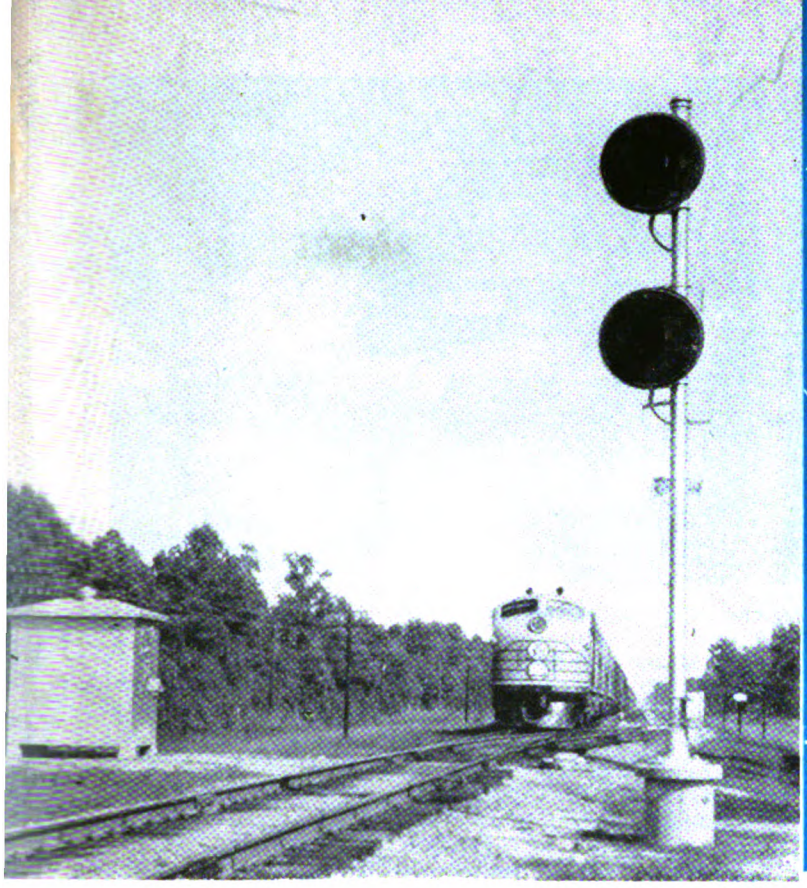
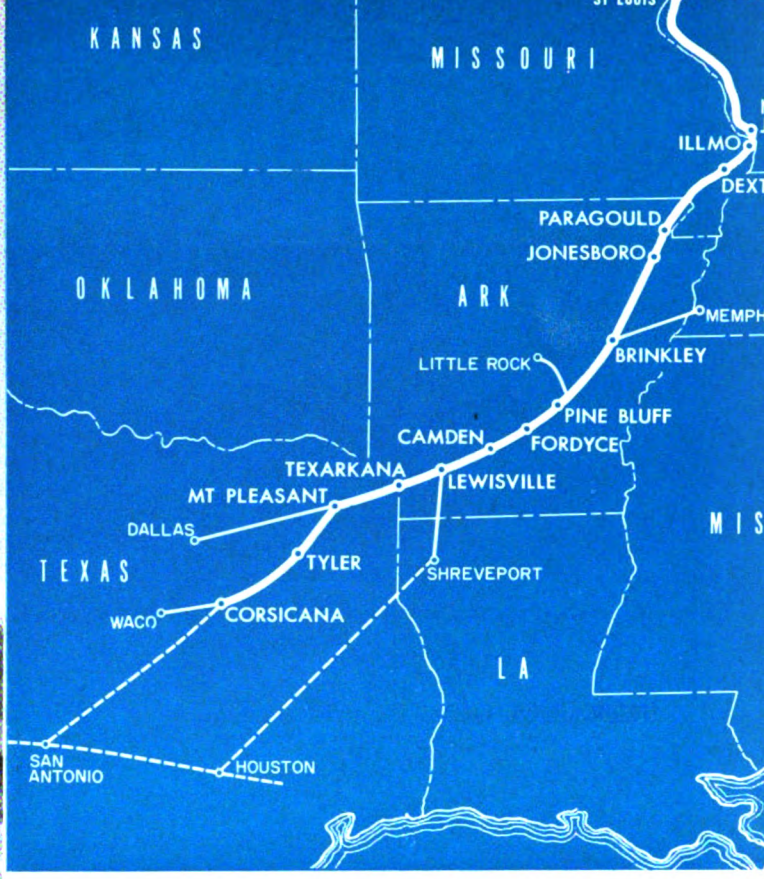


movements are authorized by signal indications



Heavy line shows centralized traffic control territory

Why Cotton Belt Installed CTC on Entire Main Line

Some of the benefits of the CTC as compared with previous timetable and train order operations, as expressed by Cotton Belt operating officers, are: (1) On a sub-division of 100 to 110 miles, the CTC saves an average of about 1 hour to 1 hour 10 minutes for each freight train. (2) CTC enables a single-track railroad to efficiently handle about 80 per cent more traffic, and at the same time expedite the movement of trains. (3) Permits trains to depart from yards promptly when ready. (4) With CTC, trains that are received behind schedule can make up time, without delaying other trains, and (5) CTC increases safety.

THE BENEFITS of centralized traffic control, on extensive sections of single track, are being demonstrated on the St. Louis Southwestern, known as the Cotton Belt.

Two Far-Sighted Decisions

Prior to 1941, train movements on this railroad had been authorized by timetable and train orders, with no automatic block signaling. When faced with an increased volume of traffic, and the necessity to get trains over the road in shorter time, the management, in 1942, made two important decisions that not only proved to be correct but also were forerunners of recognized developments that are coming to the front today.

The first of these 1942 decisions was not to add second main track, but to increase the capacity of the existing single track. Observations made on other roads proved to the management that the installation of automatic block signaling on single track would improve safety but would necessitate continued use of timetable and train orders. Therefore, the second decision made in 1942 was to improve the single track by installing a complete system of centralized traffic control, including power switches and signals for authorizing train movements by signal indication. This program has now been completed on the entire principal route mileage between Illmo and Corsicana via Pine Bluff, Texarkana, Mt. Pleasant and Tyler, totaling 628 miles, all of which is single track except four short sections of double track totaling 17.4 miles.

Between East St. Louis and Thebes, Ill., 121 miles, the Cotton Belt and the Missouri Pacific operate jointly on tracks of the MP. The bridge across the Mississippi river, and the tracks between North Junction, Ill., and Illmo, Mo., 4.5 miles, are owned jointly by the two roads. Between Illmo, Mo., and Paragould, Ark., 110 miles, trains of both these roads operate on track owned by the Cotton Belt.

The first CTC project, completed in 1943, was on 32 miles of single and 15 miles of double track between Illmo and Dexter Junction,

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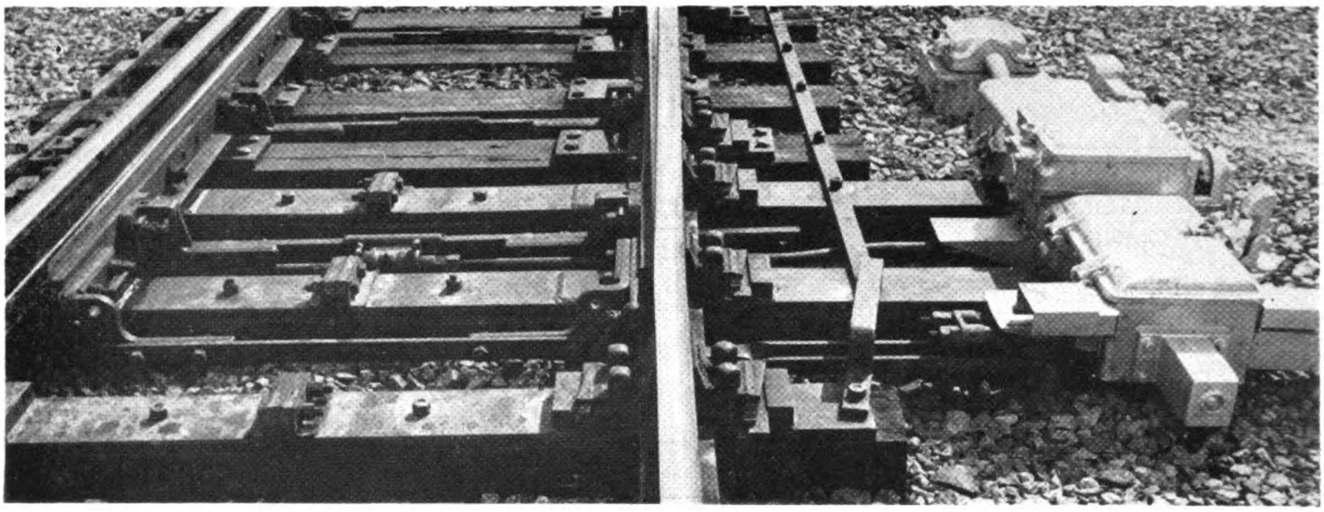

Power switches are well constructed with heavy rods, tie plates and adjustable rail braces

where traffic had increased to 60 trains daily. Other sections were equipped with CTC as fast as practicable, preference being given to sections including grades. For example, on the 152 miles between Pine Bluff and Texarkana, the railroad crosses four major rivers, and traverses hilly country with curves up to 4 degrees and grades up to 1.17 per cent. This 152 miles was the second CTC project, completed in 1945.

Because of shortages of men and materials the program was delayed. In 1952 CTC was completed on 68 miles between Pine Bluff and Brinkley; in 1953 on 84 miles between Dexter and Jonesboro; in 1954 on 60 miles betwen Texarkana and Mt. Pleasant; in 1955 on 68 miles between Mt. Pleasant and Tyler, and in 1956 on 75 miles between Tyler and Corsicana.

This program is proof that CTC has been successful in attaining the benefits as foreseen by the management of this railroad in 1942, i.e., not to add second track, but to improve the existing single track by installing CTC.

How Traffic Changed

From Lewisville, Ark., the Cotton Belt has a line extending 62 miles to Shreveport, La., where through connections are made with the Southern Pacific on the route between St. Louis and Houston. At Texarkana the Cotton Belt connects with the Kansas City Southern and the Texas & Pacific.

At Corsicana, 75 miles west of Tyler, the Cotton Belt connects with the Southern Pacific for through freight between St. Louis and points in Texas such as San Antonio, Brownsville and El Paso, as well as on west to cities in California. The overall schedule time for through freight either way on 628 miles between Corsicana and Illmo is 20 hours. The maximum permissible speed for freight trains is 60 mph.

Back in 1942 the Cotton Belt operated several passenger trains and two local freights, as well as numerous through freight trains throughout on the Illmo to Corsicana territory, the maximum traffic ranging up to about 50 trains daily on the Illmo to Dexter Junction section.

Now, passenger service has been reduced to one train each way daily between St. Louis and Texarkana. On most of the territory between Illmo and Corsicana a local freight is operated each way daily except Sunday. About 16 through freights and extras are operated daily between Illmo and Dexter Junction; about 12 between Dexter and Paragould; about 10 between Paragould and Texarkana and 8 between Texarkana and Corsicana. Thus the number of trains daily ranges from about 20 between Illmo and Dexter, to about 10 or 12 between Tyler and Corsicana.

The CTC on this railroad includes power switch machines and complete arrangement of dispatcher controlled signals at both ends of all sidings that are regularly used for meeting and passing trains. Intermediate automatic signals are spaced from 2 to 8 miles apart for following trains.

Numerous changes were made in sidings. Those that were to be equipped with power switches were lengthened to capacities ranging from 120 to 160 cars. New No. 16 turnouts, including 30-ft. points, were installed at both ends of these long sidings so that trains could enter or leave at speeds up to 30 mph. Short sidings, not needed with CTC, were either removed or converted to spurs for serving industries.

Prior to installation of CTC, this railroad had several lap siding layouts. Studies indicated that, with CTC, there would be very few instances in which lap sidings would be used effectively to hold two trains while a third passed. Considering the fact that two additional switch machines and signal layouts, as well as new No. 16 turnouts would be required, the lap sidings, as such were eliminated.

Sidings Are Signaled

Track circuits were installed on sidings, not only to control the signals directing trains to enter, but also to control track-occupancy indications on the control machine, so that the dispatcher knows the location of trains when on sidings.

When a power switch is reversed for a train to enter a siding that is unoccupied, the signal is cleared to display the red-over-yellow aspect, and at the same time the approach signal displays the flashing-yellow aspect. Thus the engineman has confidence to bring his train up to the siding and enter at 30 mph., knowing that the siding is unoccupied so that he has the entire length in which to stop. This practice saves much precious time, especially when making close meets. In CTC projects in which the control of the entering signal does not include occupancy of the siding, and which do not include a special approach aspect, the speed should be reduced, prepared to stop, not only when entering but also when pro-

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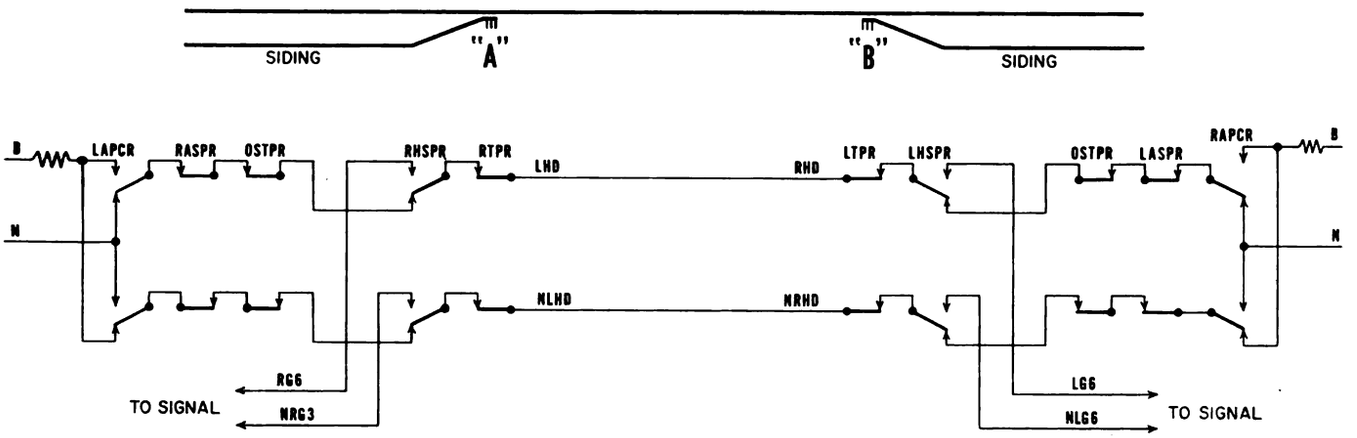

One two-wire line circuit controls signals for both directions

ceeding along the siding. This loses a lot of time.

On the Cotton Belt, if the siding is occupied by a train of the same direction, the entering signal can be cleared to display the red-over-lunar aspect. If the siding is occupied by an opposing train, the entering signal cannot be cleared.

New Signal Pole Line

The old communications pole line had only one crossarm on short poles, therefore another arm for signal wires could not be added unless this entire pole line was rebuilt, which was estimated to cost more than a new separate pole line for signal wires.

This new pole line, built by signal forces, includes 25-ft. poles, with a minimum 17½ in. circumference at the top. These poles are Southern pine, creosoted full length, 8½ lb. to the cubic ft. Poles are set 30 to the mile, which is about 176 ft. apart. Crossarms are 10 ft. long, with 10 pins. The line is storm guyed every 15 poles. A double-pole H fixture is located at each signal location. The average cost of the completed pole line with wires in place was $2,100 per mile.

A power machine, on Caterpillar tracks, including an earth borer and crane, was used to dig holes and set poles, with crossarms, pins and insulators in place. One man operated the machine, one man handled the digger, and a third man handled the line and directed the poles. This crew set an average of 60 poles in an 8-hour day .

The two line wires for the CTC code are No. 8, 40 per cent Copperweld with plastic weatherproof covering. These wires are transposed for 30 kc. The two line wires for the local signal controls are No. 10 with plastic weatherproof covering. The 550 volt a.c. signal power line is on two No. 6 bare Copperweld, or strand consisting of one No. 10 Copperweld and two No. 10 solid copper, twisted together to form equivalent of No. 6 copper. The 550-volt line circuit is transposed every half mile.

When constructing this line, reels of line wire were placed on shafts on jacks on push cars on the track. As the car or cars were pulled along the track the wires were reeled off and laid up on the crossarms. Thus no wire was nicked or scratched by being dragged on rocks.

The 550-volt a.c. distribution line is fed in sections of 15 to 25 miles, from the feed point to the far end. The voltage on the low side of the line transformers at the far end, may range from a maximum of about 108 volts, to a low of 105. On a typical section of 25 miles, including four power switch layouts, the power consumed for a typical month was 1300 kwh. The 550/110 volt transformers are rated at 150 watts at intermediate signals, and at 250 watts at power switch layouts. Storage batteries are the nickel-iron type, made by Thomas A. Edison Industries, and lead type made by Electric Storage Battery Co. The wiring in the instrument houses is No. 14 flexible, with 2/64-in. insulation and 1/64-in. neoprene covering. This wire was furnished by Simplex Wire & Cable Company.

Two-Wire Line Circuit

The drawing shows circuit used on the Cotton Belt for 2-wire signal circuit which extends from siding to siding. Battery is normally connected at both ends of the circuit, when dispatcher sends code to clear a signal, the battery is removed from the line circuit, and the signal control circuit is connected at one end. Tracing the control circuit, beginning at station A, dispatcher codes signal control for train movement from A to B, the RHSPR relay is energized, and connects signal circuit to line circuit through front contacts of RHSPR. Since battery continues to feed from station B, it will be seen that line circuit is energized for train movement A to B. Advantages of this circuit are:

(1) Traffic relays at both stations are eliminated.

(2) One less code control function is required for controlling traffic relays.

(3) Number of control and indication codes are reduced since it is not necessary to code both stations in order to set up traffic direction.

The CTC control machines for the 426 miles between Illmo and Texarkana are in the dispatcher's office at Pine Bluff. The CTC control machine for the 202 miles between Texarkana and Corsicana is in the office at Tyler. Telephone service between the dispatcher's office and the various phone booths at switches along the CTC territories, was secured by superimposing, on the two CTC line wires, a system of frequency modulation carrier which ranges from 45 kc to 65 kc, between Illmo and Texarkana. Thus, without adding to the number of line wires, this phone circuit extends to 165 booths and offices north of Pine Bluff, and to 96 booths or offices south from Pine Bluff to Texarkana. To minimize interference of the phone circuit, the two line wires are transposed for 30 kc.

These CTC projects on the Cotton Belt were planned and installed under the direction of B. J. Alford, Signal Engineer; the major items of signal equipment were furnished by Union Switch & Signal, division of Westinghouse Air Brake Company.

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