetcar*	*ICTS*	*TOTAL*
1961-65	78.7	—	—	—	78.7
1966-70	39.4	40.4	—	—	79.8
1971-75	46.8	10.0	—	—	56.8
1976-80	204.8	39.5	81.3	—	325.6
1981-85	110.9	30.0	23.2	—	164.1
1986-90	216.0	30.0	47.1	224.3	517.4
1991-95	163.4	—	23.9	546.0	733.3
TOTAL	860.0	149.9	175.5	770.3	1,955.7

Note: 1981-85 drop in subway and streetcar demand due to cyclical market after large purchases in 1976-80.

TABLE V
DOMESTIC MARKET ESTIMATES — URBAN BUSES
($000,000)

1975-81	279.5
1982-86	188.8
1987-91	236.3

Source: Bus Market Study, MSUA, November 26, 1975.

The domestic market is significant. Ontario, Quebec, British Columbia, Alberta and Manitoba have already indicated provincial readiness to accept financial responsibility, to a varying degree, for the provision of new systems and in some cases for the subsidization of operating costs. Long-term transportation planning is under way in many of the 55 Canadian cities which could exceed 50,000 in population by 2,000 A.D. Short to medium-term planning is well advanced in the nine cities likely to exceed an approximate one million in population in the same time period.

Previous attempts to obtain a national approach to the purchase of transit and equipment systems have failed. Market fragmentation remains a major problem.

Estimates of Canadian market value vary considerably and have been as high as $15 billion for the period 1975-90. Certainly, a market value of between $5 billion and $10 billion in that period is generally accepted as valid if all infrastructure and related requirements are considered. The major requirements will be for subway equipment, intermediate capacity transit systems and equipment, buses (including mini-buses) and vehicle monitoring and control systems. Emphasis will be placed on safety, capital and operating costs, energy utilization levels, passenger comfort and environmental effects.

Current Canadian ability to meet domestic (and other) needs for guided equipment results from some thirty years of industrial response to a cyclical domestic market provided mainly by the Toronto Transit Commission (TTC). As the domestic market remains cyclical, maintenance of the currently high level of industrial interest and development activity will depend on the success achieved in export markets while domestic demand is low. Equally, continued Canadian development of automatically controlled vehicle systems and intermediate capacity transit systems is essential if foreign penetration of the domestic market, and consequent reduction of the credibility of Canadian industry in export markets, is to be prevented.

Export (Vehicle System) Market

During the 1965/75 period the total value of vehicle exports was approximately $17 million, with about $14.5 million of this generated by subway and commuter car sales.

TABLE VI

ESTIMATED CANADIAN SALES INTO U.S. MARKET (GUIDED VEHICLES)
($000,000)

	Subway	*Commuter*	*Streetcar*	*ICTS*	*TOTAL*
1961-65	—	—	—	—	—
1966-70	—	—	—	—	—
1971-75	—	20.5	—	—	20.5
1976-80	207.0	82.1	190.8	—	479.9
1981-85	93.5	33.5	72.5	—	199.5
1986-90	93.5	33.5	72.5	239.5	439.0
TOTAL	394.0	169.6	335.8	239.5	1,138.9

Note: 1981-85 drop in demand due to cyclical market after large purchases in 1976-80.

A federally-inspired marketing effort to assist industry to exploit the established capability has begun to produce results. Current U.S. orders for Canadian transit vehicles are at an all-time high with an accumulated contract value of over $180 million.

As yet Canadian forays into other world markets have been limited. In 1972/73, Industry, Trade and Commerce began a phased program of market identification and analysis. Initial concentration on the U.S. market was followed by identification and preliminary analysis of short-term opportunities in Latin America.

Current phases entail an in-depth assessment of the Latin American, Australian and South East Asian markets, with a concurrent preliminary examination of other foreign markets.

Although an earlier OECD estimate has not been verified, that 1975-95 world markets for urban transportation equipment would be worth between $300 billion and $500 billion, the existence of a large and growing demand is certain.

Market characteristics are:

— Institutional customers, normally local and municipal governments;
— Significant variation in product requirements to meet perceived local needs;
— Significant variation in order size, ranging from fleet orders for 200-700 vehicles to replacement orders for 20-100 vehicles (bus orders are normally for smaller quantities);
— Increasing emphasis on contracting elements of system provision, rather than a requirement for turnkey bids;
— Packaging of system elements into technical groupings, e.g., vehicle control, passenger information system, system control.

For guided systems and systems components, the developed capability of Canadian companies to meet peculiarly Canadian market requirements (e.g., small orders, redesign to meet local requirements, resistance to adverse climatic conditions, etc.) provides a competitive edge in large segments of foreign markets. For example, economies of scale enable U.S. manufacturers to monopolize large orders in the U.S. but provide no advantage in competition for small one-off orders of less than 100 vehicles. Such small (U.S.) orders have been worth more than $180 million to Canadian companies in the period January 1976 to April 1977 and should average between $50 million and $100 million annually during the next twenty years.

The U.S. tariff on guided vehicles is 18 per cent. The Canadian (MFN) tariff is 20 per cent. In all other markets open to Canadian penetration, tariff and non-tariff barriers tend to affect all foreign bidders equally. As an example, Brazil insists on licensing rather than sale, and permits no foreign country an advantage. Although the Brazilian attitude is unusual, the development of manufacturing capability in other countries is increasing the pressure for licensing, with an associated opportunity for sale of high-technology components.

The provision of financial assistance and, on occasion, direction by other governments to companies/consortia competing in developing countries is significant. France, Germany, Japan and some other countries are almost invariably represented in such international competition by one company or consortium which has full governmental backing. Canadian companies competing against each other, as well as against foreign entities, are at a disadvantage.

Allocation of contracts in the developing countries is invariably determined by national governments. They almost invariably require that dealings with foreign private companies have the support of the companies' governments.

Despite funding problems, the world market for urban transportation systems is expected to grow substantially as energy, population and urban development problems are experienced. The evidence now available suggests that Canadian export of guided systems and system components could exceed $300 million per annum by 1982 and increase substantially thereafter.

International Competition

Save for trolley buses, Canadian urban bus manufacturers, for a variety of reasons including differing design standards and tariff and non-tariff barriers, have not competed in export markets. Current tariff levels now provide Canadian bus manufacturers with an incentive for compliance with Canadian production levels specified in the Motor Vehicles Tariff Order. It is certain that the bus manufacturers will become more capital intensive. This trend has already started in the U.S. with the General Motors modular RTS11 bus. Substantial U.S. investments in automated production could further weaken Canada's competitive position.

In the development of guided systems, Germany, France, Japan, Britain and the U.S. are funding major systems oriented programs. Industry in each of these countries has the capability to provide the necessary technological effort and each has one or more companies capable of undertaking a lead role. The only recent major system sale between developed Western countries has involved the installation of a French system in Atlanta, Georgia. However, no world leader has as yet emerged.

Even when current system development programs are successfully completed, it is most unlikely that one system will dominate the world market, although the early demonstration in revenue service of the next generation of transit systems will afford some considerable market advantage.

The most important factor affecting development programs in these countries would seem to be the level of national government involvement. In every case, government is committed to the implementation in revenue service of the system developed. The incentive for industry compliance with government urban transportation objectives is therefore high. Additionally, financial assistance in the process of bidding for system or sub-system packages by the provision of bid bonding and cross-liability insurance can effectively reduce consortia costs and prices.

ELECTRIC AND ELECTRONIC SYSTEMS

There is little present or historical data available relating to this sector of the industry.

Vehicle System Components

Canada has the potential to supply a substantial portion of any instrumentation and control system for vehicles. In this context the word system is normally deemed to refer to the electrical or electronic package fulfilling a major function in the operation of a vehicle or transportation service (e.g., ranging from a propulsion system for a single vehicle to the computerized command and control system necessary to govern the movement of automated vehicles).

The federal government has taken steps to increase the Canadian content of guided vehicles, especially in the area of propulsion equipment, by funding the development of components and by persuading multi-national corporations to locate component development and production activities in Canada. Further support for system development would inspire investment in the development of sub-systems and components. Several companies have the resources to be internationally competitive and have demonstrated their export capability.

Most of the electronic systems companies are vertically integrated with significant engineering, manufacturing and marketing capabilities. For competitive reasons, substantial portions of many contracts (usually 30 to 40 per cent) are subcontracted to specialists. Historically the electronic systems manufacturers have sourced some 10 to 25 per cent of their products from outside Canada, although this ratio is improving.

These companies now have the technological capability to provide or develop the electrical and electronic components required by the next generation of transit vehicle systems.

Control and Communication Systems

The management and control of movement in urban areas demands other electronic control and communication systems. Known variously as transportation control, traffic control, vehicle monitoring and administrative or operational control, these systems are intended to optimize the use of existing facilities. Examples are: operational control — police or taxi radio communication networks; traffic control — automated stop lights respond to variations in traffic density; vehicle monitoring — locating and reporting on the condition of buses employed on specific routes.

Ideally one system in each city would enable traffic to use road space to the full, direct and facilitate the progress of priority vehicles, and manage the use of public vehicles efficiently. As yet no such system exists, and the majority of the required sub-systems are very limited in capability. Financial, environmental and other pressures suggest that these systems, when fully developed, will find a ready and significant market.

Organizations such as the World Bank are prepared to fund the installation of traffic control systems in developing countries, and throughout the world governments are seeking some means to overcome shortages of road space. Insufficient data is available for precise calculation of domestic or export market potential, but it is already evident that if current Canadian development projects are successful, demand could exceed the dollar value of Canadian vehicle production.

Canadian Capability

The potential market is of particular importance because of existing Canadian capability. Casciato, Richardson and Associates (Toronto) developed and hold patents for the automatic (traffic movement) control system now used throughout North America and is currently well advanced in the design, development and testing of a second generation system. The IBI Group (Irwin, Beinhaker — Toronto) is completing a study of the parameters governing provision of transportation control, has defined the most promising areas and is ready to undertake the required development processes.

Some of the components (chips, circuitry) which will be used in these systems could not be produced economically in Canada. However, other components are available in Canada, and the potential for use of fibre optics is of particular interest to companies such as Canada Wire and Cable. Of more importance is the systems design and producton capability of Canadian companies.

International Competition

Research and development in this technical area is ongoing in most Western countries, but in no country have the required systems as yet been developed. The development processes involved are ideally suited to the small job-shop environment in Canada, and large conglomerates or multi-nationals gain no advantage because of size.

The evidence available suggests that Canada now has a lead in the development of urban transportation control systems, and that this lead could be exploited commercially within the next three to five years.

Industrial Benefits

Two potential benefits are of particular importance. The required research, development and production processes are labour-intensive and necessitate the employment of professionals and highly skilled technicians. Equally, since material and product transportation costs are not significant, and as the necessary skills exist in many areas in Canada, there is a real opportunity for research, development and production in geographically dispersed areas.

RESEARCH AND DEVELOPMENT

Before 1972, urban transportation equipment research and development in Canada was either limited or non-existent:

- — Canadian cities had grown increasingly automobile-oriented and the transit market was declining
- — municipalities responsible for transit lacked the resources necessary to sponsor high risks, new technology development
- — foreign-owned manufacturers relied on parent organizations for technology, where necessary adapting equipment to meet Canadian requirements.

Since 1972, strong domestic and foreign markets, provincial initiatives and expressed federal interest have encouraged R and D. Federal support since 1972 has exceeded $5 million, including approximately $3 million from Industry, Trade and Commerce. For non-industrial R and D the report of the Task Force on Urban Transportation lists three agencies, eight universities and 21 consulting firms involved in hardware development.

Despite the currently high level of R and D activity, the development of complete transportation systems is limited to the UTDC and Bombardier programs. All other related R and D effort is in sub-system or component development. Although many of these componentry programs are highly successful, providing a world lead in some product areas, most were inspired by the prospect of utilization of the finished product in a Canadian system to be sold into the Canadian and foreign markets. In effect, although the Canadian engineering and scientific community now has the capability to undertake total systems R and D, the presence of some form of systems catalyst is essential to attract R and D investment.

SYSTEMS APPROACH

For both vehicle systems and urban transportation control systems the presentation of a total systems capability is of paramount importance in development and marketing processes.

In development, the lack of a systems leader has in the past inhibited an effective approach by Canadian industry to the development of a complete transit system. For most of the companies involved the manufacture of urban transportation equipment represents a minor element of total activity. There has been a reluctance to prime at any level, as the managerial and financial commitment necessary for such activity must necessarily clash with other corporate priorities.

A general acceptance that the market potential is growing, combined with a down-turn in other product areas, is increasing the readiness of many companies to commit resources in a planned approach to the satisfaction of transit requirements. However, fragmentation of industrial capability remains a problem, inhibiting attempts to develop transportation systems and restricting ability to compete with well-established foreign development consortia in the market for systems as such.

The need for a catalyst remains, and the effectiveness of current UTDC attempts to provide the necessary systems leadership cannot yet be determined. However, other companies are now prepared to undertake or co-ordinate sub-system development. If adequate support can be provided while the industry develops and markets the first of the next generation of transit systems, the activity generated should become self-sustaining.

In export markets, even orders for individual system components are influenced by a demonstrated capability to operate within a successful systems environment. In this context, the standards achieved by Canadian transit operators provide a unique advantage. The Toronto Transit Commission, in particular, is internationally recognized as the most efficient transit organization in the Americas, and both Toronto and Montreal provide a reference sell of major significance. Present or retired TTC officials are internationally recognized as urban transportation experts, and hold directorships in or are senior consultants to various U.S. and other transit organizations. Their activities, and the TTC reputation, are a significant factor in overcoming tariff and non-tariff barriers.

The importance of a systems capability and the demonstration of that capability in the domestic market cannot be over-emphasized. Without it the companies now forming the Canadian industry sector must inevitably reduce their activity to exploitation of domestic market opportunities under foreign licence. With it, the Canadian share of the world market can continue to increase.

OUTLOOK

The potential for further development of the Canadian urban transportation systems and equipment capability is excellent. Although still small, the industry, if it can as yet be classified as such, is growing in size, output and technological ability. Current export achievements are noteworthy.

The present level of industrial activity results from opportunities in the domestic and (subsequently) the U.S. markets. Success in competition with foreign manufacturers has been achieved because of a proven Canadian capability to produce high quality products in relatively small order lots at a competitive price. Foreign technology has been adapted to meet Canadian and U.S. needs for conventional vehicles. International recognition of the Toronto and Montreal transit systems has inspired interest in and respect for Canadian equipment.

The level of demand in the domestic and U.S. markets is likely to be relatively low during the period 1981-85. Continued growth of the industry would therefore seem to depend on maximization of benefit from these established markets and penetration of new market areas.

CURRENT ISSUES

Domestic Market

The domestic market is fragmented. Provincial interests in industrial and regional economic expansion vary and the industrial aims of certain provinces, in responding to internal urban transportation requirements, are in direct conflict.

The danger of further fragmentation of the domestic market remains. The industry now has under development every type of system for which a Canadian requirement is foreseen, but its success is dependent upon its ability to penetrate the domestic market and thus demonstrate its systems capability in revenue service. For this reason the danger of further market fragmentation is significant and warrants early remedial action.

Some provinces have used internal markets to achieve short-term industrial benefit, yet in no province does the existing or potential market by itself provide an adequate base for major industrial activity. The prospect of industrial development therefore provides an incentive for provincial co-operation. Such an incentive is essential in any attempts to obtain a joint approach to effective market and industry development.

Other Markets

Current marketing activities in the United States will continue. Federal involvement under the terms of existing marketing assistance programs will be needed to assist the industry to successfully penetrate other market areas.

In this context the current lack of systems leadership in an approach to foreign markets may limit the types of opportunity which Canadian companies can access.

Normal federal programs could be used to encourage those co-operative processes essential in an approach to foreign markets. The recently authorized provision of financial guarantees by EDC to Canadian consortia bidding for a major export contract should be most beneficial.

APPENDIX A

URBAN TRANSPORTATION SYSTEMS DEFINITION

Six classes of transit systems have been identified as having a specific application for urban transit.

Moving Way Transit

Those forms of transit best suited for areas where pedestrian traffic is of higher density (example, airports, shopping centres, public buildings). Typically, the systems provide short trip service in a restricted area at slow speed (usually less than 15 mph) with little or no waiting time. Examples are systems such as moving walkways, escalators and small passive cabs or vehicles which may be carried on a moving surface or towed along a guideway.

Light Guideway Transit

Vehicles are operated singly and in some cases in small trains over an exclusive guideway under automatic control. Stations can be either on-line or off-line. The vehicles are usually the size of a small bus with approximately the same passenger capacity permitting standees. In the off-peak hours some systems may offer personal demand-activated service.

Personal Rapid Transit

PRT is a transit class in which small vehicles (two to six passengers seated) operate under total automatic control over an exclusive guideway. All stations are off-line and service is demand-activated. One passenger can have exclusive use of a vehicle for a non-stop trip from his origin station to his destination. He may take with him a small party of perhaps three to five others, possibly at no extra charge.

Light Rail Transit

LRT is generally considered to be a duo rail electric traction service. System operation and service performance fall in a range between local service and grade separated rail rapid transit or heavy rail transit (HRT). In addition, LRT service must fall into a majority of the following categories for all or a portion of the operation.

(a) Lightweight construction of rolling stock approximately 750 to 950 lb. per foot of length.
(b) Low level at grade passenger loading.
(c) Street running (with or without automobile segregation).
(d) Overhead current collection (trolley or pantograph variations).
(e) One man, single car operation.
(f) Reserved-way operation whether or not grade separated.
(g) Train operation of not more than three vehicles in rush periods.

Heavy Rail Transit

Heavy rail transit is generally considered to be duo rail, electric traction service. However, a number of recent designs include rubber tired systems and monorail as well as non-traction propulsion (linear electric motors). Therefore, to be classified as HRT a system must fall into a majority of the following categories:

(a) line haul service with on-line stations
(b) exclusive guideway separated from other traffic (can be at, above or below grade)
(c) level platform passenger boarding in stations
(d) train operation
(e) large vehicles, usually greater than 45 feet in length and 8 to 10 feet wide
(f) heavy vehicles weight range of 750 to 1,200 lb. per foot of length
(g) intra-urban or commuter service only (does not include inter-city trains)

Roadway Transit Systems

These are characterized by vehicles supported by rubber tires and operating on normal roads and streets. The vehicles in this class are of the automobile and bus types. In most cases the vehicles are mixed with other traffic, but they may also have use of an exclusive busway lane. RTS may include priority measures for buses.

There are two sub-systems in this area:

(a) Bus Transit — Vehicles of a size to accommodate 12 to 60 seated passengers, possibly plus standees, operate with a fixed pattern to meet in time or route or both. This classification includes normal city bus service and express bus service.

(b) Para Transit — Vehicles of a size to accommodate 6 to 20 seated passengers are used but are not restricted to a fixed route and time schedule. Included in this sub-class are dial-a-bus, taxi, car pools, jitneys, drive-yourself taxis, etc. These systems are generally demand-activated.

Definitions are from the LEA TRANSIT COMPENDIUM published by the N. D. Lea Transportation Research Corporation.

Note: Intermediate Capacity Transit Systems (ICTS) are those systems operating on a reserved right of way which have a capacity between that of a bus transit system (maximum 6,000 to 12,000 per hour) and that of a subway system (maximum 40,000 to 50,000 per hour) per direction on one route. As an example, an upgraded (possibly automated) streetcar system separated from other traffic could carry between 20,000 and 30,000 passengers per line, per direction, per hour. ICTS systems are of particular interest to many municipalities because:

— there are many transit corridors requiring more through-put than a bus system, but not justifying a subway system
— current ICTS development could lead to systems with low operating costs
— provision of such systems can be phased
— increase in capability of individual lines can be varied to meet local needs.