Automatic Block for Few Fast Trains

On 103 miles of single track, handling nine scheduled trains daily, the Rock Island has installed simplified station-to-station automatic block, an improved feature being staggered intermediates to eliminate a need for station overlaps

THE Chicago Rock Island & Pacific has recently completed an interesting installation of automatic block signaling on 103 miles of single track between Vinton, Iowa, and Manly, Iowa. This is a connecting line which is a part of a through route between Chicago and St. Paul, as well as between St. Louis and St. Paul. The Zephyr-Rocket, fast passenger train is operated each way daily, and a local passenger train is operated each way daily. The schedules include two time freight each way daily and a local freight each way daily except Sunday. With extra trains, about 10 to 12 trains are operated daily.

No signaling had previously been in service on this 103 miles, and, primarily as safety protection, the management authorized expenditure for a simplified form of automatic block. Within the past several years, the Rock Island installed simplified signaling in which the block extends from station-to-station with no provision for following train movements in such a block. As explained in articles in the April and May, 1946 issues of Railway Signaling, on these earlier projects, overlaps extended into siding limits. This feature necessitated that a train, when holding the main line for a meet, must not occupy the overlap. The new feature of the 1950 project, between Vinton and Manly, is that intermediate signals were installed so that opposing intermediates are spaced twice train braking distance. With this protection between sidings, no overlaps are required within station limits. Therefore a train which is holding the main track for a meet, can pull on down and occupy the main track within siding limits. Also, another advantage is that the local freight can make switching moves in station limits without holding the signals at Stop to the next station.

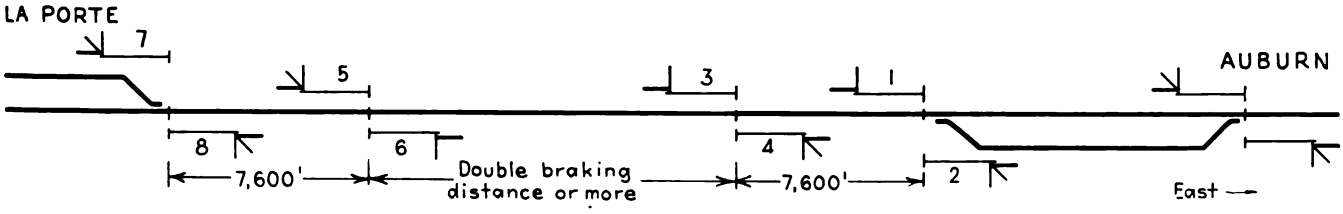
Typical head-block signal location at a siding switch

The plan herewith shows the signaling arrangement between LaPorte and Mt. Auburn, this being typical. The signals are actually numbered according to miles, but in this diagram single-digit numbers are used to expedite the explanation. The station-leaving signals, such as signal 1, govern from station to station, i.e., Auburn to LaPorte. Such signals display only two aspects, normally green for Proceed or red for Stop. There is no provision for following train movements in a station-to-station block.

When a westbound train passes signal 1, that signal stays red until the train passes beyond signal 7 at LaPorte. Signal 5 is an "approach" signal, which displays the yellow aspect when signal 7 is at red. Therefore, signals such as 5 can display three aspects; red, yellow and green. Signals 3 and 6 are opposing intermediate signals, which are staggered a minimum of twice train stopping distance, say for example, 11,000 ft. or more. These signals are included in the arrangement for the sole purpose of stopping trains safely if two opposing trains ever did leave stations simultaneously.

Coded Track Circuits

The controls of all the signals in a station-to-station block, i.e., signals 1, 2, 3, 4, 5, 6 and 8, are all



Signaling for station-to-station block including intermediates for head-on protection

accomplished by track circuits without line wires. The commonly accepted term, "coded track circuits", does not apply to this scheme because different rates of code, such as 75,120 or 180 per minute are not used. In order to explain the Rock Island project, the term "impulse" may well be used. The track circuits are the double-end type, i.e., there is a relay and a battery at both ends of every track circuit.

An impulse of d.c. energy, about 0.4 second long, is fed west, for example, from signal 2 and is repeated through the track circuits to signal 8, where it picks up the track relay, which picks up a slow-release relay. Then, an impulse 0.4 second long feeds east through the track circuits to signal 1 to pick up the track relay and a slow-release relay. This chain of events, over and back, occurs in a little less than 2 seconds, and is repeated continuously. The slow-release relays which hold the signals clear, hold up more than this 2 seconds.

All the eastward signals, 4, 6 and 8 are held at green by the westward impulses repeated. Likewise, all the westward signals 1, 3 and 5 are held green by the eastward impulses repeated. When signal 7 is at red, signal 5 is controlled to yellow by a different polarity on the track impulse, only in the track circuit from signal 7 to 5. Thus, all the signals in a station-to-station block, signals 1, 3, 5 and 4, 6 and 8 are controlled by the track circuits without line wires. A more detailed explanation of this system of circuits is given in the May, 1946 issue.

As mentioned previously, there is no provision in this scheme for following train movements in a station-to-station block. However, if an increase in traffic brings a need for following moves, additional circuits can be provided to change to conventional absolute permissive block. The signals are all in the correct locations for this now. In the signaling now in service, the track circuits on the main track within siding limits are the conventional normally-energized d.c. type, with 4-ohm neutral relays. Ordinary line relays and line circuits are used to control the signals.

Special Layout

In Vinton, the main track and siding cross several streets at grade, and, therefore, if there is a westbound freight train waiting on the siding for a westbound passenger train, the freight should be allowed to pull out behind the passenger, as soon as possible, in order to avoid undue delay to street traffic. Accordingly, a special control was introduced to clear the westbound station-leaving signal to yellow as soon as the rear of the passenger train passes beyond the first intermediate. Thus the scheme can be modified to meet special conditions without introducing any special train rules.

The relays including those for the coded track circuits are in cases

In this project the head-block double signal location is ordinarily located 200 ft. out from the siding switch. However, at locations where there is considerable local switching, in and out of a siding, the signals can be set out farther. For example, at the west end of LaPorte City the double-location headblock is out 500 ft. west of the switch, this allows a place for the switch engine to work without putting the signals to stop all the way to the next siding.

Details of Construction

The signals on this project are the searchlight type with a 500-ohm operating coil. The lamps are the single-filament type, rated at 18 watts 10 volts, and are fed at 7.5 volts as a means of lengthening the life. These lamps are normally fed from a.c., and are lighted continuously. If the a.c. power fails, the lamp feed is cut over the battery, with approach control, from station to station. The practice of continuous burning is used because of the information concerning approach of trains, for the benefit of men operating motor cars. Also continuous lighting is an aid to maintainers in checking the alinement of signals, as well as in finding burned-out lamps. The lamps are replaced with new ones every 120 days.

A two-wire 110-volt a.c. power distribution circuit was extended locally in each direction from stations or other locations where commercial power was available. Thus, 110 volts a.c. is provided at all signals to feed transformers and rectifiers. At each signal, there is a set of seven cells of Edison 80-a.h. storage battery to feed the relays and signal coil and the lamp, if a.c. is off. Each track circuit is fed by two 1,000-a.h. Edison primary cells in multiple, with a rectifier connected to carry all but about 10 m.a. of the normal load.

For the most part, the rails are bonded with Cadweld bonds, except that on some short sections, test installations were made of Hanlon & Wilson short bonds, two for each joint, each extending from an end of the angle bar to the nearest rail. The foulings on main track turnouts are double bonded—on the outside by Cadweld bonds, and on the inside by American Steel & Wire Company Tigerweld plug bonds in the web of the rail.

This automatic signaling was planned and installed by the signal forces of the Rock Island under the direction of C. M. Bishop, signal engineer. The major items of signal equipment were made by the Union Switch & Signal Company.