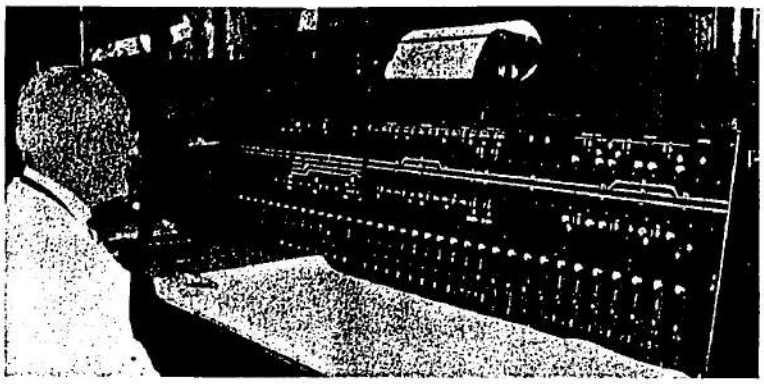
Centralized Traffic Control on the Boston & Maine



Control Machine in Dispatcher's Office at Greenfield

Extends over 76.7 miles of line, with 162 track miles and the control of two railroad crossing layouts

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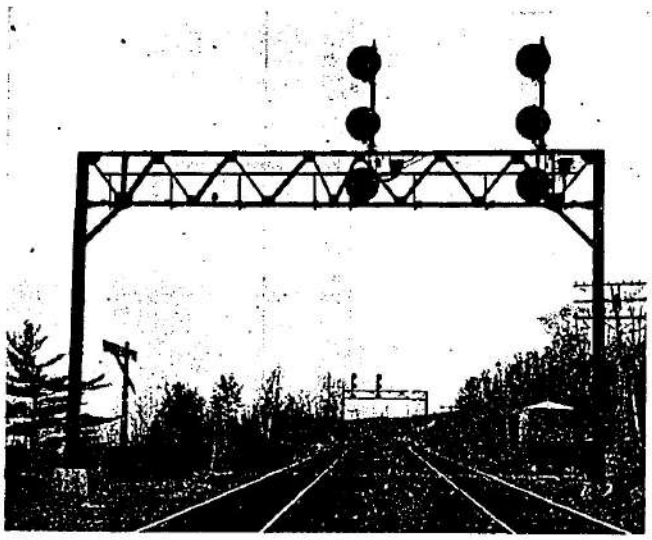
THE Boston & Maine was one of the pioneers in the direction of train movements by signal indication, especially for either-direction operation on multiple-track lines, its first installation of centralized traffic control having been placed in service in March, 1929, on 13 miles of double track between Ayer, Mass., and North Chelmsford. (See *Railway Age* for June 8, 1929.) Since that time three new and larger installations have been made on this road, which extend over



Signals at East End of Center Passing Track at West Deerfield

143 miles of line, involving 263 miles of tracks. These recent installations have required an investment of $2,608,000 and are the most extensive applications of centralized control undertaken as yet on any road. One of these new installations, extending for 67 miles between Dover, N. H., and Rigby, Me., on the Portland division, is only partially completed as yet, while the two others on the Fitchburg division between East Fitchburg, Mass., and Tyter, and between East Deerfield and East Portal, were placed in service on August 30, and will be described in this article.

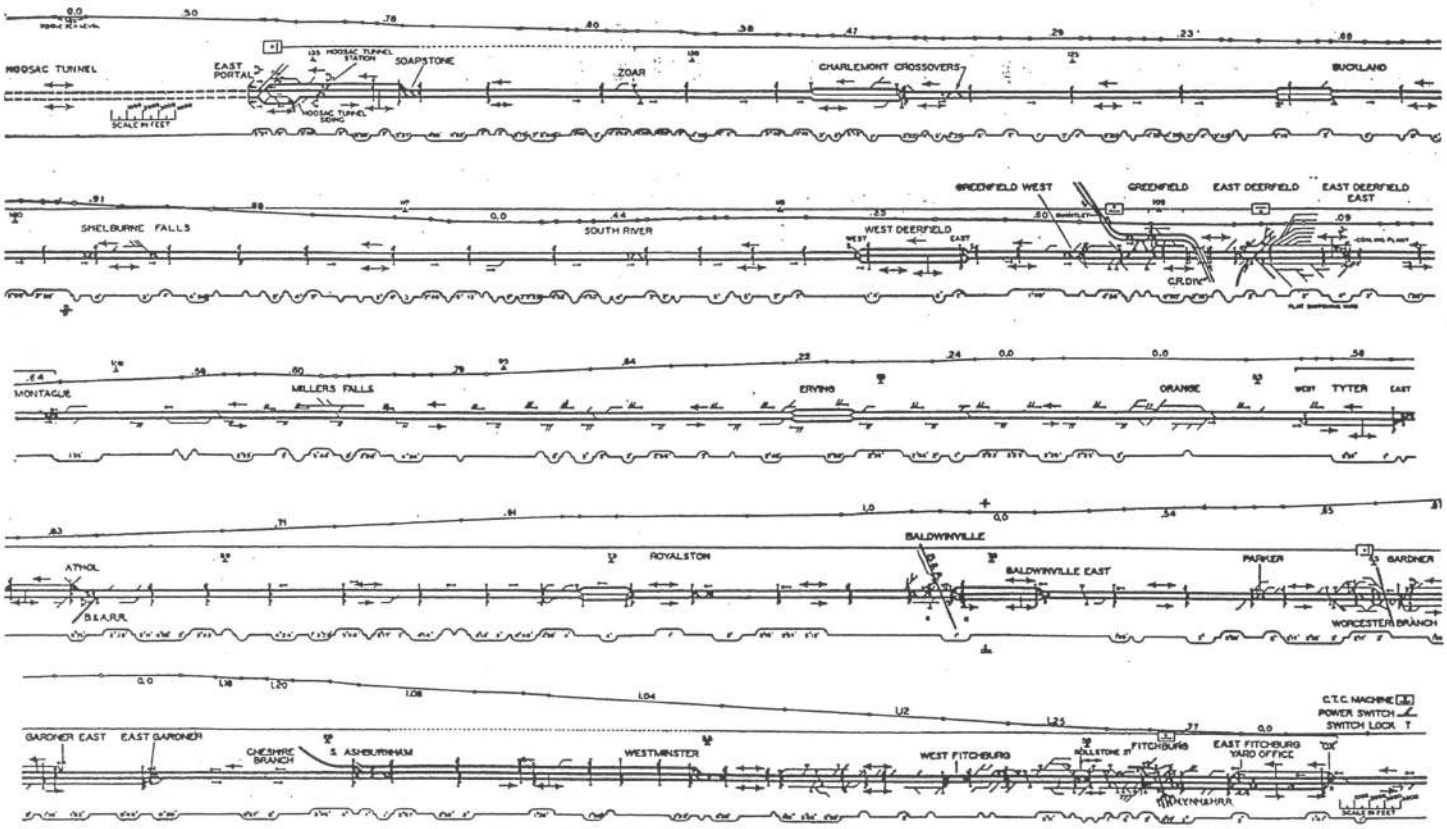
Operating Problem on the Fitchburg Division

The Fitchburg division is a portion of the B. & M. route from western connections in the Hudson River valley in New York to the interior of New England and on to seacoast points in Massachusetts and Maine. Under normal conditions, the traffic includes six passenger and about 12 freight trains each way, or a total of 36 through trains daily. The most important train is the "Minute Man," which is operated through between Boston and Chicago via the Boston & Maine and the New York Central. In normal times, the eastbound freight traffic involves from 750 to 1,250 cars, totaling from 30,000 to 60,000 tons daily. Likewise, the westbound traffic consists of 1,000 to 1,300 cars, totaling 29,000 to 37,000 tons daily. The principal freight shipments eastbound include coal, raw wool and cotton, automobiles, leather and hides, flour and such perishables as meats, fruit, vegetables and dairy products. Westbound shipments are chiefly manufactured articles such as boots, shoes, textile products, paper and lumber.

Schedules are arranged for early morning deliveries in Boston and other cities throughout New England. Likewise, cars loaded out of these cities are handled west the same night for delivery to western connections. Therefore, the train movements create peaks at different periods of the day and on different sections of the line.

Physical Characteristics of Line

As this section of the line passes through the Berkshire hills, the grades are heavy and curves numerous. The principal grades against westbound trains extend



Track and Signal Plan of the Centralized Traffic Control Territory

between Fitchburg and East Gardner, 14 miles, and between Bardwell and the Hoosac tunnel, 24 miles. Likewise, a grade adverse to eastbound trains extends from Athol to East Gardner, 19 miles. Operation of trains is further handicapped by the line being almost continuously on curves, the maximum curvature being 6 deg. 45 min.

The line had previously been equipped with semaphore automatic block signals arranged for right-hand single-direction operation. Under this arrangement following trains moving at reduced speed on grades were bunched and unless slower trains were held on sidings, there was no means of running the faster trains around them. Several important manufacturing centers are located on this division, and interchange is made with other roads and divisions on the B. & M. at different points. The blocking of the main line while making many of the switching and interchange movements was an additional source of delay to through trains.

To Facilitate Train Movements

Therefore, the problem of facilitating train movements on this division included three factors: First, to increase the track capacity on grades so as to keep all trains moving; second, to use the maximum track capacity first in one and then in the other direction; and third, to use one of the main tracks for through movements while switching or transfer movements were being made on other main tracks in industrial areas.

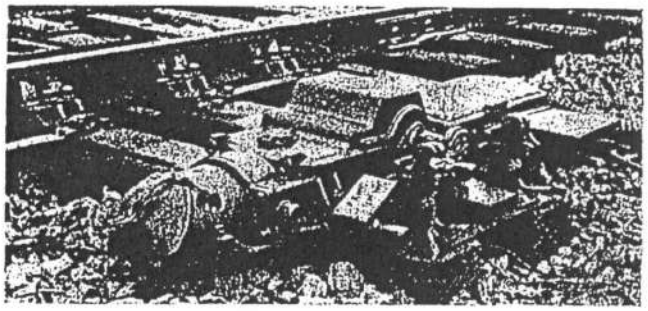
A detailed study was made of train operation, observers riding tonnage trains to secure actual results on which to base time-distance charts for existing as well as proposed methods of operation. After thorough study, it was decided to make certain changes in the track arrangement and to install a centralized traffic control system to permit the operation of trains in either direction on certain stretches of multiple track, to include power-operated switches for crossovers, and power machines or spring switches for passing tracks, so as to eliminate unnecessary train stops and delays; and to direct all train movements by signal indications, without written train orders.

In order that trains might be diverted from one track to another, that movements could be made to and from passing tracks, etc., with speed and safety, it was necessary to make extensive improvements in the switch layouts that were to be equipped for power operation. New layouts with No. 20 frogs were installed at main-line crossovers, ends of three tracks, junctions, etc., and No. 15 frogs were used at passing track turnouts. The passing tracks were lengthened to hold 100 cars.

Signaling for Directing Train Movements

Starting at Fitchburg, the line ascends at a grade in excess of 1 per cent all the way to East Gardner, 14 miles. Double-direction signaling was installed on each of the two tracks from Fitchburg to Westminster so that both tracks could be used at one time by trains going in either direction. On the five miles of three-track line between Westminster and South Ashburnham, the middle track is signaled for double-direction, and the two outside tracks for single-direction operation. From South Ashburnham to Gardner, single-direction operation is in effect on each of the two tracks.

Between Gardner and Tyter, where the grade ascends eastbound, double-direction operation is used on the north track and single direction on the south track. As no excessive grades are encountered in either direction between Tyter and Montague, 15.5 miles, the old semaphore automatic block signaling was left in service, trains being operated according to regular double-track rules with signal protection for single-direction operation on each track. Starting at Montague, the centralized traffic control extends westward to East Portal, double-direction operation being in service on the south track and single-direction on the north track on all the double track in this territory except for four miles from East Deerfield to Greenfield, in which section double-direction is effective on both tracks. It should be noted that double-direction operation is afforded through the important stations and industrial centers where transfer and switching movements are numerous. The method of operation is to turn over a section of one main track for the use of a "switcher" and use the other main track or tracks for the through trains. At Fitchburg, where the passenger station is on the north side of the main tracks, eastbound passenger trains can be crossed over at Rollstone street so as to stop on the track next the station. This permits the other track to be used for trains in either direction while a passenger train is making the station stop. On the accompanying diagram the double-headed arrows alongside the tracks indicate double-direction operation while the single arrows indicate single-direction operation.



Power Switch Machines Are Equipped For Dual Control

The entire installation of centralized traffic control includes 76.6 miles of line, of which 8.8 miles is three track and the remainder two track, totaling about 162 miles of main track. Included in this territory are 22 "controlled points," each of which is equivalent to an interlocking plant, varying in size from one to 15 switches with the necessary signals and including two railroad crossings. The track layout and method of operation at some of the more important controlled points will be described in detail later. The field equipment includes 150 power-operated and nine spring-operated switches, with 709 signal units located at 338 points. In addition, 48 outlying hand-thrown switches are equipped with electric switch locks controlled from the respective machines. The General Railway Signal Company furnished the equipment and handled the construction for the entire installation.

The Fitchburg Section

The centralized traffic control territory is divided into five control sections, the control limits for each machine being indicated on the diagram by the line extending through the symbols representing the towers. The machine in the tower at the New Haven crossing at Fitchburg controls the territory from the east end of the Fitchburg yard, "OX," to Westminster, which comprises 11 controlled points, with 34 power-operated and one spring-operated switches. This control machine is operated by a train director who reports to the chief dispatcher at Greenfield.

A line of the New Haven crosses the B. & M. just east of the station at Fitchburg, and a mechanical interlocking formerly protected the crossing and operated the switches and crossovers nearby. This plant was replaced by a centralized traffic control type of machine located in a new brick tower near the crossing. This new machine not only controls the functions formerly included in the interlocking, but also the territory from OX to Westminster.

Several other layouts are controlled from the machine in the Fitchburg tower. For example, the two main-line crossovers at Rollstone street, together with the four signals, constitute a controlled point and the same type of a layout at West Fitchburg forms another such point. The Westminster controlled point includes the three main-line crossovers, a single switch and five signals, the layout providing for double-operation on both tracks east of this point and also serving as a two-track to three-track junction. Westminster is the west limit of the control section for the Fitchburg machine. However, the train director in charge of this machine must co-operate with the man in charge of the Gardner control machine in order to direct train movements from one section to the other.

The Gardner Section

The centralized machine in the tower at Gardner controls the territory from South Asburnham to Tyter West, comprising 11 controlled points with 33 power and five spring-operated switches. This machine is operated by a train dispatcher whose territory also extends west to Montague. At South Ashburnham the junction to the branch line was moved a mile eastward in order to avoid placing the new crossovers on a 4-deg. curve, the best available location being on curves from 1 to 1.5 deg. This controlled point includes four main-line crossovers and six signals, the west switch of the most westerly crossover being spring-operated, no provision being made for a movement from the branch line to the north track.

A passing track, over two miles long, extends from East Gardner to Gardner, the east end being far enough over the top of the grade so that a train standing on this end of the passing track will be on a practically level grade. The switch at the east end of this passing track at East Gardner is spring-operated and three signals are provided to direct movements. The mechanical interlocking plant which protected the crossing of the Worcester branch and operated the switches nearby, was continued in service, the new centralized control machine being located in the tower, and one man operates both machines. The centralized traffic control system is continuous through the mechanical interlocking plant at Gardner,—that is, the operating results are the same as if the switches and signals were handled by centralized control levers.

At Baldwinville a middle passing siding is controlled, which, like the other middle sidings, is track circuited and signaled for through running. Spring switches are used for those switches, which are always trailing. Combined with the layout at the west end of the passing siding are two main-line crossovers and the railroad crossing of the Boston & Albany. The home signals on the B. & A. are controlled from Gardner.

The East Deerfield Section

The centralized traffic control machine in the new tower at East Deerfield controls the territory from Montague to East Deerfield, comprising 4 controlled points, 17 power switches and one spring switch, together with flat switching facilities at the west end of the yard, involving 18 switches. This machine is operated by a train director reporting to the chief dispatcher.

The controlled station at Montague includes four signals and a crossover facing for movements from the westward main to the eastward. The layout at East Deerfield East includes the leaving switch for the east yard and the entering switch to the west yard, together with a main-line crossover. This crossover, together with the single main-line crossover facing from the westward to the eastward track, at Montague, provides double running on the eastward track so that a train may pass around a westbound freight train taking coal and water at East Deerfield East.

The layout at East Deerfield consists of the west entrance of the eastbound East Deerfield yard and the exit from the west end of the westbound yard. Two main-line crossovers are provided, as well as a connection with the Connecticut River division and a New Haven transfer connection. In all, there are four crossovers, three turnouts, and 11 signals. These switches are operated by 110-volt d.-c. switch machines. The centralized traffic control machine is located in a new brick tower in the approximate center of this layout. In addition, this machine controls the operation of 16 single switches and one crossover operated by switch machines with trailable features. These switches are operated on the so-called "flat-switching yard" principle, no signals being used, but these switches are equipped with electric target lamps.

The Greenfield Section

The centralized traffic control machine in the dispatcher's office at Greenfield controls the territory from Greenfield to Zoar, comprising nine controlled points with 33 power and two spring switches. This machine is operated by a dispatcher who, in addition, dispatches trains on the territory between Troy, N. Y., and Rotterdam Junction, as well as on three single-track branch lines.

The Connecticut River line crosses the Fitchburg division on an overhead viaduct and comes into the Greenfield station parallel with the Fitchburg division, forming a four-track system for a short distance. The Greenfield layout consists of a set of crossovers in each direction between these mains, together with one turnout. Therefore, to permit switching at the Greenfield layout and also at East Deerfield without interfering with each other, controlled signals are located midway between, with a stagger of about 1,500 ft. These signals are controlled from the East Deerfield machine. To permit free use of both mains in switching, the tracks between East Deerfield East and Greenfield West are signaled in both directions on both tracks.

A universal layout with two crossovers and four signals is located at Greenfield West. From this point to Soapstone the eastward main is signaled for movements in the westward direction, providing two tracks up the grade with only one track down the grade. Just north of the station, on the Connecticut River line is a gauntlet in the double track, which passes through a short tunnel under a street. The signals governing over this gauntlet track are controlled from the Greenfield machine.

The centralized traffic control machine in the tower at East Portal controls the territory from that point to Soapstone, comprising three control points with 10 power-operated switches, and is operated by a towerman under the direction of the tower director at West

Portal. A double-track line extends through the Hoosac tunnel, which is 4.7 miles long. A system of signaling for directing trains in either direction on both tracks through the tunnel, which has been in service for several years, is connected with the new centralized control machine to form, in effect, a continuous system.

Description of System

The centralized traffic control system employed on the Fitchburg division is the General Railway Signal Company's unit wire system. On this installation it was felt desirable to provide directional control and signal indication. One wire is used for a switch or crossover control and an additional wire for the control of a group of associated signals.

The switch levers move up and down and are used in two positions only, the down position being normal. The track model and the arrangement of the levers are such that the switch points are directly over the levers by which they are controlled and on two-inch centers, the switch points being operated mechanically by the levers. The switch and track indication lights are located above their levers and above or below the track diagram, depending upon which track they belong to.

The signal levers are three-position rotary switches with arrows on their faces. These arrows point upward when in the normal position and to the right or left to clear a signal governing in the direction the arrow points. These signal keys are located as nearly as possible midway between the signals governed, being above the diagram for the upper track and below for the lower track. The signal indication lights are as a rule placed on the diagram in line with their control levers, and as nearly as possible in their relative positions with respect to the switches. Arrows on the face of the signal indication lamps, pointing in the direction that the signals govern, are illuminated when the signals are clear.

Recorders are provided on the Fitchburg, Gardner and Greenfield machines, the latter taking care of the records necessary for the sections covered by the East Deerfield and East Portal machines. These recorders are of the type which operate automatically upon the manipulation of the train tokens which are moved along by the operator in accordance with information regarding the train positions received by OS lights. Provision is made for three trains between any two OS points so that distinct marks are made for each train. More than three trains can be identified by pulling a token out and reinserting it.

The whole territory was re-signaled with color-light signals, replacing two-position lower-quadrant semaphore signals. All home signals governing in the direction of traffic are three arm, including those signals governing movements out of sidings. American Railway Association speed signaling has been employed throughout. For example, the signals governing movements out of sidings have a fixed top arm, the second arm being used for trains when the block is clear. The bottom arms govern all routes, including the route of the high and medium-speed signals when the blocks are occupied by a train proceeding in the same direction. An exception is that no signal is given against the established direction of traffic. Approach signals governing movements to controlled points, or, in other words, to three-arm signals, are two-arm, the lower one staggered to the right. When clear, this signal shows two green lights, the other aspects conforming with A.R.A. practice.

Freight Car Loading

WASHINGTON, D. C.

REVENUE freight car loading continues to approach more closely the figures for the past two years. In the week ended November 21 the total was 653,503 cars, a decrease of 126,249 cars as compared with the corresponding week of last year and of 296,213 cars as compared with 1929. Grain and grain products and livestock showed increases as compared with last year and miscellaneous freight showed an increase as compared with the preceding week. The summary, as compiled by the Car Service Division of the American Railway Association, follows:

Revenue Freight Car Loading

Week Ended Saturday, November 21, 1931

Districts	1931	1930	1929
Eastern	144,811	175,072	206,879
Allegheny	126,933	156,009	200,346
Pocahontas	40,408	46,159	57,327
Southern	97,845	117,910	138,199
Northwestern	75,973	89,474	114,573
Central Western	107,380	125,477	150,501
Southwestern	60,153	69,651	81,891
Total Western Districts	243,506	284,602	346,965
Total All Roads	653,503	779,752	949,716
Commodities			
Grain and Grain Products	36,872	36,348	39,780
Live Stock	25,555	24,845	29,821
Coal	116,699	147,923	188,718
Coke	4,850	7,441	11,154
Forest Products	21,325	33,111	54,864
Ore	4,901	8,223	15,744
Mdse. L.C.L.	209,032	229,521	257,825
Miscellaneous	234,269	292,340	351,810
November 21	653,503	779,752	949,716
November 14	690,366	829,023	982,926
November 7	717,029	881,517	1,048,968
October 31	740,363	934,715	1,072,234
October 24	769,673	959,492	1,134,360
Cumulative total, 47 weeks	34,440,342	42,395,342	48,653,281

The freight car surplus for the week ended November 14 averaged 588,377 cars, an increase of 29,099 cars as compared with the week before. This included 308,506 box cars, 214,073 coal cars, 26,422 stock cars, and 11,342 refrigerator cars.

Car Loading in Canada

Revenue car loadings at stations in Canada for the week ended November 21 amounted to 53,164 cars, which was a decrease from the previous week of 2,801 cars despite the holiday in the previous week. Grain accounted for a decrease of 3,534 cars, the western division being down 3,437 cars and the eastern division, 97 cars. Sub-zero weather and snow in the Prairie provinces were undoubtedly large factors in this decrease although the country elevators have large stocks of grain on hand.

Compared with last year's loadings the total was down by 7,182 cars, 5,320 cars in the eastern division and 1,862 cars in the western division. Coke and pulpwood were the only commodities to show increases, the increase of 921 cars of coal in the western division being more than offset by a decrease of 1,573 cars in the eastern division. Merchandise continued to show an improvement, amounting to 14,900 cars as against 14,134 cars the previous week.

	Total Cars Loaded	Total Cars Rec'd from Connections
Total for Canada		
November 21, 1931	53,164	21,869
November 14, 1931	55,965	21,852
November 7, 1931	61,194	21,886
November 22, 1930	60,346	31,435
Cumulative Totals for Canada		
November 21, 1931	2,349,497	1,187,913
November 22, 1930	2,904,197	1,561,148
November 23, 1929	3,249,443	1,926,629