OTTAWA WELCOMES THE

After delays and increasing political frustration, Ottawa's first electrified light rail line is finally open – marking a new chapter for this Canadian transit pioneer. Vic Simons reports.

Saturday 14 September 2019 saw the introduction of Ottawa's latest light rail service to the public – it was a day that many in the city had waited a long time for.

Although the city's bus-served Transitways have performed a valuable service for over 30 years, planning for a more robust solution for cross-city travel dates back to the early years of the 21st Century. Indeed, a north-south light rail route was designed, and contracts awarded, in 2006. This project would have seen the diesel-operated Trillium light rail service to the south of the city converted to a double-track electrified line that would have reached west from the University of Ottawa to Bayview before heading south to Leitrim and further west to Barrhaven. A change in municipal council had seen this project cancelled in December 2006.

The official opening at 14.00 followed an earlier inauguration by Jim Watson, Mayor of Ottawa, at the new Tunney's Pasture western terminus, attended by around 400 invited guests and a large press contingent. Amongst the speakers at this event was Ontario Minister of Transportation Caroline Mulroney, daughter of former Canadian Premier John Mulroney. Praising the new system, Ms Mulroney said: "Ottawa residents deserve a world-class transportation system that gets both them and the economy moving... Today, that's exactly what they are getting."

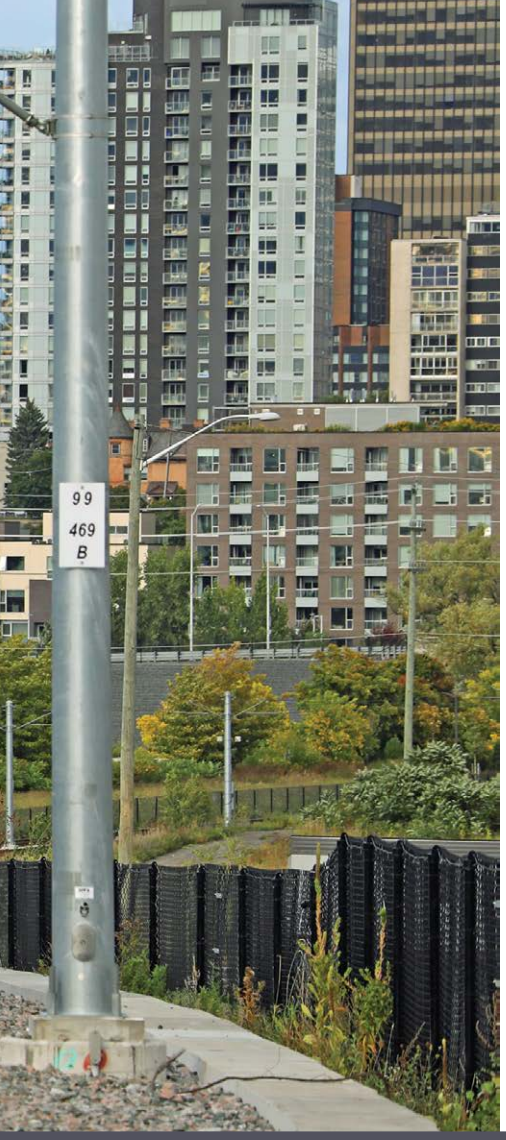
Approvals and delays

Approved by the city in late 2012, the current CAD2.1bn (EUR1.5bn) east-west scheme was originally scheduled to open to coincide with the 150th anniversary of Canada becoming an independent nation in 2017. This is reflected in the choice of the Confederation Line name. Funding was split between the Federal Government (CAD600m/EUR466m), the Province of Ontario (CAD600m), and local funding by the City of Ottawa (CAD930m/EUR722m).

Following formal political approval, in February 2013 the City signed a deal with the Rideau Transit Group (RTG) to design, build, finance and maintain the 12.5km (7.8-mile) light rail line under a 30-year Public-Private Partnership. RTG is a consortium of 15 domestic and international design, construction and engineering partners that includes SNC-Lavalin, EllisDon, Dragados, ACS Infrastructure and Alstom.

Although it became apparent relatively early in the project that the 2017 deadline for passenger operations would be unachievable, by late 2016 enough track and overhead had been completed to allow LRV testing. Coupled to infrastructure delays, the coming winter months saw a number of problems identified with the chosen Alstom rolling stock – a new 'European-style' low-floor platform for the North American market, albeit based on a proven design – in the form of heating and communications systems failures and carbody and brake system issues.

As successive 2018 deadlines came and went, the situation reached a head in the summer of 2019 when frustrations between the City and the consortium building the line saw Mayor Watson formally summon the heads of both the RTG and Alstom to an urgent meeting to give some certainty to the citizens as to a confirmed handover date. Following that meeting operator OCTranspo – a discrete operating division of the City – was given greater oversight of the project, which was subsequently delivered within three months. OCTranspo explained that this critical decision was needed to pull together "all the strands of project management so that all parties were singing from the same hymn sheet".



➤ **FAR LEFT: A view from the Confederation Line's Bayview station on 14 September with the Ottawa skyline in the background.** A. Grahl

➤ **LEFT: Ottawa Mayor Jim Watson and Transport Minister Caroline Mulroney pose with the commemorative plaque at the opening ceremony at Tunney's Pasture.** A. Grahl

Tremblay station allows connections to Ottawa's main VIA Rail station; a new pedestrian bridge also makes Tremblay convenient for the city's baseball stadium. A. Grahl

CONFEDERATION LINE

Speaking to *TAUT* the day after the opening, OCTranspo General Manager John Manconi expanded a little on the contractual difficulties and the estimated costs of the delays. He explained that the City has withheld a total of CAD59m (EUR42.6m) from RTG for late delivery of the infrastructure and vehicles. This includes CAD30m (EUR20.7m) for the mobility element of the contract, CAD28m (EUR19.3m) in "respect of project deficiencies and other contractual matters" and a CAD1m penalty (EUR690 000) for missing the planned Revenue Service Availability (RSA) date of 16 August.

He went on to give an opinion on the structure of the PPP with RTG, saying that he would like to see this refined in future agreements and that risk should only be transferred to the contractor if it is in a position to control that risk.Passing on non-controllable risks leads to massive contingency provisions that may be unnecessary, he said, which inevitably leads to higher bids. He said that such an evolution could be called "P3.5".

▲ **Rideau is one of three underground stations. It is also the deepest, with platforms 26.5m below the city.** A. Grahl

From BRT to LRT

Before proceeding, a little background is perhaps necessary. Ottawa is the Federal Capital of Canada, and whilst located within the Province of Ontario, it lies just across the Ottawa River from the Quebec city of Gatineau and thus forms a cross-boundary conurbation of almost 1.5 million residents known as the National Capital Region.

Founded in 1826 as Bytown, it was renamed to Ottawa in 1855 at the same time as its incorporation as a city. The new name originated from the native Algonquin Indians, indigenous residents of the area. Although not the largest conurbation in Ontario, that honour going to Toronto, the city was designated the nation's capital by Queen Victoria in 1857.

As with many Canadian cities, Ottawa has a climate of extremes, with cold snowy winters and warm humid summers – as an example, 2018 saw temperatures as low as -25°C in January and 35°C in July.

Streetcar service first came to the city in 1891, running for more than 60 years before succumbing to motor bus replacement in May 1959; at its greatest extent there were more than 100 streetcars and a network of lines covering almost 50km (over 30 miles). A small fleet of trolleybuses was also operated in a relatively short-lived trial from 1951 to 1959, before being sold to other cities in Ontario, principally Hamilton and Toronto. ➤

Public transport was privately-operated until 1948 when this function came under the auspices of the Ottawa Transportation Commission (OTC) that had taken over the Ottawa Electric Railway Company. Over the next decade, the OTC absorbed a number of other private operators to become the sole transit provider and as the city expanded, this agency morphed into the Ottawa Carleton Regional Transit Commission – which marketed itself as OC Transpo – in 1972. This was enlarged and became OCTranspo in 2000 (note the difference in style).

Many advocates proposed a return to rail-based solutions, although studies from the 1970s concluded that the region – for the moment at least – had too small a population to justify a light rail or streetcar revival. Thus it was that a 1981 study recommended a series of dedicated busways that would eventually become the city's famed Transitways. Ottawa was one of the first cities to adopt such segregated alignments for buses (and emergency vehicles), with the first opening in 1983. This concept has since become more commonly known as Bus Rapid Transit (BRT) and has been adopted in many locations worldwide.

Many Transitways were grade-separated from other traffic, allowing operating speeds of up to 70km/h (43.5mph) outside the city's core. They have a similar appearance to fixed-rail services, with stations that include seating, timetable information and ticket machines. The current ten-line network extends across the river into Gatineau, and that particular route is also used by Gatineau's STO bus network that provides commuter services into Ottawa. Interestingly, many of the routes are operated by double-deck UK-built tri-axle *Enviro 500* buses similar to those operating in the Toronto area.

Deemed a significant success story, Ottawa is often held up as a model for other cities considering BRT. Mr Manconi noted that Ottawa had the highest per capita transit ridership in North America, higher even than New York City. He also expressed pride in the capital's continued innovation in public transport provision, becoming the first North American city to convert a BRT route to light rail.

The main Transitway through downtown Ottawa used the Albert and Slater east–west one-way system, with dedicated bus lanes but without physical segregation. This sharing of the highway with other road vehicles led to significant delays during peak periods. In addition, this particular busway had reached capacity and was becoming worn out, being used by up to 10 500 passengers/hour in the peak.

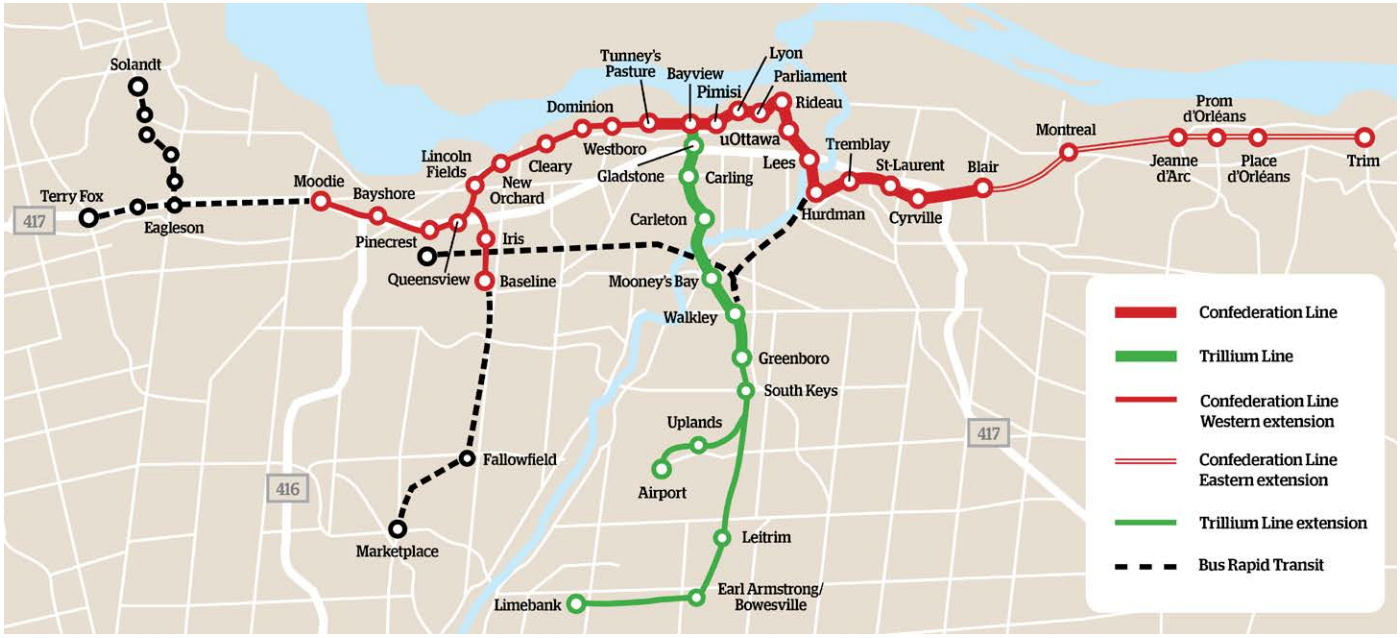
These considerations led to the 2012 approval of a new light rail line to replace the main east–west Central Transitway, taking over much of the dedicated alignment but with the crucial addition of a 2.5km (1.6-mile) underground section beneath the city centre. This serves three key purposes: ensuring high service speeds across the city; catalysing a host of public realm and environmental enhancements; and to mollify the objections of local businesses and residents.

Thanks to the initial 1970s planning that the Transitways would be constructed with future light rail conversion in mind, no grade crossings were built with services using bridges and underpasses instead. At many points the formation is therefore either elevated or in a shallow cutting. As a

◄ LEFT: The head shunt at Blair, with the elevated Transitway in the background where Stage 2 will extend eastwards. V. Simons

▼ BELOW LEFT: Double-deck *Enviro 500* buses that serve Ottawa's Transitways at the city's storage facility. V. Simons

▼ BELOW: The interior of a Confederation Line *Citadis Spirit* just before the public opening on 14 September. V. Simons



▲ *Citadis Spirit* 44 on the production line at the Belfast Assembly and Maintenance Facility on 16 September. V. Simons

▲ ABOVE: Car 1119 leads a two-car train bound for Blair at the westbound platform at Parliament station. The yellow poles denote the coupling points so passengers do not board here. V. Simons

result, the Confederation Line offers a service more akin to light metro than streetcar.

Perhaps unusually, there was a three-week delay after the opening before the bus routes were recast so that now more than 90% of routes connected with the new alignment. Mr Manconi explained that this was to allow a gradual transition for passengers to get used to using the new light rail service. Most LRT stations outside the downtown area have organised bus stations, providing a fare-paid, easy transfer environment. Space constraints around Stage 1 stations mean that none have park-and-ride facilities, although these are planned for stations on the second phase.

Going underground

The western terminus is at Tunney's Pasture, a large development of Federal Government buildings initially constructed in the 1950s and 1960s. This area is undergoing extensive redevelopment under a 25-year plan to house more than double the number of employees, as well as introducing new residential blocks.

From here the route heads east through Bayview (with its connection to the Trillium Line) and Pimisi before going underground. The three city centre stations at Lyon, Parliament and Rideau lie between 16m and 26.5m below the surface of the city. These locations are bright and airy, with both lift and escalator connections to ground level, seating and timetable information that is enhanced by real-time train describers showing the next three services due to arrive.

This western section is built entirely on a converted Transitway, itself a conversion of an earlier Canadian Pacific Railway alignment. Although clearances, stations and bridges were designed for ultimate conversion to LRT as described earlier, light rail construction still necessitated numerous upgrading works.

After coming to the surface on the east side there are seven more stations: uOttawa, Lees, Hurdman, Tremblay, St Laurent, Cyrville and Blair. Tremblay has a convenient connection with Ottawa's VIA Rail long-distance railway station, providing onward services to Toronto, Montreal and across Canada.

There are 13 innovatively-designed stations in total on Stage 1, with each featuring public art installations. End-to-end running time is 24 minutes.

The fleet

A fleet of 34 low-floor vehicles, based upon the *Citadis Dualis* manufactured and operated in France, was ordered in 2013; the contract includes 30 years of maintenance; a subsequent CAD180m (EUR123m) contract includes system maintenance.

The Confederation Line marks an important new reference point for the French manufacturer as its first such Canadian order for low-floor light rail vehicles (the company has supplied *Coradia Lint* diesel units for the Trillium Line and metro cars to Montreal).

Each four-section double-ended vehicle is 48.5m long, 2.65m wide and 3.6m high, with 120 seats, provision for wheelchairs and space for around 180 standees. Boarding is through seven doors on each side. Usually running in coupled pairs, they provide level boarding at all doors with platform heights of 356mm. The peak requirement is 26 vehicles operating at an average speed of 35km/h (25mph) although they were built for a maximum operating speed of 100km/h (62mph).

"Thanks to the initial 1970s planning, the Transitway system outside the city centre was built with future light rail conversion in mind."

Whilst in Ottawa, *TAUT* was given a tour of Alstom's Belfast Assembly and Maintenance Facility. This purpose-built workshop – part of a 16ha (40-acre) site that formerly housed an OCTranspo facility – has been used to assemble Confederation Line LRVs from components designed and produced at Alstom sites in the US (Hornell, NY), France (Saint-Ouen, Valenciennes, Ornans, Le Creusot, Tarbes and Villeurbanne), Italy (Sesto) and Poland (Katowice). Each vehicle also features a minimum 25% Canadian content and as many as 60 domestic suppliers have contributed.

The depot and workshop at Belfast Yard are reached by a short southbound single-track cut-off west of St-Laurent station connecting to the main running route in both directions.

Alstom Project Managers Pat O'Rourke, Hugo Deligne, and Alexandre L'Homme accepted the key project management lessons suggested by Mr Manconi in that greater co-ordination was needed. They agreed that "the City stepped in pull to everyone on the project together," adding that the company is "happy to be the guinea pig as we can see the long-term rewards." Lessons have clearly been learned and manufacturing processes have been refined so that it will now be able to construct three LRVs in parallel, compared to two at a time previously.

Electrification of the system is at 1500V dc, with nine traction power substations located along the route; all substations except one are at surface level. The LRVs draw power via pantograph and their length, weight and enhanced HVAC systems, insulation and double glazing – important for Ottawa's extreme winters – are the reason for the high level of drawdown voltage (600 to 750V dc being more of the norm). Thales has supplied its SelTrac CBTC signalling system for the first stage, recently winning a second contract for the future extensions.

Platforms at all stations have been built to accommodate longer vehicles, achieved through the addition of further centre sections being added as demand dictates.

Normal services are operated seven days a week, with peak headways of three to four minutes, reduced to ten minutes in the evenings. Reflecting the importance of this cross-city corridor, weekends also have a high frequency service of every four to five minutes.

The flexibility of the system and operating arrangements were tested just two days after the opening following an incident at Cyrville station on the eastern section. Two westbound services were required to operate on parallel tracks simultaneously as far as the crossover west of the St Laurent where the LRV running wrong line crossed back over to the westbound track. For a short period, services were terminated at St Laurent, two stops short of the Blair terminus. Impressively, both the train describers and vehicle destination blinds were quickly changed to reflect this temporary short working.

Electricity and diesel power

The Confederation Line is the city's second project to provide a higher-capacity

➤ **Trillium Line *Coradia Lint* C9 has just departed Greenboro for Bayview on 17 September; the tracks to the right leads to the maintenance facility.** V. Simons

alternative to the Transitway. The first was the so-called Trillium Line, originally initiated as a pilot project in 2001 for just CAD21m (approx. EUR15m). The reason for the low cost for this 8km (five-mile) five-station service is that it repurposed existing Canadian Pacific Railway metals, requiring just new station buildings and passing tracks. A simple depot and maintenance facility was added at the midway point at Walkley Yard for the diesel-powered fleet that uses six Alstom trains (these replaced the pilot scheme's Bombardier *Talent* stock in 2015).

The line links to the Confederation Line at Bayview where there is a lift and stairway connection within the fare-paid area. There are further bus connections at most stations, with the southern terminus of Greenboro also linking to the remaining Transitway network. The running time is 16 minutes, with 12-minute headways.

Ottawa uses the same Presto reloadable smartcard as within the Greater Toronto and Hamilton area. This sophisticated card can deal with each of the different operator's fare scales and will deduct the correct fare, regardless of location or operator. Purchased online, subsequent top-ups can be undertaken either online or at any of OCTranspo's retail fare outlets. The base fare as at October 2019 was CAD3.60 (EUR2.60) with discounts for disabled and elderly riders; there is also a discounted ticket known as the EquiPass for low income riders who have registered with the city. One-, three-, five- and seven-day passes are also available, as well as monthly season tickets.

All light rail and busway stations have fare gates in operation, although these are not always manned.

Moving forward

The September 2019 opening is only the beginning of Ottawa's light rail ambitions, clearly demonstrating that this is not just about replacing rubber tyres with steel wheels on steel rails. It is also about 'city-building'. Construction of residential and commercial towers close to the new stations is expected to bring billions of dollars into the city, and future plans include even more development as the city's core expands.

The environmental benefits of reducing both bus (removing over 50% of OCTranspo buses in the downtown core each day) and private car travel have also been closely accounted for. A reduction in greenhouse gas emissions and other airborne contaminants of around 100 000 tonnes in 2031 are projected. Going further, OCTranspo has estimated that the introduction of light rail will reduce the city's road salt usage by 5600 tonnes each year without the bus-operated Central Transitway, improving water and soil conditions for healthier vegetation and wildlife.

"By 2025 a further 44km and 24 new stations will bring 77% of Ottawa's residents within 5km of a rail link."

The new LRT service is certainly impressive and is ticking all the boxes, yet by 2025 a further 44km (27 miles) of track and 24 new stations will build upon the solid foundations set by the Confederation and Trillium lines, bringing 77% of the city's residents within 5km (three miles) of a rail link.

Work on this CAD4.7bn (EUR3.2bn) programme has already begun. Contracts for the design, construction and financing of the eastern and western extensions have been placed with the East-West Connectors consortium, led by Kiewit and Vinci Group with design services provided by WSP Canada and Hatch.

The 15km (9.3-mile) western extension will add nine either new or converted Transitway stations along a route to Moodie, with a two-station southern branch to Baseline; this is projected to remove another 800 buses/day from the roads to the west. It may in the future also realise the light rail connection to Barrhaven that was cancelled in 2006.

At the other end of the line an eastern extension from the current Blair terminus to the current extremity of the Transitway at Trim Road is also underway. Adding five stations, this 12km (7.5-mile) extension is planned for completion in 2024.

Stage 2 includes extending the Trillium Line south from Greenboro to a new terminus west of Limebank Road, as well as a 4km (2.5-mile) partly-elevated western link to Macdonald-Cartier International Airport. This project is to be delivered under a fixed-price CAD663m (EUR454m) contract by the TransitNEXT subsidiary of SNC-Lavalin. It includes two new stations on the existing line – Gladstone and Walkley – and six more on the southern extension – South Keys, Leitrim, Bowesville/Earl Armstrong, Limebank, Uplands and Airport. It is projected for completion by 2022.

At the same time TransitNext will also take over maintenance responsibility for all Trillium Line infrastructure. The City has also procured six new Stadler *FLIRT* diesel-multiple unit vehicles. Tantalisingly, there is also some discussion of the possibility of future electrification to harmonise services with the expanded Confederation Line.

When complete in 2025 this plan will bring the network to a total of 64km (40 miles). A further 38 *Citadis Spirit* vehicles are being built for delivery in 2021 to cater for Stage 2; the first 12 will be assembled in Ottawa, with the balance to be completed at a new plant in Brampton, Ontario, allowing the Belfast yard to focus on day-to-day maintenance of the operational fleet. The Brampton facility is also building 61 LRVs of a similar specification for the Finch West LRT (17 vehicles) and Hurontario LRT (44 vehicles) projects, promoted by Metrolinx. This contract includes an option for up to 44 more vehicles.

Intriguingly, the low-floor design and overhead power collection of the Confederation Line would seemingly allow for easy on-street operation if the need arises. With so much ambition, and a population projected to grow to 1.14m by 2031, a return to street-running is therefore entirely feasible.

As Canada's capital continues to thrive and expand, its comprehensive transit plans prove once more that it is planning soundly for the future. TAUT

› *Grateful thanks are extended to Jessica Turner from the City of Ottawa, John Manconi and Derek Puddicombe from OCTranspo and Pat O'Rourke, Hugo Deligne, and Alexandre L'Homme from Alstom for their time and assistance in compiling this article.*

Confederation Line *Citadis Spirit* 1110 at the rear of an eastbound two-car train having just departed Tremblay station. V. Simons