Editorial COMMENT

A Review of 1940 and Prospects for the Future

MORE signaling facility units were installed in the United States and Canada in 1940 than in any year since 1931; the 1940 figures were 28 per cent greater than those for 1939. Of special importance was the fact that increases were shown in all the various divisions of the field, including automatic block, interlocking, centralized traffic control, highway-crossing protection, cab signaling, train control and car retarders. The reasons for these increases, and the prospects for further growth, warrant analysis.

As recently as 1927, our annual statistics included as much as 4,700 road miles of new automatic signaling and the installation of as many as 100 new interlockings where no such facilities had been in service previously. At this rate, a large proportion of the principal main lines were ultimately signaled. As a result, the total mileage of new signaling installed in 1940 was only about 480, and it is estimated that not more than 5,000 miles of road still remain in the United States on which automatic block can readily be justified. Likewise in the interlocking field, except at new terminals, junctions and crossings, interlockings have already been installed on the vast majority of the principal lines.

On the other hand, a large proportion of the automatic block signaling on 60,000 miles of road and about 5,000 interlockings have now been in service from 20 to 40 years. In the meantime, railroad operating conditions affecting signaling have changed rapidly, especially during the last five years. Much of the signaling apparatus now in service is worn and the systems of signaling and interlocking controls are obsolete, not only with reference to the handling of modern high-speed trains, but also with reference to economy in operating expenses. It is worthy of note, therefore, that a large proportion of the signaling facilities installed in 1940 were in replacement of equipment and systems previously in service, and, furthermore, that this is only the beginning of a program which will require many years.

New Trains, Tracks and Signals Too

During the last five years, the railroads have reconstructed many of their tracks to permit higher train speeds, and have purchased new locomotives and cars designed for higher speeds, but many of these railroads are only now realizing that their signaling and interlockings, likewise, must be replaced in order that their new high-speed trains can be kept moving at the maximum permissible speeds for which the motive power is designed and for which the track is good.

Developments in the last decade have produced signal apparatus and systems which are just as modern, in terms of train performance and reductions in operating costs, as are the new tracks and locomotives. About half of the 20 automatic interlockings placed in service in 1940 were at crossings not previously so equipped, and thus train stops are now eliminated; the remainder of the 20 new automatic plants replaced mechanical plants, and each of them reduced operating expenses about $5,000 annually. Some of the remote control plants include outlying junctions not previously interlocked and thus eliminate train stops, while the majority of these plants replace mechanical plants and each save about $5,000 annually. Some of the new interlockings using the newer types of control systems, such as miniature non-interlocked lever or button control machines, replace two or more plants, and, therefore, not only reduce train delays but also reduce operating expenses from $5,000 to as much as $10,000 annually. The centralized traffic control projects completed in 1940 eliminate numerous train stops and delays, and some of these installations eliminate from two to five outlying interlockings.

Signaling for Turnouts

The utilization of new track layouts necessitates new signaling arrangements. For example, where new interlocked crossovers or turnouts are good for speeds of 35 m.p.h. or more, additional aspects are required on the home and distant signals if trains are to be brought up to and through these crossovers at the speeds for which they were designed, rather than losing time at lower speeds. Two examples of such signaling are described in articles elsewhere in this issue.

Where local conditions are such that some blocks must be shorter than braking distance, too many roads are using an Approach aspect on two signals in approach to one indicating Stop, whereas a few roads are adopting a fourth aspect. Rather than adopting Standard Code aspects involving arrangements of two lamps of different colors, some of the roads are continuing the single red for Stop, the single green for Clear and the single yellow for Approach, but are using yellow-overyellow for the additional fourth aspect. One road is using the existing single yellow and flashing it as the fourth aspect.

Single-Track Head-On Protection

Staggering problems are involved in much of the automatic block signaling now in service on single-track lines. One factor is the increased braking distances of the faster trains, especially heavy freight trains. According to opinions issued by the I. C. C., the sighting distance of a signal cannot be included in the train stopping distance, and the service application of the brakes is the basis for stopping distance. On single track, staggered intermediate signals must be spaced twice train stopping distance, or else the controls must be changed. If the stagger is one braking distance, one or the other of the signals in approach must display the Approach aspect. If the stagger is less than train stopping distance, other signals must display the Approach aspect in approach to both of the staggered signals.

Where the distances between passing tracks range from 5 to 7 miles, compliance with all these requirements involves complications. A solution to some of these problems has been devised on the Chicago, Indianapolis & Louisville. Signals were installed on 382 miles of this road years ago when there were numerous short trains and many passing tracks, spaced at comparatively short intervals. Proposed changes, approved by the I. C. C., involve the removal of one switch at 16 of the previous passing track layouts, thus permitting the removal of 266 signals, of which 14 are to be relocated. This will result in a minimum of 4,000-ft. blocks for following trains and 8,000 ft. between staggered intermediates. These signaling changes are estimated to cost $16,300 and to effect a $9,000 annual saving in operating expenses.

Intermediates Opposite

Many roads are not so fortunate as the C. I. & L. in being able to dispense with so many passing tracks and thus solve their signaling problems. Where space is not available to stagger intermediate signals twice braking distance, some roads are using a double location of intermediate signals which are opposite. Overlaps extend half of the lengths of the two station layouts. Occupancy of an overlap section sets the opposing intermediate at Stop, and the station-leaving headblock in approach thereto, at Approach. With this arrangement, no train will encounter a signal displaying the Stop aspect without previously encountering a signal displaying the Approach aspect, and, therefore, the intermediate signals need not be staggered. This arrangement was used on the 1940 projects on the Wabash for layouts where the distances between passing tracks are too short for more than two automatic blocks using three-aspect signals.

Single-Track Automatic Signaling Has Seen Its Day

As a general proposition, however, it may well be said that single-track automatic block signaling has seen its day, because the direction of train movements by timetable and train orders is not sufficiently flexible to meet modern requirements of train operation.

In the old days, passing tracks with stations and operators were located at intervals of 5 to 10 miles. As the lengths of freight trains increased, only certain of the better-located passing tracks were extended. Some stations have been abandoned, while agent operators are on duty only certain hours during the day at many of the remaining stations. As a result, on extensive mileages, especially on single-track lines, the blocks between open offices, particularly at night, are entirely too long to permit the flexibility in train operation required by changing circumstances. When some of the trains are running late or when extra trains are being handled, abnormal interference causes delays to mount up. As traffic increases, this situation will become worse, because the shortened schedules were established when traffic was light, and train interference will increase rapidly as the number of trains grows.

Modified C. T. C.

Considering these facts, as well as modern signaling systems, thought should be given to a change in practice on single-track lines to use normal-danger station-entering and station-leaving signals which are controlled manually from a central point by coded line circuits. Thus in one stroke, all of the problems involved with I. C. C. Rules 204 and 207 are eliminated, and train movements can be expedited by the use of signals which supersede timetables, and take the place of train orders.

Installations made in 1940 on the Louisville & Nashville and the Pennsylvania demonstrate that code controls can be handled on the same line wires with communication circuits, without interference, thus making it possible to utilize existing line wires for the C. T. C. codes. By limiting the track occupancy indications to the OS sections at the switches, which gives a lot more information than a dispatcher now gets from operators, the code equipment, including the office apparatus and control machine, can be reduced, according to recent estimates, to about $1,500 per passing track equipped. On many territories, the staggered signals, which can be removed, can be used to govern movements off the passing tracks. The use of interlocked normal danger station-leaving signals places the head-on protection at those signals, and thus permits the elimination of the staggered signals, which now serve no purpose other than head-on protection. For following moves, the intermediate signals can be spaced on a time-distance basis, thus further improving the efficiency of train operation.

One road, which was preparing plans for ordinary single-track signaling on a division, is now considering a modified form of centralized traffic control as explained above. Thus, on territory not now signaled, as well as on a large proportion of the single-track signaling in service, centralized traffic control is the real solution for all the difficulties. On some occasions arguments have been advanced that operators at various points serve a useful purpose in watching for defective equipment on passing trains. Much better and more economical protection of this nature can be provided, however, by a modern arrangement of dragging equipment detectors in combination with the special control of wayside signals.