Editorial Comment

A Review of 1942

Two facts stand out with reference to signaling during 1942: (1) The contribution made by modern installations to war time transportation, and (2) the large volume of new construction, especially centralized traffic control, that was carried on to increase track capacity as a part of the war program. The assistance to train operation provided by modern signaling was discussed in the Signaling In War section of the November issue and, therefore, will not be reviewed here.

Transportation in War

The railroads produced more transportation in 1942 than in any previous year. The freight traffic totaled approximately 155,000,000,000 ton miles, or 32.6 per cent greater than that handled in 1941, the previous record year. Furthermore, the 1942 total was one and one-half times the volume moved during the first World War year 1918. These results in the handling of freight traffic were in part due to heavier loading of cars and longer average hauls which reduced the proportion of time consumed while loading or unloading. On the average, each car carried 3.0 tons more in 1942 than in 1941. Counting all serviceable cars, whether in transit or not, each car moved an average of 50.6 miles daily during 1942, as contrasted with 45.7 miles in 1941. An important fact is that freight traffic was not congested, and there was no interference with the war program because of the inability of shippers to obtain cars.

The increased utilization of motive power is evidenced by the fact that the average mileage per active freight locomotive increased from 116.4 miles per day in 1941 to 122.5 miles per day in 1942. The average load per freight train was 1,030 net tons, 115 tons more than the previous record of 1941. The gross ton miles per freight train hour increased to 35,874 in 1942, as compared with 34,684 in 1941 and 22,046 in 1932.

Likewise, the railroads established new high records in passenger traffic during 1942. The passenger miles (number of passengers multiplied by the miles carried) totaled 53,000,000,000 which is 13 per cent more than the previous record of 1920, and 80 per cent more than the 1941 figure of 23,000,000,000, as well as 24.2 per cent larger than that for the war year 1918.

These various figures are, in brief, a record of the accomplishments of railroad men as their part in the winning of the war.

On account of the reductions in highway travel, resulting from the programs for conserving rubber and gasoline, the construction of new highway crossing protection was limited to crossings in the vicinities of industries and camps. As a result, only about half as many crossing signals were installed in 1942 as in the previous year. Excluding highway crossing protection, a total of 5,081 signaling units were placed in service during 1942, as compared with 4,351 in 1941, and 4,253 in 1940.

The number of operative signal units and switches installed in new interlockings, and added to existing plants during 1942, totaled 1,417, as compared with 1,291 units placed in service during 1941. Many of the new interlockings were planned in 1941, and materials were on hand before Pearl Harbor. Furthermore, some of these new plants were included in larger projects involving track changes which had already been completed, so that the only logical procedure was to install the interlockings to secure the benefits of the improvements as a whole. On the other hand, some interlocking projects were postponed; as for example, one road had assembled materials for a new electric plant to replace two old mechanical interlockings, but, when war was declared, the interlocking materials were stored, and the insulated wires and cables were released for maintenance replacements or projects which would contribute directly to expediting war traffic.

The large volume of centralized traffic control placed in service during 1942, and the extensive projects that are now planned or under construction, provide evidence of the benefits of such facilities. In 1942, centralized traffic control was installed on 807 track miles, including 264 power switches and 1,030 semi-automatic signals, as compared with 514 miles, 190 switches and 675 signals in 1941. Furthermore, the prospects are that the construction in 1943 will exceed that of 1942. The details of last year's construction activities are given in an article elsewhere in this issue, and this discussion deals, therefore, with trends and developments rather than with the quantities of conventional equipment installed in 1942.

Construction Limited by Supply of Materials

Although the total volume of signaling installed in 1942 was large, much more would have been installed if time had been available to plan projects, and if materials could have been secured. The critical items in the supply of materials for signaling are copper wire and insulation for wires and cables. Early in 1942, the Signal Section, A.A.R., and the T. & T. Section, A.A.R., issued emergency specifications which called for reduced thickness of insulation, as well as smaller wire sizes. The railroads

also revised their construction practices to permit minimum lengths of wires and cables; as for example, on the Texas & Pacific centralized traffic control project, the switch machines are placed on the side of the track nearest the instrument house, regardless of whether the machine is on the same side as the normally-closed point. Numerous roads adopted measures to minimize the number of line wires required, and one road used iron wires rather than copper on an automatic signaling project. On other projects, wooden instrument cases were used instead of steel. The allotments of signaling materials by the War Production Board were based on the necessity of the project as a means for increasing track capacity and reducing train time as a part of the war program, and, in each instance, the railroads were required to prove that such results could be accomplished thereby. Furthermore, having been allotted the materials, the manufacturers have rushed their production, and the railroads have pushed their field work in order that these projects could be completed as soon as possible so that the signaling could serve as an aid in war transportation.

As a means for completing signaling projects more quickly, arrangements were made to do more of the work at construction headquarters rather than in the field, thereby reducing work-train service and traveling time of construction forces. In addition to wiring the instrument cases and houses, the Louisville & Nashville mounted switch machines on ties at construction headquarters. On various roads the practices of using precast concrete foundations, especially the sectional types, has saved work-train service.

Coded Carrier Control

An important development of 1942 was the application of carrier currents for the transmission of codes for code control systems. Coded carrier apparatus is now in service in one project on the Seaboard, one on the Southern Pacific, and one on the Union Pacific. A number of other projects are under construction. The carrier frequencies which have been used on these installations are above the voice range, and, therefore, do not interfere with the use of such wires for other conventional purposes such as a telephone circuit.

An example of the application of coded carrier control is for the conventional d-c. line circuit to extend from the office A, a distance of say 50 miles, to point B. Also these two wires handle coded carrier which at point B is converted into d-c. pulses for controls on two line wires throughout the next section of perhaps 50 miles between points B and C. The line wires between the office and point C also handle a second coded carrier which at point C is converted to d-c. pulses for controls on two line wires throughout the third section of perhaps 50 miles between points C and D. One important advantage of this arrangement is the large saving in line wire as compared with other conventional methods for handling large code control installations. Control codes can be sent to or indication codes sent in from all three of the sections A to B, B to C, and C to D, simultaneously the same as if a separate pair of wires extended from the office to each of the three sections.

Another application of coded carrier is on projects where the control office is remote from the nearest end of the code controlled territory, in which instance coded carrier is superimposed on an existing pair of line wires between the office and the nearest end of the code controlled territory, the existing line wires being used also for other purposes such as telegraph and telephone.

Progress in Coded Track Circuits on Multiple Track

Although coded track circuits were, of course, developed several years ago, special efforts have been made to utilize them as a means for obviating the installation of new line wires on account of the restrictions on the use of copper due to the war program. As an example, on a double-track automatic block signal project, the Louisville & Nashville used coded track circuit controls in a scheme by which the searchlight signal coils, signal lamps, control relays and half of the code transmitters are normally de-energized, so that the system not only requires no line circuits but is operated from primary battery, thus obviating line wires for an a-c. power distribution circuit.

A new practice in track circuit coding was installed on the New York, New Haven & Hartford where signals display five aspects, three of the Proceed aspects being controlled by 75, 120 and 180 code respectively, while the fourth aspect is controlled by a recently devised modulated 75 code. This is fundamentally a 75 code, except that it has the "on" time of every third cycle lengthened so that there is a short "off" and long "on" cycle occurring every 2.4 seconds. The short "off," long "on" component of the 75M code is decoded to produce the Advance-Approach aspect. It may be noted that the short "off," long "on" period of the code occurs 25 times per minute, and, when considered alone, this component amounts to a 25-cycle code.

On an 11-mile section of four-track line on the New York Central, conventional d-c. track circuit and line circuit controls for automatic signals were replaced by coded track circuits. The distant signals in approach to interlockings display five aspects and the other automatic signals display four aspects. In each instance, the most restrictive aspect is displayed as a result of the absence of track circuit energy. The proceed aspects are controlled by track circuit codes at the rates of 75, 120 and 180. To obtain control of the fourth aspect, either the 75 or the 120 codes are polarized. This project also includes the approach controls of highway crossing signals and approach controls at interlockings, by means of these coded track circuits, without the use of line wires.

On Single-Track C.T.C.

On some single-track C.T.C. projects completed in 1942, the automatic controls of signals included the conventional line wire circuits, the same as for A.P.B. automatic block, with one wire in connection with common for the controls of signals for one direction, and another wire in connection with common for the control of signals for the other direction. On the Southern Pacific, as described in the October issue, a separate two-wire circuit is provided for each direction with a special circuit by means of which these line circuits are used also for the automatic control of signals at the clearance points on turnouts which are connected to the main line by hand-throw switches. Thus the line circuits serve a dual purpose, and perhaps such an arrangement would also serve for the control of electric switch locks, if required.

In a single-track C.T.C. project on the Chicago, Mil-

waukee, St. Paul & Pacific, described in the May, 1942, issue, coded track circuits which feed in one direction only, were used in combination with a two-wire line circuit which is used for the control of signals for either direction, no traffic direction levers or auxiliary apparatus pertaining thereto being required. On the single-track sections of the Bessemer & Lake Erie C.T.C. project installed in 1942, coded track circuits feed in either direction, traffic-direction levers being used to cause the coded track circuits to feed in the direction opposite to the next train movement. By this means the automatic controls of signals are accomplished without any line wires. A further important feature of this project is that an electric lock at an outlying main-line hand-throw switch is released by coded track circuit control, thereby obviating line wire circuits for control of the lock.

New Interlocking Circuits

The year 1942 witnessed an increase in the tendency to install all-relay interlocking controls in preference to the use of machines including mechanical locking between levers and electric lever locks. Furthermore, during 1942, important developments were made in circuit interlocking. For example, one new plant includes circuits which prevent pre-conditioning of switch controls, as will be explained in detail in an article to be published in an early issue.

Signal Aspects in 1942

The year 1942 brought forth a few practices in signal aspects. For example, on the Bessemer & Lake Erie centralized traffic control project, the intermediate automatic signals do not display the usual Stop-and-Proceed aspect, but the most restrictive aspect displayed is red-over-yellow, Restricting. This practice eliminates numerous unnecessary train stops.

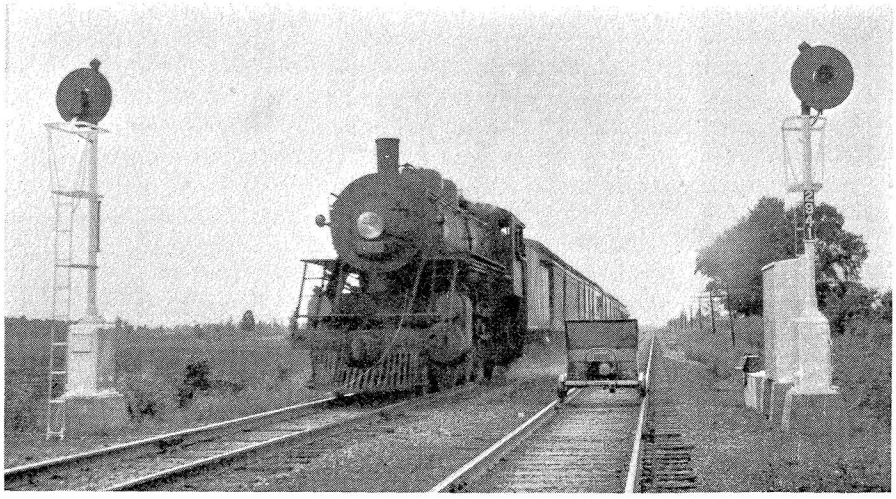
In the C.T.C. project on the Southern Pacific, as discussed in the October, 1942, issue, call-on signals are provided to facilitate switching moves when helper locomotives are being attached to or cut off trains. In the C.T.C. installation on the Texas & Pacific, the passing tracks are equipped with track circuits and each station-entering signal displays an aspect of red-over-red-over-yellow, indicating that the switch is reversed and that the passing track is unoccupied. This practice saves time when trains are entering passing tracks, as compared with the conventional practice of entering prepared to stop short of another train.

At a new interlocking installed by the Peoria & Pekin Union, which includes routes used by trains of five different railroads, the signals display aspects which assure enginemen that the route set up leads to the exit which is proper for his particular train. Color-light signals, including red and green units, are used. Advantage is taken of the fact that electric lamps can be lighted or extinguished, in contrast with the fact that oil lamps and semaphore blades cannot be made to disappear when not needed. A signal with a red unit and a yellow unit is controlled to display any one of three aspects, and a signal with a red unit and two yellow units displays any one of four aspects.

Prospects for 1943

Recognizing that general conditions are very uncertain, nevertheless certain facts indicate that a considerable volume of new signaling will be constructed during 1943. Unless conditions become worse than now anticipated, about 800 miles of C.T.C. should be placed in service during 1943. Construction is now under way on about 300 miles, and the materials have been allocated for approximately 300 miles more. The remaining projects will most likely be assigned allocations for material on the basis of war necessity.

Throughout 1942, priorities were issued for the materials and supplies required for the maintenance and operation of signaling facilities, and there were few instances in which shortages resulted in unsafe conditions or failures to operate as intended. At some interlockings, special reconstruction was required to continue the use of insulated wires and cables which were due for replacement. In spite of heavy traffic and numerous other adverse circumstances, reports indicate that the performance of signaling was good during 1942 in that a minimum number of train stops or delays were caused by signal failures which could have been avoided. Thus the maintenance forces, by extra effort in numerous instances, have contributed their part to the winning of the war.



In 1942, the Louisville & Nashville installed double track automatic block signaling using coded track circuits and with no line wires