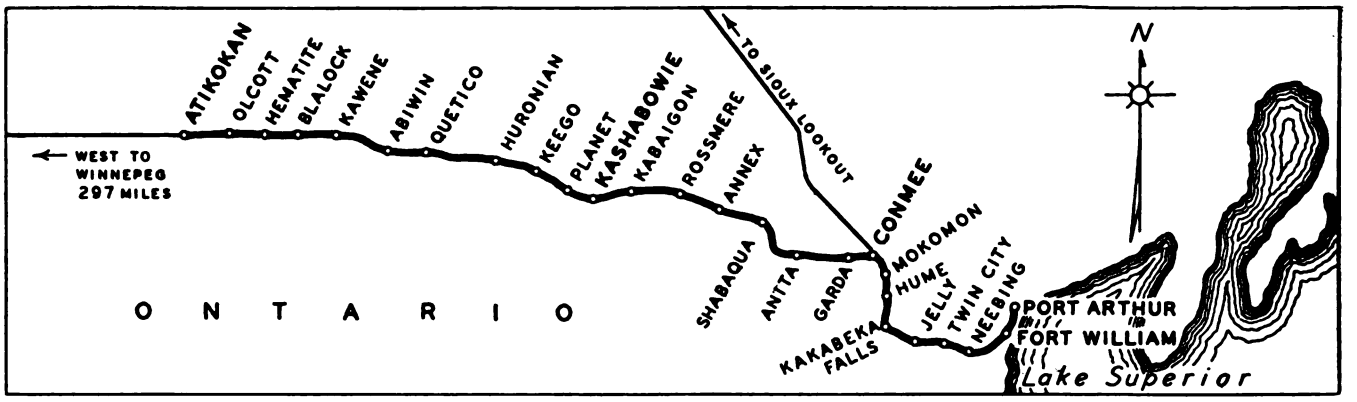


The line is single-track from Atikokan to Conmee, and double track from there to Port Arthur

How CN Increased Track Capacity . . .

. . . by installing centralized traffic control on 141 miles of single track where operating problems involve grades and curves as well as peaks of traffic to haul iron ore and grain to ports at the west end of Lake Superior

ON 141 MILES between Port Arthur, Ont. and Atikokan, the Canadian National Railways has installed new rail, extended sidings and installed new signaling as an aid in handling more traffic, the increase being due to the expected movement of approximately 5,000,000 tons of iron ore annually from mines, near Atikokan, to docks on Lake Superior at Port Arthur. This railroad improvement project is on the line from Port Arthur through Ft. William, Atikokan and Ft. Francis, 438 miles to Winnipeg. The transcontinental traffic of the Canadian National is not routed on this line, but goes on another Canadian National route which passes to the north of Port Arthur, about 250 miles.

On the Port Arthur-Winnipeg line, double track extends from Port Arthur through Ft. William and west to Conmee, 35.7 mi. From Conmee the main line is single track west through Atikokan, and Fort Francis to Winnipeg. Farming extends from Port Arthur for about 35 miles, beyond which the terrain is rough and rocky with numerous lakes. In this area, there is no agriculture or industry, except mining and the cutting of pulp wood for paper mills.

Port Arthur and Fort William, which are adjacent and called the Twin Cities, have a combined population of 46,000. One time freight, on fast schedule, is operated each way daily between Winnipeg and Port Arthur, to handle meats, foods, manufactured products and merchandise. One passenger train, which makes stops at all towns, is operated each way daily, except Sunday. A local freight operates westbound two days each week, and eastbound two days. Extra trains are operated as required to handle grain and ore. As many as 30 trains are operated some days.

Port Arthur and Fort William are the principal Canadian lakehead points at the west end of Lake Superior. Large quantities of grain grown in the western prairie provinces are routed eastbound through Winnipeg, and then over the line through Fort Francis and Atikokan to Port Arthur where it is placed in large terminal elevators to be loaded on lake boats for movement east through the Great Lakes. This grain movement is at a peak from harvest time until the close of navigation. Also, as soon as navigation opens in the spring, grain again is moved in large quantities eastbound to Port Arthur.

On this line to Winnipeg, a large open pit iron ore mine was opened at Atikokan, 141 miles west of Port Arthur. Ore from this mine moves in ore cars to Port Arthur, where these cars are moved out onto a large ore dock, to be dumped into lake boats for movement eastward on the Great Lakes. In the 1953 season of navigation on the lakes, 1,301,364 long tons of this ore were handled from the Atikokan mine to the docks. Further increases to about 5,000,000 tons annually are expected. To handle ore at this rate, in addition to other traffic, and to be prepared to handle increased traffic in the future, the Canadian National adopted an improvement program for this area. New 115-lb. rail was laid on practically all of the 141 miles. Sidings were extended as required to hold about 115 ordinary type cars or 240 ore cars. Centralized traffic control, including power switches and signals controlled by the dispatcher, was installed on the 106 miles between Atikokan and Conmee; and automatic block signaling was installed on the 35.7 miles between Conmee and Port Arthur. At Port Arthur, the previous four-track ore dock, 600 ft. long, is being extended 600 ft., so that more boats can be loaded at one time. In 1953, about 581 ore cars were assigned to this operation, rated at 50 tons capacity each, and 200 new 70-ton cars were added in 1954.

Adverse Grades and Curves

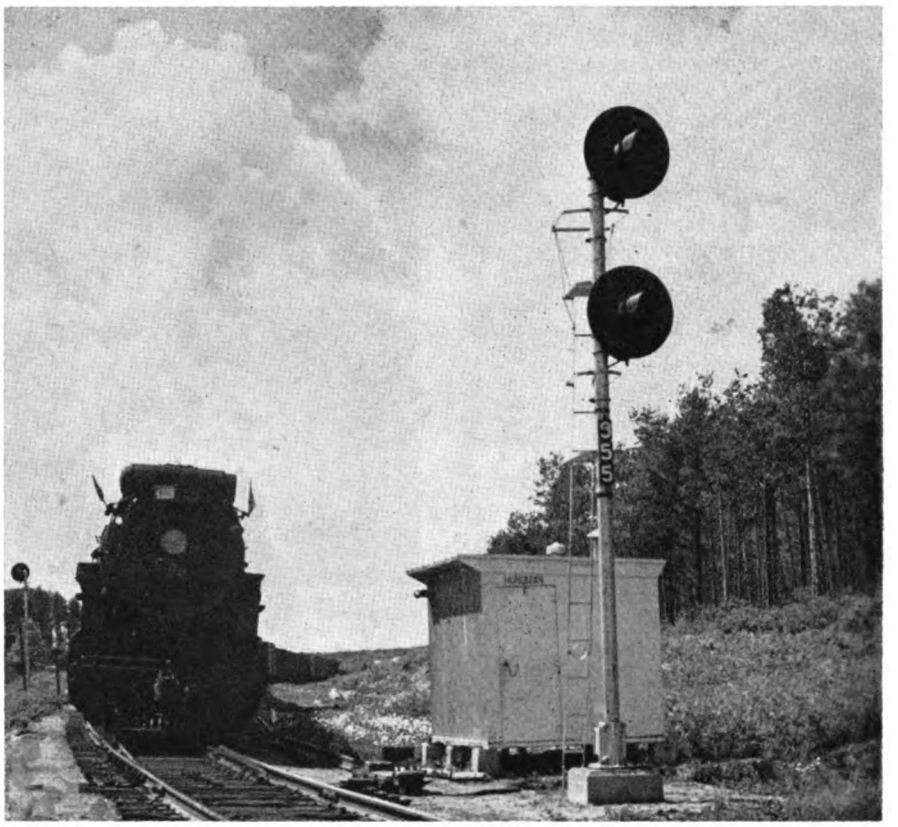
Maximum gradient eastward is 1.66 per cent to Huronian, the summit of the watershed between waters flowing to the Great Lakes and waters flowing westerly to Lake Winnipeg. Maximum rate of curvature is 8 degrees. At Port Arthur the lake level is 603 ft. above sea level and the tracks are at 608 ft. elevation. From Port Arthur to Shabaqua the railroad, in general, follows up the valley of the Kaministiguia river, the

maximum grade being about 1.08 per cent. From Shabaqua the ascending grade is about 1.18 per cent for 4 miles to MP 57.1 from which the grade continues to ascend at a maximum of 0.96 per cent for 2 miles to Annex, with practically level grade 37 miles on to Huronian. From the west end of Huronian the grade descends, ranging up to 1.66 per cent, most of the 45 miles to Atikokan. Thus, for the eastward movement of grain and ore, the grade is ascending for 45 miles from Atikokan to Huronian; level for 39 miles to Annex, and then down grade 60 miles to Port Arthur.

Much of this section of railroad is on curves, there being 300 curves in the 105 miles; many range over 5 or 6 degrees, some are 8-degree and one 9-degree. At 13 locations the speed is restricted to 30 m.p.h. for freight trains. Maximum authorized speed is 45 m.p.h. for passenger and 35 m.p.h. for freight, except for 27 miles between Conmee and Neebing yard where the limit is 55 and 45 respectively. Trains handling ore are limited to 25 m.p.h. on the entire distance between Atikokan and Port Arthur. When traffic is at normal summer volume, as many as 19 meets are made on the single track in an 8-hour shift. Thus, because of the speed restrictions, especially on the single track, the only logical means of increasing the capacity of this track was to install CTC, thus reducing the time of trains on the road by minimizing delays formerly caused by handthrow switches and operations by time table and train orders.

Ordinarily, the freight trains are handled by diesel locomotives rated to handle 3,300 tons as far as Annex, and 5,800 tons on to Atikokan; or 6,400 tons eastward from Atikokan to Huronian, and 9,620 tons from Huronian to Port Arthur. The two time freight merchandise trains, one each way daily, are handled by diesel locomotives, and make the run, either way between Neebing yard and Atikokan in about 4¼ hours.

Loaded cars of ore are usually handled as solid trains or with load cars of grain. Previous to the use of diesel locomotives a crew would take enough loaded cars to fill the locomotive tonnage rating from Atikokan up the grade 45 miles to Huronian, where these cars were set out, while the crew went back to Atikokan to get more loaded cars, and take these with those set out at Huronian to Port Arthur, that could be about 9,500 tons which the locomotive can easily handle on the descending grade, all the way. Since diesel locomotives have been placed in service these turn-arounds have been eliminated. Empties are hauled from Neebing yard to Annex and these are used as fill outs for westward trains to Atikokan.



Train movements are now authorized by signal indication

Longer Sidings

As part of the improvement program, 15 sidings were lengthened to capacities of 114 to 120 cars, with a 127-car siding at Kawane, and a 150-car siding at Annex. These numbers are in terms of 45 ft. cars, coupling to coupling, whereas the ore cars are only 21.5 ft. long. Thus, a 115-car siding will hold 240 ore cars. When lengthening the sidings and laying new rail on the main track, new No. 12 turnouts were installed at the ends of the 17 long sidings at which power switches and signals were installed as part of the CTC. Some of the previous short sidings, such as the one at Owakonze, MP 101, were removed. Other short sidings, such as the one at Shebandowan were left in place for storage of work equipment cars. These switches, as well as other main track switches leading to spurs, were equipped with electric locks as part of the CTC.

Signal Spacing

Where the distance between power sidings ranges from 5 to 6 miles, there is one double location of intermediate signals, as on the 5.5 miles between Keego and Huronian. Where the distance between sidings ranges 6.5 to 7 miles, there are two double locations of intermediate signals, as between Garda and Anita.

On the seven miles of ascending grade westward between Shabaqua and Annex, trains run slower westward than eastward. Therefore, to permit closer spacing between following westward trains, there are three westward intermediate signals, compared with two eastward, in this siding-to-siding section.

The 35 miles of double track, from Port Arthur west, ends at Conmee. At this place the Graham line branches off to the north, extending 160 miles to connect at Sioux Lookout with the direct transcontinental line of the Canadian National. The layout at the end of double track at Conmee includes two crossovers, operated by three power switches and one spring switch, all of which, including signals, are in the CTC system.

About 1 mile west of the station at Port Arthur the Canadian National main track is crossed by the main tracks of the Canadian Pacific, this crossing previously having been protected by a 34-lever mechanical interlocking. As part of the improvement program, this interlocker was replaced by power switches and signals, all of which are included

in the CTC system. This crossing layout includes, on the Canadian National, two switches leading to a yard, and a switch at the end of double track; and, on the Canadian Pacific, a crossover between main tracks, and a switch leading to a yard. Thus, a total of six power switches and home signals are included on this layout. The new automatic block signaling on the double track between Port Arthur and Conmee 34.2 miles is for single-direction, right-hand running.

Control at Port Arthur

The CTC control machine is in the dispatcher's office at Port Arthur. On the track diagram, each OS switch-detector section is repeated by a red track-occupancy lamp, and other sections by white lamps. Each siding-to-siding section of main track is represented by two independently controlled track-occupancy lamps, so that the dispatcher can know when a train has gone half way. Two green lamps above and one on each side of the signal lever are lighted when the corresponding signal clears. A white lamp in the face of each switch lever is lighted when the switch is out of correspondence with its lever. An amber lamp above each code sending button is lighted to indicate the station sending or receiving code.

Searchlight Signals

The signals on this project are the G.R.S. Co. plug-coupled searchlight type. The aspects are in accordance with the Uniform Code of Operating Rules, adopted by all the principal railroads in Canada. The aspects and indications are based on "speed" signaling rather than "route" signaling.

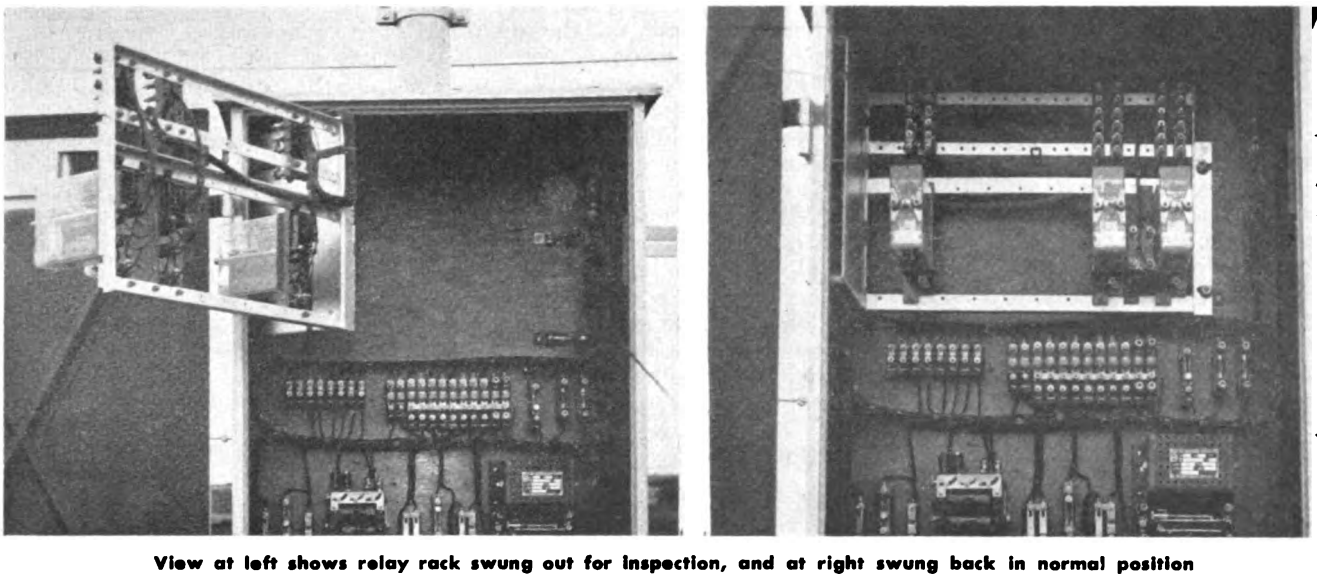
Maintainer has portable telephone that plugs in at switch machines

In order to place the leave-siding dwarf signals above snow as much as possible, the dwarfs on the field side of sidings are on masts that place the center of the lenses about 4 ft. above the level of rail, and the dwarfs between the main track and siding are also at level of 3 ft. high. Lead nuts are used on the anchor bolt on these dwarfs, with the hope (occasionally realized) that the signal, if hit by a snowplow—will go over easily, and without damage to the base casting or mechanism. The lamps in all the signals are normally lighted for two reasons: (1) as some information concerning approach of trains, for benefit to men on motor cars, and (2) to give off a little heat, as an aid in minimizing the formation of frost inside the case. These lamps are normally lighted off a.c. circuit, but are lighted off the storage batteries if the a.c. fails.

The switch machines are the GRS type 5D with dual control. The gear ratio is 214 to 1, and the operating time is about 15 seconds with 24-volts on the motor. Electric heating units are located in the machines to minimize frost. One heater, rated at 15 watts, is located in the circuit controller compartment, and another 15-watt unit is in the motor compartment. These heaters are fed on 110-volts a.c., during winter months.

Local Controls

The track circuits on this project are the conventional d.c. steady-energy type, using neutral relays, rated at 1.8 ohms, with a working current of 0.124 amp. and a drop of .075 amp. The bonds used on the 115-lb. steel are a special type using two at each joint and are connected from the web of the rail to the angle bar and another bond from the angle bar to the web of the rail. The plugs and holes are ⅝ in. in diameter, and



View at left shows relay rack swung out for inspection, and at right swung back in normal position

the bonds are 5 in. long. These are the type S8-SB, made by the United States Steel Company. On the 100-lb. rail Type S-5-T, 32 inch bonds are used.

The 250-ohm operating coil in a searchlight signal is connected across the polar line control circuit. The line circuit for each direction includes one line wire in connection with common, this totaling three wires for the two line circuits. Another line, where required, is for the approach locking in connection with the power switch and signal layouts in the CTC.

Pole Line Rebuilt

The previous communications pole line in this territory was in bad condition. Therefore, as part of the improvements, this line was rebuilt using new poles and crossarms to provide pin space, not only for the communications wires but also for the new signal wires. The new poles are creosoted pine at 40 poles to the mile.

The two new line wires for the CTC code are No. 9 bare copper. The two wires for the 550-volt a.c. power distribution are No. 6 H.D. copper with neoprene weatherproof cover. The local signal line circuits are on No. 10 Copperweld wire with neoprene covering.

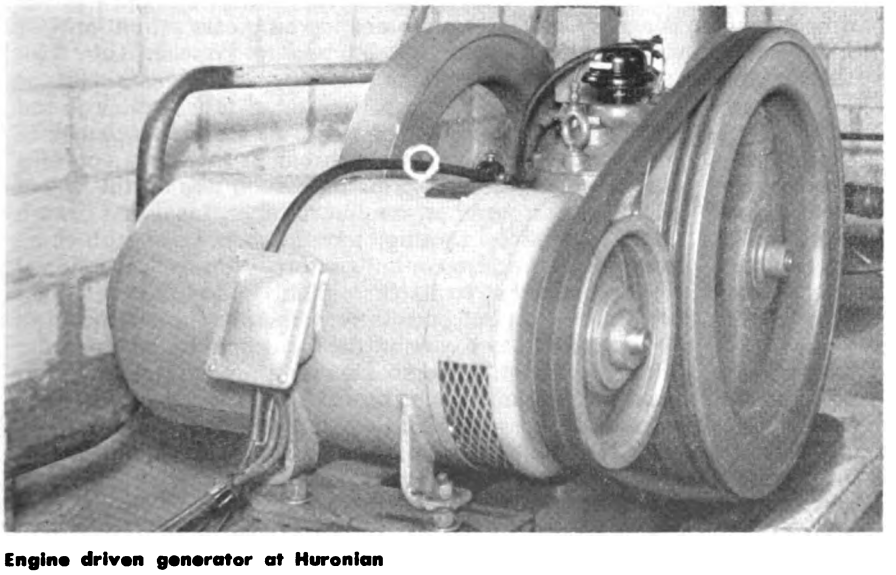
Housings and Cases

At each power switch siding there is a sheet-metal bungalow 12 ft. by 8 ft., with an 8-ft. ceiling. Each bungalow has a room 7 ft. by 8 ft. for relays, coding equipment and batteries. A second room 5 ft. by 8 ft. including an oil space heater of 23,000 B.T.U. is used as a telephone booth, as a shelter for track forces when cleaning switches and for signal maintainers. At the intermediate signals, the relays are in sheet metal cases. These bungalows and cases were wired complete in the signal shop of the C.N.R. at Montreal. They were shipped by freight to Fort William, and were set in place by power derricks or cranes. Foundations were pre-cast at Neebing yard.

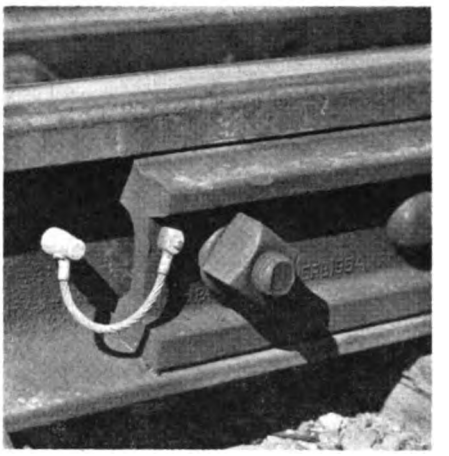
Plug-In Relays on Swing Racks

The relays are the plug-in type, which can be changed out quickly without changes in wiring. In the outdoor sheet-metal cases at signals, the relays are on swing racks, which are hinged at one side to swing out. Thus giving access to the rear. The wiring connections in the bungalows and cases are made with solderless connectors of the Aircraft-Marine Products Co.

A 550-volt a.c. circuit distributes power for the signaling system. This line is fed both ways from locations where commercial a.c. power is available. No such commercial power is available on the 34.6 miles between Kashabowie, west and Kawene, west. Therefore two dieselectric generators were installed at Huronian and feed east 15 miles and west 24.6. Measured at the 110-volt output, the generator feeds about 15 amp. each way, under normal conditions. Each generator is rated at 9.4 kva, 120 volts at 1,800 rpm. The engine has a 5-in. bore and 8 in. stroke, and at 750 rpm develops 12.2 hp. The generators are made by the Mathews Electric Machinery Manufacturing Company, Minneapolis, and the engines by the Witte Engine Works, Kansas City. The sets are operated in 10-day alternate periods to even the wear.



Engine driven generator at Huronian



New type rail bond

The 550-volt a.c. power on the distribution line is stepped down to 120 volts by line transformers. At power switch locations these transformers are rated at 250 va; at intermediate signals, 50 va; and at track cuts; 25 va. These are General Electric air-cooled transformers, with crystal valve arresters.

At each power switch a set of 12 cells 120-a-h. battery, feeds the switch motor and is split to feed code equipment. At each signal 5 cells of 60-a.h. battery feed the line circuit and are standby for lamps. Each track circuit is fed by one 60-a.h. cell. These are all lead storage batteries made by the Globelite Battery Company in Canada. At the CTC control station the code line is fed by 39 cells of Exide 10-a.h. lead battery, and the local circuits are fed by 12 cells of 180-a.h. Exide lead battery.

In the phone booth compartment of each bungalow, there is a wall phone that can be connected to the conventional dispatcher's telephone line circuit, or to a circuit that is superimposed on the CTC code line. Each maintainer has a portable telephone set, known as the Unifone, made by Western Railroad Supply Company. These phones can be connected to the dispatcher's line anywhere. Each switch machine is equipped with a telephone jack where the maintainer can plug in his portable phone.

This new signaling was planned and installed by Canadian National Railways forces, under the jurisdiction of H. L. Black, system signal engineer, and under the direction of L. W. Matson, signal engineer western region with headquarters at Winnipeg. W. G. Hindle, superintendent of signals, at Port Arthur, had charge of field construction. The major items of signal equipment were furnished by the General Railway Signal Company.