

Traffic Reversal on Double Track by Signal Indication*

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THE system about to be described is a combination of automatic block, manual block and interlocking, built upon the following standard code rules:

- (a) D-261. On portions of the road so specified on the time table, trains will run against the current of traffic by block signals, whose indications will supersede time table superiority and will take the place of train orders. Roads operating under these rules must provide proper signals to control the approach and movement of trains.
- (b) D-251. On portions of the road so specified on the time table, trains will run with the current of traffic by block signals whose indications will supersede time table superiority.
- (c) 801. Interlocking signals govern the use of the routes of an interlocking plant, and as to movements within stop signal limits, their indications supersede the superiority of trains, but do not dispense with the use or the observance of other signals whenever and wherever they may be required.

Description of Scheme

The territory is double track, operated normally with single current of traffic, right hand running. Distance between extreme interlocking home signals is 2.41 miles. Three interlocking signal stations, one at each end and one nearly midway, are involved, using high interlocking signals with current of traffic and dwarf signals for reverse movements on straight right hand running. Continuous automatic block signals and switch indicators with the current and manual blocking against the current of traffic are in service, using the interlocking signals as manual block signals. Tower indicators are used covering the entire distance showing whether or not the track is occupied and each signal station has indicators covering its part to show the situation with normal current of traffic from the reverse signal at one interlocking signal station up to the reverse signal at the next interlocking signal station on each main track.

Under Interlocking Rule 801, above quoted, no further explanation is needed as to movements on either track in either direction within stop signal limits as trains proceed upon the authority of interlocking signals. Under Standard Code Rule D-251, above quoted, no further explanation is needed to cover the movement of trains between signal stations with the current of traffic, automatic block signals being in use.

From the foregoing, this leaves only the matter of running against the current to be explained, it being authorized under Code Rule D-261 and the note in connection with it requiring proper signals to control the approach and movement of trains. It will be noted that the home signals of the interlocking plants do just this. This would also be the case at most any interlocking plant on double track on any railroad where signals are provided for reverse movements through the plant.

Trains entering or leaving main tracks or crossing over from one main track to the other, at points between interlocking plants, are controlled by manual block rules which require them to get permission before crossing over or entering the main track from a siding and to report in the clear when clearing the main track. Such requests and reports are directed to the operators at the signal stations on either side. The signalmen at the three respective signal stations look out for the rights of superior trains.

How a Reversal Is Made

Signalman at "LM" signal station having the southbound main blocked south of signal No. 59 desires to route a train against the current from signal No. 49 southward to Frankfort street. A southward movement is approaching signal No. 25 which will clear only to 45 deg. due to the obstruction above mentioned. Signalman sees that his track indicators are clear from signal 49 and signal No. 60 to signal No. 4 at Frankfort street. Signalman calls operator at Frankfort street on block phone and asks for "reversal on northbound for freight south." Frankfort street looks at his indicators between signals No. 4 and No. 27. Finding them clear and his northward interlocking signals set against conflicting signals, sets up his route for the approaching reversed train, reverses signal No. 4 admitting such train to his plant, and replies "O. K." for southward freight reversal on northbound. "LM" again checks his indicators and, if clear, lines up his switches, clears signal No. 49 and pushes the special reverse button under the signal lever. Total time elapsed, four to ten seconds. (Power interlocking.) The approaching train was not even slowed up as it was approaching and passed signal No. 25 at caution. Signal No. 49 or other signals giving possible movements against the current of traffic will not clear without pressing push button under the lever. This protects the signalman from error in pulling a lever by mistake and giving an unauthorized train movement.

If in the foregoing example, Frankfort street cannot reverse signal lever No. 4 at once due to his inability to assign a route through his plant for the approaching train he reverses a traffic lever instead of signal lever No. 4, which traffic lever prevents clearing any signal opposing No. 4. When done in this way he reports "traffic lever reversed, etc." He then clears signal No. 4 in time to prevent delay to the approaching reverse movement.

Movements against the current part way between interlocking signal stations are handled in the same way as full distance movements. A second movement against the current is not allowed until the first is cleared at the other end of the block or reported in the clear at an intermediate point. The originating operator can determine this by looking at his track indicators. When traffic warrants, two intermediate automatic block signals reverse will double the reverse capacity between plants.

It will be noted that the track indicators play the part of any automatic block sheet in the manual block system

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as well as answer for all other useful purposes to which such indicators or illuminated diagrams are usually put and as compared with the usual manual block process they do not forget to write, read, or misread the presence of a train and hence the arrangement is much safer than the ordinary manual block.

Necessity for Greater Track Capacity

Beginning November 1, 1913, the arrangement has been in successful use in this yard limit territory. The highest train speeds involved are about 45 miles an hour with the current and not ordinarily this high against the current. Most movements against the current are made at intermediate or lower speeds due to the short distance and track layout involved.

The interlocking plants were installed in the first place primarily for crossing protection with the connecting railways shown. Later on automatic signals and switch indicators were added between plants and at the same time the tower indicators were extended to show whether or not track sections were occupied, trains approaching, etc. At about this time (1913) traffic had grown to such a point that serious delays were being incurred and it was necessary to reverse traffic occasionally to relieve congestion and blockades. To do this by train orders, flagging and the usual train rule process meant still

other roads in addition. Frankfort street interlocking plant at the south end of the traffic reversal section is a smaller plant having fewer train movements, however, the signalmen handle train orders and O. S. reports, etc.

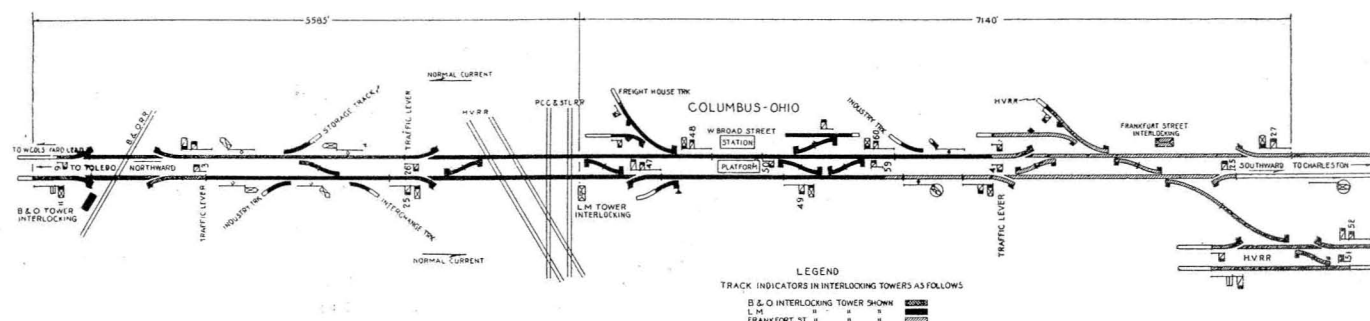
Based upon records recently kept the delays saved per month by the traffic reversal schemes are as follows:

Engine hours	11.37
Freight train hours.....	4.11
Yard cut hours.....	17.35
Passenger train hours.....	28.93
Passenger train equipment run hours.....	1.30

These delays were saved on various train movements, which were involved while making 35 reverse movements south of "LM" and 55 reverse movements north of "LM" plant per month. Each delay saved was reckoned by the operator at the time and was taken as the amount of delay that would have occurred to the train had the "train rule, train order and flagging process" been the means of reversing.

Economic Value of Reverse Traffic Facilities

The layout of capital to provide the above mentioned reversing facilities amounts to the installation of traffic reversing levers and push buttons and the addition of a few new rules, cutting out the application of many. All



Double Track Section Signaled For Reverse Movements On Each Track

more delays. To eliminate it by the usual remedy "more tracks" mean expenditures around \$100,000 with no greater benefits. In fact, less benefits due to the greater upkeep and carrying costs so incurred. The scheme being used at present was suggested and placed in trial service, found to meet the requirements, approved, and is doing duty 24 hours per day at present. With this process, traffic can now be reversed on a few second's notice by the respective signalmen arranging between themselves and without the necessity of stopping or slowing up the trains reversed.

The Traffic and Delays Saved

The movement of 16 passenger trains daily except Sunday and 10 on Sunday only is involved. All of these trains change engines at Broad street station and in addition a back-up movement of passenger train equipment is involved between the station and the coach yard for practically every train. Passenger trains are switched and do their station work on the main tracks at Broad street station. In addition to this there are approximately 85 other movements of freight trains and yard cuts per day.

"LM" interlocking plant, the signalman at which handle their part of this traffic reversal scheme, has about 265 train movements per day to handle in the plant on the three roads involved. B. & O. crossing interlocking plant at the north end of the traffic reversal section is similarly busy in handling not so many train movements but some train order and manual block work on

other facilities used were necessary for the usual "with current running." The first cost of the extra facilities is estimated to not exceed \$900. The capacity of the reversal scheme is not being approached and when approached can be doubled at small expense.

- (a) Annual cost of reversal system.
 1. Interest and depreciation of extra facilities, 10 per cent\$ 90.00
 2. Maintenance repairs, 6 per cent..... 54.00
 3. Total\$144.00
- (b) Value of time saved.
 1. Counting light engines at \$10 per hour.
Passenger equipment cuts and yard cuts at \$12 per hour.
Freight and passenger trains at \$25 per hour.
 2. Savings per month \$1,236 or per year.....\$14,833.00
- (c) Net savings per year, Item b-2, a-2..... 14,689.00
- (d) Net savings per mile of road per year..... 6,090.00
14,689×100
- (e) Annual return on the investment $\frac{14,689}{900} = 1,629$ per cent
- (f) In addition to the foregoing savings this arrangement has up to date (12 years) made unnecessary the large expenditures for additional track facilities. If the annual carrying cost of such additional facilities is credited to the foregoing savings the percentages would be materially increased.

In all, the scheme provides a simple, practical and safe way of utilizing existing facilities to expedite train movements, eliminating written train orders, also rules on superiority, directing train movements entirely by signal indication.