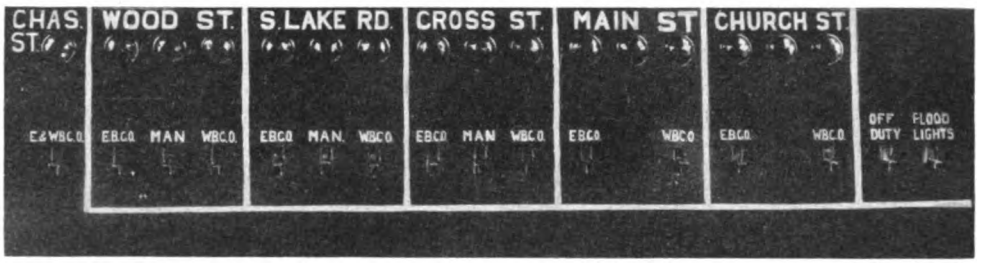
Crossing Protection Signals on the Milwaukee Road

Center of street location

Older type of protection replaced by flashing-light type with rotating stop disk

Displaying the stop indication



The control switches and indication lights are mounted in a panel

DURING the last few years, the Chicago, Milwaukee, St. Paul & Pacific has followed an active program of improving the highway crossing protection on its line. In 1927, the first signals of the improved flashing-light type with rotating stop disk were installed in Minneapolis, Minn., and later 100 signals were installed for protecting 51 grade crossings in St. Paul and Minneapolis, and the results derived in reducing the number of accidents, expediting street traffic and reducing operating expenses, led to the adoption of this type of signal as standard for the road. Older types of protection have been replaced and new installations have been made to the extent that about 334 of these signals are now in service for the protection of 166 crossings on the Milwaukee, Lines East of Mobridge, S. D. Conditions differ considerably at various locations but the improvements completed recently at Oconomowoc, Wis., are typical and will be described in detail.

Operating Conditions

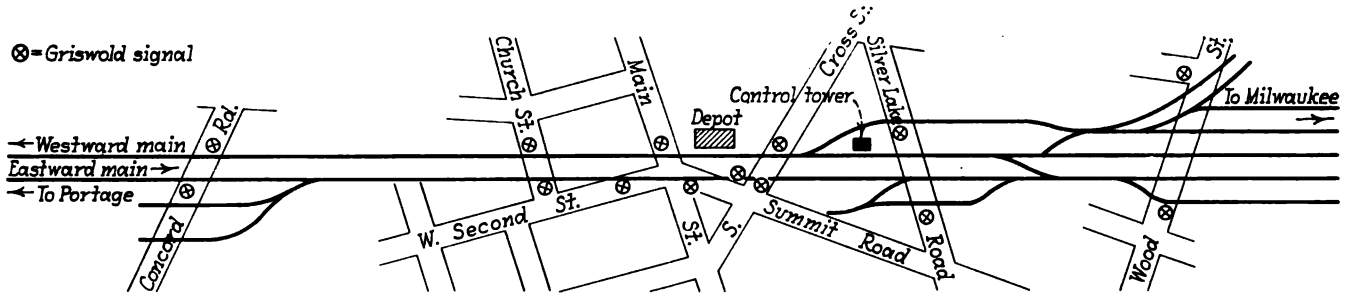
Oconomowoc is a town of about 3,500 population with several small industries such as a milk condensory, mills, etc. Being located in the famous lake region of Wisconsin, the travel on the streets is increased materially in the summer months.

The double-track main line of the railroad between Chicago and St. Paul passes through the residential section of Oconomowoc, and spurs extend to several industries, house tracks and coal yards. Two passing tracks, one for eastbound and one for westbound traffic, extend from a point about 1,770 ft. east of the station for about 4,300 ft. The traffic includes 22 passenger trains and about 12 freight trains daily. Thirteen of the passenger trains stop at Oconomowoc but none of the through freights are scheduled to stop. The local freight train, which is scheduled west through Oconomowoc about 8:00 a. m. and east about 12:30 p. m., usually switches for 30 to 45 min. while serving industries in the town. In addition, there is a patrol run which ties up at Oconomowoc and which also does switching for some of the industries.

Previous Protection

Pneumatically-operated crossing gates were formerly in service at five street crossings. The gates at Summit road and at Main, Second and South Cross street were controlled from a centrally located tower. As Main street crosses the tracks at an angle, and as Summit and Second streets join Main street at the railroad, the gates had to be so long as to be very difficult to operate and maintain them. The gates at these streets were in service 24 hr. every day.

At Silver Lake road, the gates were operated, during the period from 7 a. m. to 11 p. m., by the pumpman,



Plan showing location of signals in Oconomowoc

who also operated the water pumping station nearby. Two wig-wags, with a bell, controlled automatically and under manual control of the pumpman were also in service at this crossing. At Concord street, there was an automatically controlled wig-wag and bell, and a flagman was on duty from 6 a. m. to 6 p. m. At Wood street, a flagman was on duty from 7 a. m. to 7 p. m. Thus a total of nine men were employed as pumpmen, gatemen and flagmen.

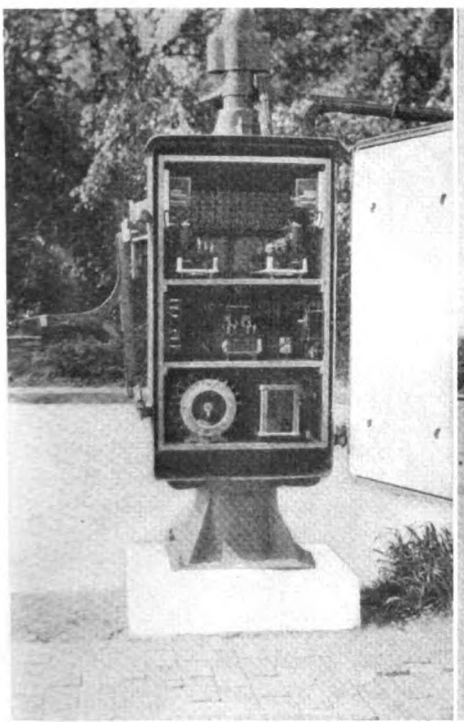
The lack of uniformity of the protection afforded at different crossings was objectionable, with gates in service full time at some crossings, and part at others, and with wig-wags and bells or flagmen at other crossings. The operation of the gates was slow, thus delaying street traffic unnecessarily. The division superintendent and the signal supervisor of the Milwaukee conferred with the city council of Oconomowoc in an effort to develop uniform full-time protection at all the crossings in the city. Members of the council inspected installations of the duplex flashing-light signal with rotating stop disk in nearby towns and after a thorough investigation, passed an ordinance authorizing the Milwaukee to install the rotating stop-sign type of signals in place of the gates, wig-wags, bells and flagmen, formerly in service at the six crossings, and required that in addition to automatic track circuit control, an auxiliary manual system of control be used to prevent unnecessary operation of the signals when trains were switching, or standing at the station.

A new rotary-type pump, operated by an electric motor controlled by a float switch, was installed to replace the old steam pumping plant, thus dispensing with the need for a pumpman.

Two rotating stop sign signals, with regular flashing lights, were installed at each of the crossings at Concord, Wood, Silver Lake, South Cross and Church streets, and four such signals were required at the combination crossing of Main, West Second and Summit streets, thus a total of 14 signals were installed.

The principal feature of this type of signal is the Stop sign, which shows the word Stop in black letters on a yellow field with a black border, constructed according to the standards of the National Conference on Street and Highway Safety, which has been adopted by almost all of the states as the official Stop signal for highway and street traffic.

In the construction of the signal, the Stop sign is attached to a vertical shaft operated by an electrical motor. The mechanism operates to clear the signal, i. e., to turn the edge toward the approaching highway traffic. When a train approaches, the mechanism is released and the sign turns by force of gravity, so as to present the word Stop to the view of approaching street traffic and at the same time, the regular red lights on either side flash alternately. Fifty-watt, 110-volt bulbs are used in these flashing lamp units and each signal is equipped with four lights, two to shine in each direction. The flashing lights for one or more crossings are



The instrument case at Main street

A side-of-street location

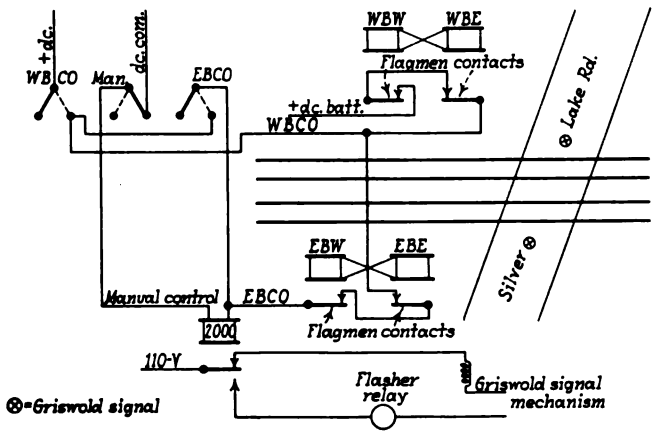
View showing signal mechanism

controlled by an induction-disk-type flasher equipped with carbon contacts. A floodlight, equipped with a 25-watt lamp, illuminates the crossbuck, "Railroad Crossing," sign continuously during the hours of darkness, this circuit being controlled by a snap switch in the watchman's tower. A second lighting unit, equipped with a 25-watt lamp, illuminates the Stop sign only when it is turned toward street traffic. This signal is said to conform with the new requisites for highway crossing signals adopted by the Joint Committee on Highway Crossing Protection of the American Railway Association, with the possible exception that these requisites state that the lettering of the stop sign is to be red, whereas the lettering is black on the disk of the signals being used on the Milwaukee.

Control of Signals

The track circuits are so arranged that the sign is turned and the flashing lights operate the usual 20-sec. interval before the arrival of the train at each crossing. This track circuit control is effective for the operation of trains in either direction on each main track.

The switching of the local freight and the operation of the passenger trains which stop at Oconomowoc, are included in the period from 8 a. m. to 7 p. m. During this period, a man is on duty in an elevated tower near



Typical combined manual and automatic control circuit

Silver Lake street. Mounted in this tower is a sheet metal control cabinet with small levers, which actuate enclosed knife-switches for controlling the signals. A set of indication lights is provided for each crossing. For example, when an eastbound train approaches, the several signals start operating through the automatic track circuit control arrangement. A green lamp on the watchman's panel flashes as soon as the corresponding signal starts to operate. If the train stops at the station, the watchman operates a lever which clears the signal at Silver Lake street. When he operates this cut-out lever, the corresponding green light is extinguished and a red light immediately above the switch is illuminated as a warning that he has cut out the automatic control. This cut out is effective for only the one direction on the one track. If a train approaches on the westbound track, the signal will operate automatically, independent of the fact that the watchman cut it out for the eastbound track. When he sees that the train is ready to start, he returns the levers to the normal position and the signals operate through the automatic track circuit control, thus warning street traffic of the approaching train. The same method of control is used when the local freight is switching on the main tracks.

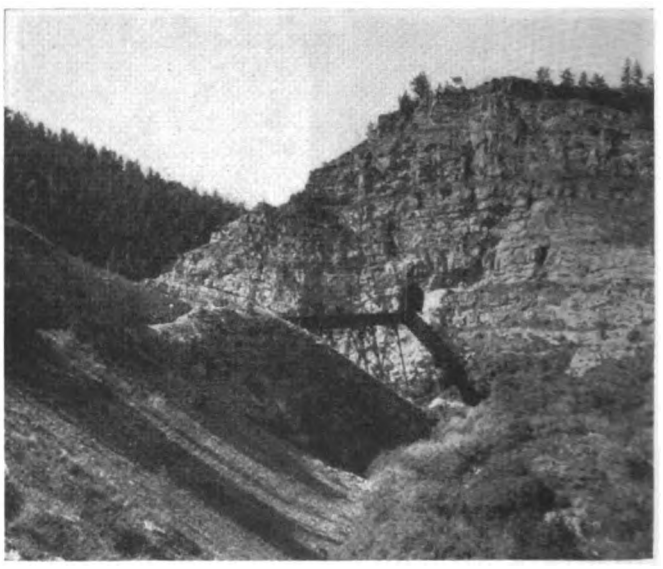
However, when a train is on the passing track or when the local is operating on an industrial track (not equipped with track circuits), the towerman watches the train and operates the signals in time to provide a warning. In such cases, his control is directly manual, no automatic features being involved. A separate switch is provided for this manual control feature for each of the crossings where non-track-circuited tracks are involved. The green light above each set of levers flashes when the signal is at Stop and this serves as a reminder to the watchman to clear the signal as soon as the train passes the corresponding street.

The signals and track circuits on this division are operated on alternating current, with a 4,400-volt single-phase feeder circuit on the pole line. Therefore, the crossing signals are fed from this line through transformers. Eighteen years of experience has shown that this power supply is very reliable. However, as an emergency source of power for the operation of the signals, a connection is made with the Oconomowoc power system, the cutover being automatic. When power is cut off of the signal line, the track circuits are all de-energized but the watchman can clear the signals by manual control. Likewise, the flashing lights and the floodlights are operated from the emergency supply. In case the normal power is cut off when the watchman is not on duty, the signals simply remain at Stop until the normal power returns or until the watchman is called or the maintainer takes control. In case both sources of supply should be cut off simultaneously, the signals assume the most restrictive indication by gravity and remain in this position, thus affording a warning to the street traffic.

Satisfactory Results

By installing these new signals in place of the previous equipment and flagmen, the Milwaukee has provided uniformly dependable protection at its crossing, which has been a success in reducing the number of accidents. The city council and the public, in general, seem to be well pleased with the improvement. The annual reduction in operating expenses represents about 36 per cent on the cost of the improvements, including the signals, the new electric pump, etc.

The signals and the control machine were furnished by the Griswold Signal Company, Minneapolis, Minn., and were installed by the signal department forces of the Milwaukee road.



Eagle Nest tunnel on the C. M. St. P. & P.