

O-Train Light Rail Project

Organization

City of Ottawa — Transportation Utilities and Public Works Department, OC Transpo

Status

Started 2001, extended to 2005

Overview

The O-Train was Ottawa’s first experience with light rail transit. The O-Train travels an 8-km track past five stations, two of which connect to the city’s bus rapid transit system (the “Transitway”), over two bridges and through a tunnel beneath Dow’s Lake. The line serves Carleton University, a major employment centre, and a shopping mall in a densely populated neighbourhood.

The O-Train was initiated to assess the technical feasibility of using an existing rail corridor for rapid transit, to validate expectations about ridership, performance and cost, and to allow proper analysis of possible larger-scale implementation.

Budget:

- Capital costs: \$21 million
- Two-year operating costs: \$8 million

Results:

- Daily ridership: 9,000+
- Car trips removed per day: 3,000+
- Wheelchair and bicycle accessible
- Annual revenues of \$1.6 million, with a revenue/cost ratio of 36% compared to the transit system average of 55%
- 99% on time, compared to 70% for the overall transit system

Contact

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Resources

- OC Transpo — O-Train information (www.octranspo.com/train_menue.htm)

- City of Ottawa — O-Train Evaluation Report

www.ottawa.ca/calendar/ottawa/citycouncil/ttc/2002/12-04/ACS2002-TUP-TRN-0012.htm

Community context

In 2001, 11 rural and urban municipalities—including the Regional Municipality of Ottawa-Carleton—were amalgamated into the new City of Ottawa. The city’s population is projected to increase by 50% by 2021, from 800,000 to 1,200,000.

The city’s 2003 Official Plan and Transportation Master Plan set the objectives and the strategies for long-range planning for the public transit system. These are discussed in more detail in the Policy Context and Rationale sections of this case study.

Overall, the city’s average transit modal share (the percentage of residents who use public transit) is 17% and is projected to be 30% by 2021.

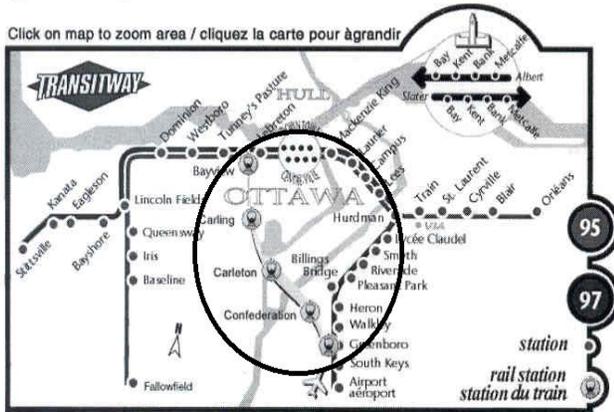
The O-Train travels on an 8-km length of existing freight rail track, and connects to the city’s bus rapid transit system (the “Transitway”) on each end of the line. The existing corridor is owned by Canadian Pacific Railway (CPR). The line serves Carleton University, a major employment centre, and a shopping mall in a densely populated neighbourhood.



The O-Train connects to the Transitway at both ends of the line

The pilot project is unique by North American standards and involves four “firsts.” It is the first time that light rail passenger trains had been mixed with heavy rail traffic on an existing rail network, and the first time passenger rail services had been operated by a single operator. In addition, this was the first time Bombardier Talent DMU trains had been used anywhere in North America, and the first trains driven by bus operators.

System Map / carte des circuits



OC Transpo's system map (the O-Train line is circled)

Policy context

In July 1997, the Regional Municipality of Ottawa-Carleton adopted a new Official Plan and Transportation Master Plan that set a target of 73% growth in transit ridership in the region over the next 25 years.

To meet the needs of anticipated growth, the region set out long-range transit strategy that included, as one element, 40 kilometres of rail-based rapid transit along existing rail lines. This network would support and enhance the city's existing transit operations, which include the 31-kilometre Transitway.

In August 1998 the Region began a year-long study to assess the feasibility of implementing a light rail rapid transit project. The Region studied the existing infrastructure, the types of trains that could be used, an analysis of ridership potential and how light rail could be expanded beyond a pilot project. In September 1999 the Region approved the O-Train pilot project.

In 2003, the new City of Ottawa adopted Ottawa 2020, its new Official Plan. After a two-year community consultation process, Ottawa 2020 resulted in five growth management plans that will guide the city's future. One of these is the Transportation Master Plan, which includes objectives and strategies for an expansion of light rail transit.

Rationale and objectives

The O-Train was initiated to:

- Assess the technical feasibility of using an existing rail corridor for rapid transit
- Validate expectations about ridership, performance and cost
- Allow proper analysis of possible larger-scale implementation

In addition, the city aimed to reach a revenue-to-cost ratio of 27% to 32% with daily ridership of between 5,100 and 6,400 passengers.

The O-Train helps to achieve the following objectives of the 2003 Transportation Master Plan:

- Increasing the overall average modal share for transit from 17% to 30%
- Enhancing the integration of transit with other travel modes, making transit services and facilities more accessible to pedestrians, cyclists, automobile drivers and passengers, and intercity travelers
- Partnering with employers, educational institutions and community groups to implement measures that encourage transit use through education, promotion and incentives
- Expanding the rapid transit system to create new Transitway and light rail networks and to build dozens of new stations and several new Park & Ride lots

Actions — Program planning

Steering committee. The steering committee created to oversee the pilot project included two municipal councillors and members of Transport 2000, a non-profit organization whose primary purpose is research, public education and consumer advocacy. The steering committee reported to council and to the Transportation and Transit Committee on a regular basis.

Negotiating an agreement with CPR. With no prior experience in light rail, the region needed considerable outside expertise to implement the pilot project. Municipal officials negotiated a lump sum build/design contract with CPR, which gave them access to CPR's knowledge and experience and enabled the region to control the project costs and implement the service quickly.

Partner expertise. There were no examples in North America of a single operator passenger train, so municipal officials relied on the expertise of its partners to design and implement the O-Train. More than a dozen partners lent their experience and knowledge to the project. Some of them include:

- *CPR*, as owner of the corridor, engaged Morrison Hershfield (an engineering and management firm) to manage the project. This included design and construction administration, upgrading the lines and maintenance facilities, and building the rail stations.
- *Bombardier* provided and maintains the trains and, with AR Concepts, developed and installed the signaling system.
- *Transport Canada* worked with the city to develop an operating plan that met federal legislation requirements under the *Rail Safety Act*. The plan includes operating rules, emergency procedures, employee training programs, and a Safety Management System.



The Carling Avenue station under construction.



The trains arrive at the Montreal harbour from Germany

Engaging the community. A Light Rail Pilot Project Sounding Board was created and consisted of representatives from community associations and schools near the line, special interest groups, and major employment centres. Other businesses and institutions that would be affected by the project were also consulted. The Board sought input from these stakeholders on issues of customer security, noise, and accessibility.

Municipal staff also worked with the Women's Initiative for a Safe Environment (WISE) and Ottawa Police Services on the design of the security system (extensive high-quality lighting, emergency call boxes and closed-circuit television surveillance). The OC Transpo security group also established partnerships with Carleton University's security department, Ottawa Police Services and the ambulance and fire services.

Environmental Assessment (EA). Environmental assessments were performed under the Province of Ontario's *Environmental Assessment Act*. The EA also met federal requirements through a harmonized process to satisfy the National Capital Commission (which owns part of the property) and Public Works and Government Services Canada.

Two station sites required EA screenings, and two stations required environmental site assessments. A bridge at Sawmill Creek, for example, required a major safety reconstruction. Under stringent environmental guidelines, new foundation requirements temporarily re-routed the creek into a culvert. On-going monitoring conditions had to meet the approval of the conservation authority, as Sawmill Creek is a sensitive environmental area with fish habitat.

Safety management system (SMS). Federal regulations required that a SMS be developed to ensure the safety of employees, contractors, the public and the environment. Municipal staff worked with Transport Canada, Human Resources Development Canada, CPR, CN, and VIA for their input and to review the SMS.

Operator training. Most railway systems operated in other North American jurisdictions employ locomotive engineers, who have already met all the necessary regulatory standards. The region, however, decided to use its existing staff pool to operate the O-Train. One hundred and twenty-five bus drivers applied for 28 positions, and those chosen successfully completed a six-week training course presented by CANAC, a consulting firm associated with CN Rail. The training was then followed by a mentoring period. When not operating the O-Train, these operators drive buses

Communications strategy. Promotion of the project started a year before the line was operational, beginning with a tracking-laying ceremony at Carleton University. Media and local politicians participated in the ceremony

and promotional literature was distributed to the public. A communication program was developed in early 2001 around selecting the O-Train name. Construction activities were highlighted in the local press, and billboards in support of the project were erected in the summer of 2001. When operations began in October 2001, passengers rode for free for the first two months.

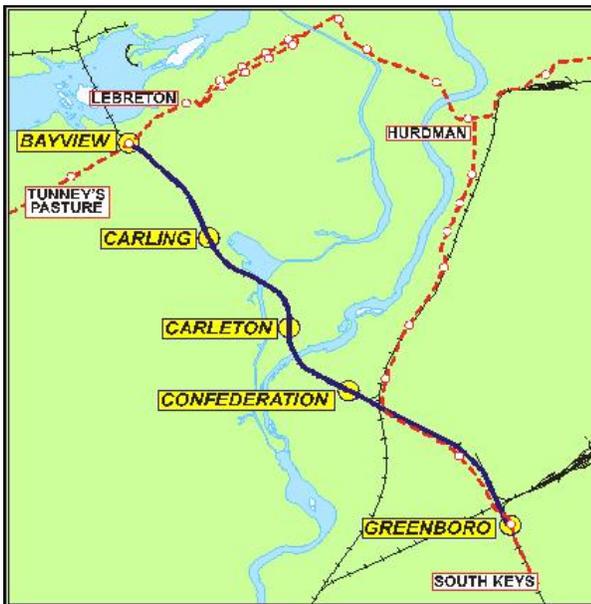
Actions — Program measures

The 8-km line. Prior to the O-Train project, the CPR freight line and its rail yard were seldom used and in poor condition. CPR upgraded the line to accommodate the O-Train, and no other trains use the track except when the O-Train is not operating.

The CPR track crosses two other active rail lines, making the signalling and braking systems (discussed below) important safety elements.

The line also runs through a 600-metre tunnel beneath Dow’s Lake. The tunnel was upgraded to meet engineering standards and to install a water system to provide a source of water for fire fighting in the tunnel. Lighting in the tunnel was improved and a walkway system installed in case of emergencies.

The original jointed track was upgraded but caused problems such as damage to the trains and excessive noise. It also made the ride uncomfortable for passengers. Instead, OC Transpo installed continuous welded rail in the summer of 2003 at a cost of \$2.2 million, adding to the original capital budget for the project.



The O-Train runs from Bayview (north) to Greenboro (south), passing Carleton University, a major employment centre, and a busy shopping mall

Signalling system. The existing Automatic Block Signal (ABS) system was overhauled as it was antiquated and did not function according to the needs of the O-Train line. Signal hardware and wiring were renovated and locations changed to provide efficient signal communication to trains.

Braking system. A German-designed Indusi automatic braking system was installed—the first time such a system had been used in North America. The Indusi system is computerized and consists of track magnets and speed monitoring devices on the trains. If the train is moving too fast, the braking system detects it and initiates the brakes automatically. The Indusi system works with the ABS system so that proper train separation is maintained. Safety is further enhanced through direct operator control.

Bombardier Talent Diesel Multiple Units (DMU). Three Bombardier Talent DMU trains were commissioned. The trains were built in Germany and shipped first to Montreal before arriving in Ottawa in January 2001.

The trains use Clear No. 1 diesel fuel, which contains less sulphur than other grades. The trains comply with exhaust emission requirements of Euro-II contaminant standards (the standards set by the European Union).

Each train weighs 72,000 kg, is 48 metres long, with seating capacity for 137 passengers and standing capacity for 150.

Each train is equipped with two four-stroke diesel engines, water-cooled in-line motors, and a horizontal-shaft design with exhaust gas turbocharger and charge cooler. Top speed is 120 km/hr.



The project enabled Bombardier to test the Talent DMUs in a cold climate



The disabled community enjoys full accessibility on the O-Train

Accessibility. The trains operate in a freight corridor and since freight trains are wider than the Bombardier trains, it was necessary to install flip-down platform extenders to allow wheelchair access. The extenders are lightweight, but strong enough to hold a wheelchair, and are easily flipped back on top of the platform when freight trains use the line.

New train stations. Five new stations were constructed. An additional bus station was built at Bayview (the north end of the line) to enhance connections between the O-Train and buses along the Transitway. To make the transfer between bus and rail easier, the city changed the grade of the ramp from the station to the Transitway and raised the O-Train track by nine feet.

Train maintenance facilities. Extensions to the shop maintenance facility were required to house the trains. Heated, tent-like structures were added to the existing building at the facility.



A prefabricated structure at the Walkley Road maintenance facility houses the trains

Results

Daily ridership after a year in operation averaged 6,200 passengers and surveys indicated that approximately 1,500 of these passengers would have previously used other modes of transit or not have made the trip. Ridership is expected to double by 2021. In the fall of 2004, ridership reached 9,500 daily trips.

Revenues and costs. Annual revenues are approximately \$1 million and the project achieved a 24.5% revenue/cost ratio—just under the target and low compared to the transit system average of 55%. However, by the fall of 2004, annual revenues had reached \$1.6 million and the revenue/cost ratio reached 36%.

On-time performance. The O-Train is on time 99% of the time, compared to 70% for the overall transit system.

Cost per mile of track. Using statistics from the United States, OC Transpo estimated the average cost to implement light rail infrastructure at between \$15 million and \$30 million per mile. For example, New Jersey is implementing a 34-mile rail line using similar Bombardier trains, at a cost of \$17.7 million (U.S.) per mile. By using an existing track, the O-Train's infrastructure cost approximately \$2.8 million (U.S.) per mile.

Vehicle efficiency. Fuel consumption for each train is 1.32 litres per kilometre. The O-Train uses 40% less fuel than when compared to the average amount of fuel per kilometre used for a transit bus.



The O-Train uses low-sulphur diesel and is more fuel-efficient than buses

Modal shift. The O-Train provides north-south connections parallel to a congested corridor (Bronson Avenue). The O-Train removes about 600 peak period vehicles from this corridor each day. Accessibility to Carleton University, which has a population of approximately 25,000, has also been greatly improved. Of the 6,200 daily trips made on the O-Train, one third of them are by Carleton University students and staff.

Potential avoided costs. If the O-Train were to be removed completely, the city would need to buy additional buses to service the same routes and accommodate the 6,000+ daily passengers. In its final report to city council, OC Transpo estimated that if the O-Train were removed, the cost to purchase additional buses would take up most of the resources for growth planned in the 2003 budget. Approximately 15 articulated buses would be required to replace the O-Train at a cost of \$715,000 each.

Recognition. The O-Train has won several awards:

- Canadian Urban Transit Association’s Corporate Innovation Award (June 2002)
- American Public Works Association’s Project of the Year Award (January 2003)
- FCM-CH2M Hill Sustainable Community Award, in the sustainable transportation category (May 2003)

Participants

City of Ottawa

Transport Canada

Human Resources Development Canada

Canadian Pacific Railway

Canadian National Railway

VIA Rail

Carleton University

Public Works and Government Services Canada

National Capital Commission

Ottawa Police Services

Women’s Initiative for a Safe Environment

Transport 2000

Canadian Transport Agency

Local citizens and advocacy groups

Resources

The municipal government funded the entire project. The total budget for the project was \$29 million. Capital costs were \$21 million to cover purchasing of the trains, upgrading signalling and the track lines, installing the braking system, constructing new stations and a maintenance facility, etc. Operating costs totaled \$8 million (\$4 million per year of the pilot project) to cover salaries, training, fuel, marketing, etc.

The city’s Transportation and Public Works department—formerly the region’s Infrastructure and Transit Services departments—took the lead on the project.

It is difficult to estimate the number of people involved in this type of project. However, the long list of partners (above) gives an indication of the breadth of expertise and human resources required.



Mayor Bob Chiarelli cuts the ribbon at the opening ceremony, October 2001

OC Transpo cites Ottawa Mayor Bob Chiarelli (who was the chair of the Regional Municipality of Ottawa-Carleton at the time that this project was approved) and the municipal council, as the pilot project’s main champions.

Several councillors also visited various European countries and saw, firsthand, how municipalities there had benefited from light rail projects. These councillors recognized that in order to halt urban sprawl, reduce traffic congestion, and avoid gridlock, a new vision for transit was needed.

The input of community and non-profit groups cannot be understated. Transport 2000 was a critical partner on both the steering committee and sounding board. Municipal staff worked with several community groups every step of the way to resolve any issues that would affect local neighbourhoods.

Timeline

August 1998. Council of the former regional government directed staff to proceed with the development and implementation of a pilot project for light rail. A year-long study of light rail including an environmental assessment was conducted.

September 1999. City council approved the light rail pilot project and an agreement was negotiated with Canadian Pacific Railway (CPR)

2000. Light rail project (Capital Railway) incorporated as a federal railway

2000-2001. Lines and signalling system upgraded and installed plus new stations constructed

January 2001. City took delivery of the trains

April 2001. City began using the CPR lines for testing and training

October 15, 2001. O-Train began operational service

Challenges

Functionality v. architectural features. The funds available to upgrade the existing infrastructure and build the new stations were quite limited for a project of this magnitude. Because of the limited budget, architectural or aesthetic decisions—the designs of the train stations for example—had to be secondary to the functionality of the O-Train.

The Bombardier trains were better suited for long distance commuter service. Although the trains were a good choice for this pilot project, as the city proceeds with a more in-depth Ottawa Rapid Transit Expansion Plan Study, alternative vehicles and propulsion systems will be studied. Several requirements including turning radius for inner city use, platform height, train acceleration and vibration would be problematic for downtown service. The new trains being studied are lighter and can be mixed with downtown traffic.

Using bus operators promoted better labour relations. The city trained its own bus drivers to operate the O-Train, maximizing the use of its human resources and providing a pool of back up operators. This promoted better labour relations, as union representatives were initially concerned that the project would threaten their members' livelihoods.

Lessons learned

Senior management and political support is critical. The former regional government approved the pilot project and this support was carried over into the council elected after amalgamation. Then Regional Chair and subsequently Mayor of the City of Ottawa, Bob Chiarelli, was singled out for his leadership, vision and support of the project.

Using the expertise of others. With no other examples in North America to learn from, the region needed considerable external expertise on the design and process of the O-Train. The knowledge and experience of the project's many partners enabled the city to implement the O-Train service quickly—only two years from the beginning of the project to final implementation.

Personal contact with key partners increased co-operation. Municipal staff met face-to-face with project partners and toured the track with them. The personal approach helped the city's partners to understand the project better and reduced the bureaucracy that is often inherent in large capital projects. In addition, the city hired a project manager from the rail industry to facilitate these partnerships and a rail superintendent who handled operational issues and dealt with CPR, CN and Transport Canada.

Public perception and support was important. Municipal staff kept a running dialogue with the public

throughout the process—using community consultation meetings, advertisements and promotions, an open house, and sessions held during the Ottawa 20/20 process. Several community groups and advocacy associations provided support for the project from the beginning.

Next steps

As part of the work to develop the 2003 Official Plan, the city undertook the Ottawa Rapid Transit Expansion Plan Study (ORTEP). The study made use of the results of this pilot project and recommended, as a top priority item of the ORTEP, extending O-Train service to many other parts of the city.

Environmental assessments are now proceeding for a light rail line from the city's downtown (Rideau Centre shopping area) to the south end (Riverside), and an east-west light rail transit corridor (Carling Avenue).

The study also recommends that the city explore public-private partnerships to implement rapid transit in other areas of the city, and continue negotiations with CPR for the acquisition of a second rail corridor.

O-Train Light Rail Project

Status

The O-Train began operating in October 2001 as a pilot project, which was then extended to 2005. The O-Train has now become an important part of OC Transpo's public transit service.

Overview

The O-Train was Ottawa's first experience with light rail transit. The O-Train travels an 8-km track past five stations, two of which connect to the city's bus rapid transit system (the "Transitway"), over two bridges and through a tunnel beneath Dow's Lake. The line serves Carleton University, a major employment centre, a high school and a shopping mall in a densely populated neighbourhood.

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Service update

Since this case study was first published in 2005, OC Transpo continues to operate this high-quality light rail service with no major service or route changes. Reliability of service (e.g., on-time performance) has held steady at approximately 99%.

Results

Ridership

The initial ridership target for the O-Train pilot project was between 5,100 and 6,400 trips per day. From October 2001 to July 2003 the service ran every 20 minutes because of track speed restrictions. During that period, maximum ridership on weekdays was about 6,000



but after installing a continuous welded rail, and moving to a 15-minute trip time in 2003, ridership increased to over 8,000 trips per day and has continued to grow since then.

Ridership Results			
2004	2005	2066	2007
8,300	8,800	9,100	9,500

Other results, as of 2007, include:

- Car trips removed during peak periods grew to 900 in 2007 from 600 in 2005.
- Modal share for transit (includes both the Transitway and the O-Train) increased to 18% in 2007 from 17% in 2005.
- Annual revenues doubled from \$1 million in 2002 to \$2 million in 2007. This represents an increased revenue-to-cost ratio of 36% in 2007, compared to 26% in 2002, which surpassed the initial goal of a 32% revenue-to-cost ratio.
- Were the O-Train to be discontinued, it would take at least 16 buses to replace the service at a capital cost of more than \$7 million and an operating cost of \$2.9 million.

Inter-modal support

The O-Train promotes the use of inter-modal transportation by providing bicycle parking facilities at every O-Train station and allowing riders to bring their bicycles onboard the train with them. Most O-Train stations are accessible from nearby bike paths and local streets, which provide the opportunity for cyclists to connect to the bus rapid transit service to the downtown core and across the city.

Technical Results

The O-Train pilot project proved that the use of an existing rail corridor for light rail was feasible.

In 2002, the implementation of remotely controlled interlockings at the two rail crossings located within the

O-Train corridor ensures that the O-Train operates with minimal delays when an O-Train and another railway's train approach the interlocking limits at the same time.

Since the O-Train is a small system, costs are not expected to increase proportionately if the system grows. Track and station maintenance would increase only slightly were the number of trains to double and the costs of providing a round-the-clock maintenance facility

would not grow in proportion to the number of trains. This is mainly due to the fact that, even though the O-Train is a small operation, the overhead required to support it could easily support a much larger operation.

A report to the City of Ottawa in July 2004 noted that, "As the system grows, it will benefit from economies of scale and, based on experience elsewhere, costs per vehicle-hour are expected to fall by close to a factor of two. This will make the cost recovery very attractive in comparison with the bus system."

Customer Satisfaction

Customer satisfaction with the O-Train is high. The average travel time reported by riders in surveys carried out in 2002 was 20 minutes per trip; average travel time is now 15 minutes per trip.

No new ridership or impact surveys have been conducted within the last two years, but a customer survey is planned for 2008.

Policy update

As of January 2008, the City of Ottawa was exploring several new transit options, including an expansion of light rail.

A white paper, *Moving Forward with Rapid Transit*, was published in the fall of 2007 for public discussion and comment. The city is also in the process of updating its Transportation Master Plan (TMP) to identify policies, programs and projects related to the provision and management of transportation services and facilities to 2031.

The city will hold interim public consultations on the TMP and the draft rapid transit network in March 2008 and again in the fall of 2008. The final version of the TMP will go before council in early 2009 as part of its Official Plan review.

Resources

City of Ottawa, <http://www.ottawa.ca>.

- White Paper: *Moving Forward with Rapid Transit*, http://ottawa.ca/residents/public_consult/beyond_2020/papers/white/rapid_transit_en.html.
- *Transportation Master Plan Update*, http://ottawa.ca/residents/public_consult/beyond_2020/tmp/index_en.html.
- *The O-Train: The Straight Facts*, July 2004. <http://www.ottawa.ca/calendar/ottawa/citycouncil/trc/2004/07-21/ACS2004-TUP-TRN-0009.htm>

OC Transpo, <http://www.octranspo.com>.