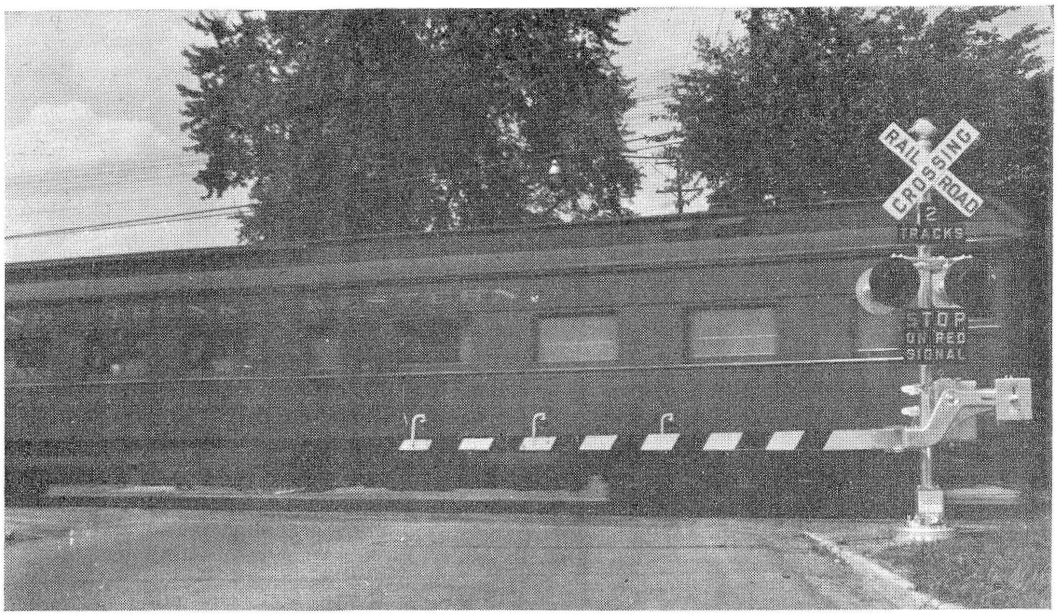


Eastbound train passing over the crossing at South Avenue, showing how gate obstructs right-hand lane

Protection at All Crossings

In Battle Creek on the Grand Trunk Western

Flashing-light signals or gates and signals at 13 crossings, controlled automatically with superimposed manual control now provides 24-hour protection every day

As A means of improving safety to the public, the Grand Trunk Western has completed an extensive program of crossing protection involving all 13 street crossings on this railroad in Battle Creek, Mich., a city of 50,000 inhabitants. The double-track main line passes through the industrial, business and residential sections of the city, so that the volume of street traffic varies at the different crossings, and, therefore, the planning of the protection was a special problem for each crossing.

Superimposed Manual Control

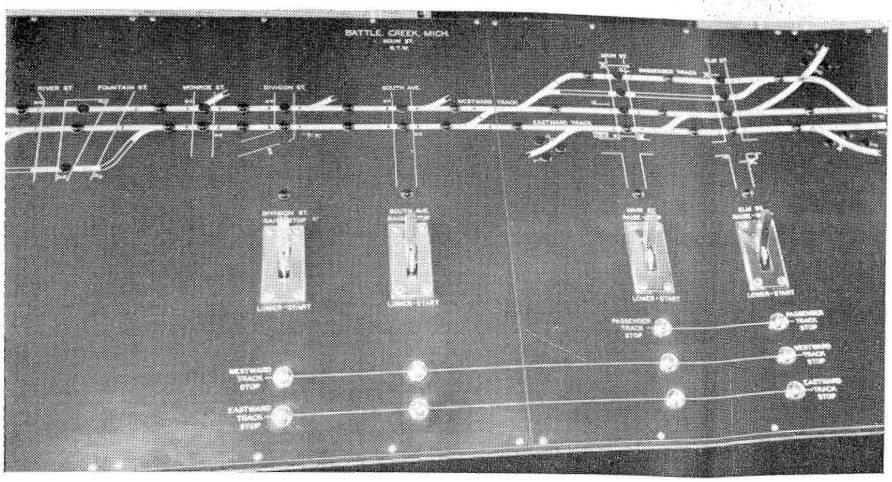
Ordinarily for through train movements, the flashing-light signals and gates are controlled automatically by track circuits. However, because of numerous switching movements and unusual train movements, superimposed manual control was required. For this manual control, there are three machines, one at Main street; one at Capitol avenue and one at McCamly street. A man is on duty three tricks daily at Main street and at McCamly street, and a man is on duty during the day trick only, and on week days only at Capitol avenue.

The panel of each control machine includes a track diagram, levers and buttons. The diagram has lamps to indicate which track circuits are occupied by trains, and lamps to repeat operation of the protection at each crossing. Under the symbol for each street crossing, there is a lever which normally stands in the raised position. Below each lever there are two buttons, one of which applies to each track.

Ordinarily for through train moves, the man in charge of each machine has nothing to do. However, if a switch engine stops in an approach section, and is not to move on toward the crossing, the man at the control machine can cut out the protection and raise the gates by pushing the button for that crossing and that track. If the switch engine again starts to move over the crossing, the man at the machine lowers the lever for that crossing which causes the gates to be lowered to protect the crossing. Also, when an insulated motor car is operated through this territory, the protection at each crossing can be set in operation by lowering the lever applying to each crossing.

On each track at every crossing, there is a short track circuit across the street and for about 30 ft. beyond in each direction. When such a track circuit is occupied, the gates stay down and flashing-light signals continue to operate, irrespective of any other controls.

When ready to make special moves, the conductor must advise the man at the control machine. At locations which are beyond range of vision from a tower, microphones and loud-



Superimposed manual control panel at Main Street tower includes controls for Elm, Main, South and Division St.

speakers are provided, so that the conductors can speak quickly to the man at the control machine to tell him of the move to be made.

When making a back-up move, the conductor of a train or switching crew has the responsibility to know that the crossing protection at each crossing is in operation. If he cannot call the man at the control machine, he must direct that the train be moved up onto the short track circuit and stopped until the crossing protection is in operation. This procedure is covered by special instructions from the division superintendent.

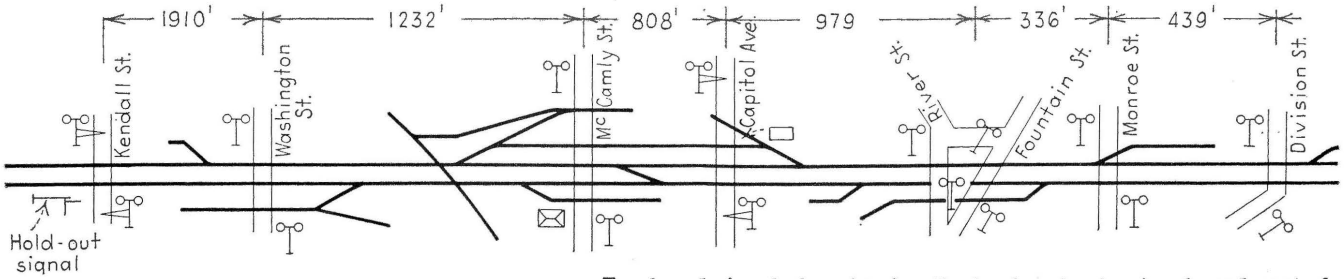
A Problem at Each Crossing

The crossing at Michigan avenue was previously protected by flashing-light signals which were controlled manually by the leverman at an interlocking at the crossing of the Grand Trunk and the Michigan Central, 317 ft. west of Michigan avenue. Now the new flashing-light signals at Michigan avenue crossing are controlled automatically by track circuits. Battle Creek is a division point. Freight trains enter and leave the yard, east of Michigan avenue which is 1,500 ft. east of the passenger station. On account of changing crews, the passenger trains stop about 15 to 20 min. at Battle Creek. Two extra tracks are provided through the station so that passenger trains can clear the main tracks while making station stops.

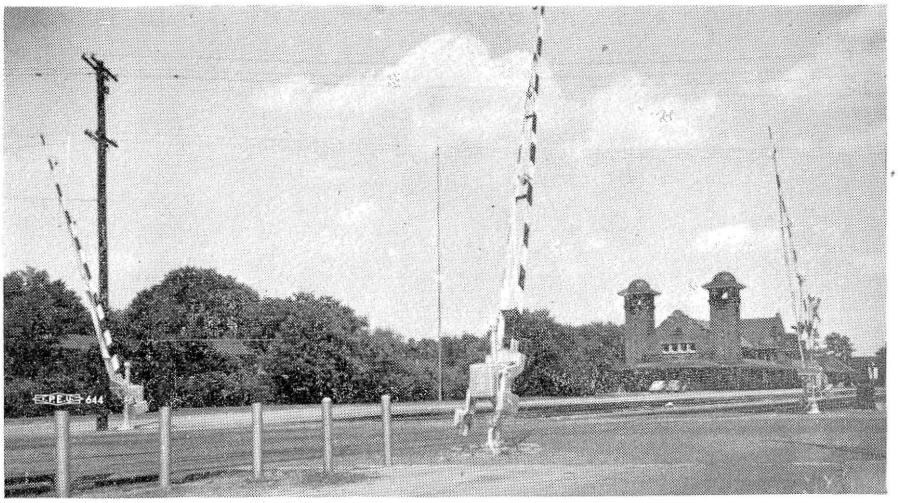
Elm street, which crosses these four tracks just east of the station platform, is primarily a residential street. This crossing was formerly protected by standard fixed signs and city "Stop" signs. Further protection was not previously considered practicable because of the complications of street traffic on Hall street which is a narrow paved driveway close to the tracks on the south side. The problem of improved protection was solved, in cooperation with city authorities who agreed to make Hall street a one-way street for eastbound traffic only. Short-arm gates with flashing-light signals were installed as indicated on the plan, to protect street traffic approaching the tracks on Elm street. A Battle Creek city type controlled "No-Left-Turn" sign was installed on the south side of Hall street at the west side of Elm street. This sign protects eastbound street traffic from turning left onto the tracks if trains are approaching.

Main street at the west end of the station platform is an important through street with heavy traffic. This crossing was formerly protected by four manually-operated gates, which were replaced with four modern electrically-operated gates. Short-arm gates, extending only across the right-hand lanes of approach, were not considered practicable at this crossing because of the possibility of street traffic turning in on the tracks from

This crew installed the new street crossing protection



Track and signal plan showing the tracks, streets, signals and controls



View looking east showing the gates and the signals at the Main Street crossing and the Grand Trunk Western passenger station shown in the background

the station driveway and eastbound from Hall street.

Westbound trains, when stopping at the station, are stopped just short of Main street. On account of these operations, as well as numerous switching moves and through freight train operations, the gates and signals at both Main street and Elm street are under superimposed manual control from a machine in a tower on the south side of the tracks just west of Main street. The man in this tower at Main street also has superimposed manual control of gates at South avenue and flashing-light signals at Division street.

Watchmen Replaced by Gates

South avenue, a through street with considerable traffic, was formerly protected by watchmen on each trick every day. The new project includes short-arm gates with flashing-light signals at this crossing. Division street leads to factories and warehouses south of the tracks, and, therefore, the traffic consists mostly of trucks, operating at slow speed. Formerly this crossing was protected by flashing-light signals mounted on foundations in the center of the street. These foundations and signals were removed and were replaced by new flashing-light signals on cantilever bracket masts at the sides of the street. The previous signals at Division street were controlled manually by the watchman at South avenue for westbound trains, and by the watchman at Fountain street for eastbound trains. In the new system, the signals at Division street are controlled automatically by track circuits, with superimposed manual control from Main street tower.

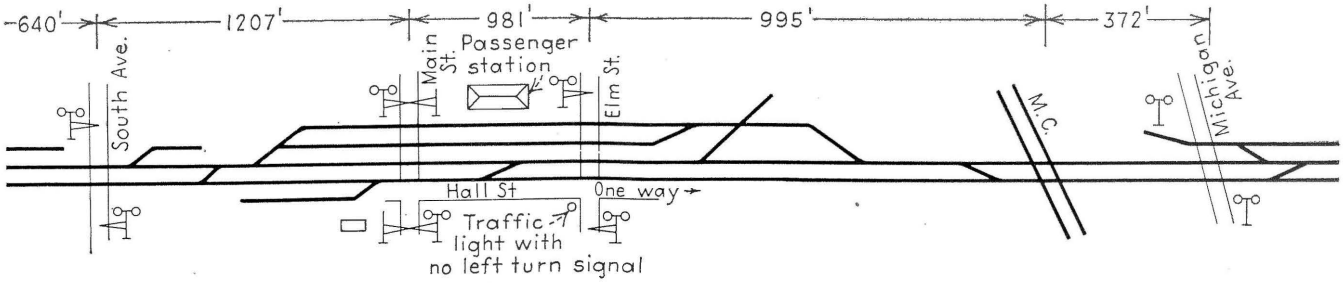
Monroe street handles industrial trucks and some residential traffic. This crossing was formerly protected by flashing-light signals, controlled manually, from Fountain street. Now the new flashing-light signals at Monroe street crossing are controlled automatically by track circuits with superimposed manual control during the day trick from Capitol avenue, and during the remainder of the time from McCamly street.

Fountain street and River street cross the tracks in a complicated Y arrangement, as shown on the plan. Previously, these crossings were protected by flashing-light signals controlled locally by a watchman on duty each trick. The new flashing-light signals at these crossings are controlled automatically by track circuits with superimposed manual control during the day trick from a tower at Capitol avenue, and during the other two tricks from a tower at McCamly street.

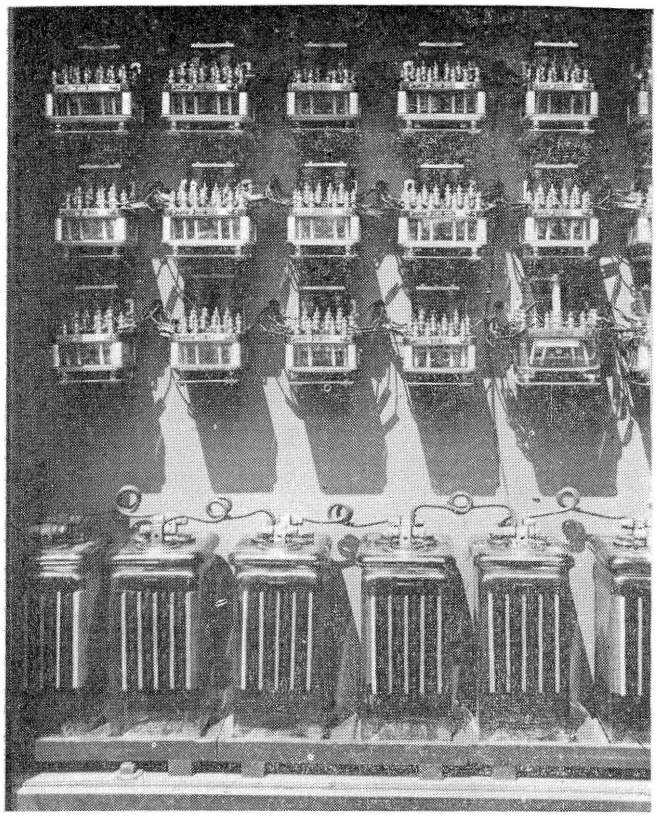
Capitol avenue is the principal through street of the city, and, therefore, handles very heavy traffic. This crossing was formerly protected by four gates operated manually by gatemen on duty all the time. The new project includes flashing-light signals with short-arm gates, one on each side of the track to obstruct the right-hand lane approaching the tracks. This crossing includes not only the two main tracks, but also two other tracks leading to industries and to the Grand Trunk freight house. Numerous switching moves are made all day long over this crossing. Therefore, in addition to conventional track circuit control, manual control was needed. This superimposed manual control is handled during the day trick, week days by a man in a tower at this street. For the remainder of the time, the manual control, if required, is from McCamly street.

Control at McCamly Street

McCamly street handles industrial truck traffic. This crossing was previously protected by flashing-light signals controlled manually by a man on each trick in a tower south of the track just west of the street. Now the new flashing-light signals are track-circuit controlled with superimposed manual control from a machine in the same tower as mentioned above. This machine also includes controls for interlocking signals to protect the crossing of the Grand Trunk Western with an industrial switch track of the Michigan Central, 331 ft. west of McCamly street. A man, on duty each trick every day in this tower at McCamly street, has superimposed manual control of the crossing protection at not only this McCamly crossing but also at Kendall street and Washington avenue. At all times, except the first hours on week days, the men on duty at McCamly street tower also have superimposed manual control of the crossing protection at Capitol avenue, River street, Fountain street and Monroe street, which, during the day trick, of week days, have also superimposed manual control from Capitol street.



throughout the entire city of Battle Creek on the Grand Trunk Western



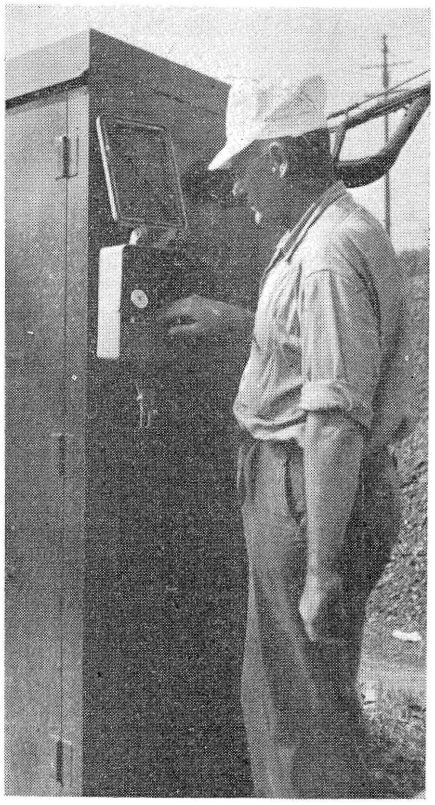
Sheet-metal case showing control relays with the wiring and also storage battery

Washington street handles local traffic. This crossing was previously protected with flashing-light signals controlled manually from McCamly street. Now the new flashing-light signals are controlled automatically by track circuits with superimposed manual control from McCamly street. Kendall street handles heavy local and through traffic. Formerly this crossing was protected by flashing-light signals controlled automatically. The new project includes flashing-light signals and short-arm gates normally controlled automatically by track circuits.

Hold-Out Signals

As mentioned previously, the freight yard is east of Michigan Avenue, 1,500 ft. east of the passenger station. If no yard track is ready for an eastbound freight train to enter, that train is held west of Kendall street by a special hold-out signal, rather than letting the train pull on down and then be stopped where it would obstruct several street crossings. This hold-out signal is controlled manually by men at McCamly street tower to display the Stop aspect when he wants a train to be held west of Kendall street.

Ordinarily, the flashing-light signals and gates at Kendall street are controlled by track circuits in the conventional manner. When an eastbound train approaches, the gates are lowered and the flashing-light signals operate as usual. If the hold-out signal is at Stop, the train stops short of that signal. Then the gates can be raised to permit street traffic to move. This control is manually from the tower at McCamly street, as well as locally by head brakemen. When the operator at Battle Creek clears the hold-out signal for the train to proceed, the gates go down automatically, irrespective of other manual controls.



Trainman using microphone

Forest avenue handles considerable local traffic, but no through traffic. This crossing was formerly protected by fixed signs. The new project included new automatically-controlled flashing-light signals at this crossing.

At All 13 Crossings

Thus, all the 13 crossings through Battle Creek, on the Grand Trunk, are now equipped with automatically-controlled protection, including flashing-light signals at 8 crossings, and gates with flashing-light signals at 5 crossings. Of special interest is that a small bell, designed primarily as a warning to pedestrians, is mounted on each mast for flashing-light signals, or signals and gates.

At each crossing with flashing-light signals only, a set of six cells of 80-a.h. storage battery feeds these signals. At other crossings, a set of six cells of 160-a.h. battery feeds the signals and gates. These are lead batteries made by Exide. Each track circuit is fed by three cells of 500-a.h. Edison primary battery.

The line circuits in this project are all in aerial cable either 19 or 37-conductor. This is self-supported cable, being attached to the messenger by a spiral wrapping of strap copper, this being done as a part of the manufacture. The wires from cases to signals or gates are in buried cable. The feeds for the gate motors are No. 6 wire. With 12 to 14 volts on the motors, the gate goes down in about 9 to 11 seconds, and goes up in 8 to 10 seconds. The circuits from cases to rail connections are No. 9.

At the control towers, such as at Main street, the relays and battery are in a sheet-metal house. At the rear wall of each house, there is a ¾-in. plywood panel on which arresters and terminals are mounted. The rows of terminals are spaced 5½ in. vertically, this spacing being used to minimize chances for accidental shorts when making changes or tests.

This project of crossing was planned by the Grand Trunk Western in cooperation with city authorities. The construction work was done by Grand Trunk signal forces under the direction of W. L. Dayton, signal engineer. J. P. Coleman is signal supervisor of this division and D. K. Wood is foreman of the construction crew. The gates, flashing-light signals, pedestrian bells and superimposed manual control machines on this project were furnished by the Western Railroad Supply Company, and the relays were made by the Union Switch & Signal Co.