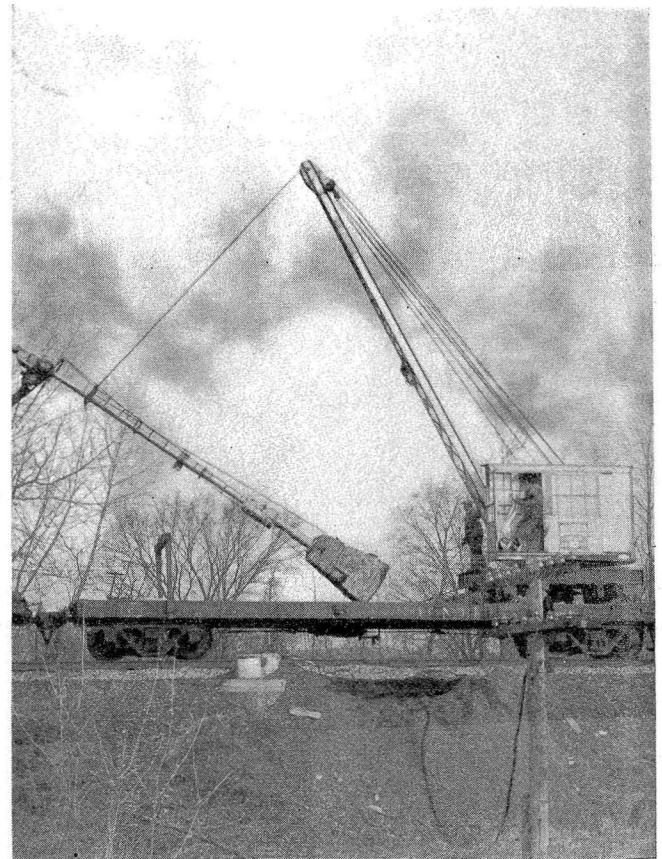


**Removal of 203 signals and re-location of 12 others on 365 miles of line provides for increased train stopping distance and adapts the system to modern operating requirements of the trains**

# Chicago, Indianapolis



THE Chicago, Indianapolis & Louisville has recently completed an extensive program of respacing automatic block signals on 365 miles of single-track line, involving changes in the location of 12 signals and the removal of 197 one-arm ground signals, six pipe bracket poles with two signals each and a second arm from three ground signals.

The primary purpose of rearranging the signaling was to lengthen the blocks in accordance with the longer braking distance now required. Train operation has changed since the signaling was installed and, furthermore, many short side tracks not used as passing tracks by through trains were removed or else one switch was taken out. Therefore, the signaling could be revised accordingly, which accounts for the fact that a comparatively large number of signals could be removed. Automatic block, using two-position

upper-quadrant signals, was installed on the 29.5 miles of single-track between Lafayette, Ind., and Monon in 1912. The signaling on the remainder of the 335.5 miles included three-position upper-quadrant semaphores, using the absolute permissive block, was installed in various sections during 1911, 1912, 1917 and 1929. The signaling equipment was furnished by the General Railway Signal Company. The control system of circuits is based on one line wire in connection with common for the control of signals for each direction. Direct-current signal mechanisms, d-c. polar-line relays and d-c. neutral track circuits were used throughout.

At the time this signaling was installed, the Monon operated a large number of freight trains daily. On account of the sizes of the locomotives, the trains were short and were operated at comparatively lower speeds of

25 to 30 m.p.h. as compared with present day speeds. Train stopping distances were comparatively short. On account of the number of trains, passing tracks were provided on a rough average of about every five to six miles, and each passing track was long enough to hold one of the short freight trains of that date. When installing the signals, double-location head-block signals were provided at each end of these numerous passing tracks. On account of the short trains and comparatively low speeds, the train stopping distances were short and, therefore, in order to provide the maximum train capacity, many of the blocks were approximately 2,500 to 3,000 ft. in length. As the years went by, the nature and the volume of the traffic changed, and newer locomotives were purchased with capacities to haul longer trains at higher speeds. Certain passing tracks at spacings of 10

# & Louisville Modernizes Automatic Signaling

to 15 miles or more were lengthened to capacities for the longer trains, and the remaining short passing tracks were no longer required.

## Blocks Lengthened

On account of the increased train speeds and corresponding increase in train stopping distances, it was obvious that the block lengths would have to be increased. On account of the comparatively short distance between passing tracks, in certain instances the relocation of signals to provide twice train stopping distances between staggered intermediates would have resulted in blocks of various lengths, some too short and others too long, and, furthermore, other complications were involved. The solution

use by through trains, no head-block automatic signals were required, and by thus extending the length of the over-all distance between passing tracks with head-block signals, it was possible to relocate the intermediate signals logically on the basis of block lengths, which are proper for train stopping distance, head-on protection and the spacing of following trains. Making allowances for varying factors, 4,000 ft. was adopted as the basis for minimum block lengths, with increases or decreases, depending on grades, curves and territories where speed is restricted by rules due to local circumstances in towns. Where local conditions are such that the blocks must be shorter than 4,000 ft., as for example in passing track layouts, two signals are controlled to

diana. From Hammond, the C. I. & L. has a single-track main line 68.3 miles to Monon, Ind., from which point one main line extends 95.1 miles to Indianapolis, Ind., and from Monon a second main line extends 230.5 miles through LaFayette, Ind., to New Albany, Ind., where connections are made for C. I. & L. trains to operate over 6.6 miles of the tracks of the Kentucky & Indiana Terminal between New Albany and Louisville, Ky.

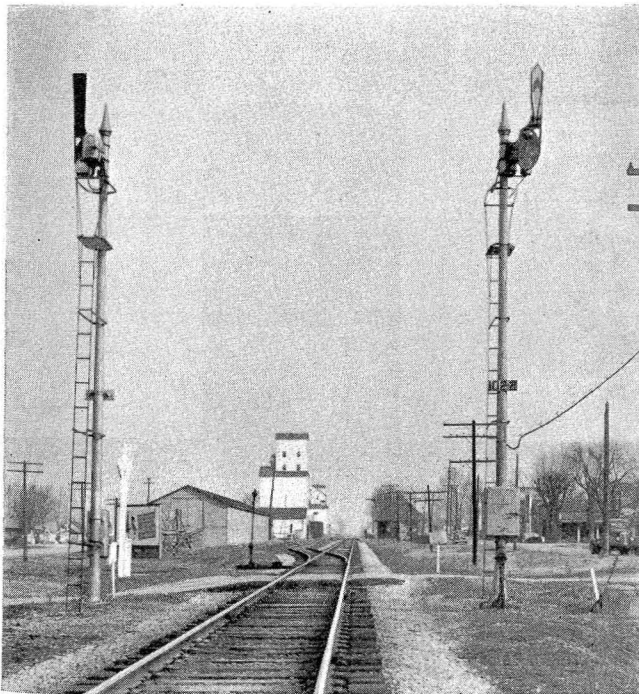
## Train Movements

Between Hammond and Monon, the daily traffic includes eight passenger trains, six scheduled through freight trains, and extra freight trains are operated as required. In addition, a local freight train is operated northward on Monday, Wednesday and Friday, and southward Tuesday, Thursday and Saturday. Between Monon and Indianapolis, the traffic includes four passenger trains and two through freight trains daily, and a third-class local freight train each way daily, except Sunday. Between LaFayette and McDoel, Ind., 103.6 miles, the traffic includes four passenger trains and six through freight trains daily. Also a local freight train daily except Sundays. Between McDoel and New Albany, the traffic includes four passenger trains and six through freight trains daily, as well as a local freight which operates in one direction one day and the other direction the next day, excluding Sunday.

## Signaling Changes

Between Hammond and Monon, 68.3 miles, a total of 21 signals were removed. No passing track changes or removals were made in this territory. Between Monon and Indianapolis, 92 miles, 81 signals were removed. At each of six passing tracks in this territory, one switch was removed to form a stub track where cars can be set out.

Between Monon and LaFayette, 29.5 miles, where two-position signaling was previously in service, the signaling was changed to three-position. A total of 21 signals were re-



Typical head-block signal location end of a siding on the Monon

was to remove many of the old short passing tracks which were used no more, and, at some of these passing tracks, which were connected to spurs for serving industries, one main-line turnout was removed, thus leaving a single switch, the same as at any outlying turnout leading to an industry. The important point was that by eliminating a passing track, as such, for

display the Approach aspect in approach to a certain signal when displaying the Stop aspect.

## General Layout

Between downtown Chicago and Hammond, Ind., 20.7 miles, the Chicago, Indianapolis & Louisville uses tracks of the Chicago & Western In-

moved, of which 9 were reinstalled at other locations. At three signals, lower arms for additional Approach indications were removed. As a part of the program, electrical signal lamps with approach control were installed in this territory.

Between Lafayette and McDoel, 103.6 miles, 59 signals were removed, of which one was reinstalled at another location. The passing tracks at Carpentersville and Putmanville were removed and one switch was removed at South Raubs. Between McDoel and Orleans, 41 miles, 25 signals were removed, 2 signals being reinstalled. The passing tracks at Guthrie and Yockey, as well as a spur track at Becks, were removed. Between Fogg and Borden, 15 miles, 8 signals were removed. A stub track at Norris was removed.

**Indicators at Stub Tracks**

At those locations where one switch of a passing track was removed, thus leaving a stub track, the time of trains at such towns is no longer listed in the timetable for the purposes of train operation. These stub tracks are for industrial switching by the way freight. In rare instances, the way freight may use one of these stub tracks to clear the main line for a scheduled train to pass. In such instances, the way freight should not leave the stub track if another train

the territory between Sand Pit and Mitchell. Formerly there was a short passing track at Yockey and a stub track at Becks. On account of the fact that the passing track at Yockey was short, a bracket mast with one northward semaphore signal 251.6 and one southward signal 251.5 had served adequately during past years because the signals could be seen from any part of the passing track. Whereas the over-all station-to-station blocks had previously been Sand Pit-Yockey, Yockey-Becks, and Becks-Mitchell, with the passing track at Yockey and the turnout at Becks removed, the station-to-station block is now between Sand Pit and Mitchell. This permitted the removal of eight signals, which are indicated as dotted lines on the diagram.

The revised automatic blocks in an overall station-to-station block vary in length, depending on averages and the desirability of utilizing existing signals at their present locations. For these reasons the lengths of the automatic blocks between passing tracks vary from about 1.5 to as much as 3 miles.

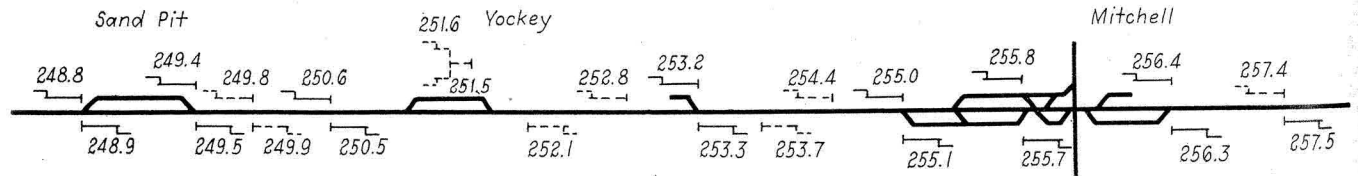
In the vast majority of instances, the overall station-to-station blocks are long enough that opposing staggered intermediate signals could be spaced twice train stopping distance. With this arrangement, if two opposing trains overlooked train order, and both simultaneously passed opposing

distance. For example, the distance between the south switch at Campbellsburg and the north switch at Smedley is only 2.8 miles. In this instance, one set of intermediates as a double location is located half way. In such instances, the controls are arranged so that, for example, when a northbound train passes Signal 281.8 at Salem, southbound signals 280.9 and 279.3, 277.3, 275.5 are set to display the most restrictive aspect, while Signals 27.7 and 273.3, 272.1 are set to display the Approach aspect. When a northbound train passes the cut section 5,000 ft. south of signal 275.5, signal 274.7 changes its aspect from Approach to Stop.

In some instances, the passing tracks are of such length that the distance between signals at the two ends of the siding is less than train stopping distance. In such cases, the controls are arranged so that if a station-leaving head-block signal is displaying the Stop aspect, the first as well as the second signal in approach will display the Approach aspect. This result is accomplished by setting the pole-changer contacts to operate at 47 deg. rather than less than 45 deg.

**Field Work Well Planned**

At a location where a pair of intermediate signals were to be removed and the layout converted to a track

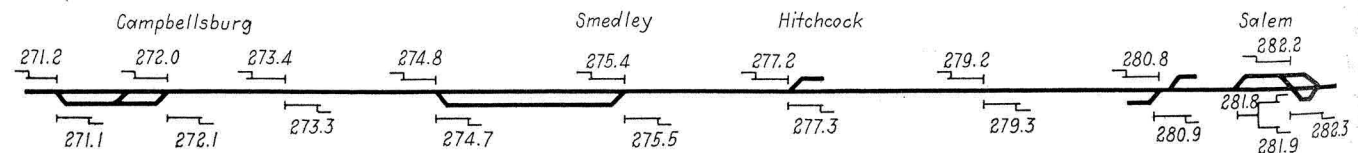


Track and signal plan of the territory between Sand Pit and Mitchell

is approaching on the main line. If signals are not located within view of such a switch, so that a conductor can

station-leaving normal-clear head-block signals, both trains would encounter Stop aspects at points which

circuit cut section, the mast on the pole line side was cut off with a gas flame cutting torch, thus leaving a



Track and signal plan of the section between Campbellsburg and Salem

determine whether trains are approaching, a switch indicator was installed to provide such information.

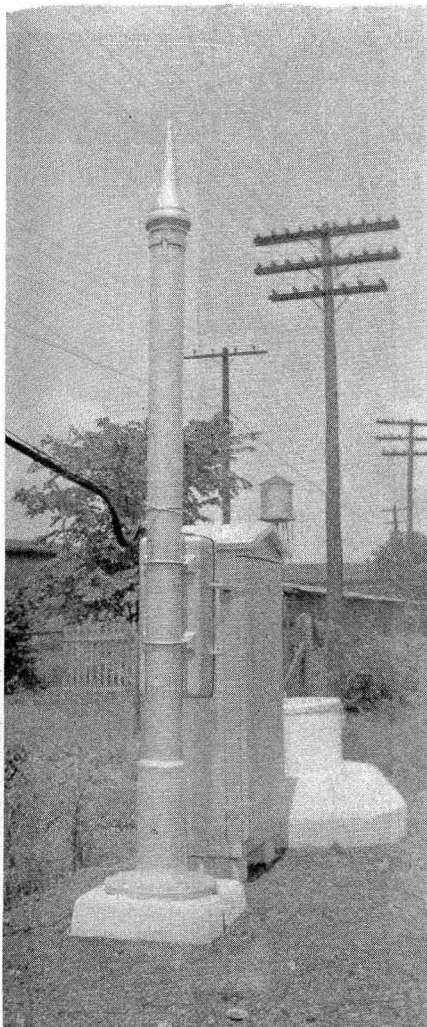
**Typical Track Change and Signal Revision**

As an example of the track and signal changes, reference is made now to the accompanying sketch showing

would allow full train stopping distance before the trains would encounter each other.

In very few instances, the distance between passing tracks is too short to space opposing staggered intermediate signals twice train stopping distance, and at the same time have blocks from the station-leaving signals to the first intermediate full train stopping

cable post 9 ft. 6 in. high on which the pinnacle was placed. The mast, at this height, was too large for the pinnacle to fit. A short section of the smaller pipe was welded inside the large pipe, with a portion of the smaller pipe extending so that the pinnacle can be fitted over the top. The cast-iron relay case, as well as the concrete battery well was left in



A cut-section location

place. The line control circuits were connected through contacts of the track relays, and thus conversion from a signal location to a track-cut location was complete.

In instances where a signal was to be moved a short distance to a new location, the dirt was dug away from the concrete foundation, and the signal as a whole, including the foundation, was picked up by a Burro crane and placed on a flat car. On arrival at the new location the foundation, with the signal still attached, is set in the new hole which had been previously excavated.

About half way down on a foundation, notches are made in the four corners so that the wire rope sling will not slip. From the sling, the wire rope extends up along the mast and through a chain around the top of the mast. With this arrangement, the

The signal construction crew was provided with cars equipped as living quarters, with a kitchen and a cook

load is well balanced, and the mast does not swing around beyond control. A hand line, attached to the top of the mast, is used for guiding when lowering the signal to the car.

The Burro crane is mounted on a flat car which is included in the way freight when a signal is to be moved. After the signal work is finished, the car is set out at the next station, so that it can be picked up again by the next way freight and returned to headquarters. The crane is operated by a gasoline engine and is controlled by an operator assigned to this work. Ordinarily, a signal can be moved in about an hour or less, thus the delay to the way freight does not incur much expense for train service.

#### Equipment for Additional Signal Mileage

Prior to these signaling changes, no automatic block was in service on two sections of main track, 22.9 miles between Orleans and Fogg, and 18.6 miles between Borden and New Albany. Using equipment and materials removed from service on the other territories, automatic block was installed on the two sections mentioned above, thus completing the signaling on all the principal main line of the Monon. The semaphore signal mechanisms and line relays were sent through the shop for complete inspection and overhauling before being shipped to the new signal projects. New two-ohm track relays were purchased as required.

At each of the signals removed, a set of 15 cells of Edison 500 a.h. primary battery was available. Where only one signal of a double location was taken out of service, the two batteries were connected in multiple until the batteries were exhausted.

At each track circuit removed, a set of two cells of Columbia high-voltage 500 a.h. primary cells were available and these were transferred as necessary to utilize the remaining useful life. Reclaimed battery jars and concrete battery wells as needed were shipped to the territories to be signaled.

As reinstalled on the new territories, the signaling is practically the same as previously in service with the exception that the signal operating batteries are equipped with rectifiers fed from an a-c. power distribution line, thus constituting an a-c. primary system. On these territories, the semaphore signal lamps are fed from low-voltage transformers, with approach lighting controls.

On account of the difficulties in securing insulated wire and cables, due to the war program, the underground cable at the signal locations being removed, was taken up with care. This cable is sent to the shop where it is immersed in a tank of water and tested thoroughly. All of the long lengths, which withstand the tests, are being saved for emergency replacements.

In the territory between Monon and Lafayette where the signaling was changed from two-position to three-position, several miles of No. 10 Copperweld line wire was removed. Although this wire has been in service about 30 years, the wire is in good condition, and the braided weather-proof covering is still serviceable. This wire, therefore, is being reinstalled as required.

The signal work explained in this article was planned and carried to completion by forces of the Chicago, Indianapolis & Louisville, under the direction of E. G. Stradling, superintendent of telegraph and signals.

