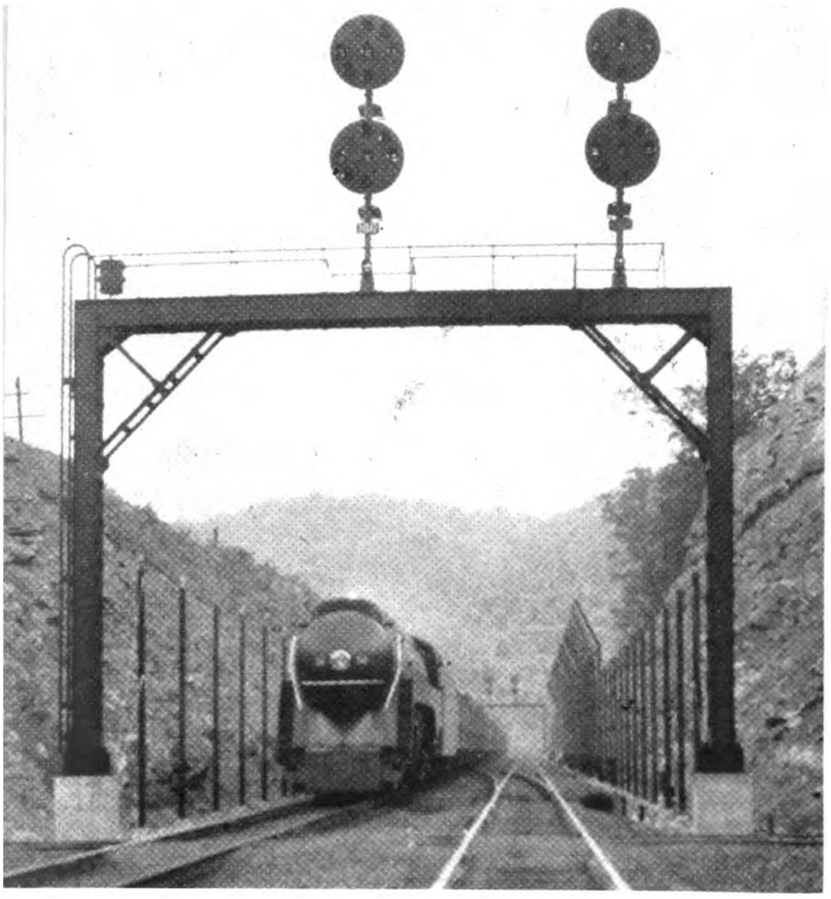
Both Tracks Both

Centralized traffic control involves junctions and crossover layouts on 11 miles of double track, including heavy grades and tunnels--Protection for men on motor cars



Westbound train at eastward home signals at west end of new crossovers near MP 378

CENTRALIZED traffic control has recently been installed by the Norfolk and Western on 11 mi. of double-track main line between Bluestone, W. Va., and Powhatan. This project includes power switches at two junctions with branch lines, one center siding, and crossovers between main tracks, as shown in the accompanying plan. The signaling is arranged for train movements in both directions on both tracks, so that faster trains can be run around slower ones, thereby increasing the track capacity.

At Bluestone, the east end of the project, the grade starts to ascend westward, at rates varying between 0.5 and 1.1 per cent for approximately 8,000 ft., to MP 375, then descending at varying rates of 0.38 to 1.78 per cent for about 9 mi. On these grades, the trains in one direction, of necessity, are operated at slower speeds and, therefore, occupy sections of track for longer periods than on adjacent sections where speeds are higher. Therefore, in order to increase the track capacity, the new track arrangements, power switches, signals and C. T. C. were planned to provide the equivalent of two parallel single-main tracks, on both of which trains can be operated in either direction by signal indication. The power crossovers are located so that, when a slower train is moving through the territory, a faster train can be crossed over to the other track to run around the slower one. This operation keeps all trains moving, rather than delaying the slower ones on sidings or holding them in a yard.

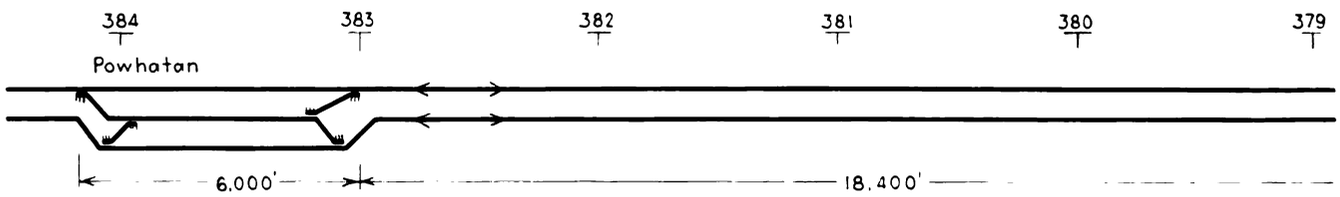
Crossovers at Bluestone

Two crossovers, one for each direction, are included in the layout at Bluestone, as shown on the plan herewith. This track layout, which also includes two junctions with branch lines, was formerly a separate interlocking controlled locally at Bluestone. In the new project, all the switches, crossovers and signals in this area are included in the new C. T. C. system. A new set of two power crossovers, one for each direction, was installed just west of MP 378. Power switch machines previously installed at both ends of the center siding extending between MP 383 and Powhatan were incorporated in the C. T. C. system.

Signaling at Tunnel

In this territory, there are two double-track tunnels. The Elkhorn Tunnel, which is the longest, is 7,110 ft. long. The new installation includes absolute signals on both tracks at each end of Elkhorn Tunnel to authorize trains to enter the tunnel. Special arrangements are provided for operation of motor cars and maintenance-of-way equipment through this tunnel, as well as the protection of maintenance-of-way employees, as will be explained later.

The signals on this installation are the position-light type. The switches are operated by dual-control electro-pneumatic machines, except at Bluestone where the existing 110-volt a.c. electric switch machines were retained. When the dual-selector levers on these switch machines are operated, the air supply is cut off, the normal and reverse valve control magnet circuits are opened, and code action is initiated to indicate at the control point that the switch is out of correspondence. Duplicate air compressors, each rated at 4.5 cu. ft. per min., are located at each electro-pneumatic layout. Each of these compressors is



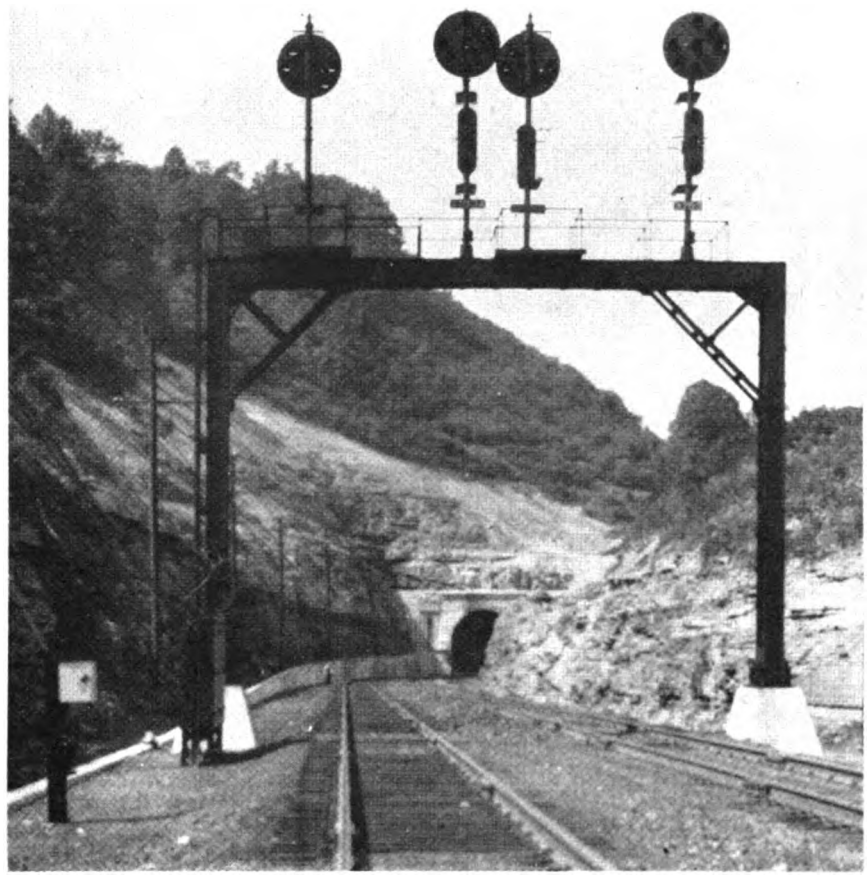
Powhatan and Bluestone showing signals at only the two ends of the tunnel, the signals

Ways on Norfolk & Western

driven by a 220-volt a.c. motor rated at ¾ h.p.

Track circuits are the a.c. coded type, using 75 code to control the Approach aspect, 120 to control the Approach-Medium, and 180 to control the Clear. Under C. T. C. control, a part of the preliminary operation to set up a route is to arrange for the track circuits to feed in the direction opposite to the proposed train movement.

The control machine for this C. T. C. is located in the dispatchers office at Bluefield, W. Va., 11 mi. east of Bluestone. On this machine, 7 levers control crossovers, 6 levers control single switches, and 9 levers control 32 signals. Conventional 504-C type line code equipment, operating on two line wires, is used to transmit control codes to the field stations and to return the indication codes to the control machine. The push-button selector control for the Western Electric 63-A type telephone train dispatching circuit is mounted in the face of the C. T. C. control machine panel as shown in the picture herewith.



Westward signals at east end of the tunnel, with special telephone box on post at left

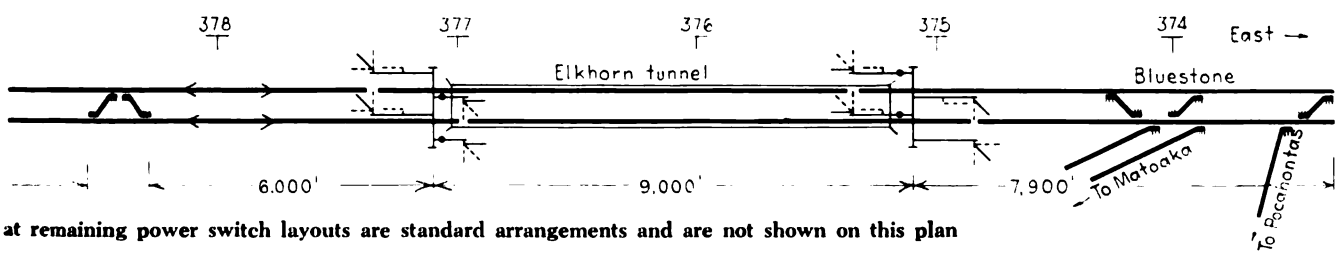
Tunnel Fans

On this railroad, all trains are operated by coal burning steam locomotives. In the 7,100 ft. tunnel, the track is on a 1 per cent descending grade westward. Because of this grade, and the prevailing winds, the draft is usually from west to east in the tunnel. Electrically operated ventilating fans are located at the west end of the tunnel to aid the natural draft to blow smoke eastward out of the tunnel. The operation of these fans is controlled by line code equipment from thumb type levers located in the bottom row on the dispatcher's C. T. C. machine. Emergency controls for both fans are provided by a simplex circuit on 2 No. 8 wires. This simplex circuit is independent of the line code equipment.

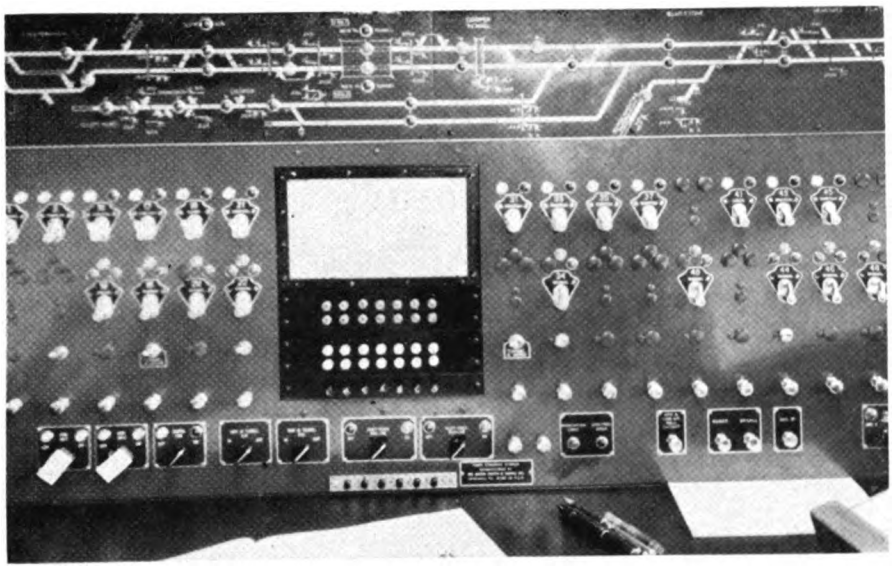
The telephone train dispatching circuit is on two line wires independent of the C. T. C. system. At Bluestone, connections from this telephone train dispatching circuit branch off to the two branch lines. As part of the new project, the connections to these branch line circuits were extended through contacts of conventional signal type relays, the operations of which are controlled by line code equipment and thumb type levers in the row at the bottom of the dispatcher's C. T. C. panel. If grounds, crosses or other faults occur on the dispatcher's telephone line circuits on either of the branches, the dispatcher can send out a code to Bluestone to cause the relays to operate and thus disconnect the line wires extending to the telephone circuit on the branch. This prevents the faults from interfering with operation of the telephone circuit on the main line.

Protection for Motor Cars

This installation includes special protection for maintenance of way employees and for the movement of track motor cars through the tunnel. Near each end of the tunnel, there is a sheet-metal telephone box mounted on a pole. A picture here-



at remaining power switch layouts are standard arrangements and are not shown on this plan



The C.T.C. control machine in the dispatcher's office has push-to-turn buttons at the bottom of panel to control motor car protection through the tunnel

with shows one of these boxes with the door open. By means of the double-throw, double-pole knife switch at the upper section of the panel, this telephone can be connected to either the block circuit or the dispatcher's telephone circuit. The press-to-talk button is just below the switch.

Red Lens and Switch

In the lower part of the telephone box, there is a special panel with a 2-in. red lens and an enclosed toggle switch at the left. When a man is ready to run a motor car through the tunnel, he stops at the telephone box for that track. He calls the dispatcher to determine whether the motor car move can be made and, if so, the man at the box throws the toggle switch which is to the left of the red lamp. This is indicated by a lamp on the dispatcher's panel, and then the dispatcher operates the corresponding thumb lever at the bottom of the panel. This prevents the clearing of the signals which govern train movements into the tunnel on that track. At the tunnel, the controls check track occupancy of the track in the tunnel, then a lamp is lighted behind the red lens in the telephone box. This indication authorizes the man to move his motor car through the tunnel on that track.

After arriving at the other end of the tunnel, the man must go to the telephone box for that track and throw the toggle switch in that box. This causes an indication to go to the dispatcher to tell him that the man is out of the tunnel, and also, when the man throws the toggle switch, certain local circuits are released. The dispatcher can then clear the signals for a train, or he can give a lineup for another motor car move through the tunnel on that track.

Protection for Track Work

When maintenance of way work is to be performed, protection is secured by consulting the dispatcher and operating the protective devices as described above. In addition, a single-pole switch mounted in a separate housing immediately below the telephone may be opened and this special housing then locked by means of a private lock. In this manner, the protection is effective until released by the employee originally securing it.

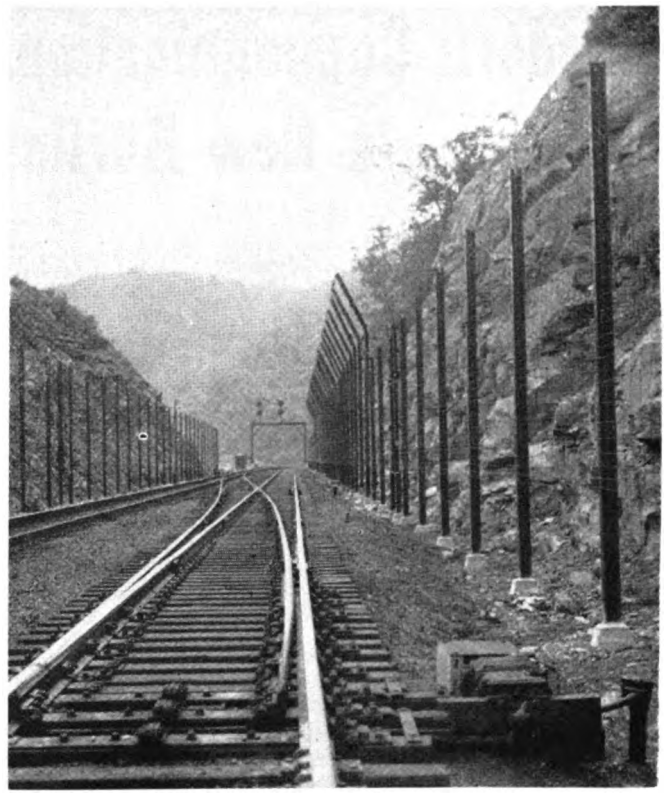
The signal, communication and power circuit cables through the tunnel are in 4-in. asbestos fibre ducts located in the concrete sidewalls of the tunnel. Pull boxes are spaced 1,000 ft. apart and are located in the safety bays.

Rock Slide Detectors

This is mountainous territory with high rock cliffs along the track at many places. Therefore, within a distance of 6 mi., twelve rock slide fences, totaling about 7,000 lineal feet, were installed as part of the new signaling project. As shown in pictures herewith, the posts for these fences are made of old 130-lb. steel rails, and are as high as may be necessary at different locations. At some places, where there

Phone box near end of tunnel includes toggle switch and the 2-inch red lens

are overhanging rocks, the upper portions of rail posts are bent out at an angle to detect rocks that may fall vertically from bluffs. Standard woven wire stock fencing extends from each end post to a location near the center, the ends of the fencing being tied around sections of 1-½-in. pipe. At the posts, the wire is held loosely in loops. At the far ends, the pipes are held by adjustment bolts. At the center, the pipes are under tension by coil springs to hold the fencing taut. From the pipe for each fence section, a small wire cable extends to a trigger mechanism. At the center location, there is a circuit controller which is normally held in the closed position by a trigger which is tripped when a rock strikes any section of the fence. One such controller arrangement will serve all the fence built to any height, and will serve as much as 225 lineal feet of such fence in each direction from the center location.

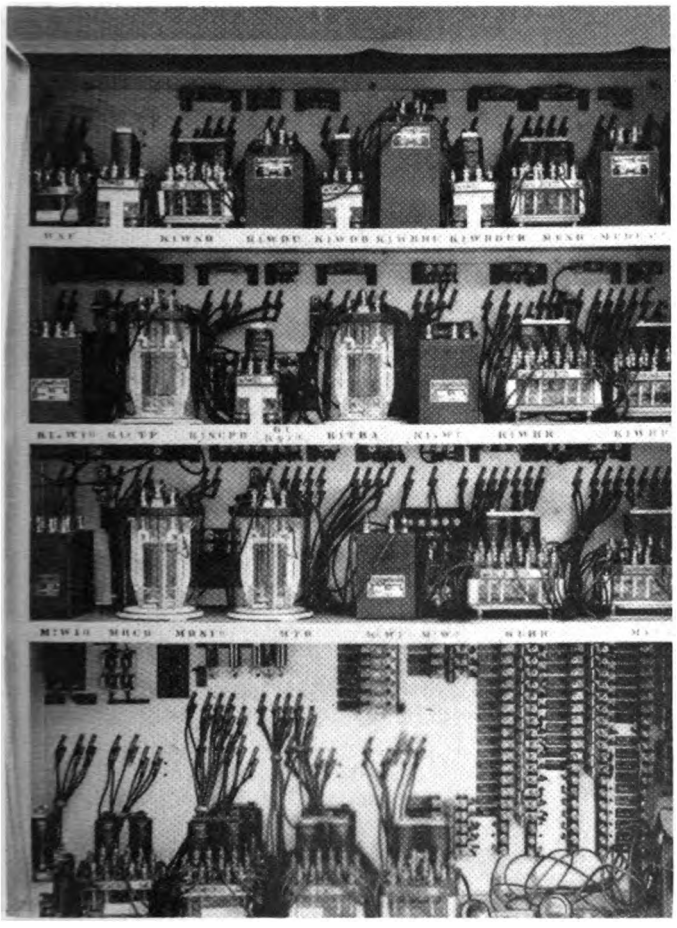


The rock-slide fences are on steel rails set in concrete and where the rocks overhang, upper end of rail is bent at angle

Trains Are Stopped

When the controller operates, the circuits are opened to set the signals at their most restrictive aspect. When a train arrives and stops at the signal, a member of the crew walks to the slide location to determine the damage and to telephone to the dispatcher. The trainman can see that the controller trigger is tripped. The Norfolk and Western now has more than 135 of these rock slide fences in service, totaling more than 340,133 lineal feet.

As part of this 1950 project, a new pole line was built through this section for 52.5 mi. between Bluefield and Iaeger. This line includes Class-5 southern pine poles, pressure treated full length with creosote. These poles are approximately 35 ft. high and are set 38 to the mile. On this line, the three wires for the 4400-volt single-phase a.c. power are No. 2 hard-drawn copper, and the overhead ground wire attached to the top of the poles is 3-strand No. 10 Copperweld. The two C. T. C. line code wires are No. 8 Copperweld. Control circuits are No. 10 Copperweld. These wires and the line code wires have Formex Flamenol plastic coating which is not only a weatherproof covering but also electrical insulation.



Typical relay case at signal location at Powhatan

Cases on Piers

At the field locations, the relays, code equipment, low-voltage transformers, batteries, and other equipment are located in sheet metal houses and cases which are set on cast iron pier foundations. The wiring in these houses and cases is, for the most part, No. 16 flexible with 4/64-in. insulation.

This centralized traffic control installation was planned and constructed by railroad forces under the direction of J. A. Beoddy, Superintendent Telegraph and Signals.