Intermediate location—approach signal (left) in advance of double track may display "Approach Limited"

Unique Combinations of Single-Track and Two-Track Developed on the Southern

Train performance improved, and track maintenance reduced, by converting 164 mi. of double track to alternate 10-mi. sections of single and double track, with centralized traffic control, and power switches and signals so that no sidings are now required

A NEW AND NOVEL track arrangement, consisting of alternate sections of single main track and two main tracks, has been developed on the Southern Railway, and placed in service on 167 mi. between Ludlow, Ky., (Cincinnati) and Tateville, Ky., which is a portion of the route to Chattanooga, Birmingham and New Orleans. Except for 3 mi. of single track, including a tunnel, between South Fork and King's Mountain, the 167 mi. between Ludlow and Tateville was previously double track, with automatic block signaling for right-hand running. Twenty-two single-direction sidings, with hand-throw switches, were used for passing of trains of the same direction. Thirty-five hand-throw crossovers between main tracks at various stations were used in emergencies, for crossing trains from one track to the other. As will be explained in detail later, the change-over included removal of these 35 hand-throw crossovers as well as the retirement of the 18 hand-throw passing tracks, as such.

Sections of Second Track Removed

Basic principles of the new track arrangement are shown in Fig. 2. All of the 30-mi. section between Rice and Mason was previously double-track. The old southward main was removed for 9.5 mi. between Rice and Bracht, and for 11 mi. between Reid and Mason. This left 10 mi. of

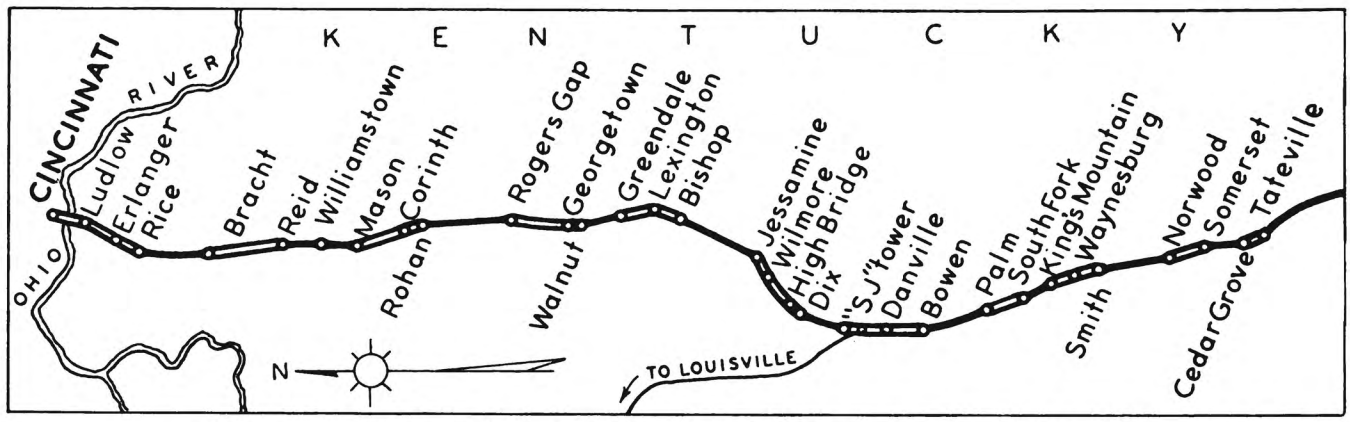


Fig. 1—Territory between Cincinnati and Tateville showing alternate sections of double track

existing double main tracks between Bracht and Reid, both tracks now being signaled for train movements in both directions, the same as on two single tracks side by side. At MP 24.5 and at MP 29.5 new power-operated remote controlled double crossover layouts were installed, so that trains can be diverted from either track to the other, at either of these locations.

How Trains are Kept Moving

The switches at the new ends of two-track and the double crossovers, as well as signals at these locations, are controlled by the dispatcher, the train movements being authorized by aspects displayed by these signals.

The sections of second track removed were, in all instances, the old southward main, so that, at each of the new ends of two-track, the No. 1 track (on the east side) is the "straight track," and the turnout is to the No. 2 track, which was previously the southward main. Therefore, when only one train is involved, it is routed on the No. 1, "straight track," thus requiring no speed reduction to make a diverging move. When two trains are involved in either a meet or a pass, the train being given "preference" is usually routed on the "straight track." Nearly all such meets are made with neither train being required to stop.

Different routing may be required when more than two trains are involved. For example, a southbound freight may be approaching Bracht, ahead of southbound passenger train No. 1, which is to meet northward passenger train, No. 4 at Reid. The southbound freight is diverted to the No. 2 track at Bracht, and keeps moving. The southbound passenger, No. 1, stays on track No. 1 to pass the freight before reaching the crossovers, at MP 29.5, where it is diverted to No. 1 track to run on to Reid. In the meantime, the northward passenger train is routed past Reid on the No. 1 track to meet, not only the northward passenger train No. 1, but also the southward freight train. Thus, the combined meets and pass are accomplished. Nine times out of ten, such moves are made with none of the three trains being required to stop. In rare instances, "time runs out," and the dispatcher is faced with a "stand-off" meet, so that one train or the other must wait a few minutes. However, such losses of time are more than offset by the time saved by other operating features of the new track and signal system.

Other Operating Advantages

Previously with the double track system, train movements were authorized by timetable and train orders. An important freight train would take siding to clear for a following passenger train. If the passenger train lost time, the dispatcher had no quick means of getting an order to the freight to move on. Therefore, the freight lost too much time on sidings. Now the dispatcher, by looking at the illuminated chart on his control machine, knows where all the trains are, and he controls the power switches and signals to keep all trains moving, as explained above.

Also, before entering sidings or crossing over from one main to the other main track, it was necessary for trains to stop and wait for the hand throw switch or switches to be operated. Now all the switches at ends of double track and main track crossovers are power operated, and no stops are required, which saves considerable time.

The over-all train performance is an improvement over the righthand running double track previously in service because of the flexibility of the new system. The dispatcher can give preference routing to trains as required, on a minute-to-minute basis, so that on-time performance of passenger trains and important through freight trains has improved, and also the slower freight trains are kept moving. Therefore, the new track arrangement and centralized traffic control have proved to be a decided success from the standpoint of train operation, as well as because of the large saving in track maintenance.

Why No Sidings Are Needed Now

As explained above, the trains, in most instances, are kept moving on

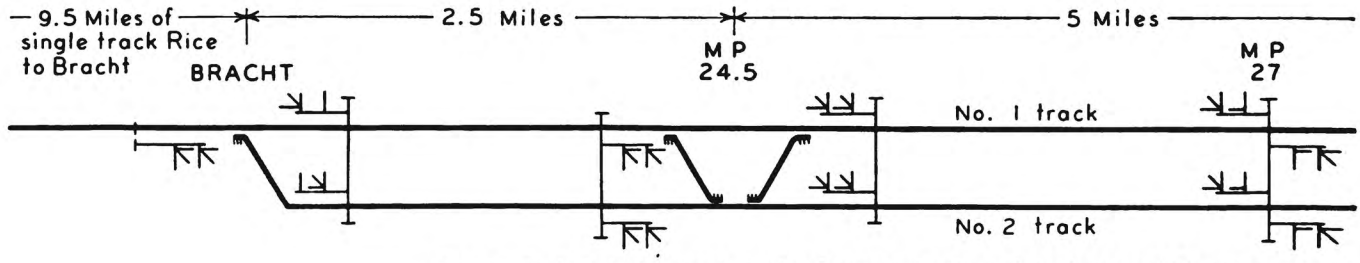


Fig. 2—Typical double track section between Bracht and Reid over which trains may be

the sections of two-track when making meets or passes. Therefore, the previous 22 single-direction hand-throw sidings were dispensed with, as such. Thirteen of these sidings were removed entirely. Parts of eight other sidings were retained for use as switching pockets and house tracks. The siding at Lexington, was (and still is) properly classed as part of the yard layout because it is used by yard engines as a pocket track, and by northbound freights when setting out or picking up cars. Thus the new system includes no siding, as such, used normally for the meeting or passing of any and all trains. This, in itself, is new and novel in railroading.

Referring to Fig. 2, the distance from Bracht to the double crossovers at MP 24.5 is about 2.5 mi. and likewise the distance from Reid to the double crossovers at MP 29.5 is about 2.5 mi. This 2.5 mi. is standard in all such layouts; this distance was chosen for two reasons: When a train enters such a 2.5-mi. section of the No. 2 track, the entire train can be pulled through the turnout at the maximum speed permitted for that turnout (45 m.p.h.), and then a second full train length of empty track ahead is available in which to stop the train, or to accelerate if the train is to continue on this No. 2 track. Also, if necessary under unusual circumstance, two trains could pull into one of these 2.5-mi. sections.

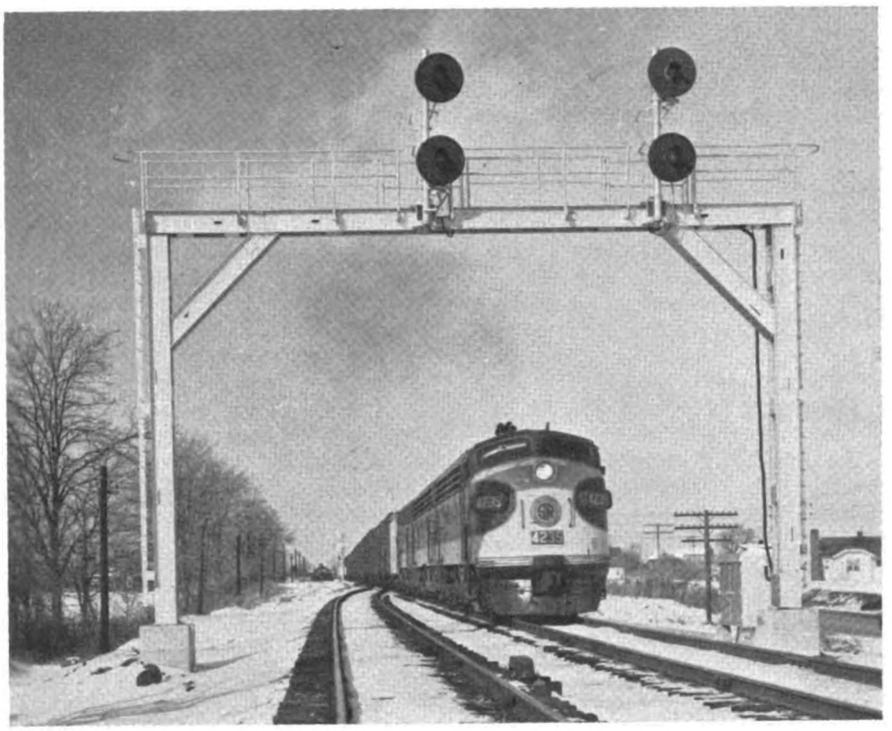
The distance between the double crossover layouts at MP 24.5 and MP 29.5 is about 5 mi., but the corresponding distance in other sections of two-track may be more or less, depending on the overall length of section of two-track.

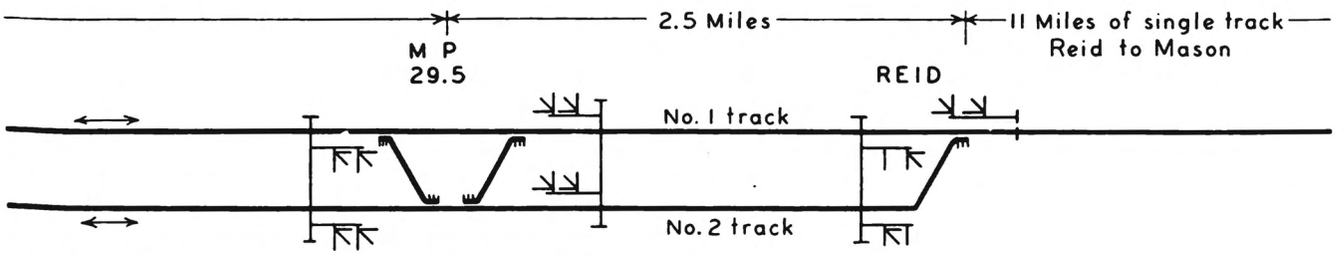
Lengths of Single and Double

Numerous factors were involved in deciding where to remove sections of second track. The first consideration was to leave two main tracks through yards at Ludlow, Lexington, Danville and Somerset, where yard and station switching are important factors. Where train speeds are materially affected by grades and curves, double track with two-way

Intermediate location—two-unit signals are in advance of a double crossover

Below: home signals at end of double track; inductor for train-stop system by rail





run in either direction on either track enabling non-stop meets and passes to be made

The centralized traffic control machine is in the dispatcher's office at Somerset

signaling was left to provide better passing and meeting.

On the Ludlow-Danville territory, the general plan called for alternate sections of approximately 10 mi. of single-track and 10 mi. of two-track. On the Danville-Tateville territory, some of the sections of single-track are less than 10 mi., as for example about 6.5 mi. between Bowen and Palm. On the other hand, with favorable grades and few curves, the single-track section between Rohan and Rogers Gap is about 11 mi.

On the entire 167-mi. project between Ludlow and Tateville, 73.8 mi. of the old southbound main track, about 11.6 mi. of siding and 35 hand-throw crossovers were removed. The rail, ties and ballast, which were removed, are salvaged for use elsewhere.

Diverging Moves at 45 m.p.h.

An important time saver, in this new system, is that the turnouts at the ends of two-track, and the double crossovers between two tracks, are No. 20 with special 39-ft. curved switch points, so that trains are authorized to make diverging moves at speeds up to 45 m.p.h. Of corresponding importance is the fact that special signal aspects, and controls, were installed to direct enginemen to bring their trains up to and through these turnouts at 45 m.p.h.

Each of the signals involved is equipped with a marker, consisting of a triangular piece of sheet metal, painted yellow, and mounted on the mast. When a home signal is cleared for movement over a diverging route, the indication displayed is "Limited Clear," red over green with yellow marker. When a home signal is also the approach signal to another home signal controlling movements over diverging route, the "Limited Clear" aspect indicates, in addition, "Approach next signal at Limited Speed."

Approach signals, with no diverging route in their block, display "Approach Limited," yellow over green with yellow marker, when the movement controlled by the next signal is lined for diverging route.

This Is a Busy Piece of Railroad

Of interest is the fact that this new system of alternate sections of single-track and two-track was installed and proved satisfactory on a heavy traffic territory. Most of the freight trains handle important through traffic, on fast schedules. For example, No. 53, known as the "Sparkplug," because the auto assembly lines located in Atlanta depend on it, is scheduled from Ludlow to Tateville, 167 miles, in 4 hr. 27 min.

The total volume of freight traffic handled on this division is high. The most recent annual figures available are for 1952, during which year the net tons mile per mile was 5,730,956 northbound between Tateville and Danville and 4,756,821 southbound. Between Danville and Cincinnati the net tons per mile was 3,732,782, and southbound 2,697,526.

Many Curves and Grades

On the entire section from Ludlow to Tateville the railroad passes through rough hilly country. Curves are numerous, ranging up to 6 deg. These curves necessitate speed reductions of freight trains to 40 m.p.h. at two places, 45 m.p.h. at four places, and 50 m.p.h. at five. Between South Fork and Kings Mountain there is a tunnel about 4,000 ft. long, as well as 4-deg. curves, three 5-deg. and one 6-deg. curves. The speeds of all trains is limited to 45 m.p.h. in this 5 mi. Two 5-deg. curves are located on the 2 mi. just north of Tateville.

Through much of this territory the grades are rolling with a few long heavy grades. The ruling grade southward is 1.13 per cent for about 5 mi. from Ludlow, Ky., up through Erlanger. A southward grade of 0.76 to 1.0 per cent extends for about 5.5 miles from South Fork to Kings Mountain. The ruling grade northbound is 1.0 per cent for about 4.5 mi. north from Somerset.

Considering the number of trains, the total gross tonnage handled and probable future growth, and the grades and curves, progressive foresight and keen analysis of all factors were required to visualize the success which has been accomplished by this new single-track, two-track arrangement, with centralized traffic control.

New Trakode Local Controls

This project includes the first installation of the General Railway Signal Company's new Trakode system, in which positive or negative impulses, as well as time spacing of impulses, fed to the rails, are used to secure any reasonable number of local controls, track-occupancy controls, etc., so that local line wires are not required in this new system.

All the signaling equipment on this installation is operated by direct current energy from storage bat-

teries, which are on floating charge through rectifiers. These batteries are the nickel-iron type made by the Thomas A. Edison, Inc. At an outlying power switch layout, the 24-volt switch machine is operated by a set of 18 to 20 cells of 150 a.h. battery. Also, at such locations two sets of 9 cells of 150-a.h. battery feeds the control circuits, and acts as standby for signal lamps which normally are fed from a.c. Each set feeds in one direction from the switch location. At the Somerset control office a set of 111 cells of 18.75-a.h. BIH cells feed 150 volts to the C. T. C. code line circuit. Two 24-volt local control batteries each include 18 cells of A6H cells.

The CTC line code circuit is on two new No. 6 weatherproof Copperweld line wires transposed for carrier and voice frequencies. The code circuit from Somerset to Lexington is operated as conventional d.c. control with carrier circuits sup-

Bridge-mounted signals at a double crossover location. Note the yellow triangular marker below the signals' lower light unit

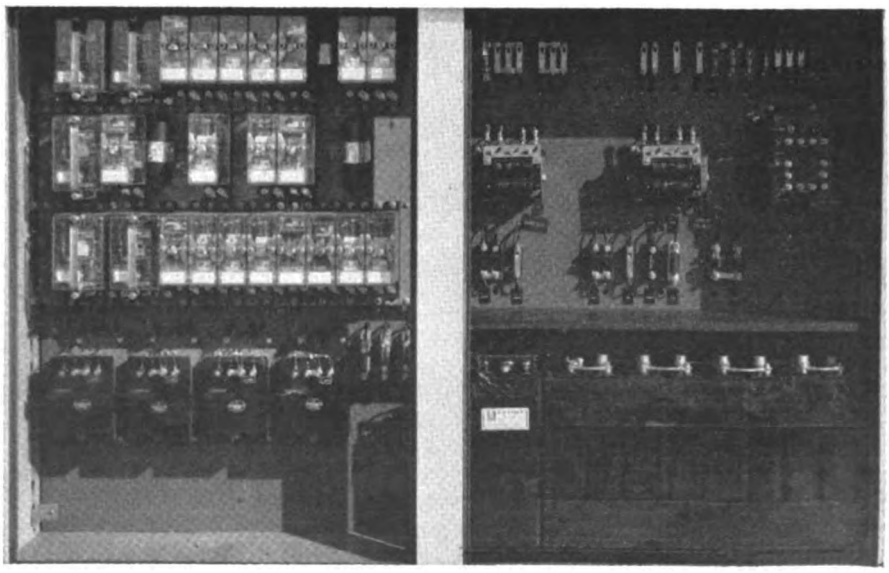
erimposed for control from Lexington to Ludlow. The 550-volt a.c. power distribution circuit is on two new No. 8 weatherproof copper wires. These four new wires are on new bottom crossarms on the pole line used for communications circuits.

The automatic block signals in service before the C.T.C. was installed were both a.c. and battery operated. Sixty-five mi. was a.c. and operated from a 4400-volt, single phase, 60-cycle power line. As the

Turnouts are No. 20 with special 39-ft. curved switch points enabling trains to make diverging moves at up to 45 m.p.h.

CTC circuits are located on the communication pole line, there is no longer any need for the a.c. power line and it will be removed.

The new single-track, two-track arrangement was conceived by the operating department of the Southern. The project was handled by its operating and engineering officers; the track work being done by local forces. The new centralized traffic control was planned by Southern's signal and electrical department working with General Railway Signal Company, which supplied the equipment.



Equipment in a relay case at a signal bridge showing relays and local battery