

OTTAWA, ONTARIO

BRT CASE STUDY

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SUMMARY

The Ottawa Transitway system — perhaps the most comprehensive system in North America — is an outgrowth of the 1974 official plan. The 60-km [37-mile] Transitway system includes 26 km [14 miles] of bus-only roadway, with most of the remaining distance on reserved freeway or arterial lanes. Costs have been estimated at \$435 million.

Service is provided by two trunk line routes, regular routes that use part of the busway, and peak-hour express routes that serve individual communities. Speeds on the Transitway (and reserved freeway lanes) range up to 80 kph [50 mph]. There are 2,00,000 daily riders, and during the peak hour, about 180 to 200 buses enter the central business district on the busway in each direction — about 9,000 to 10,000 one-way passengers.

The Transitway is reported to have generated about \$1 billion (Canadian dollars) in investment at or near its stations.

THE CANADIAN CONTEXT

As in most cities of the world, there is increasing dissatisfaction with existing transportation systems in larger Canadian cities today, as well as increasing doubt that these systems will actually be improved to effectively serve future needs. Typical concerns include

- Unacceptable congestion and delay;
- Insufficient road capacity for automobiles and trucks;
- General level of service provided by the transit system;
- Costs (both public and private);
- Effects of congestion on goods movement and economic competitiveness;
- Unsustainable forms of growth such as urban sprawl;
- Safety (injuries and fatalities), particularly for pedestrians and cyclists;
- Accessibility for specific groups (e.g., those with physical disabilities) or geographic areas within a community;
- Traffic impacts on neighbourhoods;
- Effects on pollution and health; and
- Contribution to greenhouse gas emissions and climate change.

By and large, there is a growing awareness that these problems result directly from increased dependence on private automobiles — a worldwide trend that essentially conflicts with the increased interest in sustainable development and more environmentally friendly transportation.

For these reasons, many municipal governments are rethinking transportation policies, which, at least at the planning stage, increasingly place emphasis on solutions that are less automobile-dependent and more transit oriented. In reality, however, as shown in [Figure 1](#), the use of public transportation relative to the use of private automobiles has been steadily declining. In the City of Toronto, for example, which has the highest per capita use of public transportation in Canada, less than 30 percent of all trips made during the morning peak period are taken by transit, a proportion that has been steadily decreasing over time.

Four major factors differentiate the Canadian context for public transportation from that in the United States and Western Europe.

First, there are no central government programs for public transportation operations or capital investment in Canada, making it the only Organization for Economic Cooperation and Development (OECD) country in this situation.

Second, in Canada, municipalities are entirely creatures of the provinces; their status, structure, responsibilities, areas of potential activity, and sources of revenue are created by provincial law. As a result, there is considerable variation from province to province as to the organization of municipalities. Some provinces, for example, have created regional governments, such as the former Municipality of Metro Toronto (amalgamated in 1998 as the new City of Toronto), the former Regional Municipality of Ottawa-Carleton (amalgamated in 2001 as the new City of Ottawa), and the Commission Urbaine de Montreal. Some have created regional planning agencies such as the Greater Vancouver Regional District. Large urbanized areas such as Calgary, Edmonton, and Winnipeg are governed by a single municipal council, whereas others such as Montreal, Toronto, and Vancouver are multi-jurisdictional.

Third, with the exception of British Columbia and to some extent, Quebec, transit is very closely tied to municipal governments. In the United States and many European countries, transit is run by powerful independent authorities at the regional level with their own funding sources. The majority of Canadian transit systems work as municipal departments, generally under Transportation and Public Works, with policy and funding decisions made by city councils. Even separate commissions created to provide oversight, such as the Toronto Transit Commission (TTC), the former Regional Municipality of Ottawa-Carleton's OC Transpo, and the Société de Transport de la Communauté Urbaine de Montréal, were usually composed of municipal politicians.

Until recently, British Columbia had an entirely different arrangement whereby the provincial government controlled transit throughout the province through the BC Transit Corporation. GO Transit (an inter-regional transit operator using both commuter rail and bus services) was another example of a provincial operation. Until 1998, it was a crown corporation of the Province of Ontario, but, subsequently, GO Transit was transferred to the Greater Toronto Services Board (GTSB), established in 1998 as a special board of the 28 municipalities that constitute the Greater Toronto Area.

Finally, provincial governments have traditionally limited the sources of revenue — essentially property tax and some limited user charges — that can be accessed by municipalities to fund the services for which they have responsibility. Municipalities are not permitted to accumulate

operating deficits. Sales, income, and payroll taxes are only the domain of the federal and provincial governments, and, prior to 1992, regional earmarked taxes for transit were non-existent (with the exception of a tax on electricity in British Columbia).

Under these circumstances, cost-effectiveness has always ranked high on the agenda of Canadian public transportation managers, who take pride in their economic performance. In Canada, operating ratios — which, for conventional transit (excluding special services for the disabled and seniors) are defined as the proportion of operating and maintenance costs (excluding debt service and depreciation) recovered from revenues — have averaged between 53 and 55 percent for every year from 1987 to 1995. These are national averages. Some operators achieve much higher operating ratios. As shown in [Figure 2](#), Canadian transit operators generally recover a considerably higher proportion of operating and maintenance costs from users than U.S. operators in comparably sized cities.

Despite relatively good operating “performance,” every Canadian municipality requires operating subsidies to cover the shortfall between total costs of operation and revenues obtained from the farebox. Clearly, the time has long since passed in any Canadian city when the provision of public transportation can be considered as a commercially viable operation that generates a positive return on revenues, makes any contribution to capital, or attracts private investors.

Recognizing that no contribution to capital derives from transit operations, Canadian municipalities rely on subsidies for all capital requirements. Where such subsidies are or have been obtained from provincial governments, in the larger urban centers, most transportation decision-making has traditionally focused on very capital intensive projects, generally involving rail technology. [Table 1](#) illustrates the range of capital intensive transit services provided in the larger Canadian cities. Such projects are becoming increasingly unaffordable in light of other demands for more policing and better health and education.

Moreover, preoccupation with these capital intensive projects diverts attention from less-expensive and possibly more cost-effective measures, such as higher priority for transit vehicles on existing streets or the use of lower-cost and likely more cost-effective forms of bus-based rapid transit. In this regard, the City of Ottawa provides an interesting example, inasmuch as during the period when other large Canadian cities, including Montreal, Toronto, Calgary, Edmonton, and Vancouver, were all in the process of implementing or expanding rail rapid systems, Ottawa concentrated on bus rapid transit (BRT).

CITY CONTEXT

Until January 2001, the City of Ottawa existed as a municipality within the Regional Municipality of Ottawa-Carleton (RMOC). Until that time, transit services within the RMOC were provided by OC Transpo, a separate agency of the regional government established by the Province of Ontario in 1972. However, as part of a general provincial government focus on downsizing government, realigning financial responsibilities, and municipal reorganization, municipalities within the RMOC were amalgamated as the new City of Ottawa in January 2001, and OC Transpo effectively became a new department within the municipal government.

The new City forms the southern component of the National Capital Region, which borders the boundaries (delineated by the Ottawa River) of the provinces of Ontario and Quebec.ⁱ The National Capital Region covers approximately 4,660 square km [1,800 square miles], 2,720 square km [1,050 square miles] of which are in the province of Ontario. The remaining 1,940 square km [750 square miles] are in the City of Hull and the Outaouais region, which is located within the Province of Quebec. Both federal government departments and the national parliament are concentrated in the Ottawa-Hull Centre, connected by several bridge crossings across the Ottawa River, as shown in [Figure 3](#).

The general structure of the City is defined in part by a federal government greenbelt that separates the major urbanized portion of the City, which includes the national Parliament, a variety of federal government buildings, two universities, and other typical downtown activities, from suburban municipalities and town centers. Beyond the greenbelt, several distinct communities of largely (but not entirely) residential character, have emerged that have strong linkages to the center, a pattern of development that has obviously influenced the development of the transit system that serves this area. In some cases, such as Kanata, a substantial local employment base has also been emerging. Historical and projected growths in population and employment are shown in [Figure 4](#).

The new City — formerly the Ottawa-Carleton Regional Municipality — contains eleven urban and rural municipalities. It has a population of almost 700,000. About 90 percent of the population resides in the 370-square-km [145-square-mile] urban area within the greenbelt around the City. Employment is dominated by the federal government, which accounts for some 30 percent of all jobs within the City. Hull, Quebec, on the north side of the Ottawa River, brings the urbanized area population to over a million.

Approximately 84,500 jobs — 32 percent of the Region’s total — are located in the central business district. About half of the people entering the central business district in the morning peak hour arrive by public transport.

TRANSIT IN THE NATIONAL CAPITAL REGION

OC Transpo, now a City department, is the transit operating authority. It operates a fleet of 850 buses that carry nearly 25 million riders annually (in a 348-km-service area). This ridership level represents a 24-hour market share of over 25 percent of all vehicle-based travel in the region and over 70 percent of all downtown-destined peak-hour work trips.ⁱⁱ

The relatively high use of transit stems from several factors: (1) federal government offices are concentrated in the center, (2) free parking was discontinued for civil servants in 1975, and (3) zoning bylaws have downsized required parking spaces

A network of bus rapid transit (known as the “Transitway”) serves as the backbone of the system. The 60-km Transitway includes 26 km of exclusive busways, bus-only lanes on arterial streets in the city center and outlying areas, and sections of reserved shoulder bus lanes on an existing east-west expressway (the Queensway), as well as limited operation on a relatively short section of a National Capital Commission (NCC) Parkway. OC Transpo has now implemented an experimental 8-km light rail transit (LRT) service that is intended to complement and provide

convenient interchange with the existing Transitway system. The new diesel powered LRT route opened in October 2001.ⁱⁱⁱ Statistics from 1999 available for the *entire* OC Transpo system (summarized in Table 2) provide an overview of the operation.

PLANNING AND IMPLEMENTATION BACKGROUND

In Canada, municipalities are considered “creatures” of the provincial governments, which, in various parts of the country, empower and/or assist municipalities in different ways to plan and implement improvements to urban transportation in general and urban transit in particular. There is no formal federal government participation in either the planning or funding of urban transportation, except on an ad hoc basis.

The federal government has provided occasional financial assistance for urban transportation in the case of a few commuter rail projects or in support of special projects such as Montreal’s *EXPO ’67* or Vancouver’s *EXPO ’86*. The federal government, historically, has found ways of contributing to urban transportation indirectly through regional programs for economic development and, most recently, through the Canada Infrastructure Works Program (entailing matching fund programs in collaboration with both municipal and provincial governments).

Institutional Arrangements

All public transportation within the boundaries of the new City is the responsibility of OC Transpo, first established as a separate regional agency by the government of Ontario in 1972 and reorganized as a separate department within the municipal administration following the recent amalgamation.

Under the current municipal structure, as shown in Figure 5, OC Transpo is one of four sections within the Department of Transportation, Utilities, and Public Works that reports to the Ottawa City Council through the City Manager.

OC Transpo is essentially responsible for system planning, operations, customer information systems, and facility maintenance (such as snow removal and elevator repairs in stations) within the normal budgetary constraints of the municipality itself. Fare changes require the approval of the City Council. Responsibilities for vehicle procurement, maintenance, and rehabilitation, however, have been allocated, somewhat strangely, to a separate section of the Department of Corporate Services responsible for all municipal vehicles, including transit buses.

Because of the high level of interdependence with the City of Hull and the Outaouais Region of Quebec, which is adjacent to the Ontario/Quebec boundary within the National Capital Region, OC Transpo also provides some joint services with Outaouais Transit to facilitate cross-boundary travel.

Planning Process

In Ontario, transportation projects of any consequence must be incorporated within provincially approved Official Plans, which, by law, are to be developed by each municipality and regional municipality within the province. In practice, these Official Plans can be amended from time to time to incorporate other transportation plans and projects, subject to the availability of funding.

The approved or amended Official Plan essentially provides a road map for the management of land use development within the region.

For the former RMOC, the regional Official Plan was required to be consistent with the various sub-area municipal Official Plans. Following amalgamation, the new City of Ottawa is now responsible for development of an Official Plan for what was formerly the area encompassed by RMOC. In accordance with provincial legislation, projects of any consequence are also subject to special requirements for environmental assessment and approval prior to implementation. In addition, as is the case for all Ontario municipalities, there are requirements for public consultation under the provincial Planning Act.

Another factor concerns the National Capital Commission, which has certain responsibilities within the National Capital Region. Although the NCC has no direct responsibility for land use planning and decisions concerning the City of Ottawa itself, as a practical matter, the relatively large areas under NCC located within the City's boundaries cannot be ignored as the City proceeds with development of its own Official Plan. In the case of transportation planning, for example, various NCC parkways, corridors, and parcels of land have provided opportunities for interim development of the Transitway system. (In some cases, NCC ownership and responsibilities may have been seen to constrain development of the desired transportation system.)

In 1974, the Regional Council endorsed a multicentered urban structure: downtown Ottawa would retain its position as the dominant commercial, employment, and cultural center of the region and would be orbited by a hierarchy of primary and secondary urban centers. Outside these centers, market-driven patterns of development — including low-density spread — would be largely permitted, and rapid transit would be the chief means of achieving this form.^{iv} The 1974 Official Plan called for developing a rapid transit system for the region and for giving “precedence to public transit over all forms of road construction or road widenings.”^v

The concept of rapid transit in Ottawa basically derived from transportation studies carried out by the former RMOC as part of the normal long-range planning process for a range of anticipated growth scenarios. The most extensive of these studies, in a manner somewhat analogous to many urban transportation studies of the day, basically concluded that some form of rapid transit would be needed to accommodate anticipated growth without unacceptable levels of delay and congestion.^{vi}

Attitudes regarding the need for rapid transit were prevalent throughout North America. In the case of Ontario cities, such attitudes derived in large measure from formal statements of provincial policy (1972) that favored public transit and promised both substantial funding and a commitment to highly sophisticated technological innovation (including a technology based on magnetic levitation, in particular, for both Ottawa and Toronto, which never materialized).

Simply stated, attitudes of the regional government, influenced both by its consultants and recent changes in provincial policy, which favored rapid transit development, were widely accepted within the commuting community and supported by the NCC's own vision for future growth of the National Capital Region.

One of the more striking features of BRT transit planning in Ottawa has been the emphasis on coverage of the system, rather than investing heavily in short sections of mass transit in the more congested central area. As a result, initial funding has been devoted to extending the system to capture suburban markets while relying on much lower cost transit priority measures to increase capacity and reliability within the City's core.

According to OC Transpo's Manager of Planning, for example,

Council adopted what was then an unconventional strategy for the implementation of the radial rapid transit system in the Official Plan. Rather than adopting a traditional 'inside out' approach by building the downtown link first, Council decided to delay construction in the downtown core until later on. This 'outside-in' approach allowed more kilometers of exclusive right-of-way to be built with available funding. The Plan includes a statement that the development of the stations in town centres is a high priority.... to ensure that the urban form of these town centres will incorporate the Transitway as an integral part, rather than as an after-thought^{vii}

Reasons for Bus Rapid Transit Implementation

The main reasons advanced for recommending bus-based rapid transit in the 1976 study are paraphrased below:

1. The Official Plan to guide the growth of the Region proposes rapid transit as an indispensable part of the Plan. In addition to its role in structuring the growth of new communities, public transit is proposed to carry an increasing proportion of total regional travel, with priority being given to rapid transit over road widenings and new road construction.
2. In November 1973, the Ottawa-Carleton Planning Department produced a report to establish the basis for a rapid transit development program in the Region that anticipated an initial development program requiring substantial capital funding (estimated at \$300 million in 1973 dollars over a period of up to 19 years). The reaction was that the Region could not, out of its own tax base, commit the necessary 25 percent of capital costs required by the proposed rapid transit development program. This led to a need to reexamine the Region's rapid transit implementation options for the next 15 years.
3. The 1976 study confirmed the long-term need for rapid transit in the five major travel corridors in Ottawa-Carleton. The most cost-effective strategy recommended was for the construction of transitways. "Transitway" is a term used to connote a system of separate right-of-way rapid transit in the corridors leading up to the central area with surface running on priority rights-of-way through the central area. Four corridors were in the RMOC, and the fifth corridor led to the Outdoors Region in Quebec.
4. Busways were considered the least costly option for these transitways. A bus-based system could be built for half the capital costs of light rail and would be about 20 percent cheaper to operate.^{viii} However, in recognizing an anticipated need to eventually convert the transitways to a fixed guideway service such as light rail transit, it was recommended that both busway and light rail technologies be carried forward for more detailed analysis in subsequent stages of the rapid transit development program.

5. The choice of diesel bus technology was also based on its flexibility. Buses could circulate through the suburbs, pick up riders, and then enter the Transitway for a fast run downtown, whereas a rail-based system would have required one or more transfers.

Selecting specific routes within the four corridors was a challenging issue during the 4-year life of the development program. The corridors incorporated publicly owned land, much of it falling under the purview of the National Capital Commission — a federal government agency that has considerable say over development plans within the national capital region. Community input was also an important part of the route selection process. Route selection reflected how the transitways would benefit or affect adjacent communities, as well as cost factors.

Twenty-two factors were taken into account in choosing specific routes. These were developed after consultations involving the study team, a technical advisory committee, a land use sub-committee, a citizen's advisory committee, and public meetings.

In short, acceptance of BRT as the most effective means of providing rapid transit to dormitory communities located at large distances from the central business district (CBD) reflected the view that rail-based systems (even with 75 percent provincial capital assistance for infrastructure and vehicles) were likely to be unaffordable for a city the size of Ottawa. It was also concluded that the bus-based transitway, basically the system that exists today, would be adequate to support a population level of about 625,000 (estimated to occur by 1991), which, more or less, is the current population of OC Transpo's service area.

Beyond that time, it was anticipated that some form of grade-separated transit service within the central area would be required and that possibly the Transitway itself might have to be converted to some form of rail transit technology. (As noted above, in fact, OC Transpo is now in the process of completing its first experiment with LRT, but as a *complement* to, rather than as a *substitute* for an upgrade to existing Transitway service.)

DETAILS OF THE CASE STUDY

The Transitway is Ottawa-Carleton's rapid transit system of roadways used exclusively by buses. In the early 1970s, following an exhaustive evaluation of alternative technologies, RMOC adopted bus rapid transit as the backbone of the inter-regional system of public transportation. A schematic map of the Transitway is shown in [Figure 6](#).

The Transitway first opened in 1983, linking five stations (see [Figure 7](#)): Hurdman and Lees in the east end and Baseline, Queensway, and Lincoln Fields stations in the west. The Bayshore station opened in December 2000. Construction began in 1999 for the latest Transitway extension, south of Baseline Station to Fallowfield Station in Barrhaven. The 60-km (37-mile) Transitway system is fully operational today. It includes 26 km (17 mile) of bus-only roadways, 28 stations, and five major stops. Four park-and-ride lots containing 2,140 spaces complete the system.

All OC Transpo bus routes travel along parts of the Transitway or connect at one of the stations. Many stations are located next to major shopping centers or employment centers. Two main Transitway routes (Routes 95 and 97) provide "rapid-transit-like" service; these are

complemented by peak-hour express routes and local feeder buses. An overview of the Transitway system is given in [Table 3](#).

Physical Elements and Facilities

Running Way

The BRT running ways include sections of the Transitway (dedicated roadways), reserved bus lanes on streets within the CBD, reserved bus shoulder lanes on the Queensway (Highway 417), and operation in mixed traffic on the NCC Parkway.

Planning and design of the running way was based on the assumption that for the foreseeable future, the Transitway system would be fully grade-separated from other traffic *outside the central area*, but that it might include at-grade intersections under exceptional circumstances or during early stages of implementation. Although buses are not grade-separated from other traffic within the central area (as they are at minor streets in outlying areas) they do operate within designated bus lanes. (In the longer term, as noted previously, it was assumed that some form of grade-separated central area transitway would be considered.) Design standards accommodate the current OC Transpo fleet of standard (12-m) and articulated (18-m) buses.

Normal operating speeds on the Transitway are 80 kph [50 mph], restricted to 50 kph [31 mph] or less through stations. The basic design philosophy has been that, having boarded a bus, a passenger should expect to be sheltered from the elements until leaving the bus in the central area. Recognizing that, for capacity reasons, conversion of the Transitway to rail operation might eventually be required, design provisions include vertical clearances, other elements of geometric design, and structural loadings to accommodate light rail vehicles that are currently available.

Detailed standards used for the Transitway are provided in a special 1993 Transportation Department design manual, as summarized in Appendix A of that document.^{ix} The various types of rights-of-way in the “central” 31.1-km section and the “outlying” 28.9-km section are shown in [Table 4](#). About 70 percent of the 60-km system consists of the Transitway or reserved bus lanes.

The Transitway is a two-lane, grade-separated, bus-only roadway. The basic right-of-way has two 4-m (13-ft) travel lanes and 2.5-m [8-ft] shoulders on each side for a total width of 13 m [43 ft]. The shoulders provide a place to store snow and accommodate disabled buses. At stations, the right-of-way is widened to include (1) a fenced median that inhibits grade crossings by passengers and (2) another lane in each direction to allow buses to overtake each other.

[Figure 8](#) illustrates sections of the Transitway that involve separate shoulder lanes on the expressway and the busway. [Figure 9](#) illustrates the bus lane arrangement typical in the central city. The bus lane is the second lane from the curb on four-lane, one-way streets, thereby allowing the curb lane to be used for curb parking, right turns at intersections, and passenger boardings. Graphic/multi-lingual bus lane signs are used (see [Figure 10](#)).

Stations and Stops

Generally, stations are located at existing or potential high-trip generator developments, as well as at major cross streets, with provisions for convenient transfers to local bus routes. The relatively small number of “walk-in” stations are located as closely as practical to, or fully integrated within, high-density employment or residential centers. As a rule of thumb, pedestrian walking distances do not exceed 400 m (1,300 ft) in residential areas and 600 m (2,000 ft) in commercial areas.

Transitway stations are located near major employment and activity centers and are fully integrated into major commercial and residential developments and a variety of public institutions. Such integration is found at St. Laurent, South Keys, Place d’Orleans, Lincoln Fields, Billings Bridge and Rideau Centre shopping malls; the Lees and Abbey residential developments; the University of Ottawa and Algonquin College; and the Riverside Campus of the Ottawa Hospital. The Transitway links these development nodes to one another and to the downtown core, as well as to rail, air, and inter-city bus connections. The two stations beyond the greenbelt stations — Orleans and Kanata — have been sited in the heart of planned urban centers.

In total, there are 28 stations (4 of which provide park-and-ride for over 2,100 cars at the periphery of the Transitway system) on the Transitway itself, in addition to 5 major stops within the downtown. Stations offer convenient transfer points with heated waiting areas, phones, and information displays. Many stations also have vendor kiosks and bike racks.

Stations generally have side-loading platforms and an additional lane in each direction to accommodate the bypassing of the station by non-stopping buses. To safely facilitate such operation, deceleration and acceleration lanes and tapers are required. Feeder services (that is, local bus routes) are well-integrated at all major stations. Roadways at stations slope away from the curb to allow water and slush to drain away from boarding passengers. Station design standards extracted from the previously noted 1993 Design Manual are provided in Appendix D of that document.

In station areas, the roadway itself is widened to 17 m [54 ft], with two lanes in each direction separated by a pedestrian barrier. Two 4- to 6-m [13- to 20-ft] platforms about 55 m [180 ft] in length allow for three separate bus stops (see [Figure 11](#)). A typical station arrangement plan for the Campus Station (Ottawa University) is shown in [Figure 12](#). A view of this station looking north is shown in [Figure 13](#).

Platform Arrangements

The actual design of each station reflects the specific requirements of its location. The most common design provides two parallel platforms, but there are a few examples of island platforms. In one case, the island platform acts as the junction between the Transitway, and allows maximum flexibility for all movements. The preferred layout for a feeder bus includes a single off-stop, a lay-up area, and individual pick-up stops for each route. By depressing the local platforms relative to the Transitway, the amount of passenger grade change is minimized.

Some of the Transitway stations are as complex as those found on rail systems. The largest station on the Transitway is fully integrated with a regional shopping center; the station mezzanine, which is above the Transitway but below the local station platform, is linked directly into the lower shopping level.

Design Features

High-quality concrete, resistant to de-icing chemicals, is used in the construction of station platforms. To assist the visually impaired, especially in winter, strips of colored concrete distinguish boarding areas from the rest of the platform surface. Inside the stations, an epoxy-based, stonehard flooring is installed over the concrete. Concrete flooring was found to stain easily and was difficult to clean. The stonehard flooring is reducing maintenance costs. Stations feature standardized, modular construction. They are built of glass and steel to afford optimum visibility while being easy to maintain. Glass panels are uniform in size, reducing replacement costs for panels that are damaged. A red steel pipe and glass structure is the common theme running through the design of all Transitway stations.

Each station consists of a series of individual shelters linked by covered walkways. Each shelter is 18 m long, and has red tubular steel frame sections every 1.5 m supporting glass roofs and walls (See [Figure 14](#)). The shelter door openings are located so that when a bus stops with its front door lined up with the bus stop flag, its front and rear doors line up with the shelter doorways. This shelter design accommodates the 9-, 12- and 18-m [30-, 40- and 54-ft] buses operated by OC Transpo. The tinted roof glass and shelter ventilation is adequate for summer temperatures in Ottawa, but during the winter the shelters require heating.

Passenger Amenities

Stations are equipped with radiant heaters (a necessity given Ottawa's severe winters), ample lighting, no-dial emergency telephones, pay phones, map cases, accessible bench seating, and a television monitor to indicate arrival times.

OC Transpo policy requires all stations to be fully accessible. Accordingly, multi-grade stations are equipped with elevators to assist riders with mobility impairments. Stations with especially heavy pedestrian traffic also have escalators and covered pedestrian walkways ([Figure 15](#)). Convenience stores at six stations sell sundries, bus tickets, and passes. Although stations are equipped with a full range of passenger information services, they are normally unmanned, as fare collection remains an on-bus activity.

Station Art

In 1988, OC Transpo launched TransArt to further enhance the quality of the station environment. Initially, OC Transpo rented works by outstanding Canadian artists for display at its major stations from the Canada Council Art Bank. Later, it set aside 1 percent of the construction cost of each new station to incorporate original works by local artists into the new facilities. Ten stations, built between 1990 and 1995, feature art works acquired under the program.

Service and Operations

Service design guidelines were developed through an extensive consultation process with customers, employees, and others with an interest in transit service provision. These guidelines, which reflect the need for cost-effectiveness, cover hours of operation, frequency of service, and passenger safety and security.

The service design reflected the low-density land use common in most parts of the region. Typical suburban densities, even though they may include pockets of high-rise development around focal points such as rapid transit stations, are not sufficient for the majority of passengers to access the rapid transit system other than by walking. A busway system where the same bus can provide both the feeder and the rapid transit service eliminates the need to transfer that would be required with a rail system.

For the Transitway, the general guidelines are reflected in essentially all-day service for extended hours, which, at a minimum, enable users to get into their communities very late at night, even if they then need to call home for a ride or take a taxi for a relatively short distance. Frequency of service ranges from 4 to 8 minutes throughout the day with headways of up to 25 or 30 minutes during very early morning or late night operation.

Service Concept

The Transitway service concept includes an integrated system of rapid transit, express, feeder, trunk line, and interchanging routes. There are two basic service patterns: (1) buses operate like any other rapid transit facility, stopping at every station; and (2) ramp access is provided for peak-hour express lines that provide direct no-transfer service between residential areas and downtown and other major generators. In addition, trunk-line bus routes also use sections of the Transitway. A further description of the system of services follows.

BRT Routes

Two bus rapid transit trunk lines, routes 95 and 97, run along the Transitway system from end to end (see [Figures 16](#) and [17](#)). Stopping at each station, they operate 22 hours daily (4:30 a.m. to 2:30 a.m.). They run on a 4-minute peak headway and a 5- to 6-minute off-peak headway, using articulated buses. For these two routes, the distribution of service ([Table 5](#)) between the Transitway and other lanes is as follows:

Schedule speeds for Route 95 between Base and Blair (or d'Orleans) were almost 40 kph (24 mph) including stops and bus-lane operation through the central business district.

Feeder Routes — Feeder buses on 15- and 30--minute headways operate on a timed transfer system from several stations.

Express Routes — During peak periods, about 64 express lines operate on the Transitway. Buses on these lines pick up passengers on local residential streets and at park-and-ride facilities. The buses then enter the Transitway by the special access ramps.

Other Routes — Forty-four local routes provide transfers at Transitway stations, and seven all-day trunk routes use various parts of the Transitway network; headways range from 10 to 15 minutes.

Vehicles

Vehicles used on the Transitway are part of OC Transpo's general fleet of standard buses (both 12-m [39-ft] rigid and 18-m [59-ft] articulated). The rigid bus has 45 seats and the articulated bus has 63 seats; both are configured with front and middle doors. Although the fleet mixture is considerable, including a number of vehicles "borrowed" from other transit operators, all recent acquisitions are of the low-floor variety to facilitate access by the disabled and seniors. Newer vehicles provide bicycle racks on the front of the bus.

Fares

Fares can be paid by monthly or daily passes, tickets, or exact cash fares. Transfers are free. Fare payment is on board, eliminating the need for controlled fare paid areas in stations. A proof-of-payment system is used; passengers with bus passes board by any doors — three doors for articulated buses. This operation reduces station dwell times because about 70 percent of Transitway riders use passes or transfers. (Passengers using cash, tickets, and free transfers are required to use the forward doors.)

The base fare structure is as follows:

- Monthly (adult) passes at \$72.50 for unlimited peak and off-peak travel and \$58.50 for unlimited off-peak travel,

- Monthly senior pass at \$24.00,

- Daily tickets at \$5.00 for unlimited use,

- Tickets at \$1.60 per trip including free transfer to non-express service (a 36 percent discount over regular fares),

- Cash fares of \$2.25 including free transfer to non-express services and \$1.25 for children between 6 to 11 years, and

- An adult express fare during peak periods of \$3.50.

Security

OC Transpo is responsible for security services on the Transitway. All Transitway stations are patrolled by security police. Closed-circuit television has been installed to further enhance rider safety. In addition, stations provide clear identification of "safe" zones, or "night stops," which provide easy access to emergency telephone service, particularly helpful during periods of low station utilization. To make passengers feel less isolated in these late hours, stops for several routes are combined at these "night stop" locations in several of the larger stations. (For users of other local bus routes, after 9 p.m., the "Transecure" service also allows passengers to request a special stop closer to their final destination.)

Regular safety audits, undertaken in cooperation with neighborhood communities and special interest groups, have resulted in increased lighting, the relocation of safety phones, and improvements of other safety features.

Service Control

In addition to actions taken by road supervisors, operations can be controlled centrally with the help of a computerized automatic vehicle location system. On the Transitway, detectors are located on the approaches to all stations that permit individual vehicle identification and location.

OC Transpo's infrastructure includes a fully automated telephone passenger information system. All stations and stops in OC Transpo's service area have been assigned a telephone number with a 560 prefix. Customers can dial and find out, for a particular stop, when the next two buses are scheduled to arrive, as well as route status information such as unexpected delays. Similar information is also displayed on large video screens at major transit terminals and shopping malls — a real inconvenience for those who would rather spend 5 or so minutes before a bus arrives window shopping than idly waiting.

Electronic signposts strategically placed throughout the region monitor bus movements, relaying real-time information to a centralized computer, which in turn passes schedule adherence information through digital voice transmissions, to customers who phone in.

There has been close cooperation between OC Transpo and the City traffic engineering department in providing traffic controls. Traffic signals at the curb bus lanes are set for buses, resulting in downtown bus speeds of about 15 kph [9 to 10 mph].

Taxis are allowed in the bus lane from 9 a.m. to 3 p.m.

MARKETING

Service schedules and trip planning assistance can be obtained by telephone, email (ocinfo@octranspo.com), or an extensive web site (www.octranspo.com). In addition, of course, route maps and other hardcopy information are available at specifically designated information kiosks and all Transitway stations. In addition to timetable information and direct-dial information telephones, television monitors display the next two departures on each route, and public telephones are available in each station.

Passenger information (not restricted to the Transitway itself) is probably the main element of marketing. It is facilitated by the telephone, email, and web-based services noted above; links are also provided to other web-based information sites of the City of Ottawa and the National Capital Commission.

One important marketing innovation involves the ECOPASS program, under which transit passes are paid by payroll deductions for participating employers, a method that provides a 15-percent reduction relative to the normal monthly pass and eliminates the need for monthly renewals (so long as payroll deductions are continued). This pass thus provides both added convenience and cost savings. (In addition, ECOPASS members also receive discounts from participating retailers.) Some measure of successful marketing is given by the fact that about 70-percent of all passengers make use of some form of monthly pass as their basis of fare payment.

COMPLEMENTARY POLICIES

In accordance with land use policies and guidelines, attempts have been made to encourage employment and residential concentration in close proximity to Transitway stations. In addition, several stations are extremely well integrated with local shopping centers (such as Bayshore, Orleans, and Billings Bridge).

According to one study, although Transitway implementation, thus far, has been radial with a strong focus on serving central area employment, the original Transitway strategy anticipated substantial employment-related development adjacent to Transitway stations.^x Employment around Transitway stations, however, has not developed to the extent originally envisaged, and employment growth is occurring more rapidly in areas that are not well served by transit.

Other complementary policies include the introduction of shoulder bus lanes on provincial highways and the operation of inter-city bus services on some sections of the Transitway, notably at such stations as Campus, which serves the University of Ottawa. Considerable emphasis is also being placed on expanding the capacity of park-and-ride facilities, which now accommodate about 2,100 spaces (at no charge).

RIDERSHIP

The Transitway carries about 200,000 riders each day, about 70 percent of the system's total ridership. During peak hours, the one-direction movements range from 9,000 to 10,000 people, and the bus flows range from 180 to 190 buses per hour. The high volumes are achieved by using articulated multi-door buses. A proof-of-payment system at stations with 70 percent of riders holding passes enables dwell time to be kept under 20 seconds during peak periods.

FINANCIAL IMPACTS AND COSTS

As shown in [Table 2](#), during 1999, OC Transpo earned approximately \$85 million in revenues against operating and maintenance costs of about \$148 million, an operating ratio of 57.6 percent. Separate data are not available for the Transitway itself. However, about 200,000 of a total daily ridership of 282,000 involved use of the Transitway, suggesting that the Transitway operating ratio is about 60 percent.

For purposes of illustration, comparative statistics for other Canadian cities are shown in [Table 6](#). Ottawa's 111 average annual per capita trips exceed the average for major Canadian cities, whereas its operating ratio is slightly below average. Most of the other cities in this category, however, have some form of rail transit in which the much larger capital investment in infrastructure is expected to produce lower operating deficits. In 1997, hourly costs of bus operation were estimated at \$72.79.

From 1972 to 1997, OC Transpo received substantial operating and capital subsidies through a specially designated provincial program. During this period, OC Transpo received operating subsidies equivalent to 50 percent, based on targeted cost recovery ratios. OC Transpo's operating ratio target was established at 58 percent, meaning that the provincial government covered approximately 21 percent of operating and maintenance costs. The remaining 21 percent was obtained from municipal property taxes. During that same period when most of the

existing Transitway was constructed, the provincial government provided capital subsidies of 75 percent for infrastructure and vehicles.^{xi}

Costs for the Transitway are estimated at \$435 million (Canadian dollars). In 1996, the Transitway was estimated to have cost an average of approximately \$14 million per km for the 31 km constructed subsequent to 1983 (about \$22 million per mile). For stations, costs ranged from \$1.8 million (Heron) to \$15 million (St. Laurent), averaging about \$4.5 million per station. It was also estimated that the higher vehicle productivity afforded by the Transitway reduced fleet requirements by about 150 buses.^{xii}

Annual Transitway maintenance costs, most of which are for snow clearing, averaged about \$60,000 per kilometer for the roadway and \$45,000 for each station. The total operating cost of the Transitway averaged 2.2 cents per seat-kilometer for direct operating costs. It was 2.5 cents per seat-kilometer when a full allocation of OC Transpo's system overhead was included and 5.1 cents per seat-kilometer when all vehicle and right-of-way capital costs were included.^{xiii} Despite carrying 8 percent more passengers and operating 7 percent more kilometers of service, the speed advantage of the Transitway has already allowed OC Transpo to reduce its peak bus requirements.

The Municipal Transit Program was terminated on January 1, 1998. Thus, at least for the foreseeable future, Ottawa, along with all other Ontario municipalities, is forced to rely upon farebox revenues supplemented by property taxes to cover both operating losses and capital requirements for vehicles and infrastructure.^{xiv} And, although Ottawa is the nation's capital, the federal government provides no funding for public transportation in any way analogous to the financial aid provided by the U.S. federal government, say, for the Washington Metro.

BENEFITS

The Transitway has reduced journey times and has resulted in both transportation and development benefits. These translate into increased development around stations. The operating cost savings and value of new developments have each (over the life of the Transitway) exceeded the investment costs.

Transportation Benefits

The Transitway, by bringing people to their destinations faster, has reduced the need for additional buses. Without the Transitway, OC Transpo would have required an additional 150 buses to carry the same number of passengers. The savings are \$58 million in vehicle costs and \$25 million in annual operating costs (Canadian dollars).^{xv}

The speed, identity, and reliability associated with the Transitway have resulted in high modal splits, both in the city center and at other major activity centers.^{xvi}

Illustrative examples of proximities to the Transitway on transit ridership, as derived in a 1986 Origin-Destination Study, are shown in [Table 7](#). Areas located along the Transitway consistently have higher transit use than comparable activities located elsewhere.

More than half of the people who travel into Ottawa's downtown core, including 70 percent of the people who work there, arrive by bus.

At the St. Laurent Shopping Centre, the region's largest, a third of the customers arrive via the Transitway. At the Rideau Centre in the heart of downtown, the figure is more than 60 percent.

Forty percent of the shift workers at JDS Uniphase, one of Ottawa's major high-tech companies, get to and from work on the Transitway.

The numbers of East/West commuters who use the Transitway far exceed the numbers of those who use the Queensway — the Region's major east/west freeway.

For a \$2.25 fare, the Transitway provides a 20-minute connection between Ottawa's Macdonald-Cartier International Airport and downtown. That is about \$20 cheaper and 5 minutes faster than a taxi.

At 5-minute intervals throughout the day, Via Rail passengers can catch a 7-minute Transitway ride from the Ottawa station to downtown.

Voyageur Colonial, the major inter-city bus line serving the City, provides regular service to and from Montreal, Kingston, and other points in Ontario and Quebec via the Transitway's St. Laurent, Hurdman, Lincoln Fields and Kanata Town Centre stations.

Transit ridership continues to grow. In 1999, OC Transpo's ridership was up 6.1 percent above 1998 — more than double the commission's year-over-year target. During the first quarter of 2000, ridership was up an additional 4.8 percent over the same period the previous year.

Each bus replaces about 40 cars on the road. Every passenger who opts for the bus over the car saves two tons in carbon dioxide emissions per year.

Development Benefits

The Transitway has resulted in more than one billion Canadian dollars in new construction around Transitway stations — more than double what has been spent on Transitway construction.^{xvii}

In keeping with the Official Plan, large-scale shopping centers have clustered near Transitway stops.

Concurrent with the opening of the St. Laurent station in 1987, the St. Laurent Shopping Centre completed a major expansion, which included 80 additional retail outlets.

Since Blair station opened in 1989, six new office buildings, a community shopping center, and a large cinema complex have been constructed near the site.

Shortly after the Riverside station was completed in 1991, the Riverside Hospital built a major expansion directly over the station. A new medical office building has also been connected to the station via a pedestrian walkway.

A study by the regional planning department found that between 1988 and 1996, 3,211 residential units were constructed near Transitway stations. The gross floor area of nearby

institutional and commercial buildings increased by 436,858 square meters. The construction value of these developments, over \$600 million.^{xviii}

ISSUES AND IMPLICATIONS

Probably the single most important issue faced by OC Transpo today concerns funding for both vehicle replacement and system expansion. During development and implementation of the Region's Transitway, OC Transpo received substantial operating and capital subsidies from the Province of Ontario. Subsequent to 1998, that source of operating and capital subsidies has disappeared, leaving the transit operator with only two sources of revenue, namely, user fares and municipal property taxes. The need to find approximately 42 percent of operating costs and 100 percent of funding for capital expansion from the property tax alone does not bode well for much needed vehicle replacements, let alone future expansion.

Given the growth of the system and the average age of the varied vehicle fleet, uncertainty as to the availability of funds for replacement buses and additional buses to accommodate growth in demand is clearly a major issue of concern for the transit department. This problem is exacerbated by the relatively recent withdrawal of all provincial financial subsidies for vehicle acquisition.

Another issue pertains to possible conversion of the Transitway to some form of rail transit technology, a possibility that is already recognized in certain design features of the existing busway. The likelihood of *conversion* to rail (as opposed to the *addition* of new rail-based elements of the network) appears remote, inasmuch as the capacity of the busways themselves seems appropriate to demand levels in the various corridors.

A related issue concerns the prospect of some form of grade separation that might eventually be required within the central area of the City as frequency of service increases. Within the central area, existing dedicated lanes now accommodate about 180 to 190 buses per hour each way and could probably handle an additional 10 to 20 buses per hour. Beyond that point, additional transit priority measures such as enhanced signal pre-emption and an increase in the number of lanes dedicated to buses may be required. However, the capacity provided by 200 buses per hour may be more than adequate for anticipated demand levels, particularly if more articulated buses are used. Higher-frequency feeder buses replace some of the less frequent express and limited stop routes; and more employment growth occurs in the emerging town centers beyond the central area. In any case, the current funding environment likely precludes serious consideration of grade separation of transit services within the City center.

Finally, there is an issue of technological choice with respect to expansion of the system. The experimental LRT service that opened in October 2001 will shed some light on the relative advantages and disadvantages of rail transit and busway technologies from the standpoint of costs, frequency of service, and the need for transfers.

ASSESSMENT OF THE CASE STUDY

The present OC Transpo application of bus rapid transit, namely, the 60-km Transitway system is viewed by many as one of the most comprehensive bus-based rapid transit systems in North America. It has proven successful in terms of passengers served, operating speeds, low capital

and operating costs and development impacts. In these respects, the Transitway compares favorably with many rail transit systems.

Results

The system serves 200,000 passengers per day at speeds averaging 45 to 60 kph, including stops along the Transitway and reserved freeway lanes. Even with the limitations presented by surface operation in mixed (though segregated) traffic within the central city, the system now carries between 9,000 and 10,000 peak-hour passengers per direction on approximately 180 to 190 buses per hour.

Through an innovative approach to staging the development of the system “from the outside in,” evolution of BRT has influenced the growth of the Region in a transit orientation more than in metropolitan areas elsewhere in North America.^{xix} New development related to the Transitway has approximated \$1 billion. The Transitway carries 10 times as many person kilometers of travel per kilometer of routes as the regional road system and outperforms many recently built light rail systems in terms of passengers carried per route kilometer of guideway (see [Table 8](#)).^{xx}

Under current conditions, peak volumes of up to 10,000 passengers per hour are handled on the approaches to downtown Ottawa with average operating speeds, including stops, of 50 kph. Actual and potential capacity has been estimated to be substantially higher.

The “outside-in” approach to building the Transitway has meant that in the central city, operations are still accommodated on city streets, which, because of exclusive bus lanes, provide capacities of 10,000 passengers and up to 200 buses per hour in each direction.

These exclusive lanes are usually one lane beyond the curb lane; thus, they avoid conflicts with illegally parked vehicles while allowing legal loading and parking to be provided in some places. These lanes also permit large shelters and ample passenger waiting areas to be provided at the bus stops.

Operating speeds and higher load factors on the Transitway itself lead to average cost per passenger boarding of approximately \$0.77, roughly half of the system-wide average of \$1.55.

The fact that more than 70 percent of OC Transpo riders hold passes, combined with the proof-of-payment system, saves considerable time at stations.

The Transitway system has doubled in length since its start in 1983. The general program of implementation allowed the system to expand to 31 km by 1996 and 60 km by 2001.

With high-frequency, reliable, convenient service as well as convenient transfers, bus rapid transit certainly appears as cost-effective in attracting ridership as rail-based systems for the demand levels and patterns of a city of the size of Ottawa.

Lessons Learned

Lessons learned from the Ottawa experience with bus rapid transit can be summarized as follows:

1. Bus rapid transit is capable of providing a level of service and capacity that is suitable for the City of Ottawa under more difficult weather conditions than are found in comparable or larger-sized cities throughout North America.
2. Ottawa's planning and implementation approach of providing broader coverage through its 'outside-in' priorities has proven more cost-effective in attracting ridership and influencing travel choices than the traditional concentration on shorter, more costly inner city sections typically adopted in many other North American cities.
3. Integration with feeder services at well designed transfer stations facilitates transfers and, in some cases, eliminates the need for transfers from local feeder services to line haul rapid transit by allowing for joint operation of rapid and local services on some sections of the same busway.
4. Ottawa's decision to implement the less capital intensive busway technology, even though shared funding programs and centrally (in this case provincially) developed policies provided inducements for rail, and, in some cases, technologically more 'sophisticated' alternatives, demonstrates that it is possible to make decisions at the local level based on *locally determined* priorities rather than priorities *dictated* by external funding mechanisms.
5. The rate at which rapid transit service can be expanded (about 3 km per year) is generally higher than rates associated with rail systems.
6. The Ottawa experience demonstrates that the "image" of rail-based systems being more acceptable to the community than bus-based rapid transit need not be the case for well-planned and well-designed systems that accommodate a range of needs including those of the disabled, seniors, and cyclists. The Ottawa experience also shows that the image of bus rapid transit can be enhanced by more effective fare collection methods, as well as station design features and marketing approaches that simplify use of the system and provide it with a clear identity.
7. About half of the Transitway system is composed of bus-only roads; the remainder is mainly located on reserved lanes. This reinforces the concept that effective rapid transit can be achieved with a limited number of bus-only facilities.
8. Complementary land-development and parking policies, consistent with the Official Plan, have reinforced ridership and contributed to a transit-sensitive environment.

Applicability

The Transitway concept for BRT has wide applicability whenever suitable rights-of-way can be obtained. In many communities, it would be applicable as a cost-effective alternative to LRT.

ACKNOWLEDGEMENTS

Helen Gault and Colin Leach of OC Transpo furnished valuable information and insights.

REFERENCES AND NOTES

Note: All costs in Canadian Dollars

ⁱ The National Capital Commission (NCC) is a Crown corporation whose mandate is to plan and assist in the development, conservation, and improvement of the National Capital Region in keeping with its significance as the seat of the Government of Canada.

ⁱⁱ Bonsall, J.A. “Transitways — The Ottawa Experience” in Proceedings: Second National Conference on High-Occupancy Vehicle Lanes and Transitways, Houston, Texas, October 1987, pp. 25-28. (ed. Lancaster A. and Lomax T.)

ⁱⁱⁱ Prior to 1959, some streetcar services were also provided by the Ottawa Electric Railway, a situation similar to many other Canadian cities.

^{iv} Cervero, R. “The Transit Metropolis — A Global Enquiry” Island Press, Washington DC, 1998, p. 43.

^v The Ottawa-Carleton Transitway, OC Transpo Submission to APTA 2000 Awards Program.

^{vi} Beauchemin-Beaton-Lapointe, M.M. Dillon, DeLeuw Cather Canada, and the IBI Group, *Rapid Transit for Ottawa-Carleton*, Ottawa: The Regional Municipality of Ottawa-Carleton, 1976.

^{vii} Helen Gault, *Bus Rapid Transit in Canada: Ottawa-Carleton's Transitway System*, paper presented at the Nottingham Transport Conference, 1996, p. 3.

^{viii} Source: OC Transpo. For a detailed discussion of the cost comparisons see Kain, S., Giffell, R., Danieri, A., Daniel, S., Somerville, T., and Li'v Zhi “Increasing the productivity of the Nation's Urban Transportation Infrastructure — Measures to Increase Transit and Carpooling,” Final Report, January 1992.

^{ix} *Transitway Design Manual*, Ottawa: Regional Municipality of Ottawa-Carleton, Transportation Department, October, 1993.

^x Dillon Consulting, Transportation Master Plan, Rapid Transit, Working Paper, Ottawa: Regional Municipality of Ottawa-Carleton, January 1997.

^{xi} It is interesting that although, in principle, provincial funding was made available for municipally approved transit services, there were several cases elsewhere in Ontario of investment priorities that were directly or indirectly influenced by provincial policies, based on the well-known adage that “he who pays the piper....” Pre-1998, however, RMOC resisted the temptation to implement more capital intensive rapid transit (such as the ill-fated, provincially inspired magnetic levitation system) in favor of local assessments of cost-effectiveness.

^{xii} Gault, op.cit., pp. 4, 7.

^{xiii} Bonsall, J.A “Transitways — The Ottawa Experience” in Proceedings: Second National Conference on High-Occupancy Vehicle Lanes and Transitways, Houston, Texas, October 1987, p. 68. (ed. Lancaster A. and Lomax T.)

^{xiv} The changing environment for municipal structure and finance within the province of Ontario, currently an extremely contentious issue in many parts of the province, is well beyond the scope of the present case study, and, in any event, is not easily explained. Fans (generally those favoring reduced provincial taxation) of the emerging

structure view it as a move towards efficiency, whereas foes view it as an abdication of provincial responsibility with regard to the issues and needs faced by most Ontario cities.

^{xv} The Ottawa-Carleton Transitway, OC Transpo Submission to APTA 2000 Awards Program, p. 10.

^{xvi} The Ottawa-Carleton Transitway, OC Transpo Submission to APTA 2000 Awards Program.

^{xvii} Adapted from Bonsail, S.A. "Transitways — The Ottawa Experience" in Proceedings: Second National Conference on High-Occupancy Vehicle Lanes and Transitways, Houston, Texas, October 1987, p. 68. (ed. Lancaster A. and Lomax T.). In 1987, the figure was almost \$1 billion.

^{xviii} The Ottawa-Carleton Transitway, OC Transpo Submission to APTA 2000 Awards Program, p. 8.

^{xix} It does not hurt, of course, that in the nation's capital, the federal government is the major employer, offices are highly centralized within the Ottawa-Hull core, and that parking policies have changed to eliminate free parking for most public servants.

^{xx} Gault, op. cit., p. 3 and David R. Martinelli, "A Systematic Review of Busways", Journal of Transportation Engineering, May/June 1996.

Table 1: Canadian Cities with Dedicated (Capital Intensive) Transit Facilities

City	Busways	Light Rail Transit	Rapid Transit	Commuter Railway
Calgary		O		
Edmonton		O		
Greater Toronto		O	O	O
Greater Vancouver	O^{**}		O	O
Montreal		O^{**}	O	O
Ottawa- Carleton	O	O^{**}		

* Metro (Montreal, Subway (Toronto), and Skytrain (Toronto and Vancouver))

** Planned or under construction

Table 2: 1999 Data for OC Transpo

Item	Units	No.	Notes
Urbanized Area	km ²	368	
Service Population	Population/km ²	673,000	
Density	Population/km ²	1,829	
System Ridership			
Annual Trips		74,700,000	
Annual Psgr-Km		648,600,000	
Average Daily Trips		282,000	
Transitway			
Average Daily Trips		200,000	
Pagrs/Hour/Direction		9,000	Through the CBD
Buses/Hour/Direction		190	Through the CBD
System Characteristics			
Total Route Length	km	5,325	
Average Trip Length	km	10	
Number of Buses		850	
Number of Routes		207	
Average Km/Bus		60,000	
Transitway Routes		2	
System Finance			
Revenues	\$	85,505,000	
Operating Costs	\$	148,380,000	
Operating Ratio	Percent	57.6	

Source: UC Transpo

Table 3: Overview of Ottawa Transitway System

<u>Technical Facts</u>	
Length	
Exclusive right-of-way	260 km
Priority Lanes	161 km
Mixed Traffic	<u>181 km</u>
Total	602 km
Stations	
Number of Stations	28 stations
Platforms	6 m wide x 55 m long
Roadway Width	
Mainline	13 m (2-lane, 8 m roadway with 2.5 m shoulders)
Stations	17 m (2 platform service lanes, and 2 passing lanes)
Park and Ride Spaces	2,140 parking spaces (4 park-and-ride lots)
<u>Operational Facts</u>	
Ridership	
Weekday passenger volume	200,000 passengers
Peak hour passenger volume	9,000 – 10,000 passengers
Bus Service	
Number of daily buses	700 buses
Basic Rapid Transit Routes	2 routes (95, 97)
Number of buses/peak hour/direction through CBD	180 AM peak and 180 PM peak

Source: OC Transpo Fact Sheet, 1996

Table 4: Transitway Right-of-Way (km)

Type	Central Section¹	Outlying Sections	Total
Exclusive Busway	25.8	-	25.8
Reserved Freeway Lanes (Shoulder)	-	11.5	11.5
Arterial Bus Lanes	2.0	2.5	4.5
Mixed Traffic	3.3	14.9	18.2
Total	31.1 ²	28.9	60.0

Notes:

¹ Between Baseline/Blair and South Keys

² Commonly cited figure

Source: Colin Leach, OC Transpo, Nov. 9, 2001

Table 5: BRT Segment Lengths

BRT Segment	Length (km)	Length (miles)
Transitway	26	16
Reserved Lanes in CBD	2	1
Reserved Arterial Lanes	3	2
Reserved Freeway Shoulder Lanes / Mixed Traffic	26	16
Mixed Traffic on 2-lane Parkway	3	2
Total	60	37

Table 6: Comparative 1999 Indicators for Selected Canadian Transit Operations

Area	Ridership 1000s	Trips /Capita	R/C (1)	Average Fare \$	Effectiveness (2) \$	Efficiency (3) \$	Utilization (4)
CANADA	1,436,986	78.3	0.62	1.23	2.03	77.12	43.4
<i>By Province</i>							
Alberta	121,410	67.2	0.50	0.95	2.01	69.63	37.0
British Columbia	159,530	52.1	0.50	1.34	2.72	80.40	30.6
Manitoba	39,294	59.5	0.62	1.16	1.92	55.97	31.6
New Brunswick	4,092	19.6	0.52	1.20	2.46	54.72	23.0
Newfoundland	3,334	20.5	0.51	1.16	2.46	68.52	26.8
Nova Scotia	12,193	37.8	0.80	1.46	1.93	47.27	28.9
Ontario	627,666	82.2	0.76	1.49	2.01	75.58	42.5
Quebec	454,479	112.4	0.51	0.92	1.84	87.44	62.3
Saskatchewan	14,855	35.6	0.46	0.80	1.93	53.17	28.8
Territories	133	7.2	0.49	2.01	4.07	58.84	14.5
<i>Population Group</i>							
>400,000	1,218,003	92.0	0.64	1.23	1.97	82.10	47.6
150,001-400,000	142,643	42.0	0.56	1.23	2.31	63.70	33.2
50,000-150,000	61,081	20.4	0.50	1.15	2.49	57.53	24.6
<50,000	15,260	16.6	0.43	1.04	2.48	55.15	22.9
<i>Major City</i>							
Toronto (City)	392,593	164.6	0.84	1.42	1.74	85.74	49.4
Montreal	342,000	192.6	0.53	0.83	1.61	94.22	71.0
Vancouver	127,661	68.6	0.52	1.42	2.80	85.59	32.0
Calgary	70,731	84.0	0.50	0.88	1.86	81.08	49.7
Ottawa	74,721	111.0	0.58	1.10	1.99	72.75	50.3
Edmonton	43,023	66.4	0.50	1.07	2.23	61.65	27.8
Mississauga	23,269	39.5	0.67	1.37	2.13	63.05	31.8
Winnipeg	38,553	62.2	0.63	1.16	1.90	56.18	32.1
Quebec	37,464	75.8	0.47	0.94	2.10	78.67	46.6
Hamilton	18,284	43.5	0.51	1.13	2.27	66.83	30.7

(1) Total Operating Revenue/Total Direct Operating Expenses

(2) Total Direct Operating Expenses/Regular Service Passenger

(3) Total Direct Operating Expenses/Total Vehicle Hours

(4) Regular Service Passengers/Revenue Vehicle Hours

Source: Canadian Urban Transit Association

Table 7: Comparison of Transit Modal Splits Among Neighborhoods and University Campuses by Transitway Location, 1986

	Percent of All Trips¹ in the Urbanized Area² of Ottawa Carleton	
	As a Destination, 6-9 A.M.	As an Origin, 3-6 P.M.
Mixed-Use Neighborhoods		
TUNNEY'S PASTURE*	47	49
Confederation Heights	29	31
Universities		
UNIVERSITY OF OTTAWA*	68	50
ALGONQUIN COLLEGE (WOODROFFE CAMPUS)*	51	44
Carleton University	38	40

* Directly served by a Transitway station. (shown in capital letters)

¹ For all trip purposes. Includes only trips made by mass transit, automobiles, or other motorized vehicles. Walking, bicycling, ice-skating, and other nonmotorized means of travel are excluded.

² Includes OC Transpo's service area within the RMOC and the central part of Hull, Quebec.

Source: Regional Municipality of Ottawa-Carleton, *National Capital Area Origin-Destination Survey* (Ottawa: RMOC, Transportation Department, 1986)

Table 8: Comparison of Selected Busway and LRT Ridership

City	Year Opened	Route Length km	Passengers/ Route km
Exclusive Busways			
Ottawa	1983	31	6,452
Pittsburgh	1977	16	2,658
Light Rail			
Edmonton	1978	10	2,451
Boston	1987	94	2,345
Newark	1935	7	2,029
Calgary	1981	30	1,196
Portland	1986	25	813
San Diego	1981	33	797
Pittsburgh	1981	36	778
Sacramento	1987	29	546
San Jose	1987	33	333
Buffalo	1985	13	224

Source: American Public Transit Association, Transit Fact Books and Canadian Urban Transit Association

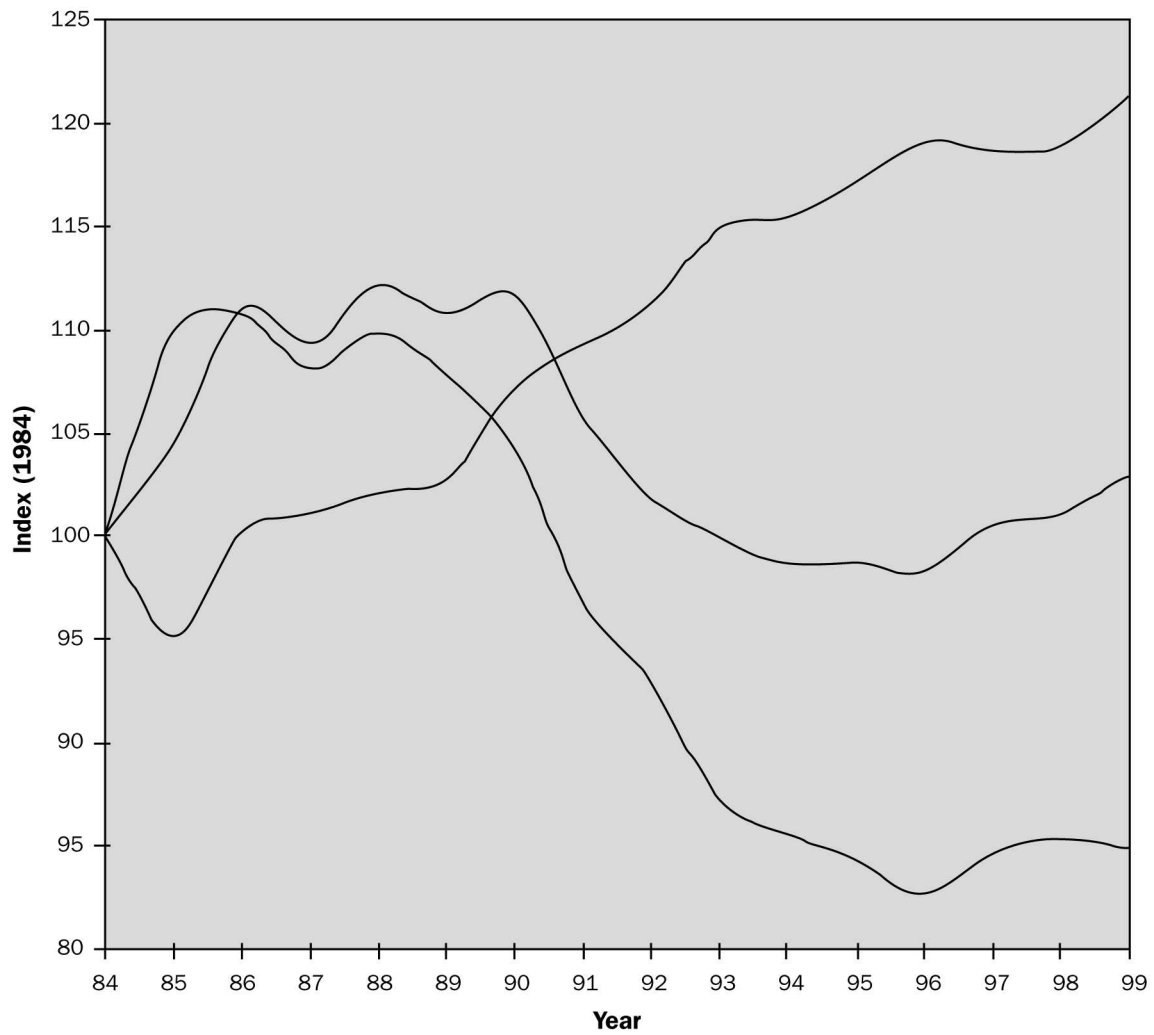
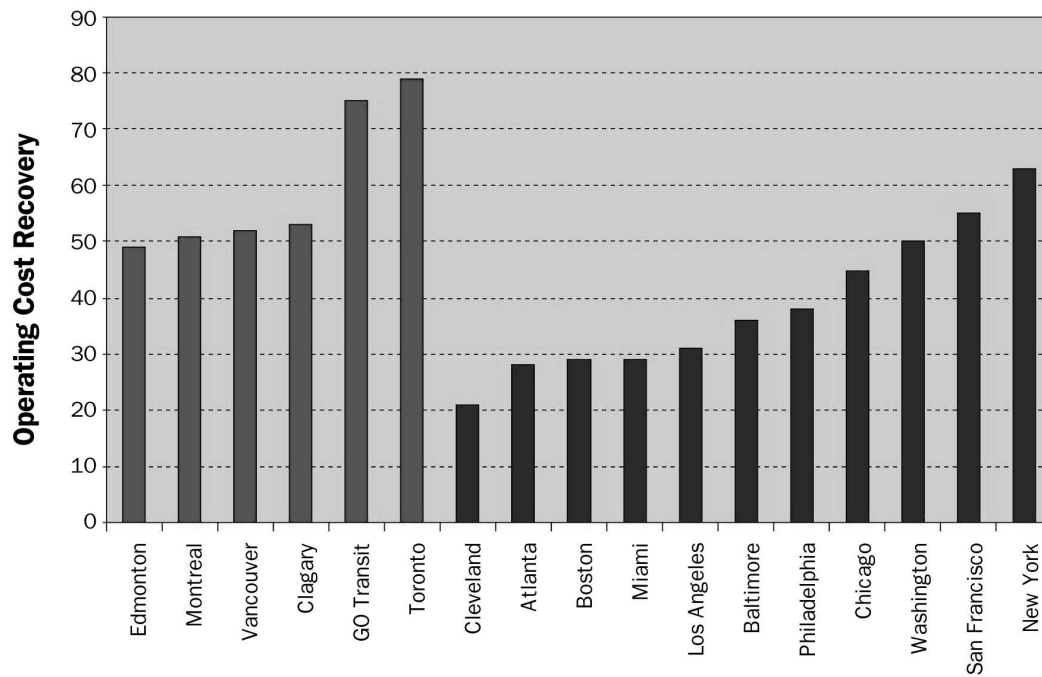


Figure 1: Trends in Canadian Population Growth and Transit Use

Figure 1



(Sources: Canadian Urban Transit Association,
Toronto Transit Commission, and GO Transit)

Figure 2: Comparison of Cost Recoveries Canadian (1999) and U.S. Transit Operators (1998)

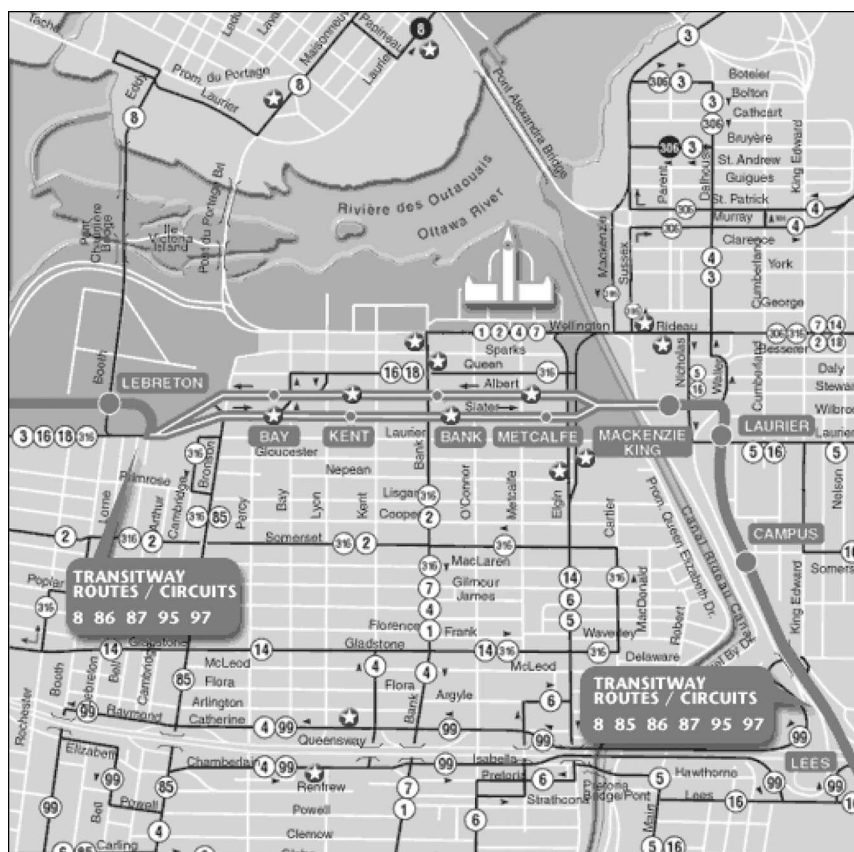


Figure 3: Downtown Ottawa and Hull

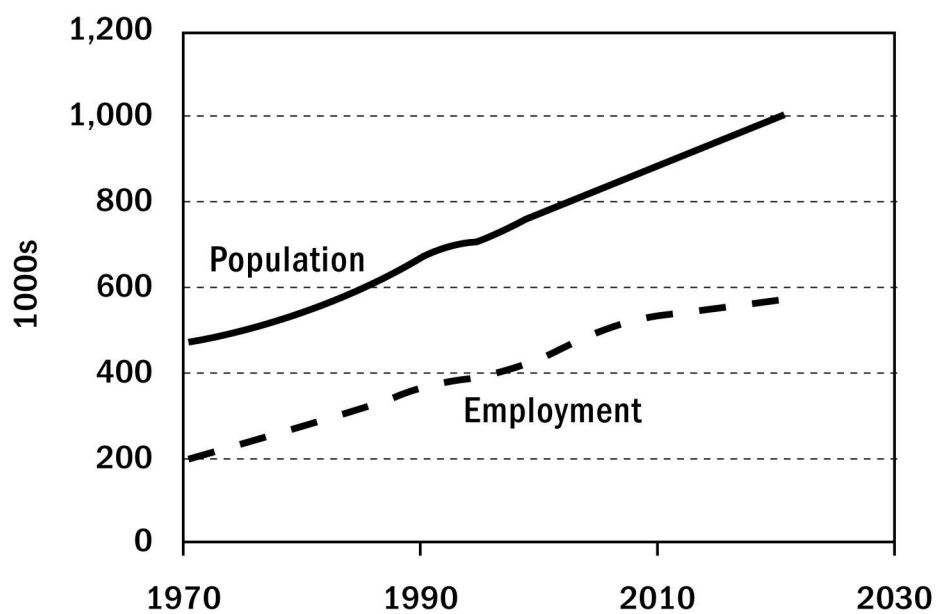


Figure 4: Historical and Projected Growth in Population and Employment

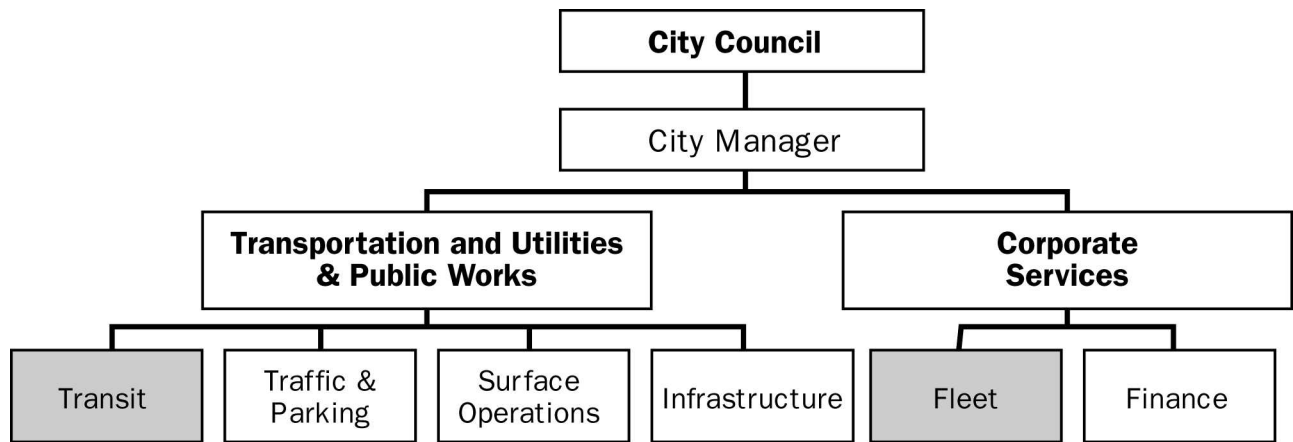


Figure 5: Partial Municipal Organization Chart

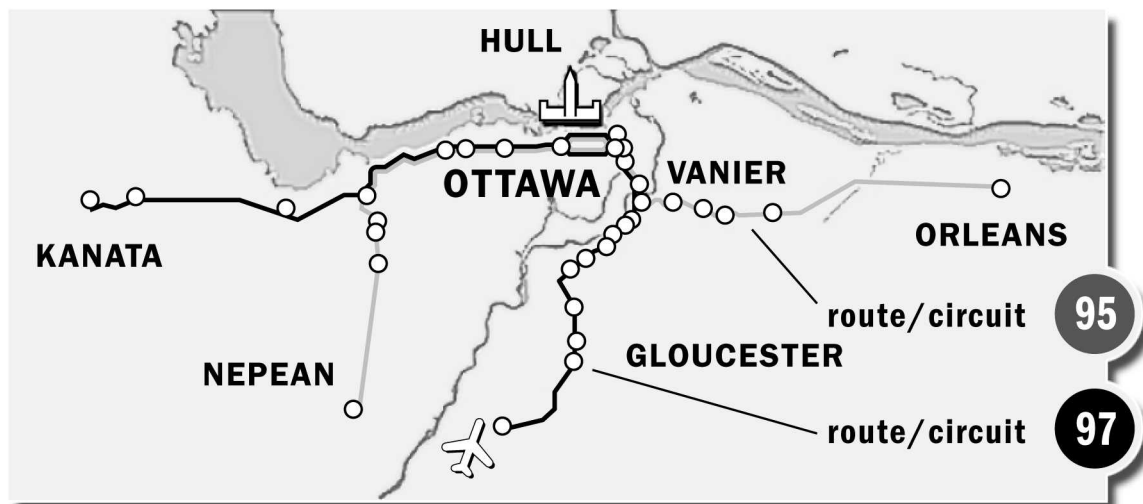


Figure 6: Schematic Diagram of Transitway Routes

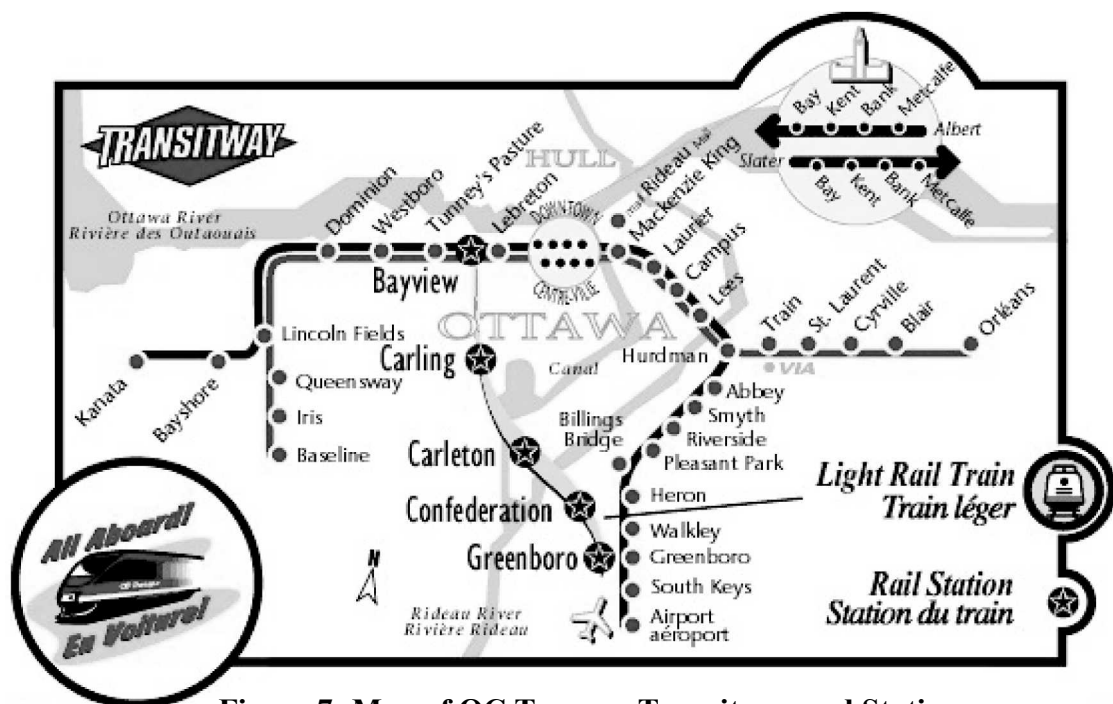


Figure 7: Map of OC Transpo Transitway and Stations



Figure 8: Ramp Approach/Bus on Shoulder Lanes

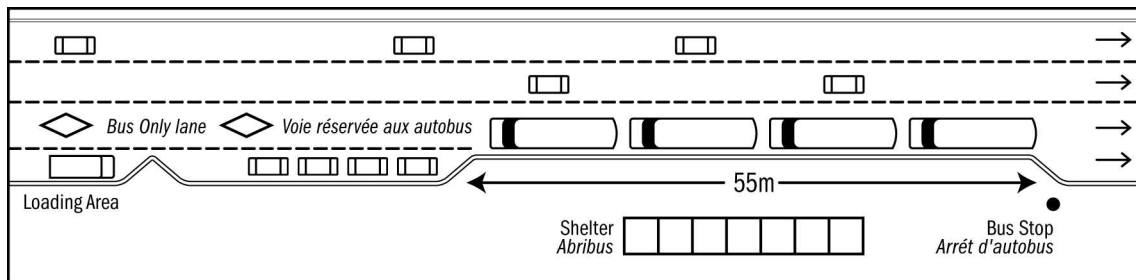


Figure 9: Basic Transitway Cross Section on Downtown Street

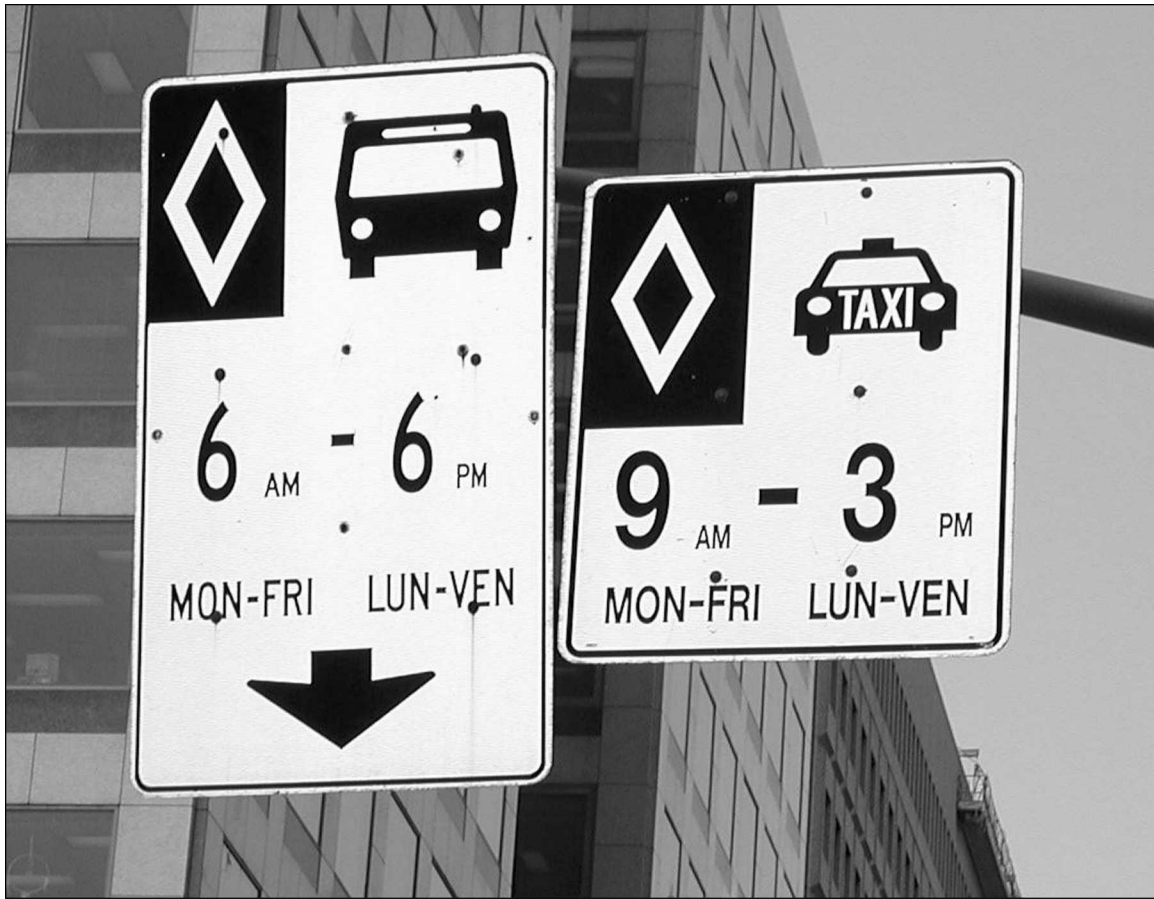


Figure 10: Typical Bus Lane Signage



Figure 11: Multiple Berths on Downtown Street

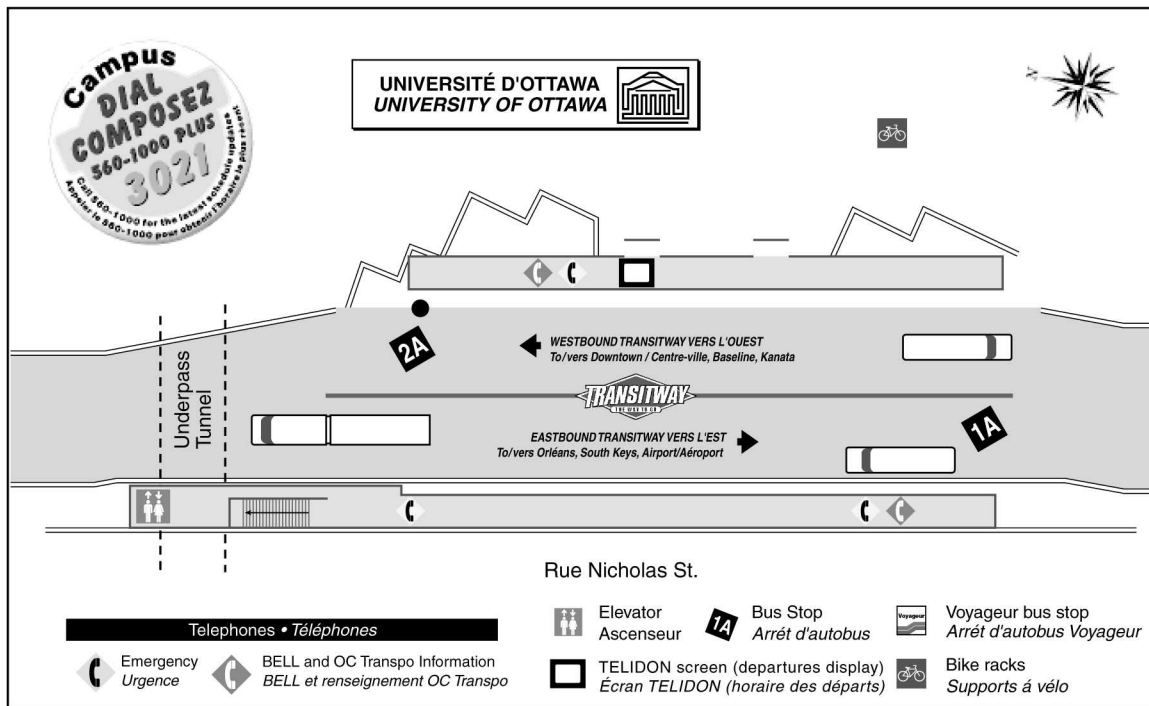


Figure 12: Ottawa University Transitway Station



Figure 13: View of Transitway at Campus Station Looking North



Figure 14: Busway Station Design



Figure 15: Pedestrian Walkway over Transitway

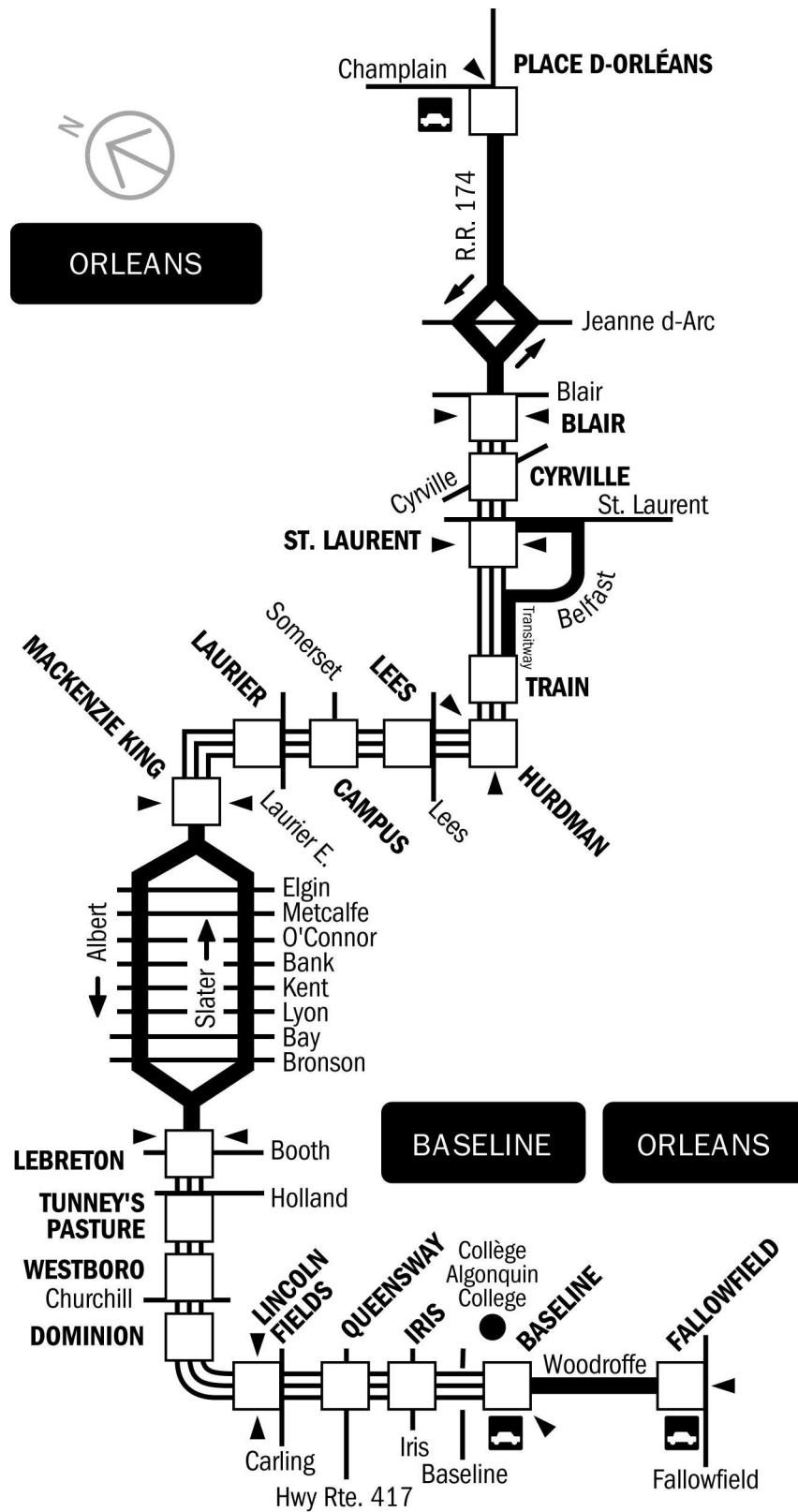


Figure 16: Route 95 Combined Transitway and Reserved Bus Lanes

