Delivering mobile connectivity across the Toronto subway

Case Study

October 2019
The proven partner for underground connectivity

BAI Communications in Canada is connecting 200,000 Wi-Fi logins from 100,000 unique users (Toronto underground passengers) on an average weekday, in 75 transit stations. BAI applied its extensive experience and leading expertise of underground communications to roll out reliable, high-performance cellular and free Wi-Fi connectivity.

Key challenges solved:
• Stringent radio frequency (RF) emissions restrictions: BAI applied advanced RF planning, detailed site surveys and independent testing to show its compliance.
• Harsh underground environment: custom enclosures designed by BAI protect sensitive communications electronics against damaging conductive dust.
• Strict constraints of the underground transit system: BAI applied proven and flexible processes to ensure project timetables were met without disrupting passenger journeys.

The network provides Toronto residents more than just access to digital connectivity. There are countless opportunities for BAI to work with the Toronto Transit Commission (TTC) to bring innovation to the city in both the public and private sectors.

“Why is the TTC Wi-Fi better than the Wi-Fi in my apartment???”
Tweet by a Toronto underground user
Keeping Toronto transit riders connected

The TTC, North America’s third largest transport authority, is committed to providing mobile connectivity to commuters. Digitizing Toronto’s transit system is powering innovation and benefiting passengers, businesses and the wider community.

A rigorous TTC selection process led in December 2012, to a partnership with BAI, to deliver connectivity to the Toronto subway as part of a 20-year license agreement, with an option for an additional five years. The deployment uses independent communications infrastructure in which BAI invests in, owns and operates, generating revenue for the TTC. BAI also provides free Wi-Fi access to TTC underground passengers.

Smooth roll out in 75 underground stations

BAI ran a complex planning phase with connectivity initially installed at two ‘prototype’ stations for the TTC to approve ahead of the full network roll-out. The two stations opened to the public in December 2013 and quickly gained TTC approval in February 2014.

Over the next four years, BAI installed the infrastructure to bring Wi-Fi and cellular connectivity to more stations. By September 2017, all TTC stations had Wi-Fi connectivity and in December 2017 BAI was able to announce all 75 stations had cellular coverage on all platforms, and through nine kilometres of tunnel.

Solving multiple complex challenges

The project’s complexity and scale created many challenges, which BAI solved using its global network expertise, including deploying similar projects on the New York and Hong Kong transit systems.

Toronto has stringent RF emissions restrictions, 100 times lower than national guidelines. To ensure the requirements were met, BAI conducted surveys and even assessed cumulative RF that may arise from future deployments. BAI’s network design was independently tested at the two prototype stations to prove their compliance.

The difficult underground environment presented further challenges. Steel-based train brake dust is a hazard, threatening sensitive electronics. BAI has designed its own enclosures that have been proven to provide the required dust ingress protection. These enclosures are also easy and quick to install within the limited time available on site.

The roll-out involved laying fibre optic cables throughout the underground, including the tunnels, installing access points on station platforms and building three data centres to relay cell signals underground to antennas in stations. BAI is currently expanding tunnel service for cellular throughout the TTC.

“"Our internal network is being extended onto the BAI network. Ticket collectors will be moved onto the platform and all are getting tablets that will enable them to help passengers and provide guidance. There are other initiatives too. The benefits are huge.”

Andrew Bakos - PROJECT MANAGER AT TORONTO TRANSIT COMMISSION (TTC)

Extreme flexibility keeps the project moving

The success of the network deployment took meticulous planning and extreme flexibility. The TTC’s top priority is to provide safe and reliable transport services. BAI had to work within the train timetables and around the priorities of other projects, such as work on signalling systems or elevator upgrades.

Being prepared was also vital at all times. Work scheduled to take place at one station could sometimes be postponed for a variety of reasons, and BAI teams had plans in place to move to a different, accessible station to keep the project moving.

BAI also wanted the best network quality. Although the TTC does not specify Wi-Fi availability service levels, BAI achieves four nines uptime, or 99.99%. The network has redundancy built in, with three to four access points and cellular antennas on either side of the platform.
Productivity boosted, safety increased

The cellular and Wi-Fi access are popular and used increasingly. On an average weekday, BAI sees 200,000 Wi-Fi logins from 100,000 unique users (as at May 2019). Growth has been rapid. There were 162,000 monthly sessions on average in 2014, jumping to more than 5 million per month in 2019.

In an independent survey, 81%* of respondents said underground mobile connectivity is the sign of a world-class city. Most also said cellular service in the underground helps them keep in touch with friends and family, improves the underground experience, increases productivity and makes Toronto living more satisfying.

The survey also revealed that people believe connectivity makes the underground safer. To further promote safety, the TTC launched the SafeTTC app in 2017, which is supported by BAI's network and enables users to report harassment and send images silently to the authorities. This also supports the TTC's efforts to reduce unnecessary use of alarms on trains.

The fibre network brings opportunities to offer other connectivity services. BAI provides IP connectivity at TTC stations to PRESTO, the TTC's fare payment card. By using the BAI network, PRESTO met its commitment to implement the fare payment system on time; a deadline that was seriously at risk if they had to implement their own connectivity.

In a recent vendor performance review conducted by Metrolinx, PRESTO's parent company, BAI was given a score of >97% for exceeding the requirements of the project.

In addition, anonymised data from the Wi-Fi network has the potential to support rail operations. By analysing the association of devices to the network, BAI can help the TTC streamline services. For example, when a train comes into a station, if many people stay associated to the network it shows that they were unable to board due to crowding. Real-time analysis of the data will enable BAI to provide instant insights to the TTC.

The project's success shows how BAI's deep understanding of communications in the transit space, plus its financial backing and efficient project management are critical ingredients in meeting passenger demand for connectivity and modernizing the passenger experience.

What’s next?

Our ultimate goal is to expand the cellular network into every tunnel in the TTC, creating a completely seamless experience throughout every journey for every commuter. By May 2019, the entire downtown loop was cellular-enabled, which was a major step towards that goal.

*Source: Mobile service on the TTC leger study - October 2017

“As Mayor, I am committed to modernizing both the services the City offers and the way they are delivered to Toronto residents. I’d like to congratulate WIND [Freedom] Mobile and BAI [Communications] Canada for working with the TTC to put customers first and expanding cellular service underground.” — John Tory, Mayor of Toronto

Source: “TTC, BAI Canada & WIND Mobile launch cellular service underground”; TTC website, 17 June 2015