RAILWAY SIGNALING AND COMMUNICATIONS
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CNR Uses Speed Selection for Gates

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Two heavily traveled Toronto suburban streets cross double-track mainline at grade. Speed selection and time cut-out circuits for crossing gates reduce vehicular traffic delays to a minimum.

● Midland and St. Clair avenues are two heavily traveled streets serving Scarboro, a rapidly expanding residential and industrial suburb in eastern Metropolitan Toronto. They are 1,100 ft apart, one either side of the Scarboro station on the Canadian National's mainline to Montreal.

The double-track mainline has automatic signaling for single-direction running. Two interlockings east of Scarboro station are controlled by the operator at the depot. He also controls two electric switch locks west of the depot which govern movements on to the Uxbridge subdivision. Heavy grades (averaging 1%) ascend from the east and the west, reaching an apex approximately 1,500 ft east of Midland avenue. Freight trains require helpers, and these engines are cut off at Scarboro.

Through trains total 70 a day with some wayfreights stopping to do switching. In addition, a switch engine works two shifts in the area. Helper engines also cross over in the depot area to return to their terminals.

Freight trains seldom exceed 30 mph due to the grades. Westward passenger trains run at the maximum authorized speed of 80 mph, while eastward passenger trains are restricted to 60 mph.

The wide variation in train speeds called for a speed selection circuit for eastward trains at both crossings, but only at St. Clair for westward trains. It was not desirable to provide speed selection for westward trains at Midland, because speed selection circuit would have been on ascending grade and approach circuits on descending grade. Thermal cutout circuits east of the crossing are used for trains stop-

Pushbuttons are provided to lower and raise gates for reverse moves. This view is looking east toward the Midland avenue crossing.

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ping in this area.

Timing sections were installed on both main tracks and adjusted so that trains traveling under 30 mph start the flashers only when they reach the shorter approach circuit. Trains exceeding that speed utilize the longer approach. The diagram shows the layout of the crossings with the length of warning at the various designated speeds.

Typical of the speed selection operation is the circuit for eastward trains. Track circuit AT is used as a timing section for both crossings. It is also used as an extended approach for St. Clair, that is, if the gates at St. Clair are down for a train, a second train coming on AT will hold them down if the first train clears the crossing circuits or times out on a thermal circuit. This prevents the gates from partially clearing and then descending on top of traffic.

Referring to the circuits (Figure 1), a train entering AT track circuit energizes the ETEXR relay over the unoccupied track circuit BT and check contact of the time element relay, ETER, thus starting the motor-driven timer into its cycle. If the timer completes its cycle (approximately 25 seconds) before the train shunts BT, the stick relay ETESR is energized, and the St. Clair protection will not start until the train reaches CT. Contacts on this relay bypass track BT in the St. Clair approach circuits. A repeater of ETESR bypasses CT and ET in the Midland approach circuits.

If the train is exceeding 30 mph, it will shunt BT before the timer completes its cycle. BTR down deenergizes ETEXR, which releases the timer ETER, thus allowing the St. Clair crossing protection to start operating when the train reaches BT. This same train would start the Midland avenue flashers operating when it reached CT. Track circuit BT is also used as the extended approach for Midland avenue.

Because of station stops, switching, and trains moving from the mainline to the Uxbridge subdivision over hand-throw switches, time cutout circuits using thermal time element relays were installed. The timing is set for one minute. A typical thermal circuit is shown in Figure 2. A series track relay CTZR is used in all thermal circuits to prove that the track relay is down for a shunt and not an open circuit.

A typical operation is an eastward train moving to the Uxbridge subdivision. It will stop on CT, but short of St. Clair avenue to avoid blocking the crossing. When the train entered circuit CT, it set the St. Clair protection equipment into operation. The CT thermal circuit times out in one minute, provided the ET track is not occupied, which raises the gates. After the hand-throw switches are reversed (locks released by the operator in the station) to line the route, the signal clears to red-over-staggered green. The train restarts the St. Clair protection by entering the 300-ft long positive ET track circuit. This circuit provides the positive start circuit for St. Clair avenue.

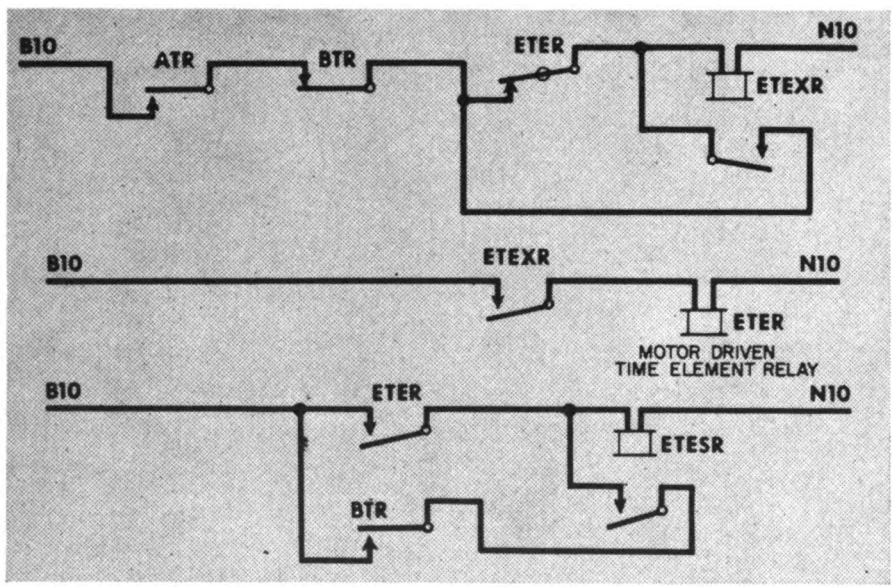

Figure 1: Typical speed selection circuit. This applies for eastward trains. Track circuit AT is the timing circuit for both crossings.

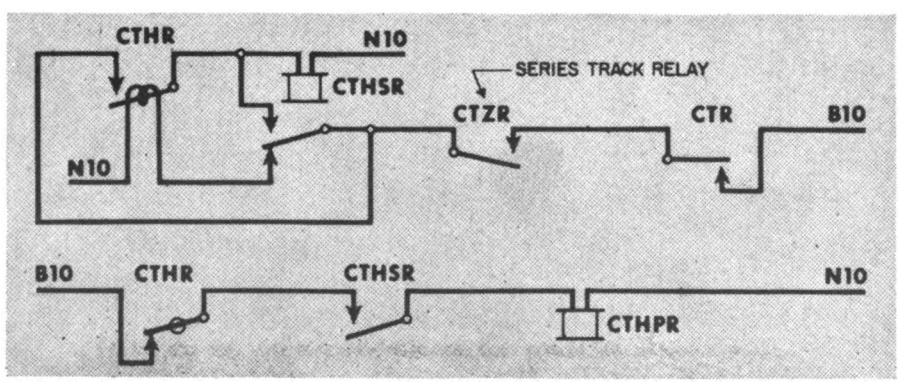

Figure 2: Typical thermal circuit uses series track relay CTZR.

Reverse Switch Cutouts Used

There are nine switches within the crossing circuits. All of these have reverse switch cutouts. Directional stick circuits are used at both crossings so that the gates will clear as soon as the train clears the crossing. All the track circuits between the two crossings have thermal circuits and directional stick circuits. A move stopping on any of these track circuits and then proceeding toward either crossing will start the protection at that crossing only. If the train is in the thermal circuit adjacent to the crossing, the gates can be lowered after being raised by the thermal time out by operation of a pushbutton.

Pushbuttons (**start** for lower, **stop** for raise) are also provided for moves over St. Clair on the side tracks. On the mainline, the pushbuttons may be used for both normal and reverse moves over crossings. If the **start** button is used to lower the gates and the

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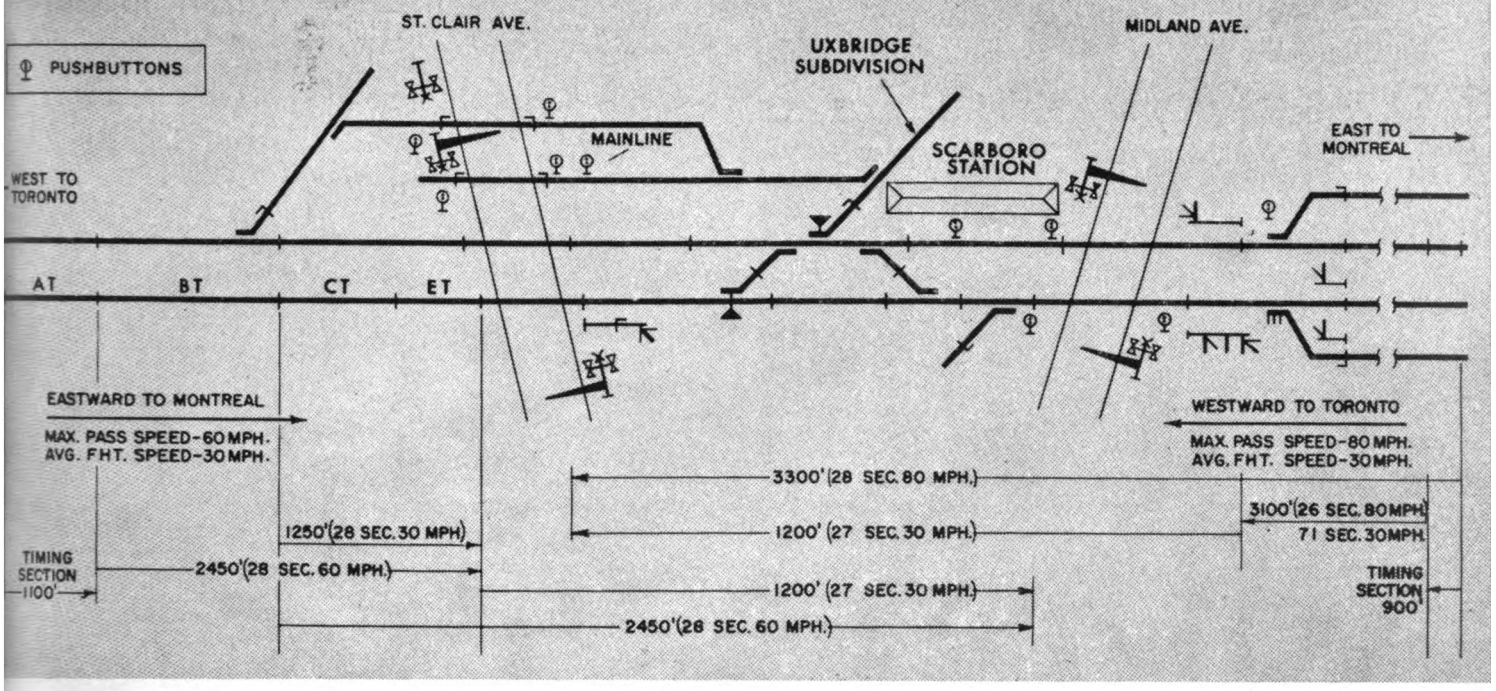


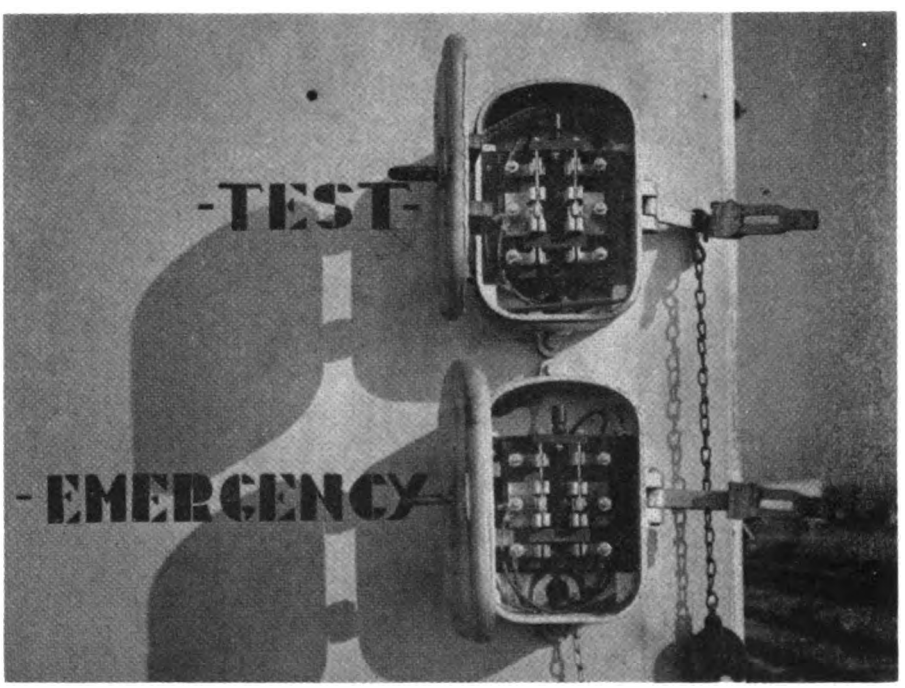
Grade crossings are subject to heavy vehicular and rail traffic with switching moves and station stops.

move is not made over the crossing, the **stop** button is pressed to raise the gates.

Because of the heavy vehicular traffic over these crossings, the protection equipment operation is checked daily by use of a test switch. This test switch is in a box (with a switch padlock) on the end of the relay case at each crossing. This DPDT switch is pulled down to set the flashers and gates into operation. The door of the box can only be closed and padlocked when the test switch is in its normal or **up** position. A similar DPDT switch can be pulled down to raise the gates and cutout the flashers if they continue to operate because of a faulty track circuit or other failure.

CN policy is to endeavor to keep interlocking and highway crossing protection circuits separate. This enables changes to be made in one facility without incurring necessary changes in the other. Thus controls of the signal governing moves from the mainline to the Uxbridge subdivision, and the signal governing moves to the yard lead just east of Midland avenue are not tied in with the crossing protection. When these signals are at Stop, trains stop short of the street crossing.

Design engineering was carried out under the jurisdiction of D. H. Green, Signal Engineer, Canadian National at Toronto and installation under direction of A. P. Young, District Supervisor of Signals, Toronto. The gates are Western Railroad Supply Co. model 10, with 27-ft arms for spanning half of the roadway.



Above: Test switch is pulled down daily to check protection operation. Emergency switch is used to raise gates and cutout flashers if they operate because of a faulty track circuit or other failure.

Left: Pushbuttons (start for lower, stop for raise) are for moves over St. Clair on the side tracks.

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