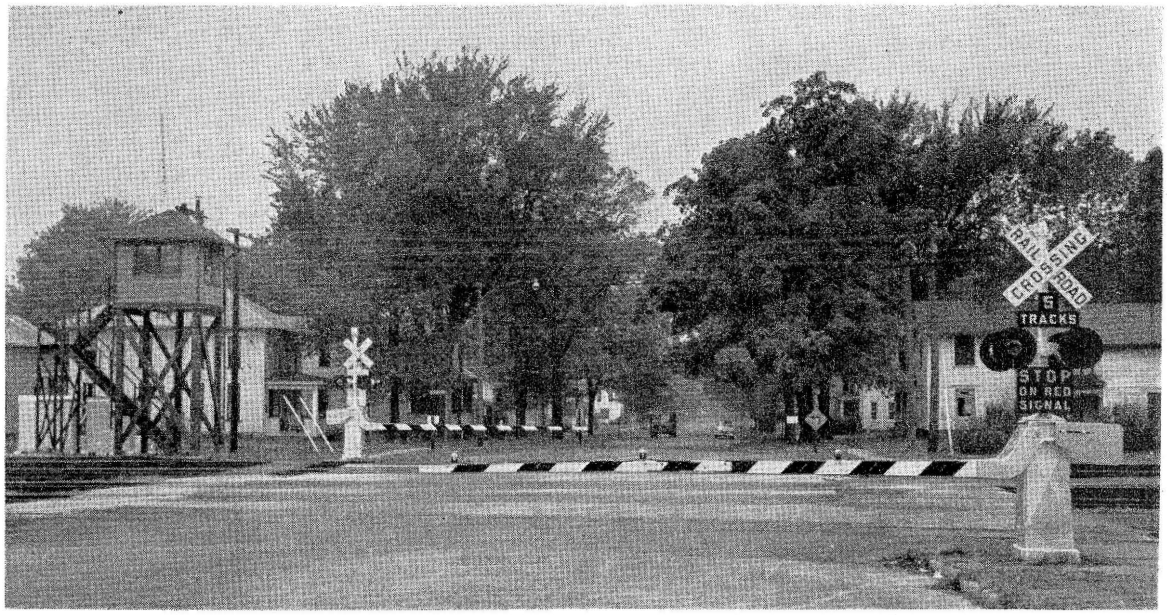
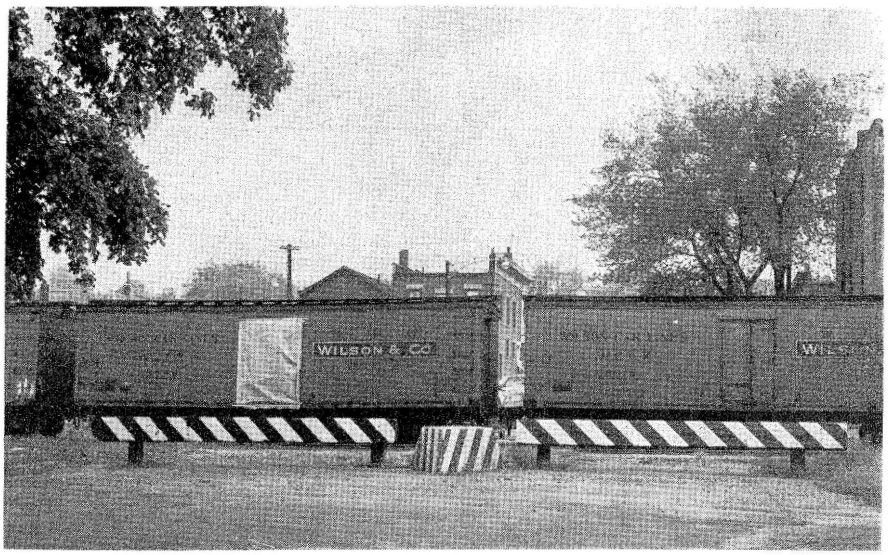


Gates Installed at Five Crossings . . . Barriers at Four

THE CHICAGO & NORTH WESTERN, in cooperation with the city and state authorities, has carried to completion a program of improved protection and safety at all of the crossings over the double-track main line through Morrison, Ill., 124 miles west of Chicago on the route westward to Omaha. Morrison grew up on both sides of the tracks. The business district is on a street which is parallel with and about two blocks north of the tracks. About a third of the residences and a few small industries are south of the tracks. As the city developed, nine streets were extended across the railroad.



Flashing-Light Signals Previously

In 1929, automatic flashing-light signals were installed at each of the crossings with manual supervision from two separate points. Since the installation of this protection, the number of trains operated on the railroad has decreased, due in part to the discontinuance of some local passenger trains and the increased tonnage hauled per freight train. During the same period, as the city of Morrison expanded, the pedestrian and vehicular traffic increased.

With the increase in auto traffic and its usual quota of careless or indifferent drivers, it appeared desirable to provide improved protection at the more heavily traveled street-railway intersections and to close the less important ones. After several conferences, the city, the state and the railroad decided upon the installation of flashing-light signals with short-arm traffic gates at five of the crossings, and the placing of barricades at the remaining four crossings. Representatives of the city and the railroad made extensive studies of the pedestrian and vehicular traffic at each of the nine crossings, careful consideration being given to the location of fire stations, schools, churches, industries and stores.

The crossings protected are: Cherry Street, which crosses the tracks at the east end of the passenger station platform. This crossing carries much of the local pedestrian and vehicle traffic, and is also a state highway. Jackson Street, serving the residential district at the east end of town. Genesee Street, which crosses the tracks at the west end of the passenger station platform, and carries much of the pedestrian and vehicle traffic between the business section on the north side and the residences on the south side of the tracks. Heaton Street, serving an industrial area west of town, and Orange

Street, in the center of the business district. The remaining streets, Clinton, Madison, Grape and Base are closed and barricaded.

Being a state highway, the State of Illinois shared in the cost of the installation at Cherry Street; the city of Morrison also contributed to the project, and the balance of the cost was borne by the Chicago & North Western.

The New Protection

Each of the five crossings is now protected by flashing-light signals with short-arm gates, which, when lowered, extend across the right half of the pavement approaching the tracks. This leaves the other half of the roadway unobstructed to permit vehicles to depart from the crossing. The gates are on the same mast with the flashing-light signals, and a warning bell is attached to one of the signals at each crossing. The protection is automatically operated, on the approach of trains, by track circuits.

When a train enters an approach section, the bell, the flashing-light signals and the lamps on the gate arms are operated for a pre-warning period of 5 sec., after which the gates operate, reaching the lowered position in about 8 sec. The gates are electrically driven down 44 degrees and lowered by gravity the rest of the way. The circuits are designed so that the gates are down a minimum of 10 sec. before the arrival of a train at the crossing. When the rear of a train clears the crossing, the gates start to raise and will reach the fully raised position in approximately 6 sec.

Speed Selection Controls

Regularly scheduled daily train movements through this district consist of 10 passenger trains, 10 freight trains, 1 local freight daily except Sunday, and about 6 extra freights daily. The passenger trains which do not stop at Morrison operate at speeds ranging up to 90 mph, and the freight trains at speeds up to 60 mph.

Six of the passenger trains regularly stop at Morrison. These trains, and the local freight, reduce speed when approaching and stopping at Morrison. Therefore, if the controls had been laid out for only the maximum speed, the slower trains would cause the gates to be down a longer time than desirable, thus delaying street traffic. To reduce such delays to a minimum, selective approach speed control was installed, so that, for the slower moving trains, the protection does not operate until they are closer to the crossing. The protection is designed to operate a minimum of 25 sec before any train reaches a crossing.

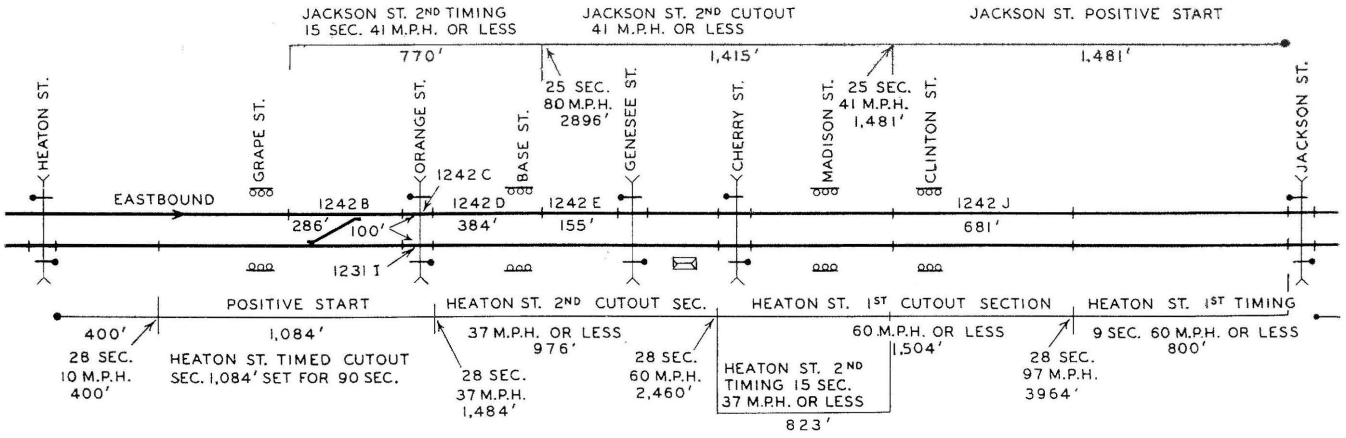
If the leading wheels of a westward train pass through timing track circuit 1211B at more than 81 mph, the protection at Jackson Street is set in operation when the train enters track circuit 1211C, thus providing 3,694 ft. warning, which is adequate for speeds up to 100 mph. On the other hand, if the average speed in timing circuit 1211B is 81 mph or less, then the protection at Jackson Street is not set in operation until the train enters track circuit 1211D, thus providing a 2,994 ft. approach. This is typical of the selection between through passenger trains of two speed ranges.

If the front wheels of an eastward train pass through the 2nd timing section, track sections 1242B, C & D, at more than 41 mph, the protection at Jackson Street is set in operation when the front wheels enter track circuit 1242E, thus providing a 2,896 ft. approach, which is good for 80 mph. This is an example of selection between a through (non-stop) passenger train and a through freight train.

The next example deals with an eastward passenger train or a local freight that approaches at reducing speed for a stop at the passenger station. If the front wheels of the eastward train pass through the Jackson Street 2nd timing section at 41 mph or less, then the protection at Jackson Street does not cut in until the front wheels enter track circuit 1242J which is the beginning of the 1,481 ft. positive start for Jackson Street. Thus the Jackson Street protection is not put in operation while an eastward train approaches and makes its station stop. When determining the length of the speed measuring sections, an allowance is made for a possible acceleration of 5 mph.

Time-Out Control, Too

For a westward passenger train that is to make a station stop, the speed selection circuits are arranged so that the protection at Heaton Street will not be set in operation if the average speed of the train is 60 mph or less in the Heaton Street 1st measuring section, or is 37 mph or less in the Heaton Street 2nd measuring section, and also if the train makes a station stop with the leading wheels east of track circuit 1231I at Orange Street crossing. In some instances, when making a station stop, the locomotive may go beyond Orange Street, in which case it occupies the positive control section, setting the protection in operation at Heaton Street. When the leading wheels enter the positive section, a 90-sec. time-element relay is started in operation. The train may be stopped for 7 to 10 min. to unload mail and express, in the meantime, however, at the end of the 90-sec. timing period, the control at Heaton Street is cut out and the gates raise, to let street traffic proceed over the crossing. When the train finishes its station work and starts toward Heaton Street, the pro-



tection will cut in again when the leading wheels enter a track circuit 400 ft. long in approach to the crossing.

When a switch engine is approaching eastward on the eastward track, the gates will go down at Orange, Genesee and Cherry Streets. This switch engine may stop just east of the crossover between Grape and Orange Streets and use the crossover switches to go over onto the westward track. When the trainman throws the switch, a circuit through the switch circuit controller, picks up a stick relay which cuts out the protection and raises the gates at Orange, Genesee and Cherry Streets.

Supervisory Manual Control

The previous flashing-light signals at the nine crossings were normally controlled automatically by track circuits in the conventional manner, with supervisory manual control to cut out operation of the signals and let street traffic proceed when approach sections were occupied but no movement over the crossing was imminent, as for example during switching moves. A watchman, on duty 8 am to 4 pm at Cherry Street crossing, had supervisory manual control of the signals at Clinton, Madison and Cherry. A watchman on duty 8 am to 4 pm at Base Street had control of the signals at Orange, Genesee and Base Streets.

The new installation includes not only automatic track circuit control as previously explained, but also supervisory manual control. The control machine, located in an elevated cabin on the south side of the tracks just east of Cherry Street, includes manual controls for the protection at Cherry, Genesee and Orange Streets. A watchman is on duty in this tower 8 am to 4 pm daily, except Sunday.

The panel of the machine is slanted toward the attendant to provide better visibility. On this panel, the tracks are represented by heavy white lines, the occupancy of each approach track circuit is indicated on the panel by a white light. A red light repeats occupancy of each of the short track circuits which extend across the street at each crossing. When one of these short track circuits over a crossing is occupied, the manual control will not cut out the protection.

Lighter white lines represent the outlines of the streets where they cross the tracks. Below the location representing each crossing, is a telephone-type key, which is normally in the raised position. When an insulated motor car is approaching a crossing, or a movement approaches on a side track, the towerman throws the key for that crossing in position to manually operate the crossing protection. After the movement passes, he restores the key to return the protection to automatic operation.

Below the telephone-type key for each crossing is a group of four red push buttons, and below the red buttons is one black button. An example of the use of supervisory manual control could be as follows: An eastward switch engine approaching on the eastward track would automatically put the gates down at Orange, Genesee and Cherry Streets. However, the switch engine stops short of Genesee Street to set out a car on the spur just east of Orange Street. The towerman pushes the eastward red buttons for Genesee and Cherry, the button pushed in each group being that at the upper left. This cuts out the protection and raises the gates at Genesee and Cherry. At the time each button is pushed, 1-in. red lens are lighted above the symbol for Genesee and Cherry Streets, as a reminder to the towerman that he has cut out the protection, and is responsible for watching the switching. When he sees that the switch engine has set the car out and is back on the main track ready to proceed toward Genesee Street, he pushes the black button below the red ones for that street. This sets the protection in operation and lowers the gates.

In the discussion above, when the towerman pushes the red button, a circuit was closed to pick up a stick relay, which sticks up through a back contact of the relay for the track circuit occupied by the switching move. This stick relay cuts that approach out of the controls, so that the gates are raised, but in no case can it cut out the protection if the track circuit on a crossing is occupied. Thus, this one red button and its corresponding stick relay are associated only with the eastward approach section to Genesee Street and streets beyond on the eastward main track. The other button for the eastward track and its stick relay are associated only with the westward approach on the eastward track. Similarly, two other red buttons are for the westward track at Genesee Street. The reason for the separate buttons and associated stick relays is to isolate these special controls to the switching move being watched by the towerman. In the meantime, if some other train approaches in the opposite direction on the same track, or in either direction on the other track, the flashing-light signals will operate and the gates will automatically go down regardless of the supervisory controls then in effect.

At each crossing is a cast-iron box, locked with a signal department padlock, which contains a three-position switch, for use by signal forces in periodic maintenance and inspections. By moving the switch handle to the right, the gates are raised by direct application of battery to the control relay, cutting around all other relay selections. If a train approaches, the switch handle can be moved to the left to lower the gates and operate the flashing-light signals. The switch must be in the normal or automatic position, which is the center position, to close the cover, because of an interlocking feature on the inside of the cover.

Primary-secondary track relays are used on each of the short track circuits at the crossings. This use of primary-secondary arrangement not only provides better shunting but also insures proper sequence of directional controls.

The flashing-light signals with short arm-gates and the supervisory control panel for this project were manufactured by the Griswold Signal Company. The relays, transformers, housings and other signal material was manufactured by the General Railway Signal Company. The installation was planned and constructed by signal department forces under the direction of H. T. Fleisher, assistant chief engineer, communications and signals.