

Looking west over the crossing and intersection of Eighty-Seventh street and Crawford avenue. View shows the combined gates, flashing-light signals and color-light traffic signals for crossing protection

Gates, Signals and Traffic Lights at a Wabash Crossing

A solution for the problems at an intersection of two highways on the main line of a railroad

NEAR Ashburn, Ill., on the southwest side of Chicago, two main highways, Crawford avenue and Eighty-Seventh street, cross at right angles, and the angle of this crossing is bisected by the double-track main line of the Wabash between Chicago and St. Louis. A further complication of this layout is that the Southwest highway, Route 7, which parallels the railroad on the west side at a spacing of about 100 ft. centers, crosses Crawford avenue and Eighty-Seventh street near the railroad. Thus, from the standpoint of protection and traffic direction, the complete layout includes a crossing of one railroad with two highways, and three separate crossings of highways. Each of the three highways handles heavy traffic, and, as the crossing is in open country, the speeds of highway vehicles are high. The railroad handles 8 passenger trains, 6 through freight trains and 2 local freight

trains daily, totaling 16 train movements daily as well as extra trains when required. The speed limit for passenger trains is 80 m.p.h.

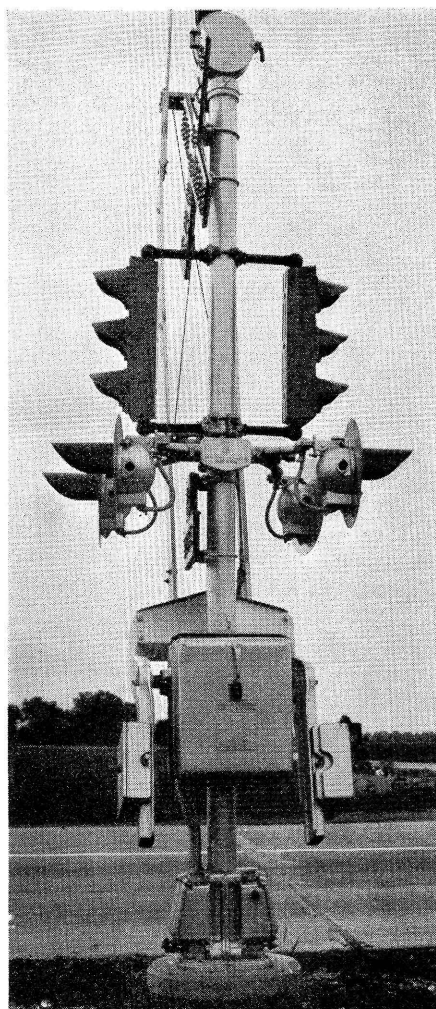
Previous Layout of Protection

Prior to the recent improvement program, Southwest highway was considered as the major route, traffic on this highway being allowed to operate through without stops. Vehicles on Crawford avenue or Eighty-Seventh street were required to stop at "Stop" signs before entering or crossing the Southwest highway. Crawford avenue was superior to Eighty-Seventh street, and vehicles on Eighty-Seventh street had to stop at "Stop" signs before entering or crossing Crawford avenue.

As protection to prevent vehicles on Crawford avenue and Eighty-Seventh streets from entering on the railroad tracks when trains were approaching, flashing-light signals located at the right of each of the four approaches to the railroad-highway

crossing were in service. These signals were installed under first Illinois program in January, 1936, and were of the Illinois standard type with back-to-back lights, reflex stop-on-red-signal signs, reflex number-of-tracks signs and cast-iron crossbuck signs. The operation of these signals was controlled automatically by track circuits.

As a means of improving safety and facilitating highway traffic, the State of Illinois proposed an installation of red-yellow-green stop-and-go traffic signals at the three intersections of highways which included the intersection of Crawford avenue and Eighty-Seventh street located exactly on the Wabash tracks. This decision meant that the stop-and-go traffic signals would have to be adjacent to or on the same masts with the highway-railroad crossing signals. Also as a means of increasing the effectiveness of the protection of the highway-railroad crossing, Cook County agreed to add short-arm gates to the existing flashing-light signals, also the re-



Combined red, yellow and green traffic signal, flashing-light signal and short-arm-type gate

on each of these four masts, the equipment includes, reading from top to bottom, a crossing bell, a reflectorized "Railroad Crossing" cross-buck sign, a red-yellow-green traffic signal, a flashing-light signal, a reflectorized "2 Tracks" sign, and the gate.

Operation of the Protection

While ordinary operation is in effect, the gates stand clear, the bells are silent, and the flashing-light signals are non-illuminated, but the red-

on the gate arms are set in operation for a pre-warning period of 5 sec., and then the gate arms start operation and are lowered in from 9 to 12 sec., then the bells are cut out of operation. For a train traveling at 80 m.p.h., the pre-warning period starts at least 30 sec. before the arrival of the train at the crossing, and the gates are down at least 13 sec. before the train gets to the crossing. The track circuit controls are arranged for train movements in either direction on both tracks of the double-track line.

During the change-over control period, the northward traffic signal on Crawford avenue at Southwest highway, and also the westward traffic signal on Eighty-Seventh street at Southwest highway, hold the green aspect for several seconds, so that highway vehicles that may have been

flex crossing signs and bells, re-using such parts as possible from the existing installation. The gates are of the short-arm type with arms 27 ft. long which is adequate to reach across the right-hand lane of traffic approaching the crossing. One gate and signal mast is used at the right side of the pavement for each of the four approaches to the crossing, and no gate obstructs the lane of traffic departing from the crossing so that vehicles are free to move off the crossing.

Each gate arm is equipped with three red lamps with $5\frac{3}{8}$ -in. spread-lite lenses arranged to direct rays in each direction along the highway. One lamp is located 3 ft. from the tip end of the arm, a second is 5 ft. from the first and a third is 5 ft. from the second. When in operation, the lamp nearest the tip end burns constantly, and the other two flash alternately in synchronism with the flashing-light signals. The electric bulbs in the gate lamps as well as those in the flashing-light signals are rated at 10 volts, 18 watts.

A stop-and-go traffic light signal also is mounted on the mast of each of the four gates approaching the Crawford avenue—Eighty-Seventh street—Wabash crossing. Therefore,

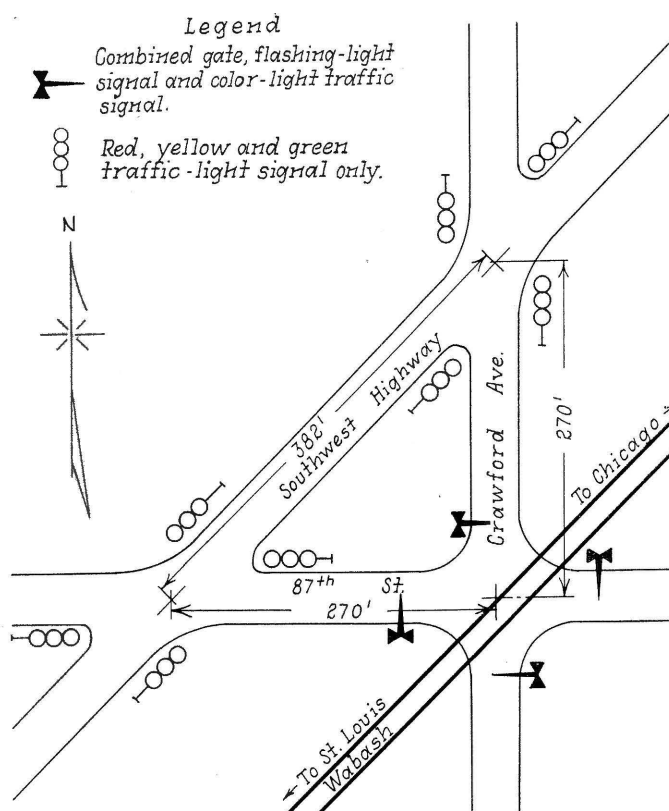
yellow-green traffic signals continue operation according to a predetermined timing cycle in the usual manner to direct traffic first on Crawford avenue and then on Eighty-Seventh street, this operation also being coordinated with the traffic signals at the two other highway crossings.

When an approaching train enters an approach control track circuit section, the four traffic signals at the Crawford-Eighty-Seventh intersection display the red, Stop aspect, the bells start ringing and the lamps in the flashing signals as well as those

standing on the railroad crossing will be free to move off the crossing. After this period, the traffic signals for the northeast-southwest through route on the Southwest highway display the green aspect, and continue to do so until the rear of the train clears the crossing.

Duration of Protection

The gates stay down, the flashing-light signals continue to operate and the red aspect is displayed in the traffic signals at the crossing until the



Track, highway and signal location plan of the crossing

rear of the train clears the crossing. Then the gate arms are raised in about 9 sec. The flasher signals and gate lamps are extinguished, as the gates near their raised position. After the gates are cleared, the control of the traffic signals is returned to the normal timing cycle.

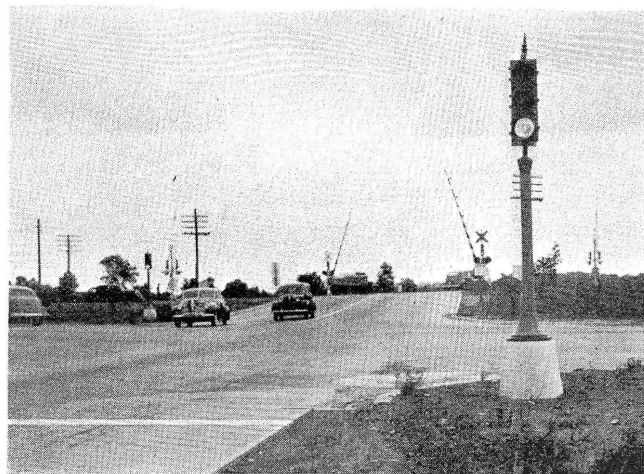
Connection Between Two Systems

The only circuit connection between the traffic signal system and the railroad-highway signal system is one circuit of the traffic system through front contacts of a preemptory relay in the railroad's instrument case. This relay is the equivalent of a ZPR relay which is so controlled that it is released whenever a train is approaching the crossing or occupying either of the short track circuits which include the crossing on the two tracks. This relay is, of course, controlled in the usual manner by stick relays to cut out the operation of the protection when a train is receding from the crossing.

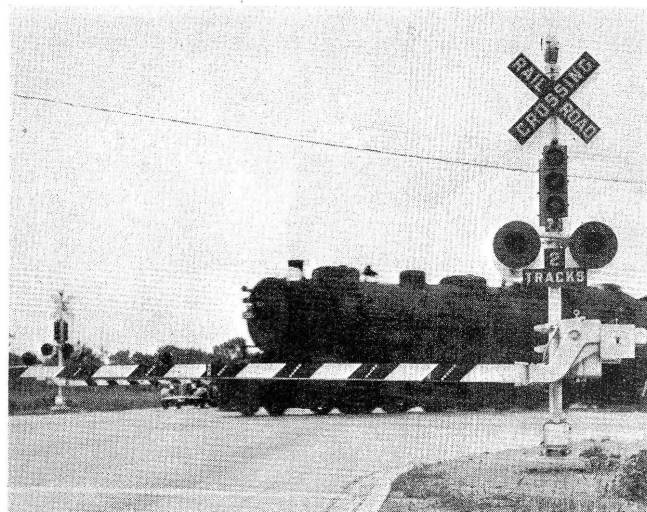
Details of Protection Equipment

The combination gate and flashing-light form of protection used on this project is the Model 10 of the Western Railroad Supply Company, which furnished the gates, flashing signals and bells, while the red-yellow-green traffic light signals were made by the General Electric Company. The gate mechanisms are of the Type 3564, using a 12-volt d-c. motor to drive a gear arrangement to move the gate arm from the lowered to the raised position, the ratio of revolutions of the motor to the gate shaft being 220 to 1. The gate is held in the raised position by maintaining energy on the coil of a ratchet hold-clear device. Release of this coil permits the gate arm to be lowered by force of gravity,

Looking east over the intersection of the Southwest highway and Eighty-Seventh street with traffic signals displaying green. The crossing and gates are shown in the background



View looking south over the crossing from Crawford avenue with a train on the crossing. One of the combined stop-and-go traffic signals, flashing-light signals and gates in the downward position is shown in the foreground



effected by counterweights which are arranged to accomplish a "downward" torque of 280 lb. when the gate arm is at 70 deg., and this gradually decreases to 50 lb. when the arm is lowered to the horizontal position. A downward torque of 280 lb. when the gate is in the 70-deg. clear position is adequate when the arm is released, to force it down promptly

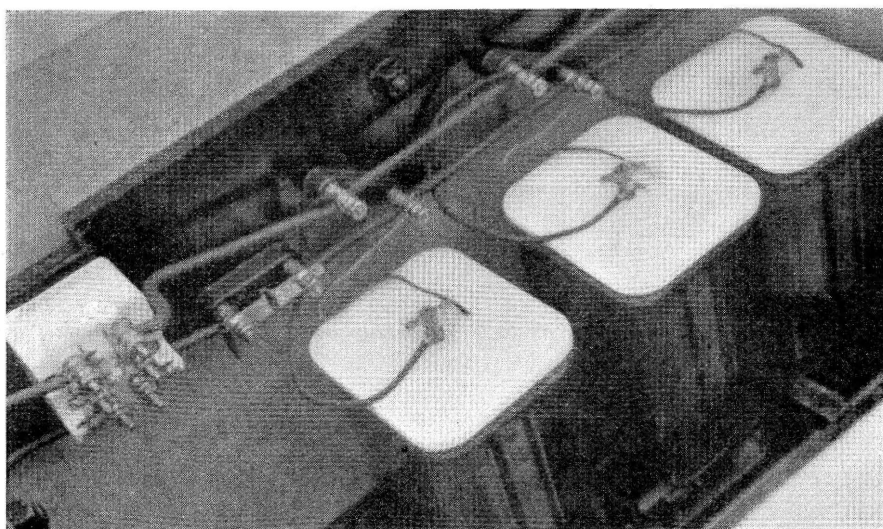
against a wind of 50 m.p.h. velocity. A downward torque of about 50 lb. is required when a gate is in the horizontal position in order to prevent the arm from "bouncing" or "drifting" in a strong wind.

By locating the foundation so that the center of the mast is 6 ft. from the curb line, the minimum vertical clearance from the surface of the pavement to the gate arm is 14 ft. or more, and 14 ft. is the national standard vertical clearance for bridges and other structures over highways.

Power Supply System

The incoming 220-volt a-c. power supply to this installation is brought in through a Raco Type 324-1 disconnect switch with 3-amp. fuses. The gate lamps and flashing-light signal lamps are fed normally from a low-voltage transformer, but, in case of an a-c. power outage, they are fed from a set of five cells of 120-a.h. Exide Type EM-7 storage battery, which is used also to feed control circuits. A set of nine cells of 80-a.h. Edison Type B4H storage cells is used to feed the two of the gate oper-

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Three cells of primary battery in multiple feed each track circuit

C.T.C. on the Pennsylvania

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single-post terminals, lightning arresters, resistance units, switches in the code line, low-voltage transformers, rectifiers, telephone set, filters, automatic overload cut-out relays in the switch power circuits, and the manual control levers.

Using facilities at Terre Haute, these panels were drilled and assembled, according to scaled drawings, and all of the equipment was mounted in place, complete with tagging. Wires from the terminals on these large boards run through overhead ducts and down to the terminals on the back boards behind the relays. The relay racks in these houses are made up with shelves made of sheet iron and back boards of asbestos supported on angle-iron frames. A rubber mat is provided on each shelf. The relay racks, terminal boards and all interior wiring, complete with tags, were installed in the concrete houses before they were shipped from Terre Haute. The racks and boards were installed in the brick houses after they were constructed.

The relays in the house at Casey are of the modern quick-detachable type, using plugs and receptacles, as shown in one of the illustrations. The relays on the remainder of the installation are of the shelf type, and, where required, are equipped with spring mounting to minimize the effects of vibration.

Cable Distribution

At the line pole at each field station, taps from the line wires are extended to terminals in a cast-iron junction box mounted just below the crossarms. From this box, cable extends down the pole and underground to the instrument house. This cable, which is of the type buried directly in the earth, is made up with protective coverings including a lead sheath, two steel tapes, and impregnated jute. Cable of the same construction extends from the house to each switch and signal, for example, 5 No. 9 and 7 No. 14 wires extend to each switch. In the bootleg riser box at each switch, the ends of the wires of the cable are soldered to pieces of No. 9 flexible insulated wires which extend through flexible metal conduit to the switch machine.

At Terre Haute, the line batteries and charging equipment are located in a separate room provided for the maintainer. Also located in this room is a special test panel with levers, indication lamps, meters and rheostats,

for making complete tests of the coding apparatus.

This centralized traffic control was planned and installed by signal forces of the Pennsylvania.

Wabash Crossing Protection

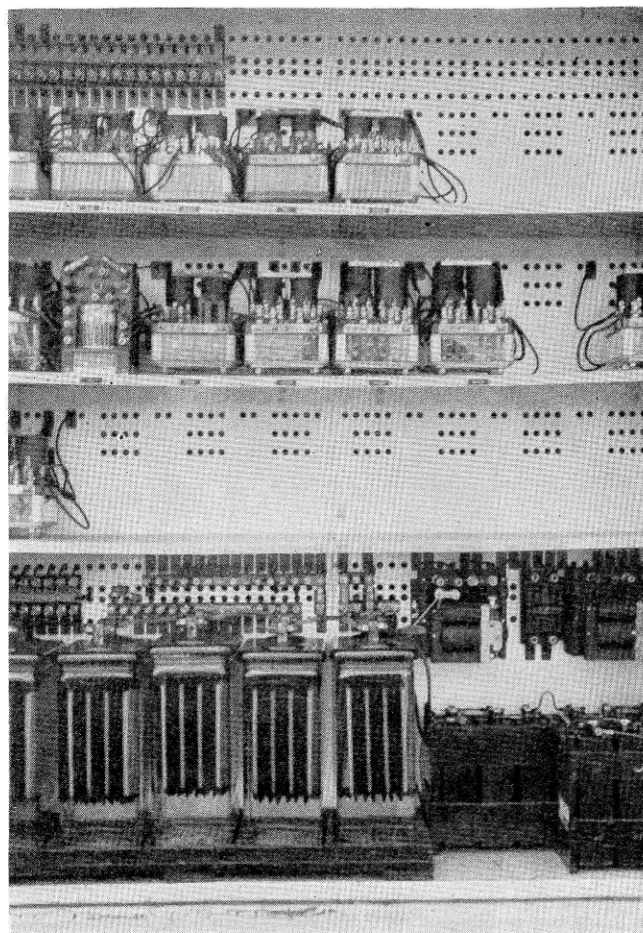
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ating mechanisms, and a similar set of batteries operates the other two gates. The batteries are on floating charge through Union copper-oxide rectifiers. Each track circuit is fed by three cells of No. 572 Columbia 500-

dle of the case. This frame rests on two precast concrete foundations 27 in. by 27 in. by 48 in. Before the case is set in place, the bottom and the portions which rest on the frame are covered with a coating of No-Oxide Grade A grease to prevent oxidation. Plastic, elastic and adhesive signal cement are used to fill any space between the case and angle-iron rack.

The slow-acting relays are of the 350-ohm DN-19 type, the control relays are of the 500-ohm DN-11 type, the track relays are of the 4-ohm DN-11 type, and the flasher relays are of the 500-ohm FN-16 type, all of which were supplied by the Union Switch & Signal Company.

All wiring distribution to the signals is underground cable, the outer



Interior view of one of the instrument cases at the crossing, showing the control relays and storage battery for control and gate operating circuits

a.h. primary battery, connected in multiple, with a 2.5-ohm Raco limiting resistance in series with the circuit.

The relays, rectifiers and batteries are located in two sheet-metal instrument cases, one to the northwest and the other to the southwest of the crossing. As a means of supporting each case it is mounted on a rack or frame made of $\frac{3}{8}$ -in. by 2-in. by 2-in. angle iron, with a piece of this material along the front and back, across each end, and across under the mid-

protection being of the mummy type, excluding all metal, which was furnished by the Kerite Insulated Wire & Cable Company. The cables leading to signals 3 and 2 pass under the highway from the instrument cases in $4\frac{1}{2}$ -in. conduit.

This crossing protection was planned and installed by the regular signal construction and office forces of the Wabash under the jurisdiction of G. A. Rodger, signal engineer. The project was installed under agreement with and financed by Cook County.