

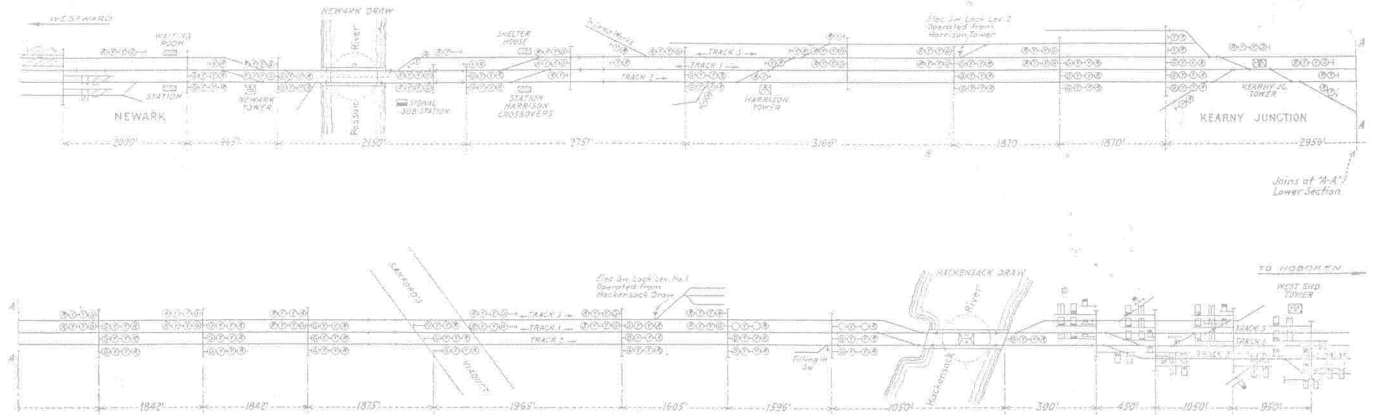
the variation is not great) trains on a two-minute headway must maintain minimum speeds as follows: Thirty-six miles an hour on "clear signal indication"; twenty-five miles an hour on "approach restricting" signal indication; 14.3 miles an hour on "approach" signal indications.

Special Arrangement to Handle Traffic

To handle this traffic on but three tracks it is absolutely necessary for eastward trains to move over certain tracks in the morning, and for westward trains to

ing interlocking plants. An automatic inter-control of levers at adjoining plants known as traffic locking, safeguards reversal of traffic. A signal cannot be cleared for a train to enter a section of track between interlocking plants which is occupied or about to be occupied by a train running in an opposite direction. The automatic signals between towers are controlled for one-way traffic, so that one train can follow another running in the same direction the same as on double track.

The instructions concerning the use of reversible



Signaling Plan for Handling a Heavy Commuter Traffic on the Lackawanna by Signal Indication

use the same tracks at night. Provision must, therefore, be made for the following routing of trains:

- Hoboken to West End: Tracks 1 and 2 reversible.
- West End to Hackensack bridge: Track 1 reversible.
- Hackensack bridge to Newark: Tracks 1 and 3 reversible.
- Track 2 also reversible over Hackensack and Passaic bridges.
- Newark to Millburn: Track 1 reversible.

The natural consequence is that two tracks from Millburn to Harrison and all three from Harrison to Hackensack bridge are used for eastward trains during the rush hours in the morning, and two tracks throughout used for westward trains during afternoon and evening. Thus three tracks are made to provide a capacity equivalent to four with unidirectional train movement.

All train movements in this district are directed by train dispatchers located at Hoboken. Under normal conditions each scheduled passenger train has a regular track assignment. This may be varied by instruction of dispatchers and co-operation between levermen at adjoining

tracks by trains are very simple. "Current of traffic will be authorized only by interlocking signals. Enginemen will accept signal indications as per track assignment." There is also the following provision, "Interlocking home block signals at the entrance to each block must not be passed when indicating 'stop' without clearance card, Form B, issued by towerman, which will be authority for proceeding as per Rule 705." Rule 705 is the customary rule outlining engineman's responsibility when passing an automatic block signal which indicates "Stop, then Proceed."

To evaluate the facility provided by the reversible tracks through this district, we can compare the cost of reverse traffic signaling on one track with the cost of a fourth running track from Hackensack bridge to Millburn. To signal one track already providing protection for trains in one direction, for reverse train movements, would cost approximately \$90,000, while the cost of a fourth track would run into some millions.

Excellent Results for 35 Years on Burlington

By J. B. LATIMER

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IN 1888 the first 19 miles of the main line of the Chicago, Burlington & Quincy, westward from Chicago, consisted of four main tracks, Canal street, Chicago to the station at Hawthorne, a distance of approximately 5.5 miles, and three tracks from Hawthorne to Downer's Grove, 14 miles farther. From Downer's Grove to West Burlington, Ia., 190 miles was double track.

In that year we installed two electro-pneumatic interlocking plants in the Chicago yard, one at Western and one at California avenues. The four track line had two tracks assigned to passenger and two to freight service. Mechanical interlocking plants were in service at Throop street and Wood street, east of Western avenue and at Hawthorne, west of California avenue. This made five interlocking plants in a distance of less than five miles

and it was decided to use them as block stations and operate trains by block signals in this territory. As it was all in Chicago yard limits, no orders were issued and trains were moved by signal indication only. Moving trains by signals soon demonstrated its advantages to our operating officers and in 1889 it was decided to extend the system to Aurora, 37 miles west of Chicago.

Regular stations were used for block stations, where practicable, but several special block cabins were built. There were seven blocks on the three track line between Hawthorne and Downer's Grove, averaging 1.75 miles long, and eight blocks on the double track between Downer's Grove and Aurora, averaging two miles long. These block signals remained in service until replaced by automatics in 1914—25 years of faithful service.

The signals were wooden semaphores, made in our own shops. The mast was hollow and the lamp was drawn up inside on an endless chain. These signals were two-armed, lower quadrant, 60 degree signals, the upper blade being red with a square end and a white stripe and the lower one was green with fish-tailed end and white stripe. The aspects and indications were as follows:

Both blades horizontal—Stop.

Red blade inclined downward, green blade horizontal—Proceed with caution, expecting to find block occupied.

Both blades inclined downward—Proceed.

In other words, the second aspect was used instead of a caution card, not as a distant signal indication for the next block signal, no distant block signals as such being used.

On the three track line these signals were displayed from bracket masts set on the outside of the track. In this way the middle track was signaled for movements in both directions, the north and south tracks were signaled for westward and eastward movements respectively only. By time-table rule the middle track was used regularly as an eastward track for certain hours of the day and as a westward track at the other hours.

Method of Three Track Operation by Signal Indication

Like most roads entering large cities the preponderance of business is towards the city in the morning and away from it in the evening. The use of the middle track was arranged accordingly, but it was not long before the dispatchers found that once in a while on account of a delayed train it was convenient to use the middle track in the direction opposite to that given at the time by time-table. Being familiar with single track operation, they issued orders for such movements just as they would for single track. It was from this beginning that the general practice of running against the current on double track finally developed.

Running without orders between Chicago and Aurora proved so satisfactory that in the winter of 1894-5 it was extended to cover the double track as far as Burlington, Ia. Wherever double track was extended, the practice went with it and we are now operating all of our double track, 1,064 miles, in this way. We do not absolutely give up the use of telegraph or telephone orders, as the orders eliminated are the running orders, but orders for other purposes are still issued. In discussing the matter with many of the dispatchers who remember the old days, the consensus of opinion is that the use of signals in place of orders has reduced the number of orders given at least 60 per cent and has allowed the closing of many offices which otherwise it would have been necessary to maintain. The practice as I have explained commenced with a manual block system; but where automatic signals have been installed, the practice has not been changed.

In 1907 we decided to install the lock and block system on 1,300 miles of our more important single track lines. The General Railway Signal Company's machines were used to operate our regular train order signals. Of this single track 55 miles consisted of stretches connecting the ends of double track, on which sections track circuits were installed and electric locks placed on the outgoing switches of sidings in addition to the lock and block. The arrangement was A.P.B. in that it allowed following movements after a reasonable interval, but was absolute for opposing movements. The electric switch locks were controlled by the block operators and also automatically by opposing movements. On this 55 miles we operated without running orders.

Four stretches were so equipped, the longest of which was 24 miles between Red Oak, Ia., and Balfour. There are six intermediate stations between Red Oak and Bal-

four and on this stretch we continued to give meet orders but running orders were dispensed with. On the other stretches there were no intermediate stations and consequently no meet orders were required. Some of these original installations have been taken out on account of double tracking, or replaced with automatic block signals and a few additional installations have been made. At the present time we are operating 8 separate sections totaling 34 miles this way.

Operation of Trains Against Current of Traffic on Double Track

The practice of operating trains against the normal current of traffic started by some crowded dispatcher deciding that he would take a chance and use the middle track between Downer's Grove and Chicago as a single track. After which he, or some other dispatcher, leaned back in his chair, and said to himself: "We are using this middle track as a single track but here it is eight in the morning and the time-table says it is an eastbound track now, at one o'clock it will become a westbound track, yet I just sent a westbound train out on it. Now, if I can do that and keep trains moving, why cannot I do the same thing on the double track, where the tracks are east or westbound all the time. Here is a dead freight train that has been waiting at Bristol for two hours to get out between stock extras. I will just cross the dead freight over and let it come in on the north track." And so he did and it has been done ever since.

We issue orders for such moves and for many years there were no signals governing them; although in 1916 we equipped that part of the main line from Aurora to Wataga, 119 miles, with reverse current automatic signals. The third track had been extended from Downer's Grove to Aurora and from Wataga to Galesburg so that we have either three tracks or double track signaled for both directions all the way from Chicago to Galesburg, 163 miles, the first freight engine division west from Chicago. Data on traffic handled show that we are bringing in as many cars on this three and double track line as most of our neighbors do with four or more tracks and our overtime for freight crews is reduced to a minimum.

After the dispatchers had developed this practice for themselves the management took it up and some special rules were promulgated for it, the principle one of which required a train running against the current to get a standard clearance card at each block station it passed; but as automatic block replaced the manual, it was found impossible to do this and the practice has been abandoned as unnecessary even in manual block territory.

We are still making reverse current movements by order on the double track between Aurora and Wataga even with the signals, but the matter is now before our train rules committee and I think this practice likely to be changed in the near future. The signaling is A.P.B. just two single track lines side by side. On the middle track between Hawthorne and Aurora the signaling is not A.P.B. but an item on our 1925 budget for changing it is approved and when this is done, we will discontinue issuing running orders there.

At practically every second station between Aurora and Galesburg, which spaces them about ten miles apart, we have a standard lap siding arrangement with the two main line cross-overs one facing and one trailing point handled by an interlocking plant and the reverse current movements and returns are made through these without stopping a train. Form "19" orders are used exclusively.

The whole question is one of getting the most use out of existing facilities. Why delay freight trains and pay overtime with a perfectly good track costing thousands of dollars a mile standing idle for hours?