



NINTH STREET CROSSING (looking south) has overhead traffic lights to govern vehicular movements

Unusual Control for Crossing Protection

In area where tracks are used only for switching moves, traffic lights for street vehicles, and colorlight signals for enginemen, are combined with radio, to improve protection and reduce expenses.

PROTECTION FOR STREET VEHICLES has been improved in Richmond, Va., where streets cross tracks of the Chesapeake & Ohio which are used for switching moves to serve the freighthouse and several industries in this area.

The freighthouse is just east of Ninth street and north of Canal street. The tracks from the west which enter this freighthouse are stub-end at the east end. Also in this general area there are numerous spurs which serve warehouses, tobacco factories and cold-storage plants. No tracks that are in service extend east of the area, and therefore the only moves are switching moves. The freight yard is near Second street which is west of this freighthouse area. When the switch engine, in the Second street yard, gets a cut of cars ready to go to the freighthouse, the move is made into this area from west to east via the track which enters at the lower left corner of the plan and runs diagonally across Sixth, Seventh and Eighth streets. Ordinarily one switch

crew does all the work in this area; therefore the possibility of opposing moves is eliminated.

As shown on the plan, 11 tracks cross Ninth street; 7 tracks cross Eighth street; 3 tracks cross Seventh street; and 4 tracks cross Sixth street.

Heavy Street Traffic

Canal is an important east and west street which handles heavy vehicle traffic both ways. Ninth street handles heavy traffic both north and south. Eighth street is a one-way street, southbound only. Seventh is one-way, north only. Sixth handles traffic both north and south, and Byrd street handles traffic both east and west. This entire area is built up with factories, warehouses, mills and cold-storage plants. To avoid delay to street traffic during rush hours, no switching moves are made in this area between 7 am and 9 am, or between 5 pm and 7 pm.

Previously the crossings of the tracks and streets were protected by watchmen on the ground. On

each of three eight-hour tricks daily, one man was on duty at Ninth street, one man at Eighth street and one man at Seventh street. On each of two tricks daily one man was on duty at Sixth street. This protection was in effect seven days every week. Thus the forces included 11 five-day watchmen and 5 swing men who worked 22 days each week. Because of the ever-increasing volume of vehicular street traffic, the watchmen had difficulty in stopping this traffic, and furthermore the watchmen's work was hazardous because too many of the drivers purposely ignored the watchman's warning, unless they could see the switch engine or cars approaching closely. With the cooperation of the traffic department of the City of Richmond, the Chesapeake & Ohio signal and communication forces planned a system of protection that has now been in service several months, and has improved safety. The project cost \$79,000, and effects an average saving of 48 per cent annually.

Conventional red, yellow, green



EIGHTH STREET CROSSING (looking east): colorlight signals No. 8 governing train movements in both directions over crossing are controlled from tower

traffic lights are in service at intersections of streets throughout Richmond, including some intersections in the switching area, such as at the intersections of Ninth and Canal, or Seventh and Canal. In order to get approval from city authorities, this same type of street traffic lights was

utilized in the new protection project to stop street traffic short of railroad tracks. If a motorist disregards one of the traffic lights at a railroad track he is subject to fine, the same as if he had disobeyed a traffic light at a street intersection. Some of the traffic lights previously

in service now serve with additional controls in the new crossing protection system.

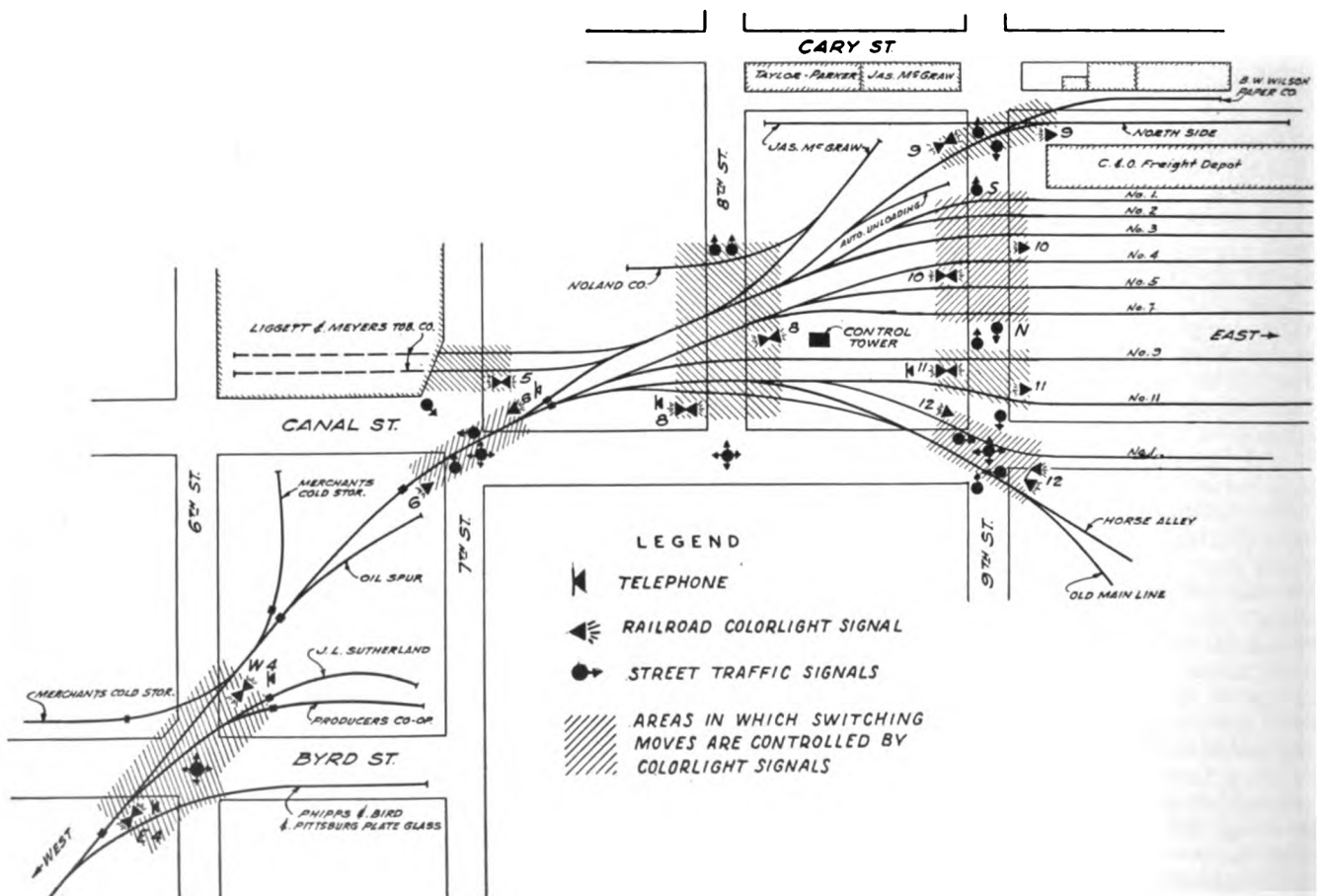
Colorlight Signals

Another interesting feature of this project is that the switching moves over the crossings are governed by conventional colorlight signals, similar to those used as interlocking home signals of the two-aspect type. Such a signal normally displays the red aspect. When a train is to move over a crossing the traffic light (or lights) are controlled to display yellow and then red. The aspect of the colorlight signal will change from red to green to direct the switch engine to proceed over the crossing.

For a track or a group of tracks crossing a street there is one group of eastward and one westward colorlight signals. When controlled, all signals in the group are cleared at the same time. This practice simplified the control circuits, and introduced no hazard because only one switching crew is assigned to work in this area.

Normally Controlled By Watchman in Tower

With some exceptions, the traffic lights and the railroad colorlight



signals are controlled manually by a control machine in a three-story tower located just east of Eighth street. On the panel of this machine, the diagram shows the tracks and streets.

Two Groups of Freighthouse Tracks

Eight tracks extend from the west across Ninth street into the freighthouse where they stub-end. Tracks No. 1, 2, 3, 4, 5 and 7 are in one group, which is protected by one northward traffic signal and one southward traffic signal marked "N" and "S" on the plan. Switching moves across Ninth street on any of these six tracks are directed by colorlight signals marked 10 on the plan. When a switch engine is ready to make a move across Ninth street on any one of these six tracks, the watchman in the tower throws lever 10 from the "St" position to the "RR" position. This changes the aspect of the traffic lights from green to yellow, and then from yellow to red, in the proper timing sequence, thus stopping street traffic. Then the aspect of the colorlight signals marked "10" on the plan, change from red to green to direct the switch engine to move across Ninth street. After the engine and cars are clear of the street, the lever is returned to the "St" position.

Tracks No. 9 and No. 11 are one group, with separate traffic lights and colorlight signals which are controlled by lever No. 11 in a manner previously explained.

One track across Ninth street extends along the north side of the freighthouse and also connects to a spur serving a warehouse. This track across Ninth street is protected by a southward traffic light and a northward traffic light. Switching moves on this track are directed by colorlight signals marked 9 on the plan. The control is by lever 9 in a manner previously discussed.

Combined With Timing Control

Two tracks extend diagonally across the intersection of Ninth street and Canal street. A four-direction traffic light is suspended over the center of this street intersection, and four one-direction traffic lights are located on the "far" side at the right. Colorlight railroad signals marked "12" on the plan are for directing switching moves over this intersection of streets.

On the control machine in the tower there is a lever, No. 12, which is for the control of the traffic lights at the intersection of Ninth and

Canal. Normally this lever is at the left in the position marked "St" for street traffic, and accordingly the traffic lights are controlled in the conventional manner by an automatic timing system to direct traffic to move for timed intervals on one street or the other.

When a switch engine is ready to make a move over the street intersection on one of these tracks, the watchman in the tower throws lever 12 to the right position marked "RR" for railroad. This cuts out the automatic timing control of the traffic lights; the ones which are red stay red, and the ones which are green change from green to yellow, and from yellow to red in the standard timing sequence, so that street traffic approaching from all four directions is stopped short of the street intersection and short of the tracks. After all traffic lights are red, the colorlight signals change from red to green, thus directing the switch engine to make its move over the crossing. After the locomotive and cars are clear of the crossing, the watchman restores the lever to the "St" position. This controls the colorlight signals to change their aspect from green to red, and then to return the control of the traffic lights to the automatic timing system.

Seven Tracks Cross Eighth Street

The seven tracks which cross Eighth street are treated as a group. This is a one-way street for traffic southbound only. As extra protection, because of one-way traffic, two southward traffic lights were installed—one over each half of the pavement. Four colorlight signals, two eastward and two westward, direct switching moves across Eighth street on any one of the six tracks. Lever 8 controls the traffic lights and colorlight signals at this Eighth street crossing, in a manner similar to that previously explained. While the lever is in the "RR" position, the traffic light at the intersection of Eighth and Canal holds the "green" for east and west traffic on Canal.

Auto-Manual at Sixth Street

The so-called main track extends diagonally across the intersection of Sixth street and Byrd street. From this track one spur extends east just north of Byrd street, and a second spur extends across Sixth street on the south side of Byrd street. A third spur extends west across Sixth street north of Byrd street. This crossing is beyond the range of vision of the watchman in the tower. When a

switch crew in the Second street yard has a cut of cars ready to go to the freighthouse area, the conductor is supposed to use a telephone or the radio to tell the watchman. To inform the watchman exactly when the switch engine is approaching Sixth street, a special approach track circuit 250 ft. long was installed west of Sixth street to control a track-occupancy lamp and communicator bell on the watchman's control panel. With No. 4 lever in the "Auto" position, an eastward movement on the approach track circuit will automatically cause the traffic signals to stop street traffic, and cause the colorlight signals to display green to permit train movement across the intersection of Sixth and Byrd streets.

Also as a special feature at this crossing, a track circuit extends on the section of so-called main tracks from the south side of the street across Byrd and Sixth. This track circuit starts about 15 ft. west of signals E4 and ends about 15 ft. east of signals W4, the total length being about 250 ft. This track circuit is repeated by an occupancy lamp on the watchman's panel. Also, this track circuit enters into the controls.

Normally lever No. 4, for the control of the Sixth and Byrd streets crossing, stands on center or "Automatic" position. When in this position, an engineer could start his engine slowly and "creep up" on the 15 ft. section of the track circuit in approach to signals E4 or W4. This would shunt the track circuit, which would control the traffic lights to display red, and would clear signals W4 and E4 to display green. Thus directing the switch engine to proceed across the street intersection. In some instances when making local switching moves, the engine or cars must occupy one of the ends of the crossing track circuit, but no move is to be made over the crossing. In such cases the conductor uses a phone or the radio to tell the watchman, and he throws lever 4 to the left under "St." This cuts out the track circuit control so that the traffic light remains on normal control although the track circuit may be occupied. Also when the watchman must prevent the switch engine from clearing the signal by occupying the approach circuit, he places the lever to the "St" position which holds the traffic lights on normal control and the colorlight signals red.

No track circuits are in service on the two spurs serving Merchants Cold Storage and Pittsburgh Plate Glass. When a switching move is to



SEVENTH STREET CROSSING (looking west): signal No. 5 at right governs in both directions; additional traffic signals govern vehicular movements

be made on either of these two spurs the watchman throws the lever to the "RR" position to cause the red aspect to be displayed on the traffic light and the green aspect on the colorlight signals.

Three Tracks at Seventh Street

Two spur tracks, which serve the Chesterfield factory, extend across Seventh street north of Canal street. Switching moves across Seventh street on these tracks are directed by lever 5.

The so-called main track extends diagonally across the intersection of Seventh street and Canal street. Because of buildings, this crossing is near the limit of the range of vision

of the watchman in the tower which is east of Eighth street. When a switch engine is working at this point, the watchman may not know exactly when it will enter Seventh street. Therefore, to save unnecessary delay, track-circuit control was incorporated with the manual control, which is by means of lever No. 6.

Normally lever 6 is in the center position, under "Auto." When the switch engine or cars enter the track circuit, the aspect of the traffic lights stay red or change to red. Then the aspect of the colorlight signals marked "6" change from red to green, to direct the train to proceed across the street. After the engine and cars clear the track circuit, the

colorlight signals resume the red aspect, and the traffic lights are returned to the automatic timing control.

On the other hand, when a local switching move is to be made on this track which runs diagonally across the street intersection, the watchman places lever 6 to the "St" position which is to the left. This cuts out the automatic track circuit control, so that the switch engine can occupy portions of the track circuit (beyond the street-property lines) without interfering with the automatic timing control of the traffic lights. When ready to go across the street intersection, the conductor uses a phone or the radio to tell the watchman. The watchman then throws lever 6 all the way over to the right, under "RR," which controls the traffic lights to display red, and later to change the aspects of colorlight signals 6 to change from red to green. After the engine and cars clear the track circuit, as indicated to the watchman by a track-occupancy lamp, he returns lever 6 to the center position.

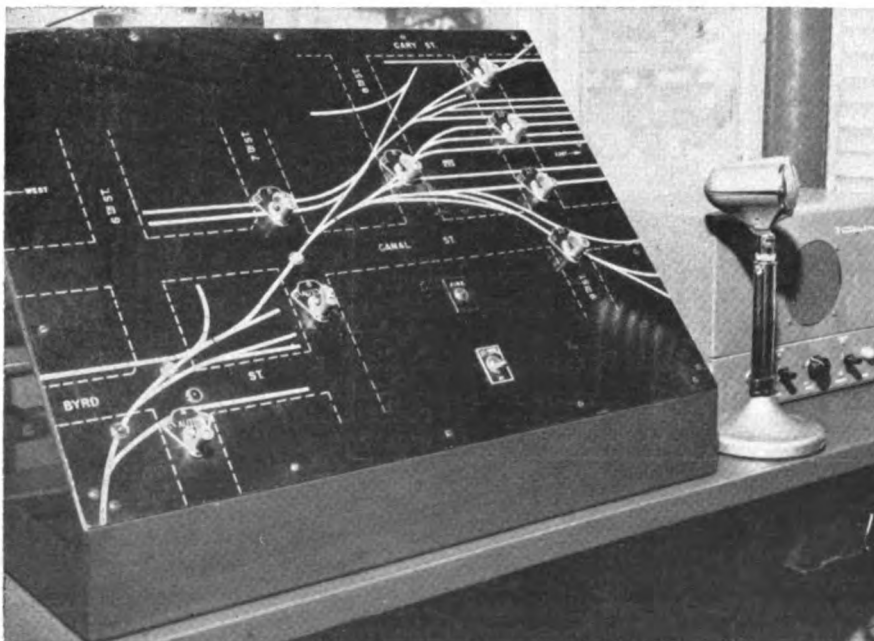
Emergency Control

The city of Richmond traffic department has a special control of traffic light for use in emergencies. When the city fire fighting trucks are going to a fire, special control is transmitted to cause flashing-yellow to be displayed on all traffic lights along the route or in the area where the fire truck is going.

This special emergency circuit extends from the city control office to the C&O watchman's tower, so that he is warned by a special lamp on his panel, when such a control is being sent out to his area of the city. Accordingly, his duty is to clear no colorlight signals for the switch engine to make a move over a street. Also if such a move is underway, he uses his radio to tell the crew so that they can clear the crossing as quickly as possible.

Importance of Communication

In order to operate this system of protection properly, the watchman, in his tower, must know exactly when the switching crew is ready to make each move across a street. When the crew is working near the tower the watchman can see the conductor, but on much of the remainder of the area the crew is beyond the range of vision of the watchman. Therefore, an interesting combination of intercom and radio communication was installed as part of this project.



WATCHMAN'S MACHINE for controlling railroad and street traffic signals; radio control unit and microphone are for communication with engine crews

The radio-fixed station is at the watchman's tower. On his desk he has a microphone, and a remote-control unit including a loudspeaker with control switches. Each of the three switch engines, which may work in this area, are equipped with radio transmitter-receiver apparatus, loudspeaker, handset and controls. A special feature is that a talk-back loudspeaker is located on the footboard for use by the conductor.

Footboard Speakers

All calls received on the locomotive are reproduced by both loudspeakers; the one in the cab and the one on the footboard. If the conductor is on the footboard, he can answer an incoming radio call by pressing one of two knee-switches which changes circuits to convert his receiving loudspeaker to a talk-back speaker, and keys the transmitter on the locomotive to broadcast the conductor's reply.

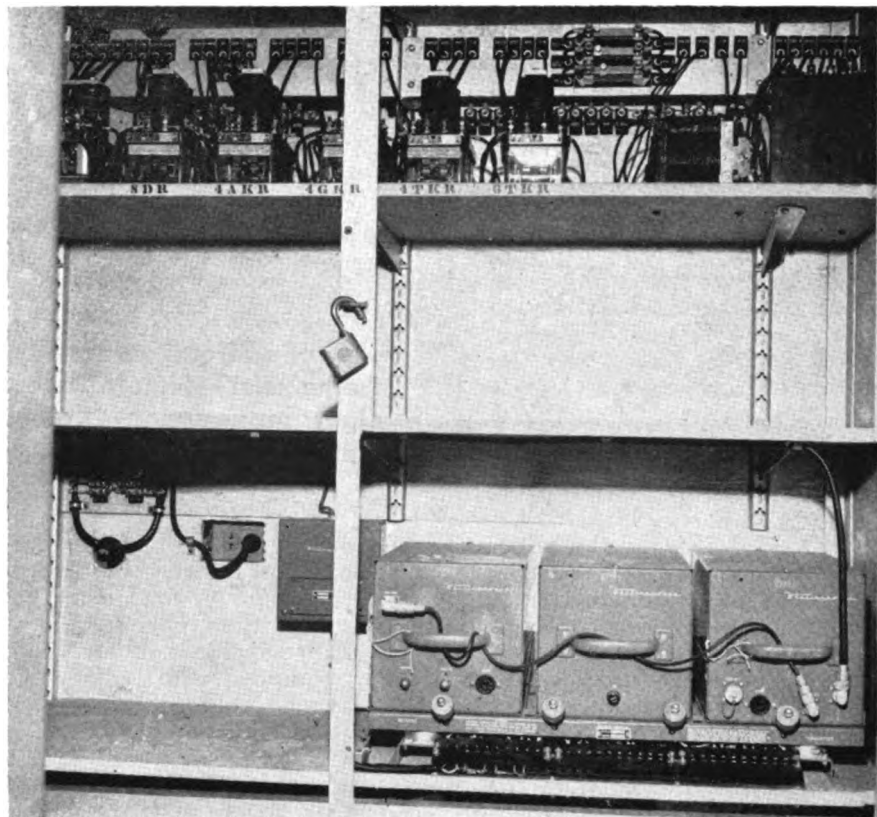
By using the other knee switch the conductor on the foot-board can call "intercom" to the engineman in his cab, without the call going out via radio. In a similar manner, the engineman by not using the push-to-talk button on his handset, can make an "intercom" call to the conductor's loudspeaker on the footboard.

The radio transmitting and receiving equipment in the fixed station and on the locomotives is the Westinghouse type FE, operating on 161.37 mc.

Five Communication Boxes In Switching Area

From the radio equipment located in the tower a two-wire circuit extends to five communications boxes at strategic locations throughout this switching area. In each of these boxes there is a modified Automatic Electric type 43 monophone set. If the conductor at one of the five communication boxes wants to talk by radio to his locomotive crew, he removes the telephone handset from its hook, and presses the push-to-talk button on the handle of the set when he speaks into the transmitter. Operation of the button remotely controls the radio transmitter at the tower so that the conductor's call goes out by radio to the locomotive. The engineman's answer via radio is received at the tower, and goes via the pair of wires to the handset being used by the conductor at the communication box.

When the conductor wants to talk to the watchman, he takes the hand-

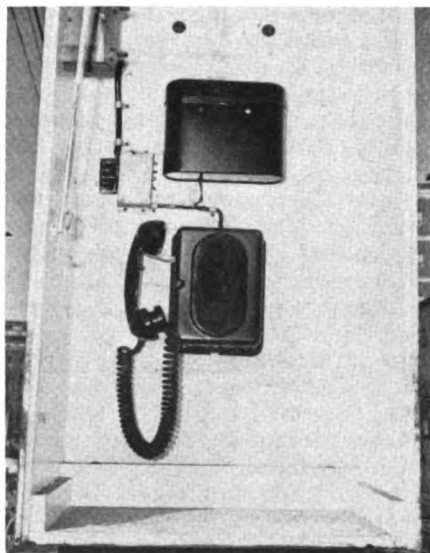


EQUIPMENT CASE in ground floor room of crossing watchman's tower contains signaling control relays and base station radio equipment

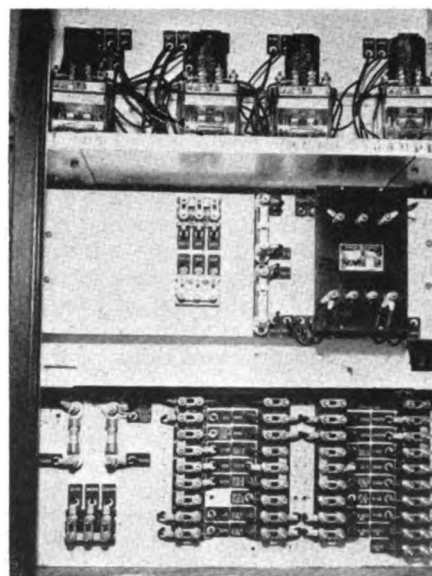
set off the hook and speaks into the transmitter without pressing the push-to-talk button. This speech goes over the wire pair to the tower and is reproduced by the watchman's loudspeaker. To answer, the watchman throws his "intercom" switch on the radio control console to intercom position.

This project was planned by signal and communication forces of the

Chesapeake & Ohio. The colorlight signals, relays and other conventional equipment was furnished by Union Switch & Signal, division of Westinghouse Air Brake Company. The traffic light and automatic timing controls were made by General Electric Company. The radio was made by Westinghouse Electric Corporation, and the telephone sets by Automatic Electric Company.



TELEPHONE HANDSET provides intercom to watchman in tower and radio to engines



RELAY CASE at Ninth street crossing contains signal relays and terminals