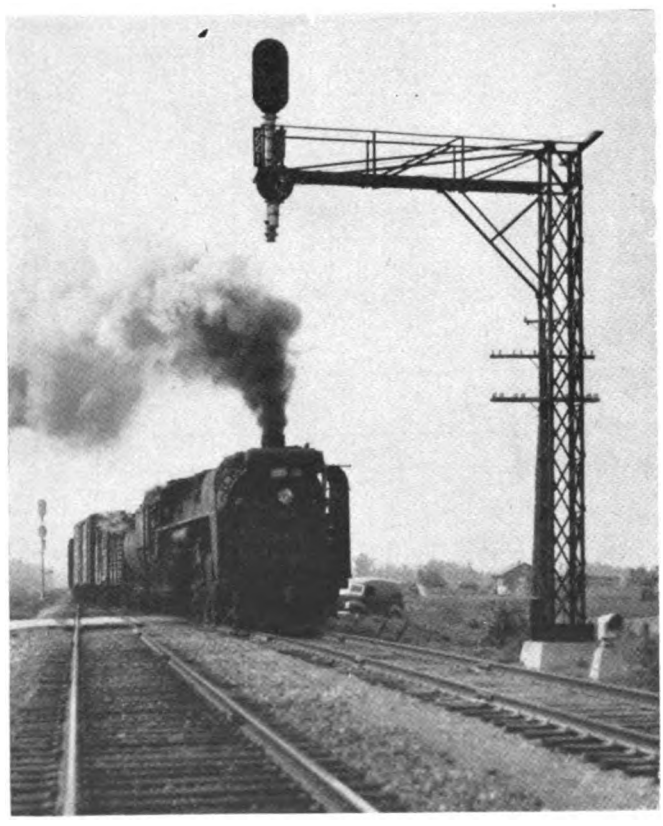
Canadian National Installs Centralized Traffic Control On a 117-Mile Sub-Division

Hours of train time saved, and track capacity increased on territory which handles up to 60 trains daily--Construction practices planned to withstand cold weather

ON 117 miles of single track, between Ste. Rosalie, Que., and West Junction, the Canadian National has installed centralized traffic control, as a means of increasing track capacity and reducing train time. This project is on the route eastward from Montreal, Que., to Halifax, N. S. Ste. Rosalie, the west end of this new C.T.C., is 36 miles east of Montreal; and West Junction is the west end of the freight yards just west of Levis, Que., which is on the south side of the St. Lawrence river opposite Quebec, Que.

From Montreal, double track extends south across the St. Lawrence and 36 miles to Ste. Rosalie, at which point one line diverges southeast through Richmond, Que., and Sherbrooke, Que., to Portland, Me., and from Ste. Rosalie, the Drummondville sub-division, on which the new C.T.C. was installed, extends east to Levis. Branch lines connect with the Drummondville sub-division at St. Leonard Junction, Aston Junction, Villeroy, and Chaudiere, as shown on the map. Therefore, in addition to trains which run through on the entire sub-division, some trains operate only part way. For example, two passenger trains each way daily, to and from the Nicolet branch, are operated over that portion of the Drummondville sub-division between St. Leonard Junction and Ste. Rosalie, 45 miles. A mixed train each way daily to and from the Deschaillons branch is operated over the Drummondville sub-division between Villeroy and Levis, 46 miles.

The schedules include three through passenger trains each way daily, and in busy seasons second sections of these trains are operated. The fast through freight traffic is handled by 8 to 12 through freight trains each direction daily, depending on the volume of traffic. Counting all through trains and branch line trains, as discussed above, the total number of train movements range from about 35 to 45 daily in the summer, and from 50 to 60 daily in the winter. On March 9, 1950, a total of 62 trains were operated.



Typical signal arrangement at end of a siding

Saves Train Time

On this territory the train movements were previously authorized by timetable and train orders, and there was no automatic signaling in service. About 225 train orders were issued every 24 hours. Train order offices are now maintained at only the junction points with branch lines, no orders now being issued at 11 offices formerly in service for that purpose. Now, train movements are authorized by signal indications controlled by the C.T.C. system. Previously, the freight trains were required by rule, to clear the main track at least 20 minutes ahead of the passenger trains. If a passenger train lost time, there was no means of getting out orders in time to advance the freight trains. As a result, they often lost 45 minutes to an hour or more in situations where now, with the C.T.C., these trains are kept on the move to make meets on close time.

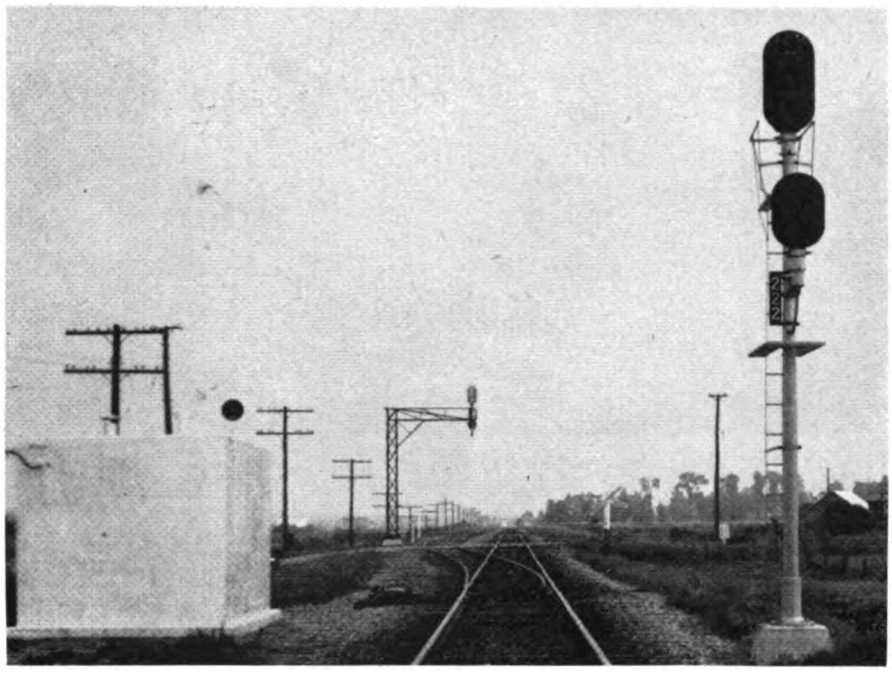
Eastward passenger train No. 4 is due at Ste. Rosalie at 8:58 p.m., and a second passenger train No. 60 is due at the same station at 9:28 p.m. On one occasion, there were two sections of eastward fast freight train No. 406, one of these sections was ahead of No. 4 and the other was between No. 4 and No. 60. In such a circumstance, under previous train order operation, both freight trains would have waited on sidings until both passenger trains had

passed, thus losing an hour or more. However, with C.T.C., the dispatcher kept these trains moving.

On a recent date, there were several extra trains, so that the dispatcher had five eastbound passenger trains and four eastbound freight trains to deal with at one time. By means of the C.T.C., he kept fast through eastbound freight No. 406 on the move ahead of eastbound passenger train No. 4 all the way to St. Leonard, whereas with previous train orders the freight would have taken siding and waited. After an inspection at St. Leonard, the freight No. 406 was run from there to Val Alain, 40 miles, between the first and second sections of passenger train No. 60. Thus, in this instance, the C.T.C. saved at least 2 hours for fast freight No. 406.

An important advantage with the C.T.C. is that the dispatcher can send out controls on a minute-to-minute basis to direct trains to move, and thus utilize idle track and time that is available. This permits freight trains to be moved out of yards when they are ready to depart, and makes it possible to keep such trains moving for close meets. Fast through freights formerly required 5½ to 6 hours on the 117 miles between Ste. Rosalie and West Junction, and on the average, this time has now been reduced to about 3 hr. to 3 hr. 30 min. Recently, for example, this run was made in 2 hr. 50 min. Extra freight trains, which previously encountered more delays than scheduled trains, now save about 3 hr.

Passenger train schedules have not been shortened. However, if a passenger train departs from a terminal behind schedule, the C.T.C. can be used to make up time. For example, at least 10 minutes can be saved by the power switches and C.T.C. when making a meet between two passenger trains. Also, by making closer meets, time is saved, so that the chief dispatcher reports that the C.T.C. can be used to make up 35 to 40 minutes on a passenger train if it is behind schedule when received on the C.T.C. sub-division.



Concrete house has a room for relays and a warning room for trackmen

In the 117 miles between Ste. Rosalie and West Junction, the railroad traverses rolling terrain with numerous short grades but no long heavy grades. The curvature is relatively light except for a few instances. One curve of 4 deg. is near the east end of Lemieux. The track is well constructed and maintained. The maximum permissible speed for passenger trains operated by Northern type locomotives is 75 m.p.h., and for freight trains operated by Northern and Mikado type locomotives, 60 m.p.h.

At West Junction, there was formerly a mechanical interlocking where the west end of the freight yard connects with the main track. This interlocking has been replaced by power switch machines and signals which are included in the C.T.C. system. A power switch and signals at the junction at Chaudiere, formerly controlled remotely from West Junction, are now in the C.T.C. At Aston Junction, a mechanical interlocking was replaced by power switch machines and signals in the C.T.C. At St. Leonard Junction, the two legs of the wye from the Nicolet sub-division connect to the main line at spring switches, as shown in Fig. 2. Train movements from the Nicolet line to the main track are governed by dwarf signals, controlled by the C.T.C. system. At Villeroy, the Deschaillons branch connects to the main line at a hand-throw switch, and train movements from the branch to the main line are governed by a dwarf signal controlled by C.T.C.

As a general rule, freight trains are stopped at St. Leonard Junction to permit trainmen to inspect the cars on both sides for the entire length of the train. At this layout, there are two sidings, the one on the north being used normally by eastward trains, and the one on the south by westward trains. Spring

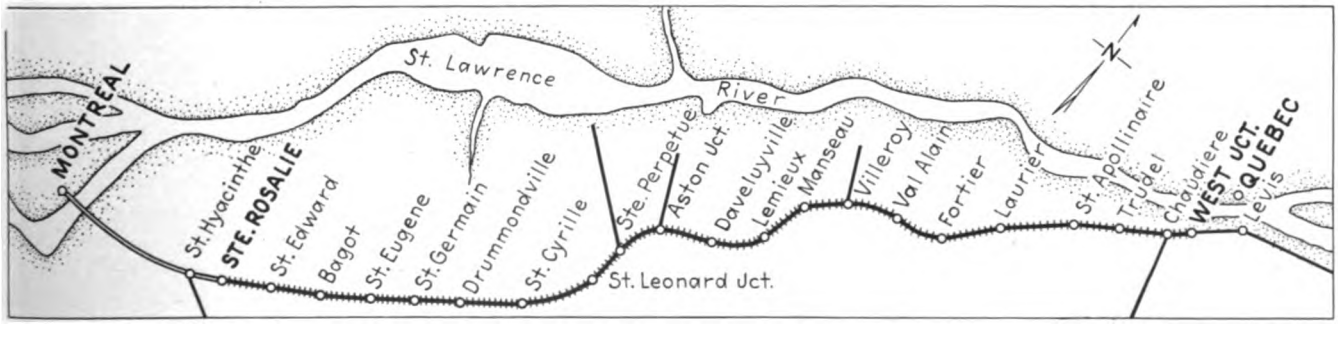
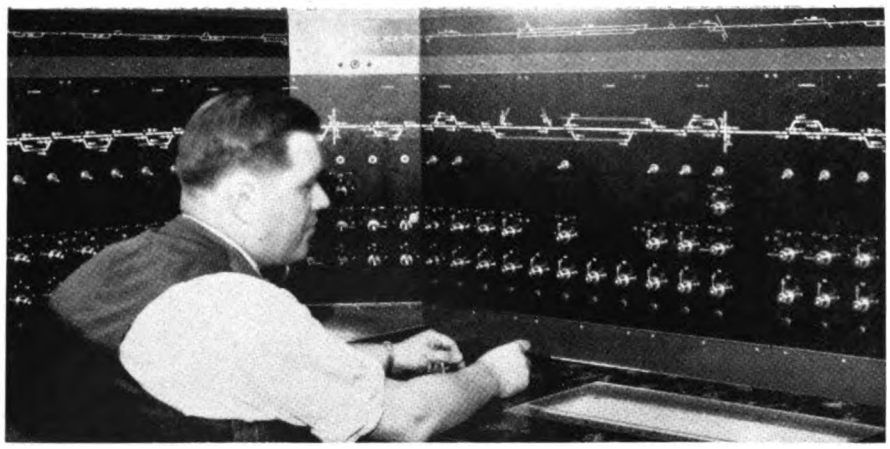


Fig. 1—Map showing locations of power sidings and junctions in C.T.C. territory



The control machine is in the dispatcher's office

switches are used at the departure ends of these sidings.

The layout at Drummondville includes two sidings with a power switch at both ends on the siding north of the main track, while the siding on the south has a power switch at the east end and a spring switch at the west end. Single sidings with power switches at both ends are located at 17 towns as indicated on the map. The C.T.C. also includes a power switch at the east end of the siding at Ste. Rosalie, the west end being in an interlocking. Thus, as a whole, the C.T.C. includes 42 power switches and 5 spring switches, and also 133 high signals, 90 of which are controlled, and 48 dwarfs.

Where the distance from one siding to the next ranges up to 5 miles, there is only one intermediate signal for each direction, and in each instance the signal is about 1.6 miles from its corresponding station-entering signal. Where the distance between sidings range from 6 miles to 8 miles, there are two intermediate signals for each direction, thereby reducing the block length so that following trains can be operated on closer spacing.

All signals are at the immediate right of the track governed. In order to accomplish this result, at one end of each siding a cantilever signal bridge was used to bring the station-departure main track signal over and to the right of the track governed. This made it unnecessary to throw the siding over to 20-ft. centers to place this signal on a ground mast at the right of the main track. These cantilever bridges are of lattice steel construction, as shown in one of the pictures.

The high signals are the Model D color-light with the color units in a vertical row. The dwarfs are searchlight signals. In the three-aspect type D color-light high signals, an 18-watt, 10-volt lamp is used in the green unit and 10-watt 10-volt lamps are used in the yellow and red units. The voltage on these lamps is adjusted to 9.5 volts. A light-out relay, rated at 0.1 ohm, is in series with the filament in the lamp in the green unit. If this filament fails, the relay is released, and the yellow lamp is lighted through a back contact. This avoids train stops. All main-track signals are normally dark, with approach-lighting control. Because there are no track circuits on the sidings, the leave-siding dwarf signals are normally lighted.

Local Controls

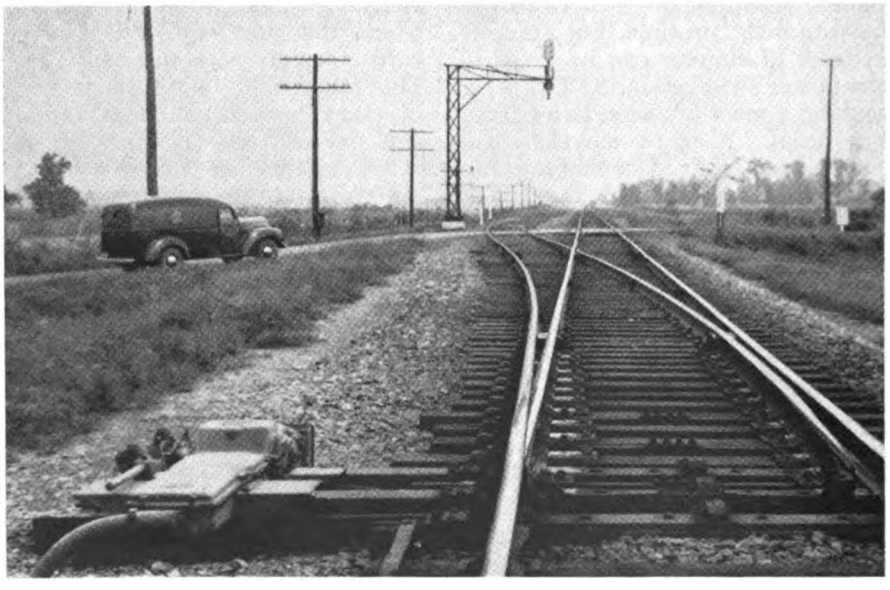
The track circuits are the d.c. neutral type with 2-ohm relays. The longer track circuits, 5,000 ft. to 7,000 ft., are fed at the center with a relay at each end. Track circuits shorter than 5,000 ft. are end-fed. The track circuits are fed by two cells of 80-a.h. Exide storage battery connected in parallel, except in cases where the 220 volts power line is only carried to the approach signals. Then, between these points, track circuits are fed by three cells of 500-a.h. Edison primary battery. The rail joints are bonded with United States Steel Company S-3 stranded bonds, with ⅜-in. pins in the web.

Local Line Circuits

Each polar signal line control circuit operates a 100-ohm d.c. neutral H relay through a rectifier, and a 66-ohm biased neutral relay for the D control. These local line circuits are on No. 10 Copperweld wires, 30 per cent conductivity. The 110-volt or 220-volt a.c. power distribution circuit is on No. 10 Copperweld wires, 40 per cent conductivity. The C.T.C. code line circuit is on two cadmium copper wires, 80 per cent conductivity. All these wires have Neoprene covering. The signal line wires were installed on a lower crossarm which was added to the existing pole line previously used only for communication wires. Brown porcelain insulators were used for the a.c. power circuit and glass insulators for the remaining circuits.

C.T.C. Line Code System

The control machine is in the dispatcher's office at Levis, which is 8.5 miles east of the east end of the C.T.C. at West Junction. The outgoing contols and incoming indications are handled over a two-wire line circuit by Type-K, Size-10, Class M coding equipment. Carrier operates between the office and



The switch machines are the dual-control type

a field station at Aston to handle outgoing controls and incoming indications on the territory west from Aston to Ste. Rosalie. The outgoing controls for that section are 13.0 kilocycle and the incoming codes are 17.0 kilocycle. Office facilities include complete equipment for testing and adjusting the line coding and carrier apparatus. In addition to an adequate number of ammeters and voltmeters, the instruments include a Weston Model 797 analyser.

Power Switch Layouts

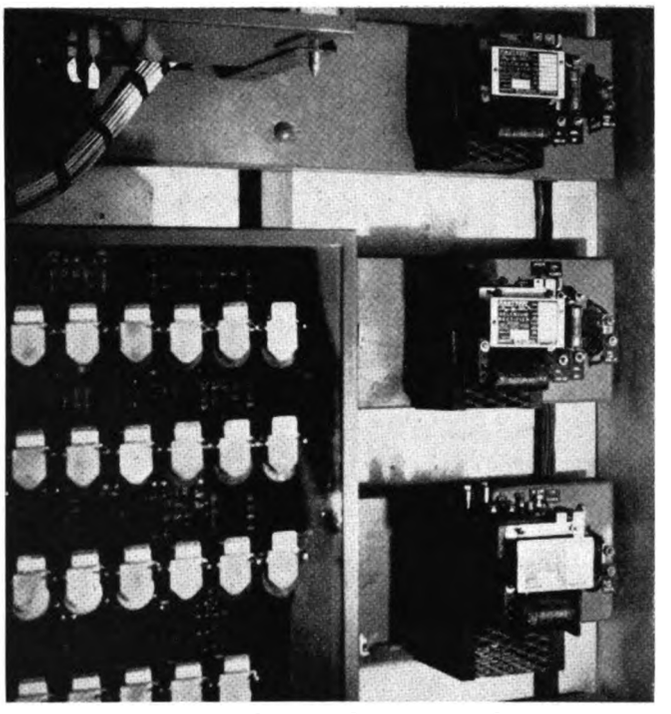
The power switch machines are the dual-control Model 5D with 24-volt d.c. motors. Electrical space heating units are used in these machines to prevent frost and the freezing of moisture. These units are fed from 220-volt a.c. A 12-watt unit is used in each motor housing and in each brake housing, and a 15-watt unit is used in each circuit controller compartment and in each contact housing.

Insulated gage plates, 1 in. thick and 7 in. wide are used on three ties, including the No. 0 tie and the No. 1 and No. 2 ties under the points. Adjustable rail braces are used on these ties. At the ends of the sidings, the turnouts are No. 12 with 20-ft. switch points.

Concrete Houses

At each end of every power siding, there is a pre-cast one-piece reinforced concrete house, 16½ ft. by 9 ft., with an 8 ft. ceiling. The floors of these houses are 10 in. thick and serve as a foundation. The walls and the roof are 6 in. thick. The roof slopes ¼ in. per foot, all one direction. Such a house, empty, weighs 56,000 lb. Each such house includes a room 8 ft. by 7½ ft. for signal equipment, and a separate room 8 ft. by 7½ ft., used as a telephone booth, and as a warning room for trackmen when on duty to sweep snow out of switches.

These houses were made by the railroad forces at construction headquarters near West Junction. All relays, rectifiers and wiring were installed in these houses at construction headquarters, and then, by means of power cranes, they were loaded on flat cars and hauled to their field locations where power cranes were used to set them in place. Likewise, the sheet-metal cases at intermediate signals were wired at headquarters. In all this wiring, connections were made with solderless connectors made by the Aircraft-Marine Company, a total of about 85,000 of these connectors being used on this entire C.T.C. project. The Railroad Accessories Corporation's Clearview lightning arresters were used on the code line, and the Type 20 made by the Western Railroad Supply Company were used on other circuits. Rare-gas arrester inserts were used on the 220 and 110-volt a.c. power circuits.



Code equipment and rectifiers in instrument house at switch

At each power switch layout at an end of a siding, there is a set of 12 cells of 80-a.h. Exide storage battery to operate the switch machine and also feed the line code equipment. The local signal battery includes 2 sets of 5 each of 80-a.h. cells. As stated elsewhere in this article, 80-a.h. storage cells are used on the track circuits, with the exception of a few track circuits where no power lines were run. All the storage batteries are on floating charge through Fansteel selenium rectifiers.

Telephone and Call Lamps

Telephones, which are connected to a separate two-wire line circuit, are located in the dispatcher's office and at all concrete houses and industry switches. Mounted on top of each concrete house, as shown in one of the pictures, there is a call lamp, which displays an aspect in each direction along the track. This lamp has a 3½ in. lens with a black background shield 12 in. in diameter. When the dispatcher wants to talk to the maintainer or to a member of the crew of a train on the siding or stopped by a signal on the main track, the dispatcher sends out a special code control that causes the call lamp at that field house to be lighted.

This centralized traffic control was planned and installed by Canadian National signal forces. The signaling equipment for this project was made by the General Railway Signal Company.

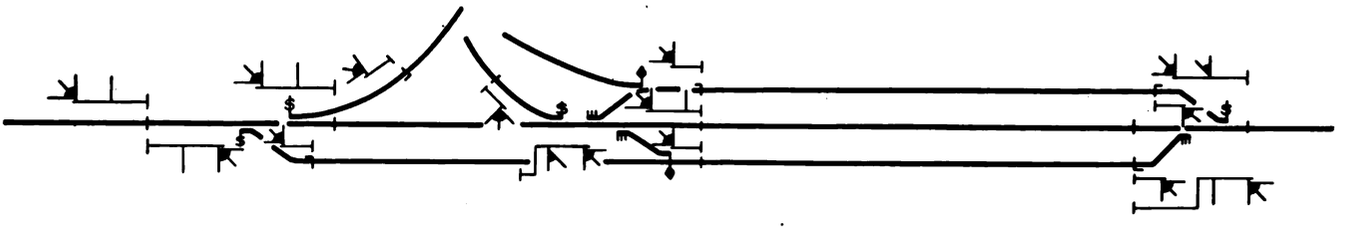


Fig. 2—Track and signal arrangement at St. Leonard Junction showing connections to Nicolet branch