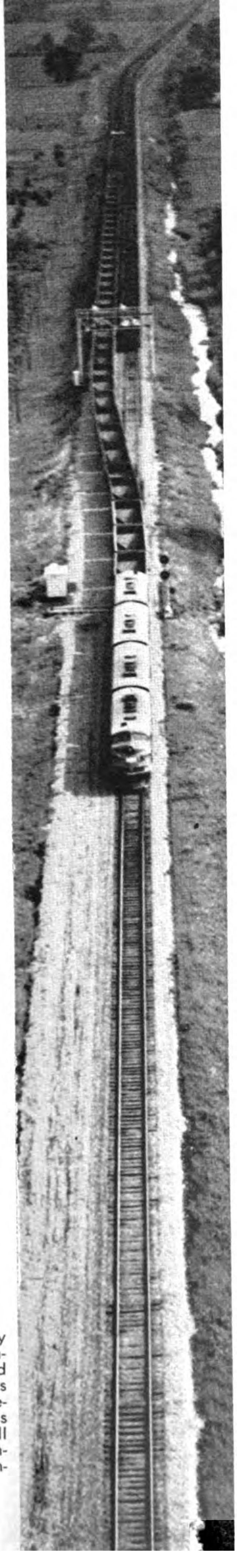
Railway
Signaling &
Communications



CTC enables many railroads to eliminate a second main track, thus reducing maintenance expenses and taxes as well as improving on-time train performance.

WHAT CTC CAN DO FOR YOU

Increasing capacity of existing trackage, reducing operating expenses, improving on-time performance of trains, and generally providing for a more efficient operation are some of the well-known advantages of CTC. To review these fundamentals, cites one signal engineer, is appropriate under today's operating conditions.

"Today's 200-car freight trains operating at near passenger train speeds may create operating problems in older CTC territories. For example, where you have 100 or even 150-car passing tracks, you'll have to let the long one hold the main and hope you have a short train to take the siding. Frankly, we've got some traffic control territories, dating from the 40's, that we've got to rebuild to handle these long, fast trains. It's a case of upgrading CTC to meet the changing operating conditions. Although we're only working on one CTC section at the present time lengthening sidings, removing others, etc., we are taking a look at all our existing CTC installations with the view as to what might be done to improve their operation." That's one major railroad's signal engineer's commentary.

Not only are railroads putting more cars behind locomotives these days, but many of the cars are longer than the 44 ft used for siding capacity calculations. Use high horsepower locomotives to roll these long trains at upwards of 50 mph, "and you can really get some delays in traffic control territory. This was considered impossible a few years ago because CTC was 'the answer' to solving the problem of traffic delays," is one dispatcher's comment.

Signal engineers are taking a long, hard look at existing CTC installations with the goals of making them efficient and improving operations under today's traffic patterns. Some of the methods of accomplishing these goals are described on the next two pages.

How to improve your CTC operation ▶

How to improve your CTC

Upgrade CTC: lengthen sidings

The obvious answer, of course, to handle longer trains in centralized traffic control territory is to lengthen existing passing tracks. However, not every siding has to be lengthened; some may be removed or converted to house or industry tracks. "With higher speed freight trains, we don't need our sidings so close together," reports a chief dispatcher.

One road which had lap sidings spaced about six miles apart in a traffic control territory removed the power switches at the lap. At one location this gained them a 7,700-ft siding, which replaced 3,200 and 4,700-ft sidings. By removing alternate lap sidings or converting them to house tracks, the road increased the spacing between passing tracks to an average of about 11 miles. Although cost figures are not available, it is understood that the salvage from signal equipment removed, rail taken up, etc., just about paid for the siding and signal changes. In those sections where track was removed, real estate taxes have been reduced. Also, annual track and signal maintenance expenses in the territory have been reduced.

On a 98-mile section of track between Hazard and Ravenna, Ky., Louisville & Nashville spent $793,000 for siding changes in which six passing tracks were eliminated and the lengths of eight others adjusted so that meets and passes could be made expeditiously by 170-car coal trains. L&N is also upgrading other CTC territories to improve their operations with today's longer trains.

Light traffic CTC upgraded

Some roads which had installed CTC with a power switch at one end of a siding and a spring switch at the other have now replaced the spring switch with a power switch as a result of traffic increases. One road, which had this type of modified CTC, made the change to complete power switch operation and a full complement of signals to provide added flexibility. Also, a considerable time saving was achieved for through freight trains.

Seaboard Air Line has a territory of light traffic CTC in Florida with hand-throw and spring switches at the ends of sidings. Also, no intermediate signals are in service so that siding-to-siding blocks obtain with no provision for following moves. SAL is adding intermediate signals, replacing hand-throw and spring switches with power machines at the ends of sidings, and in some cases lengthening sidings in this territory. Other former passing tracks are being removed or converted to industrial tracks with hand-throw switches and electric locks. An increase in traffic is the main reason for the 150-mile conversion project.

Does the average number of trains operated in a 24-hr period provide a good index as to the type of CTC that would best serve both from an economic and operating standpoint? Yes and no. There are other factors to be considered. According to one railroad's signal engineer: "the capacity to keep all trains moving with minimum delay is important. This depends upon the number of meets in a section of the territory within a few hours' time. Also you should consider grades, curves, tonnage, train speeds, speed restrictions, and spacing between sidings on a time-distance basis."

Some roads use a figure of 6 to 8 trains daily for light traffic CTC using hand-throw and spring switches at ends of sidings, and no following moves allowed. For modified CTC with the power-spring switch combination, the traffic figure may rise to 12 to 18 trains. One railroad installed modified CTC on 240 miles of line in which daily traffic consisted of 4 passenger trains, 4 through freight trains, 2 to 4 local freights and extra freights during the fall each year.

Where the power and spring switch combination is used in CTC, some roads obtain flexibility by alternating the spring switch end of sidings. One road installed this form of CTC on a territory which generally was uphill for half the distance. It located the power switches on upper ends of all sidings. Trains moving downhill entered at the power end. Normal practice was for uphill trains to hold the main when making meets.

Move CTC machines together

Another way to improve or lower costs of a CTC operation is to centralize dispatching, where possible, by moving control machines. Missouri Pacific, for example, had three CTC control machines in Arkansas handling territories of 54, 7 and 61 miles, respectively. By moving two control machines to Gurdon and putting them together with the third machine, one dispatcher is able to control 122 miles of main-line. Annual savings from this consolidation amount to $63,644. Under an overall plan, MP intends to consolidate CTC machines on each district at a central location.

There is more to the job of centralizing CTC control machines than the actual moving of equipment. Often additional circuits must be provided to bring controls and indications, and the dispatcher's voice circuit from the old point of control to the new headquarters. In a consolidation of dispatching offices at Des Moines, Iowa, the Rock Island moved a 10-ft CTC machine 115 miles from Trenton, Mo. In addition, carrier equipment was installed at both points and repeater equipment at a third location.

Centralize your dispatching

Instead of moving three control machines when consolidating controls at Grand Junction, Colo., the Denver & Rio Grande Western installed a new machine with a double-decked track diagram panel containing the switch and signal levers. The new machine handles 285 miles of CTC territory, compared to 133 miles controlled by the largest of the former control machines. The new double-deck panel enables the dispatcher to easily reach all operating levers. Double-decking of this conventional control panel was a forerunner of the new pushbutton CTC machines which may control upwards of 300 miles of line.

Pushbutton machines control more

The use of the compact pushbutton CTC machines enables a man to control much more territory than he would be able to physically handle with conventional machines. One railroad, for example, is controlling 228 miles of line from a conventional machine, 27½ ft long which practically surrounds the dispatcher. Another railroad replaced a conventional CTC machine, 22½ ft long, handling 155 miles of traffic control territory with a 15-ft pushbutton machine which controls an additional 95 miles of line.

A feature of these compact CTC machines is that a set of common pushbuttons provide switch and signal control for all locations. Another set of numbered pushbuttons are pressed to select a controlled location, such as the end of a siding. Thus the dispatcher can easily reach the pushbuttons in front of him. He does not have to be able to reach any area of a panel that may be 15 to 20 ft or more in length.

Along with the pushbutton control machines has been the development of incorporating communications equipment in the console within reach of the dispatcher. For example, the telephone selector equipment, microphones, dial telephones, and talk-back speaker units are mounted in the console adjacent to the signal control pushbuttons.

This concentration of the signal and communications controls within easy reach of the dispatcher has met with favorable response. However, the larger mileages which can be accommodated on these compact machines has been accompanied by an increase in the number of persons calling the dispatcher to request lineups or permission to use sections of the line for motor car operation.

Automatic CTC is helpful

What with motor car movements, giving train lineups and answering other telephone inquiries, some railroads are finding the new larger-capacity CTC machines (with pushbutton consoles) are not providing the payoffs anticipated, because a second operator may be required to handle first trick operation. One solution to this problem has been solved by the Southern Pacific development called automatic dispatching. This type of automated CTC frees the dispatcher from the purely mechanical operations of controlling switches and signals.

"Approaching trains advance on signals they automatically clear by their forward progress," says SP's executive vice-president B. F. Biaggini. "We've found that its timing is so precise that more than half the train meets are being made non-stop." SP has more than 800 miles of automatic dispatching in service. In operation, a train will cause signals to clear far enough in advance so the train will always receive a Proceed indication, if traffic conditions allow. Ordinarily, the train will stay on the main track at siding locations. When the system senses a meet, the first of the two opposing trains to arrive will enter the siding. The second train will then hold the main track.

Thus freed from routine duties of clearing signals and controlling switches for meets, the dispatcher is able to concentrate on overall operations and extra-ordinary moves. He can take over control from automatic operation when necessary or desirable.

Earlier the Norfolk & Western developed circuitry to clear CTC-controlled signals automatically in advance of a train. The dispatcher need only clear the entering signal into CTC territory. Thereafter the signals clear sufficiently in advance of the train so that the engineer will always receive a green aspect if track conditions allow. Whenever a train enters the block of the approach signal to a home signal giving a stop indication, a vibrating bell sounds until acknowledged by the dispatcher. Appropriate action must be taken if the stopping of trains is to be avoided. Thus, for meets and passes the dispatcher must take over control. N&W installed this automatic clearing of CTC signals on 96 miles of single-track traffic control between Portsmouth and Cincinnati, Ohio. There are 11 controlled sidings with power operated switches. At the time of installation, 8 of the 13 scheduled daily trains operated in the territory during the hours when the system is clearing signals automatically.

Computers aid in CTC planning

A new tool which can materially help in the planning of centralized traffic control installations is simulation of train operation by a digital computer. Canadian National has developed a "single track capacity analyzer which simulates the CTC dispatcher and moves trains across a subdivision making meets with other trains," reports P. B. Wilson, chief of operational research.

Evaluation of the results of the simulation program are described by Mr. Wilson: "When a CTC subdivision analysis is required, transportation personnel usually propose five or six different siding configurations for test. From the statistical analysis and train charts, the feasibility of a configuration can very easily be determined . . . From the quantitative results for each siding configuration, costs of interference can be derived. From this and the capital and maintenance costs involved, the most economic siding configuration can be selected for any given level of performance.

"The current program produces a redispatch reasonably close to that of a CTC dispatcher. . . . Its prime function is to assist in the planning and evaluation of CTC installations."

The speed with which the computer can "run trains" over a CTC territory (1 day's trains in 12 min.) is what makes the computer simulation feasible and economical. It has been estimated that this method of evaluating siding configurations for a CTC project reduces the cost of planning such a project by at least 10%.

Statistical information developed by the CN in its simulation program includes: train interference, lateness of scheduled trains leaving and arriving at terminals, distribution of the number and duration of delays by sidings, average delay per meet or pass, and a density of distribution of the number of meets per hour.