

## Toronto tries cable management system



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### Toronto Transit was looking for an alternative to the traditional messenger cable wire support system due to brief nightly two-hour work windows.

When the Toronto Transit Commission decided to replace the electrical cabling on the entire length of the oldest and busiest of its three subway lines, the Yonge/University/Spadina (Y/U/S) line, with new signal and communications cabling, the engineering department was given the task of finding a way to perform the work without affecting passenger service or revenue.

The TTC has a very brief overnight shutdown after the last trains of the night (around 1:30 am-2 am) and before the first trains of the morning start rolling out by 4:30am. Typically, there is a two-hour lull during which crews can work unimpeded and the TTC wanted a streamlined solution that could be implemented entirely during that period.

The tunnels are very narrow, with barely enough room for the trains and no room for work crews to pull or lay cable when trains are running.



Crew working on one of two specially-designed flatbed cars.

The new cabling will operate two systems: a conventional signal system and an automatic train control system. The conventional signaling system will use computer-based interlocking products. The automatic train control system will utilize a communication-based train controller.

The project is broken into four phases, with the first phase covering the South Yonge area. Phase 1 will use approximately 155 miles of copper cable and 46.5 miles of fiber, which is about one-third of the total cable for all four phases.

For the new installations, the TTC was looking for an alternative to the traditional messenger cable wire support system because of the difficulty of starting and completing the hanging of the new cable runs to the messenger wire (which requires hanging 1,500 foot lengths and then setting up, lifting and strapping the cable to the wire every 12-16 inches) during the brief nightly two-hour work window. That system would have presented time-constraint problems and resulted in the possible disruption of schedules.

When Justin Veillieux, the senior designer-construction management, Signals & Train Control Engineering, Rail Division-Operations Branch, was researching how best to design the project for minimal disruption, he came across an article in an old Railway Track & Structures about how the electrical contractor for the Chicago Transit Authority was able to proceed with cable installation along sections of Chicago's Blue Line (the city's busiest subway line) at a very brisk pace using an innovative type of cable management system and realized the same type of support system could work for the TTC.

The article related how the CTA took advantage of a flexible, bendable wire cable management system engineered and manufactured by Snake Tray® of Bay Shore, N.Y., specifically for quick mounting to concrete walls and ceilings and other surfaces and easy lay-in of cables.



The new installation of the Rail Tray system above the existing messenger cable to be replaced.

Seeing parallels in need for efficient cable laying, Veillieux contacted the electrical contracting firm for details. After hearing about the product and the process firsthand, he called Snake Tray himself to explore a similar type of installation for the TTC using that company's flexible open steel cable tray, called Rail Snake Tray, that mounts directly to a concrete surface using integrated mounting rings. The trays, which are hand-bendable without tools, enable on-site adaption to fit unique contours and bypass obstructions.

The trays connect with a single bolt. The cable management system gives continuous support for the runs, eliminating the risk of stresses on the cables from tension of suspended cables, on the one hand, or clenching of bundled cables, on the other.

TTC ordered two new custom-designed 65-foot flatbed cars for the project, one for holding and installing Rail Snake Tray along the line and the other for holding the spools of cable for feeding directly into the installed tray. The flatbed cars, which also act as moving work platforms, are dual propulsion and can be operated by traction power (600 vdc) or by diesel generator.

The 32-station U-shaped Yonge-University-Line, which runs mostly underground, has the oldest original cables in the transit system. It opened in 1954 and has several extensions built between 1963 and 1996. It encompasses two 20-mile tunnels, one northbound, one southbound, which meet at Union Station in downtown Toronto.

The first step in the installation is the mounting of the trays to the walls and ceiling and under the station platforms. The trays vary in depth and width to accommodate the volume of cable to be carried for both the TTC's legacy system and the new fiber optic systems and to accommodate the tight clearances in the tunnels.

Snake Tray was able to provide product to accommodate all the TTC tunnel structures with trays that fit the profile and contours of the tunnels, which included a couple of oddball angles or required fitting into a chamfer area within the precast tunnel.

For example, one tray was modified to hold TTC's system of RF coaxial cables for communication systems in the tunnels. Another tray, a crossover tray, had to go from one side of the tunnel across the ceiling to the other side.

The manufacturing process for the trays uses special machines that automatically bend the wire to form the tray into whatever dimensions or curvatures are needed to stay within the tight tolerances within the tunnel. All the trays for the project are made of stainless steel to prevent corrosion.

## Manageable lengths

Because the tray arrives at the jobsite in manageable 10-foot lengths, each section can be installed one after another right up until it is time to shut down installation, daily, without leaving any unsafe conditions as could arise with 1,500 foot lengths of messenger wire not fully installed within the allotted time, anchored and tied.

The second step is to reel out cable from spools stacked on the flatbed car. The work car for the TTC installation is custom built to hold two five-foot cable spools and several smaller spools. An articulating arm upfront of the cable spools enables feeding of the cable off the spools through the arm, dropping the cable right into the cable tray.

Because the mounting bracket cantilevers the tray out from the wall or other surface, the outer facing side is fully accessible, enabling unimpeded loading from the flatbed train. The open access to the cable also facilitates maintenance and upgrading, as needs arise.

At the end of the run, a worker cuts the cable and the spooling starts again at the beginning of the next run. The ability to spool directly from the flatbed car so efficiently within the two-hour work window was a very important factor in selecting the Rail Snake Tray cable management system. The cable ranges in diameter from close to an inch and three quarters down to about 1/2 inch. Because the cables feed directly off the spools onto the trays, the TTC can pull as many runs at a time as there are spools on the work train, depending upon what is needed in the area.

With one work vehicle installing cable, TTC averages 200 to 250 feet per night. Crews installed about 50,000 feet of the trays as of early September.

Once all the cabling is laid, TTC will plug in the new wayside signaling equipment and test the system. When everything is OK, TTC will turn off the older (existing) signaling system and decommission it, Veillieux explained.

The project, which began a few years ago, is scheduled to be completed by the beginning of 2015.

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